

LEADER'S GUIDE

SAFE HANDLING OF TOLUENE DIISOCYANATE

INTRODUCTION

SAFE HANDLING OF TOLUENE DIISOCYANATE is a training program designed to inform employees of the potential hazards associated with the handling of toluene diisocyanate, or TDI, and the recommended procedures to follow in order to minimize potential hazards. The program also discusses the recommended procedures for drum or intermediate bulk container handling, unloading TDI from tank containers (isotainers), cargo tank trailers, and rail tank cars, as well as emergency response procedures and proper disposal procedures.

It should be recognized that this video presentation is only one part of a comprehensive training program on the safe handling of TDI. For optimum results, this presentation should be a part of your hazard communication program, supplemented with hands-on exercises, and reporting procedures, along with evacuation drills in case of an accidental spill or leak.

Stringent measures have been taken to ensure that the information contained in the **SAFE HANDLING OF TOLUENE DIISOCYANATE** program and this Leader's Guide is accurate and reliable. Any company specific or facility specific policies and procedures relating to the handling of TDI should be discussed when presenting this program.

TARGET AUDIENCE

All individuals who handle TDI, and its derivatives—especially those who are involved in the handling of drum or intermediate bulk container, and the unloading of tank containers (isotainers), cargo tank trailers, and rail tank cars—and their supervisors or team leaders will benefit from viewing this program.

OBJECTIVES

At the conclusion of this training program and participation in a thorough discussion of the TOPICS FOR REVIEW, each participant should be able to:

1. Describe the physical characteristics of TDI.
2. Describe the routes of entry and potential health effects of overexposure to TDI.

3. Describe the first aid procedures that should be taken if an accidental exposure occurs.
4. Describe the proper personal protective equipment required when transferring TDI from drums or intermediate bulk containers, tank containers (isotainers), cargo tank trailers, and rail tank cars.
5. Describe the recommended procedures for safely handling drums and intermediate bulk containers of TDI, and TDI transfers from tank containers (isotainers), cargo tank trailers, and rail tank cars.
6. Describe the resources that are available in the event of a TDI spill.
7. Describe how to clean up a TDI spill.
8. Describe what to do with waste material generated during the cleanup of a TDI spill.

LEADER PREPARATION

The training session leader plays a key role in the success of the **SAFE HANDLING OF TOLUENE DIISOCYANATE** training program. The leader must manage the training experience by encouraging group discussion, relating the material to the participants' specific environments and company policies, and conducting follow-up exercises or meetings.

Prior to the training session, the leader should:

- Preview the appropriate sections of the program, and read the Leader's Guide.
- Study the suggested TOPICS FOR REVIEW.
- Obtain visual aids which would make employees aware of safety hazards.
- Obtain material safety data sheets (MSDS) or technical data sheets for toluene diisocyanate.
- Develop additional discussion questions, as required, to amplify the key points presented and relate them to the specific situations encountered in their environments.
- Secure a well-ventilated meeting room large enough to avoid overcrowding and quiet enough to minimize distractions.
- Secure the audiovisual equipment required to present the program.
- Allow sufficient time to conduct the training session. *NOTE: A typical training session should include a discussion of objectives, presentation of this program, review of the material, testing, and test review.*
- After the training session, arrange to have the video training program made available for periodic review by employees, supervisors or team leaders, and managers.

AUDIOVISUAL PROGRAM OUTLINE

Introduction (2:14)

- A. Typical Uses of TDI
- B. Common Shipping Containers
- C. Modes of Transportation

I. Hazard Communication (9:04)

- A. Physical Characteristics
- B. Routes of Entry
- C. Potential Health Effects
- D. First Aid
- E. Personal Protective Equipment

II. Drum and Intermediate Bulk Container Handling (6:50)

- A. Receiving Deliveries
- B. Personal Protective Equipment
- C. Discarding Empty Containers

III. Tank Container (Isotainer) Transfers (15:37)

- A. Preparation for Unloading
- B. Documentation
- C. Regulatory Information
- D. Pre-Unloading Procedures
- E. Personal Protective Equipment
- F. Connecting Procedures
- G. Transfer Operations
- H. Disconnecting Procedures
- I. Preparation for Return

IV. Cargo Tank Trailer Transfers (15:34)

- A. Preparation for Unloading
- B. Documentation
- C. Regulatory Information
- D. Pre-Unloading Procedures
- E. Personal Protective Equipment
- F. Connecting Procedures
- G. Transfer Operations
- H. Disconnecting Procedures
- I. Preparation for Return

V. Rail Tank Car Transfers (15:36)

- A. Preparation for Unloading
- B. Documentation
- C. Regulatory Information
- D. Pre-Unloading Procedures
- E. Personal Protective Equipment
- F. Connecting Procedures
- G. Transfer Operations
- H. Disconnecting Procedures
- I. Preparation for Return

VI. Emergency Response (7:05)

- A. Resources
- B. Spill Control, Containment and Cleanup
- C. Notification
- D. Disposal

PRESENTATION

The **SAFE HANDLING OF TOLUENE DIISOCYANATE** program has been divided into six parts so that training can be specifically targeted to the container in which TDI is received. All employees must view both Part One—Hazard Communication and Part Six—Emergency Response. Then choose one or more of the other parts based on how TDI is received at your facility:

Drum and Intermediate Bulk Container Handling	Part Two
Tank Container Transfers	Part Three
Cargo Tank Trailer Transfers	Part Four
Rail Tank Car Transfers	Part Five

WARNING

Employee training in the safe handling of TDI will not be complete without also viewing Part One—Hazard Communication and Part Six—Emergency Response.

The sequence of a typical training session using this program would be as follows: The leader should...

- Welcome the group, and ask them to place name cards in front of themselves if appropriate.
- Introduce the subject area, and explain what is to be presented.

- Review the objectives for the program with the participants, and explain that these objectives will be tested by means of a written quiz at the end of the session.
NOTE: Four written quizzes that review the program's objectives are provided for use at the instructor's discretion.
- Start the video training program and watch it with the participants.
- Answer any immediate questions that the participants may have.
- Use TOPICS FOR REVIEW to relate the material presented to the participants' situation. *NOTE: The question/answer format is provided as a guide. It is best to relate this information to questions that the group considers important.*
- Briefly review the key points of the program, and facilitate a group discussion.
- Administer the quiz, and review the answers with the participants.
- Give each participant additional written information on company policies and programs (if available).
- Schedule and develop additional training, as necessary.
- Make the video presentation available for periodic review by employees.

TOPICS FOR REVIEW

Hazard Communication

1. *What are the physical characteristics of TDI?*
 - Physical data testing has shown that at temperatures above 57°F, TDI will remain in liquid form. At temperatures below 57°F, TDI will begin to solidify. At about 77°F, TDI has a viscosity similar to water.
 - TDI has a flash point above 375°F. Thus, it is not ignited readily. However, it will burn if exposed to an ignition source at or above the flash point temperature, and fires are possible if proper care is not taken.
 - Testing has also shown that TDI is reactive with certain types of materials, including water. When these are mixed together, heat and carbon dioxide are generated. Over time, this can create excessive pressure in closed containers. It's extremely important that TDI should not come in contact with moisture or water during transfer operations. Other reactive agents include, but are not limited to, ammonia, polyols, alcohols, amines, caustic soda, and caustic potash.
 - TDI is a clear, water-white to pale yellow liquid.
 - TDI has a sharp pungent odor that can be very irritating to the respiratory system.
 - Additional information can be obtained from the material safety data sheet (MSDS) or the technical data sheet.
2. *What are the three major "routes of entry" through which a chemical can cause health effects?*
 - Inhalation or breathing

