

Safe Operation of Vacuum Trucks Handling Flammable and Combustible Liquids in Petroleum Service

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Introduction

Vacuum truck personnel working in petroleum facilities shall be trained in the safe operation of the vacuum equipment; familiar with the hazards of the products being handled; and aware of relevant facility permit requirements, safety procedures, and emergency response requirements. It is the responsibility of the vacuum truck owner and operator to comply with (1) applicable federal, state, and local regulations; (2) this RP; and (3) facility requirements regarding the safe operation of vacuum trucks, including, but not limited to, the following items:

- construction, inspection, maintenance, and certification of the vacuum tank;
- selection and safe operation of the vacuum truck, vacuum pump, hoses, and accessories;
- regulatory requirements for safe highway operation of the truck;
- proper transportation, handling, and disposal of hazardous materials;
- safe vacuum truck loading, unloading, and transport operations within the facility;
- training and qualification of operators and other assigned vacuum truck personnel.

Although the material contained in this document is intended to be consistent with regulatory requirements, API 2219 is not a compliance document. Each user or operator must ensure compliance with all applicable laws and regulations. The United States Department of Transportation (DOT) *Code of Federal Regulations*, 49 *CFR*, specifies the minimum requirements for the design, construction, maintenance, testing, and operation of vehicles used for handling and transporting hazardous materials within the United States. Criteria for minimum training and qualifications of drivers and operators are also found in 49 *CFR*. The Department of Labor, Occupational Safety, and Health Administration's (OSHA) requirements for safety, health, and hazard awareness applicable to operators and other personnel working with vacuum truck operations are found in the *Code of Federal Regulations*, 29 *CFR* 1910. U.S. Coast Guard regulations in 33 *CFR* 154 for bulk transfer of hazardous materials to and from vessels at marine facilities could include certain vacuum truck transfer operations.

The procedures contained herein are intended to apply to vacuum trucks, skids, and trailers used in flammable and combustible liquid service. These requirements include, but are not limited to, 49 *CFR* parts 178.345–178.348 as well as DOT 407 and DOT 412 (formerly designated MC307 and MC312) cargo tank trailers used in vacuum and transfer operations for handling and transporting flammable and combustible liquids and corrosive materials.

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Safe Operation of Vacuum Trucks in Petroleum Service

1 Scope

1.1 General

This fourth edition of Safe Operation of Vacuum Trucks in Petroleum Service provides information concerning the safe operation of vacuum trucks engaged in all aspects of handling flammable and combustible liquids, associated waste water, produced water, sour water, basic sediment and water (BS&W), caustics, spent acids, or other fluids stemming from petroleum operations, products, powders, and the hazard of dust explosions. This publication discusses the types of vacuum pumps and cargo tanks associated with vacuum truck operations, the common hazards associated with those vacuum truck operations, and representative safe work practices and precautions to help prevent accidents and injuries. Annex F provides brief descriptions of a variety of incidents involving vacuum trucks, including offloading into open areas. These may be useful in reviewing specific operating procedures or developing materials for safety meetings or pre-job briefings.

The scope of this Recommended Practice (RP) includes the use of vacuum/pressure trucks, skids, portable tanks, and trailers (herein referred to as vacuum trucks) to remove flammable and combustible liquids from tanks and equipment and to clean up liquid hydrocarbon spills. The scope includes movement of liquid mixtures (such as “produced water”, BS&W, or tank bottoms) that may contain sufficient hydrocarbon material to present comparable hazards.

These safe practices also apply to the operation of portable vacuum tanks, skids, and trailers typically used in emergency flammable and combustible liquid spill cleanup activities. While not included in the specific scope of this standard, Annex E presents information related to pneumatic (air moving) trucks and hoppers, typically used in the petroleum industry for removal of dry materials such as catalysts, dusts, powders, or residue.

1.2 Applicability

Vacuum trucks are used in all segments of the petroleum industry with varied applications. Appropriate safe operating practices may vary because of different hazards associated with the materials to be moved and the facilities serviced. This RP seeks to assist in the development and implementation of practical and safe operating practices that will help identify hazards and reduce risks.

