

Recommended Practice for Pipeline Operator Qualification (OQ)

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Contents

	Page
1 Scope	1
2 Normative References	1
3 Terms, Definitions, Acronyms, and Abbreviations	2
3.1 Terms and Definitions	2
3.2 Acronyms and Abbreviations	5
4 Guidance for Developing an OQ Program	6
4.1 Roles and Responsibilities	6
4.2 Participation in an Industry Group	6
4.3 Language	7
4.4 Program Improvement	7
5 Element 1: Identify Covered Tasks	7
5.1 General	7
5.2 Guidance on Identifying Covered Tasks	8
5.3 Guidance on Interpreting the Four-part Test	8
6 Element 2: Ensure, Through Evaluation, That Individuals Performing Covered Tasks Are Qualified	9
6.1 General	9
6.2 Guidance on Establishing Criteria for Qualification Through Evaluation	9
6.3 Other Circumstances That Require Qualification Considerations	15
7 Element 3: Allow Individuals That Are Not Qualified Pursuant to the Regulation to Perform a Covered Task if Directed and Observed by an Individual That Is Qualified	16
7.1 General	16
7.2 Span of Control	16
7.3 Guidance on Emergency Response	17
8 Element 4: Evaluate an Individual if the Operator Has Reason to Believe That the Individual's Performance of a Covered Task Contributed to an Accident/Incident as Defined in the Regulation	17
8.1 General	17
8.2 Guidance on Determination of Appropriate Action Following Individual's Involvement in an Accident or Incident	17
9 Element 5: Evaluate an Individual if the Operator Has Reason to Believe That the Individual Is No Longer Qualified to Perform a Covered Task	18
9.1 General	18
9.2 Guidance on Determining if an Individual Should No Longer Be Qualified	18
9.3 Suspension Process	19
10 Element 6: Identify Those Covered Tasks and the Intervals at Which Evaluation of the Individual's Qualifications Is Needed	19
10.1 General	19
10.2 Guidance on Developing Reevaluation Intervals	19
11 Element 7: Communicate Changes That Affect Covered Tasks to Individuals Performing Those Covered Tasks	19
11.1 General	19
11.2 Guidance on Developing Processes to Communicate Changes That Affect Covered Tasks	20

Contents

Page

12	Element 8: Provide Training, as Appropriate, to Ensure That Individuals Performing Covered Tasks Have the Necessary Knowledge and Skills to Perform the Tasks in a Manner That Ensures the Safe Operation of Pipeline Facilities	20
12.1	General	20
12.2	Guidance on Providing Training, as Appropriate	20
13	Element 9: Notify the Administrator or a State Agency if the Operator Significantly Modifies the Program After the Administrator or State Agency Has Verified That It Complies with Regulation	21
13.1	General	21
13.2	Guidance on Determining a Significant Change	21
13.3	Guidance on Transmitting OQ Program Revisions	21
13.4	Recordkeeping	22
13.5	Guidance on Developing Recordkeeping Criteria	22
	Annex A (normative) Covered Task List	24
	Annex B (normative) Covered Task Standards	27
	Annex C (informative) Evolution of the Covered Tasks	254
	Annex D (informative) Testing and Evaluation Guidance	255
	Annex E (informative) Program Effectiveness Guidance	261
	Annex F (informative) Management of Change Guidance	266
	Annex G (informative) AOC Guidance	268
	Bibliography	276
Figures		
G.1	AOC Identification Process	273
Tables		
D.1	Internal Controls Checklist	255
D.2	Test Administration Personnel—Evaluator	256
D.3	Test Administration Personnel—Proctor	256
D.4	Knowledge Testing	257
D.5	Evaluation Process	258
D.6	Training	259
D.7	Test Security	259
D.8	Record Control	260
D.9	Audits	260
G.1	AOC Identification Process Description	272

Recommended Practice for Pipeline Operator Qualification (OQ)

1 Scope

The purpose of this recommended practice (RP) is to provide guidance for developing and maintaining an operator qualification (OQ) program. This document is comprised of the RP along with normative and nonmandatory, informative annexes.

This RP is applicable for all pipelines, both onshore and offshore, subject to 49 *Code of Federal Regulations (CFR)* Part 192 and/or Part 195. References to 49 *CFR* Part 192 are applicable to gas-transmission-only tasks, and references to 49 *CFR* Part 195 are applicable to liquid-only tasks. Operators may choose to use all, part, or none of this document as applicable to their operations.

Operators should be aware that the OQ regulation is applicable only to United States Department of Transportation (DOT) jurisdictional pipelines. For purposes of this document, the word “pipeline” is used interchangeably with pipeline, pipeline facility, pipeline system, and any and all jurisdictional pipeline components as defined in 49 *CFR* Part 192 and Part 195.

Annexes F and G have been added to this edition to address management of change and abnormal operating conditions.

2 Normative References

The following referenced documents are indispensable for the application of this document. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

API 510, *Pressure Vessel Inspection Code: In-service Inspection, Rating, Repair, and Alteration*

API Standard 653, *Tank Inspection, Repair, Alteration, and Reconstruction*

API Standard 1104, *Welding of Pipelines and Related Facilities*

API Recommended Practice 2350, *Overfill Protection for Storage Tanks in Petroleum Facilities*

ASME *Boiler and Pressure Vessel Code* ¹, Section IX: *Welding and Brazing Qualifications*

ASNT Recommended Practice SNT-TC-1A ², *Personnel Qualification and Certification in Nondestructive Testing*

U.S. DOT Title 49, *Code of Federal Regulations (CFR)* Part 192 ³, *Transportation of Natural and Other Gas by Pipeline*

U.S. DOT Title 49, *Code of Federal Regulations (CFR)* Part 195, *Transportation of Hazardous Liquids by Pipeline*

U.S. DOT Title 49, *Code of Federal Regulations (CFR)* § 191.23, *Reporting Safety-related Conditions*

¹ ASME International, 2 Park Avenue, New York, NY 10016-5990, www.asme.org.

² American Society for Nondestructive Testing, PO Box 28518, 1711 Arlington Lane, Columbus, OH 43228, www.asnt.org.

³ Department of Transportation. The *Code of Federal Regulations* is available from the U.S. Government Printing Office, Washington, DC 20402, www.gpo.gov/fdsys.

3 Terms, Definitions, Acronyms, and Abbreviations

3.1 Terms and Definitions

For the purposes of this document, the following definitions apply.

NOTE When identical terms are defined within the task standard and in this section, the task standard definitions apply.

3.1.1

abnormal operating condition

AOC

A condition identified by the 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.

NOTE As defined in 49 *CFR* § 195.503 and 49 *CFR* § 192.803.

3.1.2

accident

A failure in a pipeline system in which there is a release of the hazardous liquid or carbon dioxide transported, resulting in any of the following.

- a) Explosion or fire not intentionally set by the operator.
- b) Release of 5 gal (19 L) or more of hazardous liquid or carbon dioxide, except that no report is required for a release of less than 5 bbl (0.8 m³) resulting from a pipeline maintenance activity if the release is:
 - 1) not otherwise reportable under this section,
 - 2) not one described in 49 *CFR* § 195.52(a)(4),
 - 3) confined to company property or pipeline right-of-way, and
 - 4) cleaned up promptly.
- c) Death of any person.
- d) Personal injury necessitating hospitalization.
- e) Estimated property damage, including cost of clean-up and recovery, value of lost product, and damage to the property of the operator or others, or both, exceeding \$50,000.

NOTE As defined in 49 *CFR* § 195.50.

3.1.3

complexity

An analysis type that includes a review of the knowledge and skill components of a task.

NOTE Factors that may be used to determine complexity minimally include:

- level of knowledge required,
- amount of independent judgment required,
- advanced skills that are necessary,
- technical training or certifications that are required,
- required training or certification needed by regulation.

3.1.4**covered task**

Defined as follows:

- is a discrete activity performed by an individual or group of individuals,
- has a beginning and an ending point,
- has two or more steps,
- can be observed and measured,
- is identified by the company,
- meets all four of the conditions of the “Four-part Test.”

NOTE As defined in 49 CFR 195.501 and 49 CFR § 192.801.

3.1.5**criticality**

An analysis type that includes a review of the potential adverse impacts that could result from improper performance of a task.

NOTE 1 Criticality can be determined as a factor of the likelihood and consequences of improper performance.

NOTE 2 Consequences that may be used to determine criticality minimally include:

- exceeding design limits,
- personal injury,
- release of a product,
- ignition source.

3.1.6**evaluation**

A process, established and documented by the operator, to determine an individual's ability to perform a covered task by any of the following:

- a) written examination;
- b) oral examination;
- c) work performance history review (WPHR);
- d) observation during:
 - 1) performance on the job,
 - 2) on-the-job training (OJT), or
 - 3) simulations;
- e) other forms of assessment.