- Skin or eye contact
 - Ingestion or swallowing
3. *What should you do if you are overexposed to TDI?*
 - If overexposure by any route of entry occurs, seek immediate medical attention.
 4. *What is the greatest health hazard of TDI?*
 - The greatest health hazard of TDI is the potential for adverse effects on the respiratory system. At room temperature, TDI can form vapor concentrations above the permissible exposure limit.
 5. *What are the health effects associated with overexposure to TDI vapors?*
 - TDI can cause irritation of the eyes, nose, throat, and lungs. Difficulty breathing, tightness in the chest, and coughing are also symptoms of overexposure. In most cases these symptoms will disappear within a few hours after the exposure takes place.
 - Overexposure to airborne TDI may cause respiratory allergy, or sensitization. Skin contact may also be associated with respiratory allergy. Once sensitized, or allergic to TDI, a person may react to extremely low airborne concentrations of TDI.
 6. *What should you do for the person who exhibits symptoms of TDI sensitization?*
 - Anyone who shows signs of irritation, or asthma-like symptoms, should be moved to fresh air and given immediate medical attention.
 - The onset of these symptoms may occur immediately or be delayed. Therefore, medical personnel should observe sensitized individuals for several hours after exposure.
 7. *What are the health effects associated with overexposure to liquid TDI?*
 - Liquid TDI can be irritating to the skin or eyes. Skin contact may result in redness and may also cause skin sensitization, an allergic reaction. Symptoms such as redness, itching, and rash may occur when a sensitized person contacts TDI. Once a person has become sensitized, that individual should no longer work with TDI.
 - Eye contact may result in redness, and tissue injury may occur.
 - Therefore, it is important an eyewash station and safety shower be located in the immediate area when TDI is being handled.
 8. *What first aid is appropriate for skin/eye exposure to TDI?*
 - For skin exposure, wash with soap and water. Remove any contaminated clothing. For exposures requiring the use of emergency showers, remove contaminated clothing and other sources of vapor before removing respiratory protection.

- For eye exposure, flush the eyes with running water for at least 15 minutes, and then seek medical attention.
9. *Is ingestion of TDI toxic?*
- Although unlikely, accidental ingestion or swallowing of any chemical could occur. TDI has a low potential of toxicity by ingestion.
10. *What first aid is appropriate for ingestion of TDI?*
- For ingestion of TDI, do not induce vomiting. Seek medical attention immediately.
11. *Where would you find safe handling information for TDI?*
- As with all chemical shipments, hazard communication information is attached to all containers either by a warning label or tag.
 - If additional handling information for TDI is required, please refer to the manufacturer's material safety data sheet (MSDS).
12. *What personal protective equipment (PPE) is required when handling TDI?*
- Everyone involved in the handling of TDI must be equipped with the appropriate personal protective equipment. This includes appropriate impervious clothing such as chemical protective suits, chemical resistant gloves and boots, as well as an approved full-face air supplied respirator.
13. *What has been done to prevent overexposure to airborne vapors of TDI?*
- To prevent overexposure to airborne vapors, the Occupational Safety and Health Administration (OSHA) and the American Conference of Governmental Industrial Hygienists (ACGIH) have established exposure limits for TDI. Airborne concentrations must be kept below these limits.
14. *Should you use the odor of TDI as an indicator of overexposure?*
- No. The odor threshold (or point at which you can detect TDI with your sense of smell) is above the permissible exposure limit. Therefore, odor should never be used to indicate the presence of TDI.
 - Since TDI has poor warning properties, the workplace should be periodically monitored for airborne TDI. If you can smell TDI, you may be exposed above the permissible exposure limit.
 - Since harmful airborne concentrations may occur unexpectedly, a positive pressure self-contained breathing apparatus or a positive pressure airline respirator should be readily available in areas where TDI is handled. These should be worn to prevent overexposure to airborne vapors should a release occur. Approved respiratory protection must comply with OSHA requirements.

- 15 *What resources are available if you have additional questions about handling TDI?*
- If you have any further questions or are unsure of the actions required of you, ask your supervisor or team leader, or contact the product manufacturer.
 - For more information on handling TDI, consult the following literature developed by the Center for the Polyurethanes Industry (available at www.polyurethane.org):
 - *Model Respiratory Protection Program*
 - *TDI User Guidelines for Protective Clothing Selection*
 - *Industrial Hygiene Air Monitoring for MDI and TDI*

Drum and Intermediate Bulk Container Handling

1. *How is toluene diisocyanate (TDI) regulated in transportation?*
 - The U.S. Department of Transportation (DOT) regulates transportation of toluene diisocyanate as a hazardous material.
 - Although there are various regulations covering the shipment of TDI, it will be classified UN2078, Toluene Diisocyanate, Class 6.1, Packing Group II.
 - The letters RQ will be entered either before or after the description of the shipment when individual packages contain 100 pounds or more of TDI
 - The Toxic placard with the UN marking 2078 displayed is the required placard for shipment of this material.
 - TDI containers must have the required labels or placards applied.
 - The storage and handling of TDI at your facility may be subject to other federal, state, and local regulations. For example, the EPA's Risk Management Program applies to facilities with more than 10,000 pounds of TDI in a single storage source.
2. *What should you do when the truck arrives?*
 - When the truck arrives, all paperwork should be checked for accuracy. Verify the purchase order number, and ensure the proper material and correct number of containers have been received.
 - When you have checked the security seals against the paperwork, break the seals, and open the doors of the trailer. Use caution when opening the doors as items may have shifted during transportation.
 - Check the trailer hazard placards. Make sure they are correct for the product noted on the shipping documents.
 - Assist the driver in positioning the trailer at the dock.
3. *How should the truck be prepared before unloading?*
 - Make sure that the driver has set the emergency brake on the truck once it is in position.
 - Wheel chocks should be placed under the tires of the trailer, as well as the rear tires of the truck to prevent movement in either direction.

4. *What safety precautions should be followed when unloading TDI drums?*
 - When forklifts are used to unload drums, they should be adapted with the proper drum handling apparatus in order to move the drums.
 - Never use the forks to pick up a drum by the chimes.
 - Never try unloading a trailer without using the proper equipment and techniques.
5. *What should you do after unloading the drums or intermediate bulk containers?*
 - Make sure that the name on the container label matches the name on the shipping documents, and confirm that no containers are leaking.
6. *What types of drums and intermediate bulk containers are appropriate for the transport of TDI?*
 - Drums used to transport TDI should be made of metal with tight head construction. Open top drums are not recommended.
 - Intermediate bulk containers should also be made of metal.
7. *How should drums be stored?*
 - Drums can be stored on their chimes or on pallets. However, they should never be stacked more than three high.
8. *What personal protective equipment (PPE) and other controls are required to avoid contact or exposure to TDI?*
 - In order to avoid contact or exposure to TDI, personal protective equipment must be worn during transfer operations. For TDI, this includes chemical splash goggles and chemical resistant gloves.
 - If local ventilation is used, best industry practice requires that any discharged vapors be absorbed or scrubbed free of TDI before being discharged to the atmosphere.
 - When transferring TDI without adequate ventilation, an approved full-face air supplied respirator is required.
9. *How should empty drums be disposed?*
 - The preferred way to dispose of empty TDI drums is to contract with an approved drum reconditioner. If you need help in locating an approved drum reconditioner, contact the product manufacturer.
 - If you do not use the services of a drum reconditioner, make sure you neutralize any residual product, or "cling," puncture the drums so they cannot be reused, and remove the product label.
10. *What happens when TDI contacts water?*
 - Containers with even a little moisture, water, or any foreign substance must not be refilled. Reaction between TDI and water will slowly emit carbon dioxide gas and, in a closed container like a drum, could cause a violent rupture.

11. *What should you do if you suspect a reaction is taking place inside a sealed container?*
 - Whenever you suspect that a reaction is taking place inside a sealed container, you should isolate the area immediately, and contact the manufacturer or the shipper for assistance.

