

11-D Investigation of Failures

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1.0 SCOPE

The chapter describes the procedures for investigating material, equipment and operating failures, and reportable incidents occurring on the DENC and DESC *pipeline* system, in order to prevent hazardous leaks and minimize the release of natural gas from pipeline facilities.

2.0 REGULATORY REFERENCES

49 CFR Part 191 §§ [191.3](#), [191.5](#), [191.7](#), [191.9](#), [191.15](#)

49 CFR Part 192 §§ [192.613](#), [192.617](#), [ADB-2021-01]

3.0 PROCEDURES [192.617]

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3.1 General [191.3]

All failures on DENC and DESC pipelines, components and facilities *shall* be investigated to determine the cause(s) and to reduce the possibility of recurrence. All Leaks, Damages, and Failures shall be documented in the LDF program.

When investigations result in conclusions that *may* have the potential to impact DENC and DESC operations the results of those investigations will be communicated and documented in the form of Training Bulletins. Office supervisors and managers are to share the information contained in Training Bulletins and document as required.

Reportable Incidents, as defined in 49 CFR Part [191.3](#) and described in this manual in [Chapter 1-B Incident Reporting](#), *must* be investigated and reported accordingly. Not all failures result in an *incident* reported to federal and state authorities, but all failures shall be investigated as needed.

3.2 Leaks, Damages, and Failures

Any condition, damage or defect that exists which weakens a part of the pipeline system and results in, or could result in, a *leak* or an abnormal or unsafe operating condition shall be documented when found. This documentation is important for reporting, to identify risks on the system, discover trends, gain knowledge of the system, etc. The LDF application will maintain a record of all system failures for the lifetime of the pipe.

Reminder: Damages or Failures that are not leaking must also be documented. Information from this data is used to identify material and manufacturing issues. A LDF order *should* be created to capture this data.

Once identified and reported, the failures can be investigated to determine the cause or causes. Efforts can then be made to prevent recurrence or to reduce hazards by increased recognition of identified failures and improved quality control.

Causes:

1. Corrosion – any failure or leak in the pipe or another component that is caused by galvanic, atmospheric, stray current, microbiological, chemical, or other corrosive action.
2. Natural Forces – earth movements, earthquakes, landslides, subsidence, heavy rains/floods, washouts, lightning, high winds and storm debris, temperature, thermal stress, frozen components, tree root or rock impingement, or other natural causes.
3. Excavation Damage – resulting from excavation equipment or excavation activities performed by, operator personnel, contractor, or people not associated with the operator. Excavation equipment includes earth moving or other similar equipment and tools. Excavation activities include digging, drilling, boring, grading, etc. Leaks that are later discovered as having resulted from previous damage from excavation activities should be classified as Excavation Damage.
4. Vehicle Damage – car, truck, boat, or other motorized vehicle/equipment.
5. Outside Force – industrial or man-made fire or explosion (i.e. not caused by natural forces), or deliberate or willful acts (e.g. vandalism, terrorism, or theft).
6. Material, Weld, or *Joint* Failure – resulting from a material defect (i.e. within the pipe, component, pipe longitudinal weld, or joint) due to faulty manufacturing procedures, engineering design defects, or in-service stresses (e.g. vibration, fatigue, and environmental cracking). It also includes leaks as a result of faulty wrinkle bends and faulty field welds.
7. Equipment Failure – malfunction of control/relief equipment (e.g. regulators, valves, meters, compressors, or other instrumentation), or failure of threaded components (e.g. flanges, collars, couplings), or sub-components (e.g. O-rings, gaskets, seals, packing, or similar components). Equipment Failure also includes leaks caused by overpressurization resulting from a malfunction of control or alarm devices, relief valves, or control valves not positioning as required.

8. Incorrect Operation – resulting from inadequate procedures or safety practices, or failure to follow correct procedures, or other operator error. This includes leaks due to improper valve selection or operation, inadvertent overpressurization, or improper selector or installation of equipment. This includes damage resulting from ignition of the transported *gas* during a welding or maintenance activity.
9. Other Cause –any other cause not attributable to the above causes. Note: a best effort should be made to assign a specific cause before choosing this category.

3.3 Material and Equipment Failure Investigations [ADB-2021-01]

- (a) Failures or damages that have a cause of 'Material', 'Incorrect Operation', or 'Corrosion' will be sent to a Lead Investigator for additional review. The failed/damaged pipe/component/etc. *should*, when possible, be sent to the lead investigator.

- (1) Lead Investigators

- (i) Corrosion/CP related – Lead CP Technician @ Local Operations Office
 - (ii) Material, Incorrect Operation, including Manufacturer Defect – Material Failure Coordinator at local training centers

State Specific: South Carolina

Meters that are condemned or that have failure issues shall be sent to Measurement Operations Center for testing and recorded in meter history database.

