



Material Transfer and Vacuum Operation CoW Technical Standard

Version	Date	Approver
1.0	March 31, 2024	JO EHS

Introduction

Material transfer and vacuum operations (including vacuum trucks, trailer mounted vacuums, and other mobile vacuum systems) have the potential to cause serious injury, fires and explosions, spills, and the release of environmentally damaging vapors or materials. Safer alternatives to vacuum equipment should be evaluated prior to use (e.g., positive displacement pump).

Scope

This standard defines the minimum requirements when performing material transfer of flammable materials and for in scope vacuum operations.

The operations that are in scope for this Standard are:

- transfer of flammable materials, and
- vacuum operations involving materials that could ignite, combust, or explode as a result of the accumulation of heat, static electricity, or other source of ignition caused by the vacuum operation.

The following table provides examples of the types of operations that are within scope of this Standard.

Examples of In-Scope Activities	
Vacuum truck service for hazardous process fluids, catalyst, and chemicals	Material transfer or vacuum services provided in a hazardous area (classified area)
Combustible liquid service where the combustibles are within 15° F (8.3° C) of their flash point	Rotary Lobe (solids and dry materials, and sludge) vacuum trucks in any area

Activities that present a low risk of static accumulation and a low risk of ignition, combustion, or explosion are out of scope for this standard. Examples of out-of-scope activities include using fixed systems that are designed and engineered to eliminate the hazard of static accumulation, combustion, or explosion, and material transfer activities that deal with substances that are nonflammable.

The following table provides examples of the types of material transfers and operations that are out of scope for this Standard.

Examples of Out-of-Scope Items and Activities	
Produced water	Material transfer using conveyer belts/tracks
Portable toilet or sanitation activity	Hazards to electrical components from static
Fixed Engineered vacuum systems uses for operations or refining	Engineered fixed material transfer systems used for operation
Hazards of vacuum pressure	Fixed Ship to Shore Material transfer
Design of vacuum systems or equipment	Design of material transfer systems or equipment
Removal of rainwater	Permanent fixed equipment designed for material transfer or vacuum operations

Requirements

The following sections provide minimum requirements for material transfer and vacuum operations as well as supporting guidance to clarify the intent of those requirements.

- Requirements of this Standard **shall** be met.
- Guidance in this Standard **may** be used as an aid to develop local documents that meet or exceed Control of Work (CoW) requirements. If examples are provided within guidance sections, they are not meant to represent the only acceptable means for meeting a requirement. WJO may develop or utilize other suitable methods not discussed in this document as long as the requirements are met. Implementation of guidance is not auditable.

<p>1. Requirement:</p> <p>Guidance:</p>	<p>A Hazard Analysis (HA) shall be conducted in accordance with the Hazard Analysis OE Standard when planning work involving material transfer or vacuum operations.</p> <p>The Hazard Analysis (HA) or Control of Work (CoW) documentation shall address:</p> <ul style="list-style-type: none">a. Respiratory protectionb. Chemical protective equipmentc. PPE requiredd. Sources of ignitione. Flammability of the material being transferred <p>Ignition sources could include vacuum equipment engine, exhaust heat, pump overheating, faulty or improper electrical devices, static electricity discharges. Additional hazards, mitigations, and controls are listed in the Hot Work OE Standard.</p>
<p>2. Requirement:</p> <p>Guidance:</p>	<p>Material transfer and vacuum operations shall be authorized in accordance with the Work Authorization OE Standard.</p> <p>WJO may include additional documentation with the work authorization, for example: operating procedure/checklist, isolation of hazard energy documents, and waste disposal documents.</p>
<p>3. Requirement:</p>	<p>Grounding and bonding requirements shall include to:</p> <ul style="list-style-type: none">a. All conductive equipment involved in material transfers shall be grounded and/or bonded.b. The ground point shall be verified or established, and the grounding/bonding components (e.g., ground clamps, couplings, conductors, etc.,) shall be visually inspected to assure the integrity of the grounding/bonding system.c. Vacuum equipment shall be grounded while loading or discharging, regardless of transfer material.d. Bonding to a verified or established ground point shall be verified for manually grounded vacuum equipment (i.e. when a Mobile Ground Verification (MGV) is not used) prior to beginning vacuum operations.