12. *What resources are available if you have additional questions about handling TDI?*
 - If you have any further questions or are unsure of the actions required of you, ask your supervisor or team leader, or contact the product manufacturer.
 - For more information on handling TDI, consult the following literature developed by the Center for the Polyurethanes Industry (available at www.polyurethane.org):
 - *Model Respiratory Protection Program*
 - *Melting Toluene Diisocyanate (TDI) in Drums*
 - *TDI User Guidelines for Protective Clothing Selection*
 - *TDI Transportation Guidelines*
 - *Working with TDI: What You Should Know*

Tank Container Transfers

1. *What should you be aware of before handling TDI in tank containers, or isotainers?*
 - The receiving, handling, and shipment of TDI require compliance with federal, state, and local regulations concerning hazardous materials. Make sure you know these regulations and follow them at all times.
 - It is recommended that a comprehensive checklist be developed and followed throughout the unloading sequence.

2. *How should the truck be prepared before unloading?*
 - Make sure that the driver has set the emergency brake once the truck is in position.
 - Wheel chocks should be placed under the tires of the trailer chassis, as well as the rear tires of the tractor to prevent movement in either direction.
 - As an added precaution, you may wish to put barricades or warning signs around the unloading area.

3. *What should you check for on the paperwork?*
 - All paperwork should be checked for accuracy. Verify the purchase order number, that the material being received is TDI, and that the weigh ticket shows the quantity being delivered.
 - Review the values on the Certificate of Analysis to ensure that the product meets required specifications.

4. *What should you check on the tank container itself?*
 - Check the tank container to make sure the numbers on the security seals match the numbers shown on the paperwork. Also confirm that the seals are not broken and have not been tampered with in any manner. Then cut the seals.
 - Verify that the pad pressure and temperature are within the required parameters. If they are not, contact the shipper for further instructions.
 - Check the hazard placards. Make sure that they are correct for the product noted on the shipping documents.

5. *What regulations apply to the shipment of TDI?*
 - The U.S. Department of Transportation (DOT) regulates the transportation of toluene diisocyanate as a hazardous material.
 - Although there are various regulations covering the shipment of TDI, it will be classified UN2078, Toluene Diisocyanate, Class 6.1, Packing Group II.
 - The letters RQ will be entered either before or after the description of the shipment when individual packages contain 100 pounds or more of TDI
 - The Toxic placard with the UN marking 2078 displayed is the required placard for shipment of this material.
 - TDI containers must have the required labels or placards applied.
 - The storage and handling of TDI at your facility may be subject to other federal, state, and local regulations. For example, the EPA's Risk Management Program applies to facilities with more than 10,000 pounds of TDI in a single storage source.

6. *What checks of your own equipment should you make before unloading begins?*
 - If the content of the tank container is to be off loaded into a receiving tank, make sure that the tank is the correct one for the product and that there is enough room in the tank to hold this shipment.
 - The unloading connection on the receiving line should be clearly identified.
 - The unloading operator should show the driver the location of the nearest eye wash station and safety shower.
 - The driver should show the operator where the container's remote emergency shut off is located.
 - It's recommended that unloading hoses be 2-inch in diameter. They should also be color coded and/or labeled to assist in eliminating transfer errors. Because TDI reacts with moisture, it's extremely important that the hoses are dry. If there is any possibility of a problem with a hose, set the hose aside, tag it, and get another hose to complete the transfer.

7. *Why are all of these checks necessary?*
 - All these checks may seem unnecessary because the operation is routine, but taking these precautions every time will prevent product contamination and a potential overflow.

8. *How are tank containers unloaded?*

- Tank containers are usually unloaded with nitrogen or dry air pressure.
- An alternative method would be off loading using a pump, while adding nitrogen or dry air to maintain a dry atmosphere within the tank container.
- When unloading with either of these methods, it is recommended that all discharge vapors be absorbed or scrubbed free of TDI.
- If dry air is used, it is extremely important to check for signs of moisture. Dry air is recommended to have a dew point of -40°F as a minimum.
- A “closed loop vapor exchange” system using a product pump is another means for unloading TDI. “Closed loop” means that no vapors escape from the system into the atmosphere and no moisture from the atmosphere enters the system.

9. *What personal protective equipment (PPE) is required during transfer operations?*

- In order to avoid contact or exposure to TDI, personal protective equipment must be worn during transfer operations. This includes appropriate impervious clothing such as a chemical protective suit, chemical resistant gloves and boots, as well as an approved full-face air-supplied respirator.
- Both the unloading operator and the truck driver should be wearing personal protective equipment.

10. *What is the role of the truck driver and unloading operator during transfer operations?*

- The driver will make connections to the tank container, and operate the tank container valves and all other tank container equipment.
- The unloading operator should take responsibility for connecting the unloading hose to the receiving line and operating the valves in the receiving system.

11. *What connection procedures should be followed?*

- Check the nitrogen or dry air source. Make sure the gauge is working properly and that the hose is attached securely.
- Remove the dust cap from the nitrogen inlet on the tank container, and install the required adapter. Check the hose gasket for splits or cracks that could prevent a good seal. Connect the nitrogen or dry air supply hose to the nitrogen inlet on the tank container, and secure it.
- Before connecting the product discharge hose, inspect the fitting on the receiving line. It should be free of any moisture, dust, or grease. If it is a female fitting, inspect the gasket for splits or cracks that could cause a leak or spill. Replace the gasket, if necessary, and make sure you dispose of the old one properly.
- Inspect the unloading hose, and make sure the quick disconnect fittings and gaskets are in good working order so that the connection will be secure. If everything is OK with the hoses, gaskets, and fittings, connect the hose to the receiving line, and secure it.
- Remove the closure cap or blank flange from the product discharge outlet, and install any adapter, if required. Now, attach the unloading hose to the product discharge outlet, and secure it.

12. *What should you do after all connections have been properly secured and the checklist completed?*
- Sign the driver's paperwork indicating a good hook-up has been made.
13. *What steps should be followed to begin the transfer operation?*
- Open the nitrogen inlet valve on the tank container, and then open the valve on the nitrogen or dry air source.
 - Introduce nitrogen gas or dry air into the top of the tank container up to about 5 psig.
 - Open the tank container's internal valve, and then carefully open the external valve.
 - Open the receiving line valve. The product should now be flowing through the unloading line.
 - Once you have verified there are no leaks in the system, the nitrogen or dry air pressure will need to be increased to an acceptable pressure, usually between 10 to 20 psig, depending on the desired rate of unloading. The pressure should remain constant within the tank container until unloading is complete. Do not exceed the working pressure of the tank container. Refer to the tank containers nameplate for the rated pressure if you are not sure.
14. *What are the attendance requirements during the unloading process?*
- During the unloading process, operators should stay in the area to monitor the transfer of product. The U.S. Department of Transportation (DOT) requires that a qualified person attend the unloading operation.
 - "Attend" means that the person in attendance is alert, has an unobstructed view of the unloading operation, and stays within 25 feet during the entire process.
 - According to DOT, to be "qualified" the person must understand the potential hazards of TDI, know the procedures to follow in an emergency, and have the authority and means to move the tank container.
15. *What additional safety precautions should be followed?*
- No smoking or use of other tobacco products, no eating, and no drinking should be permitted during the transfer process.
16. *The amount of product being transferred should be monitored at all times. How can this be accomplished?*
- Monitoring the amount of product being transferred can be accomplished using an in-line flow meter, by watching the tank container weight (if there is a truck scale at the unloading station), or by monitoring the level rise in the storage tank. For safety reasons, it is strongly recommended that two methods of level measurement be used.

