

Anhydrous Ammonia

Bulk Carrier Training Program



Fertilizer Safety & Security Council

Conseil de la sécurité en fertilisation

Acknowledgments:

This document was compiled by a working Committee, under the auspices of the
Fertilizer Safety and Security Council.

Chaired by: Dennis Black, Koch Fertilizer Canada Ltd.

Writer: Doug Wurzer, Western Co-operative Fertilizers Limited
Technical Support: Cyndee Holdnick

Christopher Albrechtsen, Paul's Hauling Ltd.
Vern Nystedt, Paul's Hauling Ltd.
Robin Doherty, Westcan Bulk Transport
Keith Beuker, Keith's Hauling Ltd.

Anhydrous Ammonia Bulk Carrier Training Program

Table of Contents

Course Introduction	Page 1
Product Characteristics	Page 2
Transport Requirements & Regulations	Page 3
Anhydrous Ammonia Vessel Signage Requirements	Page 8
Truck/Trailer Transport Requirements	Page 11
WHMIS Information	Page 12
Personal Protective Equipment	Page 12
Pre-Trip Inspections	Page 14
Product Loading Procedures	Page 15
Delivery Procedures	Page 15
Unloading Procedures	Page 17
Compressor Unloading of Trailers (Individually)	Page 17
Compressor Unloading of Pup & Lead in Series	Page 20
Pump Unloading of Trailers (Individually)	Page 22
Pump Unloading of Pup & Lead Trailers in Series	Page 24
Managing Pressure Differentials	Page 26
Delivery to Unattended NH₃ Storage Tank	Page 26
First Aid	Page 29
First Response for Emergencies	Page 30
Incident Reporting	Page 30
Security Measures	Page 35
MSDS	Page 36
Hands-on Training Checklist	Page 40
Glossary	Page 41

COURSE INTRODUCTION



The purpose of this course is to provide specialized training for bulk carriers in the safe handling and transporting of anhydrous ammonia, and to meet the requirements outlined in the Canadian Transportation of Dangerous Goods (TDG) Regulations. The intent is to standardize a set of processes used in the industry, in aspects such as loading, transporting, and ensuring that vessels, personnel and equipment are within regulatory standards and industry best practices.

The information contained in this material applies to shipments within Canada. For any United States bound shipments, please refer to the current US Regulations (C-49). For more information on how to comply with the US federal hazardous materials regulations, please refer to the Federal Motor Carrier Safety Administration website (www.fmcsa.dot.gov/safetyprogs/hm/complyhmregs.htm).

An understanding of this course will provide a bulk carrier with the knowledge necessary to complete the test and obtain a 36-month TDG certificate for safe handling of anhydrous ammonia.

Transporter certification is a two-part process – the course and written test is only part one. Part two consists of the hands-on site-specific requirements set out by each company.

An employer will provide their own approved anhydrous ammonia TDG certificate to the employee once he/she has completed both parts of the training.

PRODUCT CHARACTERISTICS

To be able to safely work with anhydrous ammonia, a person must understand the product's characteristics. Anhydrous ammonia, identified by its chemical formula NH₃, is an agriculture fertilizer that is used throughout Canada and the United States. Nitrogen accounts for approximately 82% by weight and hydrogen less than 18%, and thus anhydrous ammonia is often written as 82-0-0.

When dealing with anhydrous ammonia, remember that:

- ◆ Anhydrous ammonia is a liquid when stored and transported under pressure.
- ◆ It is a gas at atmospheric temperature (21°C) and pressure.
- ◆ It has a high expansion ratio (500-1). A small blast of anhydrous ammonia can cover a large area.
- ◆ When released in the air, anhydrous ammonia forms a vapour cloud that is lighter than air and will dissipate quickly.
 - With high humidity, however, the vapour will take on moisture and linger within the general vicinity of the release, or move with wind and collect in low-lying areas.
 - The coldest part of the vapour cloud, at the point of release, is about –43°C (-45°F), and can drop as low as –73°C (-100°F), freezing everything that it contacts.
- ◆ Ammonia is attracted to *any* type of moisture. Since the human body is made up of 91% water, exposed areas (including eyes, mouth, throat, skin) are very susceptible to an anhydrous ammonia burn.
- ◆ An anhydrous ammonia vapour cloud may be oxygen deficient.
- ◆ Anhydrous ammonia is an inhalation hazard. Breathing in ammonia could be life threatening.
- ◆ It has a strong, pungent odour, even at low concentrations.
 - The normal working pressure of ammonia is at levels anywhere from 30 to 200 PSI.
 - Occupational Health & Safety classifies a concentration of 300-500 parts per million (ppm) as immediately dangerous to life and health (IDLH).

- ◆ With prolonged exposure, or levels of over 700 ppm, anhydrous ammonia can cause severe skin & eye damage, and may lead to blindness and respiratory stress.
- ◆ Anhydrous ammonia is highly alkaline (pH 12), making it very corrosive to human lungs, eyes and skin.
- ◆ NH₃ is very reactive to copper, zinc, brass, copper-based alloys. Always use steel pipes and fittings, and approved steel containers for anhydrous ammonia.
- ◆ Anhydrous ammonia is generally not a flammable product – its temperature of ignition is over 850°C (1560°F). However, in an enclosed area, with ammonia concentrations of 16% to 25% by volume, and an ignition source of approximately 650°C (1200°F), there is a risk of explosion. It is important to do any maintenance work on ammonia equipment in a well-ventilated area.

The Material Safety Data Sheet (MSDS) for anhydrous ammonia contains more valuable information, which you can refer to for more details (pg. 36).

TRANSPORT REQUIREMENTS & REGULATIONS

The Canadian Transportation of Dangerous Goods (TDG) Act was designed to protect people and the environment from the shipping hazards of dangerous materials. This Act covers all aspects of handling and transporting dangerous goods, such as anhydrous ammonia.

Under the current TDG Regulations, anhydrous ammonia falls into Class 2, Division 2, sub-class 8, which makes it a “non-flammable, non-toxic gas with a corrosive sub-class”. The US Department of Transport (DOT) has listed anhydrous ammonia as a non-flammable compressed gas.

	US – DOT	Canada – TDG
Proper Shipping Name	Ammonia, Anhydrous	Ammonia, Anhydrous
Hazard Class	2.2 Non-Flammable Compressed Gas	2.2 (8) Non-Flammable / Non Toxic Compressed Gas, Sub-class Corrosive
Identification Number	UN 1005	UN 1005
Placard	Non-Flammable Gas 2.2, colour: green	Class 2.2, Non-Flammable and Non-Toxic Gasses; 

For international shipments, remember to refer both to the current Transport Canada and the current US Department of Transportation (DOT) requirements.

TDG Regulations

- ◆ A driver must not take possession of dangerous goods for transport unless he/she has the shipping document for the dangerous goods.
- ◆ Drivers must hold an anhydrous ammonia TDG certificate, valid only for their current employer (i.e. not transferable to another employer).
- ◆ Dangerous goods in transport are in the possession of a bulk carrier from the time the bulk carrier takes possession of the product for transport until another person takes possession of the product.
- ◆ Drivers must stop at all uncontrolled railway crossings in Canada and must stop at all railway crossings in the USA.
- ◆ A person must not handle, offer for transport or transport dangerous goods unless the means of containment (trailer) is designed, constructed, filled, closed, secured and maintained so that under normal conditions of transport, including handling, there will be no accidental release of dangerous goods that could endanger public safety.

Document information

The following information must be included on a shipping document:

- ◆ The name and address of the consignor.
- ◆ The date the shipping document was prepared or given to a carrier.
- ◆ The description of each of the dangerous goods.
- ◆ The shipping name.
- ◆ The primary class, which may be shown under the heading “Class (2)”.
- ◆ The subsidiary class or classes (8), in parentheses, which may follow the words “subsidiary class”.
- ◆ The UN number (UN1005).
- ◆ The quantity of each dangerous good and unit of measure.
- ◆ The appropriate number of placards for each individual vessel (4).
- ◆ The words “24-Hour Number”, or an abbreviation of these words, followed by a telephone number, including the area code, at which the consignor can be reached immediately, and from whom technical information can be obtained about the dangerous goods in transport.

- ◆ The Emergency Response Assistance Plan number preceded or followed by the letters "ERP" or "ERAP"; and the telephone number, including the area code, to call to have the consignor's emergency response assistance plan activated.
- ◆ If the quantity of dangerous goods in a means of containment is less than 10 per cent of the maximum fill limit of that means of containment, the quantity may be described as "RESIDUE LAST CONTAINED", followed by the shipping name of the dangerous goods last contained in the means of containment. Also, the Carrier copies of shipper manifest are to be marked "RESIDUE LAST CONTAINED" when product is off loaded.
- ◆ When quantity of dangerous goods changes during transport, the bulk carrier must show on the shipping document or on a document attached to the shipping document the change in the quantity of dangerous goods.

Whenever the tractor and trailer are separated, a copy of the shipper manifest must be inserted into the last contained document tube on the trailer. The dangerous goods document must be removed from the tube prior to re-loading trailer.

Shipper Provided Short form Bill of Lading - NOT NEGOTIABLE

RECEIVED in apparent good order, exceptions noted, and subject to individually determined rates or contracts that have been agreed upon in writing between the carrier and the shipper, if applicable, otherwise to the rates, classifications and rules that have been established by the carrier and are available to the shipper upon request.

