Common Covered Task 619
Damage Prevention during Vacuum Excavation

Directions

This training guide is to be used by a Veriforce Authorized Evaluator/Trainer and Trainee during on-the-job training (OJT) or prior to an evaluation as a resource. (S) Indicates a demonstration or skill task; (K) indicates a knowledge task.

OJT Reminder

OJT is an active hands-on process. Practice should be as similar to the actual job task as possible. However, if the training is being provided on an actual job site while a covered task is actually being performed, the Evaluator either needs to be qualified on that covered task or be assisted by someone who is qualified on the covered task. The Evaluator should closely monitor the Trainee's practices to ensure safe and correct task performance. At no time should a non-qualified individual perform, or train for, a covered task unless directed and observed by a qualified individual. However, if the ***"span of control"*** for that particular covered task is "1:0" (requiring only qualified individuals to perform the covered task), the training must be simulated. Training is simulated by "walking through" the task and simulating all actual manipulations (valves, switches, tools, etc.) an individual would use during the performance of a covered task. Simulating includes the use of safety and administrative requirements as if the task were being performed live. Refer to the Veriforce Evaluator Training Program for more on how to conduct formal OJT.

Disclaimer

This training resource is offered in good faith. Anyone choosing to utilize or rely on this training resource is doing so at their own discretion, risk and choice. Although every attempt has been made by Veriforce, LLC (the "Company") to ensure the correctness and suitability of this document and to correct any errors brought to the attention of the Company, the Company makes no representation or warranty regarding correctness or suitability (either directly or indirectly) of information referenced or implied within this training resource.

In no event shall the Company be liable for any damages (including, but not limited to, special, incidental or consequential damages) whatsoever (including, but not limited to, death, personal injury, damage to person or property, loss of use, and/or loss of revenues), whether in an action of contract, negligence, or other action, arising out of or in any way associated with the use or misuse of this document.

All critical information should be independently verified by the user and the user shall not rely on the contents provided herein without such independent verification. The subject matter included in this training has been compiled from a variety of sources and is subject to change without notice. The Company reserves the right to add, remove and alter information contained in this document without notice.

The Company may provide links to other sites for your convenience; however, the Company takes no responsibility and makes no representation or warranty regarding the accuracy or currency of information contained within such sites. The Company does not endorse any information, goods, or services referred to within such sites, and the provision of links by the Company shall not be interpreted to be an endorsement of such information, goods or services. The content of this training resource is provided for personal use only, and all other use, copying or reproduction of this training or website or any part of it is prohibited.

Common Covered Task 619
Damage Prevention during Vacuum Excavation

Recommended Student Training or Resources:

- DOT 49 CFR 192.614
- DOT 49 CFR 195.442

Introduction

The United States consumes billions of gallons of crude oil and millions of cubic feet of natural gas daily. Though many different methods are used for transportation and distribution of these commodities, pipelines are the safest, most efficient, and most economical method of transportation.

Between the liquid petroleum, gas transmission, and gas distribution systems, there are more than 2.5 million miles of pipeline in the United States. A vast majority of these systems are buried safely below the ground.

With that much sub-surface piping, and more going in daily, maintenance and construction is continuous, and excavation activities play an important role in these constantly expanding systems. Excavation activities, however, are one of the leading causes of pipeline damage. The Department of Transportation (***DOT***) requires pipeline operators to have a written program to prevent damage to the pipeline from excavation activities. Pipeline Safety Regulations 49 CFR §192.614 (gas) and §195.442 (liquid) Damage prevention program defines "excavation activities" as excavation, blasting, boring, tunneling, backfilling, the removal of above-ground structures by either explosive or mechanical means, and other earthmoving operations.

There are many different methods of excavation commonly used in pipeline construction and continuing operations. Some of these methods are mechanical digging, blasting, hand digging, and vacuuming.

Vacuum excavation is a non-mechanical process, using either pressurized water or air to loosen the dirt and a high powered vacuum to simultaneously extract the soils.

Air vacuum excavators utilize a high velocity air stream that penetrates the soil, causing it to expand and break up. Once the soil and rock is loosened, the debris is removed from the hole with a powerful vacuum.

Wet vacuum or "hydrovac" systems work by using high-pressure jets of water to reduce and loosen the soil. The wet soil/mud slurry is then removed to a spoil tank by a high powered vacuum.

When it is properly performed and all precautions are taken, vacuum excavation is perhaps the safest method of excavation when considering possible damage to the pipeline system.

Knowledge: Explain what is required prior to performing this task.

