



# the human energy company™

MSW Initial/Refresher  
Training:  
Vacuum Truck Operations

# Purpose, Objectives and Scope

## **Purpose of the Training**

- Learn the requirements of the Vacuum Truck standard in order to avoid incidents involving the use of vacuum trucks.

## **Objectives of the Training**

- For the learner to understand the key concepts and requirements of the Vacuum Truck standard
- Understand the steps involved with the safe management of vacuum truck usage

## **Scope**

- This standard applies to the use of any vacuum trucks in Chevron facilities

## **Out of Scope**

- The use or requirements of trucks used in the service Portable Toilets and similar sanitary containments.
- Engineered, fixed systems involving the use of vacuum
- Other material transfer operations using other methods



# General Information

## Use of Vacuum Trucks

- Vacuum Trucks are used for collecting and transferring solids, liquids, and sludge from one location to another.
- Vacuum trucks are used when other means of material collection or transfer are not safe, feasible or practical.



# Hazards

## Hazards of Vacuum Truck Operation

- Fire from vapor releases or spills
- Fire or explosion from static generation
- Personnel exposure from spills or vapor releases
- Environmental incidents from spills or releases
- Equipment incompatibility with material being vacuumed
- Co-mingling of incompatible materials resulting in chemical reaction
- Material misidentification leading to any of the above



# Key Definitions for Vacuum Truck Operations

## **Common liquid vacuum truck (sliding vane pump)**

- Used for liquids and light slurries—including flammable and combustible materials

## **Dual purpose wet vacuum truck (liquid ring pump)**

- Used for liquids, sludge's and slurries—including flammable and combustible materials.

## **Dry vacuum truck; turbo vac or air mover (rotary lobe blower)**

- High volume air movement, used for dry solids, i.e. dirt, and residue. Is not to be used in an environment with a flammable atmosphere and must remain <5% LFL during any transfer operation.





# Common Types of Vacuum Trucks

Physical differences between a Sliding Vane truck and Liquid Ring & Rotary Lobe trucks are primarily the addition of filter canisters and/or cyclones that are used in Liquid Ring and Rotary Lobe trucks.



Sliding Vane



Liquid Ring/Rotary Lobe  
(very similar in appearance)

# General Truck Operation Requirements

**All vacuum trucks being used in our operations must meet specific standards.**

- **Examples:**
- Meet all regulatory requirements, including inspections of the truck, tank, and tank appurtenances.
- Inspected using a Vehicle Inspection Report (VIR) **daily** by their drivers as required by the regulating transportation agency. All maintenance and maintenance records managed by the truck owners.
- Have a functioning level indicator
- Liquid trucks only: Are equipped with a 20 lb. A,B,C fire extinguisher, and a spill kit.



# Vacuum Truck Worksheet

## Vacuum Truck Worksheet

When requesting vacuum truck service

- The written request contains the following information:
  - Vacuum Truck Type
  - Location (tank number, etc.)
  - Flash Point of Material
  - Total Vapor Pressure (required for light hydrocarbons only)
  - Temperature of the Material
  - Quantity of Materials
  - Other relevant Hazards with the Material
- In addition, the worksheet contains a pre job safety checklist.

## For material with temperatures exceeding 120°F

- Mitigation steps must be taken to reduce temperatures or a variance must be developed and issued to ensure temperature of material does not exceed any of the vacuum truck equipment's limits.





# Liquid Vacuum Truck Start Work Check

## ESSENTIALS SAFEGUARD QUICK REFERENCE GUIDE

### REFERENCE A – Make ground connections to a verified ground point.

Ensure that ground connections are made for:

1. Truck, 2. Collection Pans and 3. If required, the scrubber.

#### Trucks equipped with Mobile Ground Verification (MGV):

1. Witness Red light on MGV then proceed to connect to ground.
2. Once Green light is established on MGV, ground is verified.

#### Trucks NOT equipped with Mobile Ground Verification (MGV):

1. Must be connected to a verified ground point with <1000 ohms of resistance.
2. Bond connections from the clamp to ground point must be verified as <10ohms.

### REFERENCE B – Place exhaust hose in safe location.

**Option 1:** 50 feet (15 m) horizontally downwind. If scrubber is required, scrubber has to be grounded. If carbon is used, a flame arrestor is required.

**Option 2:** Equipped with a vertical stack venting minimum of 12 ft (3.6 m) above truck.

### REFERENCE C – Complete circuit test of suction and exhaust hoses and all clamps for bonds/grounds.

Bond & ground clamps must be less than 10 ohms each.