1.3 Basic Vacuum Operations

The two basic types of vacuum truck operations are as follows.

- a) Vacuum loading and off-loading operations that eliminate or minimize the introduction of air into the system by:
 - 1) completely submerging the suction nozzle into the liquid during the transfer process, or
 - 2) directly connecting the transfer hose to the source or receiving tank, vessel, or container below the surface level of the liquid contained therein.
- b) Vacuum truck operations that introduce air into the system during the transfer process, including:
 - 1) air conveying operations (Annex E) involving the incidental removal of solid materials when the suction hose is either partially submerged or not submerged (or, if submerged, when air is entrained or entrapped in the material) or the intentional removal of solids when used in a vacuum excavation system; or
 - 2) liquid transfer operations where the end of the hose is not directly connected to the source or receiving tank, container, or vessel or the nozzle is not submerged into the liquid within the tank, container, or vessel; or

- 3) vacuum truck operations involving spill cleanup of liquids where air enters the transfer hose as liquids are skimmed off the surface (water or land).

1.4 Concept of Hazard vs Risk

Hazards are conditions or properties of materials with the inherent ability to cause harm. Risk involves the potential for exposure to hazards that will result in harm or damage. For example, a hot surface or material can cause thermal skin burns or a corrosive acid can cause chemical skin burns, but these injuries can occur only if there is contact exposure to skin. A person working at an elevated height has “stored energy” and a fall from a height can cause injury, but there is no risk unless a person is working at heights and is thus exposed to the hazard. There is no risk when there is no potential for exposure.

Determining the level of risk for any activity involves understanding hazards and estimating the probability and severity of exposure that could lead to harm or damage. The preceding examples relate the consequences of hazard exposure, severity, and probability to determine risks to people. The same principles can be applied to property risk. For instance, hydrocarbon vapors in a flammable mixture with air can ignite if exposed to a source of ignition resulting in a fire that could damage property as well as cause injury.

The U.S. Department of Transportation and the United Nations provide specific definitions and classifications for “Hazardous Materials”. These more general performance-based concepts are significant in order to understand the potential risk associated with vacuum truck operations.

1.5 Job Hazard Analysis

Those in charge of vacuum truck operations can implement the principles of Hazard vs Risk by conducting a job safety analysis (JSA) to assess hazards and risks associated with specific tasks. This review helps identify hazards so that protective equipment, procedures, and contingency plans can be put in place to mitigate risks associated with identified hazards.

Prior to engaging in job site vacuum truck operations, the relevant written JSAs shall be reviewed by all relevant and responsible parties to help everyone become familiar with the hazards, risks, and exposure protection safeguards. Such JSAs should be periodically reviewed so they remain current and can help to prevent incidents. (See OSHA Publication 3071, *Job Hazard Analysis*, or other JSA-related material from OSHA's web site.)

2 Normative References

The most recent editions of each of the following standards, codes, and publications are referenced in this RP as useful sources of additional information. Further information may be available from the cited Internet World Wide Web sites or references included in the Bibliography.

API Recommended Practice 2003, *Protection Against Ignitions Arising Out of Static, Lightning & Stray Currents*

ACGIH¹, *TLVs® and BEIs® Based on Threshold Limit Values for Chemical Substances and Physical Agents and Biological Exposure Indices*

ASME², *Boiler And Pressure Vessel Code Section VIII: Pressure Vessels-Division 1*

ASME, *Boiler And Pressure Vessel Code Section XII: Rules for Construction and Continued Service of Transport Tanks*

¹American Conference of Governmental Industrial Hygienists, 1330 Kemper Meadow Drive, Cincinnati, Ohio, 45240, www.acgih.org.

²American Society of Mechanical Engineers International, Three Park Avenue, New York, New York, 10016, www.asme.org, ASME International [Publications], 22 Law Drive, Box 2900, Fairfield, New Jersey, 07007-2900.

