

Pipeline Construction Inspection

API RECOMMENDED PRACTICE 1169
SECOND EDITION, MARCH 2020



AMERICAN PETROLEUM INSTITUTE

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Pipeline Construction Inspection

1 Scope

This recommended practice covers the basic requirements and their associated references needed to perform inspection activities safely and effectively during onshore pipeline construction. This recommended practice provides the details related to the role of the operator's pipeline construction inspector ("Inspector"), in terms of monitoring and inspection requirements throughout the lifecycle of the pipeline construction process. This document is written to address general inspection duties. Areas of specialty inspection are noted and are beyond the scope of this document (in-line inspection and anomaly evaluation are not included in this document's scope). This includes basic knowledge of, and where to find, detailed information related to each facet of pipeline construction inspection activities.

The scope of this document is limited to gas and liquid pipeline construction. Specifically, content is focused on those items that are relevant to the role of an Inspector as it relates to best practices within the industry in the United States and Canada. This document provides Inspectors with background and context, beyond existing regulation, regarding best practices in the industry. Whereas the content is organized in a manner consistent with construction of new facilities, where relevant, the content can also be applied to construction associated with existing facilities (e.g. maintenance-related activities).

Users of this document include pipeline Owner Companies and those individuals either engaged in pipeline construction inspection or seeking to become certified inspectors. Pipeline Owner Companies and pipeline inspection service companies may also use this document to develop their inspection processes and responsibilities for inspectors, as well as to develop and enhance their inspector training programs.

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 Standard 1104, *Welding of Pipelines and Related Facilities*

CGA ¹, *Best Practices*

3 Terms, Definitions, and Abbreviations

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

3.1 Terms and Definitions

3.1.1

activity quality plan

AQP

Document(s) that establishes procedures, minimum personnel qualifications, roles and responsibilities, inspection methods, and record requirements of construction activities. The intent of an activity quality plan (AQP) is to identify quality concerns and methods of control.

¹ Common Ground Alliance, 908 King Street, Suite 330, Alexandria, VA 22314, <https://commongroundalliance.com>.

3.1.2**chainage****station numbers**

An imaginary line used to measure distance along the centerline of a pipeline and to identify the location of objects such as fences, roads, ditches, utility crossings, etc.

3.1.3**confined space**

Any tank or space that meets all three of the following requirements:

- is large enough and so configured that an employee can bodily enter and perform assigned work;
- has limited or restricted means for entry or exit;

NOTE Examples of spaces that may have limited means of entry or exit are tanks and vessels, storage bins, hoppers, and vaults.

- is not designed for or meant to be continuously occupied by employees.

3.1.4**contractor**

An entity that includes the primary organization and any subcontractors engaged in pipeline construction covered by this recommended practice.

3.1.5**corrective action**

The action to eliminate the cause(s) of a nonconformance and prevent recurrence.

3.1.6**ditch plug**

Earth fill placed within a pipeline trench to block the flow of water or allow access or crossing.

3.1.7**exclusion zone**

Area where access is controlled due to increased hazard.

3.1.8**heritage sites**

Locations of historic or cultural significance as identified by the Operator.

3.1.9**holiday**

A discontinuity in a protective coating that exposes unprotected surface to the environment.

3.1.10**inspection and test plan****ITP**

Written description of an inspection plan that may include evaluation methods, hold points, project-specific technical requirements, and resources, typically used in manufacturing.

3.1.11**inspector**

An individual qualified to monitor, assess, evaluate, verify, discuss, decide, resolve, report, and document pipeline construction activities to establish that the requirements of the design, drawings, specifications, regulations, and industry practices are being met safely, efficiently, and in an environmentally sound manner.

NOTE There are numerous types of inspectors, such as utility, coating, welding, and chief inspectors with employment arrangements including Operator employees, inspection service company-supplied inspectors, or freelance contract inspectors (see annexes for details on other inspector classifications).

3.1.12**material test report****MTR**

Documentation of a metal product's physical and chemical properties to indicate compliance with standards as a means of quality assurance.