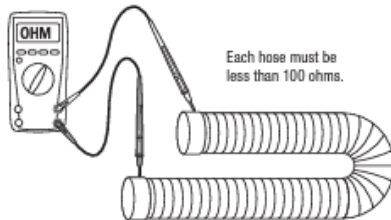
#### Option 1 Circuit Test:

Test resistance from the end of the last vacuum hose (A) to the ground clamp (B). Must be <10,000 ohms resistance. If higher, **STOP** and call Supervisor.

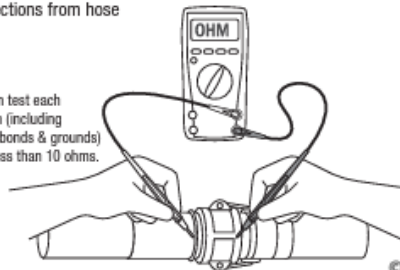


#### Option 2 Individual Hose & Connection Tests:

Hoses and connections must be tested individually if managed separate from the circuit test. Test each hose (<100 ohms) and connection (<10 ohms) including connections from hose through tree to truck's frame. If higher, **STOP** and call Supervisor.



Connection test each connection (including clamps of bonds & grounds) must be less than 10 ohms.



## Liquid Material Vacuum Truck Operations Start Work Check

Manufacturing

### NON-OPEN FLAME HOT WORK

#### SWC-VT-LIQ-1

Apr 1, 2016

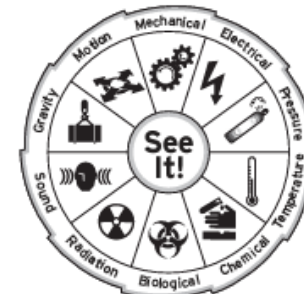
Applies only to Vacuum Trucks used for hydrocarbon transfers such as Liquid Ring and Sliding Vane Vacuum Trucks. Also applies to Liquid Ring Vacuum Trucks moving solid materials containing hydrocarbon.

Rotary Lobe Blower Vacuum Trucks used for non-hydrocarbon transfers use EC-VT-DRY-1.

Fill out new Checklist for every location and/or material change.

#### Standard equipment:

- 20 lb. B/C (9 kg DCP) fire extinguisher
- Wheel chocks
- Personal 4-gas monitors (LEL, O<sub>2</sub>, CO, H<sub>2</sub>S)
- Spill kit
- Emergency communication



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# Liquid Vacuum Truck Start Work Check

## STEP 1: BEFORE LEAVING FOR JOB SITE

### Completed by Truck Driver

1. Inspect grounding and bonding cables.  
No fraying; strong clamps with sharp points.
2. Inspect all vacuum and exhaust hoses.  
No visible damage; no exposed wires.
3. ID tags are current and within expiration.

## STEP 2: LIMITATIONS & SPECIAL INSTRUCTIONS

### Completed by Competent Verifier\* and Truck Driver

Request/Permit #: \_\_\_\_\_

Material: \_\_\_\_\_

Equipment Name: \_\_\_\_\_ N/A

1. Material must be less than 120°F (49°C).  
If material Temperature is greater than 120°F (49°C), **STOP** and call Supervisor.
2. Materials with a TVP of greater than 11 PSI must never be loaded onto a vacuum truck.  
  
If the material being loaded is a light hydrocarbon (examples gasoline, naphtha), **STOP** and verify the TVP is less than 11 PSI before proceeding.

If the material being loaded is a light hydrocarbon (examples gasoline, naphtha), **STOP** and verify the TVP is less than 11 PSI before proceeding.

3. When connecting to live process equipment, an approved procedure or MOC must be used. MOC/Procedure Number \_\_\_\_\_ If no approved procedure/MOC, **STOP** and call Supervisor.
4. The process pressure must not exceed the PSV set point on the vacuum truck when connecting to process piping.  
  
If process pressure is above vacuum truck PSV set point, **STOP** and call Supervisor.
5. When pans are used for collection, ensure they are conductive and grounded. If pan is non-conductive, **STOP** and call Supervisor.

### Switch Loading/Compatibility Instructions Completed by Truck Driver

Truck must be cleaned between transfers. If not, **STOP!** The Chevron VT Coordinator must approve material compatibility and required relaxation time before mixing loads. Approval documented on permit/request form.

## STEP 3: ON JOB SITE

### Confirmed by Truck Driver and Competent Verifier\*

Complete area gas test if in hazardous classified area. Verify lockable fittings are secured before transfer. Identify work taking place within 50 ft (15 m) and safeguards needed. Identify **STOP!** criteria for the job.