NFPA 30³, *Flammable and Combustible Liquids Code*

NFPA 77, *Recommended Practice on Static Electricity*

NFPA 326, *Safeguarding of Tanks and Containers for Entry, Cleaning or Repair*

NFPA 650, *Pneumatic Conveying Systems for Handling Combustible Particulate Solids*

NTTC⁴, *Hazardous Materials Transportation—The Tank Truck Driver's Guide*

NIOSH⁵, *Pocket Guide to Chemical Hazards*

Pratt, Thomas H., *Electrostatic Ignitions of Fires and Explosions*, ISBN 0-8169-9948-1, AIChE CCPS

OSHA 29⁶, *Code of Federal Regulations (CFR), Parts 1910*

OSHA 1910.38, *Employee Emergency Plans and Fire Prevention Plans*

OSHA 1910.1000, Subpart Z, *Toxic and Hazardous Substances*

OSHA 1910.132 Subpart I, *Personal Protective Equipment*

OSHA 1910.147, *Control of Hazardous Energy (Lockout/Tagout)*

OSHA 1910.157, *Fire Protection*

OSHA 1910.1200, *Hazard Communication*

EPA 40⁷, *CFR, Protection of Environment*

U.S. DOT⁸, *Federal Motor Carrier Safety Administration DOT 49, CFR Federal Motor Carrier Safety Regulations*

For specific requirements, carriers and shippers should consult the most current edition of 49 *CFR*, Parts 100–185. Motor carriers should also consult the *Federal Motor Carrier Safety Regulations*.

3 Definitions

For the purposes of this document, the following definitions apply.

3.1

atmospheric pressure

At sea level, atmospheric pressure equals 14.7 psi (105 pascals) or 29.92 in Hg (760 mm Hg).

³National Fire Protection Association, 1 Batterymarch Park, Quincy, Massachusetts, 02169, www.nfpa.org.

⁴National Tank Truck Carriers, Inc., 2200 Mill Road, Alexandria, Virginia, 22314, www.tanktruck.org.

⁵National Institute for Occupational Safety and Health, 4676 Columbia Parkway, Cincinnati, Ohio, 45226, www.cdc.gov/niosh.

⁶U.S. Department of Labor, Occupational Safety and Health Administration, 200 Constitution Ave. NW, Washington, D.C., 20210, www.osha.gov.

⁷U.S. Environmental Protection Agency, Ariel Rios Building, 1200 Pennsylvania Avenue NW, Washington, D.C., 20460, www.epa.gov.

⁸U.S. Department of Transportation, 400 7th Street SW, Washington, D.C., 20590, www.dot.gov.



3.2

bonding

Providing electrical connections between isolated conductive parts of a system to equalize their electrical potential (voltage). A resistance less than 1 megohm [$<1 \times 10^6$ ohm] is traditionally considered adequate for static dissipation. The targeted goal for bonding should be 0 ohm. For stray current protection, lightning protection, and other electrical systems, the bonding resistance needs to be significantly lower, no more than about 10 ohms.

3.3

BS&W

An abbreviation for “basic sediment and water”, measured as a volume percentage from a liquid sample of the production stream. It includes free water, sediment, and emulsion. BS&W may entrain flammable or combustible hydrocarbons or oily emulsions and then may release those hydrocarbons during service handling.

3.4

CHEMTREC

An acronym for “CHEMical TRansportation Emergency Center”, a system organized and coordinated by the American Chemistry Council to provide chemical-specific information to emergency responders around the clock.

3.5

cyclone separators

Devices that separate oil and water or solid materials from air by cyclone action.

3.6

exposure limit

The maximum concentration limits for toxic substances to which workers may be safely exposed for a prescribed time without protection (e.g. respiratory protection).

Exposure limits are usually expressed in parts per million (volume) or milligrams per cubic meter, averaged for a prescribed time, e.g. 15 minutes, 8 hours. They may also be expressed as ceiling limits, which should not be exceeded. Safety Data Sheets (SDSs) available from employers, manufacturers, or suppliers of the material should identify recommended exposure limits.

Permissible Exposure Limits (PELs) and **Short-Term Exposure Limits (STELs)** are regulatory exposure limits established in the Occupational Safety and Health Administration, U.S. Department of Labor regulations and are those found in the most current editions of OSHA 29 *CFR* 1910.1000 and chemical specific standards.

