

CASE NO. 731-S-12

SUPPLEMENTAL MEMORANDUM

July 25, 2013

Petitioners: Warner Brothers, Inc.

Champaign
County
Department of

PLANNING &
ZONING

Site Area: .96 acre (38.55 acre parcel)

Time Schedule for Development: Under
Construction

Prepared by: **Andy Kass**
Associate Planner

John Hall
Zoning Administrator

Request: Authorize the storage and dispensing of 28% urea ammonium nitrate fertilizer solution as a "Farm Chemicals and Fertilizer Sales including incidental storage and mixing of blended fertilizer" facility as a Special Use in the AG-1 Agriculture Zoning District.

Location: A .96 acre (41,817.6 square feet) portion of a 38.55 acre tract in the East One-Half of the Southeast Quarter of Section 18 of Rantoul Township and commonly known as the farm field adjacent to the Kinze farm equipment dealership at 1254 CR 2700N, Rantoul.

Brookens
Administrative Center
1776 E. Washington Street
Urbana, Illinois 61802

(217) 384-3708

STATUS

This case is continued from the June 13, 2013, public hearing. New evidence and revisions are proposed to be added to the Summary of Evidence (see Attachment B). Special conditions are proposed below as well as revisions to existing conditions.

ROAD AGREEMENT

The petitioner's have reached an agreement with Rantoul Township to assist with maintenance costs of the roads. The agreement does not specify which roads the petitioner's are to use. The amount the petitioner's will pay to the township is based upon how many gallons of product are stored per year (see Attachment A).

PROPOSED SPECIAL CONDITIONS

~~B. The Zoning Administrator shall not issue a Zoning Compliance Certificate for the proposed Special Use until the petitioner provides documentation of compliance with Illinois Department of Agriculture regulations for fertilizer storage tanks.~~

The above special condition is required to ensure the following:

~~That the proposed use is in compliance with the Illinois Department of Agriculture regulations.~~

- D. The Special Use shall be void if the owner/ operator fails to comply with the road agreement with Rantoul Township.**

The special conditions above are required to ensure the following:

There is no undue burden for Rantoul Township arising from any damage to public streets or extra street maintenance caused by the Special Use.

- E. All inbound and outbound trucks delivering ~~28% liquid~~ fertilizer and any other associated product to the proposed Special Use shall enter and exit the subject property on the east side of the Warner Farm Equipment building (~~subject to a road agreement with Rantoul Township~~).**

The special condition stated above is required to ensure the following:

To prevent nuisance issues on the adjacent property.

- F. Regarding the ongoing operation of the Special Use as authorized by the Illinois Department of Agriculture and Illinois Environmental Protection Agency:**

- (1) The Special Use shall at all times be operated in conformance with Illinois Department of Agriculture and Illinois Environmental Protection Agency requirements, permits, and any special conditions thereof.**
- (2) The owner/operator of the Special Use shall provide the Zoning Administrator with copies of all semi-annual testing of product piping that is required by the Illinois Department of Agriculture (IDAG) and Illinois Environmental Protection Agency (IEPA) and the copies shall be provided to the Zoning Administrator concurrently with their submission to IDAG and IEPA.**
- (3) The owner/operator of the Special Use shall make all inspection and maintenance records required by the Illinois Department of Agriculture (IDAG) and Illinois Environmental Protection Agency (IEPA) available to Champaign County upon request by the Zoning Administrator and shall cooperate with Champaign County in resolving any valid complaint or concern that is related to public safety and environmental protection.**
- (4) The owner/ operator of the Special Use shall provide the Zoning Administrator with copies of renewal permits over the lifetime of the Special Use for Illinois Department of Agriculture (IDAG) and Illinois Environmental Protection Agency (IEPA) Permit #AC13030985 that expires on April 17, 2015, or Permit #AC13020954 that expires on April 17, 2018.**
- (5) The Special Use shall become void under any of the following situations:**
 - (a) Failure to receive a renewal permit for either Illinois Department of Agriculture (IDAG) and Illinois Environmental Protection Agency (IEPA) Permit #AC13030985 that expires on April 17, 2015, or Permit #AC13020954 that expires on April 17, 2018, over the lifetime of the Special Use.**

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- (b) **If the experimental design approved by the Illinois Department of Agriculture (IDAG) and the Illinois Environmental Protection Agency (IEPA) in Permit #AC13030985 fails to provide adequate containment in which case the owner/operator of the Special Use shall provide notice to the Zoning Administrator upon a determination by either IDAG or IEPA that the experimental design fails to provide adequate containment.**
- (c) **Failure of the owner/operator to comply with any part of the special conditions in Case 731-S-12.**

The special conditions above are required to ensure the following:

To ensure that Champaign County is fully informed of any risks that arise for public safety and environmental protection.

ATTACHMENTS

- A Road Agreement received July 25, 2013
- B Proposed Evidence and Revisions
- C IDAG Experimental Permit for Agrichemical Containment Facility received May 1, 2013
- D IDAG Permit Agrichemical Containment Facility received May 1, 2013
- E *UAN Material Safety Data Sheet* prepared by Terra Industries, Inc. revised September 25, 2006
- F *Nitrogen Sources*, Tom Dorn, University of Nebraska-Lincoln Extension, accessed July 24, 2013

**AGREEMENT WITH RANTOUL TOWNSHIP
ROAD COMMISSIONER**

This Agreement is entered into this 25 day of July, 2013 by Warner Brothers, Inc., an Illinois corporation (hereafter "Warner") and Dan Sage, Road Commissioner for Rantoul Township, State of Illinois (hereafter "Commissioner") in consideration of their mutual covenants herein.