\* Competent Verifier is the Permit Issuer unless transferring material in a pre-approved location. Permit Issuer only required for first transfer.

### Verification of Essential Safeguards.

1. Make ground connections to a verified ground point. **(See REFERENCE A)**
2. Vent exhaust hose to safe location. **(See REFERENCE B)**
3. Complete Circuit Test (do either Circuit or Individual Hose & Connection Tests). **(See REFERENCE C)**

Truck Driver  
(Initial)

Competent Verifier\*  
(Initial)

Transfer	Circuit Test		
	Max Circuit Test Reading	Truck Driver (Initial)	Competent Verifier* (Initial)
1st	_____ ohms	_____	_____
2nd	_____ ohms	_____	_____
3rd	_____ ohms	_____	_____
4th	_____ ohms	_____	_____
Max Circuit Test Reading Less than 10,000 ohms			

Transfer	Individual Hose & Connection Tests			
	Record Hose Max Reading	Record Max Connection Reading	Truck Driver (Initial)	Competent Verifier* (Initial)
1st	_____ ohms	_____ ohms	_____	_____
2nd	_____ ohms	_____ ohms	_____	_____
3rd	_____ ohms	_____ ohms	_____	_____
4th	_____ ohms	_____ ohms	_____	_____
Max Hose Reading Less than 100 ohms		Max Connect Reading Less than 10 ohms		

OR

## STEP 4: PRINT AND SIGN BEFORE BEGINNING WORK

### Competent Verifier

Print Name \_\_\_\_\_

Signature \_\_\_\_\_

Date \_\_\_\_\_

### Truck Driver

Print Name \_\_\_\_\_

Signature \_\_\_\_\_

Date \_\_\_\_\_

## STEP 5: FOR AUDIT PURPOSE ONLY (10%)

### Site Checker Review

Print Name \_\_\_\_\_

Signature \_\_\_\_\_

Date \_\_\_\_\_

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# Dry Vacuum Truck Start Work Check

## ESSENTIALS SAFEGUARD QUICK REFERENCE GUIDE

### REFERENCE A – Make ground connections to an approved ground point.

#### Trucks equipped with Mobile Ground Verification (MGV)

1. Witness Red light (unit on, no ground verified) on MGV then proceed to connect to ground.
2. Once Green light is established on MGV, ground is verified.

#### Trucks NOT equipped with Mobile Ground Verification (MGV)

1. Must be connected to an approved ground point with <1000 ohms of resistance.
2. Bond connections from the clamp to ground point must be verified.

### REFERENCE B – Conduct gas test on material to be transferred.

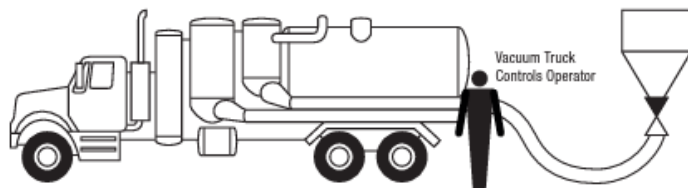
A gas monitoring plan is required for any material that could potentially contain hydrocarbon (examples: tank sludge, potentially contaminated soils, catalyst). The frequency of monitoring should be often enough to anticipate changes in the material (once an hour, once every two hours, etc.). If liquid is observed in the material, **STOP!** and do a gas test. If hydrocarbon is detected **STOP!** and notify your supervisor.

### REFERENCE C – Vacuum breaker or E-STOP use.

For all dry vacuum truck operations, a Vacuum Truck Controls Operator is required to manage the controls at the back of the truck.

#### Scenario 1: Dry Vacuum Truck connected to equipment

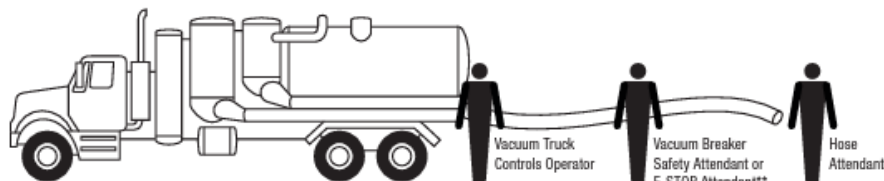
If the hose end will be connected directly to equipment for material extraction, and the Vacuum Truck Controls Operator has a clear view of the entire operation, one person may be sufficient to safely control the material collection.



#### Scenario 2: Dry Vacuum Truck NOT connected to equipment

In any situation where the hose is not attached directly to equipment, a hose attendant is **always** required to man the hose end to ensure it does not move or whip around.