Threshold Limit Values® (TLVs®) are advisory exposure limit values published by the ACGIH and frequently provided as exposure guidance on SDSs.

3.7

grounding

Providing a means for electrical continuity so currents can dissipate to ground (earth). A resistance less than 1 megohm [$<1 \times 10^6$ ohm] is traditionally considered adequate for static dissipation. For other purposes, such as grounding electrical systems, lightning protection, etc., much lower resistances are needed. For new equipment, a design target of 10 ohms is considered appropriate.

3.8

hazard

An inherent physical or chemical characteristic (flammability, toxicity, corrosivity, stored chemical, electrical, hydraulic, pressurized, or mechanical energy) or condition that has the potential for causing death or damage to people, property, or the environment.

3.9

hazardous material

A term defined in U.S. DOT and EPA regulations or UN standards to identify materials that trigger specific mandatory or precautionary requirements (equipment, labeling, training, work practice, etc).

3.10

job safety analysis (JSA)

The systematic assessment of work activities and the workplace to identify potential hazards as a step to controlling possible risks.

3.11

liquid

Any material that has a fluidity greater than that of 300 penetration asphalt when tested in accordance with ASTM D5 (NFPA 30).

Combustible liquid is any liquid with a closed-cup flash point at or above 100 °F (37.8 °C). Combustible liquids at temperatures at or above their flash points are considered to be flammable.

Flammable liquid is any liquid that has a closed-cup flash point below 100 °F(37.8 °C). (NFPA 30).

3.12

pressure relief (safety) valve (PRV)

A device that limits pressure to a preset level by exhausting surplus air, vapor, or liquid, thereby ensuring that the permissible operating pressure is not exceeded.

3.13

risk

The probability for exposure to a hazard that could result in harm or damage.

3.14

risk assessment

The identification and analysis with judgments of probability and consequences, either qualitative or quantitative, of the likelihood and outcome of specific events or scenarios that can or could result in harm or damage.

3.15

risk-based analysis

A review of potential hazards and needs to eliminate or control such hazards based on a formalized risk assessment.

3.16

vacuum cargo tank

An enclosed space (tank) mounted on a vacuum truck (trailer or skid) from which most of the air (or gas) has been removed by a vacuum pump and where the remaining air (or gas) is maintained at a pressure below atmospheric.

3.17

vacuum, inches Hg

A measurement of the suction produced in a vacuum system where pressure is reduced relative to ambient atmospheric pressure. An inch of mercury (Hg) is a measure of vacuum that equals a solid column of water being lifted 13.6 in. or a "negative" pressure of 0.491 psig.

3.18

vacuum intake (suction air) filters

Filters mounted on the suction flange to prevent airborne solid materials from entering vacuum pump systems.

3.19**vacuum pump**

A pump that is designed to remove air (or gas) in order to create a vacuum (pressure below atmospheric) within a vacuum cargo tank.

3.20**vacuum pump exhaust muffler (silencer)**

A device that reduces vacuum pump exhaust noise during suction and pressure operations.

3.21**vacuum pump oil separator**

A small vessel that captures exhausted oil when the pump is operated under the vacuum mode. When a vacuum pump operates in the pressure mode, the oil separator acts as an oil bath filter to prevent airborne material from entering the vacuum pump.

3.22**vacuum pump relief valve**

A device that reduces the potential for damage to the pump from overheating during long duration solid column loading or when there is insufficient cooling air or liquid.

3.23**vacuum pump scrubbers (secondary shutoffs or moisture traps)**

Inlet devices that reduce vacuum pump damage and wear by trapping materials that may escape the vacuum pump's primary shutoff trap during loading.

3.24**vacuum truck**

A transportable vacuum system consisting of a vacuum pump, vacuum cargo tank, and associated appurtenances and accessory equipment mounted on a motor vehicle.

4 Safe Handling of Hazardous Materials

4.1 Hazardous Materials Awareness

4.1.1 It is the responsibility of vacuum truck owner/operators to train vacuum truck operators in the proper transfer, handling, and transportation of flammable and combustible liquids and hazardous materials.