Whereas Warner has filed a petition with the Champaign County Zoning Board of Appeals under Case No. 731-AM-12 seeking amendment to the Champaign County Zoning Map to change the zoning designation of a 3.8 acre site commonly known as 1254 CR 2700 North, from AG-1 (Agriculture Zoning District) to B-1 (Rural Trade Center Zoning District); and

Whereas Warner owns and maintains a 750,000 gallon tank and ancillary structures for storage and mixing of liquid agricultural fertilizer (all such structures and tank hereafter jointly referred to as the "Tank Facilities") upon property immediately adjacent to the north and east of the property which is the subject of the foregoing petition; and

Whereas Warner has filed a petition with the Champaign County Zoning Board of Appeals under Case No. 731-S-12 seeking authorization for Special Use of the above-described Tank Facilities in the AG-1 Agricultural Zoning District for storage, mixing and dispensing of agricultural fertilizer from the Tank; and

Whereas the petitions above described are related and mutually dependent, and neither may be approved without approval of the other; and

Whereas use of the Tank Facilities for storage, mixing and distribution of liquid fertilizer by or on behalf of persons other than Warner is presumed to increase wear on the Rantoul Township road system; and

Whereas Warner and Commissioner wish to provide for contribution by Warner to the cost of maintenance of said roads arising from such increased wear, upon condition that the above-described petitions are approved, a Zoning Compliance Certificate for the Special Use is issued and the requested zoning map amendment is accomplished.

Now therefore, subject to the foregoing conditions, it is agreed as follows:

1. Warner shall pay to Commissioner an annual road maintenance fee for commercial use of the Tank Facilities as determined in accordance with the schedule set forth on Exhibit "A" which is attached hereto and incorporated by reference.

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2. Warner shall cause to be provided annually to Commissioner, not later than March 1, a record of deliveries to the Tank Facilities indicating the number of gallons delivered for the use of persons other than Warner during the preceding calendar year.
3. Payment of the annual road maintenance fee shall be made upon the same schedule as that for payment of real estate taxes in each year next succeeding the year for which such record has been provided.
4. In any action taken to interpret or enforce this Agreement, the prevailing party shall be entitled to recover costs and reasonable attorney fees.
5. This Agreement shall be binding on the successors and assigns of the parties.
6. This Agreement shall be recorded in the office of the Recorder for Champaign County, Illinois.

In witness whereof the parties have executed the foregoing Agreement on the day and year above stated.

WARNER BROTHERS, INC.

RANTOUL TOWNSHIP

by:

Joseph H. Warner
President

by:

[Signature]
Road Commissioner

Subscribed and Sworn this 23 day
of July, 2013.

[Signature]
NOTARY

"OFFICIAL SEAL"
PAUL R. COLE
NOTARY PUBLIC, STATE OF ILLINOIS
MY COMMISSION EXPIRES 1/4/2014

Subscribed and Sworn this 25 day
of July, 2013.

[Signature]
NOTARY

"OFFICIAL SEAL"
Sandra A Langley
Notary Public, State of Illinois
My Commission Expires 6/22/2017

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EXHIBIT "A"

TOWNSHIP ROAD MAINTENANCE FEE

0 to 125,000 Gal at \$.005/Gal
125,000 to 350,000 Gal at \$.003/Gal
350,000 to 750,000 Gal at \$.002/Gal
above 750,000 Gal at \$.005/Gal

Examples:

125,000 Gal	at \$.005	=	\$ 625.00
275,000 Gal			
	125,000 at \$.005	=	\$ 625.00
	150,000 at \$.003	=	\$ 450.00 + TAX
			<u>\$1,075.00</u>
360,000 Gal			
	125,000 at \$.005	=	\$ 625.00
	225,000 at \$.003	=	\$ 675.00
	10,000 at \$.002	=	\$ 20.00
			<u>\$1,320.00</u> + TAX
500,000 Gal			
	125,000 at \$.005	=	\$ 625.00
	225,000 at \$.003	=	\$ 675.00
	150,000 at \$.002	=	\$ 300.00
			<u>\$1,600.00</u> + TAX
775,000 Gal			
	125,000 at \$.005	=	\$ 625.00
	225,000 at \$.003	=	\$ 675.00
	400,000 at \$.002	=	\$ 800.00
	25,000 at \$.005	=	\$ 125.00
			<u>\$2,225.00</u> + TAX

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Attachment B
Proposed Evidence and Revisions
Case 731-S-12
July 25, 2013

Revise Item 3. as follows:

3. The subject property is not located within the one and one-half mile extraterritorial jurisdiction of a municipality with zoning but Rantoul Township does have a plan commission. Generally regarding comments from Rantoul Township:
- (1) At the March 28, 2013, public hearing James Rusk, Rantoul Township Supervisor, submitted a letter from Danny Sage, Rantoul Township Road Commissioner, stating that Mr. Sage has concerns with the volume of heavy traffic over Township roads. Mr. Rusk also testified that the road is a ten inch gravel base road with oil chip over it, and the Township has concerns regarding the number of 80,000 pound vehicles that will travel the road if the Special Use Permit is approved.
- (2) At the June 13, 2013, public hearing Brian Schurter, Attorney for Rantoul Township testified as follows:
- (a) The Township is not opposed to the project, however, they are concerned about the impact that it will have on the roads.
- (b) It costs approximately \$9,000 to oil and chip one mile of road.
- (c) The Township wants to ensure that the impact that will be caused will not be borne by the other citizens of the Township, but that the business creating the impact will be bearing the cost.
- (3) The petitioner's have reached an agreement with Rantoul Township to assist with maintenance costs of the roads. The agreement does not specify which roads the petitioner's are to use. The amount the petitioner's will pay to the township is based upon how many gallons of commercial product are stored per year. The agreement was finalized on July 25, 2013.