A separate safety attendant must manage the vacuum breaker or E-STOP. Attendant must have direct line of sight of the Hose Operator (or use an additional "Hose Watch" to communicate with the attendant.)



\*\*E-STOP attendant not required if emergency shutdown controls are integrated with the truck's vacuum and snorkel controls panel.

## Dry Material Vacuum Truck Operations Start Work Check

Manufacturing

### NON-OPEN FLAME HOT WORK

ID#: SWC-VT-DRY-1

May 1, 2017

Applies to Vacuum Trucks used for non-hydrocarbon transfers using Rotary Lobe ONLY.

Vacuum Trucks used for transfer of hydrocarbon must use EC-VT-LIQ-1.

Fill out new Checklist for every location and/or material change.

#### Standard equipment:

- Wheel chocks
- Personal 4-gas monitors (LEL, O<sub>2</sub>, CO, H<sub>2</sub>S)
- Emergency communication



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# Dry Vacuum Truck Start Work Check

## STEP 1: BEFORE LEAVING FOR JOB SITE

Completed by Truck Driver/  
Crew Member \_\_\_\_\_ (Initial)

Inspect grounding and bonding cables.  
No fraying; strong clamps with sharp points. \_\_\_\_\_

Inspect all vacuum hoses.  
No visible damage and no exposed wires. \_\_\_\_\_

Verify at least one of the following is used  
to protect from static shock:

- Static PPE  
(e.g., rubber boots, rubber gloves).
- Conductive hoses continuity  
test with ohm meter

## STEP 2: LIMITATIONS & SPECIAL INSTRUCTIONS

Completed by Truck Driver/Crew Member and  
competent verifier

Request/Permit #: \_\_\_\_\_

Material: \_\_\_\_\_

Equipment Name: \_\_\_\_\_  N/A

- When connecting to live process equipment, an approved  
procedure must be used.  
MOC/Procedure number \_\_\_\_\_  
If no approved procedure, then **STOP!** and call Supervisor.
- If connecting directly to any process or other equipment,  
then verify adequate venting to prevent equipment  
damage.

## STEP 3: ON JOB SITE

Completed by Truck Driver/Crew Member and competent verifier

Complete area gas test if in hazardous classified area.

Verify work area is barricaded to prevent entry by others.

Verify lockable fittings are secured and hoses are secured to avoid whipping.

Verify material is compatible with truck (i.e. not pyrophoric or containing any type of combustible dust (sulfur).

Verify hose is compatible with material.

Identify work taking place within 50 ft (15 m) and verify any additional safeguards needed to address conflict.

Identify **STOP!** criteria for the job.

### Verification of Essential Safeguards

1. Make ground connections to a verified ground point. **(See REFERENCE A)**

2. Perform gas test on material to be transferred. Must be <5%LEL.

If higher, then **STOP!** Call supervisor.

A gas monitoring plan is required if there is a potential for hydrocarbons. **(See REFERENCE B)**

Yes \_\_\_\_\_ No \_\_\_\_\_

3. Install vacuum breaker on hose, or use electronic emergency shutdown device (E-STOP)

if a hose operator will be required.  N/A if connected to process equipment

Perform test Vacuum Breaker / E-STOP prior to use. **(See REFERENCE C)**

Truck Driver/  
Crew Member  
(Initial)

Competent  
Verifier\*  
(Initial)

## STEP 4: PRINT AND SIGN BEFORE BEGINNING WORK

Competent  
Verifier

Print Name \_\_\_\_\_ Signature \_\_\_\_\_ Date \_\_\_\_\_

Truck Driver/  
Crew Member

Print Name \_\_\_\_\_ Signature \_\_\_\_\_ Date \_\_\_\_\_

## STEP 5: FOR AUDIT PURPOSE ONLY (10%)

Site Checker  
Review

Print Name \_\_\_\_\_ Signature \_\_\_\_\_ Date \_\_\_\_\_

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# Hazard Analysis

Begin your Planning Phase Hazard Analysis (PPHA) as soon as you know you need to remove material. Consult the Task Consequence Catalogue (TCC).