In Emergency (USA) call CHEMTREC (800) 424-9300

CARRIER: <i>Parslow Trucking Inc (20018)</i>		DRIVER: <i>MCCLOUD, DOUG (144)</i>											
BILL OF LADING NO.: 20002912 REV 1		RELEASE NO.: 11462876	TANK NO(S): 1										
CUSTOMER'S PO:		TIME ARRIVED: 11/14/2006 13:56	TIME DEPARTED: 11/14/2006 14:38										
SHIPPER: <i>ABC Company</i>		SEND FREIGHT BILL TO: <i>ABC Company</i>											
CONSIGNOR: <i>ABC Company</i>		CONSIGNEE: <i>Parslow Trucking Inc (88462)</i> P O Box 204 - Hansboro ND 58339											
ORIGIN: <i>ABCville</i>		DESTINATION: <i>FARMERS UNION OIL (20478)</i> <i>RUGBY, , ND</i>											
<table border="1" style="width: 100%; border-collapse: collapse;"> <thead> <tr> <th>NO. & TYPE OF PACKAGES</th> <th>DG</th> <th>PROPER SHIPPING DESCRIPTION (COMMODITY)</th> <th>STCC</th> <th>WEIGHT</th> </tr> </thead> <tbody> <tr> <td>1 T/L</td> <td>X</td> <td>Ammonia, Anhydrous, 2.2 (8), UN1005 ERAP No. 2-0039, 24 hr Telephone - (204) 729-2999</td> <td>49-042-10</td> <td>39370 Gross kg 18830 Tare kg 20540 Net kg 45282 Net lbs</td> </tr> </tbody> </table>				NO. & TYPE OF PACKAGES	DG	PROPER SHIPPING DESCRIPTION (COMMODITY)	STCC	WEIGHT	1 T/L	X	Ammonia, Anhydrous, 2.2 (8), UN1005 ERAP No. 2-0039, 24 hr Telephone - (204) 729-2999	49-042-10	39370 Gross kg 18830 Tare kg 20540 Net kg 45282 Net lbs
NO. & TYPE OF PACKAGES	DG	PROPER SHIPPING DESCRIPTION (COMMODITY)	STCC	WEIGHT									
1 T/L	X	Ammonia, Anhydrous, 2.2 (8), UN1005 ERAP No. 2-0039, 24 hr Telephone - (204) 729-2999	49-042-10	39370 Gross kg 18830 Tare kg 20540 Net kg 45282 Net lbs									

NON-RE COURSE: If this shipment is to be delivered to the consignee without recourse <i>ABC Company</i> , the carrier may decline to make delivery of this shipment without payment of freight and lawful charges. Signature:	
GUARANTEED ANALYSIS <i>Total Nitrogen (N): 82%</i> <i>Derived from Anhydrous Ammonia</i>	
REMARKS	

If the cargo tank for this shipment is supplied by the Carrier, Carrier certifies that the cargo tank is a proper container for the transportation of this commodity. Carrier acknowledges that it has, or has been offered and accepted, the required hazardous materials placards and emergency response information.

I hereby declare that the contents of this consignment are fully and accurately described above by the proper shipping name, and are classified, packaged, marked and labelled/placarded, and are in all respects in proper condition for transport according to applicable international and national governmental regulations [49 CFR 172.204(a)(2)].

Signature of Carrier:



Date: *Nov 14/2006*

To request a current MSDS in NON-EMERGENCY situations, please call (316) 828-7672

Location of shipping document:

During road transport, a copy of the shipping document must be kept as follows:

- ◆ In a pocket mounted on the driver's door or within the driver's reach, if the driver is in the power unit; or
- ◆ In a pocket mounted on the driver's door, on the driver's seat or in a location that is clearly visible to anyone entering through the driver's door if the driver is out of the power unit.
- ◆ During temporary storage, a carrier must ensure that a shipping document is placed in a waterproof receptacle that is securely attached to or near the means of containment containing the dangerous goods, at a readily identifiable and accessible location, when the dangerous goods are stored in the course of transport if:
 - The dangerous goods are left in an unsupervised area;
 - After being unloaded from a means of transport,
 - After the cargo unit of a road vehicle containing the dangerous goods has been disconnected from the power unit,
 - Or, possession of the dangerous goods has not been transferred to another designated person.
 - ◆ When dangerous goods in transport are left in a supervised area, the person in charge of the supervised area is considered to have taken possession of the dangerous goods. The carrier must leave a copy of the shipping document with that person, who must keep it and give it to the next person who takes possession of the dangerous goods.
 - ◆ When the person in charge of a supervised area is absent from the area, that person must ensure that the copy of the shipping document is:
 - Placed in a waterproof receptacle securely attached to or near the means of containment containing the dangerous goods, at a readily identifiable and accessible location; or
 - Left in the possession of an employee who is present in the supervised area and is designated for this purpose by the person in charge of the supervised area.



Employee Certification

TDG Regulations require that employees be adequately trained in the safe handling and transportation of anhydrous ammonia. A person is adequately trained if the person has a sound knowledge of all aspects of handling, offering for transport, and transporting anhydrous ammonia that relates directly to the person's duties.

Remember that the certification requirements for anhydrous ammonia include passing a written test to indicate understanding of the written material, as well as completing a hands-on exercise with the employer. Results from the written test and the hands-on requirements must be retained by the employer.

Upon completion of training, each person would receive a certificate that is valid for 36 months. The certificate must have:

- ◆ The date the training is completed;
- ◆ The product on which the employee was trained;
- ◆ The class of the product (2.2 sub-class 8);
- ◆ The employer's name, signature, and address;
- ◆ The employee's name and signature;
- ◆ The date of expiry.

It is important to remember that this TDG certificate is valid only for anhydrous ammonia for the specified carrier. Employers must keep records of employee training for 5 years. If employees change employers, they must obtain a new certificate.

All personnel handling or transporting anhydrous ammonia must carry their valid TDG certificate at all times, or work under the direct supervision of someone who possesses a valid certificate.

RCMP, OPP, QPP, Occupational Health and Safety and TDG officials randomly check for these requirements, so it is crucial to carry a valid certificate when hauling NH₃.

ANHYDROUS AMMONIA VESSEL SIGNAGE REQUIREMENTS

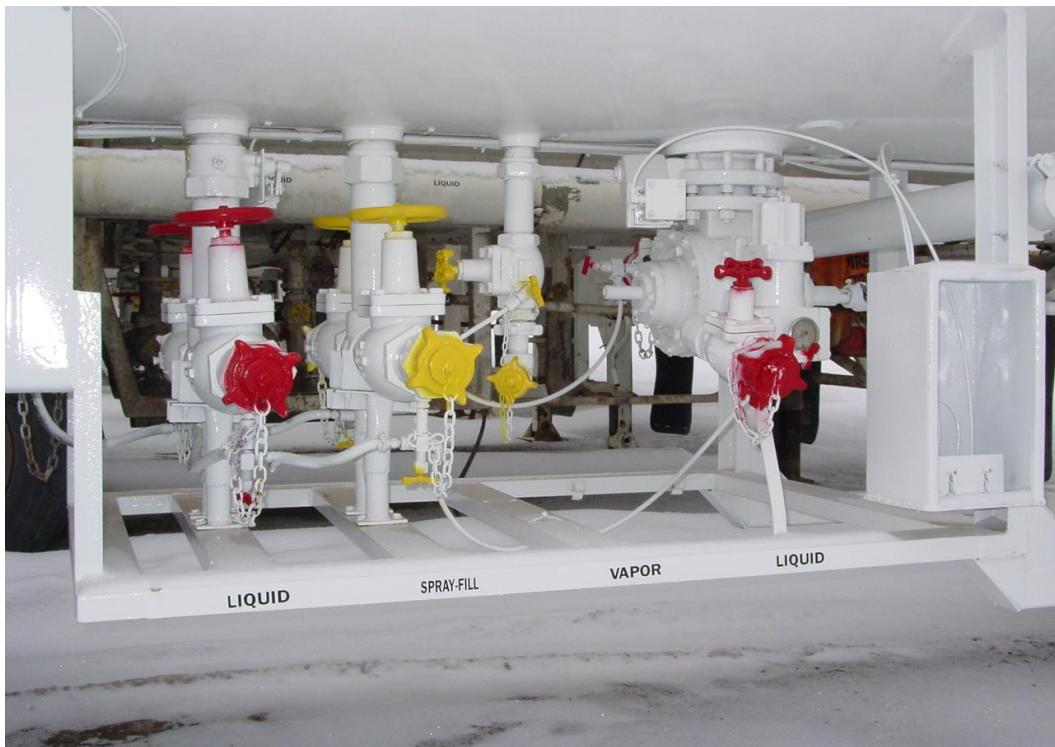
Vessels used to transport anhydrous ammonia have a variety of signage requirements. These include:

- ◆ Green (PANTONE 335) “UN1005” placards must be displayed, in good condition, and clearly visible, on all 4 sides of each means of containment (MoC or trailer).
- ◆ The words CAUTION AMMONIA or DANGER AMMONIA shown, in contrasting colour, on the sides and rear of the tank. ***Check your provincial regulations for jurisdictional markings.***



- ◆ In the United States, “INHALATION HAZARD” decals are required, on the two opposing long sides of the tank. The letters must be $\frac{1}{4}$ ” wide and 2” high.
- ◆ Tank inspection markings (PVIK) legibly marked in letters not less than 32 mm ($1 \frac{1}{4}$) high on the tank shell or jacket near the metal identification plate or anywhere on the front head where it will be clearly visible from the ground.
 - P – Pressure test (5 years)
 - V – External inspection (yearly)
 - I – Internal inspection (5 years)
 - K – Leakage test (yearly)

- ◆ All liquid and vapour valves must be properly colour-coded & labeled.
 - Liquid – safety orange
 - Vapour/spray fill – safety yellow



Labels and Placards

Class and Placard	Commonly Hauled Products	Hazards for this Class
Class 2.2, Non-flammable and Non-toxic Gases 	UN 1005 ANHYDROUS AMMONIA Shipped as 2.2(8); non-flammable gas (corrosive) when loading point is in Canada; Shipped as 2.3(2.2); poison gas (non-flammable) when loading point in the USA Placard according to shipping document.	BLEVE (<i>Boiling Liquid Expanding Vapour Explosions</i>) Asphyxiation Irritation Container rocketing Explosion Corrosiveness Container rupture Frostbite

When to display placards

A person must not load dangerous goods into a trailer (MoC) for transport unless, immediately before the loading, the trailer (MoC) has displayed on it the dangerous goods placards that will be required when the loading is complete.