Pipeline Operator-Approved Procedures and Appropriate Equipment/Material

Prior to performing this task, you will need to have the pipeline operator-approved procedures as well as the appropriate equipment and materials. The procedures will outline requirements for performing this task that are specific to the pipeline operator. Operators may also have specific requirements regarding the type of equipment that can be used to perform this task.

Therefore, it's important to follow the specific requirements of the procedures and only use operator-approved equipment. Doing so can ensure the task is performed correctly and according to the pipeline operator's standards.

Knowledge:	Describe steps that must take place prior to vacuum excavation (including air and/or water lancing techniques) activities.

Though it is ideal having our pipeline systems and other facilities, such as power, communication, water, and sewage lines out of the way and buried below the ground, there are disadvantages as well. Primarily, you cannot see what is below you, or exactly where it is located.

Because of these visibility limitations, there are several required steps to complete prior to excavation.

First, it is very important to review any necessary requirements from:

- The Operator
- State or Federal agencies or laws
- Local laws or regulations

Immediately notify the operator of any conflicts.

Pipelines and other utilities are often buried at different depths, ranging from a few feet to over a hundred feet in depth. Thus, any excavation activities could potentially damage buried pipelines, which can result in a release or other serious issue.

Because of these potential dangers, it is required that you use the One-Call system to help identify and locate buried facilities. One-Call is a federally-mandated, national, "Call Before You Dig" number (811) created to help prevent anyone performing an excavation from unintentionally hitting underground utilities or structures.

Contacting the One-Call center begins the process of identifying what is buried on your location.

Upon notifying One-Call of the proposed excavation location, you will be assigned a One-Call request ticket number. The One-Call center will then begin the process of contacting all known facility owners near the proposed location.

> ***Note:*** The ticket number is verification that a One-Call request was made, it is not verification that all utilities have been marked.

The person initiating the request will get a list of all companies who are in the vicinity of the identified location. The person responsible for the One-Call should verify that all identified companies respond by E-mail, fax, phone, or some other traceable method with “no conflict”, or mark their facilities.

IDENTICATION OF PIPELINE MARKERS

Once they have been contacted, facility owners are required to either mark the approximate location of their facilities or to notify One-Call that they are clear of the excavation site.

The owners will use temporary markers in order to do this.

There are several acceptable methods of temporary markings available. Some of the more common are:

- Pin flags
- Whiskers
- Stakes
- Paint

> ***Note:*** To prevent accidental damage to buried facilities, care must be taken when working around temporary markings. You should make every effort to ensure traffic is diverted around the markings and inform personnel not to remove the markings until they are no longer needed.

Due to the importance of these temporary markings and the potential dangers of buried facilities, The American Public Works Association (***APWA***) has established guidelines which consist of a color code system to help identify underground facilities. Refer to American National Standards Institute (***ANSI***) standard Z535.1 Safety Colors for temporary marking and facility identification for more information

The color codes established for marking and identifying the placement of buried facilities are as follows:

- White – proposed excavation
- Pink – temporary survey marking
- Red – electric power lines, cables, conduit and lighting cables
- Yellow – gas, oil, steam, petroleum or gaseous materials
- Orange – communication, alarm/signal lines, cables/conduit
- Blue – potable water
- Purple – reclaimed water, irrigation and slurry lines
- Green – sewers and drain lines

Buried facilities also have permanent signs and markers that provide information about their presence and the type of product they transport/distribute.

Some of the more common permanent signs used for identification of buried facilities are:

- Caution/Warning: Pipeline signs
- Flat posts
- Round posts
- Aerial markers
- Curb and pavement markers

IDENTIFICATION OF FOREIGN STRUCTURES AND UTILITIES

Though the One-Call system is mandatory and very effective in locating underground structures and facilities, there are additional avenues also at your disposal.

You should obtain any available schematic documents, such as maps, drawings, alignment sheets, and as-builts. These can be used to assist in determining the presence of sub surface structures and facilities.

It is always important to have an awareness of what is on or around your excavation site.

For example, noticing any of the following can help you identify foreign structures or facilities:

- Telecommunication posts
- Transformer pads
- Manhole covers
- Test leads

It is important not only to be observant before the beginning of a job, but also to continue observation during the job. Visible trench or soil disturbance, changes in soil type, or the presence of materials while excavating could be an indicator that unexpected buried facilities or structures may be present.

Look for physical structures that indicate that there are buried facilities or structures. Also, settling of the ground, raised surfaces, or disturbed soil are indicators that something may be present.