NOTE As defined in 49 CFR § 195.503 and 49 CFR § 192.803.

3.1.7**incident**

Any of the following events.

- 1) An event that involves a release of gas from a pipeline, gas from an underground natural gas storage facility, liquefied natural gas (LNG), liquefied petroleum gas, refrigerant gas, 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 \$50,000 or more, including loss to the operator and others, or both, but excluding cost of gas lost; or
 - iii) unintentional estimated gas loss of 3 MMcf 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 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 Item 1) or Item 2) of this definition.

NOTE As defined in 49 *CFR* § 191.3 Definitions.

3.1.8**operator qualification program****OQ program**

Operators of natural gas and hazardous liquid pipelines to develop a program to ensure that personnel who are performing the operations and maintenance tasks on a pipeline are qualified to do so.

3.1.9**practicality**

An analysis type that includes a review of typical situational factors inherent in the performance of a task.

NOTE Factors that may be used to determine practicality may include:

- number of individuals required to perform a task,
- number of individuals that can reasonably fit in a job performance area,
- number of individuals that can be directly observed at one time,
- location where the task is performed,
- coordination with other individuals or groups.

3.1.10**qualification**

The result of a process determined by the operator that includes successful completion of task-specific evaluation(s) with the associated abnormal operating conditions (AOCs), documentation, and any other requirements as documented in the OQ program.

3.1.11**qualified**

An individual who has been evaluated and can:

- a) perform assigned covered tasks, and
- b) recognize and react to AOCs associated with those tasks.

3.1.12**remote evaluation**

An evaluation that is conducted and controlled by an evaluator where the evaluator is not physically present.

3.1.13**span of control**

The ratio of nonqualified to qualified individuals where the nonqualified individual may be directed and observed by a qualified individual when performing a covered task, with the consideration to complexity of the covered task and the operational conditions when performing the covered task.

3.1.14**training**

Act of facilitating the learning, development, and improvement of new and existing knowledge and skills and not the evaluation or qualification of those knowledge and skills.

3.2 Acronyms and Abbreviations

AC	alternating current
AO	abnormal operation
AOC	abnormal operating condition
CP	cathodic protection
CPM	computational pipeline monitoring
DC	direct current
DCF	density correction factor
DRA	drag reducing agent
HMI	human machine interface
HQ	headquarters
HVL	highly volatile liquid
HVLP	high-volume low-pressure
I/O	input/output
KCl	potassium chloride
KS	knowledge and skills
LNG	liquefied natural gas
MIL	$1/1000$ in.
MOP	maximum operating pressure (liquid)
NDT	nondestructive testing
OJT	on-the-job training
O&M	operations and maintenance

OPD	overfill protective device
OPID	operator identification number
OPS	Office of Pipeline Safety
OQ	operator qualification
PCR	polarization cell replacement
PHMSA	Pipeline and Hazardous Materials Safety Administration
PLC	programmable logic controller
PV	pressure/vacuum
RMU	remote monitoring unit
RTD	resistance thermal device
SCADA	Supervisory Control and Data Acquisition
SRC	safety-related condition
SSD	solid state decoupling
VOM	volt-ohm meter
WPHR	work performance history review

4 Guidance for Developing an OQ Program

4.1 Roles and Responsibilities

Operators should define roles and responsibilities for the administration, management, and consistent implementation of the OQ program. Clear responsibilities for implementing the elements of the OQ program should be established and communicated to affected individuals. Responsibilities associated with the OQ program may include but are not limited to the following:

- central management and oversight of the OQ program;
- training, as appropriate;
- conducting and administering evaluations;
- recordkeeping;
- assigning covered tasks to individuals;
- verifying individuals' qualifications;
- managing contractors and other entities.

4.2 Participation in an Industry Group

The operator may consider participating in an industry OQ group. These groups develop and update OQ guidance materials, share best practices, and interact with regulatory agencies.

4.3 Language

The operator's OQ program should include a policy on language to ensure effective communication when non-English-speaking individuals perform covered tasks. Options may include but are not limited to the following:

- maintain a single-language policy, whereby all individuals performing covered tasks speak the same language (i.e. English);
- utilize bilingual individuals to interpret for non-English-speaking individuals performing covered tasks;
- ensure availability of acceptable qualification methods in applicable language(s).

4.4 Program Improvement

4.4.1 General

While not specifically required by the regulation, an operator may consider developing processes for periodic review of the OQ program and auditing program implementation. Operators should determine the process for incorporating program improvements based on the findings.

4.4.2 OQ Program Review

The purpose of periodically reviewing the OQ program is to ensure that it meets current regulatory compliance and any additional needs of the operator. The operator has the flexibility to structure the review as formally or informally as deemed necessary and should document the results and identify any modifications to the OQ program.

NOTE Refer to Annex E for further information.

4.4.3 Internal Audit

The purpose of an internal audit is to assure that the OQ program is being implemented as written. The operator has the flexibility to structure the audit as formally or informally as deemed necessary and should document the results of the audit and identify any modifications to the OQ program.

NOTE Refer to Annex E for further information.

5 Element 1: Identify Covered Tasks

5.1 General

The program shall identify and document covered tasks. A covered task is an activity identified by the operator that:

- is performed on a pipeline facility, and
- is an operations or maintenance task, and
- is performed as a requirement of 49 *CFR* Part 192 and/or Part 195, and
- affects the operations or integrity of the pipeline.

The four criteria listed above are referred to hereafter as the Four-part Test.

5.2 Guidance on Identifying Covered Tasks

5.2.1 General

In developing the covered task list, the operator shall consider tasks performed on the pipeline facility, regardless of who performs them (employees, contractors, subcontractors, or other entities such as other pipeline operators or those with access to the operator's equipment). For example, if an operator contracts out pipeline repair activities, those activities shall be considered in the identification of covered tasks.

The operator has flexibility to determine how to accomplish covered task identification. The operator should document the method and justification for selecting covered tasks. Options for establishing a covered task list may include but are not limited to the following two methods.

5.2.2 Adoption of an Industry-developed Covered Task List

Industry and technical associations, qualification product providers, and others have developed covered task lists through subject matter expert consensus. The Covered Task List developed by API (in conjunction with the Operator Qualification Workgroup under the Pipeline Committee) is attached to this document as Annex A. The operator should take additional steps if adopting such a list and at a minimum should compare the covered task list to its operations and maintenance activities to ensure completeness. The operator has the flexibility to combine or separate covered tasks as suitable to its operations and if gaps are identified should apply the Four-part Test to add or delete covered tasks as applicable.

5.2.3 Analysis of Operations and Maintenance Activities

An analysis of operations and maintenance activities may be used in the process of determining which activities should be included in an operator's covered task list. Items to be considered when conducting activity identification and analysis may include but are not limited to the following:

- 49 CFR Part 192 and/or Part 195;
- state or local requirements;
- operations, maintenance, and safety procedures;
- industry-developed covered task list(s);
- applicable Pipeline and Hazardous Materials Safety Administration (PHMSA) Advisory Bulletins.

It may be helpful to record each applicable activity on a master list and document the answers to the Four-part Test questions, adding justification notes as needed. This method of documentation produces a list of covered and noncovered tasks and may assist in regulatory and internal reviews. Subject matter experts, regulatory compliance personnel, and others may be enlisted to assist in the identification and analysis of activities. Operators have the flexibility to include additional tasks that do not meet the Four-part Test.

5.3 Guidance on Interpreting the Four-part Test

5.3.1 Part 1—Is the Task Performed on a Pipeline Facility?

Operators should review the regulatory definitions of pipeline and pipeline facility. Components, piping, and equipment that are physically connected to the pipeline or pipeline system (i.e. by wires, tubing, pipe, or by the pipeline right-of-way) or that are connected by signals through the air are considered part of the pipeline facility.

A component, piping, or equipment disconnected and physically removed from the pipeline or pipeline system is not considered part of the pipeline facility. A component that is disconnected, but not physically removed from the pipeline facility, would meet the Part 1 requirement of the Four-part Test.

5.3.2 Part 2—Is the Task an Operations or Maintenance Task?

Operations tasks may be defined as those activities associated with monitoring and controlling the transportation of hazardous materials within a pipeline system. Maintenance tasks may be defined as those activities performed to maintain, restore, replace, or relocate existing pipeline facilities.

5.3.3 Part 3—Is the Task Performed as a Requirement of 49 CFR Part 192 and/or Part 195?

The operator should review all subparts of 49 CFR Part 192 and/or Part 195, including documents incorporated by reference, and state and local requirements to ensure completeness of all tasks. Operations and maintenance tasks are not limited to those tasks addressed in 49 CFR Part 192, Subparts L and M and/or 49 CFR Part 195, Subpart F.

5.3.4 Part 4—Does the Task Affect the Operation or Integrity of the Pipeline?

Tasks that, if performed incorrectly, could adversely affect the operations or integrity of the pipeline during or after the performance of the task would meet the Part 4 requirement of the Four-part Test.