The bulk carrier of dangerous goods must:

- ◆ Display the required dangerous goods placards on the trailer (MoC), and ensure that the placards remain displayed while the dangerous goods are in transport; and
- ◆ Provide and display, or remove, the dangerous goods placards if the requirements for dangerous goods placards change while the dangerous goods are in transport.

Placard Locations

A UN number must be displayed with the dangerous goods placard on each trailer (MoC). The number is most often displayed within a white rectangle located on the primary class placard for the dangerous goods. It must not obscure the symbol, class number, or text on the placard.



Dangerous goods placards must remain displayed on a trailer (MoC) until the trailer has been purged and cleaned so that there is no longer a danger present. The person who purges and cleans the trailer must cover or remove the placards when there is no longer a danger present.

TRUCK/TRAILER TRANSPORT REQUIREMENTS

All trucks used to transport anhydrous ammonia must follow, in Canada, the TC331 specifications, and in the US the equivalent MC331 specifications.

All trucks must have a current and valid Motor Vehicle Inspection safety certificate and all drivers must hold a valid commercial driver's license. Trucks must be equipped with:

- a minimum 5 lb fire extinguisher;
- 3 reflective triangles; and a
- First aid kit.

All tanks used to transport anhydrous ammonia must comply with government regulations (CSA B620 & B622). The upper 2/3rds of each vessel must be painted reflective white, while the colour of the remaining bottom 1/3rd is up to each company.

All trailers with a total width of 80" or more and 10,000 pounds or more Gross Vehicle Weight require 2-inch reflective strips between 15 to 60 inches from the ground level at the following areas of tank/trailer assembly:

- ◆ Sides – red/white strips along at least half of the overall length. The strip does not need to be continuous, as long as the spaces are distributed as evenly as possible.
- ◆ Upper rear corners – two pairs of 300mm long (12") white strips applied horizontally and vertically to the right and left upper contours of the body.
- ◆ Lower rear – strip of sheeting with alternating red & white colours across the full width of the trailer.



- ◆ Be sure to check provincial requirements regarding decaling (and current US Regulations for cross-border loads), as well as company-specific requirements for more hardware specifications.

WHMIS INFORMATION

The *Workplace Hazardous Materials Information System*, or **WHMIS**, is a separate Act from the *TDG Act*. It is administered under the Federal Hazardous Products Act and the Controlled Products Regulations, Provincial Occupational Health and Safety (OHS) Acts and Regulations. **THIS COURSE DOES NOT QUALIFY AS WHMIS TRAINING.** The information included here is to provide a general understanding of what *WHMIS* means.

WHMIS provides information about the hazards and characteristics of various products found at the work site, including anhydrous ammonia. It is referred to as *The Workers Right to Know Act*.

All manufacturers/shippers of a controlled product must supply a current Material Safety Data Sheet (MSDS). It contains product information, first aid measures, hazardous ingredients, physical data, fire and explosive data, reactivity data, toxicological properties, preventative measures, and preparation information.

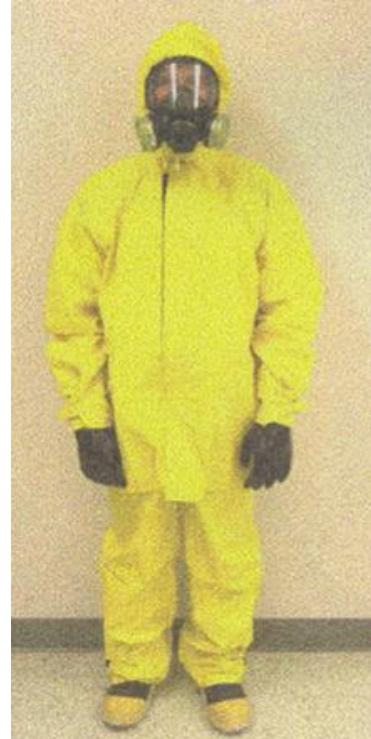
PERSONAL PROTECTIVE EQUIPMENT

Since anhydrous ammonia is corrosive to human lungs, eyes and skin, and will attack any exposed areas, it is important to wear proper personal protective equipment (PPE) when working around this product. Accidents do happen, but injuries can be minimized if proper equipment is worn.



People handling ammonia must wear:

- ◆ A full-face respirator with approved ammonia cartridges. They must be fit-tested to ensure a proper seal, as everyone's face-shape is different. Men must also be clean-shaven at the respirator seal outline to make sure that it fits snugly on the face. Prescription glasses can be fit to the respirator for those requiring glasses.



- ◆ The industry recommendation is 1 or 2 piece Class C ammonia resistant chemical suit.
- ◆ Fourteen-inch minimum gauntlet-style ammonia resistant gloves. The gloves should have the cuff rolled forward to prevent liquid anhydrous ammonia from running down onto a person's arms.



- ◆ Always wear a CSA approved safety-toe boot, with a minimum 6" upper (leather or rubber).
- ◆ A personal sized water bottle full of clean, fresh water.

Some companies request hard hats at their locations. Make sure that you are familiar with the loading and unloading PPE requirements for each location.

Never wear contact lenses when working around anhydrous ammonia. In the event of a product release, ammonia could get trapped behind the lens onto the eye, and would be impossible to remove.

PRE-TRIP INSPECTIONS

All drivers must complete a pre-trip inspection once in every 24-hour period, or every time they change equipment (tractor or trailer). For the mechanical portion, each company's driver logbook outlines the requirements set by the provincial transport guidelines or Transport Canada.



Bulk carriers must meet all National Safety Code (NSC) requirements (these may be obtained from Transport Canada or the provincial motor carrier office).

All drivers hauling anhydrous ammonia must also:

- ◆ Have all their required personal protective equipment;
- ◆ Ensure that the personal water bottle is available;
- ◆ Do a visual inspection of the hoses to check that they are secure;
- ◆ Do a visual check that there are no defects, bulges, or exposed wire braid on hoses (do not use hoses with any defects);
- ◆ Ensure hoses are properly marked or tagged with the annual pressure testing date or reference number;
- ◆ Do a visual check of the valves to make sure that they are closed & caps are replaced;
- ◆ Visual check of trailer (MoC) labeling/marking/placarding;
- ◆ Visually check the unloading equipment (pumps, compressors & jackshafts);
- ◆ Verify that there are no leaks (valve frosting, audible leaks);
- ◆ Check the operation of the remote cable for emergency release valves;
- ◆ Make sure that there are spare gaskets;
- ◆ Have a spanner wrench or hammer (brass);
- ◆ Check the percentage of product in the tank;
- ◆ Make sure that all gauges are in working condition;
- ◆ Make sure all safety water containers are filled with a minimum supply of 20 litres of clean, fresh water.

PRODUCT LOADING PROCEDURES

1. Obtain order number from dispatch.
2. Identify US, primary, secondary or road ban weight restrictions.
3. Check empty weight.
4. Advise dispatch of any retained product.
5. It is the responsibility of the driver to load to the legal capacity of the trailer and/or the legal weight of the route to be travelled. Be sure to get weights from your dispatch in all cases.
6. Follow all plant regulations and procedures.
7. Complete circle check of trailer before leaving loading station.
8. Check tank percentage gauge to ensure 85% fill has not been exceeded.
9. Complete and confirm all documentation including log book.
10. Obtain US Customs documents when applicable.
11. Before leaving the plant site, call the customer with your expected time of arrival to confirm delivery.
12. Call dispatch regarding any changes to the delivery, required rest or delays en route.
13. Loading procedures will vary for each terminal, so be sure that you are familiar with their requirements.

DELIVERY PROCEDURES

Accessing the Receiving Terminal

Conduct a visual inspection of the delivery hose deployed during each unloading operation. Rejection criteria include exposed reinforcement; permanently deformed wire braid reinforcement; soft spots (hose not under pressure); bulging (hose under pressure); loose outer covering; damaged, split or worn couplings and loose, missing or severely corroded bolts.

Prior to delivery, check the site for unsafe conditions, including any leaks. Do unload if the rejection criteria have been met. Call dispatch for instructions in this situation. Check that:

1. Access to site is wide and clear with firm ground.
2. Check wind direction upon entry to site.
3. Emergency water supply is clean and accessible.
4. Emergency phone numbers are provided.