<p>Guidance:</p>	<p>e. Continuity of ground for manually grounded vacuum equipment and hose connections shall be verified each time the vacuum equipment is moved and prior to reinitiating operations.</p> <p>f. An industry-recognized technique for verifying continuity of hoses and equipment to achieve ground/bond continuity shall be required (e.g., MGV, continuity testing, etc.), including frequency requirements for grounding confirmation, maximum ohms of resistance allowed, and acceptable grounding locations.</p> <p>Verified grounding point could include:</p> <ul style="list-style-type: none"> • Grounding location that is part of a large piece of equipment with an underground grounding system exposed lugs or other grounding locations. • Temporary locations that have been installed by an electrician and verified sufficient for grounding protection. This type of location may be identified with signage or placards. • Remote locations without adequate grounding points may require installation of verified grounding points or other portable static grounding kits
<p>4. Requirement:</p>	<p>Conductive hoses, connectors, and static lines used for material transfer operations shall be suitably designed and rated for the material and transfer activity and shall meet or exceed recommendations of API-2219, NFPA 70 & 77, or equivalent industry standard.</p>
<p>5. Requirement:</p> <p>Guidance:</p>	<p>Hoses and connectors shall be inspected per API RP 2219 (or equivalent industry standard) and the manufacturer’s recommendations.</p> <ul style="list-style-type: none"> a. Hoses and connectors which have lost their conductivity shall be removed from service. b. Hoses constructed of conductive material or thick-walled with imbedded conductive wiring shall be used when transferring flammable and combustible liquids. c. Conductive hoses shall provide electrical resistivity less than 1 megohm (<1X10⁶ ohm) per 100ft (30.48m) as determined by the hose manufacturer. <p>Thin-walled or vapor recovery metallic spiral-wound conductive hoses are suitable for routing exhaust vapors to a safe location but are not suitable for liquid transfer,</p>
<p>6. Requirement:</p> <p>Guidance:</p>	<p>All hoses, both liquid and exhaust, shall be easily identified as conductive by permanent labeling.</p> <p>Acceptable hose identifiers include: glued, welded, or soldered name plates, stainless steel banding, or other similar attachments that can display information and that are designed to be permanent (identifying serial number, manufacturer name, and most recent certification date). Bar codes, QR codes, and</p>

		other similar technology are acceptable if the information can be viewed in the field by the user and permit issuer as needed. (Examples of identifiers can be found in the Material Transfer and vacuum operations repository)
7.	Requirement:	The bottom or lowest feasible connection point of tanks, vessels, or containers shall be used for transfers. <ul style="list-style-type: none"> a. A fill rate that mitigates the risk of static accumulation shall be maintained until the fill nozzle is completely submerged. b. Splash loading is discouraged. If splash loading cannot be avoided, a loading procedure that includes appropriate risk mitigations for static accumulation and High-Level Approval is required
	Guidance:	Use of the lowest point for transfers minimizes splash, slosh, and introduction of air into the system, and minimizes accumulation of electrostatic charge. High-level Approver can approve procedures for repeatable tasks, such as tank car loading, where the design of the vessel or system requires splash loading.
8.	Requirement:	The flow rate and nozzle velocity of the material being transferred shall be based on the safe operating limits recommended in American Petroleum Institute (API-2219 table C1 and C2) or equivalent industry standards.
9.	Requirement:	Persons performing material transfer and/or vacuum equipment operations, shall be knowledgeable and competent in the following areas: <ul style="list-style-type: none"> a. Static electricity hazards associated with flammable materials. b. Grounding and bonding techniques including methods to minimize the potential for static electricity to accumulate. c. Hose and transfer line techniques that are required to minimize or prevent static electricity accumulation (e.g., splash loading, rate of transfer, keeping suction end submerged, etc.). d. Emergency response actions and reporting requirements in the event of a fire, spill, release, or other emergency. e. Safe operation of equipment necessary for material transfer and vacuum operations. f. Familiarity with hazards of petroleum products, byproducts, wastes, and materials being transferred. g. Relevant government and facility safety requirements and procedures.
	Guidance:	Competency verification methods and training requirements should be managed locally.
10.	Requirement:	a. Material transfer and vacuum equipment shall be operated within design specifications and limits.

		<p>b. Only properly grounded conductive pipes, funnels, and containers shall be used for intermediate collection of flammable or combustible material.</p> <p>a. The use of plastic non-conductive dip pipes, funnels, and intermediate collection pans (including kiddie pools) for spill response or draining activities is prohibited.</p>
11.	<p>Requirement: Gas testing shall be performed in the areas where material transfer and vacuum equipment will be operated in accordance with the Portable Gas Detection CoW Technical Standard. Lower explosive limit (LEL) shall be within acceptable limits set in the Hot Work CoW Technical Standard.</p> <p>Guidance: Simultaneous operations (SimOps) near material and/or vacuum transfers involving flammable vapors should be delayed if possible. If unable to delay, air monitoring should be performed. Hot work activities that cannot be delayed near the material transfer and/or vacuum operations should be tested to confirm vent gases are not affecting these activities.</p>	
12.	<p>Requirement:</p> <p>a. Equipment shall not be over-pressured or under-pressured during material transfer or vacuum operations, including pressurization of cargo tanks, source containers, and receiving containers.</p> <p>b. Equipment pressurization limits shall be communicated as part of the HA or CoW documentation.</p>	