6 Element 2: Ensure, Through Evaluation, That Individuals Performing Covered Tasks Are Qualified

6.1 General

Operators shall have a documented process to ensure individuals performing a covered task are qualified through an evaluation process.

6.2 Guidance on Establishing Criteria for Qualification Through Evaluation

6.2.1 General

The terms qualification and evaluation are frequently used interchangeably throughout the industry; however, they are two distinct terms.

Qualification is the result of a process determined by the operator that includes successful completion of task-specific evaluation(s) with the associated AOCs, documentation, and any other requirements as documented in the OQ program. An evaluation is a step in the qualification process that determines an individual's knowledge, skill, and ability.

6.2.2 Qualification

6.2.2.1 General

The operator encounters several decision points when developing a qualification process. At a minimum, consideration should be given to the covered task, the individual or groups of individuals to be qualified, and the type of qualification. The resulting qualification process(es) should be documented.

6.2.2.2 Covered Task

The operator should review the covered tasks to determine the appropriate evaluation method(s) and other qualification requirements. Items to be considered may include but are not limited to the following:

- scope and complexity of the covered task,
- level of knowledge and/or skill needed to perform the covered task,
- any other factors as determined by the operator.

6.2.2.3 Individuals or Groups of Individuals

The operator has flexibility to determine the evaluation methods and other qualification requirements for all individuals who perform covered tasks and may utilize the same evaluation methods and other qualification requirements for all groups of individuals (employees, contractors, subcontractors, or other entities such as other pipeline operators or those with access to the operator's equipment) or may establish different requirements for different groups. The operator may establish provisions in its OQ program to accept qualifications from other entities' internal OQ programs.

6.2.2.4 Type of Qualification

Types of qualification should be considered when determining evaluation methods and other qualification requirements. Requirements may differ by type of qualification (e.g. initial qualifications, current qualifications prior to an expiration date, qualifications that have exceeded an expiration date, or qualifications that may require additional actions as described in Element 4 and Element 5).

6.2.3 Evaluations

As stated in the regulation, evaluation is the process, established and documented by the operator, to determine an individual's ability to perform a covered task through application of any of the following:

- written examination;
- oral examination;
- WPHR;
- observation during:
 - performance on the job,
 - OJT,
 - simulation;
- other forms of evaluation.

Neither WPHR nor observation of performance on the job can be used as the sole evaluation method for determining qualification. These methods shall be used in conjunction with other allowable methods of evaluation.

6.2.4 Evaluation Methods

Written and oral examinations consist of standard, predetermined questions and shall contain enough questions to adequately measure the knowledge required to perform a covered task. A written examination is a knowledge test on paper or electronic format, whereas oral examination is a verbal knowledge test. Consideration should be made for the role of a proctor and/or evaluator to ensure tests are administered in a secure and controlled setting.

WPHR is a structured, documented review of an individual's task-related performance records. WPHR was originally established to aid operators in transitioning their employees past work experience to meet regulatory requirements. If an operator chooses to use WPHR as an evaluation method, the following steps should be completed and documented at a minimum:

- a search of existing records for documentation of an individual's past satisfactory performance of a covered task(s);

- verification that the individual's work performance history contains no indications of substandard work or involvement in an accident caused by an error in performing a covered task; and
- verification that the individual has successfully performed the covered task on a regular basis.

Observation during performance on the job is a casual, unstructured observation.

Observation during OJT is a performance evaluation conducted at the conclusion of training on a covered task. (See other forms of evaluation.)

Observation during simulation can be any of several evaluation methods described as follows:

- simulated scenario of a closed pipeline system such as those used in control centers,
- off the right-of-way using a mock-up scenario to perform various covered tasks,
- demonstrating and communicating the intended performance of the covered task without physically touching the equipment.

Other forms of evaluation are as follows.

- Performance evaluations are formal, structured observations to measure skills and knowledge. An individual independently performs a covered task in a real-time or simulated environment while an evaluator assesses his/her skills based on a set of predetermined and documented criteria (such as a checklist).
- Professional certifications [e.g. National Association of Corrosion Engineers (NACE), American Society for Nondestructive Testing, (ASNT), API, American National Standards Institute (ANSI)] that include evaluation.

6.2.5 Evaluation Material

Evaluations should assess an individual's knowledge and skills necessary to perform a task. An operator has the option to develop internal evaluation materials or utilize material developed by third-party organizations.

If developing internal evaluation material, the operator may base evaluations on operations and maintenance procedures. If using third-party vendors, the operator is responsible for assessing the vendors' processes and materials to ensure that all requirements are met.

The operator should consider periodically reviewing and updating evaluations to ensure they meet requirements.

6.2.6 Evaluation Process

6.2.6.1 General

The evaluation process is established and documented by the operator to determine an individual's ability to perform a covered task. This evaluation establishes that an individual is qualified to perform covered tasks.

Qualified means that an individual has been evaluated and can:

- a) perform assigned covered tasks and
- b) recognize and react to AOCs.

Operators should develop the acceptance criteria for evaluations.

Operators should track and maintain an individual's qualification records, including the methods used to verify an individual's knowledge, skills, and ability to perform a task.

The evaluation process should include, at a minimum, the following.

- Grading system:
 - identify grading system(s); examples of grading systems include, but are not limited to:
 - pass/fail—no number or alphabetic grade given,
 - criterion-based scale—graded on a scale, for example, an 80 % score;
 - operators should be prepared to provide justification for the grading method(s) applied.
- Number of allowable attempts.
- Consequences of failure.
- Process for communicating evaluation results.
- Minimum requirements for testing:
 - ensure that environment is conducive for testing,
 - ensure all operator testing requirements are met,
 - maintain control of test materials,
 - establish requirements for proctors,
 - establish requirements for evaluators.
- Rules to ensure test integrity:
 - fair and consistent administration,
 - security of test questions and answer banks.
- Rules for ensuring the integrity of evaluations performed remotely

Evaluators should have the technical knowledge and skills for the task they are evaluating and the ability to recognize and respond to AOCs.

Evaluators should have training to ensure that they understand the evaluation process and their role in the process.

The operator may also consider if the evaluator needs to maintain the qualification for each task that they are able to evaluate. This is especially important if the evaluation is performed on an active system and there are no other qualified individuals available to direct and observe task performance.

6.2.6.2 Evaluation Qualification Documentation

Qualification records shall include:

- identification of qualified individual(s);

- identification of the covered tasks the individual is qualified to perform;
- date(s) of current qualification; and
- qualification method(s).

Records supporting an individual's current qualification shall be maintained while the individual is performing the covered task. Records of prior qualification and records of individuals no longer performing covered tasks shall be retained for a period of 5 years.

NOTE Documentation requirements for OQ are found under *CFR* § 192.807 and *CFR* § 195.507.

6.2.6.3 Alternative Methods of Evaluation

6.2.6.3.1 General

Individuals may be qualified using alternative methods. Examples of these alternative methods would include the use of remote software applications when performing performance verifications. There are many applications that are currently available to perform alternative methods of evaluation. Some examples of these types of tools include video conferencing platforms and communication equipment used by diving personnel, as well as computer-generated simulated environments such as augmented reality and virtual reality.

Qualification records should identify if a qualification was performed using an alternative method. Alternative methods should have well-defined processes and be properly documented.

As defined in 3.1.6, the term “evaluation” identifies other forms of assessment [Item e)] as a qualification option. Section 6.2.3 describes evaluations as formal, structured observations to measure knowledge, skills, and ability.

6.2.6.3.2 Remote Evaluation Considerations

Evaluations should be performed in real-time or in a simulated environment while an evaluator assesses the individual's skills based on a set of predetermined and documented criteria. These criteria should not vary whether the evaluation takes place remotely or with an evaluator physically present, but there are some important considerations when an operator determines if a covered task can be remotely evaluated.

- *Active System vs Simulation*—A remote evaluation presumes the evaluator is not physically in control of the performance evaluation. If an evaluation is taking place on an active system, and the candidate is not currently qualified for the task being evaluated, the span of control oversight rule applies, and the task performance shall be directly observed by a qualified individual. Tasks that have been identified by the operator as more critical or more complex may not be suitable for remote evaluations.
- *Initial vs Subsequent Qualification*—Initial qualification presumes the individual has not yet been evaluated on the covered task. When performing an initial qualification, it should be recognized that there is an additional layer of novice risk associated with the evaluation. Tasks that have been identified by the operator as more critical or more complex may not be suitable for initial remote evaluations.
- *Covered Task Considerations*—The operator should assess and determine which evaluations of tasks on their covered task lists are eligible to be performed remotely. Tasks that have been identified by the operator as more critical or more complex may not be suitable for remote evaluations.
- *Remote Evaluation Limitations*—Remote evaluations require the evaluator to have a video and audio connection to the evaluated individual. The operator should assess if a particular facility has sufficient communications access to permit effective remote evaluations.