- The vacuum truck driver meets with Operations (or the requesting party) to complete the Vacuum Truck Safety Worksheet, the required Permits, the JLA, and the Vacuum Truck Essentials Checklist..
- Identify resources needed. Drivers must remain within 7.5 meters / 25 feet of the vacuum truck. Attendants or additional help may be needed. Operations is responsible to provide additional resources required to perform the work.
- Before vacuum truck set up and before the vacuum truck work begins, all personnel associated with the vacuum truck operation or affected by the presence of the vacuum truck at the job site will review the JLA for awareness and understanding of work being performed in their work area. This common understanding is vital to personal safety.
- Identify if it is needed for Vacuum Truck Operators to wear a monitor that measures four gases: H<sub>2</sub>S, O<sub>2</sub>, LEL, CO.
- Identify potential hazards from surrounding work or equipment in the area. Use hazard wheel to guide your inquiry.
- Identify nearby personnel and activities in the work area
- Barricading of the work area and the vacuum exhaust arrangement is included in the discussion to ensure any concerns for odors or vapors are properly addressed.



# Static Hazards

An electrostatic charge is normally generated by contact and generation between surfaces of dissimilar materials. Examples include:



- Fluid flowing through a pipe, hose or filter

- Splash filling

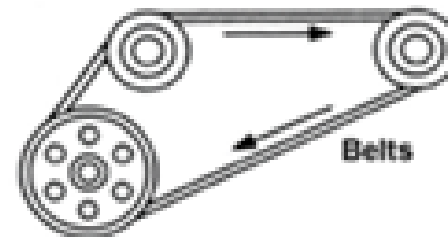
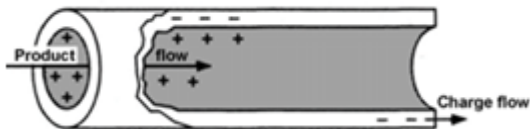
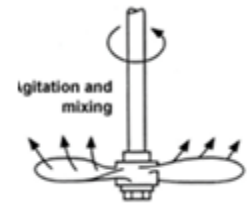
- Bubbling or agitation

- Steaming

- Two phase flow – liquid and gas or liquid and solid

- Sand or grit blasting

- Conveyor, roller or belt motion





# Static Hazards

## Conductive Equipment (Conductivity)

- Conductive equipment allows for the flow of electric current, including static electricity generated by material transfers.
- Conductivity of materials is measured in Ohms ( $\Omega$ ).
- The greater the Ohm reading, the greater the hazard.
- Metal is a good conductor, plastic is a very poor conductor.
- An Ohm Meter or Multimeter is used to measure ohms
  
- It is important to verify ground to earth for every job.
  
- Understand how your Volt/Ohm meter works.
- The Essentials Checklist has a job aid to reference correct bonding and grounding resistance readings.
- Vacuum Truck Equipment



# Static Hazards

## **Bonding**

- Connecting conductive equipment together to eliminate a difference in static charge potential between them.
- Provides a conductive path across possible spark gaps
- It provides a safer path for the charge to follow

## **Grounding, or Earthing**

- Connects conductive equipment to ground to limit the build-up/accumulation of static electricity.
- Connections are made using conductive cable and approved clamps.
- Static generated in a conductive system is dissipated through its path to ground.
- The earth can absorb an unlimited amount of electrostatic charge (or current).
- Please note: Grounds connected to electrical equipment should NOT be used.



# Bonding

**Bonding** (bonded connections) can be metal to metal shown in Figure A or connecting two conductive pieces of equipment using a cable shown in Figure B must be maintained at  $<10$  ohms during a transfer.



Shown here, testing a hose to hose bond connection using a Multimeter



Bond of conductive container to a steel tank, (shown using indicating bonding cable that lights when bond is  $<10$  ohms)

# Grounding

## Grounding

- Many vacuum trucks are equipped with Mobile Ground Verification Systems (MGV).
- When the cable is connected to a ground point that provides a means for dissipation of static charge at <math><1000</math> ohms of electrical resistance the MGV's green LED display will light.
- Trucks without these ground verification devices will have to use either proven/verified ground points such as a tank, vessel or tank grounding point, a ground installed for the vacuum truck activity, or by use of a handheld ground detection meter by a person trained to use it.



Mobile Ground Verification (MGV) System showing Green Light Indicator



# Hoses

## Conductive Hoses

- Hoses used on vacuum trucks must be conductive.
- Hoses should be tested annually and marked with the test date and unique tracking number.
- Before each job and at the beginning of each shift the hoses are tested for conductivity by the driver.
- Each hose length/segment, coupling to coupling, is tested to confirm the electrical resistance is <math><10,000</math> ohms.
- Rotary Lobe (Air Movers) trucks are exempt from this requirement.



- The picture shows a vacuum truck driver checking hoses for conductivity.
- The collection end of the hose is looped back around near the other end to access with the probes of the multimeter.