Additional Vacuum Equipment Requirements

13.	<p>Requirement: Inspection requirements for vacuum equipment, hoses, and associated equipment shall include, but is not limited to:</p> <p>a. Inspection/testing intervals. Vacuum equipment conductive hoses shall be tested at a minimum annually.</p> <p>b. Inspection criteria</p> <p>c. General condition expectations</p> <p>d. Expectations for repairs or removal from service when deficiencies are found.</p> <p>e. Documentation of inspection</p> <p>f. Preventive maintenance</p>	
14.	<p>Requirement: Vacuum truck driver shall be certified to drive and operate equipment per local regulation.</p> <p>Guidance: Vacuum truck driver credentials could include commercial driver license, hazardous material endorsement, etc. Additional considerations for operating in an industrial environment should be considered when selecting a service provider.</p>	
15.	<p>Requirement: Vacuum equipment operators shall have CoW documentation that communicates relevant safety information for flammable</p>	

	<p>hydrocarbon service before starting work. At a minimum, the information provided shall include:</p> <ol style="list-style-type: none"> a. Material name (or SDS) b. Quantity (estimated) c. Location d. Flash point e. Total Vapor Pressure (TVP)(required for light hydrocarbons) f. Temperature g. Identification of hazards associated with the material (e.g., presence of toxins such as benzene, H₂s, pH or corrosivity, reactivity, static accumulators, etc.)
<p>16. Requirement:</p> <p style="margin-left: 20px;">Guidance:</p>	<p>WJO vacuum operations documentation shall, at a minimum, cover Rotary Lobe (dry), Sliding Vane (liquid), and Liquid Ring Pump (dual purpose wet and dry vacuum truck) equipment, and shall address:</p> <ol style="list-style-type: none"> a. The use of vacuum equipment and their acceptable applications including but not limited to the following activities: <ol style="list-style-type: none"> i. Work associated with tank or vessel cleanup for inspection and/or repair. ii. Operations supporting hydro-excavation, maintenance, turnaround, and shutdown activities. iii. Spill and emergency response activities iv. Sump and drain cleaning. b. The method by which vacuum equipment is verified to be clean prior to entering facilities and between loads of potential incompatible materials shall be defined. <ol style="list-style-type: none"> i. Loading incompatible mixtures shall be prohibited. ii. Relaxation time shall be required before removing grounding cables of a switch load to dissipate static charge. c. Vent systems must be bonded and /or grounded with continuity testing performed prior to use. <p>Switch loading compatible materials that have disparate densities can generate static. The switch load materials will determine the relaxation time that is required to dissipate static buildup, before removing grounding cables. This is typically 10 to 30 minutes. See requirement 25 for additional requirements related to Liquid Vacuum Trucks.</p>
<p>17. Requirement:</p>	<p>Vacuum equipment shall include the following items at a minimum:</p> <ol style="list-style-type: none"> a. Fire extinguisher b. Grounding/bonding cables and clamps c. Grounding/earthing verification equipment (i.e., multi-meter, mobile ground verification (MGV) etc.) d. On-board spill kit (for liquid vacuum trucks only)

<p>Guidance:</p>	<ul style="list-style-type: none"> i. Minimum content of the kit includes pads and granular absorbent e. Debris tank level gauge (for liquid vacuum trucks only) f. Warning tape or barricades g. Appropriate methods for directing or mitigating exhaust fumes to a safe location <p>Appropriate methods for mitigating exhaust fumes could include the following: carbon absorption canisters, use of positive displacement pumps, 50' (15m) exhaust hose, vent stack exhausting 12 ft (3.65 m) above the truck's cab, use of vapor recovery unit, etc.</p> <p>Reference motor vehicle safety standard for additional requirement related to heavy equipment including wheel stoppers, engaging side brakes, spotter requirement, etc.</p>
<p>18. Requirement:</p>	<p>During Rotary Lobe vacuum operations (dry vac), vacuum breakers and additional personnel (hose assistant) are required as follows:</p> <ul style="list-style-type: none"> a. Vacuum breakers and/or an electronic emergency shutdown system, with additional personnel to operate the equipment, shall be in place when a hose operator is required. b. Vacuum breakers and/or electronic emergency shutdown systems shall be tested prior to equipment use and at intervals of no less than daily when vacuum equipment is in service.
<p>19. Requirement:</p> <p>Guidance:</p>	<ul style="list-style-type: none"> a. When exhausted vapors are directed from the vacuum discharge to a portable or facility vapor recovery unit, a flame arrestor shall be in the vapor recovery line, near the vapor recovery unit. This is to prevent flashbacks into the vacuum truck. b. Alternately, when exhaust vapors are directed to a carbon adsorber canister, the canister shall be properly rated to handle the volume of airflow generated by the vacuum pump. The canisters shall be bonded to the vacuum units to prevent static charge build-up. <ul style="list-style-type: none"> i. When using carbon to scrub flammable vapors, the temperature of the canister contents shall be monitored, an upper temperature limit shall be established, and the operator response to a reading at or above the limit shall be clearly defined. ii. Carbon adsorber canisters shall be inspected and replaced before they become saturated by lubricating oil or contaminated by exhaust vapors, as spontaneous combustion could occur. <p>The use of liquid scrubber with diesel (or similar) media prior to routing through carbon, may greatly diminish saturation and heating of carbon media.</p>