6.2.6.3.3 Alternative Evaluation Considerations

When qualifying using an alternative method the following should be taken into consideration.

- 1) Before performing the evaluation, the evaluator should verify all equipment being used to perform the evaluation is working properly. Evaluations through a conversation on a phone will not be allowed unless using some form of a video-capable app. Before performing a remote evaluation, the evaluator should verify that all audio and visual equipment is working properly.
- 2) If necessary, the evaluator shall ensure that there is a designated observer on premises to verify the individual and the environment is safe. The designated observer shall remain at the evaluation until it is complete.
- 3) The evaluator shall verify that the individual being evaluated is the person to be qualified. This should be done through the verification of an individual's picture identification (such as company ID, government-issued ID, etc.).
- 4) The evaluator shall verify that no other person is assisting the individual during the evaluation. The onsite designated observer or any other person that is needed to assist with holding the phone, camera, microphone, etc., cannot provide direction to the individual being evaluated.
- 5) The evaluator and individual performing the qualification should be in an area that limits distractions.
- 6) Unless used as part of the evaluation, phones or other communication devices should be turned off/silenced before beginning the evaluation.
- 7) The individual being evaluated and the evaluator shall remain at the evaluation until it is complete. If an individual leaves for any reason, the evaluation should be discontinued and restarted when he/she is available.
- 8) The name of any additional person(s) in the room shall be documented. This includes the onsite designated observer and others that might be required to assist.
- 9) The task steps shall be completed in a manner that the evaluator can easily determine that the individual qualifying has the proper knowledge, skills, and ability to perform the task both safely and correctly.

6.2.7 AOCs

As stated in the regulation, qualification shall include an evaluation of the individual's ability to recognize and react to AOCs associated with covered tasks.

The operator has the flexibility to determine method(s) for ensuring that individuals can recognize and react to AOCs. These methods may include but are not limited to the following:

- develop a standalone AOC evaluation,
- incorporate AOCs into task evaluation,
- review AOCs in pre-job meetings and document review,
- review AOCs in periodic meetings and document review,
- any combination of the above.

Identifying AOCs for covered tasks includes but is not limited to analyzing the covered task procedures to identify any steps that, if performed incorrectly, could lead to a release, overpressure, or other potentially hazardous condition. Upon identification of these steps, determine and document the AOC and the

recognition and appropriate corrective response. Further guidance on identifying AOCs is provided in Annex G.

6.3 Other Circumstances That Require Qualification Considerations

6.3.1 New Construction

The operator's OQ program should address how OQ regulation applies to new construction. As defined by PHMSA, new construction is the act of building a pipeline facility or expanding an existing pipeline facility (as in looping a pipeline segment, which may also be construction to meet increased load requirements or to enhance reliability of the system) to provide new service to a customer(s) or in order to meet increased demand. New construction ends when the pipeline facility is being commissioned or during the act of connecting to an active pipeline (the tie-in).

6.3.2 Mergers and Acquisitions

An operator's OQ program should include provisions for mergers and acquisitions of assets subject to 49 *CFR* Part 192 and/or Part 195 to ensure that qualified individuals perform covered tasks. It is important to note that the availability and timing of receipt of the information to the operator may vary for each merger or acquisition. Upon transfer of ownership of the newly acquired asset, steps should be taken to ensure that OQ covered tasks are being performed by qualified personnel.

When acquiring a new asset, the operator has several options, which may include but are not limited to the following:

- accept all or part of the acquired asset's program (conduct review),
- temporarily accept all or part of the acquired asset's program during the transition period (conduct review),
- incorporate any new personnel/contractors from the acquired company into the operator's program.

A review of the asset's OQ program should be conducted if the asset's qualifications and/or any part of their program is to be used. The purpose of the review is to identify compatibility with the operator's program and any improved processes that may need to be addressed. Additional review items to be considered may include but are not limited to:

- covered tasks;
- span of control;
- reevaluation intervals;
- evaluation methods;
- contractor qualifications;
- AOC modifications may be necessary due to differences in product transported, technology, or equipment, among other factors.

At the review's conclusion, a plan may be established to transition the personnel and contractors under the acquired asset's program to the operator's program. Consideration may be given for incorporating any improved processes identified during the review.

If the operator incorporates the new personnel/contractors into their own OQ program, an asset review for product transported, technology, or equipment should be reviewed and incorporated into program as applicable.

The operator should document the process and OQ program actions taken during the merger or acquisition. An example of an OQ program merger and acquisition review guidance document that may be utilized during a merger or acquisition is included in Annex E.

6.3.3 Comingling of Operations

Comingling of operations is operational responsibilities by more than one operator of a pipeline system [i.e. cathodic protection (CP), valve operations, relief tank]. Operators should determine demarcation line of responsibility.

The agreed operations between the companies should be documented and on file with both parties. When operators have comingling of operations, each operator should establish a mechanism for ensuring qualifications. This may include providing OQ records when requested or be present when covered tasks are being performed.

7 Element 3: Allow Individuals That Are Not Qualified Pursuant to the Regulation to Perform a Covered Task if Directed and Observed by an Individual That Is Qualified

7.1 General

Operators may consider a mechanism to observe and direct performance of a covered task by nonqualified personnel.

7.2 Span of Control

An operator's program may allow nonqualified individuals to perform some covered tasks, providing they are directed and observed by a qualified individual. For a qualified individual to direct and observe a nonqualified individual, the qualified individual shall be in close proximity and within line of sight to the nonqualified individual so that the qualified individual may intervene if needed, assume control if the task is being performed incorrectly, and respond to an AOC if one should arise.

Operators that choose to use span of control shall determine the span of control for each task. The number of nonqualified individuals that may perform a task under the direction of a qualified individual (span of control) should be determined based on criteria. The following criteria may be considered: task's practicality, complexity, and criticality. Typical industry spans of control range from 1:0 through 1:5 (ratio is qualified:nonqualified). It is recommended operators not exceed spans above 1:5.

- An operator may consider temporarily reducing span of control for a specific task when actual jobsite conditions (i.e. language barriers, weather conditions, excessive distraction) limit the qualified individual's ability to direct and observe nonqualified individuals.
- If an operator sets the span of control for tasks at 1:0, then the operator may consider including a provision in its program to allow a nonqualified individual to perform covered tasks during OJT providing that a qualified individual is present for the training and is in close proximity and within line of sight in order to intervene, assume control, or respond to an AOC.
- Span of control only applies to individuals who are physically performing steps of a covered task. Span of control does not apply to individuals who are only performing ancillary functions (such as a welder's helper) in support of the completion of a covered task.

- A qualified individual can only direct and observe nonqualified individuals performing a single task at any given time.

In addition, the program should state that the qualified individual shall be in close proximity and within line of sight to the nonqualified individual so that he/she can intervene or assume control if the task is being performed incorrectly and can respond to an AOC if one should arise.

7.3 Guidance on Emergency Response

An emergency is considered a fire, explosion, or release of hazardous liquid/gas occurring near or directly involving a pipeline facility caused by accidental failure and/or natural disasters. The emergency phase extends until the source has been secured, the threat of harm to the environment and/or public has been removed, and the safety of all responders is achieved. Once the emergency phase ends, OQs shall thereafter be required for all individuals performing covered tasks.

8 Element 4: Evaluate an Individual if the Operator Has Reason to Believe That the Individual's Performance of a Covered Task Contributed to an Accident/Incident as Defined in the Regulation

8.1 General

Operators may temporarily suspend and review an individual's qualification upon determination that the individual's performance of a covered task(s) may have contributed to an accident or incident.

8.2 Guidance on Determination of Appropriate Action Following Individual's Involvement in an Accident or Incident

If the operator has determined that a covered task was being performed by an individual at the time the accident/incident occurred, the operator shall investigate to determine if the improper performance of a covered task was a causal factor to the incident/accident. When making this determination, an operator's consideration may include:

- an individual's lack of knowledge on how to perform a covered task,
- a change in an individual's skills or ability required to perform a covered task,
- deficiency in the performance of a procedure,
- unsatisfactory or unsafe performance of a covered task,
- nonqualified individual.

The operator shall determine and execute appropriate action(s) to review qualification and effectiveness. Appropriate actions to be taken may include:

- suspend individual's performance of covered task,
- provide training for individual,
- conduct procedure review with individual,
- evaluate and/or requalify individual,
- revise the procedure(s),
- revise the OQ program,

- other actions as warranted.

Operators should document the results of the review, evidence of requalification, disqualification, or suspension.

9 Element 5: Evaluate an Individual if the Operator Has Reason to Believe That the Individual Is No Longer Qualified to Perform a Covered Task

9.1 General

Operators shall review an individual's performance of covered tasks if there is reason to believe the individual should no longer be qualified.