- (2) When a failure work queue is received by the lead investigators, they will review the failure information and material or equipment to determine the cause of the failure. They will also review the repair steps noted. They will then note the cause of failure and any recommendations on the repair made in the LDF application.
 - (3) Where failures involve potentially defective materials currently being purchased and used, the lead investigator should also notify the Materials Committee Chair or the Manager of the Integrity Management and Compliance department. The chair will coordinate with the material/equipment manufacturer about the failure as well as replacement of the defective material where applicable. The purpose of this is to address the replacement or remediation of pipelines that are known to leak due to their material, design, or past LDF history.
 - (4) The lead investigator should notify management when and where material or equipment defects indicate potential patterns or trends across the system. The Training Manager will send a [Training Bulletin](#) (PDF file) to alert supervisors, managers and field employees. The lead investigator should also notify management when failures may be attributed to operator errors such as inadequate procedures or failure to follow procedures so that the proper human factors investigations can take place.
- (b) If the lead investigator cannot determine cause of failure, consider the need for testing by an outside engineering lab when deemed appropriate.
- (c) Some failures may occur in new, unused materials. New parts with obvious or suspected defects should also be reported through this process; they are not to be installed but rather returned to the investigation lead.
- (d) Field analysis requiring destructive tests of failures should not be attempted.

- (e) Failures determined by the lead investigator to be caused by incorrect operations shall communicate details of the failure to local office supervisor and the training department to discuss possibility of disqualifications and/or necessary training needs.
- (f) All material failures or operator failures that occur while working on gas facilities before being placed in service should have a Gas Maintenance order created so an LDF will be created. The purpose of this is to collect data which will be used to feed the company risk model and to perform trending/historical analysis for a variety of failure parameters.
 - (1) The CSR or designee creates a Gas Maintenance order with a Damage/Failure Work Type in CIS
 - (2) The CSR or designee completes the associated LDF form which is generated from the CIS order
 - (3) The inspector tags the failed material with the LDF Master ID order number
 - (4) Failed material is sent to the Material Failure Coordinators at the training centers.

3.4 Specimens

All specimens related to a Material or Incorrect Operations leak, damage, or failure that are able shall be removed. All specimens should be sent to the Material Coordinator for full investigation and verification of cause.

- (a) If cutting is required to remove a failed part, the cuts should be made far enough away from the failure (at least 12 inches on each side) to not affect the properties or structure of the failed part. For plastic pipelines, print line data is essential to identifying the material type. Removed sections should include as much of the print line data as possible (24" of pipe may be needed to contain the entire print line).
- (b) Specimens are to be identified with the LDF Master ID order number by attaching tags or by marking the component or pipe with a paint pen or sharpie marker in a contrasting color.
- (c) When a specimen is desirable but where removal and/or replacement costs are excessive, pictures and or sketches should be taken of the failed material if practical. See [Failure Return Guidelines](#) (PDF file) for documentation examples.

3.5 Incident Investigation [[191.5](#)] [[191.7](#)] [[191.9](#)] [[191.15](#)] [[192.617](#)]

Incidents involving DENC and DESC pipelines shall be investigated to determine the cause(s) and to reduce the possibility of recurrence. This procedure establishes guidelines for the actions to be taken after an incident has occurred. There are procedures in [Chapter 12-B Leak Response, Leak Classification, and Gas Emergencies](#) that deal with leak response activities. These leak response procedures shall be observed as the situation warrants.

Additionally, in relation to rupture detection and mitigation, the requirements and procedures responding to post-failures and incidents, analysis of rupture and valve shut-offs, rupture post-failure and incident summary shall be performed in accordance with [GD-OM-L-060-002](#), Requirement of Valve Installation and Minimum Rupture Detection Standards.

Events meeting the definition of a Reportable Incident (see [Chapter 1-B Incident Reporting, 3.1 Telephonic Notification of Incidents](#)) must be reported according to the requirements of that chapter.

Once the incident scene has been made safe in accordance with leak response procedures, the focus of this procedure is to provide investigation guidelines for field responders and supervisors. The order of these actions is not sequential, as many activities may be in progress at the same time. The person in charge of the incident shall ensure that the appropriate actions are taken to adequately investigate the incident and that all information is compiled and properly documented. Do not speculate on the cause - treat all information as confidential.

Incident – For the purposes of this procedure an incident is defined as:

1. An event, as defined in CFR Title 49, Part 191, §[191.3](#), that involves a release of gas from a pipeline, gas from an underground natural gas storage facility, liquified natural gas (LNG), or gas from an LNG facility, and that results in one or more of the following consequences:
 - i. A death, or personal injury necessitating in-patient hospitalization;
 - ii. Estimated property damage of \$122,000 or more, including loss to the operator and others, or both, but excluding the cost of gas lost; or
 - iii. Unintentional estimated gas loss of three million cubic feet or more.
2. An event that results in an emergency shutdown of an LNG facility or an underground natural gas storage facility. Activation of an emergency shutdown system for reasons other than an actual emergency within the facility does not constitute an incident.
3. An event that is significant in the judgment of the operator, even though it did not meet the criteria of paragraph 1. or 2. of this definition.