5. Off load hoses, fittings and gaskets are in good repair.
6. Off load lines are well supported and have no visible leaks.
7. Remote trip cables for internal safety control valves are installed and visible.
8. Gauges are accessible, visible, in good repair and function properly.
9. Maximum safe fill capacity of storage tanks and trailers is 85%. Do not exceed this amount.

Nominal Tank Capacity		Tank Capacity at 85% Fill		Tank % Increase per Tonne Delivered
USG	Tonnes	USG	Tonnes	
60 000	142.2	51 000	120.9	0.7
42 000	99.5	35 700	84.6	1.0
30 000	71.1	25 500	60.4	1.4
18 000	42.7	15 300	36.3	2.3
12 000	28.4	10 200	24.2	3.5

10. Tank % per tonne X weight of your load = % your load will increase the tank volume.

Example: Calculations for a 22.5 Tonne load delivered into a 30,000 USG Tank

$$1.4 \times 22.5 \text{ tonnes} = 31.5\%$$

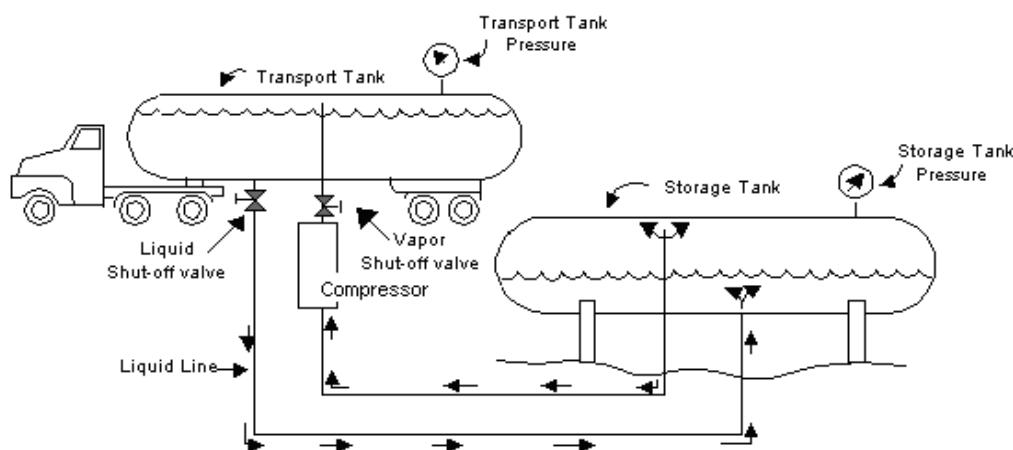
Add 31.5% to the tank beginning percentage to calculate the end percentage.

11. The driver must always be aware of where the remote shutoff controls are located and how to operate them in the event of an emergency. When pumping is finished, make a habit of occasionally closing the internal safety control valve from the remote closure point to check that the control actually works.
12. The driver attending the unloading operation must be alert and remain upwind and within 25 ft. of the cargo tank. The driver must have an unobstructed view of cargo tank and delivery hose to the maximum extent possible, except for short periods when the driver must activate controls or monitor the receiving tank as necessary.

UNLOADING PROCEDURES

There are four unloading procedures outlined in this section: compressor unloading of trailers (individually), compressor unloading of pup and lead in series, pump unloading of trailers (individually), and pump unloading of pup and lead in series. Each bulk carrier should be familiar with the unloading procedures for their specific equipment.

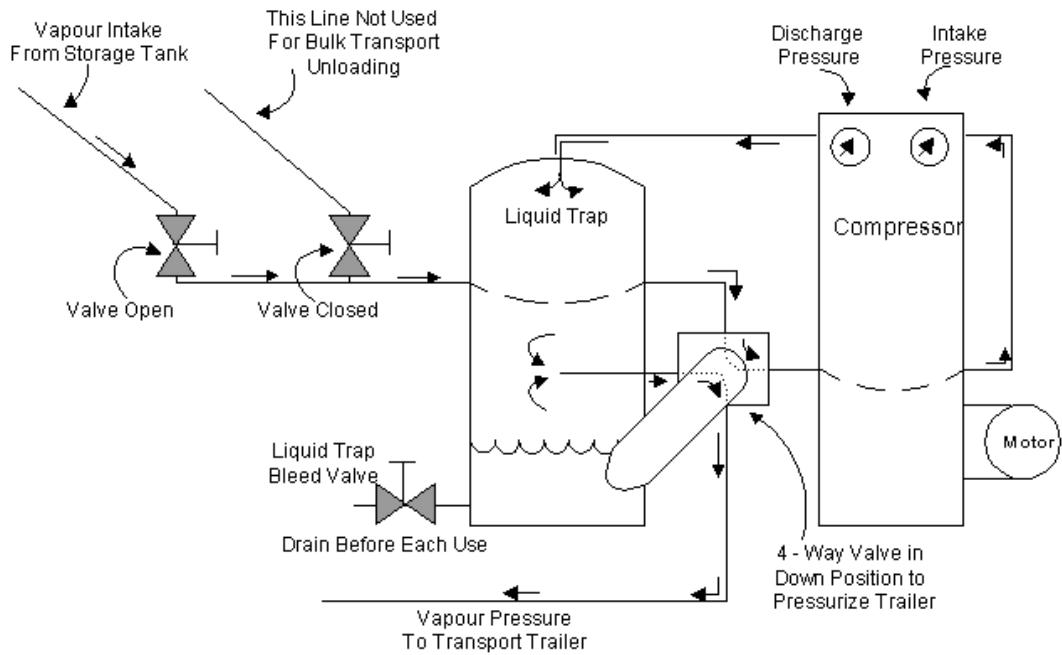
Compressor Unloading of Trailers (individually):



If you are unloading train units, complete the steps for the pup trailer first, and then repeat the steps for the lead trailer.

1. Check the wind direction and identify an emergency evacuation route, should the need for one arise.
2. Put on personal protective equipment.
3. Check for: **correct delivery site; good site access; clean emergency water source; storage tank percent gauge and storage tank temperature & pressure.**
Record storage tank percentage and time of arrival on Bill of Lading.
4. Position unit; check hose layout; chock wheels and connect jackshaft if applicable.
5. Compressor set-up:
 - a. Check and drain liquid trap
 - b. Check oil level
 - c. Check and adjust position of directional flow valve to neutral or bypass position.





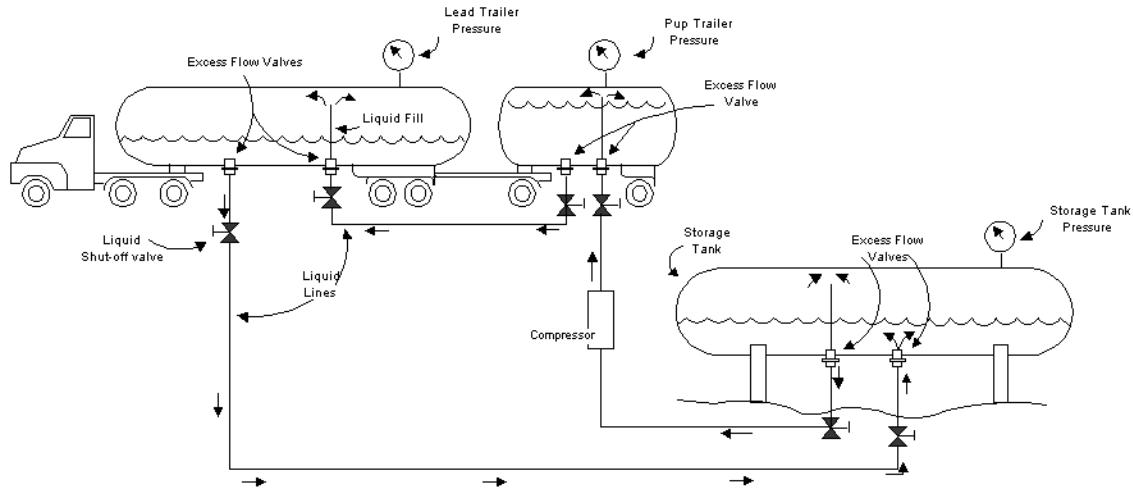
6. Connect vapour hoses from:
 - a. Customer tank to compressor inlet
 - b. Compressor outlet to transport unit
7. Open the trailer and the customer internal safety control valve for vapour line.
8. Open the vapour line valves.
9. Connect liquid line from customer storage to the trailer.
10. Slowly open trailer and customer internal safety control valve for liquid line.
11. Slowly open liquid line valves starting from customer storage tank to trailer.
12. Check compressor inlet and outlet pressure gauges to ensure that all lines are open.
13. Start compressor in neutral or bypass position. Then move the flow valve to offload position.
14. Check compressor pressure gauges – the differential pressure should be 10 to 15 psi (higher on the outlet side).
15. Confirm product flow by checking:
 - a. Flow gauge
 - b. Tank percentage gauge or rotary gauge
16. Stand upwind, and within 8 metres (25 feet) of an emergency shut-off and monitor the product transfer.