9.2 Guidance on Determining if an Individual Should No Longer Be Qualified

Operators should develop a process to determine if and when an individual is no longer qualified to perform a covered task. Reasons an individual may no longer be qualified, other than an accident or incident as defined by 49 *CFR* Part 192 and/or Part 195, may include:

- failure to properly perform a covered task;
- failure to recognize or react to an AOC;
- extended leave;
- prolonged period of nonperformance of a covered task;
- loss of motor skills, vision, or impairments.

The operator has the flexibility to establish a policy that applies to all affected individuals or may choose to determine qualification on an individual basis, or a combination of both. It may be helpful to consider the following.

- If covered tasks were performed improperly, does the individual lack knowledge, skill, or ability?
- If extended leave was involved, consider the following.
 - Did the reason for leave effect the individual's ability to perform covered tasks?
 - Have procedures changed during a leave of absence?
 - Have qualifications expired during a leave of absence?
- How much experience does the individual have at performing the covered tasks?
- How much time elapsed since the last performance of the covered tasks?
- Are there other contributing factors to consider?

If the individual is no longer qualified, the operator may consider additional actions, which may include:

- restrict performance of covered task (such as performing task under span of control),
- training,
- reevaluation,

- procedure review,
- no action required.

9.3 Suspension Process

If an individual fails to demonstrate proficiency, the operator has reason to believe an individual is no longer able to satisfactorily perform a covered task, or the individual's actions may have contributed to an incident or accident (see 8.2), then upon knowledge of inadequate performance, the operator shall immediately suspend the individual's qualification for the specific covered task.

The suspension of an individual's qualifications shall at a minimum apply to the specific covered task(s). Suspension of such qualifications may not affect the individual's ability to perform other covered task(s).

The suspension shall be documented and continue until the operator has determined the successful completion of the necessary retraining and/or evaluation process or it was determined that the individual's actions did not contribute to an incident or accident.

An operator may have a separate suspension process for contractors.

10 Element 6: Identify Those Covered Tasks and the Intervals at Which Evaluation of the Individual's Qualifications Is Needed

10.1 General

Operators shall establish reevaluation intervals for each covered task.

10.2 Guidance on Developing Reevaluation Intervals

When developing reevaluation intervals, the operator has the option of utilizing industry associations' (or other entities) recommended intervals or developing operator-specific intervals. A reevaluation interval of 36 months is the recognized industry standard for most covered tasks. If an operator chooses to adopt an industry-developed interval, the operator should review the interval to ensure that the operator's OQ program's requirements are met. Some covered tasks, such as welding or nondestructive testing (NDT), have regulatory requirements that may affect reevaluation intervals.

When developing intervals internally or revising intervals, the operator should document the rationale used to determine the intervals and may consider the following:

- complexity of the task (difficulty of the knowledge and skill components of a task),
- criticality of the task (the potential adverse impacts that could result from improper performance of a task),
- frequency of performance of the task (how often the task is performed).

The operator may establish a method of notification prior to the expiration of the qualification(s).

11 Element 7: Communicate Changes That Affect Covered Tasks to Individuals Performing Those Covered Tasks

11.1 General

The operator shall have a mechanism for communicating changes that affect covered tasks.

11.2 Guidance on Developing Processes to Communicate Changes That Affect Covered Tasks

The operator should have processes in place for communicating the change to the affected individuals.

Examples of changes that affect covered tasks may include the following:

- task addition or deletion;
- revisions or additions to identified AOCs;
- policies, procedures, and standards;
- tools, equipment, or technology;
- evaluation methods, materials, and criteria;
- suspension and disqualification processes;
- reevaluation intervals;
- span of control.

Significant changes to covered tasks may necessitate additional evaluation to maintain qualification.

12 Element 8: Provide Training, as Appropriate, to Ensure That Individuals Performing Covered Tasks Have the Necessary Knowledge and Skills to Perform the Tasks in a Manner That Ensures the Safe Operation of Pipeline Facilities

12.1 General

The operator should address the role of training in the qualification of individuals.

12.2 Guidance on Providing Training, as Appropriate

There may be circumstances that require training to ensure that individuals have the knowledge and skills required for qualification. Operators may provide training on specific covered tasks and/or based on the individual's need for training.

Examples of when training may be appropriate include:

- initial qualification;
- suspension;
- per incident investigation;
- addition of a covered task;
- revisions to policies and procedures;
- changes to tools, equipment, or technology;
- failed evaluation.

Training delivery methods may include:

- OJT,
- instructor-led training,
- computer-based training,
- certification programs,
- table-top/simulation,
- self-study.

13 Element 9: Notify the Administrator or a State Agency if the Operator Significantly Modifies the Program After the Administrator or State Agency Has Verified That It Complies with Regulation

13.1 General

Operators are required to identify significant modifications that would require notification and submission to PHMSA and appropriate state regulatory agencies.

13.2 Guidance on Determining a Significant Change

Operators should determine what changes would be considered significant to the OQ program. Examples of changes that may be considered significant include:

- modifications to covered task list;
- modifications to evaluation process;
- modifications to qualification process;
- revisions to span of control;
- wholesale changes made to the operator's OQ program (e.g. consolidation of programs following a merger, acquisition, or divestiture; changes to roles and responsibilities; or other changes the operator deems significant).

13.3 Guidance on Transmitting OQ Program Revisions

Notifications to PHMSA may be submitted by electronic mail to InformationResourcesManager@dot.gov, or by mail to ATTN: Information Resources Manager DOT/PHMSA/OPS, East Building, 2nd Floor, E22-321, New Jersey Avenue SE, Washington, DC 20590. The operator should submit the complete OQ program accompanied by a revision/change log and the effective date of change(s). The OQ program should be written such that changed areas of the program can be readily identified. Employee-specific information (i.e. social security numbers) and testing material do not need to be sent.

Each notification to PHMSA should include the following:

- operator identification number(s) [OPID(s)], operator name(s), headquarters (HQ) address;
- name of individual submitting notification;
- data/email/phone number;

- commodity (gas/liquid/both);
- PHMSA region(s) where pipeline(s) operates;
- names of respective facilities or pipeline systems where changes apply.

NOTE Operators subject to pipeline safety regulations by state agencies are required to send OQ notifications directly to each affected state agency.

13.4 Recordkeeping

In addition to Elements 1 through 9, 49 *CFR* § 192.807 and 49 *CFR* § 195.507 require that the operator maintain the following records for all individuals performing covered tasks:

- identification of qualified individual(s),
- identification of the covered task(s) the individual is qualified to perform,
- qualification date,
- qualification method(s).

Records supporting an individual's current qualification shall be maintained while the individual is performing the covered task(s). Records of prior qualification and records of individuals no longer performing covered task(s) shall be retained for a period of 5 years. It is important to note that this 5-year period begins on the last date the qualification was valid.

13.5 Guidance on Developing Recordkeeping Criteria

Operators may consider developing and documenting a process that ensures that individuals performing covered tasks have valid qualifications. Examples of validation methods may include but are not limited to:

- hard copy records,
- electronic records,
- ID cards.

Qualification records may be maintained by the operator or a third party. It is important to note that different methods may be used to validate qualification for employees, contractors, subcontractors, or other entities.

The operator may consider maintaining additional records to demonstrate compliance with the program. While this list of records is not required by regulation, many are integral to the OQ program:

- documented history of OQ program and all program revisions, including covered task changes;
- communication of the OQ program;
- management of change, including the notification of applicable contractors;
- evaluation criteria;
- span of control;
- applicable training;
- reevaluation records for cause;

- feedback from field personnel, accident and incident investigations, near miss programs, or other sources that could enhance the OQ program, such as AOCs, evaluations, and training;
- results of program review and/or auditing;
- history file of checklist used for performance verifications and written/oral exams;
- justification for selection of evaluators;
- revision log.

Annex A (normative)

Covered Task List

The covered tasks listed below were identified by API and may be adopted by the operator as described in 5.2 of this document.