Pipeline Event - For the purposes of this procedure a pipeline event is defined as:

1. A fire or explosion affecting a pipeline facility;
2. A natural disaster significantly affecting a pipeline facility; or
3. Other Events not reported as an Incident, but investigation would be valuable. Factors to consider when making this decision include: type of event, location and proximity of the Event to the public, any injury to non-company persons, nature and extent of service interruption, extent of damage to property of others, extent of company response actions, closure of major transportation corridors, involvement of public or emergency response officials, and involvement of news media.

(b) Event Investigation Procedure and Checklist

[GD-OM-L-000-001, Pipeline Incident and Event Investigation](#) defines the eligible incidents or pipeline events that require an investigation. These events are classified as Level 1 or Level 2 events. All other events not classified as Level 1 or Level 2 are outside of the scope of GD-OM-L-000-001, however investigations may utilize the guidelines within.

[GD-OM-L-000-001, Appendix A](#) contains an Onsite Checklist of records and information, which should be gathered as soon as is practicable. (Link to fillable PDF: [Onsite Checklist](#))

(c) Incident Response

Upon arrival at the incident site, DENC and DESC representatives should identify themselves to the Incident Commander and suggest/recommend the actions DENC and DESC desires to pursue. In the event several DENC and DESC employees are present, the employee coordinating DENC and DESC actions may be the one to communicate with the Incident Commander. The Incident Commander may be from the fire department, HAZMAT team, or other jurisdictional agency. The Incident Commander is in charge of the site and actions by DENC and DESC should be coordinated through him/her.

(d) Recommended Checks

1. Check for evidence of any tampering, damage or modification involving gas meters or piping.
2. Check and record the *main* pressure(s) and any meter readings.

3. Check and document the odor level of the gas in accordance with [Chapter 11-F Odorization](#). This may be done by conducting a sniff test near the incident but a test using a portable odorization meter is preferred.
4. Collect charts and record pressure and flow characteristics in the vicinity.
5. Consider all possible causes – LP gas, gasoline storage cans, gasoline service stations, or chemical at the incident site and in the vicinity.
6. Photograph or videotape the incident site and vicinity.
7. Record the names of witnesses, their telephone numbers, place of employment, and any statements they may offer.
8. Check for evidence of recent construction activity at the incident site and vicinity.
9. Photograph, measure and diagram locations where paint markings, line markers or flags were used to indicate DENC and DESC pipeline locations.

(e) Additional Information

1. Contact Customer Service Relations (CSR) to determine if there had been any odor complaints reported in the vicinity.
2. Gather CSR and meter history data for the vicinity.
3. Check Leak Data Records for historical records of leaks in the vicinity.
4. Document any one-call notifications () or direct location requests and responses to these notifications.

(f) Physical Property

1. Discuss with the Incident Commander the disposition of company property. If the officials want the property, allow them to have it. Record what property was taken and by whom. This begins the chain of custody documentation.
2. Photograph property (meters, regulators, piping, etc.) prior to the property being moved.
3. Note any evidence of tampering even if done by an investigating authority.
4. If the officials do not want the property, collect the property and take it to a DENC and DESC office where it shall be identified and secured. Exercise care to avoid damage or modification of the property while moving.
5. Record when and to whom the property is transferred and where it will be secured.

(g) Follow-up and Reporting

1. Provide information to the proper authorities as required.
2. Prepare all necessary forms and reports as required in accordance with the procedures in Chapters [1-B Incident Reporting](#), [12-B Leak Response](#), [Leak Classification, and Gas Emergencies](#), and [12-C Leakage Surveys](#). This includes the following as applicable:
 - LDF Record
 - Incident Report - Gas Distribution System

- Incident Report - Gas Transmission and Gathering System

3.6 Human Factor Failures and Investigations

- (a) Human Factor Investigations should be performed in accordance with the guidelines in [GD-OM-L-000-001](#), starting in section 4.7.2, and should be documented on the [Human Factors and Lessons Learned Report](#) (.docx file).
- (b) When preparing for an investigation, it is generally advantageous to capture the background information as quickly as possible following an incident or near miss to ensure accuracy.
- (c) Human Factors Incident Investigations should generally be scheduled to complete interviews within two weeks.
- (d) Per 49 CFR Part 192 § [192.631](#), investigators must determine in each incident if control room activities possibly contributed to the event; issues to consider are controller fatigue, controller actions/inactions, failures of SCADA field equipment, operation of pressure control devices, control room procedures, and SCADA system configuration and performance.
- (e) In certain circumstances, the supervisor and/or manager may consider not allowing the individual(s) involved to perform the task (or observe a non-qualified individual perform a task for operator qualification purposes) until the investigation is completed. This, however, DOES NOT mean that the individual(s) is/are disqualified.

4.0 TRAINING/QUALIFICATIONS

See the appropriate system Operator Qualification Program.

5.0 DOCUMENTATION/FORMS

System specific forms should be used where applicable.

- [Human Factors and Lessons Learned Report](#) (.docx file)
- [Important Training Bulletin](#) (.docx file)

6.0 RELATED DOCUMENTS

None at this time.

7.0 APPENDICES

- [Failure Return Guidelines](#) (PDF file)

(UNCONTROLLED IF PRINTED)