	An analysis should be conducted to determine the proper safety measures required prior to each specific use of vapor control canisters and vapor recovery systems.
20. Requirement:	Workers shall not be exposed to discharged vent vapors that exceed Occupational Exposure Limits.
Guidance:	<p>Consideration should be given to potential hazards associated with the surrounding area and atmospheric conditions during vacuum equipment operations.</p> <p>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.</p>
21. Requirement:	<p>a. Vacuum equipment operators shall be trained in the use of portable fire extinguishers.</p> <p>b. Portable fire extinguishers shall remain with the vacuum equipment and be maintained in accordance with applicable regulatory requirements.</p>
22. Requirement:	<p>a. Materials transported in the vacuum equipment tanks shall be compatible with other materials previously transported.</p> <p>b. Vacuum equipment tanks shall be cleaned between loads of incompatible materials, or if compatibility of the materials is unknown.</p>
Guidance:	<p>Placing incompatible materials into vacuum equipment tanks can lead to violent reactions or cross contamination of material. Clean the vacuum equipment tanks thoroughly between loads to prevent cross contamination (e.g., load of oily water and a load of uncontaminated groundwater).</p> <p>Steam or high-pressure water should not be used for initial washing of residue from a tank that contained flammables or combustibles due to the propensity to develop high levels of static electricity.</p> <p>Proper PPE must be worn by all personnel involved in the cleaning operation with consideration for all potential exposures. Vacuum equipment tanks should be emptied and rinsed after completion of assigned work. Hoses and lines should be emptied, flushed, and capped before entering or exiting the site.</p>
23. Requirement:	<p>a. At no time shall vacuum operations be used for materials that could contain Liquid Petroleum Gas (LPG) or other high vapor pressure hydrocarbons.</p> <p>b. Materials with True Vapor Pressure (TVP) greater than 11 psia shall not be handled with a vacuum truck of any type.</p>
Guidance:	<p>Reference appendix B, "TVP-RVP Conversion for Vacuum Truck Loading".</p> <p>Vapor pressure information can be obtained from the material SDS or through material testing.</p>
24. Requirement:	Gravity off-loading and pumping off material from vacuum equipment shall be the preferred method.

<p>Guidance:</p>	<ul style="list-style-type: none"> a. The use of alternative methods such as pressuring off material, shall only be used with a hazard analysis and proper safeguards for hazard mitigation. b. Pressure off-loading is prohibited for materials with an open cup flash point below 100°F (37.8°C). <p>When using alternative methods such as pressuring off material from vacuum equipment, a detailed permit (short-term) or MOC (long-term) showing process steps with risks and mitigations should be reviewed and approved by WJO and Contractor Vacuum Truck Service Provider.</p>
<p>25. Requirement:</p>	<p>For all Liquid Vacuum Trucks, the following material and equipment limits apply:</p> <ul style="list-style-type: none"> a. Materials with 2.5 pH or less shall be handled in a tank made of stainless steel or other metallurgy designed for low pH liquids. Hose type and fittings shall also be compatible. b. The vacuum truck driver/operator shall remain within 25 feet (7m) of the truck during the transfer. c. Temperature limit of 120°F (50°C) for the material to be transferred unless the truck and disposal site equipment are specifically verified to accommodate higher temperature materials. d. Pyrophoric or oxidizing materials shall not be handled by any vacuum truck unless measures have been taken to mitigate risks and verify that the hazard has been neutralized. e. Combustible solids such as sulfur dust shall not be handled with any type of vacuum truck. f. If the vacuum hose is to connect to process equipment, a site approved procedure shall be used to prevent collapse or overpressure of the process equipment and vacuum truck tank. <ul style="list-style-type: none"> i. For connecting to in-service equipment, an MOC or site-specific procedure shall be used. ii. The procedure shall address the necessity of a drain/vent valve on the vacuum truck piping for confirmation the hose is safe to disconnect. g. If connecting to process equipment, the process pressure shall not exceed the PSV set point on the vacuum truck. h. If the vacuum exhaust is to be returned to the source container, approval shall be obtained from Vacuum Truck Coordinator/SME and engineering SME. i. If exhaust scrubbers are used, they shall be rated for the vent rate. j. The vendors/providers of scrubbers and media used for exhaust scrubbers shall provide a technical or engineering review of equipment size and type recommendations, media limitations (including break-thru and heat-up considerations) and cautions

necessary to make informed decisions on use of the equipment.