3.1.13**nonconformance**

A recurring deficiency or major deviation from regulation or Operator specification such that safety, environment, structural integrity, cost, or schedule could be impacted.

3.1.14**One Call**

A system set up to establish a line of communication (e.g. typically a centralized phone system) between all parties that may be affected by any type of excavation and those who operate underground facilities to reduce injury and damage as a result of unauthorized excavations.

NOTE Refer to equivalent systems for areas outside the United States and Canada.

3.1.15**operator**

Organization that owns and/or operates a pipeline.

3.1.16**permit-required confined space**

A confined space that has all three of the confined space requirements and has one or more of the following four characteristics:

- contains or has the potential to contain a hazardous atmosphere;
- contains a material with the potential to engulf an entrant;
- has an internal configuration such that an entrant could become trapped or asphyxiated by inwardly converging walls or by bottoms that slope downward, tapering to smaller cross-sections;
- contains any other recognized serious safety or health hazard.

3.1.17**quality**

The degree to which requirements are fulfilled by an object's inherent characteristics.

3.1.18**quality assurance****QA**

Proactive, process-oriented activities, independent of production, with the goal of preventing nonconformances, including checklists and standards implementation.

3.1.19
quality control
QC

Reactive, product-oriented activities with the goal of identifying nonconformances before work is finalized. Examples of QC activities include inspection and testing.

3.1.20
quality management system
QMS

A framework of policies, processes, and procedures used by an organization to fulfill the requirements for quality.

3.1.21
right-of-way
ROW

The property in which a pipeline company and a landowner both have a legal interest, usually established through a written document known as an easement.

3.1.22
safety culture

The collective set of attitudes, values, norms, beliefs, and practices that a pipeline operator's employees and contractor personnel share with respect to risk and safety.

3.1.23
strength test

A test is used to establish the operating pressure limit of a pipeline segment. Typically, the test pressure ratio is 1.25 and the duration is 4 hours or longer, but these values may differ depending on applicable codes and/or regulations.

3.1.24
test bus

A mobile bus or trailer that is used to maintain equipment and examinations for hydrostatic testing.

3.1.25
tolerance zone

The space in which a line or facility is located and where construction activities are limited or prohibited.

NOTE Jurisdictions often define tolerance zones.

3.2 Abbreviations

ALARA	as low as reasonably achievable
AQP	activity quality plan
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act
CFR	<i>Code of Federal Regulations</i>
FWPCA	Federal Water Pollution Control Act, also known as the Clean Water Act
HAZCOM	hazard communication
HAZMAT	hazardous material
HDD	horizontal directional drilling

HVAC	high-voltage alternating current
GIS	geographic information system
GPS	global positioning system
IDLH	immediately dangerous to life and health
ITP	inspection and test plan
JSA	job safety analysis
LEL	lower explosive limit
LFL	lower flammable limit
LPG	liquefied petroleum gas
LOTO	lockout/tagout
MAOP	maximum allowable operating pressure
MARSEC	Maritime Security
MAWP	maximum allowable working pressure
MOC	management of change
MTR	mill test report
NDE	nondestructive examination
NDT	nondestructive testing
NORM	naturally occurring radioactive material
NPDES	National Pollutant Discharge Elimination System
OPP	over pressure protection
OQ	operator qualification
OSHA	Occupational Safety and Health Administration
PE	professional engineer
PEL	permissible exposure limit
PPE	personal protective equipment
QA	quality assurance
QC	quality control
QMS	quality management system
RCRA	Resource Conservation and Recovery Act
ROW	right-of-way

SCBA	self-contained breathing apparatus
SDS	safety data sheet
SWP3	stormwater pollution prevention plan
TWIC	Transportation Worker Identification Credential
TWS	temporary workspace

4 Pipeline Construction Inspector—Foundational Information

4.1 General

The items covered in this section are those that are relevant through all phases of the pipeline construction process. Any specific content in other sections of this publication is intended to be used in conjunction with the information provided within this section. Beyond the foundational information, material in Annex A is aligned to the typical construction process as shown in Figure 1.