Revise Item 5.A.(1) as follows:

5. Regarding the site plan and operations of the proposed Special Use:
- *A. The Plat of Survey prepared by Nicholas P. McCabe received March 21, 2013, and revised on June 5, 2013, indicates the following:
- (1) The location of the existing 750,000 gallon indicated capacity storage tank that is approximately 48 feet in height. This tank is proposed to be utilized to store 28% ~~nitrogen fertilizer~~ urea ammonium nitrate fertilizer solution

Attachment B
Proposed Evidence and Revisions
Case 731-S-12
July 25, 2013

for the petitioner's agricultural operation as well as providing bulk storage space to lease.

Revise Item 5.C. as follows:

- C. The petitioner intends to utilize the storage tank and mixing building for the storage and mixing of 28% ~~nitrogen fertilizer~~ urea ammonium nitrate fertilizer solution for their farm operations. In addition, the petitioner intends to lease excess storage space in the tank to farmers and agricultural business. The subject property will be accessed from the property that is the subject of Case 747-AM-13.

Add New Item 7.E. as follows:

- E. Dane Ehler, 1185 CR 2700N, Rantoul, testified at the June 13, 2013, public hearing as follows:
- (1) He lives 1 mile west of the subject property for over 20 years.
 - (2) He is a farmer and appreciates what the Warner's have done in constructing a state of the art tank and he believes that it will help him out.
 - (3) Currently, he has to travel to Cissna Park or Danville to get 28% fertilizer on a wholesale manner.
 - (4) He said that he does have some neighbors who store five to ten thousand gallons of 28% and their tanks do not have dikes or bladders and are not certified. This will help eliminate some of that because a farmer will be able to take the product to a certified facility and not have the risk of having it on his farm where it could spring a leak.
 - (5) He thinks the proposed storage tank will benefit local farmers.

Add new Item 8.C.(g) as follows:

- (g) The petitioner's have reached an agreement with Rantoul Township to assist with maintenance costs of the roads. The agreement does not specify which roads the petitioner's are to use. The amount the petitioner's will pay to the township is based upon how many gallons of commercial product are stored per year. The agreement was finalized on July 25, 2013.

Attachment B
Proposed Evidence and Revisions
Case 731-S-12
July 25, 2013

Add new Item 8.L. as follows:

- L. Dan Ray, 100 South, Center Street, Mahomet, testified at the June 13, 2013, public hearing as follows:
- (1) He is a Board Certified Regulatory Compliance Consultant specializing in environmental safety compliance consulting.
 - (2) Because of the volume of fertilizer that will be stored the Illinois Department of Agriculture suggested that it should be permitted as a commercial facility.
 - (3) The applicants have all of the required State of Illinois permits for commercial storage of 28% ammonia.
 - (4) The facility is state of the art and has been built to a much higher standard than most other on-farm storage facilities.
 - (5) The Warner's permit will be an experimental permit because of the tank and bladder combination and the permit will be reviewed and renewed every two years for the first four years and then it will move to a five year cycle.
 - (6) There are on-farm storage facilities of this size in Sangamon County, Winnebago County, and Stark County.
 - (7) He has written the standard operating procedures for the facility and will train the workers on the procedures.
 - (8) The facility will be inspected by the Illinois Department of Agriculture annually and the requirements for a commercial facility are more stringent than for an on-farm storage facility.

Add new Item 8.M. as follows:

- M. As briefly reviewed in Nitrogen Sources from the University of Nebraska Extension and the UAN Material Safety Data Sheet from Terra, the safety concerns related to the storage and use of 28% urea ammonium nitrate fertilizer are not as significant as the safety concerns related to the storage and use of anhydrous ammonia fertilizer.

State of Illinois
Department of Agriculture
AGRICHEMICAL CONTAINMENT PERMIT

EXPERIMENTAL

Permittee: Warner Brothers, Inc. 1254 CR 2700 N. Rantoul, IL 61866	Facility ID Number: AC0193410000 Facility Location: Rantoul
Permit #: AC13030985 Facility Type: Commercial; Retail Dealer Date Issued: April 17, 2013	Log Number: 13030985 Date Received: March 6, 2013 Expiration Date: April 17, 2015

An Experimental Permit is hereby granted to the above designated permittee to construct and operate an agrichemical containment facility as follows:

SECONDARY CONTAINMENT STRUCTURES

Installation and operation of a steel bulk liquid fertilizer storage tank with a storage capacity of 750,000 gallons with the installation and operation of a synthetic membrane liner within the aforementioned tank to serve as primary containment within each tank, in accordance with 8 Illinois Administrative Code 255.60.

There shall be no discharge of wastewater from the herein permitted facilities.

This experimental permit has been reviewed and approved by the Illinois Environmental Protection Agency per the attached permit endorsement. This experimental permit is subject to standard conditions on the reverse side of this document and the following special conditions:

SPECIAL CONDITION 1: The permittee shall provide backflow protection in accordance with the Illinois Department of Public Health Plumbing Code (77 Ill. Adm. Code 890) and the Illinois Environmental Protection Agency's Technical Policy Statement (35 Ill. Adm. Code 653.803(c)(4).

SPECIAL CONDITION 2: All product piping associated with the herein permitted structure shall be pressure tested semi-annually (2 times per year). Records of said testing shall be maintained on file at the facility.

SPECIAL CONDITION 3: The permittee shall notify the Department immediately of any detection of agrichemicals in the effluent recovered from the leak monitoring ports installed under the synthetic liner and the valve containment boxes.

SPECIAL CONDITION 4: The Department and the Agency may require conventional secondary containment structures in accordance with 8 Illinois Administrative Code 255.80 to be installed if the experimental design permitted herein fails to provide adequate containment.

SPECIAL CONDITION 5: The permittee shall maintain all monitoring valves in a closed position, except when facility personnel are directly attending these valves for leak monitoring and maintenance.