4.1.2 Vacuum truck owners/operators shall ensure that vacuum truck operators are aware of the physical and chemical characteristics of flammable, combustible, toxic, and corrosive materials in accordance with applicable regulations. These regulations include, but are not limited to:

- OSHA 29 CFR 1910.120 (*Hazardous Waste Operations and Emergency Response*),
- OSHA 29 CFR 1910.1200 (*Hazard Communication*),
- DOT 49 CFR (*Transportation and Hazardous Materials Regulations*).

Training materials addressing some of the regulatory requirements are available from the respective agencies' web sites noted in Section 2 and in the Bibliography.

4.1.3 Care shall be taken to ensure that the materials being loaded are compatible with materials previously loaded and that the mixing of these materials will not create hazards such as fire, explosion, heat, toxic gases, or vapors. Unless the vacuum truck has been thoroughly cleaned and inspected, it should not be used to load materials that are not compatible with those previously handled. The same principles apply when materials are unloaded. Care shall be

taken to ensure that the materials being unloaded are compatible with the materials presently or previously contained in the receiving container.

4.1.4 All parties involved with vacuum truck operations shall be aware that combustible liquids transferred at or above their flash point temperatures shall be handled as if they were flammable liquids. When transferring a combustible liquid that is within 15 °F of its flash point, it shall be handled as a flammable liquid. This is especially significant when transferring combustible liquids into non-conductive tanks, containers, or vessels.

4.1.5 All parties involved with vacuum truck operations shall be aware that waste products from petroleum operations may contain trace amounts of flammable or combustible liquids and gases or other hazardous materials that may cause serious injury, illness, or death if not properly handled. In addition, vacuum truck operators shall be aware that when under vacuum, even trace amount of hydrocarbons and hydrogen sulfide gas can be easily released and create flammable and/or toxic atmospheres.

4.1.6 All parties involved with vacuum truck operations shall be aware that although BS&W may consist primarily of free water, sediment, and/or emulsion, it may also entrain flammable or combustible hydrocarbons. Care should be exercised to understand the potential ignition and fire hazards associated with the material(s) being handled. If condensate has been mixed with BS&W during the removal process, this can significantly increase the fire hazard.

4.2 Product Information

4.2.1 The facility operator shall make safety data sheets (SDSs) and any other pertinent information about hazards and necessary precautions associated with the specific materials to be handled, available to the vacuum truck operator prior to the job starting. The NIOSH *Pocket Guide to Chemical Hazards* is a useful resource to properties of materials, their hazards, and some exposure limits.

SDSs should provide correct information on materials originally stored in tanks or vessels, but might not accurately reflect the hazards when the material is co-mingled with other chemicals, waste products, tank bottoms, contaminated catalysts, spent acids, or other materials that are being transferred. The vacuum truck operator shall be provided with available and relevant information regarding the properties of the material to be handled.

4.2.2 In emergency situations such as spill response and cleanup, product safety information may be obtained from sources other than the manufacturer or shipper, including, but not limited to: CHEMTREC, Department of Transportation, state and local emergency response agencies, U.S. Coast Guard, fire departments, etc.

4.3 Personal Protective Equipment

4.3.1 Both good practice and OSHA regulations (1910.132) require a hazard determination to evaluate the need for personal protective equipment (PPE). When necessary, appropriate respiratory protection, chemical protective equipment, goggles, gloves, boots, and other required PPE shall be provided by vacuum truck owners and used by vacuum truck operators for protection from exposure to the material being handled. It is the responsibility of vacuum truck owners to ensure that vacuum truck operators are trained and qualified.

4.3.2 Vacuum truck operators shall know which type of personal protective equipment to use under various conditions of potential exposure or known exposure. Personal protective equipment may be required to provide body, eye, and respiratory system protection.

4.3.3 Vacuum truck operators shall be aware of applicable OSHA personal protective equipment requirements including, but not limited to, 29 *CFR* 1010.132, Subpart I, *Personal Protective Equipment*, and PPE elements in regulations listed in 4.4. Vacuum truck operators shall also be aware of the facility's industrial hygiene and safety requirements relevant to the vacuum truck operations being conducted.

