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.

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Common Covered Task 713OP
Test/Maintain Gas Detection and Alarm Systems

Recommended Student Training or Resources:

- DOT 49 CFR 192.736(c)

Introduction

Gas detection and alarm systems play an important role in the overall safety of personnel and the integrity of the pipeline facility. A properly operating gas detection system can preserve the integrity of the pipeline and save lives. Therefore, it is important that the system is maintained, tested, and calibrated in accordance with the pipeline operator’s procedures and the manufacturer’s instructions. Additionally, due to the importance of the system, the DOT has imposed regulations that require operators to ensure that each gas detection and alarm system be maintained to function properly. Such maintenance must include performance tests on the system. Because there are several devices on the market, there is no “one” standard testing and inspection procedure that will cover all devices and operator’s requirements. Therefore, it is vital that you become familiar with and understand the system(s) installed and follow the pipeline operator’s and manufacturer’s procedures when performing any maintenance or testing on the 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/Skill: Describe and demonstrate how to test/maintain gas detection and alarm systems.

Test/Maintain gas detection and alarm systems.

While the procedures for inspection and testing may vary from different pipeline operator and manufacturer, the basic points that should be covered will ultimately be similar. At a minimum, you should complete the following:

- Visually inspect the system.
- Isolate the gas detectors from the station shutdown, (ESD/EBD) system.
- Connect gas detection system test equipment.
- Calibrate all sensors.
- Verify that the alarms and shutdown circuits activate.
- Clear alarms and shutdowns and return system to service.
Visually inspect the system.

Visual inspections are used for examining a wide variety of components for damage, corrosion, contamination, etc. For the most part, visual inspections can usually be conducted without the need of any support equipment or tools. However, depending on the setup of the system within the compressor building, you may need to utilize ladders or an approved lifting device to inspect equipment such as sensors and alarms. When inspecting each component, you should inspect for signs of dirt, excessive paint, wasp nests, or contamination that may impede the proper operation of the system. Clean the device of any foreign debris, making sure the cleaning method used is compatible with the device.

Always refer to the manufacturer’s instructions. If any damage is discovered during the inspection, you should immediately notify the appropriate personnel and repair or replace the damaged component if authorized and qualified to do so.

Isolate the gas detection system from the station shutdown, ESD/EBD system.

Depending on the pipeline operator, gas detectors may be used to trigger emergency shutdown (ESD) or emergency blowdown (EBD) systems when a preprogrammed set point is reached. This is a key safety feature as the compressors then automatically shutdown, preserving the integrity of the compressor station and the pipeline. The up- and downstream valves close to isolate the source of lost product from the pipeline (ESD).

Then the system activates the EBD system (at the set point prescribed by the operator), which removes the explosive gas from the compressor station piping. This ultimately eliminates the key component (methane) required for an explosive combustion.

Activating the ESD/EBD system for the purpose of testing, maintaining, and calibrating gas detectors and alarm systems can potentially disrupt normal operations of product flow to customers and can cause unnecessary venting of product in the atmosphere. To ensure the ESD/EBD systems do not physically activate during the test, the system will need to be isolated from the gas detection system prior to testing. Prior to isolating the gas detection system from the station shutdown, you will need to notify gas control to ensure that control room personnel do not respond to an alarm that is triggered during testing and calibration.

Due to the numerous gas detection manufacturers and different system designs, there is no “universal” method for isolating the ESD/EBD system. In fact, there are several ways that the system may be isolated.

For example, isolating procedures may consist of, but are not limited to, the following:

- Menu selection on the detector.
- SCADA input by gas control.
- Removing control card in the programmable logic controller (PLC).
- Cutout switches.

The isolation methods mentioned here are just some examples. Many other methods may be available, depending on the system used. The procedures and steps required to isolate the system may also vary, depending on the manufacturer.

Therefore, the most important thing to remember when isolating the gas detection system from the station shutdown (ESD/EBD) is to refer to the pipeline operator’s procedures and manufacturer’s instructions.