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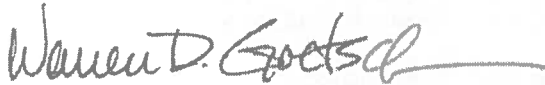
State of Illinois
Department of Agriculture
AGRICHEMICAL CONTAINMENT PERMIT

SPECIAL CONDITION 6: The permittee shall submit on the permit renewal application an inspection report indicating the condition of the liner system and the steel storage tank. The said inspection shall be performed by a qualified individual based upon education and/or equivalent experience who is employed outside of the company. The inspections shall be performed between **September 2014** and **March 2015** at a time that is convenient to empty the storage vessel(s).

SPECIAL CONDITION 7: The inspection and maintenance records for the structures and detection valves shall be maintained at the facility. The permittee shall notify the Department immediately of any detection of agrichemicals in effluent sampled or recovered from the leak monitoring ports installed under the proposed synthetic liner and the valve containment structures. The permittee shall sample, on a quarterly basis, any effluent collected at the monitoring ports and analyze samples for fertilizer content. Results of any analysis shall be reported to the Department immediately.

SPECIAL CONDITION 8: The permittee shall submit to the Department the results of all post-leak analyses used to establish baseline nitrate-nitrogen levels associated with the synthetic liner. Samples shall be taken of flush water removed during decontamination of the monitoring area and of any effluent forced out during the post repair filling of the storage tank.

THE STANDARD CONDITIONS OF ISSUANCE ON THE REVERSE SIDES OF THIS MUST BE COMPLIED WITH IN FULL.



Warren D. Goetsch, P.E.
Chief, Bureau of Environmental Programs

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State of Illinois
Department of Agriculture
AGRICHEMICAL CONTAINMENT PERMIT

Permittee: Warner Brothers, Inc. 1254 CR 2700 N. Rantoul, IL 61866	Facility ID Number: AC0193410000 Facility Location: Rantoul
Permit #: AC13020954 Facility Type: Commercial: Retail Dealer Date Issued: April 17, 2013	Log Number: 13020954 Date Received: February 13, 2013 Expiration Date: April 17, 2018

Permit is hereby granted to the above designated permittee to construct and operate an agrichemical containment facility as follows:

OPERATIONAL CONTAINMENT STRUCTURES

Installation and operation of a reinforced concrete operational containment structure measuring 22' (width) x 72' (length) x 1.17' (depth) with a total design capacity of 746 cubic feet (ft.³). The floor shall slope to a single trench measuring 1' (width) x 20' (length) x 0.5' (depth), which shall drain to a single sump measuring 2' (width) x 2' (length) x 1.5' (depth) to facilitate the collection and recovery of all escaped product and/or agrichemical wastewater. All recovered effluent shall be transferred to one (1) of two (2) 250 gallon recovery tanks with a manually activated sump pump. Segregation shall be performed based upon the applicable target crop and label use. All loading, unloading, and washing of bulk liquid agrichemical transportation and application equipment shall be performed within the said structure. This structure shall be referred to as **OC-1**.

Installation and operation of a reinforced concrete operational containment structure measuring 23.2' (width) x 43.1' (length) x 0.5' (depth) with a total design capacity of 333 cubic feet (ft.³). The floor shall slope to a single sump measuring 2' (width) x 2' (length) x 1.5' (depth) to facilitate the collection and recovery of all escaped product and/or agrichemical wastewater. All recovered effluent shall be transferred to one (1) of the two (2) aforementioned 250 gallon recovery tanks with a manually activated sump pump. Segregation shall be performed based upon the applicable target crop and label use. All mixing of liquid agrichemicals shall be performed within the said structure. This structure shall be referred to as **OC-2**.

SECONDARY CONTAINMENT STRUCTURES

Installation and operation of a reinforced concrete secondary containment structure measuring 23.2' (width) x 26.2' (length) x 0.83' (height) with a total design capacity of 503 cubic feet (ft.³). The floor shall slope to a single sump measuring 2' (width) x 2' (length) x 1.5' (depth) to facilitate the collection and recovery of all escaped product and/or agrichemical wastewater. All recovered effluent shall be transferred to one (1) of the two (2) aforementioned 250 gallon recovery tanks with a manually activated sump pump. Segregation shall be performed based upon the applicable target crop and label rate. All bulk liquid pesticides shall be stored within the said structure. This structure shall be referred to as **SC-1**.

There shall be no discharge of wastewater from the herein permitted facilities.



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State of Illinois
Department of Agriculture
AGRICHEMICAL CONTAINMENT PERMIT

This permit has been reviewed and approved by the Illinois Environmental Protection Agency per the attached permit endorsement. This permit is subject to standard conditions on the reverse side of this document and the following special conditions:

SPECIAL CONDITION 1: The permittee shall provide backflow protection in accordance with the Illinois Department of Public Health Plumbing Code (77 Ill. Adm. Code 890) and the Illinois Environmental Protection Agency's Technical Policy Statement (35 Ill. Adm. Code 653.803(c)(4).

THE STANDARD CONDITIONS OF ISSUANCE ON THE REVERSE SIDES OF THIS MUST BE COMPLIED WITH IN FULL.