4.4 Hazardous Materials Regulations

Vacuum truck owners shall ensure that vacuum truck operators are trained, knowledgeable of and comply with applicable federal, state, and local regulations including, but not limited to, the following:

- 29 *CFR* 1910.1000–1096, Subpart Z, *Toxic and Hazardous Substances* (including Benzene at 1910.1028),
- 29 *CFR* 1910.120, *Hazardous Waste Operations and Emergency Response*,
- 29 *CFR* 1910. 1200, *Hazard Communications*,
- 40 *CFR* 263, *Protection of Environment*,
- 40 *CFR* 311.1, *Worker Protection Standards for Hazardous Waste Operations*,
- 49 *CFR*, *Motor Carrier Safety*.

4.5 Emergency Response

4.5.1 Vacuum truck owners shall ensure that vacuum truck operators are trained or educated in appropriate emergency response actions and regulatory reporting requirements in the event of a fire, spill, release, or other emergency.

4.5.2 Vacuum truck operators shall be trained in the use of portable fire extinguishers. Portable fire extinguishers shall be provided with the vacuum truck and maintained in accordance with applicable regulatory requirements such as 29 *CFR* 1910.157, *Fire Protection*, and also be available at the work site.

4.5.3 Vacuum truck owners shall prepare an emergency response plan conforming to OSHA requirements in 29 *CFR* 1910.38 (*Employee Emergency Plans and Fire Prevention Plans*) and shall train all operators in the use of that plan.

Vacuum truck operators shall be aware of facility emergency reporting and response procedures.

5 Safe Vacuum Truck Operations

5.1 General

5.1.1 Compliance

Vacuum truck owners are responsible to comply with federal, state, and local regulations regarding the construction, maintenance, and operation of vacuum trucks and to ensure that operators and other assigned personnel are trained and qualified for their assigned work.

5.1.2 Hazards of Vacuum Truck Operations

5.1.2.1 Although using vacuum trucks provides a fast, safe, and efficient method of cleaning up spills and removing liquids, tank bottoms, solid materials, and waste from tanks and vessels in petroleum facilities, incidents have occurred during vacuum truck operations. See Annex F for specific examples.

Vacuum truck owners and operators, as well as facility personnel, should be aware of the numerous potential hazards associated with vacuum truck operations in petroleum facilities. Some (but not all) of the potential hazards associated with vacuum truck operations are listed below.

5.1.2.2 Sources of ignition include vacuum truck engine and exhaust heat; pump overheating; faulty or improper electrical devices; static electricity discharges; and outside ignition sources such as smoking, motor vehicles, stationary engines, etc.

5.1.2.3 Potential hazards include spills; flammable atmosphere within and around the vacuum truck, cargo tank or source container; hose failures and discharges of flammable vapors to the atmosphere from the vacuum truck or the source or receiving container; and worker exposures to toxic vapors, liquids, or solids.

5.1.2.4 Consideration for potential hazards associated with the surrounding area and atmospheric conditions during the vacuum truck operations. Discharged vapors can exceed Permissible Exposure Limits (PELs) for exposed workers. Vapors can collect in low spots, particularly during atmospheric inversions with high humidity and no wind. Vapors should not be discharged onto roadways or other areas where sources of ignition may occur.

5.1.2.5 Unloading materials containing flammable components to open pads or pits can release vapors resulting in a fire, explosion, or substance exposure hazard.

5.1.2.6 Toxic vapors that are below hazardous concentrations prior to handling may become concentrated and thereby hazardous at or near the discharge port of the vacuum pump.

5.1.2.7 From a precautionary standpoint, the mixture in the transport container should be treated as a flammable liquid absent positive proof to the contrary.

5.1.2.8 Additional hazards include those typical to tank truck operations such as slips and falls, spills and releases, fires and explosions, and accidents within the facility or vehicle incidents on the highway.

5.1.3 Inspection Requirements

Before beginning operations, vacuum truck operators shall obtain any required permits and inspect vacuum trucks, equipment and loading/off-loading sites to ensure safe operations. See Annexes B and C for inspection, maintenance, and operating requirements.