17. Confirm empty trailer by checking:
 - a. Flow gauge
 - b. Tank percentage gauge or rotary gauge
 18. Stop compressor and return flow valve to neutral or bypass position.
 19. Close the internal safety control valve & liquid line valve on the trailers and on the customer tank.
 20. Close customer liquid line valve closest to trailer then remaining liquid line valves.
 21. Close the internal safety control valve and then all vapour line valves.
 22. Bleed vapour lines; disconnect; store and cap fittings. Close the bleed valve.
 23. Bleed liquid lines; disconnect; store and cap fittings. Close the bleed valve.
- (Repeat steps 6 through 23 to unload lead trailer.)*
24. Remove jackshaft, if applicable.
 25. Leave a signed copy of the shippers manifest with the customer.
 26. Record “Residue Last Contained” on the carrier’s copy of the shippers manifest.
 27. Record time; tank percentage; if a customer was loading product while the transport truck was unloading; and update logbook.
 28. Prior to re-entering the vehicle, complete a safety walk-around ensuring that all equipment is safely stored and the vehicle is ready for travel.
 29. Store all personal protective equipment.
 30. Call dispatch for next destination or further instructions.



Compressor Unloading of Pup and Lead Trailers Connected in Series:

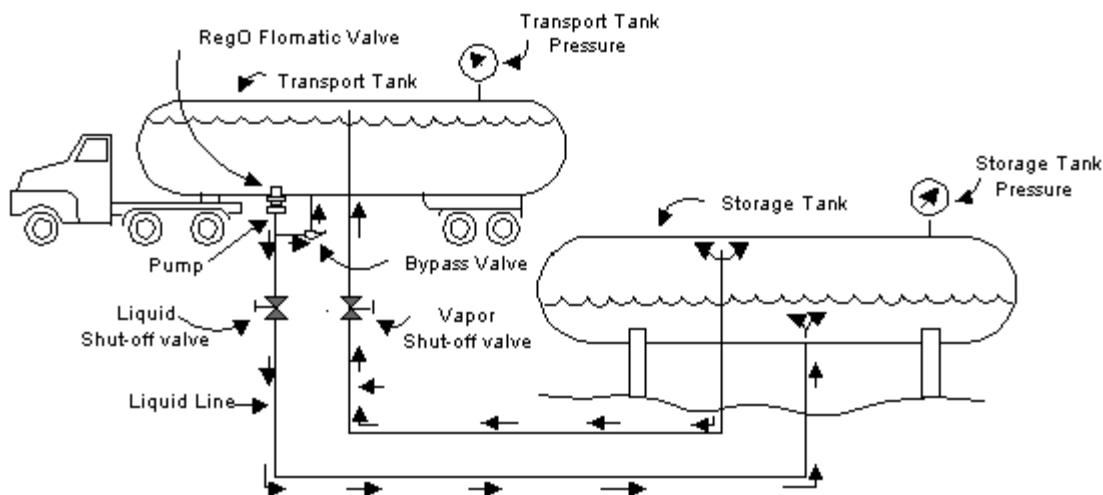


This procedure uses vapour pressure to transfer product from the pup to the lead trailer and then into storage.

1. Check wind direction and identify an emergency evacuation route, should the need for one arise.
2. Put on personal protective equipment.
3. Check for: **correct delivery site; good site access; clean emergency water source; storage tank percent gauge and storage tank temperature & pressure.** Record storage tank percentage and time of arrival on Bill of Lading.
4. Position unit; check hose layout; chock wheels and connect jackshaft if applicable.
5. Compressor set-up:
 - a. Check and drain liquid trap
 - b. Check oil level
 - c. Check and adjust position of directional flow valve to neutral or bypass position
6. Connect vapour hoses from:
 - a. Customer tank to compressor inlet
 - b. Compressor outlet to pup trailer
7. Open vapour line valves.
8. Connect liquid line from customer storage to lead trailer.
9. Connect liquid line from pup to spray-fill on lead trailer.
10. Slowly open trailer internal safety control valve for liquid line.
11. Slowly open spray-fill/liquid line valves starting from customer storage tank to trailer.

12. Open internal safety control flow valve and liquid line valve on pup trailer.
13. Open spray-fill/liquid valve on lead trailer.
14. Check compressor inlet and outlet pressure gauges to ensure that all lines are open.
15. Start compressor in neutral or bypass position. Then move flow valve to off load position.
16. Check compressor pressure gauges. Differential pressures should be 10 to 15 psi (higher on the outlet side).
17. Confirm product flow between the pup and lead trailers by checking the percentage gauge or rotary gauge.
18. Confirm product flow between the lead trailer and customer tank by flow indicator and tank percentage gauge.
19. Stand upwind, and within 8 metres (25 feet), of an emergency shut-off and monitor the product transfer.
20. Confirm empty trailer by checking:
 - a. Flow indicator
 - b. Tank percentage gauge or rotary gauge
21. Stop compressor and return flow valve to neutral or bypass position.
22. Close internal safety control valve & liquid line valve on trailers.
23. Close customer liquid line valve closest to trailer then remaining liquid line valves.
24. Bleed liquid lines; disconnect; store and cap fittings. Close liquid bleed valves.
25. Close pup liquid line and lead spray-fill valve, and bleed the line. Close the bleed valve.
26. Close the internal safety control valve and then all vapour line valves.
27. Bleed the vapour lines; disconnect; store and cap fittings. Close vapour bleed valves.
28. Remove jackshaft, if applicable.
29. Leave a signed copy of the shippers manifest with the customer.
30. Record time; tank percentage; if a customer was loading product while the transport truck was unloading; and update logbook.
31. Record “Residue Last Contained” on the carrier’s copy of the shippers manifest.
32. Prior to re-entering the vehicle, complete a safety walk-around ensuring that all equipment is safely stored and the vehicle is ready for travel.
33. Store all personal protective equipment.
34. Call dispatch for next destination or further instructions.

Pump Unloading of Trailers (individually):

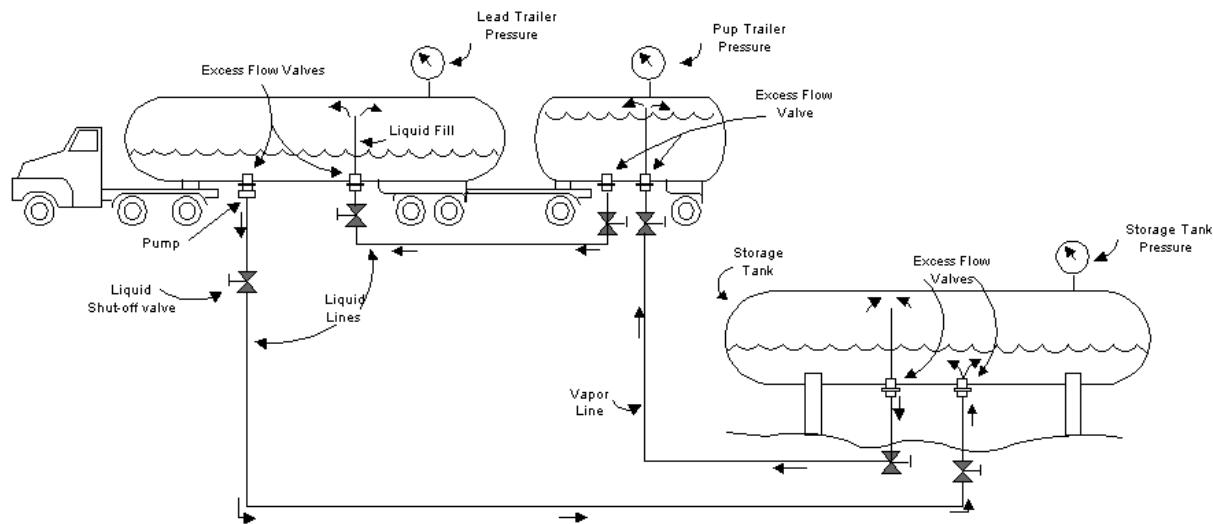


If train units are being unloaded, complete the steps for the pup trailer first, and then repeat the steps for the lead trailer. This procedure can be used to unload a pup trailer where the piping allows direct connection of the pup off-load line to lead trailer pump.

1. Check wind direction and identify an emergency evacuation route, should the need for one arise.
2. Put on personal protective equipment.
3. Check for: **correct delivery site; good site access; clean emergency water source; storage tank percent gauge and storage tank temperature & pressure.** Record storage tank percentage and time of arrival on Bill of Lading.
4. Position unit; check hose layout; chock wheels and connect jackshaft if applicable.
5. Connect vapour hoses from storage tank to trailer.
6. Open trailer and customer vapour line valves.
7. Connect liquid line from the pump to the storage tank.
8. Slowly open trailer and customer internal safety control valve for liquid line.
9. Slowly open liquid line valves starting from customer storage tank to trailer.
10. Start the pump at an idle speed and check product flow.
11. Confirm product flow by checking:
 - a. Flow indicator
 - b. Tank percentage gauge or rotary gauge
12. Increase the pump to operating speed.
13. Stand upwind, and within 8 metres (25 feet) of an emergency shut-off to monitor the product transfer.

14. Confirm empty trailer by checking:
 - a. Flow indicator
 - b. Tank percentage gauge or rotary gauge
15. Stop the pump when the product transfer is complete.
16. Close internal safety control valve.
17. Close customer liquid line valve closest to trailer then remaining liquid line valves.
18. Close the internal safety control valve and then all vapour line valves.
19. Bleed the vapour lines; disconnect; store and cap fittings. Close the bleed valve.
20. Bleed liquid lines; disconnect; store and cap fittings. Close the bleed valve.
(Repeat steps 6 through 20 to unload lead trailer.)
21. Remove jackshaft, if applicable.
22. Leave a signed copy of the shippers manifest with the customer.
23. Record time; tank percentage; if a customer was loading product while the transport truck was unloading; and update logbook.
24. Record “Residue Last Contained” on the carrier’s copy of the shippers manifest.
25. Prior to re-entering the vehicle, complete a safety walk-around ensuring that all equipment is safely stored and the vehicle is ready for travel.
26. Store all personal protective equipment.
27. Call dispatch for next destination or further instructions.