17. *Should you rely on automatic shut-off systems to stop the unloading process?*
- Don't rely on automatic shut-off systems to stop the unloading process. Such systems are not foolproof! There is absolutely no substitute for an "attentive" operator.
18. *In addition to monitoring the amount of product being transferred, what else does the unloading operator need to monitor?*
- Monitor the operation to assure that the pad of nitrogen or dry air is maintained in the tank container.
19. *What are the steps to disconnect the tank container from the system?*
- Close the nitrogen or dry air inlet valve on the tank container, and shut off the nitrogen or dry air source.
 - Close the internal valve on the tank container. Wait about a minute, then open the internal valve to blow the hose clear to the storage tank. Be careful not to overpressurize the receiving tank during the hose clearing operation.
 - After the hose is cleared, close the internal valve on the tank container and the valve on the receiving line.
 - Open the bleed valve to depressurize the unloading hose. Make sure you collect any excess product in a catch container that contains a neutralizing solution.
 - Close the bleed valve and the external valve on the tank container.
 - Carefully disconnect the unloading hose from the tank container and the receiving line. A catch container should be used under the ends of the hose to capture any product drippage.
 - The ends of the hose should be capped and plugged immediately after disconnection.
 - Remove any required adapter. Then apply the closure cap to the tank container's discharge outlet and the closure cap or plug to the fitting on the receiving line.
 - Recheck to see that the tank container is still pressurized with 5 to 10 psig of nitrogen or dry air. This will assure that moisture will not enter the tank container and react with the residual TDI on the return trip.
 - Depressurize and carefully disconnect the dry air or nitrogen hose from the tank container's inlet valve, remove the adapter, and replace the dust cap.
17. *What should you do to get the tank container ready for return?*
- Sign the delivery report, and note any unusual problems or delays that might have occurred.
 - Remove the barricades and wheel chocks.
18. *What resources are available if you have additional questions about handling TDI?*
- If you have any further questions or are unsure of the actions required of you, ask your supervisor or team leader, or contact the product manufacturer.
 - For more information about handling TDI, consult the following literature developed by the Center for the Polyurethanes Industry (available at www.polyurethane.org):

- *Model Respiratory Protection Program*
- *Equipment Guidelines for Diisocyanate Storage Tanks*
- *TDI User Guidelines for Protective Clothing Selection*
- *TDI Transportation Guidelines*
- *Working with TDI: What You Should Know*

Cargo Tank Trailer Transfers

1. *What should you be aware of before handling TDI in cargo tank trailers?*
 - The receiving, handling, and shipment of TDI require compliance with federal, state, and local regulations concerning hazardous materials. Make sure you know these regulations and follow them at all times.
 - It is recommended that a comprehensive checklist be developed and followed throughout the unloading sequence.

2. *How should the truck be prepared before unloading?*
 - Make sure that the driver has set the emergency brake once the truck is in position.
 - Wheel chocks should be placed under the tires of the tank truck, as well as the rear tires of the tractor to prevent movement in either direction.
 - As an added precaution, you may wish to put barricades or warning signs around the unloading area.

3. *What should you check for on the paperwork?*
 - All paperwork should be checked for accuracy. Verify the purchase order number, that the material being received is TDI, and that the weigh ticket shows the quantity being delivered.
 - Review the values on the Certificate of Analysis to ensure that the product meets required specifications.

4. *What should you check on the cargo tank trailer itself?*
 - Check the tank truck to make sure the numbers on the security seals match the numbers shown on the paperwork. Also confirm that the seals are not broken and have not been tampered with in any manner. Then cut the seals.
 - Verify that the pad pressure and temperature are within the required parameters. If they are not, contact the shipper for further instructions.
 - Check the hazard placards. Make sure that they are correct for the product noted on the shipping documents.

5. *What regulations apply to the shipment of TDI?*
 - The U.S. Department of Transportation (DOT) regulates the transportation of toluene diisocyanate as a hazardous material.
 - Although there are various regulations covering the shipment of TDI, it will be classified UN2078, Toluene Diisocyanate, Class 6.1, Packing Group II.

- The letters RQ will be entered either before or after the description of the shipment when individual packages contain 100 pounds or more of TDI
 - The Toxic placard with the UN marking 2078 displayed is the required placard for shipment of this material.
 - TDI containers must have the required labels or placards applied.
 - The storage and handling of TDI at your facility may be subject to other federal, state, and local regulations. For example, the EPA's Risk Management Program applies to facilities with more than 10,000 pounds of TDI in a single storage source.
6. *What checks of your own equipment should you make before unloading begins?*
- If the content of the tank truck is to be off loaded into a receiving tank, make sure that the tank is the correct one for the product and that there is enough room in the tank to hold this shipment.
 - The unloading connection on the receiving line should be clearly identified.
 - The unloading operator should show the driver the location of the nearest eye wash station and safety shower.
 - The driver should show the operator where the tank truck's remote emergency shut off is located.
7. *What personal protective equipment (PPE) is required during transfer operations?*
- In order to avoid contact or exposure to TDI, personal protective equipment must be worn during transfer operations. This includes appropriate impervious clothing such as a chemical protective suit, chemical resistant gloves and boots, as well as an approved full-face air-supplied respirator.
 - Both the unloading operator and the truck driver should be wearing personal protective equipment.
8. *What special precautions should be taken regarding the unloading hoses?*
- It's recommended that unloading hoses be 2-inch in diameter. They should also be color coded and/or labeled to assist in eliminating transfer errors. Because TDI reacts with moisture, it's extremely important that the hoses are dry. If there is any possibility of a problem with a hose, set the hose aside, tag it, and get another hose to complete the transfer.
9. *Why are all of these checks necessary?*
- All these checks may seem unnecessary because the operation is routine, but taking these precautions every time will prevent product contamination and a potential overflow.
10. *How are cargo tank trailers unloaded?*
- Cargo tank trailers are usually unloaded with nitrogen or dry air pressure.
 - An alternative method would be off loading using a pump, while adding nitrogen or dry air to maintain a dry atmosphere within the tank truck.

- When unloading with either of these methods, it is recommended that all discharge vapors be absorbed or scrubbed free of TDI.
 - If dry air is used, it is extremely important to check for signs of moisture. Dry air is recommended to have a dew point of -40°F as a minimum.
 - A “closed loop vapor exchange” system using a product pump is another means for unloading TDI. “Closed loop” means that no vapors escape from the system into the atmosphere and no moisture from the atmosphere enters the system.
11. *What special precautions should be kept in mind when the tractor’s compressor is used to generate the air pressure?*
- If the tractor’s compressor is used to generate the air pressure, it is extremely important to check the sight glass on the air dryer for signs of moisture. If a color-indicating type of dryer is used, the pellets should be blue.
 - The dryer must not be used if there is moisture in the sight glass or if the pellets are pink.
 - If the tractor’s air compressor is used, the driver will start the compressor and maintain suitable pressure at the unloading operator’s direction.
12. *What is the role of the truck driver and unloading operator during transfer operations?*
- The driver will make connections to the tank truck, and operate the tank truck valves and all other tank truck equipment.
 - The unloading operator should take responsibility for connecting the unloading hose to the receiving line and operating the valves in the receiving system.
13. *What connection procedures should be followed?*
- Check the nitrogen or dry air source. Make sure the gauge is working properly and that the hose is attached securely.
 - Check the hose gasket for splits or cracks that could prevent a good seal. Remove the dust cap from the nitrogen inlet on the cargo tank trailer. Connect the nitrogen or dry air supply hose to the nitrogen inlet on the tank truck, and secure it.
 - Before connecting the product discharge hose, inspect the fitting on the receiving line. It should be free of any moisture, dust, or grease. If it is a female fitting, inspect the gasket for splits or cracks that could cause a leak or spill. Replace the gasket, if necessary, and make sure you dispose of the old one properly.
 - Inspect the unloading hose, and make sure the quick disconnect fittings and gaskets are in good working order so that the connection will be secure. If everything is OK with the hoses, gaskets, and fittings, connect the hose to the receiving line, and secure it.
 - Remove the closure cap or blank flange from the product discharge outlet, and install any adapter, if required. Now, attach the unloading hose to the product discharge outlet, and secure it.