The One-Call process, observation, and marking the buried facilities will give you an approximate location to work with. Once you have determined that there are buried structures present, the location and depth need to be verified.

Use a line locater if qualified to do so, and reference the plot maps and as-builts to verify the location and depth of any underground structures or facilities in the area. The operator may require that pictures be taken of the marked facilities before starting the excavation.

If the soil type permits, verify depth and location by probing with a T-bar. The T-bar method is accomplished by driving the bar in the ground until you feel positive contact with the pipeline. You then measure the distance that the rod traveled into the ground, determining the depth of the pipe.

Caution: There is always a possibility of hitting power lines or a charged facility when probing with a T bar. You should use a T-bar with rubber handles to reduce the possibility of electric shock. Additionally, the tip of the T-bar should not be pointed, and care should be taken to avoid damage to the pipe when probing.

After you have identified and verified the depth and location of buried facilities and structures, but before you begin vacuum excavation, you need to ensure that your equipment is grounded. Refer to the manufacturer's instructions and guidelines to make sure this is completed properly and safely.

Failure to properly ground the equipment can lead to a fire or explosion if static electricity builds up and is discharged near a leak or contaminated soil.

Knowledge: Identify considerations during vacuum excavation of pipelines.

There are various types and materials of piping, from plastic to fiberglass to metallic. Metallic pipes are commonly made of steel or iron and are most likely to be encountered in pipeline and oilfield environments. In order to protect against corrosion, these pipes are normally sealed with a protective coating.

Protection of this coating is very important when performing any type of excavating to ensure protection against corrosion. To prevent damage to the coating, reduce the nozzle pressure (if required) for the anticipated coating before reaching the expected depth of the pipeline.

Consult the manufacturer's guidelines in order to determine proper pressure settings if it is not known.

Failure to properly adjust the pressure of the nozzle could result in damage to the coating on the pipe. It is also important to adjust the pressure when vacuum excavating around plastic or poly pipe. Too much nozzle pressure in these types of pipes could penetrate the body of the pipe or compromise the integrity of the system.

> ***Note:*** When using high pressure water near or around communications or electrical cables, it is possible to damage the coating, resulting in system failure and shock hazards.

It is often required by the operator to hand excavate the last few feet or inches before reaching the pipe. This is done to maintain better control and lessen the opportunity for damage to the pipe or components. The Operator's procedures will determine what that distance may be.

It is possible to encounter unexpected foreign structures and pipeline components, such as taps, valves, cathodic leads, or other materials. It is important to anticipate this possibility and maintain awareness while excavating to reduce the possibility of damage to these components.

Skill: Explain how to perform vacuum excavation.

Now that you are familiar with the prep work involved and considerations to take prior to performing vacuum excavation, let's take a look at how to perform this task.

This objective is broken up into the following two sections.

- Pre-Operating Procedures
- Excavating

Note: Due to the varying types of vacuum equipment, always follow your pipeline-approved operator procedures and the manufacturer's instructions for your specific equipment.

Pre-Operating Procedures

Inspect your safety gloves, boots, and other PPE prior to performing this task. If you mistakenly lance through an electrical line while performing this task, your rubberized PPE can help protect you against potential electrocution, especially if you are using water. Replace any defective PPE.

Inspect all of your connections and equipment. The equipment needs to be in good working order. The hose lines need to be clear of any debris. The filters should be clean and in place. Belts and seals should not be cracked or worn. Clean or replace any disposable parts as needed prior to operation.

Check the fuel level of the engine, and ensure that the coolant and all of the oil levels meet the manufacturer's specifications. Make sure that the spoil tank has enough capacity for the intended job.

Ensure that you are familiar with the soil type and density to be removed. Soil that is more compact or frozen will require a higher level of pressure than loose dirt.

Once you've performed your inspections, you can start setting up for the excavation task. This can include, but is not limited to, the following steps:

1. Engage the brakes and set the wheel chocks for safety.
2. Start the engine and allow it to warm up.
3. Connect the water line or air line to the reduction tool (depending on the type of vacuum excavation).
4. Attach the vacuum hose to the spoil tank.
5. Turn on the water pump and open the valve or turn on the compressed air (depending on the type of vacuum excavation).

Remember that the manufacturer's instructions can vary from one piece of equipment to the next. Always follow the manufacturer's instructions for your specific equipment.

Complete any other pre-operating procedures outlined in the manufacturer's instructions and the pipeline-approved operator procedures.

Excavating

Now that everything has been inspected, connected, and powered on, you are ready to begin excavating.