The Inspector acts as the Operator's authorized representative, observes the Contractor's progress, and monitors all activities in their assigned areas in accordance with codes and standards; regulatory requirements; Operator safety and environmental requirements, drawings, plans, and specifications; and the terms of the construction contract or agreement. An Inspector may also be asked to assist other specialized Inspectors (e.g. Welding Inspector), as directed.

In addition to executing specific responsibilities in the following sections, the Inspector has key responsibilities in the main areas identified in Table 1 with additional detail provided in the corresponding section.

Table 1—Main Areas of Inspector Roles and Responsibilities

Topic Area	Section Number
Authority	4.2
Code of conduct	4.3
Worker, site, and construction safety	4.4
Quality, deficiencies, and nonconformance procedures	4.5
Environmental considerations	4.6
Execution of work	4.7
Administration of contractual obligations	4.8
Records management	4.9
Personnel qualifications and certifications	4.10
Equipment calibration	4.11
Incident reporting	4.12

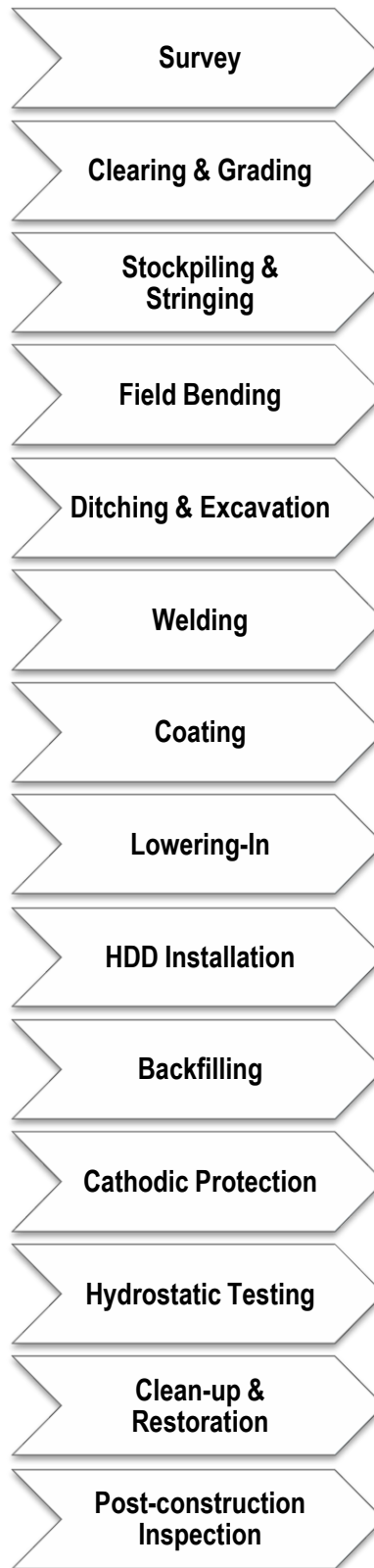


Figure 1—Typical Pipeline Construction Phases

4.2 Authority

4.2.1 General

The Inspector onsite is part of a larger project team; the Inspector should understand their role within the established chain of command and recognize situations that may need to be escalated. This is important for inspection activities and becomes particularly important in the handling of deficiencies/nonconformances discussed later in this section. In particular:

- Roles of the Contractor and Inspector should be established before performing the tests or measurements to determine whether the work or an item complies with specifications and permit requirements.
- The Inspector should be clear about the level of witnessing required and make sure that the equipment and instruments used by the Contractor are correct and properly calibrated.
- The Operator should make the Contractor aware of the Inspector's duties and authority (as defined in 4.2) outlining quality, deficiencies, and nonconformance procedures.