14. *What should you do after all connections have been properly secured and the checklist completed?*
- Sign the driver's paperwork indicating a good hook-up has been made.
15. *What steps should be followed to begin the transfer operation?*
- Open the nitrogen inlet valve on the tank truck, and then open the valve on the nitrogen or dry air source.
 - Introduce nitrogen gas or dry air into the tank truck up to about 5 psig.
 - Open the tank truck's internal valve, and then carefully open the external valve.
 - Open the receiving line valve. The product should now be flowing through the unloading line.
 - Once you have verified there are no leaks in the system, the nitrogen or dry air pressure will need to be increased to an acceptable pressure, usually between 10 to 20 psig, depending on the desired rate of unloading. The pressure should remain constant within the tank truck until unloading is complete. The nitrogen or dry air pressure must be controlled to a maximum of 25 psig to prevent the tank truck's pressure relief valve from opening.
16. *What are the attendance requirements during the unloading process?*
- During the unloading process, operators should stay in the area to monitor the transfer of product. The U.S. Department of Transportation (DOT) requires that a qualified person attend the unloading operation.
 - "Attend" means that the person in attendance is alert, has an unobstructed view of the unloading operation, and stays within 25 feet during the entire process.
 - According to DOT, to be "qualified" the person must understand the potential hazards of TDI, know the procedures to follow in an emergency, and have the authority and means to move the tank truck.
17. *What additional safety precautions should be followed?*
- No smoking or use of other tobacco products, no eating, and no drinking should be permitted during the transfer process.
18. *The amount of product being transferred should be monitored at all times. How can this be accomplished?*
- Monitoring the amount of product being transferred can be accomplished using an in-line flow meter, by watching the tank truck weight (if there is a truck scale at the unloading station), or by monitoring the level rise in the storage tank. For safety reasons, it is strongly recommended that two methods of level measurement be used.

19. *Should you rely on automatic shut-off systems to stop the unloading process?*
- Don't rely on automatic shut-off systems to stop the unloading process. Such systems are not foolproof! There is absolutely no substitute for an "attentive" operator.
20. *In addition to monitoring the amount of product being transferred, what else does the unloading operator need to monitor?*
- Monitor the operation to assure that the pad of nitrogen or dry air is maintained in the tank truck.
21. *What are the steps to disconnect the tank container from the system?*
- Close the nitrogen or dry air inlet valve on the tank truck, and shut off the nitrogen or dry air source.
 - Close the internal valve on the tank truck. Wait about a minute, then open the internal valve to blow the hose clear to the storage tank. Be careful not to overpressurize the receiving tank during the hose clearing operation.
 - After the hose is cleared, close the internal valve on the tank truck and the valve on the receiving line.
 - Open the bleed valve to depressurize the unloading hose. Make sure you collect any excess product in a catch container that contains a neutralizing solution.
 - Close the bleed valve and the external valve on the tank truck.
 - Carefully disconnect the unloading hose from the tank truck and the receiving line. A catch container should be used under the ends of the hose to capture any product drippage.
 - The ends of the hose should be capped and plugged immediately after disconnection.
 - Remove any required adapter. Then apply the closure cap to the tank truck's discharge outlet and the closure cap or plug to the fitting on the receiving line.
 - Recheck to see that the tank truck is still pressurized with 5 to 10 psig of nitrogen or dry air. This will assure that moisture will not enter the tank truck and react with the residual TDI on the return trip.
 - Depressurize and carefully disconnect the dry air or nitrogen hose from the tank truck's inlet valve, remove the adapter, and replace the dust cap.
22. *What should you do to get the tank truck ready for return?*
- Sign the delivery report, and note any unusual problems or delays that might have occurred.
 - Remove the barricades and wheel chocks.
23. *What resources are available if you have additional questions about handling TDI?*
- If you have any further questions or are unsure of the actions required of you, ask your supervisor or team leader, or contact the product manufacturer.
 - For more information on handling TDI, consult the following literature developed by the Center for the Polyurethanes Industry (available at www.polyurethane.org):

- *Model Respiratory Protection Program*
- *Equipment Guidelines for Diisocyanate Storage Tanks*
- *TDI User Guidelines for Protective Clothing Selection*
- *TDI Transportation Guidelines*
- *Working with TDI: What You Should Know*

Rail Tank Car Transfers

1. *What should you be aware of before handling TDI in rail tank cars?*
 - The receiving, handling, and shipment of TDI require compliance with federal, state, and local regulations concerning hazardous materials. Make sure you know these regulations and follow them at all times.
 - It is recommended that a comprehensive checklist be developed and followed throughout the unloading sequence.

2. *How should the rail tank car be prepared before unloading?*
 - The brakes on the rail tank car must be set, the wheels properly chocked to prevent roll in either direction, and blue flags used as a warning to prevent access to the unloading area. Using derails will also provide additional access prevention.

3. *What should you check for on the paperwork?*
 - In most cases, the shipping documents and the Certificate of Analysis will have been sent to your company's receiving office ahead of the rail tank car delivery.
 - All paperwork should be checked for accuracy. This would include such things as the purchase order number and that the material being received is TDI.
 - Review the values on the Certificate of Analysis to ensure that the product meets required specifications.

4. *What should you check on the tank car itself?*
 - Check the hazard placards. Make sure that they are correct for the product noted on the shipping documents.
 - Compare the tank car number against the number identified on the shipping documents.
 - Check the tank car to make sure the numbers on the security seals match the numbers shown on the paperwork. Also confirm that the seals are not broken and have not been tampered with in any manner.
 - Break the seal on the valve cover hatch, remove the securement pin, and open the hatch.
 - Carefully remove the closure cap from the thermowell tube. If the car is equipped with a valve on the thermowell tube, carefully open the valve. Insert an appropriate thermometer into the thermowell to determine that the car is at the proper temperature for unloading.

- Verify that the air inlet valve on the rail car is closed, then carefully remove the plug, and install a fitting that is equipped with a pressure gauge. Ensure the air inlet valve on the adapter fitting is closed, then carefully open the air inlet valve on the rail car to verify the pad pressure on the rail car.
5. *What regulations apply to the shipment of TDI?*
- The U.S. Department of Transportation (DOT) regulates the transportation of toluene diisocyanate as a hazardous material. .
 - Although there are various regulations covering the shipment of TDI, it will be classified UN2078, Toluene Diisocyanate, Class 6.1, Packing Group II.
 - The letters RQ will be entered either before or after the description of the shipment when individual packages contain 100 pounds or more of TDI
 - The Toxic placard with the UN marking 2078 displayed is the required placard for shipment of this material.
 - TDI rail cars must have the required labels or placards applied.
 - The storage and handling of TDI at your facility may be subject to other federal, state, and local regulations. For example, the EPA's Risk Management Program applies to facilities with more than 10,000 pounds of TDI in a single storage source.
6. *What personal protective equipment (PPE) is required during transfer operations?*
- In order to avoid contact or exposure to TDI, personal protective equipment must be worn during transfer operations. This includes appropriate impervious clothing such as a chemical protective suit, chemical resistant gloves and boots, as well as an approved full-face air-supplied respirator.
 - Unloading operators should always wear personal protective equipment whenever there is a chance of TDI exposure.
7. *What checks of your own facility and equipment should you make before unloading begins?*
- Verify the location and operation of the nearest eyewash station and safety shower.
 - If the content of the tank car is to be off loaded into a receiving tank, make sure that the tank is the correct one for the product and that there is enough room in the tank to hold this shipment.
 - The unloading connection on the receiving line should be clearly identified.
8. *What special precautions should be taken regarding the unloading hoses?*
- It's recommended that unloading hoses be 2-inch in diameter. They should also be color coded and/or labeled to assist in eliminating transfer errors. Because TDI reacts with moisture, it's extremely important that the hoses are dry. If there is any possibility of a problem with a hose, set the hose aside, tag it, and get another hose to complete the transfer.