Pump Unloading of Pup and Lead in Series:



This procedure is used to off load a train unit by transferring product from pup to lead and then into storage.

1. Check wind direction and identify an emergency evacuation route, should the need for one arise.
2. Put on personal protective equipment.
3. Check for: **correct delivery site; good site access; clean emergency water source; storage tank percent gauge and storage tank temperature & pressure.** Record storage tank percentage and time of arrival on Bill of Lading.
4. Position unit; check hose layout; chock wheels and connect jackshaft.
5. Connect vapour lines from storage tank to pup trailer.
6. Open vapour line valves.
7. Connect pup liquid line to lead trailer spray fill/liquid line.
8. Open liquid line internal safety control valve, spray-fill/liquid line valve on pup trailer and open spray-fill/liquid valve on lead trailer.
9. Confirm product flow between the pup and lead trailers by checking the percentage gauge or rotary gauge.
10. Connect liquid line from pump on lead trailer to storage.
11. Slowly open trailer and customer internal safety control valves for liquid line.
12. Slowly open liquid line valves starting from customer storage tank to trailer.

13. Start the pump at an idle speed and check product flow.
14. Confirm product flow from the trailer to customer tank by checking:
 - a. Flow indicator
 - b. Tank percentage gauge or rotary gauge
15. Increase pump to operating speed.
16. Stand upwind, and within 8 metres (25 feet) of an emergency shut-off and monitor product transfer.
17. Confirm empty trailer by checking:
 - a. Flow indicator
 - b. Tank percentage gauge or rotary gauge
18. Stop the pump when product transfer is complete.
19. Close internal safety control valve on the lead trailer.
20. Close customer liquid line valve closest to trailer then remaining liquid line valves.
21. Close the liquid line between the spray-fill/liquid on the lead trailer and the pup liquid valve. Bleed the line.
22. Close the internal safety control valve and then all vapour line valves.
23. Bleed the vapour lines; disconnect; store and cap fittings. Close the bleed valve.
24. Bleed liquid lines; disconnect; store and cap fittings. Close the bleed valve.
25. Remove the jackshaft, if applicable.
26. Leave a signed copy of the shippers manifest with the customer.
27. Record time; tank percentage; if a customer was loading product while the transport truck was unloading; and update logbook.
28. Record “Residue Last Contained” on the carrier’s copy of the shippers manifest.
29. Prior to re-entering the vehicle, complete safety walk-around ensuring that all equipment is safely stored and the vehicle is ready for travel.
30. Store all personal protective equipment.
31. Call dispatch for next destination or further instructions.

MANAGING PRESSURE DIFFERENTIALS

Always remember that ammonia will flow from the tank with the higher pressure to the tank with the lower pressure. This means that the tank to be filled must have a lower pressure than the one being emptied. This is called a *normal or forward flow condition*. If the tank to be filled has a greater pressure, is in a *reverse flow* position, since the flow would be in the opposite, or reverse, direction. If the pressures are equal, there is a *neutral or no-flow condition*.

Before beginning any transfer, ensure that all the hoses are properly connected (vapour hoses to vapour lines and liquid hoses to liquid lines).

Then, look at the pressure gauges. If the pressure in the transport unit is higher than the pressure in the storage vessel, you can manage this pressure differential to make the product transfer more efficient.

At this time, do not open any vapour valves. Proceed as follows:

- ◆ Open the transport and customer liquid internal safety control valves **very** slowly.
- ◆ Open the transport and customer liquid valves **very** slowly.
- ◆ Once the liquid starts flowing, monitor vapour pressures in both the transport trailer and the customer storage vessel, and start the pump.
- ◆ When the vapour pressures equalize, open all vapour lines and continue with unloading procedures.

DELIVERY TO UNATTENDED NH₃ STORAGE TANKS

The purpose of this section is to address the issue of delivering product to an anhydrous ammonia storage facility that is not attended by a site operator.

In this context, "unattended" means that although the site operator may be present, he or she has not elected to participate directly and *the delivery is under full control of the carrier driver*.

Drivers should have access to a communication device when working alone.

Be sure to check with the company's specific requirements prior to delivering to their sites.

General guidelines to follow:

Upon arrival at the delivery site, the driver will:

1. Unlock the gate.
2. Check the wind direction upon entering the site, prior to parking the unit.
3. Check the mailbox for delivery documents and instructions.

4. The driver should always double-check information on the Unattended Delivery document, dispatch instructions and Bill of Lading.
5. Check for adequate water supply.
6. If a discrepancy is discovered between the load and the delivery instructions (i.e., NH₃ Unattended Delivery documents are missing or do not match delivery instructions, additional instructions from the site operator are in conflict), delay unloading until the discrepancy is resolved with the site operator. If this is not possible, contact the Carrier dispatch for further instructions (i.e., re-routing).
7. Put on all appropriate personal protective equipment.
8. Read the gauge and calculate the volume that the tank can hold. Record gauge readings and time on the NH₃ Unattended Delivery documents as well as on the Carrier's BOL. Tank capacity must be sufficient to accommodate the product based on the 85%-fill policy.
9. Now follow the appropriate unloading procedures to complete your delivery, as referenced in previous "Unloading Procedures" sections.

When the product is unloaded the driver will:

1. Take the gauge readings. Record both gauge readings and time on the NH₃ Unattended Delivery documents as well as on the shipper's manifest/Carrier's BOL. Record any nurse units that may be filling while unloading. Verify that the difference between opening and closing volumes correspond with the shipper's manifest/Carrier's BOL volumes.
2. Obtain a signature of any on-site personnel on the shipper's manifest/Carrier's BOL (if available).
3. Complete the "final check" of all documentation. Leave a copy of the shipper's manifest/Carrier's BOL and NH₃ Unattended Delivery documents with the on-site personnel, or leave it in the mailbox.
4. Prior to re-entering the vehicle, complete safety walk-around ensuring that all equipment is safely stored and the vehicle is ready for travel.
5. Leave the unloading area slowly. Whenever feasible, move the truck in a forward direction and avoid reversing if at all possible.
6. Lock delivery site gate, if applicable.

The best practice in the industry is to use an Anhydrous Ammonia Unattended Delivery Document when delivering to unattended sites. The next page has a sample of an NH₃ unattended delivery document.

NH₃ Unattended Delivery Document	
Sales Associate Section	Date
Location	Maximum tank percentage allowed to start unload
Special Delivery Instructions	
Sales Associate Signature (Before Delivery)	

Driver Section	Date of Delivery
Order Number	Amount of Product Loaded
Arrival Time	Departure Time
Start Gauge Reading	Finish Gauge Reading
Number of Nurse Trucks Loading	Bill of Lading Number
Driver Name	Unit Numbers
Driver Signature	

White Copy to Carrier

Yellow Copy to Agent

FIRST AID

Water is the only first aid measure in the event of an ammonia burn. Make sure there is enough clean fresh water at all times when loading and unloading.



The instant that anhydrous ammonia comes in contact with skin, a person's first reaction *must* be to get to water quickly. Due to the freezing action of ammonia, clothing could be frozen to a person's skin – flush with water *before* removing any clothing. If possible, apply a wet towel to a burn while seeking medical attention.

Human eyes are made up of about 85% water. The slightest hint of anhydrous ammonia in an eye requires *immediate* flushing with water. Flush eyes for a minimum of 15 minutes while holding the eyelids open and away from the eye.

DO NOT use any lotions, salves, or creams. They will form a barrier that could trap ammonia onto the burn, potentially causing more damage.

High concentrations of anhydrous ammonia can quickly restrict breathing. To get away from a vapour cloud, immediately move upwind and perpendicular to the vapour cloud. Prompt medical attention is required for cases of ammonia inhalation.

Do not induce vomiting. However, if a person is vomiting, make sure that their head is below their waistline to prevent liquid from getting into the lungs. A conscious person that has ingested ammonia should drink lots of water or juice to dilute the ammonia.

Do not use mouth-to-mouth to resuscitate a person if they have ingested or inhaled anhydrous ammonia. Alert medical personnel of the victim's situation immediately. It is always beneficial to have first aid training.

A person should never work around anhydrous ammonia while are on medication that affects concentration, ability to perform duties, or respond to an emergency.

Handling emergencies safely is a matter of pre-planning and training.

FIRST RESPONSE FOR EMERGENCIES

When an emergency occurs, take immediate action to protect yourself and others.

This includes:

- ◆ Notifying the branch office or dispatcher. The dispatcher can call the shipper and/or receiver and, if necessary, get help by calling the local police or emergency services;
- ◆ Checking for injured people and moving them from the accident scene if safe to do so;
- ◆ Using the emergency shutoff to stop product flow, if safe to do so;
- ◆ Eliminating any sources of ignition, if safe to do so;
- ◆ Assisting and cooperating with authorities.

Do not make statements about the probable cause or events of the incident to anyone except a company assigned investigator or a company approved insurance adjuster.

Canada to US Emergency Response

Transporting anhydrous ammonia to the United States, a bulk carrier must be aware of the US regulations as well. The bulk carrier has the prime responsibility for shipments to the US. Emergencies or incidents must be reported to the National Response Center (1-800-424-8802). Please refer to CFR-49 for more information.