- k. **WJO Engineer(s)/SME shall be consulted for first time use of a vacuum truck in a specific operation and shall participate in and approve the MOC for that operation.**

Appendix A: Terms and definitions

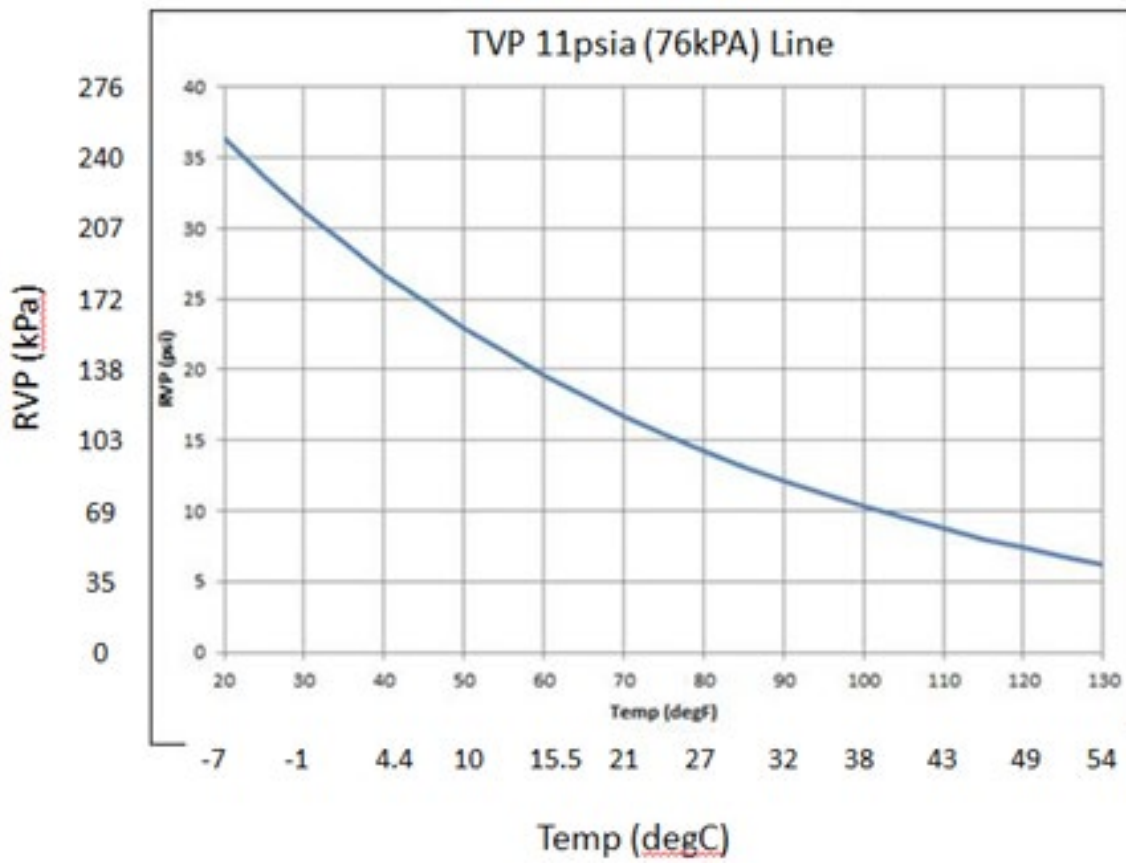
Term	Definition
Bonding	Providing electrical connections between isolated conductive parts of a system to equalize their electrical potential (voltage). A resistance less than 1 megohm [$<1 \times 10^6$ ohm] is traditionally considered adequate for static dissipation. The targeted goal for bonding should 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.
Combustible Liquids	Liquids with a flash point at or above 100°F (37.8°C) Examples of combustible liquids are Diesel, Kerosene, Fuel Oil and Vacuum Gas Oil.
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.
High-Level Approver	Person with the competency and authority to make a risk-based evaluation and determine whether proposed deviations from a CoW requirement and alternate controls adequately reduce risk and allow safe execution of work. BUs determine the appropriate organizational level of “high-level approvers” based upon the risk of the task, requirement, and/or deviation.
Mobile Ground Verification (MGV)	A permanently installed and WJO approved continuous self-checking grounding / monitoring verification device.
Produced Water	Water exposed to hydrocarbon and has a flash point greater than 200 degrees F, or 93 C, and less than 1% hydrocarbon content remaining in the water. This includes water brought up from the hydrocarbon-bearing strata during the extraction of oil and gas. It can include formation water, injection water and any chemicals added downhole during the oil/water separation process.
Relaxation Time	The time required for static charge to dissipate in a substance after mixing compatible materials that have differing densities that may generate static.
Switch Loading	The practice of loading one material followed by another compatible material with different properties (e.g. conductivity, resistivity, etc.) into a vacuum truck.
True Vapor Pressure (TVP)	A measure of the volatility of a fuel as measured at its actual temperature.
Vacuum trucks	Vacuum trucks are vehicles equipped with both a pressure vessel or tank and a vacuum pump. These vehicles have the capability to vacuum liquid and/or dry materials into their tank and some also have the ability to reverse the vacuum pump to pressure offload the contents of their tank.
Vacuum Breaker (safety Tee)	An inline vacuum relief valve or device that can be used to interrupt line suction in the event of an emergency.