- The hose gaskets should be free of any moisture, dirt, and grease. Inspect them carefully to ensure that there are no splits or cracks that could cause spills or leaks.
 - Replace the gasket, if necessary, and make sure you dispose of the old one properly.
 - The quick disconnect fittings and gaskets of the hose should be in good working order so that the hose can be securely locked onto the discharge valve of the tank car and the receiving line.
9. *Why are all of these checks necessary?*
- All these checks may seem unnecessary because the operation is routine, but taking these precautions every time will prevent product contamination and a potential overflow.
10. *How are tank cars unloaded?*
- Tank cars are usually unloaded with nitrogen or dry air pressure.
 - An alternative method would be off loading using a pump, while adding nitrogen or dry air to maintain a dry atmosphere within the tank car.
 - When unloading with either of these methods, it is recommended that all discharge vapors be absorbed or scrubbed free of TDI.
 - If dry air is used, it is extremely important to check for signs of moisture. Dry air is recommended to have a dew point of -40°F as a minimum.
 - A “closed loop vapor exchange” system using a product pump is another means for unloading TDI. “Closed loop” means that no vapors escape from the system into the atmosphere and no moisture from the atmosphere enters the system.
11. *What connection procedures should be followed?*
- Check the nitrogen or dry air source. Make sure the gauge is working properly and that the hose is attached securely.
 - Check the hose gasket for splits or cracks that could prevent a good seal. Connect the nitrogen or dry air supply hose to the fitting installed in the air inlet valve, and secure it.
 - Verify that the rail tank car discharge valve is closed, and carefully remove the plug from this valve. Install the necessary adapter fitting into the discharge valve.
 - Connect the unloading hose to the fitting installed in the rail car’s discharge valve, and secure it.
12. *What steps should be followed to begin the transfer operation?*
- Open the air inlet valve on the adapter fitting, and then open the valve on the nitrogen or dry air source.
 - Open the discharge valve on the rail car.
 - Open the receiving line valve. The product should now be flowing through the unloading line.
 - Once you have verified there are no leaks in the system, the nitrogen or dry air pressure will need to be increased to an acceptable pressure, usually between

15 to 25 psig, depending on the desired rate of unloading. The pressure should remain constant within the rail car until unloading is complete.

13. *What are the attendance requirements during the unloading process?*
 - A qualified person should attend the unloading operation at all times.
 - “Attend” means that the person in attendance is alert and has an unobstructed view of the unloading operation during the entire process.
 - A qualified person should be properly instructed in unloading procedures, be responsible for compliance with all applicable regulations, be familiar with the nature and properties of the material involved, be instructed in proper emergency procedures and, in the event of an emergency, have the authority and ability to immediately halt the flow of the product.
14. *Can a signaling system be used during transfer operations?*
 - Signaling systems that include surveillance equipment, such as cameras, may be used to notify people within the facility that a problem may exist so that product flow may be halted.
15. *What additional safety precautions should be followed?*
 - No smoking or use of other tobacco products, no eating, and no drinking should be permitted during the transfer process.
16. *The amount of product being transferred should be monitored at all times. How can this be accomplished?*
 - Monitoring the amount of product being transferred can be accomplished using an in-line flow meter, by watching the rail car weight (if there is a scale at the unloading station), or by monitoring the level rise in the storage tank. For safety reasons, it is strongly recommended that two methods of level measurement be used.
17. *Should you rely on automatic shut-off systems to stop the unloading process?*
 - Don't rely on automatic shut-off systems to stop the unloading process. Such systems are not foolproof! There is absolutely no substitute for an "attentive" operator.
18. *In addition to monitoring the amount of product being transferred, what else does the unloading operator need to monitor?*
 - Monitor the operation to assure that the pad of nitrogen or dry air is maintained in the tank car.
19. *What are the steps to disconnect the rail tank car from the system?*
 - Close the nitrogen or dry air inlet valve on the tank car, and shut off the nitrogen or dry air source.

- Close the product discharge valve on the tank car. Wait about a minute, then open the product discharge valve to blow the hose clear to the storage tank. Be careful not to overpressurize the receiving tank during the hose clearing operation.
 - After the hose is cleared, close the product discharge valve on the tank car and the valve on the receiving line.
 - Open the bleed valve to depressurize the unloading hose. Make sure you collect any excess product in a catch container that contains a neutralizing solution.
 - Close the bleed valve.
 - Carefully disconnect the unloading hose from the tank car and, if necessary, from the receiving line. A catch container should be used under the ends of the hose to capture any product drippage.
 - The ends of the hose should be capped and plugged immediately after disconnection.
 - Remove the fitting from the tank car discharge valve, and install the closure plug.
 - Recheck to see that the tank car is still pressurized with 5 to 10 psig of nitrogen or dry air. This will assure that moisture will not enter the tank car and react with the residual TDI on the return trip.
 - Depressurize and carefully disconnect the dry air or nitrogen hose from the tank car's inlet valve. Remove the fitting from the tank car's nitrogen valve, and install the closure plug.
 - Remove the thermometer from the thermowell, close the valve (if one is present), and install the closure cap.
 - Check all valves to verify they are fully closed, and all closure plugs to verify they are wrench tight.
 - Close the valve cover hatch, install the securement pin, and apply a tamper evident seal for the return trip.
17. *What should you do about any spilled material or product residue on the tank car?*
- The U.S. Department of Transportation (DOT) requires that any spilled material or product residue must be removed from the tank car's exterior surface prior to it being offered for return shipment.
18. *What should you do to get the tank container ready for return?*
- Complete the checklist to ensure the rail tank car is properly prepared for return shipment.
 - If there are any defects that must be corrected before the car can be returned or before the car is loaded for the next shipment, notify the supplier.
 - Remove the wheel chock, blue flag, and derail.
 - Return the paperwork to the receiving office and, if there are no defects, notify appropriate personnel that the empty tank car is ready for return.
18. *What resources are available if you have additional questions about handling TDI?*
- If you have any further questions or are unsure of the actions required of you, ask your supervisor or team leader, or contact the product manufacturer.

- For more information on handling TDI, consult the following literature developed by the Center for the Polyurethanes Industry (available at www.polyurethane.org):
 - *Model Respiratory Protection Program*
 - *Equipment Guidelines for Diisocyanate Storage Tanks*
 - *TDI User Guidelines for Protective Clothing Selection*
 - *TDI Transportation Guidelines*
 - *Working with TDI: What You Should Know*

Emergency Response

1. *What resources are available in the event of a TDI spill?*

- An emergency response plan must be in place before handling TDI. The emergency response plan will give you the information you need to control a release of TDI, prevent injury to yourself or your coworkers, or damage to the environment.
- Some manufacturers may supply their own in-house emergency response telephone numbers and contacts in case of an incident involving a spill, leak, or damage. All producers of TDI have response capabilities and can provide assistance if requested.
- All manufacturers are registered with CHEMTREC—the Chemical Transportation Emergency Center—established by the American Chemistry Council.

2. *How can CHEMTREC help in the event of a spill?*

- CHEMTREC is staffed twenty-four hours a day, seven days a week, toll free at 1-800-424-9300, and is available to provide emergency response information. A call to CHEMTREC will provide first action advice on handling procedures for emergencies involving TDI, and they will also make contact with the manufacturer. Providing accurate information to CHEMTREC is imperative in order to receive correct response information. It is important to identify the product by its trade name.

3. *What should you do if you discover a leaking package?*

- If a package arrives at your facility and is leaking, follow your company's emergency plan or call the product manufacturer for assistance.

4. *Who should be permitted into the spill area?*

- In the event of an incident, only trained and qualified individuals are permitted into the spill area.