- This test indicated 1 ohm, well under the 10,000 ohm limit for each hose length.
- This same test must be done on each of the hoses used including vapor hose(s).



# Hoses

## Hose Connectors Requirements

- All Cam-lock type fittings must be securable by locking handles with locking pins, velcro or arm wires. Locking handles must be secured with wires strung through the rings or be Velcro strapped, “taped” to prevent inadvertent release.
- Cam-lock fitting metallurgy must be suitable for the material being transferred.
- Hose ends and gaskets are inspected by the driver to confirm they’re free of damage or wear that could lead to a leak or spill.



Hose attachments or appurtenances shown in the picture at left are required to be:

- conductive
- lock and bond securely to the hose’s metal end



# Hoses

## Rotary Lobe trucks –

- Hose Requirements
  - These hoses must be equipped with a vacuum breaker and an attendant to provide quick shutdown of vacuum at the operated end of the hose to protect the worker from the powerful suction should it be needed.



A Vacuum Breaker Attendant is required for all rotary Lobe transfers where a person is manning the suction end of the hose

# Static

- Even with proper grounding, bonding, and use of conductive equipment it's still important that static generation be reduced where a flammable atmosphere may be present in the receiving tank.
- Transferring materials can generate and accumulate static at a rate faster than can be dissipated to ground.
- Skimming of hydrocarbon materials can pose particular static hazards due to the natural agitation and large intake of air.
  - Is it possible to pull materials into an intermediate container like a drum using a squeegee or some other means in order to avoid sucking air?

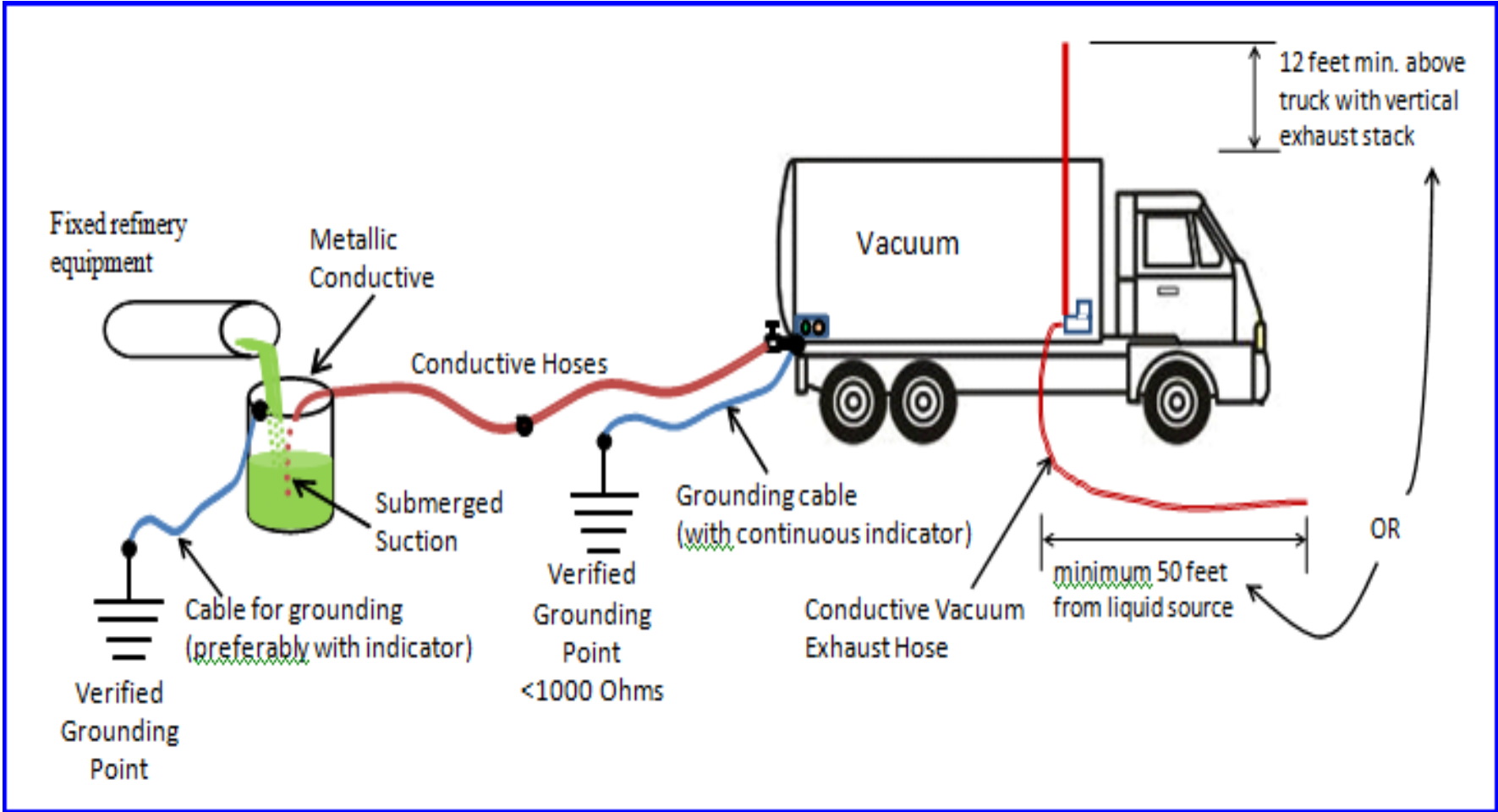
## Safe Practices and Driver Responsibilities:

- Only transfer using the bottom inlet line. Avoid “splash filling”.
- Transfer at a reduced rate by having the inlet valve pinched down until the liquid level covers the inlet line to the tank.
- Transfer at a reduced rate using a smaller diameter hose (typically 2” (5 cm)) .
- After the transfer is complete, let the truck stand before disconnecting ground, bonding, and hoses. This allows for any accumulated static to dissipate. Use this ‘relaxation’ time whenever the intent is to allow accumulated static to dissipate.
- Depending on materials of previous loads, the driver may be directed to let the truck stand for 30 minutes relaxation time to allow accumulated static to dissipate. This time can be used to clean up the work area, close out the permits, etc.
- Special instructions must be captured on the Permit and JSA.



# Bonding and Grounding

## Safely Bonded & Grounded Vacuum Truck including Collection Equipment



# Vacuum Truck Setup

- The vacuum truck must be spotted on level ground safely away from flammable sources.
- Establish a work area by barricading the area around the back of the vacuum truck to keep others from entering the work area, and:
- The vacuum exhaust area should also be well identified using cones and/or barricades to prevent unknowing personnel and vehicles from straying into it.
- If at any time during the operation surrounding conditions change, that may warrant concern, shut the vacuum operation down to ensure the conditions are adequately addressed.
- No one is permitted to remain in the truck cab during loading or unloading
- The vacuum truck operator must remain within 7.6 meters / 25 feet of the truck
- Prevent rubbing of hose to prevent damage to hose.
- The truck shall not be connected to vessels/tanks/pipes that are not fully vented to atmosphere.



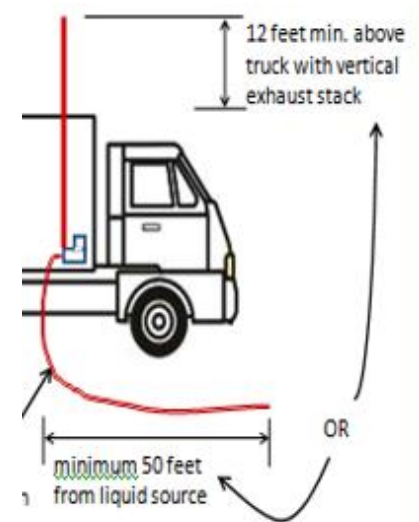
# Vacuum Truck Setup

Control and management of truck exhaust are critical to safe vacuum truck job preparation.

- Generation of offensive or hazardous odors should always be considered when planning for exhaust control. Additional measures to control vacuum operation exhaust may be required. These include:
  - Use additional lengths of hose
  - Use engineered scrubber or carbon canisters on the exhaust. The application of carbon must be reviewed to ensure loading will not create heat..
- The vapor hose must be bonded to the equipment.
- Equipment receiving truck vacuum exhaust must be reviewed and approved for receiving exhaust volume