Task No.	Covered Task Name
1.1	Measure Structure-to-Soil Potentials
1.2	Conduct Close Interval Survey
1.3	Test to Detect Interference
1.4	Inspect and Perform Electrical Test of Bonds
1.5	Inspect and Test Electrical Isolation
2.1	Verify Test Lead Continuity
2.2	Repair Damaged Test Lead
2.3	Install Test Leads by Non-exothermic Welding Methods
2.4	Install Test Leads by Exothermic Welding Methods
3	Obtain a Voltage and Current Output Reading from a Rectifier to Verify Proper Performance
4.1	Troubleshoot Rectifier
4.2	Repair or Replace Defective Rectifier Components
4.3	Adjust Rectifier
5.1	Examine for Mechanical Damage on Buried or Submerged Pipe
5.2	Examine for External Corrosion on Buried or Submerged Pipe
5.3	Inspect the Condition of External Coating on Buried or Submerged Pipe
7.1	Perform Visual Inspection of Atmospheric Coatings
7.2	Prepare Surface for Coating Using Hand and Power Tools
7.3	Prepare Surface for Coating by Abrasive Water Blasting
7.4	Prepare Surface for Coating by Abrasive Blasting Methods Other than Water
7.5	Apply Coating Using Hand Application Methods
7.6	Apply Coating Using Spray Applications
7.7	Perform Coating Inspection
8.1	Measure Pit Depth with Pit Gauge
8.2	Measure Wall Thickness with Ultrasonic Meter
8.3	Measure Corroded Area
9.1	Install Bonds
9.2	Install Galvanic Anodes
9.3	Install Rectifiers
9.4	Install Impressed Current Groundbeds
9.5	Repair Shorted Casings
9.6	Install Electrical Insulating Device

Task No.	Covered Task Name
10.1	Insert and Remove Coupons
10.2	Monitor Probes (Online)
11	Monitor and Control the Injection Rate of the Corrosion Inhibitor
12	Perform Visual Inspection of Internal Pipe Surface
14.1	Locate Line
14.2	Install, Inspect, and Maintain Permanent Marker
14.5	Install, Inspect, and Maintain Temporary Marker
15.1	Perform Visual Inspection of Surface Conditions of Right-of-way
16.1	Inspect Navigable Waterway Crossing
19.1	Perform Valve Body Winterization or Corrosion Inhibition
19.2	Perform Valve Lubrication
19.3	Perform Valve Seat Sealing
19.4	Perform Valve Stem Packing Maintenance
19.5	Adjust Actuator/Operator, Electric
19.6	Adjust Actuator/Operator, Pneumatic
19.7	Adjust Actuator/Operator, Hydraulic
20	Inspect Mainline Valves
21.1	Repair Valve Actuator/Operator, Pneumatic
21.2	Disassemble/Reassemble Valves
21.3	Perform Internal Inspection of Valves
21.4	Repair Valve Actuator/Operator, Hydraulic
21.5	Repair Valve Actuator/Operator, Electric
22.1	Inspect Tank Pressure/Vacuum Breakers
22.2	Inspect, Test, and Calibrate HVL Tank Pressure-relief Valves
23.1	Maintain/Repair Relief Valves
23.2	Inspect, Test, and Calibrate Relief Valves
24.1	Maintain/Repair Pressure-limiting Devices
24.2	Inspect, Test, and Calibrate Pressure-limiting Devices
25.1	Inspect, Test, and Calibrate Pressure Switches
25.2	Inspect, Test, and Calibrate Pressure Transmitters
27.1	Perform Routine Inspection of Breakout Tanks (API 653 Monthly or DOT Annual)
27.2	Perform API 653 Inspection of In-service Breakout Tanks
27.3	Perform API 510 Inspection of In-service Breakout Tanks
30	Test Overfill Protective Devices
31	Inspect and Calibrate Overfill Protective Devices
32	Observe Excavation Activities
38.1	Perform Visual Inspection of Pipe and Pipe Components Prior to Installation
38.3	Perform Visual Inspection of Welds

Task No.	Covered Task Name
38.4	Perform NDT—Radiographic Testing
38.5	Perform NDT—Liquid Penetrant Testing
38.6	Perform NDT—Magnetic Particle Testing
38.7	Perform NDT—Ultrasonic Testing
39	Perform Backfilling
40.1	Fit Full Encirclement Welded Split Sleeve (Oversleeve, Tight-fitting Sleeve, etc.)
40.3	Apply Composite Sleeve
40.4	Install Mechanical Bolt-on Split Repair Sleeve
40.5	Install Weldable Compression Coupling
40.6	Install and Remove Plugging Machine
40.7	Install a Tap 2 in. and Under on a Pipeline System
40.8	Install a Tap Larger than 2 in. on a Pipeline System
40.9	Install and Remove Completion Plug on Pipelines Larger than 2 in.
40.11	Install and Remove Completion Plug on a Pipeline 2 in. and Under
41	Conduct Pressure Test
42.7	Perform Welding
43.1	Perform Start-up of a Liquid Pipeline (Control Center)
43.2	Perform Shutdown of a Liquid Pipeline (Control Center)
43.3	Monitor Pressures, Flows, Communications, and Line Integrity and Maintain Them Within Allowable Limits on a Liquid Pipeline System (Control Center)
43.4	Operate Valves Remotely on a Liquid Pipeline System
44.3	Inspect, Test, and Maintain a Flow Computer for Hazardous Liquid Leak Detection
44.4	Inspect, Test, and Perform Corrective and Preventative Maintenance of Tank Gauging for Hazardous Liquid Leak Detection
44.5	Prove Flow Meters for Hazardous Liquid Leak Detection
44.6	Maintain Flow Meters for Hazardous Liquid Leak Detection
44.7	Inspect, Test, and Maintain Gravitometers/Densitometers for Hazardous Liquid Leak Detection
44.8	Inspect, Test, and Maintain Temperature Transmitters for Hazardous Liquid Leak Detection
63.1	Perform Start-up of a Liquid Pipeline (Field)
63.2	Perform Shutdown of a Liquid Pipeline (Field)
63.3	Monitor Pressures, Flows, Communications, and Line Integrity and Maintain Them Within Allowable Limits on a Liquid Pipeline System (Field)
63.4	Operate Valves Locally on a Liquid Pipeline System

Annex B

(normative)

Covered Task Standards

Annex B includes task standards for each task identified in Annex A (Covered Task List). All task standards follow a standardized format that includes the following sections: task description; knowledge component (including AOCs specifically associated with the performance of the task); and a skill component.

Task 1.1—Measure Structure-to-Soil Potentials

1.0 Task Description

This task consists of taking a structure-to-soil reading with a half cell during an annual survey or CP analysis.

The task begins with equipment selection. This task ends with documenting the readings as required by the operator's procedure.

2.0 Knowledge Component

The purpose of the task is to verify electrical continuity between structures and soil.

An individual performing this task must have knowledge of:

- CP systems;
- types of reference cells to use in combination with a high-impedance volt-ohm meter (VOM):
 - copper/copper sulfate half cells,
 - saturated potassium chloride (KCl) calomel reference electrodes,
 - saturated silver/silver oxide half cells;
- minimum requirements for negative voltage;
- considerations that must be made to account for IR drop. Voltage drops other than those across the structure-to-electrolyte boundary must be considered.

AOCs associated with the performance of this task include the following.

AOC Recognition	AOC Reaction
Damaged coating; scratches, dents, and gouges.	Implement mitigation measures per operator's procedures.
Missing or broken test points, leads, and/or stations.	Repair the test leads or equipment as needed.
Damaged or malfunctioning reference electrode.	Replace reference electrode.

3.0 Skill Component

To demonstrate proficiency of this task, an individual must perform the following steps.

Step	Action	Explanation
1	Select the instrumentation (test leads, voltmeter, and reference electrode) to be used.	Incorrect or faulty equipment will not provide accurate results.
2	Identify the correct test point locations where measurements will be taken.	The reference electrode must be correctly located to obtain accurate results. A structure may have several locations for taking measurements.
3	Connect the test leads to the voltage meter and reference cell.	Damaged equipment or improper connection of equipment will lead to inaccurate potential measurements.
4	Measure the structure-to-soil potential.	This step takes the actual potential difference between the soil and the structure being tested.
5	Field-analyze readings and check polarity to ensure that they are within the desired range of readings.	Readings should be reviewed as they are taken to ensure that measurements fall within the desired range with the correct polarity. This is not meant to be an engineering analysis or to account for IR drop considerations. This may include a comparison to historical data at that location. If readings are outside desired range or are erratic or floating, implement mitigation measures per operator's procedures.
6	Document the readings as required by operator's procedure.	Documentation is critical to future analysis and identification of problem areas.

Task 1.2—Conduct Close Interval Survey

1.0 Task Description

This task consists of using equipment to obtain and record structure-to-soil potential readings at specific intervals along the length of a located pipeline.

The task begins with identifying the test point locations where connections will be made. The task ends when the readings are documented as required by the operator's procedures.

Data analysis is not part of this covered task.

The performance of this covered task may require the performance of other covered tasks such as the following.

- Locate Line (reference Task 14.1).
- Measure Structure-to-Soil Potentials (reference Task 1.1).

2.0 Knowledge Component

The purpose of this task is to verify electrical continuity between structures and soil along the length of a pipeline.

An individual performing this task must have knowledge of the following.

- Types of close interval surveys, which may include but are not limited to, the following:
 - “ON” survey,
 - interrupted survey,
 - depolarized survey.
- CP systems and components comparable to NACE Certification Level CP 2. This knowledge includes, but is not limited to, the following.
 - The specific survey being conducted and the designated spacing between readings. Spacing determines the amount of data collected and the accuracy of the data profile.
 - The location of the pipeline and appurtenances (road crossings, test stations, river crossings, foreign crossings, casings, valves, isolation devices, rectifiers, galvanic anodes, aerial markers, bonds, pump stations, etc.) typically found in alignment sheets or system mapping should be marked on the survey for validation of the line and its location.