Term	Definition
Common Types of Vacuum Trucks (for reference)	
Sliding Vane Pump (common liquid vacuum truck)	This design is the most common vacuum truck design currently in use for petroleum service. These systems utilize a sliding vane pump to generate a negative pressure in the tank. They are commonly used for transferring liquids and slurries, including flammable and combustible materials.
Liquid Ring Pump (dual purpose wet and dry vacuum truck)	This design can be used to transfer liquids or solid materials. Although the liquid ring pump is classified as a pneumatic conveyor system, the pumps typically operate at much lower temperatures than rotary lobe type system and produce less vapor discharge than other types of vacuum truck systems. Liquid ring pumps are commonly used for transferring liquids, slurries and solid materials, including flammable and combustible materials.
Rotary Lobe Blower (dry vacuum truck)	This design is less commonly used and its use must be reviewed carefully for appropriate applications. Common uses are for transfer of non-liquid materials such as pellets, catalyst, powders, dust, dirt and heavy sludge. Do NOT use this type of vacuum truck to remove flammable or combustible liquids. The higher operating temperatures created by the blowers, along with the higher air-flow and negative pressures which can atomize and vaporize materials, can quickly create hazardous conditions if flammable or combustible materials are handled with this type of equipment.

Appendix B: Roles and Responsibilities

Role	Responsibilities
Material Transfer or Vacuum Equipment Operator	<ul style="list-style-type: none"> • Understands hazard associated with the task. • Possesses documentation that communicates relevant safety information about the material to be loaded or off loaded. • Trained and competent in grounding and bonding techniques • Training in emergency response actions and reporting requirements related to their equipment and task. • Cleans container and associated equipment prior to loading incompatible material. • Directs vent gases to a safe location
Vacuum Truck Driver / Operator	<ul style="list-style-type: none"> • Certified to drive and operate equipment. • Competent in best practices to eliminate or reduce static accumulation. • Fully understand all aspects and hazards of their planned vacuum truck operations before conducting work • Understand and use stop work authority when appropriate. • Current with training and know procedures for safe use of equipment. • Conduct a pre-trip and pre-job audit as well as all required equipment inspections. • Participate in and assure completion of specific jobsite assessment, Start Work Check, and permits
Vacuum Truck hose operator	<ul style="list-style-type: none"> • Fully understand all aspects and hazards of their planned vacuum truck operations before conducting work • Understand and use stop work authority when appropriate. • Current with training and know procedures for safe use of equipment. • Communicates to the Vacuum truck operator when to start and stop the vacuum pump. • Maintains control of the end of the hose when vacuum pump is running. • Secures end of hose when not in use.
Hose assistant for Rotary lobe vacuum (Dry Vac)	<ul style="list-style-type: none"> • Has direct sight of the hose operator. • Has direct sight or communication with the Vacuum Truck Operator. • Remains at the vacuum breaker and/or an electronic emergency shutdown system while vacuum pump is running. • Ensures the vacuum breaker remains open until the Hose Operator is ready to start vacuuming (including when the vacuum is not in use) • If more than one additional personnel is needed to help move the vacuum piping or hose, one dedicated person shall stay at the vacuum breaker and/or electronic emergency shutdown down while vacuum pump is running.