Warren D. Goetsch, P.E.
Chief, Bureau of Environmental Programs

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Terra Industries Inc.
Terra Centre – 600 Fourth Street
Sioux City, Iowa 51101

Material Safety Data Sheet

UAN
Urea Ammonium Nitrate Solution

MSDS Number 2040 (Revised September 25, 2006)

6 Pages

1. CHEMICAL PRODUCT and EMERGENCY TELEPHONE CONTACT

Product Name:..... Urea Ammonium Nitrate Solution
 Chemical Family:..... Nitrogen Fertilizer Solution
 Synonyms:..... TerraSol, UAN, UAN Solution, 28%, 30%,
 32% (As N)
 Formula:..... $CH_4N_2O + NH_4NO_3 + H_2O$
 Product Use..... Fertilizer

EMERGENCY TELEPHONE NUMBER

CHEMTREC (U.S.):..... 800-424-9300
 CANUTEC (Canada):..... 613-996-6666

2. COMPOSITION/INFORMATION ON INGREDIENTS

Component Name	Percentage by Weight			CAS Number
	28%	30%	32%	
Ammonium Nitrate	37-41%	40-44%	42-47%	6484-52-2
Urea	29-32%	31-34%	34-37%	57-13-6
Water	34-27%	29-22%	24-16%	7732-18-5
Free Ammonia	<.05%	<.05%	<.05%	7664-41-7
UAN Solution				15978-77-5

Exposure Limits

Component	TWA	STEL	PEL	IDLH
Ammonia	25 ppm	35 ppm	50 ppm	300 ppm

No limits established for urea or ammonium nitrate.

3. HAZARDS IDENTIFICATION

EMERGENCY OVERVIEW

Colorless liquid with a slight ammonia odor. When the water in UAN evaporates, residue may include solid ammonium nitrate and urea. When sensitized or during decomposition, solid ammonium nitrate may become unstable and/or explosive. UAN pumps operated with blocked discharge have been known to detonate. When UAN is heated to decomposition it may produce vapors containing nitrogen oxides (NO_x) and ammonia. Use water to control fires involving UAN if water is compatible with burning material. UAN itself is non-flammable. UAN can cause irritation to eyes and skin.

POTENTIAL HEALTH EFFECTS

Primary Routes of Entry: Skin contact/absorption and eye contact.

General Acute Exposure: Contact with skin or eyes may cause irritation. UAN is not acutely toxic by the oral route of exposure.

General Chronic Exposure: No test data available.

Carcinogenicity:

NTP: Not Listed

IARC: Not Listed

OSHA: Not Regulated

Medical Conditions Aggravated by Exposure: No test data available.

4. FIRST AID MEASURES

First Aid for Eyes: Immediately flush eyes with copious amounts of tepid water for at least 15 minutes. If irritation, pain, swelling, excessive tearing, or light sensitivity persists, the patient should be seen in a health care facility.

First Aid for Skin: Immediately flush exposed area with copious amounts of tepid water for at least 15 minutes followed by washing area thoroughly with soap and water. The patient should be seen in a health care facility if irritation or pain persists.

First Aid for Inhalation: Generally not considered an inhalation hazard. If irritation develops, move patient to fresh air and monitor. If cough or difficulty in breathing develops, evaluate for respiratory tract irritation. If needed, administer supplemental oxygen if trained to do so. If irritation, coughing, or difficulty breathing persists, the patient should be seen in a health care facility.

First Aid for Ingestion: If conscious, give the patient large quantities of milk or water to drink immediately. Do not induce vomiting. Seek medical attention.

5. FIRE FIGHTING MEASURES

UAN is not flammable.

Extinguishing Media: Use water to extinguish a fire involving UAN if water is compatible with the burning material.

Special Fire Fighting Procedures:

- a. Apply cooling water to sides of containers that are exposed to flames until well after fire is out.
- b. Positive pressure self-contained breathing apparatus (SCBA) should be used when there is a potential for inhalation of vapors and/or fumes.

- c. Wear full fire fighting protective equipment that is appropriate for conditions.

Caution:

- a. Runoff from fire control or dilution water may cause pollution.
- b. When the water in UAN evaporates, residue may include solid ammonium nitrate and urea. When sensitized or during decomposition, solid ammonium nitrate may become unstable and/or explosive. UAN pumps operated with blocked discharge have been known to detonate. When UAN is heated to decomposition it may produce vapors containing nitrogen oxides (NO_x) and ammonia.
- c. Avoid welding or burning on pipes, valves, or tanks that have contained UAN solution until they have been thoroughly rinsed. Residual ammonium nitrate may explode under conditions of confinement and high temperature.

6. ACCIDENTAL RELEASE MEASURES

Spill or Leak Measures: Keep unnecessary people away, isolate hazard area and deny entry. UAN may be toxic to cattle (ruminants) or poultry if ingested.

Determining Spill Size: Generally, a small spill is one that involves a single, small package (i.e. up to a 55 gallon drum), small cylinder, or a small (non-continuing) leak from a large container.

Small Spill:

- a. Stop leak if you can do so without risk.
- b. Spilled area may become slippery.
- c. Wash contaminated areas with large volumes of water if approved by local, state, and federal environmental agencies.
- d. Runoff may cause pollution.

Large Spill:

- a. Dike ahead of liquid spill for later recovery of usable product and proper disposal of any residue.
- b. Stop leak if you can do so without risk.
- c. Spilled area may become slippery.
- d. Wash contaminated areas with large volumes of water if approved by local, state, and federal environmental agencies.
- e. Runoff may cause pollution.

7. HANDLING AND STORAGE

Do not use zinc or copper (brass, bronze, etc.) alloys in contact with UAN solution due to corrosion. Also, cast iron, malleable iron, or ductile iron are much more susceptible to corrosion than aluminum or carbon steel. Be especially wary of plugs and fittings on storage tanks made from these materials.

Handling Precautions: Use proper personal protective equipment when working with or around UAN (See section 8).

8. EXPOSURE CONTROLS, PERSONAL PROTECTION

Respiratory Protection Requirements: UAN itself does not pose an inhalation hazard. Decomposition of UAN may produce nitrogen oxides (NO_x vapors) and ammonia. Use fresh air supply systems to protect against NO_x and/or ammonia vapors. If necessary to enter a confined area that contains UAN, monitor for ammonia vapors. If ammonia vapors are present, protect as follows:

<25 ppm:	No protection required.
25 to 35 ppm:	Protection required if the daily TWA is exceeded.
35 to 50 ppm:	Protection required if exposed for more than 15 minutes.
50 to 250 ppm:	Minimum of an air-purifying respirator equipped with ammonia canister(s) or cartridge(s).
250 to 300 ppm:	Minimum of a full-face air-purifying respirator equipped with ammonia canister(s) or cartridge(s).
>300 ppm:	A fresh air supply system must be used (i.e. positive pressure self contained breathing apparatus).