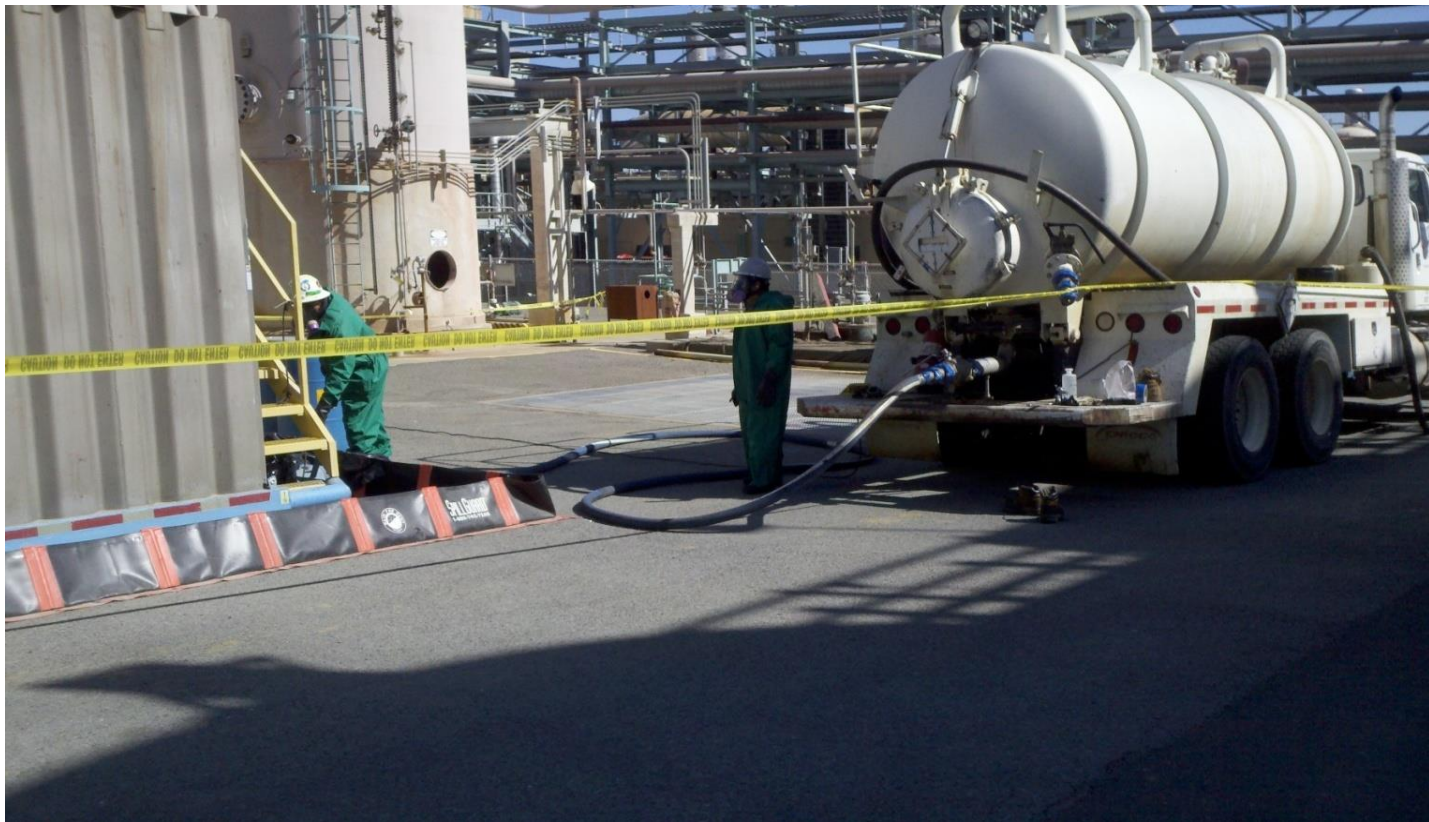
## When used in classified areas:

- Truck exhaust shall be run a minimum 15 meters / 50 ft. down wind from the truck to a safe location away from personnel and ignition sources.
- Trucks designed and equipped with vacuum vent stack exhausting at 12 feet (3.65 meters) above the truck's cab are also acceptable.
- Additional requirements for vacuum truck use in classified areas are located in section 4.2.3 of the Vacuum Truck standard.



# Vacuum Truck Setup

Warning signs or barricade tape should be deployed around vehicle during loading/discharging activities. This identifies the vacuum truck operator's work area and protects others from possible exposure.





# Vacuum Truck Operations Standard

## Job Completion and Record Retention

### Job Completion

- When the work has been completed, the Permit Requester/Holder must return the General Work Permit and all related documents to the Permit Issuer
- The Permit Issuer or the nominated Responsible Person will review the job site to ensure that:
  - i. The work area has been left in a safe, clean and tidy condition
  - ii. The work performed meets the specific work scope and task specifications
- If the above conditions have been met the Issuer or Responsible Person will sign and date the General Work Permit as completed.

### Record Retention

- Copies of all Permit to Work and associated documents retained one year or from audit to audit, whichever is the lesser
- If an accident occurred while work was in-progress, then documentation must be retained for incident investigation
- If permitted job involved potential health hazard, consider retaining permit documentation for an extended period (beyond 90 days).