4.2.2 Authority to Stop Work

Inspectors are empowered and expected to shut down any work based on, but not limited to, conditions, situations, or activities that have occurred, are occurring, or may occur that could result in:

- imminent danger to any person;
- imminent danger to property or the environment;
- substandard quality or work techniques that do not meet Operator specifications;
- unanticipated discovery of environmental, cultural, or historical items.

4.3 Code of Conduct

As the Inspector represents the Operator, they should always act ethically, professionally, objectively, consistently, and honestly when performing the required roles and responsibilities. Owner Companies should inform Inspectors of their policies regarding ethics and behavior and understand the consequences of taking part in any activity that would not withstand the scrutiny of Operator management or other observers due to the appearance of the activity. These activities include offers of gifts, entertainment, trips, excursions, etc., offered by contractors, vendors, or suppliers.

The ethical conduct required from Inspectors is governed by the Operator's Code of Conduct, which can include (but is not limited to) the items identified in Table 2.

Table 2—Typical Code of Conduct Considerations

✓	Description
Behaving in an Ethical Manner	
	— Abide by confidentiality agreements (i.e. all information, data, and knowledge of the affairs of the Operator acquired during the performance of work shall be kept confidential and shall not be disclosed to third parties, including social media, without prior written consent from the Operator)
	— Avoid and disclose potential conflicts of interest to employers and clients, such as familial, business, and personal relationships
	— Not accepting gratuities of any kind that may be perceived to affect judgment in the work being performed as an Inspector; if gratuities are offered, this information should be reported to the Operator
	— Endeavor to be fair, reasonable, and objective toward performing work requirements always
	— Do not make assumptions; consult with the Operator if there are uncertainties in the requirements
	— Accept or reject the work performed by the Contractor based on the quality of the work
	— Comply with all relevant codes, standards, systems, permits, contracts, agreements, specifications, procedures, approved drawings, and line lists
	— Document all deviations and when required, escalate in an appropriate manner for approval
	— Notify employer as well as the appropriate operator resource of any ethical concerns and cooperate with investigations and resolution processes
	— Perform duties only within your job scope as directed by the Operator
Professional Approach to Work	
	— Be knowledgeable of the relevant parts of the construction process
	— Be knowledgeable of Operator's standards and specifications
	— Be knowledgeable of relevant industry and government standards
	— Confirm that all applicable permits required to execute the work are in place and onsite prior to commencing the work
	— Uphold Operator's industry practices regarding safety to minimize risk and avoid hazards in the workplace
	— Comply with Operator's construction timelines and be knowledgeable of Operator's construction schedule, costs, and components of the work
	— Engage other stakeholders in the construction process, as required
	— Make accurate decisions by being well informed and familiar with all contract documents and design requirements
	— Arrive onsite before the Contractor's crew and remain until after the crew leaves the site for the day, if appropriate
	— Take breaks when the Contractor's crew takes breaks and remain onsite during construction activities that require inspection
	— Obtain current version of all applicable documents before start of inspection
	— If questions arise that cannot be answered, seek those that have the authority to resolve
	— For conflicts needing resolution, communicate with appropriate operator representative
	— Be proactive in problem solving and raise issues/concerns to the attention of the Operator
	— Inspectors are not to perform contractor construction tasks
Positive Image in Representation of Operator	
	— Behave in a courteous and professional manner to all stakeholders
	— Conduct oneself in a respectable manner during off-time hours
	— Show respect through good driving habits on the right-of-way (ROW) or public roads
	— Check the work area for good housekeeping and tidiness (e.g. equipment and consumables should be correctly handled, stored, and maintained)

4.4 Worker, Site, and Construction Safety

4.4.1 General

One of the key roles of the Inspector is to assist the Operator in ensuring a safe work environment both for its workers as well as the public. The topics in this section should be used to establish the Inspector's knowledge and awareness of hazards inherent to pipeline construction, as well as the safety regulations, industry practices, and responses needed to address these hazards. Inspectors and all personnel are responsible for their personal safety and share responsibility for those personnel around them. Attentiveness, caution, and hazard awareness should be a continuous and integral part of each Inspector's behavior. All onsite Inspectors have "stop work" authority per 4.2.2.