Skin Protection Requirements: It is recommended that if a person may come into contact with UAN for an extended length of time or if a person demonstrates sensitivity to UAN, skin protection should be used. Most liquid tight gloves and liquid resistant clothing is acceptable.

Eye Protection Requirements: If there is a potential for UAN to contact eyes, it is recommended that safety glasses or goggles be used.

Other Protective Equipment: Safety shower and eyewash fountain or at least 5 gallons of accessible clean water should be provided in a UAN handling area.

9. PHYSICAL AND CHEMICAL PROPERTIES

Physical Form:	Liquid
Color:	Colorless
Odor:	Slight ammonia odor (pungent)
Boiling Point:	Approximately 225° F (107° C)
Melting/Freezing Point:	28% UAN salts out at 0° F (-18° C)
	30% UAN salts out at 16° F (-9° C)
	32% UAN salts out at 32° F (0° C)
pH:	6.8 - 7.5
Solubility:	100%
Specific Gravity:	28% 1.281; 30% 1.304; 32% 1.330
Vapor Density:	Approximately 1.07 (@ 60° F)
Vapor Pressure:	8.6 - 17.5 mmHg (@ 100° F)
% Volatile by Volume:	No test results
Molecular Weight:	Not applicable
Density:	28% 10.67 lb/gal at 60° F
	30% 10.86 lb/gal at 60° F
	32% 11.07 lb/gal at 60° F
Critical Temperature:	No test results
Critical Pressure:	No test results

10. REACTIVITY

Stability: This is a stable material.
Hazardous Polymerization: Will not occur.

Decomposition: When the water in UAN evaporates, residue may include solid ammonium nitrate and urea. When sensitized or during decomposition, solid ammonium nitrate may become unstable and/or explosive. UAN pumps operated with blocked discharge have been known to detonate. When UAN is heated to decomposition it may produce vapors containing nitrogen oxides (NO_x) and ammonia.

Incompatibilities: UAN will form nitrogen trichloride, which may be explosive, when mixed with chlorine and hypochlorites. If UAN solution has been dehydrated to ammonium nitrate and urea, refer to the incompatibility/decomposition information for those chemicals. UAN will form urea nitrate when mixed with nitric acid at low pH. Urea nitrate may become unstable and/or explosive under certain conditions.

11. TOXICOLOGICAL INFORMATION

Toxicity

Acute Oral Toxicity

LD₅₀ Rat: > 2,000 mg/kg bw (OECD 425)

Ecotoxicity

Acute Toxicity to Fish

LC₅₀ *Oncorhynchus mykiss*: 103 mg/L (96 hrs)

LC₅₀ *Pimephalas promelas*: 100 to 500 mg/L (96 hrs)

Source: TFI Product Testing Program 2003

12. ECOLOGICAL INFORMATION

Notify local health and wildlife officials and operators of any nearby water intakes of contamination or discharge into or leading to waterways.

Fertilizers containing ammonium nitrate and urea can cause poisoning in livestock and poultry. Nitrogen solutions can be toxic to aquatic life and spills may cause algae blooms in static waters. The conversion of ammonia to nitrites/nitrates by bacteria in aquatic systems can reduce the concentration of dissolved oxygen (referred to as nitrogenous oxygen demand).

Note: See Ecotoxicity information in section 11.

13. DISPOSAL CONSIDERATIONS

UAN is not listed by the Federal EPA as a hazardous waste. Consult state/provincial and local environmental agencies for acceptable disposal methods. Recover product for use as a fertilizer if possible.

14. TRANSPORTATION INFORMATION

UAN is not listed by any U.S. or Canadian transportation authority as a hazardous material and as such, no specific information is available.

15. REGULATORY INFORMATION

SARA TITLE III:

UAN contains ammonia and nitrate ions from ammonium nitrate which are subject to the reporting requirements of section 313 of SARA and 40 CFR Part 372. Terra is required by 40 CFR 372.45 to notify certain customers as to which of its mixtures or trade name products contain those substances. The purpose of that notification requirement is to ensure that facilities that may be subject to the reporting requirements of section 313 and that use products of unknown formulation will have knowledge that they are receiving products that contain substances subject to those reporting requirements.

CERCLA Hazardous Substances List:

Not Listed

TSCA Inventory:

Listed

16. OTHER INFORMATION

Nov. 5, 1996: The MSDS was rewritten to comply with ANSI Standard Z400.1-1993.

July 1, 2003: Added toxicity information from the TFI Product Testing Program 2003

September 25, 2006: Reviewed and reissued without revisions.

The information and recommendations herein are taken from data contained in independent, industry-recognized references including but not limited to NIOSH, OSHA, NFPA, DOT ERG, the TFI product testing program, MEDITEXT, HAZARDTEXT, CHRIS, and SAX's Dangerous Properties of Industrial Materials - ninth edition. Terra Industries Inc. makes no guarantee, warranty or other representation concerning this substance, since conditions of its use are beyond the control of the company. Terra Industries Inc. disclaims any liability for loss or damage incurred in connection with the use of this substance.

Nitrogen Sources

Nitrogen is an essential plant nutrient. It is a key component in plant proteins and chlorophyll. This educational resource will discuss natural and man-made nitrogen sources and will describe the fate of nitrogen in the soil.