5.2 Atmospheric Testing

5.2.1 The areas in which vacuum trucks are to operate shall be free of hydrocarbon vapors in the flammable range. The areas where the vacuum truck operator and others work without respirators must also be at or below air-contaminant PELs or STELs. Therefore, testing shall be conducted when appropriate. Where required by facility procedures, permits shall be issued prior to the start of any vacuum truck operations.

Atmospheric testing shall be performed by a qualified person using properly calibrated and adjusted combustible gas indicators, appropriate toxic gas testers, or hydrocarbon vapor analyzers. While combustible gas indicators can provide information indicating that substance levels are too high for personnel exposure, they are not sensitive enough to provide valid information that air concentrations are below personal exposure limits. The atmosphere should be continuously monitored for sources of flammable gas or vapor to determine if a flammable atmosphere exists. The continuous air monitoring will provide the vacuum truck operator an early warning of conditions at the location. Testing shall be conducted before any operation is started, and if necessary, during operations, including, but not limited to, the following.

5.2.2 When operations in the area are subject to change such as automatic pump startup or product receipt into or transfer out of a tank located in the vicinity of the transfer operations. In these situations, consideration should be given to use of lockout/tagout procedures on equipment that could create a hazardous condition or where required by regulation (see 29 CFR 1910.147).

5.2.3 When off-loading a waste container where pockets or layers of hydrocarbon, hydrogen sulfide, water, and other hazardous materials may exist.

5.2.4 When atmospheric condition changes, such as wind direction, storm, etc., affect the operation.

5.2.5 When an emergency situation, such as a product or vapor release, occurs within the facility that may affect atmospheric conditions in the transfer area.

Vacuum trucks shall not be allowed inside diked areas around petroleum storage tanks, other production units, or operations vessels until the areas have been tested for hydrocarbon vapors by qualified persons, determined to be safe and entry authorized, and/or a permit issued if required by facility procedures.

5.3 Conductive and Non-conductive Hose

5.3.1 General

Vacuum truck operators may use either conductive or non-conductive hose, dependent on the material being transferred and subject to 5.3.2 and 5.3.3. Petroleum industry experience indicates that electrostatic ignitions can present a significant hazard when using non-conductive transfer hose. Any isolated (unbonded) conductive object may accumulate a charge and provide a spark gap. Even when using conductive hose, vacuum truck operators shall bond and ground their trucks to reduce the possibility of electrostatic discharges. (See 5.4.)

5.3.2 Conductive Hose

Vacuum hoses constructed of conductive material or thick-walled hoses with imbedded conductive wiring shall be used when transferring flammable and combustible liquids. Conductive hose shall provide suitable electrical resistivity less than 1 megohm ($<1 \times 10^6$ ohm) per 100 ft (as determined by the hose manufacturer).

Thin-walled, metallic spiral-wound conductive hoses should not be used due to the potential for electrical discharge through the thin plastic that covers the metal spiral.

All hoses, both liquid and exhaust, must be easily identified as conductive by some permanent means, for example, stainless steel banding. The marking must include an identifying serial number, manufacturer name, and most recent certification date.

All vacuum truck hoses must be tested annually, certified, and steel banded or tagged with certification date. The vacuum truck service provider is responsible for the compliance testing, tracking, rejections, and documentation of all hoses transported on the vacuum trucks or supplied by the vacuum truck service provider. Hose testing records must be maintained for at least one year. Hoses provided by parties other than the vacuum truck service provider shall be responsible for compliance testing, tracking, and documentation of all hoses provided (typically used at frequently serviced, stationary sites).

In addition to the annual certification testing specified above, all hoses must be inspected prior to each job and a minimum of once each shift for longer duration jobs by the truck operator. Any hose that does not meet the requirements must be rejected and the supervisor notified. Inspect all hoses for the following.

- Check for wear points exposing braids and kinks on the hose.
- Test continuity of all hoses. Recommended guidance considers up to 10^6 ohms/100 ft (1 megohm/100 ft) to be sufficient to allow for dissipation of static electricity (typical measurements are well below 10^6 ohms, so 10,000