Connect the gas detection system test equipment.

After the gas detection system has been isolated from the station shutdown, the next step is to connect the test equipment to the gas detection system. Since methane is lighter than air, gas detecting sensors are usually installed near the ceiling of the compressor building. Most (but not all) gas detection manufacturers have the option for a testing/calibration port or tube that can be routed to ground level for easier access. If a testing/calibration port or tube is not installed, you may be required to use an approved lifting device to reach the gas sensors before beginning.
Calibrate all sensors.

Once the testing equipment has been connected, the next step is to calibrate all sensors per the manufacturer's instructions and check the percent of LEL (lower explosive limit) levels in accordance with the pipeline operator's requirements.

Depending on the type of system in use, this may involve injecting or exposing a known concentration of gas that is supplied by the gas detector's manufacturer into the sensor(s) in order to verify its function.

The test gas used for testing and calibrating the gas detector should only be obtained from the system manufacturer or an approved substitute as defined by the manufacturer. To calibrate the sensors, you will need to put the gas detector in calibration mode. This is usually completed by accessing a series of menus on the controller.

Once the system is in calibration mode, you will need to select all sensors that need to be calibrated per the manufacturer's instructions. Next, apply the calibration gas to the sensor(s). The system will then read the calibrated gas and calibrate itself. When the calibration is completed, the system display will read “0.”

Once you have completed the calibration, you should verify that the gas detector is set to the appropriate percent of LEL, as specified by the pipeline operator. Follow the manufacturer’s instructions for procedures on how to set the LEL levels (Low= 25%, High= 30-40%).

Verify that the alarms and shutdown circuits activate at appropriate “percent of LEL.”

Upon completing calibration and LEL level checks on the system, you will need to verify that alarms and shutdown circuits activate at the appropriate “percent of LEL,” as required by the pipeline operator and the DOT.

Clear alarms and shutdowns.

After testing, calibration, and/or maintenance are completed, verify that the sensor(s) are clear of any residual gas and clear any alarms that were set off during testing and calibration. Return all switches, logic controllers, or settings back to their normal operational mode and document as required. Complete any necessary follow-up and verification of alarms with gas control, if required by your pipeline operator. Finally, ensure the ESD/EBD system is returned to service.

As mentioned throughout this training, there is no single method or procedure that will cover every system. Therefore, the most important aspect of performing this task is to follow the pipeline operator’s procedures and manufacturer’s instructions.

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

- Blowing gas
React/Respond: Proper reactions/responses to take in the event of an unintentional release, vapors, or hazardous atmosphere include the following:

- Eliminate potential ignition sources.
- Move to a safe location.
- Notify emergency response personnel, as appropriate.
- Limit access to location, as necessary.
- Follow appropriate procedures for notification, documentation, and remedial action.

Recognize: Material defects, anomalies, or physical damage of pipe or a component that have impaired or are likely to impair the serviceability of the pipeline are abnormal operating conditions. Examples could include, but are not limited to:

- Mechanical damage to gas detection component/device

React/Respond: Proper reactions/responses to take in the event of material defects, anomalies, or physical damage of pipe or a component that have impaired or are likely to impair the serviceability of the pipeline include the following:

- Determine extent, cause, and potential hazard(s) of defect, anomaly, and/or damage.
- Mark the location so it may be easily located, as appropriate.
- Follow appropriate procedures for notification, documentation, and remedial action.

Recognize: Failure or malfunction of pipeline component(s) is an abnormal operating condition. Examples could include, but are not limited to:

- Unintended activation of safety device such as ESD/EBD
- Communication system failure

React/Respond: Proper reactions/responses to take in the event of a failure or malfunction of pipeline component(s) include the following:

- Determine extent, cause, and potential hazard(s) of failure and/or malfunction.
- Follow appropriate procedures for notification, documentation, and remedial action.

Glossary

**AOC**
abnormal operating condition

**CCT**
common covered task

**CFR**
Code of Federal Regulations