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Tom Dorn

UNL Extension Educator

Natural Sources of Nitrogen

Some plants “make their own nitrogen”. If a legume (i.e., soybeans, alfalfa, clovers) is colonized by certain strains of Rhizobium bacteria, nodules will form on the plant roots where the bacteria live and reproduce. Within these nodules, a symbiotic relationship develops between the bacteria and the host plant. The bacteria utilize plant sugars as a source of energy and in turn “fix” nitrogen, converting nitrogen gas into forms that can be used by the plant. Once nodules form, the plant usually receives all of the nitrogen necessary for growth from that “fixed” by the bacteria. Other crops, including all grass crops (e.g., corn, sorghum, wheat, forage grasses, etc.) and non-leguminous broadleaf crops (e.g., sunflowers, potatoes, sugar beets, cotton, etc.) are not colonized by nitrogen fixing bacteria and therefore must obtain the nitrogen they need from the soil.

In addition to nitrogen fixed by Rhizobium bacteria, other natural sources that contribute to the soil nitrogen include: mineralization of organic matter and nitrogen released as plant residues are broken down in the soil. Animal waste is a good source of natural nitrogen as well.

Barnyard or poultry manure and other animal waste products (e.g., bat guano) were used as a source of

supplemental nitrogen long before inorganic nitrogen fertilizer came into popular use. Composted plant residues, legumes plowed under as green manure, and animal wastes continue to be used today, especially by organic crop producers, as a source of nitrogen.

A small amount of nitrogen is also contributed by rainfall in the form of nitric acid (HNO_3), which when dissolved in the soil water disassociates into hydrogen and nitrate ions. The nitric acid is formed when nitrogen and oxygen gases are combined with water by the intense heat of a lightning bolt during a thunderstorm.

While all these natural sources can make significant contributions to soil nitrogen levels, they usually do not supply enough nitrogen to meet all of the needs of high yielding non-leguminous crops in what are now considered “conventional” agricultural systems. Additional nitrogen in the form of added fertilizer is usually required for optimum yield. The remainder of this fact sheet will discuss inorganic (man-made) nitrogen fertilizer sources.

Inorganic nitrogen sources

The air we breathe is about 78% nitrogen in the form of N_2 gas and about 21% oxygen in the form of O_2 gas. The remaining one percent of the atmosphere is a combination of all the other gases, including carbon dioxide that is the source of carbon used by green plants. Even though there are 33,000 tons of

nitrogen in the air over every acre, the nitrogen gas is so chemically stable, plants cannot directly use it as a nutrient.

Plants readily take up and use two forms of soil nitrogen, ammonium (NH_4^+) and nitrate (NO_3^-). Other forms of nitrogen must be converted to one of these compounds by natural or artificial means before plants can utilize them directly as a source of nitrogen for plant growth.

The ammonium molecule (NH_4^+) carries a positive electrical charge and is attracted to the clay and organic matter in the soil, which carry negative charges. Once attached to the soil matrix, ammonium becomes part of the cation (pronounced “kat-i- n”) exchange process whereby plants exchange a hydrogen ion (H^+) for one of the positively charged molecules in the soil. Besides ammonium, other essential nutrients obtained by cation exchange include: potassium, calcium, magnesium, iron, manganese, and zinc.

Nitrification

The conversion of ammonium to nitrite and then to nitrate is referred to as nitrification. Given aerobic soil conditions and soil temperatures above freezing, all forms of nitrogen in the soil, except nitrogen gas, are converted to the nitrate (NO_3^-) form by soil microorganisms. Nitrification occurs most rapidly between 60 and 85 degrees F. Nitrite (NO_2^-), the intermediate product in the conversion of ammonium to nitrate is toxic to

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plants and animals. Fortunately, under most soil conditions, the conversion of nitrite to nitrate occurs very rapidly.

Nitrate (NO_3^-) carries a negative electrical charge, which is the same charge carried by clay particles. Unlike ammonium ions, nitrate ions are not attracted to clay particles, since like charges repel each other. Nitrate molecules are therefore free to move with the soil water. They are carried to the soil surface as moisture evaporates, and carried back down with rainfall or irrigation. Plants take up the nitrate form of nitrogen through the root system along with water as the plant transpires. If water leaches below the root zone, nitrate dissolved in the water will be leached as well. Therefore while the ammonium form of nitrogen is held in the soil, the nitrate form can be lost if water percolates below the active root zone of the crop.

Denitrification

Under anaerobic (saturated) soil conditions, denitrifying organisms in the soil will reduce nitrate to nitrogen gas through a series of intermediate steps, (NO_3^- to NO_2^- to NO to N_2O and finally to N_2). The final two forms are not available to plants. The final product, nitrogen gas, will leave a saturated soil and return to the atmosphere. Some studies indicate that about four

to five percent of the nitrate can be lost from a soil for each day it remains saturated.

Anhydrous Ammonia

Anhydrous ammonia (NH_3) is produced commercially by reacting nitrogen gas (N_2) from the atmosphere in the presence of a catalyst with steam and with methane (natural gas, CH_4). The tonnage of anhydrous ammonia used in agriculture is greater than any other form of nitrogen fertilizer due to its lower cost per pound of nitrogen and its relative nutrient density (82% nitrogen by weight) which keeps the transportation cost per ton of nitrogen as low as possible. Anhydrous ammonia is a gas at normal temperatures and atmospheric pressure but converts to the liquid state when sufficiently pressurized. The need for pressurized containers and additional personal safety precautions reduces some of the advantages for anhydrous ammonia over more easily handled forms of nitrogen.

All other forms of inorganic commercial nitrogen fertilizer are derived from anhydrous ammonia. They are more expensive per pound of nitrogen because of the additional processing steps involved in their manufacture and greater transportation costs because they have lower nutrient density

than anhydrous ammonia. These other forms of nitrogen fertilizer have advantages in terms of personal safety and ease of storing, handling, and application which make them attractive to many farmers in spite of the higher cost per pound of nitrogen.