5. *Is respiratory protection required?*

- Never approach a spill without the appropriate personal protective equipment, including an approved air-supplied positive pressure breathing apparatus.

6. *What is the first thing that should be done when attempting to control a spill?*
 - In order to control the spill, the first action is to stop the flow of product from the source. This should only be done if it can be accomplished safely.
 - If you puncture a drum, leave the forks in the drum and obtain assistance to clean up the spill.
7. *What should be done to contain the spill?*
 - Spilled TDI must not be allowed to flow into drains or sewers. To stop the spread of the spilled material use absorbent material such as vermiculite, saw dust, clay earth, sweeping compound or sand to create a barrier around the spill or the inlet to the sewer or drain.
 - Depending on the size of the incident, spill pillows or other containment materials may be used to prevent further spreading of the product.
8. *What should be done after the spill has been contained?*
 - Once the spill has been stopped; absorbed, pumped off, or removed from the receiving surface; and there is no chance of further spread of the product, the area must be decontaminated with a neutralizing agent.
9. *Where can you find out additional information about neutralizing solutions?*
 - Consult the product manufacturer's MSDS or contact the product manufacturer for neutralizing solution recommendations.
10. *When should the neutralizing solution and absorbent material be prepared?*
 - The neutralizing solution, as well as the absorbent material, should be prepared ahead of time and be readily available should an emergency arise.
11. *How should the neutralizing solution and absorbent material be used?*
 - Apply the neutralizing solution over the entire spill area.
 - Once the neutralizing solution has been applied, cover the area with additional absorbent material.
 - Spread the absorbent material around to aid in contact between the surface and the neutralizing solution.
 - Then shovel all of the absorbent material into a metal drum.
 - Apply neutralizing solution again to ensure adequate decontamination.
12. *What is the recommended ratio for thorough decontamination?*
 - The recommended ratio for thorough decontamination is tens parts of neutralizing solution to one part spilled material.

13. *What is the disposition of the drum into which waste material from the cleanup has been placed?*
- Place the lid loosely on the drum, and move it to a well-vented area, in case further reaction occurs. Do not tighten the lid because dangerous pressures may result from the neutralization process.
 - Carbon dioxide gas is generated through the neutralization process so the drum should be monitored frequently, and the lid should not be securely applied until the reaction is complete.
 - After the product has fully reacted and prior to disposal, tighten the lid on the drum securely. Always check with regulatory authorities for proper disposal procedures.
14. *What should you do with contaminated protective equipment?*
- All protective equipment must be disposed of properly, or thoroughly cleaned and decontaminated after use.
15. *What regulations apply to waste materials generated during a TDI spill cleanup?*
- Any waste material that has been generated during spill cleanup must be disposed of in accordance with federal, state, and local regulations.
 - TDI is a hazardous waste, listed as U223 under the Resource Conservation and Recovery Act.
 - Containers used for waste disposal must be labeled in accordance with DOT and EPA waste regulations. A hazardous waste label is appropriate for a drum that contains waste materials from a TDI spill cleanup.
16. *Who needs to be notified when a spill occurs?*
- Depending upon the circumstances and the amount of the spillage, local, state, and federal agencies may have to be notified. Of course, your company's own hazardous materials team or outside contractor will be able to judge this.
17. *What resources are available if you have additional questions about handling TDI?*
- If you have any further questions or are unsure of the actions required of you, ask your supervisor or team leader, or contact the product manufacturer.
 - For more information on handling TDI, consult the following literature developed by the Center for the Polyurethanes Industry (available at www.polyurethane.org):
 - *Model Respiratory Protection Program*
 - *TDI User Guidelines for Protective Clothing Selection*
 - *Working with TDI: What You Should Know*
 - *Guidelines for Responsible Disposal of Wastes and Containers from Polyurethane Processing*

QUIZ

The purpose of these quizzes is to assure the instructor that the participants have been receptive to, and have mastered the objectives of this training program. The test results may be retained in the participant's file as a means of demonstrating to company health and safety managers that all concerned are familiar with proper work procedures and safety rules.

Four separate quizzes have been provided with this Leader's Guide. One is for employees handling drums or intermediate bulk containers, the second for employees involved in tank container (isotainer) transfers, the third for employees involved in cargo tank trailer transfers, and the fourth for employees involved in rail tank car transfers. Use the quiz that is most appropriate for your work site.

Each participant should be able to demonstrate mastery of the objectives by achieving an acceptable test score. A participant who scores lower than that should review the missed questions with the leader.

The quizzes included in this Leader's Guide may be reproduced without further permission.

Answers to the quiz questions follow:

DRUM AND INTERMEDIATE BULK CONTAINER HANDLING QUIZ

- | | |
|-------|-------|
| 1. T | 11. T |
| 2. F | 12. T |
| 3. F | 13. F |
| 4. F | 14. F |
| 5. T | 15. T |
| 6. T | 16. T |
| 7. F | 17. F |
| 8. T | 18. F |
| 9. F | 19. F |
| 10. F | 20. T |

TANK CONTAINER TRANSFERS QUIZ

- | | |
|-------|-------|
| 1. T | 11. T |
| 2. F | 12. F |
| 3. F | 13. T |
| 4. F | 14. T |
| 5. T | 15. T |
| 6. T | 16. T |
| 7. F | 17. F |
| 8. T | 18. F |
| 9. F | 19. F |
| 10. T | 20. T |

CARGO TANK TRAILER TRANSFERS QUIZ

- | | |
|-------|-------|
| 1. T | 11. T |
| 2. F | 12. F |
| 3. F | 13. T |
| 4. F | 14. T |
| 5. T | 15. T |
| 6. T | 16. T |
| 7. F | 17. F |
| 8. T | 18. F |
| 9. F | 19. F |
| 10. T | 20. T |

RAIL TANK CAR TRANSFERS QUIZ

- | | |
|-------|-------|
| 1. T | 11. T |
| 2. F | 12. F |
| 3. F | 13. T |
| 4. F | 14. T |
| 5. T | 15. T |
| 6. T | 16. T |
| 7. F | 17. F |
| 8. T | 18. F |
| 9. F | 19. F |
| 10. T | 20. T |

NAME: _____

DEPT.: _____

DATE: _____

Drum and Intermediate Bulk Container Handling Quiz

SAFE HANDLING OF TOLUENE DIISOCYANATE

TRUE - FALSE: Circle "T" if the statement is TRUE or "F" if the statement is FALSE.

- T. F 1. At a temperature about 77°F, TDI has a viscosity similar to water.
- T F 2. TDI has a flash point less than 300°F.
- T F 3. TDI will only react when mixed with water.
- T F 4. TDI does not form vapor concentrations above the permissible exposure limit at room temperature.
- T F 5. Asthma-like symptoms such as difficulty breathing, tightness in the chest, and coughing may be an indication of overexposure to TDI.
- T F 6. For ingestion of TDI, do not induce vomiting. Seek medical attention immediately.
- T F 7. The sharp, pungent odor of TDI can be used to indicate its presence since the odor threshold is below the permissible exposure limit.
- T F 8. When TDI is transferred from a drum or intermediate bulk container in the presence of adequate ventilation, the proper PPE includes chemical splash goggles and chemical resistant gloves. Without ventilation, PPE would also include respiratory protection.
- T F 9. The U.S. Department of Transportation (DOT) does not regulate the transportation of toluene diisocyanate as a hazardous material. .
- T F 10. The best way to move a drum of TDI is to pick it up by the chimes.
- T F 11. Intermediate bulk containers used to transport TDI should be made of metal.
- T F 12. Drums can be stored on their chimes or on pallets, but never stacked more than three high.
- T F 13. Containers with just a small amount moisture, water or foreign substance can be refilled with TDI.