Position the reduction tool vertically at the determined excavation site. Refer to the operator's procedures for the pressure that is appropriate for the soil composition.

Squeeze the trigger on the reduction tool and work it in a circular motion. Do not stop movement and hold the tool in one place because that could damage a utility and/or its coating. Avoid aiming the pressurized water or air directly at exposed facilities, and be aware of facilities and changes in soil density as you excavate.

Vacuum the soil as it is cleared away by the reduction tool. Maintain some distance between the vacuum hose and the soil. You don't want to submerge the vacuum tube into the soil that's been broken up. Monitor the levels in the spoil tank as it fills up with debris.

Continue excavating until the utility is exposed, as required by your operator procedures. If damage to the facility or coating occurs, stop the activity and notify the designated pipeline operator representative. If you are an employee of the operator, follow your company's notification requirements. Mark the location so that it may be easily located. The pipeline operator will need to ensure that repairs are done in accordance with their procedures.

Shut down equipment in accordance with the manufacturer's instructions when the excavation process is complete.

After you have excavated the site, you will need to properly dispose of any material in the spoil tank and then clean the tank as well as the tools, hoses, filters, and other parts as indicated in the manufacturer's instructions. Be sure to store items appropriately when finished.

Conclusion

Excavation is an unavoidable operation when dealing with sub surface pipelines. Prevention of damage is extremely important during the excavation process. If the integrity of the pipeline or adjacent facilities is damaged, it could result in costly, dangerous situations for the public and the environment.

It is very important to understand how to prevent damage in both the vacuum excavation and the backfilling process. Observing the techniques discussed during this course will help to make our pipelines and our environment safer for everyone.

Abnormal Operating Conditions (AOCs)

Candidates are required to possess the ability to **RECOGNIZE** and **REACT** to the listed AOCs for each task. Be prepared to answer questions concerning additional AOCs that may be relevant. Evaluators may ask questions about AOCs throughout the evaluation.

An AOC is defined in **49 CFR §§ 192.803** and **195.503** as:

A condition identified by the pipeline operator that may indicate a malfunction of a component or deviation from normal operations that may:

- Indicate a condition exceeding design limits; or
- Result in a hazard(s) to persons, property, or the environment.

Recognize: Improperly marked and/or unmarked foreign structures and utilities are abnormal operating conditions and can possibly cause serious accidents.

React/Respond: Proper reaction/response to be taken for improperly marked and/or unmarked foreign structures and utilities should they occur, are as follows:

- Stop activity.
- Mark the location so it may be easily located.
- Notify designated operator representative.

Recognize: Unintentional releases, vapors, or hazardous atmosphere could be signs that an abnormal operating condition has occurred. Some examples could include, but are not limited to:

- Blowing gas
- Puddles
- Dead vegetation

React/Respond: Proper reaction/response to be taken in the event unintentional releases, vapors, or hazardous atmosphere are as follows:

- Eliminate potential ignition sources.
- Move to a safe location.
- Notify emergency response personnel, as appropriate.
- Notify designated operator representative.

Recognize: Damage to pipe, coating or a component that has impaired or is likely to impair the serviceability of the pipeline are abnormal operating conditions. Examples could include, but are not limited to:

- Damaged risers

- Dents
- Gouges

React/Respond: Proper reaction/response in the event of damage to pipe, coating or a component that has impaired or is likely to impair the serviceability of the pipeline are as follows:

- Stop activity and notify designated operator representative.
- Mark the location of damage so it may be easily located.

Recognize: Failure or malfunction of pipeline component(s) are abnormal operating conditions and can cause serious issues later if not properly addressed. Some examples could include, but are not limited to:

- Valve leaking
- Pipe support failure
- Disbonded coating
- Corrosion

React/Respond: Proper reaction/response to take in the event of a failure or malfunction of pipeline component(s) are as follows:

- Stop activity.
- Notify designated operator representative.

Recognize: Unintended movement or unusual loading of a pipeline that has impaired or is likely to impair the serviceability of the pipeline are signs of abnormal operating conditions. Examples could include, but not limited to:

- Washout/erosion
- Soil subsidence
- Improper pipe placement
- Pockets of air/no soil support under pipeline
- Improper placement of breakers

React/Respond: Proper reaction/response to take in the event of unintentional movement or unusual loading of a pipeline that has impaired or is likely to impair the serviceability of the pipeline are as follows:

- Stop activity.
- Notify designated operator representative.

Glossary

AOC
abnormal operating condition

CCT
common covered task

CFR
Code of Federal Regulations