Terms applicable to this task are as follows.

current interrupter

A device that stops/interrupts the transfer of an electric charge used to cycle rectifiers, anodes, bonds, etc., on and off.

data logger

A digital device used to record multiple structure-to-soil potentials.

depolarized (off) survey

Measures the potential difference between the structure and the ground surface after the CP current has been switched off long enough for the structure-to-soil to stabilize.

“instant off” potential

The polarized half-cell potential of an electrode taken immediately after the CP current is stopped. This process closely approximates the potential without IR drop.

interrupted (on/off) survey

Measures the potential difference between the structure and the ground surface as the CP current is switched on and off.

IR drop

The voltage or potential difference as a result of current flow. From Ohm's Law, $V = IR$. When evaluating structure-to-soil measurements, IR drop is the voltage drop other than the drop across the structure-to-soil boundary.

“ON” survey

Measures the potential difference between the structure and the ground surface as the CP current is applied.

AOCs associated with the performance of this task include the following.

AOC Recognition	AOC Reaction
Missing or broken test points, leads, and/or stations.	Repair the test leads or equipment as needed.
Reverse polarity of readings.	Document and notify the appropriate operator personnel immediately.
Damaged or malfunctioning reference electrode.	Replace reference electrode.

3.0 Skill Component

To demonstrate proficiency of this task, an individual must perform the following steps.

Step	Action	Explanation
1	Identify the test point locations where connections will be made.	To confirm that potentials taken are on the intended pipeline and are the most accurate readings.
2	Connect the test leads, the voltage meter or data logger, and reference cell.	Damaged equipment or improper connection of equipment will lead to inaccurate potential measurements.
3	Verify that current sources are operational (on for "ON"/interrupted surveys and turned off/disconnected for depolarized survey).	All current sources must be operational for an "ON"/interrupted survey, and all sources must be off or disconnected for a depolarization survey.
4	Place the reference cell directly above the pipeline being surveyed.	The reference electrode must be in contact with the electrolyte to obtain accurate results.
5	Select the instrumentation to include survey wire, voltmeter, data logger, reference electrodes, etc. to be used.	Incorrect or faulty equipment will not provide accurate results.
6	For interrupted surveys, install current interrupters at all identified current sources. They should be set at the operator-determined time cycle and synchronized.	Current interrupters are necessary to obtain accurate "instant off" potentials. Time cycle selection is important to prevent excessive depolarization of the structure when performing an interrupted survey. Synchronization is important to get an accurate "instant off" potential.
7	Measure the structure-to-soil potential according to the desired intervals for this survey.	This step takes the actual potential difference between the soil and the structure at specified intervals to establish a potential profile of the pipeline. If readings are outside desired range or are erratic or floating, implement mitigation measures per operator's procedures.
8	Verify data is recorded.	Readings should be continuous; a lack of data may be a sign of equipment failure or faulty electrode location.
9	Document the readings as required by operator's procedures.	Documentation is critical to future analysis and identification of problem areas.

Task 1.3—Test to Detect Interference

1.0 Task Description

This task consists of testing a cathodically protected structure for interference from other sources.

This task begins with testing for direct current (DC) or alternating current (AC) interference. The task ends when the readings are documented as required by the operator's procedures.

The performance of this covered task may require the performance of other covered tasks such as the following.

- Measure Structure-to-Soil Potentials (reference Task 1.1).
- Obtain a Voltage and Current Output Reading from a Rectifier to Verify Proper Performance (reference Task 3).

2.0 Knowledge Component

The purpose of this task is to assess structures in proximity to each other and their respective CP systems.

An individual performing this task must have knowledge of the following.

- CP systems and components comparable to NACE Certification Level CP 2. This knowledge must include, but is not limited to, the following.
 - Determining interference by analyzing abnormal DC currents or potentials or the presence of AC or potentials.
 - Communicating with foreign structure owners for collaboration of testing (working with other cathodic system owners enables the interruption of their systems and coordination for testing for both cathodic systems).
 - Interrupting a CP system to detect its influence on other structures (installation of current interrupters on either or both systems is necessary to determine the extent of system interference).
 - Troubleshooting CP systems.
 - Documenting the readings and recommendations for future reference.

AOCs associated with the performance of this task include the following.

AOC Recognition	AOC Reaction
Missing or broken test points, leads, and/or stations.	Repair the test leads or equipment as needed.
Damaged or malfunctioning reference electrode.	Replace reference electrode.

3.0 Skill Component

To demonstrate proficiency of this task, an individual must perform the following steps.

Step	Action	Explanation
1	Select instrumentation, test leads, and reference electrodes.	Incorrect equipment and/or improper usage will not provide accurate results.
2	Assess the area for other CP systems or sources of electrical interference.	Potential sources of electrical interference can be the sources of cathodic interference.
3	Measure the structure-to-soil potential.	This step takes the actual potential difference between the soil and the structure pipe being tested.
4	Field-analyze readings to ensure that the readings fall within the desired range.	Readings should be reviewed as they are taken to ensure readings fall within the desired range. This may include a comparison to historical data at that location. If readings are outside the desired range check for possible causes such as reversed polarity, open bonds, shorted diodes, or changes in cathodic system. Take appropriate action per operator's procedures.
5	Interrupt rectifiers to determine if interference exists.	Interrupting one of the structure's CP systems can help detect its influence on other structures.
6	Document all results. If interference is found, take corrective action.	Documentation is critical to future analysis and identification of problem areas. Corrective action may involve making notifications.

Task 1.4—Inspect and Perform Electrical Test of Bonds

1.0 Task Description

This task consists of the visual and electrical inspection of connections related to the electrical connection (bond) of two or more structures.

This task begins with identifying the location of the bond(s). The task ends with the collection of data.

2.0 Knowledge Component

The purpose of this task is to test for electrical continuity and the direction and magnitude of current flow between two or more structures.

An individual performing this task must have knowledge of the following.

- How to identify the location and type of bond that is currently in place.
- Types of bonds that may include critical and noncritical interference bonds (other bonds that may be inspected include continuity bonds).
- Voltmeters or multimeters.
- Shunts [bond currents are measured by taking a millivolt reading across a shunt that has a defined resistance; the current passing through the shunt (bond) is calculated by dividing the voltage reading by the shunt's resistance].

Terms applicable to this task are as follows.

continuity bond

A connection, usually metallic, that provides electrical continuity between structures that can conduct electricity.

critical bonds

Bonds whose failure would jeopardize the integrity of a pipeline.

interference bond

An intentional metallic connection, between metallic systems and contact with a common electrolyte, designed to control electrical current interchange between the systems.

AOCs associated with the performance of this task include the following.

AOC Recognition	AOC Reaction
Broken bond connection.	Repair or request a repair and document.

3.0 Skill Component

To demonstrate proficiency of this task, an individual must perform the following steps.

Step	Action	Explanation
1	Identify the bond locations where measurements will be taken.	To confirm that potentials and current measurements are taken at the correct location.
2	Conduct a visual inspection of the bond test station for physical damage to the bond station, a burned or damaged shunt, loose connections, disconnected wires, arcing across terminal, etc.	Faulty equipment can cause inaccurate results. If the shunt is burned or damaged, measure the current to ensure that it is not underrated.
3	Select the instrumentation, including VOM, ammeter, test leads, or reference cell.	Incorrect equipment and/or improper usage will not provide accurate results.
4	Make connections with the test equipment to take and record readings.	Equipment that is improperly connected or scaled may yield faulty data. Repair/replace any damaged tests leads or equipment.
5	Measure the potentials for each of the structures at the bond location.	This step allows for comparison of the pipe-to-soil potentials of each structure.
6	Identify the shunt type and size.	This step is required to calculate current flow.
7	Measure the direction and magnitude of current flow between the structures.	A change in current magnitude or current direction may indicate a need for further testing.
8	Field-analyze the readings to confirm that they are within a desired range of readings, including a check of the polarity.	Readings should be reviewed as they are taken to verify that measurements fall within the desired range with the correct polarity; this is not meant to be an engineering analysis. This may include a comparison to historical data at that location. If readings are outside desired range or are erratic or floating, implement mitigation measures per operator's procedures.
9	Document readings as required by operator's procedures.	Documentation is critical to future analysis and identification of problem areas.

Task 1.5—Inspect and Test Electrical Isolation

1.0 Task Description

This task consists of the inspection and testing of electrical isolation.

The task begins with identification of the isolation device. The task ends when measurements have been taken and recorded.

The performance of this covered task may require the performance of other covered tasks such as the following.

- Measure Structure-to-Soil Potentials (reference Task 1.1).

2.0 Knowledge Component

The purpose of this task is to assure that electrical isolation is adequate.