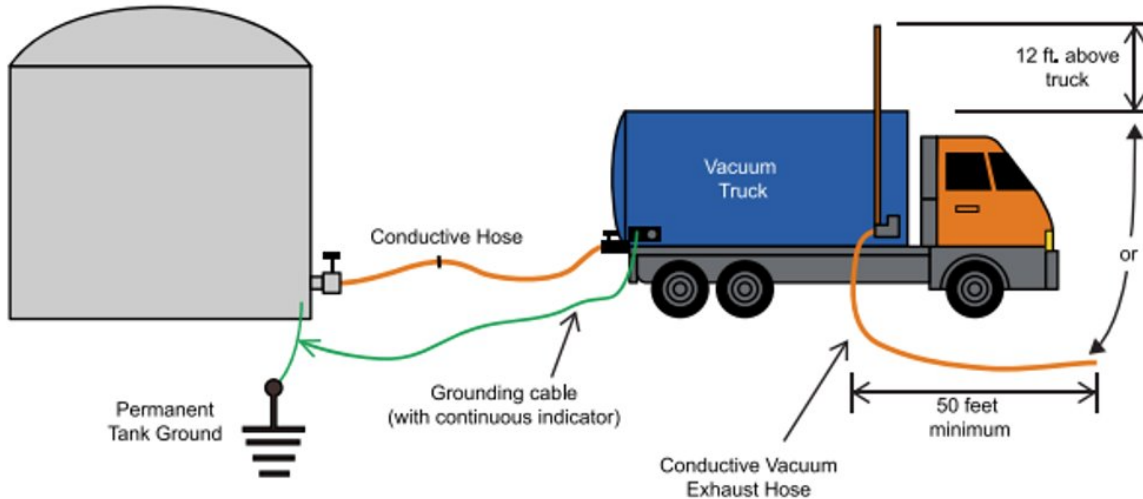
Appendix C: TVP-RVP Conversion for Vacuum Truck Loading



Appendix D: Best Practice Illustrations

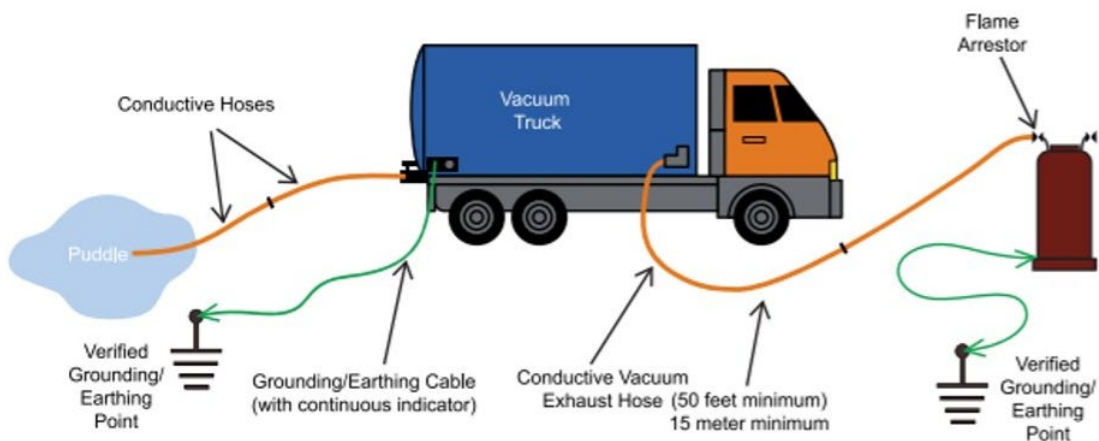
The following illustrations represent both requirements and best practices.

Tank Load/Discharge with Fixed Pipe Connection to Vessel



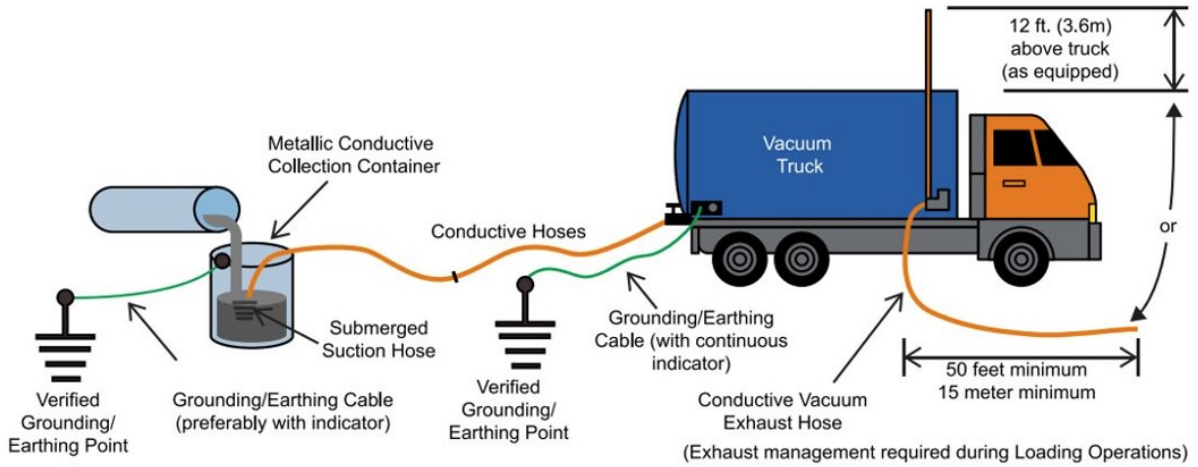
The tank and the truck are bonded via the conductive hose. Both tank and truck are grounded, and the truck-to-ground connection is verified and monitored during transfer by truck mounted continuous ground verification system