INCIDENT REPORTING

Depending upon the nature of the incident, or the amount of damage involved, a report may have to be made to the local police services and to the insurance company.

In the event of an emergency or accident, carriers must call the shipper's 24-hour emergency number, which is located on the Bill of Lading.

Contact dispatch or the trucking company's safety representative to activate the shipper's Emergency Response Assistance Plan (ERAP).

Have a witness, bystander or next party on scene to call 911 for emergency assistance.

Avoid leaving the scene unattended and stay upwind from the incident.

All follow up reporting must be in compliance with Part 8 requirements of the TDG Clear Language Regulations.

Information to provide to dispatch:

- ◆ Driver name, equipment unit number, and a callback telephone number;

- ◆ Date, time & location of the occurrence;
- ◆ Injuries;
- ◆ Product involved (anhydrous ammonia);
- ◆ Shipping document details (destination, quantity);
- ◆ Weather – such as wind direction, overcast or clear, etc.;
- ◆ Urban or rural;
- ◆ Type of terrain;
- ◆ Location or proximity of any waterway, sewer, drain, or ditch;
- ◆ Type of occurrence (spill, leak, fire, or collision);
- ◆ Identify if any emergency personnel have been called, or if they are already at the scene.

Reporting Property Damages

Damages to the property of others caused by an employee during the course of his or her workday must be reported to the employee's Dispatcher or Safety Supervisor before leaving the scene.

In the event of an incident, documentation is very important. The best practice is to carry a disposable camera in the truck at all times, and to take photos of the scene/incident for records.

On Scene Photography

If a transport unit is involved in a collision, and if safe to do so, the following photographs should be taken before the vehicles are moved:

- ◆ At a point back from the accident that shows what each driver would have been able to see as he approached the point of collision.
- ◆ Any traffic sign, signal, or lane markings along the path of travel for either vehicle.
- ◆ A general overview of the scene.
- ◆ Skid marks and debris in the area of impact.
- ◆ The final resting place after impact.
- ◆ Damage to the vehicle(s).
- ◆ The license plate of each vehicle involved.
- ◆ The setup and location of product transfer equipment that was in use at the time of a spill.
- ◆ The area of ground covered by spilled product.

Reporting Personal Injuries

Drivers injured in the course of employment may be obliged to report injuries to their employer and should follow their employer's procedures to do so. When appropriate due to the type or extent of injury, and as soon as possible following the injury, the employee shall report for a scheduled appointment with the company physician to have the injury examined.

TDG Reportable Release Quantity

In the event of a release of any quantity that could pose a danger, or a sustained release of anhydrous ammonia of 10 minutes or more, from a means of containment, an immediate report of the accidental release is required.

Roadway breakdown:

- If it becomes necessary to park on a roadway because of an emergency or breakdown, move the vehicle as far over to the side as possible without risking the collapse of the shoulder of the road.
- All vehicles must be equipped with reflector triangles, as per the Commercial Vehicle Safety Alliance (CVSA). These reflector triangles must be used for emergency parking on a roadway. Set out 3 reflector triangles; 10 paces ahead, 20 paces behind and 40 paces behind the unit if breakdown occurs while on the road.

Any personal injury; loss or damage to equipment or property; vehicle breakdown; product contamination; leak or spill, regardless of the severity, must be reported to the Safety Supervisor or Dispatcher as soon as it is safe to do so.

The following is a sample of an incident reporting form and time log. Carry a copy in each truck to complete in the event of an incident.

INITIAL INCIDENT REPORTING FORM

Incident reported by:		Call Back #		
Identify terrain and location by: city/town, highway #, street address or other landmark				
Incident occurred at: Time:		Date:		
Describe type of injury and give name of treatment facility: N/A <input type="checkbox"/>				
Name:		Name:		
Injury:		Injury:		
Treat:		Treat:		
Describe the Incident:	Equip. Damage <input type="checkbox"/>	Fire/Explosion <input type="checkbox"/>	Injury/ Med Emergency <input type="checkbox"/>	MVA <input type="checkbox"/>
	Property Damage <input type="checkbox"/>	Spill/Mix <input type="checkbox"/>	No Contact <input type="checkbox"/>	Threat <input type="checkbox"/>
Identify personnel and equipment:				
Name:		Name:		
Unit #:		Unit #:		
Trailer #:		Trailer #:		
Trailer #:		Trailer #:		
Emergency Services Required:	Police <input type="checkbox"/> contacted by:			
	Fire <input type="checkbox"/> contacted by:			
	Ambulance <input type="checkbox"/> contacted by:			
	Towing <input type="checkbox"/> contacted by:			
Report received by:	Time:	Date:		
Remind Driver to:	Alert others. Attend to injured. Eliminate sources of ignition. Contain cargo if possible. Isolate the area or set out hazard reflectors.		Get name and address of witness. Complete accident report. Photograph scene. Do not make comments about the accident.	

TIME AND EVENT LOG

Name: _____ Page No. _____

Page No. _____

SECURITY MEASURES

Due to the theft of ammonia, heightened awareness of security issues is crucial. Any suspicious activities should be reported immediately. If there is a suspicious vehicle or person in the proximity of the truck/vessel, do not approach! If possible, take a license plate number of the suspicious vehicle, or a description of the person, and call the police.

General security guidelines

- ◆ Transport vessels containing anhydrous ammonia, or residue, should be stored in a fenced compound.
- ◆ Check that locks and other protective measures are operational and adequate.
- ◆ Carefully scrutinize uncommon, obscure, or isolated delivery points.
- ◆ Follow dangerous goods routes when transporting anhydrous ammonia.
- ◆ Drivers must lock their vehicle whenever it is left unattended. All efforts should be made to deliver dangerous goods without delay.
- ◆ Don't leave the load unattended for long periods of time. Conduct a walk-around inspection of the vehicle if it has been left unattended.
- ◆ If possible, equip trucks with satellite tracking systems to monitor vehicle movement.
- ◆ Make frequent checks of the kingpin to ensure the load is secure.
- ◆ Park the truck and trailer in an area that reduces the risk of tampering.
- ◆ Always look out for suspicious activity and individuals in the course of operation.
- ◆ Use a system to identify unauthorized access to valves. Secure all valves to deter unauthorized access.

MATERIAL SAFETY DATA SHEET

1. 1. PRODUCT AND COMPANY INFORMATION

Manufacturer: ABC Fertilizer Co.

Business Phone No.: (204) 444-2222

Fax. No.: (204) 444-2224

Emergency Phone No.: (204) 444-1111

Address: 123 Street A, ABCville, MB, R2R 2R2

Product Name: Anhydrous Ammonia

Product Use: Agricultural Fertilizer

Chemical Formula: NH₃

2. COMPOSITION/ INFORMATION on INGREDIENTS

Chemical Name	CAS #	WT%	LD ₅₀ (species, route)	LC ₅₀ (species, route)
Ammonia	7664-41-7	99.5 – 99.8	350mg/Kg (rat, oral)	3670 ppm (3496 mg/m ³)/ 4Hr (rat, inhalation)
Water	7732-18-5	0.2 – 0.5		

3. HAZARDS IDENTIFICATION

Emergency Overview

Ammonia is very corrosive to human tissue reacting with body moisture on contact.

It can promote algae growth in waterways and is toxic to fish.
Under fire conditions, it can decompose to yield toxic gases.

Reacts violently with acids to release heat.

Dissolves readily in water evolving a lot of heat.

Intimate contact with chlorinated compounds can result in explosion.

Primary Routes of Entry: Ingestion, Inhalation, Skin Contact, Eye Contact

Short Term Exposure (Acute)

Ingestion: Liquid ammonia causes severe irritation or ulceration of the mouth, throat and digestive tract resulting in nausea, vomiting, diarrhea, and in severe cases, collapse, shock and death.

Long Term Exposure (Chronic)

Not Applicable

Inhalation: Gas is very irritating to mucous membranes of the nose, throat, and lungs. High concentrations (5,000 ppm) may cause sudden death.

Desensitization to irritating effects

Skin Absorption: Not Applicable.

Not Applicable

Skin Contact: Liquid, or high concentrations of vapour ammonia produces very severe skin burns on contact.

Not Applicable

Eye Contact: Exposure to high gas concentrations may cause temporary blindness and sever eye damage. Direct contact of the eyes with liquid ammonia will produce serious eye burns. Excessive exposure to gas or liquid ammonia may result in permanent blindness.

Desensitization to irritating effects

4. FIRST AID MEASURES

Remove From Contaminated Area and Get Medical Help Immediately

Ingestion: If the patient is conscious, he should try to drink large quantities of water or weak acids such as dilute vinegar or citrus juice. NEVER GIVE FLUIDS OR INDUCE VOMITING IF PATIENT IS UNCONSCIOUS OR HAVING CONVULSIONS.

Inhalation: Immediately remove to fresh air. In severe exposures, if needed, apply artificial resuscitation. Take to a doctor immediately. Qualified persons may administer oxygen.

Skin: IMMEDIATELY REMOVE contaminated clothing, being careful not to tear the skin as clothing may be frozen to tissue. Promptly flush the skin with flowing water for at least 15 minutes, or completely immerse the affected area. Do not use salves or ointment on skin or mucous membrane burns for 24 hours. Treat as for thermal burns.