In addition to safety items detailed in the following sections, the Inspector should keep in mind the overall safety culture (see "safety culture" definition in 3.1.22) as well as the items identified in Table 3.

Table 3—Typical Safety Considerations

✓	Description
General	
	Confirm roles and responsibilities with respect to safety in the execution of the work for each member of the activity crew
	Actively participate in safety meetings
	Confirm and actively participate in safety meetings prior to commencing sensitive work (e.g. tie-ins, excavations requiring shoring, line evacuation, hot cuts)
	Be aware of changes in work activities or site conditions that were not identified in the daily tailgate meeting or job safety analysis (JSA) along with any changes to precautions that need to be taken as a result of these changes
	Promote a safe working environment of continuous improvement through communications of project issues and solutions
	Confirm that any required emergency medical services are in place
	Inspect and monitor safety practices and monitor conformance to project Health and Safety standards and plans
	Monitor for compliance to safety regulations
	Monitor for compliance to manufacturer's requirements (e.g. for specific work activities and materials used), where applicable
	Confirm that emergency/after-hours contact information is posted in site offices and provided to active Contractors
	Monitor for compliance to personal protective equipment (PPE) requirements
	Confirm that "safety zones" (i.e. fenced or otherwise marked areas based on the specifics of the project) are in place and maintained at known hazardous locations
	Confirm that site personnel have access to key safety documents such as safety data sheets (SDS), emergency procedures, and first aid procedures
	Be aware of any hazardous materials (HAZMAT) and associated SDS, including location, handling, and additional requirements (e.g. Emergency and First Aid procedures)
	Be aware of, and identify, any specific and necessary precautions for new and/or short-service employees
Safety Audits	
	Participate in Project Site-Specific Safety Audits, as required
	Communicate project Safety Site Audit results and Corrective Action Plans, as applicable

In support of a safe work environment, the Operator's safety policies typically include (but are not limited to) those identified in Table 4.

Table 4—List of Typical Operator Safety Policies/Practices/Procedures

✓	Description
	H ₂ S Safety
	Working Alone Policy
	Fall Protection Practice
	Restricted Work Areas Policy
	Confined Space Entry Practice
	Hearing Conservation Practice
	Manual Lifting and Carrying Practice
	Lockout/tagout (LOTO) Procedure
	Vehicle and Equipment Safety Practice
	Drug and Alcohol Policy
	Job Safety Analysis (JSA)
	Short-service Employee Policy
	Fatigue Management Plan
	Incident Reporting Policy, including for Near Misses
	Other Operator- or project-specific requirements, as applicable

4.4.2 Job Safety Analysis

4.4.2.1 General

Job safety analysis (JSA) shall be conducted per Operator and Contractor requirements, and inspectors shall participate. This analysis determines potential hazards and the plans and mitigative measures needed to address these hazards. Pipeline Operator documents supplement these safety awareness concepts.

The practice of analyzing and planning hazardous jobs, use of written procedures or permits, job review and discussion among key personnel, and walk-through inspections make personnel aware of potential hazards and the precautions needed to address them.

A new JSA should be conducted if conditions change, additional hazards are identified, or there is a change to the project scope.

NOTE Alternative terms for similar concepts include "authority to work" and "job hazard analysis."

4.4.2.2 Hazard Recognition

Inspectors should evaluate the following areas to avoid incidents and raise awareness of hazards.