Vacuum with use of a vent scrubber



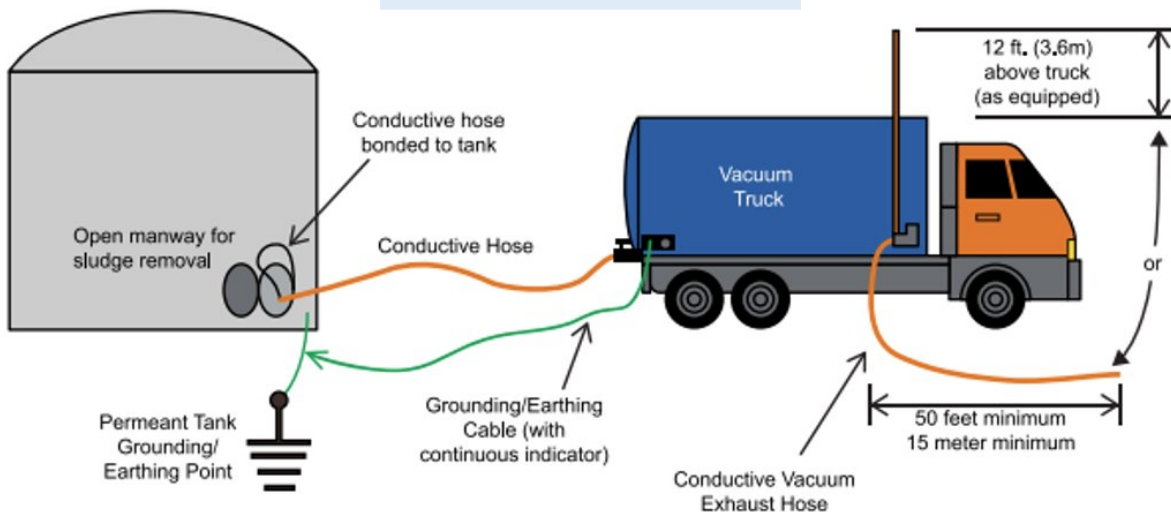
The scrubber and truck are bonded via the conductive hoses. Both scrubber and truck are grounded. The scrubber is grounded with cable and clamps to a verified ground point of the scrubber is verified as grounded through the contact of its base to earth.

Vacuumping from an Intermediate Collection Basin



The metallic, conductive collection container is grounded to a grounding point using a bonding cable with <10 ohms electrical resistivity at its connections. The truck is grounded, and the truck-to-ground connection is verified and monitored during transfer by truck mounted continuous ground verifications system.

Vacuumping from an Open Manway



CAUTION: When vacuuming from open manway, refer to tank cleaning procedure and HA/JSA to ensure proper procedures are being followed. This includes monitoring for flammable/combustible mixture.

The tank is grounded to a grounding point using a bonding cable with <10 ohms electrical resistivity. The truck is grounded, and the truck-to-ground connection is verified and monitored during transfer by truck mounted continuous ground verification system. A conductive vacuum hose is used, and its suction end is bonded to the tank. Where an appurtenance is used, verify the bound connection to both tank and hose

Appendix E: References and Support Documents

Internal References

Control of Work (CoW) / Managing Safe Work (MSW)
Repository Transfer and Vacuum Equipment Operations
(Including old standards, images of placards, examples of hose
identification tags, Illustrations of best practice, MFG-200)
SHEERS Control of Work Process
WJO Hazard Analysis CoW Standard
WJO Work Authorization CoW Standard
WJO Electrical CoW Standard
WJO Training and Competency OE Standard
MFG-200 Manufacturing Standard for Vacuum Truck
Operations

American Petroleum Institute (API)

API-2219 Safe Operation of Vacuum Trucks in Petroleum Service; fourth
edition
API-2003 Protection Against Ignitions Arising Out of Static, Lightning,
and Stray Currents
API-2013 Cleaning Mobile Tanks in Flammable or Combustible Liquid
Service

National Fire Protection Association

NFPA code 77 Recommended Practice of Static Electricity
NFPA code 30 Flammable and Combustible Liquids Code
NFPA 326 Safeguarding of Tanks and Containers for Entry, Cleaning or
Repair

Occupational Safety & Health Administration (OSHA) & U.S. Federal Regulation

OSHA 1910.1000 Subpart Z, Toxic and Hazardous Substances
CFR Title 49 Transportation

Other

ACGIH 1 TLVs® and BEIs® Based on Threshold Limit Values for
Chemical Substances and Physical Agents and Biological
Exposure Indices
NTTC 4 Hazardous Materials Transportation—The Tank Truck Driver's
Guide