Eyes: Immediately flush with flowing water for at least 15 minutes with the eyelids held apart. No oil or other non-water soluble preparation should be placed into the eyes. TAKE TO A DOCTOR.

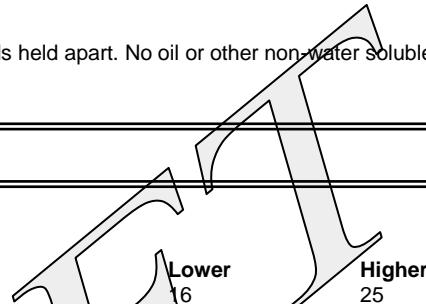
5. FIRE FIGHTING MEASURES

Flammability: Ammonia is combustible

Flash Point (Test Method): Not Applicable

Flammable Limits:
(% By Volume)

Autoignition Temperature: 651 °C; 1204 °F



Extinguishing Media: Water spray or fog type of streams (chemical or carbon dioxide on small fires only).

Special Fire Fighting Procedures: Stop flow of gas. Use water fog to keep fire-exposed containers cool and to protect persons effecting the shut-off. Wear self-contained breathing apparatus. Wear full protective clothing. Approach fires upwind and evacuate area downwind.

Unusual Fire and Explosion Hazards: The presence of oil or other combustible materials will increase the fire hazard. Ammonia is not readily ignited but a mixture of ammonia and air will explode when ignited under favourable conditions. Under fire conditions it can liberate toxic and explosive gases, ammonia, hydrogen, nitrogen, and oxides of nitrogen.

6. ACCIDENTAL RELEASE MEASURES

Steps to be taken in Case Material is Released or Spilled: Do not apply water onto a leaking vessel. Stop the flow of gas or liquid. Use water to protect persons effecting the shut off. Wear full protective clothing and self-contained breathing apparatus. Stay upwind. Dike liquid spills to contain liquid and cover pooled liquid with tarps etc. to control vapourization. Evacuate unprotected persons from the area immediately, or shelter in place. Eliminate sources of ignition in the vicinity of spills or released vapour. Water fog can be used to cleanse atmosphere of ammonia vapour. Contact manufacturer for assistance.

7. HANDLING AND STORAGE

Precautions to be taken: Avoid contact with incompatible materials (See Section 10). Protect container against physical damage. Outside or detached storage is preferred. Inside storage should be in a cool, dry, well ventilated, non-combustible location, away from all possible sources of ignition. Workers must be adequately trained in the handling and use of ammonia in accordance with government regulations.

8. EXPOSURE CONTROLS/PERSONAL PROTECTION

Ventilation: Local exhaust is essential. Intrinsically safe fans with mechanical ventilation are desirable.

Respiratory Protection: Wear approved respiratory protections such as a full-face ammonia canister/cartridge mask or an approved air-supplied respirator. Full-face canister or cartridge types must not be used at concentrations over 300 ppm.

Protective Clothing: Ammonia resistant gloves and boots, and a one or two piece full body ammonia resistant suit is required for normal handling. A vapour tight, fully encapsulating suit is required for emergency response, or for use in unknown exposure conditions.

Eye Protection: Additional eye protection is not required when full-face respiratory protection is used.

Other: Eyewash and/or safety showers must be available in the immediate area. Persons subject to ammonia exposure must not wear contact lenses.

9. PHYSICAL and CHEMICAL PROPERTIES

Physical State:	Gas or Liquid	Odour & Appearance: Colourless gas or liquid with extremely pungent odour.
Boiling Point:	-33.4°C; -28°F	Odour Threshold: 1-5 ppm
Freezing Point:	Not applicable	Vapor Pressure, mm Hg: 6612 @ 20° C; 68° F
Density:	Sp. Gr. 0.58 @ -33.4°C; -17°F	Vapour Density (air = 1): 0.6
pH:	11.6 (N/1 aqueous solution)	Evaporation Rate: Not Available
Solubility in Water:	Complete	Coefficient of Oil/Water Distribution: Not Available

10. STABILITY AND REACTIVITY

Stability (Normal Conditions): Stable	Conditions of Reactivity: Ammonia is an alkaline gas or liquid that will react violently with acids. Ammonia is readily absorbed in water with great evolution of heat.
Incompatibility (Materials to Avoid):	Contact with oxidizing gases, chlorine, bromine, iodine, and acids. Mercury, gold, silver oxide or hypochlorite can form explosive compounds. Copper, brass, bronze, sulphur, zinc and other alloys.
Hazardous Decomposition Products:	Combustion will yield nitrogen and water.

11. TOXICOLOGY INFORMATION

Exposure Limits: IDLH Level: 300 ppm; TLV-STEL 35 ppm for 15 min. exposure, TLV-TWA 25 ppm for 8 hour exposure.
Acute Oral Toxicity: LD50 (rat) is 14,200 mg/kg (ppm/w); not acutely toxic by oral exposure. (TFI Product Testing Results)
Acute Inhalation Toxicity: LC50 (rat, mouse) 4,230-19960 mg/m ³ ; acutely toxic by inhalation. (TFI Product Testing Results)
Carcinogenicity: Not listed by ACGIH, IARC, OSHA, NTP
Teratogenicity: Not listed by ACGIH, IARC, OSHA, NTP
Mutagenicity: Not listed by ACGIH, IARC, OSHA, NTP

12. ECOLOGICAL INFORMATION

Acute Aquatic Toxicity: 96-hour LC50 (fish) is 21.4-279 NH ₃ /L (0.09-3.51 mg of un-ionized NH ₃ /L). Slightly toxic to fish and aquatic life. Do not contaminate any body of water by direct application, cleaning of equipment or disposal. Since ammonia is a fertilizer, it promotes algae growth in waterways. Ammonia is neither persistent nor bio accumulative.
--

13. DISPOSAL CONSIDERATIONS

Waste Disposal Procedures: Disposal of spilled material should be in accordance with applicable local, provincial and federal environmental regulatory requirements.

14. TRANSPORT INFORMATION

Shipping name: Ammonia, Anhydrous, 82-0-0, contains 0.2% water	TDG Placard Required: Compressed Gas
TDG Hazard Class: Compressed Gas 2.2 (8) Corrosive	
TDG Labels Required: Compressed Gas	

PIN: UN 1005

WHMIS Hazard Class: Compressed Gas (A), Corrosive (E), Toxic (D18)

15. REGULATORY INFORMATION

This product has been classified according to the hazard criteria of the CPR and the MSDS contains all the information required by the CPR.

16. OTHER INFORMATION

Version No.: CFI Draft 4PC

Revision Date: Sept 2004

Sections Revised: Politically correct terminology.

Disclaimer: This information relates to the specific material designated and may not be valid for such material used in combination with any other materials or in any process. Such information is to the best of our knowledge and belief, accurate and reliable as of the date compiled. However, no representation, warranty or guarantee is made as to its accuracy, reliability or completeness. **No warranty of merchantability, fitness for any particular purpose, or any other warranty, expressed or implied, is made concerning the information herein provided.** It is the user's responsibility to satisfy themselves as to the suitability and completeness of such information for their own particular use. We do not accept liability for any loss or damage that may occur from the use of this information nor do we offer warranty against patent infringement.

DRAFT

Appendix B

ANHYDROUS AMMONIA HANDS-ON TRAINING CERTIFICATION

TRAINEE:

TRAINER:

COMPANY:

LOCATION:

CERTIFICATE NUMBER:

DATE:

EXPIRY DATE:

Each employee must perform the activities on this list that pertain to his/her job. By signing this form, the trainer acknowledges the trainee understands these requirements, and that the trainee has satisfactorily demonstrated his/her ability to competently handle anhydrous ammonia.

Protective and Safety Equipment:

- 1 or 2 piece Class C ammonia resistant chemical suit.
- Fourteen-inch minimum gauntlet-style ammonia resistant gloves.
- A full-face respirator with approved ammonia cartridges.

- CSA approved safety-toe boot, with a minimum 6" upper.
- Personal Water Bottle

Transport and Handling

- Understanding of TDG Regulations
- Proper loading and unloading techniques
- Operation of pumps and/or compressors
- Pressure and temperature gauges
- Load limits (tanks filled to 85% only)
- Pressure limits
- Emergency Response/Incident Reporting
- Security Guidelines

Trainee's Signature

Trainer's Signature

Trainer's Position

IMPORTANT: EMPLOYERS MUST KEEP TRAINING DOCUMENTS ON FILE.

Glossary:

1. **BOL** – Bill of Lading
2. **Bulk Carrier** – vessel used to transport bulk items
3. **CSA** – Canadian Safety Association
4. **CVSA** – Commercial Vehicle Safety Alliance
5. **ERAP** – Emergency Response Assistance Plan
6. **FSSC** – Fertilizer Safety & Security Council
7. **IDLH** – Immediately Dangerous to Life and Health
8. **MoC** – Means of Containment
9. **MSDS** – Material Safety Data Sheet
10. **NH₃** – Anhydrous Ammonia
11. **NSC** – National Safety Code
12. **OPP** – Ontario Provincial Police
13. **PPE** – personal protective equipment
14. **PPM** – Parts Per Million
15. **PSI** – Pounds per square inch
16. **QPP** – Quebec Provincial Police
17. **RCMP** – Royal Canadian Mounted Police
18. **TDG** – Transportation of Dangerous Goods
19. **US DOT** – United States Department of Transport
20. **UN 1005** – United Nations 1005
21. **WHMIS** – Workplace Hazardous Materials Information System