Urea and Urea - Ammonium Nitrate

Urea ($\text{CO}(\text{NH}_2)_2$) is produced by combining anhydrous ammonia (NH_3) with carbon dioxide (CO_2). (Carbon dioxide (CO_2) is a byproduct of the anhydrous ammonia production process. It is produced by combining oxygen from the air (O_2) with the carbon atom that remains after stripping the hydrogen from the methane molecule).

Fertilizers which contain urea and urea-ammonium nitrate (UAN) solution are the most widely used nitrogen fertilizers in Nebraska after anhydrous ammonia. Dry pelletized urea is popular as a nitrogen fertilizer compared to other forms because of its relatively high nitrogen content (46% of the total weight is nitrogen), good storage and handling properties, and widespread availability.

Urea-ammonium nitrate (UAN) is made by dissolving urea and ammonium nitrate in water. This results an

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The 16 Chemical Elements Essential for Plant Growth

Nitrogen is one of sixteen chemical elements essential for plant growth⁽¹⁾. Green plants must be able to assimilate all sixteen nutrients to carry on cell growth and metabolic activities.

Plants get oxygen (O), carbon (C), and hydrogen (H) from the air and water, the other nutrients are taken from the soil. Nitrogen (N), phosphorus (P), potassium (K), are sometimes referred to as the primary nutrients while calcium (Ca), magnesium (Mg), and sulfur (S) are referred to as secondary nutrients. Another seven essential nutrients are taken up in much smaller quantities and are collectively referred to as micro-nutrients. These are: boron (B), chlorine (Cl), copper (Cu), iron (Fe), manganese (Mn), molybdenum (Mo), and zinc (Z). Table 1 lists the total crop removal of soil nutrients to produce a 150 bushel corn crop.

(1) Cobalt has not been proven essential for higher plant growth but nodulating bacteria need it for fixing atmospheric nitrogen in legumes. It therefore sometimes will appear in a listing of essential nutrients.

Table 1.

Total Crop Removal, lb/acre of Essential Soil Nutrients by a 150 bushel corn crop.

Nitrogen	200
Phosphorous (P_2O_5)	85
Potassium (K_2O)	200
Calcium	42
Magnesium	44
Sulfur	25
Zinc	0.15
Iron	0.10
Manganese	0.08
Boron	0.06
Copper	0.05
Molybdenum	0.03
Chlorine	unknown

aqueous solution usually containing 28% nitrogen by weight (a more concentrated product containing 32% is also available in some locations). Liquid UAN solution is popular because of the versatility of a liquid source, as well as widespread availability.

The urea form of nitrogen cannot be utilized directly by plants. It must first be converted to the ammonium form by chemical processes which, in turn, may be used by the plant or converted to the nitrate form by microbiological processes. The conversion of urea ($\text{CO}(\text{NH}_2)_2$) to ammonium (NH_4^+) occurs in a two step process. When the urea combines with water (hydrolyzes) it forms ammonium carbonate ($\text{NH}_4)_2\text{CO}_3$. Ammonium carbonate is unstable and decomposes to form ammonia gas (NH_3) and carbon dioxide (CO_2). The ammonia gas produced is chemically identical to anhydrous ammonia. If the ammonia gas is in physical contact with water, it reacts to form the ammonium ion (NH_4^+). If the ammonium ion is in contact with the soil, it is attracted to the clay and organic matter particles and is held in the cation exchange complex.

Broadcasting urea-based fertilizers without incorporating them with tillage carries the risk of nitrogen loss to the atmosphere by ammonia volatilization. If just enough moisture is

present to hydrolyze the urea but not enough to convert it to ammonium and carry it to the soil, the ammonia gas can escape into the atmosphere (volatilize). Volatilization is favored by high soil pH, warm temperatures, wet soils under drying conditions, and crop residues that insulate the urea from the soil. Under extremely unfavorable conditions, urea fertilizer that is broadcast to the soil surface with no mechanical incorporation can have volatilization losses exceeding 75%. On the other hand, surface applied urea that receives sufficient rainfall to hydrolyze the urea and to incorporate the resulting ammonium (e.g., one-half inch of rainfall or irrigation) will suffer very little volatilization loss.

Ammonium Nitrate

Another popular form of dry nitrogen fertilizer is ammonium-nitrate ($\text{NH}_4\text{-NO}_3$). Ammonium-nitrate is 34% nitrogen, by weight. It is produced by reacting anhydrous ammonia (NH_3) with nitric acid (HNO_3). When dissolved in water, the ammonium (NH_4^+) and nitrate (NO_3^-) fractions disassociate. The nitrate fraction remains dissolved in the soil water. The ammonium fraction becomes bound to negatively charged soil particles. Both the ammonium and nitrate fractions are available for direct plant uptake and neither form

is subject to appreciable volatilization losses. The volatilization losses from surface applied ammonium nitrate are therefore usually quite small, especially compared to urea-based fertilizers.

A selling point for both urea and ammonium-nitrate fertilizers over anhydrous ammonia is that they can be broadcast as a dry product to the soil surface whereas ammonia must be injected into the soil to prevent vaporization. Broadcast application is faster and less expensive than injection and therefore would have advantages if volatilization losses from urea can be minimized.

Phosphorus / Nitrogen Sources

Some fertilizers that are applied primarily as sources of phosphorus also contain significant levels of nitrogen. Diammonium phosphate (DAP) contains 18% N and 46% P_2O_5 by weight (18-46-0). Monoammonium phosphate (MAP) is usually formulated as 11-52-0. Other common phosphorus sources that contain nitrogen include 10-34-0 and 11-37-0. If any of these compounds are applied as a source of phosphorus, one should credit the nitrogen contained in these compounds when computing total nitrogen fertilizer to apply.