- T F 14. The first thing you should do when you suspect that a reaction is taking place inside a sealed container of TDI, is to immediately open the top of the drum or intermediate bulk container to release the pressure.
- T F 15. CHEMTREC can provide first action advice on handling procedures for emergencies involving TDI.
- T F 16. In the event of an incident, only trained and qualified individuals are permitted into the spill area.
- T F 17. The first step to take when attempting to control a spill is to decontaminate the area with a neutralizing solution.
- T F 18. Spilled TDI can run into the local sewer system as long as it is washed down with plenty of water.
- T F 19. Protective equipment used during the cleanup of a spill can be rinsed off with water and stored for the next time it's needed.
- T F 20. Drums containing materials contaminated by TDI should be kept in a well-ventilated area and monitored frequently.

NAME: _____

DEPT.: _____

DATE: _____

TANK CONTAINER TRANSFERS QUIZ

SAFE HANDLING OF TOLUENE DIISOCYANATE

TRUE - FALSE: Circle "T" if the statement is TRUE or "F" if the statement is FALSE.

- T. F 1. At a temperature about 77°F, TDI has a viscosity similar to water.
- T F 2. TDI has a flash point less than 300°F.
- T F 3. TDI will only react when mixed with water.
- T F 4. TDI does not form vapor concentrations above the permissible exposure limit at room temperature.
- T F 5. Asthma-like symptoms such as difficulty breathing, tightness in the chest, and coughing may be an indication of overexposure to TDI.
- T F 6. For ingestion of TDI, do not induce vomiting. Seek medical attention immediately.
- T F 7. The sharp, pungent odor of TDI can be used to indicate its presence since the odor threshold is below the permissible exposure limit.
- T F 8. During transfer of TDI from a tank container, the appropriate PPE includes a chemical protective suit, chemical resistant gloves and boots, as well as an approved full-face air-supplied respirator.
- T F 9. TDI is classified by DOT as a non-hazardous material.
- T F 10. Unloading hoses used to transfer TDI from a tank container should be 2-inch in diameter, and color coded and/or labeled to assist in eliminating transfer errors.
- T F 11. If dry air is used to unload the tank container, it should have a dew point of -40°F at a minimum.
- T F 12. When the receiving line valve is opened and TDI begins flowing from the tank container through the unloading line, it is common for the nitrogen or dry air to be increased to 3-5 psig depending on the desired rate of unloading.
- T F 13. The U.S. Department of Transportation (DOT) requires that a qualified person attend the unloading operation.

- T F 14. Once the unloading hose has been cleared and you are ready to bleed the hose, a catch container that contains a neutralizing solution should be used to collect any excess product.
- T F 15. CHEMTREC can provide first action advice on handling procedures for emergencies involving TDI.
- T F 16. In the event of an incident, only trained and qualified individuals are permitted into the spill area.
- T F 17. The first step to take when attempting to control a spill is to decontaminate the area with a neutralizing solution.
- T F 18. Spilled TDI can run into the local sewer system as long as it is washed down with plenty of water.
- T F 19. Protective equipment used during the cleanup of a spill can be rinsed off with water and stored for the next time it's needed.
- T F 20. Drums containing materials contaminated by TDI should be kept in a well-ventilated area and monitored frequently.

NAME: _____

DEPT.: _____

DATE: _____

CARGO TANK TRAILER TRANSFERS QUIZ

SAFE HANDLING OF TOLUENE DIISOCYANATE

TRUE - FALSE: Circle "T" if the statement is TRUE or "F" if the statement is FALSE.

- T. F 1. At a temperature about 77°F, TDI has a viscosity similar to water.
- T F 2. TDI has a flash point less than 300°F.
- T F 3. TDI will only react when mixed with water.
- T F 4. TDI does not form vapor concentrations above the permissible exposure limit at room temperature.
- T F 5. Asthma-like symptoms such as difficulty breathing, tightness in the chest, and coughing may be an indication of overexposure to TDI.
- T F 6. For ingestion of TDI, do not induce vomiting. Seek medical attention immediately.
- T F 7. The sharp, pungent odor of TDI can be used to indicate its presence since the odor threshold is below the permissible exposure limit.
- T F 8. During transfer of TDI from a cargo tank trailer, the appropriate PPE includes a chemical protective suit, chemical resistant gloves and boots, as well as an approved full-face air-supplied respirator.
- T F 9. TDI is classified by DOT as a non-hazardous material.
- T F 10. Unloading hoses used to transfer TDI from a cargo tank trailer should be 2-inch in diameter, and color coded and/or labeled to assist in eliminating transfer errors.
- T F 11. If dry air is used to unload the cargo tank trailer, it should have a dew point of -40°F at a minimum.
- T F 12. When the receiving line valve is opened and TDI begins flowing from the cargo tank trailer through the unloading line, it is common for the nitrogen or dry air to be increased to 3-5 psig depending on the desired rate of unloading.
- T F 13. The U.S. Department of Transportation (DOT) requires that a qualified person attend the unloading operation.

- T F 14. Once the unloading hose has been cleared and you are ready to bleed the hose, a catch container that contains a neutralizing solution should be used to collect any excess product.
- T F 15. CHEMTREC can provide first action advice on handling procedures for emergencies involving TDI.
- T F 16. In the event of an incident, only trained and qualified individuals are permitted into the spill area.
- T F 17. The first step to take when attempting to control a spill is to decontaminate the area with a neutralizing solution.
- T F 18. Spilled TDI can run into the local sewer system as long as it is washed down with plenty of water.
- T F 19. Protective equipment used during the cleanup of a spill can be rinsed off with water and stored for the next time it's needed.
- T F 20. Drums containing materials contaminated by TDI should be kept in a well-ventilated area and monitored frequently.

NAME: _____

DEPT.: _____

DATE: _____

RAIL TANK CAR TRANSFERS QUIZ

SAFE HANDLING OF TOLUENE DIISOCYANATE

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- T. F 1. At a temperature about 77°F, TDI has a viscosity similar to water.
- T F 2. TDI has a flash point less than 300°F.
- T F 3. TDI will only react when mixed with water.
- T F 4. TDI does not form vapor concentrations above the permissible exposure limit at room temperature.
- T F 5. Asthma-like symptoms such as difficulty breathing, tightness in the chest, and coughing may be an indication of overexposure to TDI.
- T F 6. For ingestion of TDI, do not induce vomiting. Seek medical attention immediately.
- T F 7. The sharp, pungent odor of TDI can be used to indicate its presence since the odor threshold is below the permissible exposure limit.
- T F 8. During transfer of TDI from a rail tank car, the appropriate PPE includes a chemical protective suit, chemical resistant gloves and boots, as well as an approved full-face air-supplied respirator.
- T F 9. TDI is classified by DOT as a non-hazardous material.
- T F 10. Unloading hoses used to transfer TDI from a rail tank car should be 2-inch in diameter, and color coded and/or labeled to assist in eliminating transfer errors.
- T F 11. If dry air is used to unload the rail tank car, it should have a dew point of -40°F at a minimum.
- T F 12. When the receiving line valve is opened and TDI begins flowing from the rail tank car through the unloading line, it is common for the nitrogen or dry air to be increased to 3-5 psig depending on the desired rate of unloading.
- T F 13. A qualified person should attend the unloading operation at all times.

- T F 14. Once the unloading hose has been cleared and you are ready to bleed the hose, a catch container that contains a neutralizing solution should be used to collect any excess product.
- T F 15. CHEMTREC can provide first action advice on handling procedures for emergencies involving TDI.
- T F 16. In the event of an incident, only trained and qualified individuals are permitted into the spill area.
- T F 17. The first step to take when attempting to control a spill is to decontaminate the area with a neutralizing solution.
- T F 18. Spilled TDI can run into the local sewer system as long as it is washed down with plenty of water.
- T F 19. Protective equipment used during the cleanup of a spill can be rinsed off with water and stored for the next time it's needed.
- T F 20. Drums containing materials contaminated by TDI should be kept in a well-ventilated area and monitored frequently.