- a) Job site—Job site incidents, including, but not limited to, slips, trips and falls, pinch points, elevated work surfaces, planned lifts, atmospheric conditions, etc.
- b) Environmental—Changing environmental conditions, such as flooding, wind, dust, fires, and other potential conditions that could affect personnel and their work performance.
- c) Site-specific hazards—Physical features, such as terrain, waterway crossings, utilities (including overhead powerlines), general ROW conditions, and other features the pipeline construction activities will encounter as they traverse the selected route.
- d) Climatic and other work condition hazards—The impact of adverse conditions, such as extremely hot weather (which could cause heat exhaustion and heat stroke) and cold weather (frostbite, hypothermia, encumbrance from extra clothing, etc.) on personnel.
- e) Materials and material handling—Materials, including, but not limited to, their use, movement, and handling within the job site to consider adverse exposure and potential handling incidents. This may include, but not be limited to, pipe, valves, fittings, equipment, and hazardous materials (HAZMAT). Use of safety data sheets (SDS) should be included along with hazard communication (HAZCOM) principles to inform workers of potential hazards and protective measures to be followed. Also, be aware of HAZMAT exposed during work activities.
- f) Work task review—An overall review of all major tasks to be performed since most construction activities involve moving equipment and lifting and carrying heavy loads in the proximity of personnel, trenches, holes, welding, metal sparks, and other hazardous activities.
- g) Emergency conditions—Preparation for response to safety-related incidents. Inspectors should be familiar with the emergency response plan, including, but not limited to, emergency phone numbers and locations of response equipment, such as water, fire extinguishers, first aid supplies, etc.

4.4.2.3 Contractor Requirements

Inspectors should be familiar with the contract provisions regarding contractor(s) and their safety procedures and Operator expectations. The Contractor should be monitored for adherence to their internal requirements, as well as project-specific requirements.

4.4.3 Loss Prevention

Inspectors should have a basic knowledge of general loss prevention systems and may require additional training in Operator-specific processes. Inspectors should be familiar with these systems, which are designed to aid in observation, analysis, and reporting of occurrences or actions that could harm or damage property, equipment, or materials.

4.4.4 Occupational Safety

4.4.4.1 Safety Meetings

Inspectors should be capable of organizing and conducting safety meetings, prior to beginning work, to cover such topics as potential hazards likely to be encountered, precautions necessary to lessen their threat, use of personal protective equipment (PPE), lessons learned, near misses, and other topics relevant to the safety of workers, the general public, the inspection team, and potential property damage.

Inspectors should actively participate in all levels of safety planning in which they are engaged. Inspectors should actively participate in all safety meetings.

4.4.4.2 Personal Protective Equipment

JSA identify hazards that necessitate the use of PPE. PPE for a particular location or activity is identified for the project by the Operator, Contractor, and/or regulatory requirements (i.e. the more stringent of the requirements). PPE is to be worn by all individuals (e.g. company personnel, contractor employees, agency personnel, visitors) during and near all construction-related activities.

Inspectors should be knowledgeable about PPE requirements, uses, and limitations. PPE for pipeline construction activities includes, but is not limited to, approved equipment detailed in Table 5 and is project specific based on the anticipated hazards (i.e. JSA per 4.4.2). Inspectors are expected to intervene when personnel are not wearing appropriate PPE as identified in Table 5.

Table 5—Typical Examples of Personal Protective Equipment

✓	Description
Eye Protection	
	Safety glasses
	Safety glasses with rigid side shields, goggles, face shields, and welding goggles and hoods
Head Protection	
	Approved hard hats (generally required when injury could occur from impact or electrical shock; normally worn always)
Foot Protection	
	Boots or shoes of leather or leather-type construction that cover the entire foot along with safety toes (normally worn always)
Hand Protection	
	Approved gloves (task dependent)
Hearing Protection (based on noise level survey)	
	Ear plugs
	Ear covers with suitable noise reduction factors
Safety Apparel	
	Long pants and shirts with sleeves extending over the shoulders
	High visibility vest or other outer most high visibility clothing
	Fire retardant clothing
	Chemical resistant suits
	Leather for metal spark protection
Respiratory Protection (may require specific training)	
	Dust masks
	Air-purifying respirators
	Air-supplied respirators
	Self-contained breathing apparatus (SCBA) respirators
	Personal gas monitors

Certain situations that require specialized PPE beyond the typical items listed in Table 5 include:

- confined space entry (refer to 4.4.5.7);
- working over water (e.g. life jacket, buoyancy device, safety net);
- elevated conditions (e.g. fall protection system).