An individual performing this task must have knowledge of the following.

- Isolation devices (which may include insulated flanges, couplings, unions, monolithic insulating pipe joints, and nonmetallic pipe and structural members).
- Casings (which need to be electrically isolated from the carrier pipe so as not to shield the carrier pipe from CP).
- Proper use of equipment [which may include a reference cell and voltmeter or isolation (flange) tester; most tests for isolation are based on potential differences in structures using a reference cell and voltmeter].

NOTE Using the ohmmeter setting to check the effectiveness of an isolation joint is not reliable because of the parallel resistance paths through the soil.

- Isolation (flange) testers (which are based on high radio frequency and can be used to validate the isolation of flange joints or for troubleshooting shorted joints; these testers are not typically used for isolation joints other than flanges).

AOCs associated with the performance of this task include the following.

AOC Recognition	AOC Reaction
No AOCs identified.	

3.0 Skill Component

To demonstrate proficiency of this task, an individual must perform the following steps.

Step	Action	Explanation
1	Identify the isolation locations and isolation device where measurements will be taken.	This step is to confirm that measurements are taken at the correct location.
2	Conduct visual inspection of the isolation location for things such as physical damage to the test station, a burned or damaged shunt, loose connections, disconnected wires, arcing across a terminal, etc.	This step verifies that there is no visual damage. Implement mitigation measures per operator's procedures.
3	Select the instrumentation, including voltmeter, isolation (flange) tester, test leads, or reference cell.	Incorrect equipment will not provide accurate results.
4	Make connections with the test equipment to take and record readings.	Improper usage will not provide accurate results.
5	If using a reference cell, measure the potential for each of the structures. The reference cell should remain in the same location during the measurements.	This step allows for a comparison of pipe-to-soil potentials to help determine if structures are isolated. If the difference in potential is approximately 100 mV or greater, the isolation is effective. If the reading is less than 100 mV, further testing may be necessary. If readings are outside desired range or are erratic or floating, implement mitigation measures per operator's procedures.
6	Check for continuity on flanges using an isolation/flange tester.	Verifies electrical isolation (or lack of continuity) between flanges.
7	Document the readings as required by operator's procedures.	Documentation is critical to future analysis and identification of problem areas.

Task 2.1—Verify Test Lead Continuity

1.0 Task Description

This task consists of the electrical inspection of test leads connected to a structure.

This task begins with identification of the test lead wire. The task ends when a determination is made about whether valid data may be obtained using the test lead wire.

This task does not include but may lead to the performance of other covered tasks such as the following.

- Repair Damaged Test Lead (reference Task 2.2).
- Install Test Leads by Non-exothermic Welding Methods (reference Task 2.3).
- Install Test Leads by Exothermic Welding Methods (reference Task 2.4).
- Measure Structure-to-Soil Potentials (reference Task 1.1).

2.0 Knowledge Component

The purpose of this task is to test for electrical continuity between a structure and test station.

An individual performing this task must have knowledge of the following.

- Interpretation of structure-to-soil potential measurements taken at a test station [which may not meet expected results (lower than anticipated, unstable, or erratic) and may be indicative of a broken test lead].
- Multimeters (which are used to measure resistance between a structure and a test lead wire to determine if continuity exists).

Terms applicable to this task are as follows.

This section intentionally left blank.

AOCs associated with the performance of this task include the following.

AOC Recognition	AOC Reaction
Improper or loose wire connection.	Implement mitigation measures per operator's procedures.
Damaged or malfunctioning reference electrode.	Replace reference electrode.

3.0 Skill Component

To demonstrate proficiency of this task, an individual must perform the following steps.

Step	Action	Explanation
1	Identify the test lead to be tested.	This step is to confirm that measurements are taken on the intended test lead.
2	Select the proper instrumentation (multimeter, reference electrodes, etc.) to be used and verify the proper operation.	Incorrect or faulty equipment will not provide accurate results.
3	Connect the multimeter and/or reference cell.	Improper connection of equipment will lead to inaccurate potential measurements.
4	Measure the structure-to-soil potential and/or continuity.	This step determines the potential and/or continuity of the structure and test lead. A potential may be compared with historical data to determine continuity. If test lead wire, test points, and/or test stations are damaged, missing, or loose, implement mitigation measures per operator's procedures.
5	Record all required information per operator's procedures.	Up-to-date records are essential for maintaining a corrosion control system.

Task 2.2—Repair Damaged Test Lead

1.0 Task Description

This task consists of the repair or replacement of test leads connected to a structure.

The task begins when test lead damage has been identified. The task ends when repair or replacement has been completed.

The performance of this covered task may require the performance of other covered tasks such as the following.

- Measure Structure-to-Soil Potentials (reference Task 1.1).
- Verify Test Lead Continuity (reference Task 2.1).
- Install Test Leads by Non-exothermic Welding Methods (reference Task 2.3).
- Install Test Leads by Exothermic Welding Methods (reference Task 2.4).

2.0 Knowledge Component

The purpose of this task is to repair or replace leads that do not exhibit continuity.

An individual performing this task must have knowledge of the following.

- Measurement of a pipe-to-soil potential taken at a test station that does not meet expected results (lower than anticipated, unstable, or erratic) may be indicative of a damaged test lead.

Terms applicable to this task are as follows.

test lead

A connection to the structure being tested, usually a wire in a supporting stand or test station, with an easy connection point for structure-to-soil measurements.

AOCs associated with the performance of this task include the following.

AOC Recognition	AOC Reaction
<i>This section intentionally left blank.</i>	<i>This section intentionally left blank.</i>

3.0 Skill Component

To demonstrate proficiency of this task, an individual must perform the following steps.

Step	Action	Explanation
1	Identify test lead damage. Perform a visual inspection of the aboveground wire and components. If the test station is intact, continuity must be verified.	The test lead connection may be loose, corroded, or disconnected; the wire may be broken; or the test station may be damaged or moved.
2	Can the test lead damage be repaired?	Repair that can be made in the test station or in the immediate area may not require excavation of the pipeline.
	Yes—Continue with Step 3. No—Continue with Step 4.	
3	Repair the test lead damage. This repair may require reconnecting the lead to the test station or faceplate by stripping the insulation and reconnecting.	This step corrects the damage if it can be repaired above ground or in the immediate area of test station.
4	Replace the test lead by connecting a new lead to the structure by exothermic weld or non-exothermic connection.	If a structure appurtenance is not available, excavation is necessary to expose the pipe. The lead should be routed loosely to relieve soil stress during backfill and then connected to the test station or termination point.
5	Verify that the test leads function properly and are no longer damaged.	Checking the test lead repair is done by taking a structure-to-soil potential and/or by verifying continuity.
6	Document actions and readings according to operator's procedures.	Proper documentation is critical to future analysis and identification of problem areas.

Task 2.3—Install Test Leads by Non-exothermic Welding Methods

1.0 Task Description

This task consists of making an electrical connection by mechanical means that may include magnetic coupling, conductive epoxy, clamp, and/or split bolt connectors.

The task begins after the test point is properly located. The task ends when the installation is documented.

The performance of this covered task may require the performance of other covered tasks such as the following.

- Verify Test Lead Continuity (reference Task 2.1).
- Prepare Surface for Coating Using Hand and Power Tools (reference Task 7.2).
- Apply Coating Using Hand Application Methods (reference Task 7.5).

2.0 Knowledge Component

The purpose of this task is to install test leads on a structure by methods other than exothermic welding.

An individual performing this task must have knowledge of the following.

- Proper connection preparations such as cleaning metallic surfaces and/or connecting wires.
- Proper size clamps or split bolt connectors for a given wire size.
- Manufacturer's specifications (if using a conductive epoxy).
- Manufacturer's recommended safety procedures.

Terms applicable to this task are as follows.

This section intentionally left blank.

AOCs associated with the performance of this task include the following.

AOC Recognition	AOC Reaction
<i>This section intentionally left blank.</i>	

3.0 Skill Component

To demonstrate proficiency of this task, an individual must perform the following steps.

Step	Action	Explanation
1	Identify the location where the test lead will be installed.	This step confirms that work is done on the intended pipeline or pipe component.
2	Determine the size of wire to be used.	The normal gauge of a general test wire is per operator specifications. If the test station is to be used for an interference bond between two facilities, the wire gauge will be greater to eliminate any unwanted wire resistance.
3	Determine the method to attach the wire to the pipeline or facility.	The actual method used will be based on the existing structure.
4	Prepare the pipe surface for wire installation according to manufacturer or operator's specifications.	If foreign materials are not removed, they could cause a failure to bond reducing or eliminating electrical continuity.
5	Install the wires to the structure using magnetic connection, epoxy adhesive or clamp method verifying metal to metal continuity.	The actual connection is dependent on operator requirements and the test lead location.
6	Document installation as required by the operator's procedures.	