4.4.4.3 Vehicle Operation

Inspectors operate various types of vehicles off and on the pipeline ROW, including vehicles that may be company owned, rented/leased, or personal vehicles. Inspectors should be aware of Operator policies and procedures governing the use of vehicles and be licensed appropriately. Inspectors should be able to identify vehicles that may not be suitable for operation and are driven with due care and attention and according to the conditions of the road and weather.

4.4.4.4 Fatigue and Fitness for Duty

Inspectors should be able to recognize when personnel appear either physically or mentally unfit to perform work and other activities associated with work, including driving. Operators should communicate fatigue management plans with inspectors and contractors so that all personnel are operating at full capacity.

4.4.4.5 Near Misses

Inspectors should be familiar with near-miss programs, which formalize observation, analysis, reporting, and communication of occurrences that had the potential to, but did not, lead to injury or damage. These programs can improve awareness and avoid future reoccurrences. Near misses should be discussed and communicated with relevant personnel and documented per the Operator's and contractor's policies.

4.4.5 Site and Construction Safety

4.4.5.1 One Call

One Call is an excavation notification system set up to coordinate excavators' activities with utility Owner Companies to prevent damage to underground facilities. Inspectors should be knowledgeable of these systems and know the appropriate One Call contact information for the area of pipeline construction activity. Inspectors should confirm that the contractor has the current One Call ticket number and has cleared or marked the area with the pipeline and utilities.

NOTE One Call applies only in the United States and Canada.

4.4.5.2 Site Security

Inspectors should have knowledge of the measures needed for public and worker safety as well as safeguards for equipment, property, and materials such as the following:

- procedures for site security and other safekeeping procedures, including use of surveillance and monitoring devices, security personnel, barriers, locking devices/systems, fencing, and other methods to deny access to materials, supplies, and equipment;
- traffic control, barrier, and marking procedures;
- familiarity with and requirements for Transportation Worker Identification Credential (TWIC) and Maritime Security (MARSEC); this is only necessary when working in facilities covered by these requirements; Owner Companies should provide training on the pertinent requirements;
- inspectors are responsible for recognizing and reporting security concerns to the operator, including but not limited to:

- 1) terrorist threats;
- 2) threats of sabotage;
- 3) threats of violence, including workplace violence;
- 4) labor disruptions, protests, or work stoppages.

4.4.5.3 Isolation of Hazardous Energy Sources

Inspectors should be aware of when and how electrical, mechanical equipment, or pressure in the system is de-energized and isolated to prevent unexpected start-up or release of stored energy that may cause a hazard. This should include systems requiring lockout/tagout (LOTO) or Operator equivalent practices for electrical hazards.

LOTO processes are also in place for equipment owners (e.g. contractors) working on heavy equipment. Regardless of the specific equipment, the fundamental principle of LOTO processes is to confirm that all individuals involved with a piece of equipment install a lock on the system. This lock is only removed by the individual responsible for installing the lock once their scope of work is complete. This provides an inherently safe system in that the system is not energized or put into service until all work is complete.

4.4.5.4 Safe Use of Tools

Inspectors should monitor the following for both safety and job efficiency purposes.

Pipeline construction requires many kinds of tools, from hand tools to various power tools (electric and pneumatic), and numerous hazards exist.

Key factors for avoiding these hazards include:

- use of the right tool for the job;
- use of tools in good condition;
- correct use of the tool;
- use of safety features such as guards and welding hoods;
- proper use of PPE by personnel as per 4.4.4.2.

4.4.5.5 Safe Use of Equipment

Inspectors should monitor the condition and operation of work equipment. Work equipment from large trucks and tracked dozers/side booms to trenching equipment and other machinery may be used from one end of the job site (spread) to the other.

Safety considerations include:

- employee qualification by training or experience to operate equipment or machinery;
- personnel actions and ability to smoothly and properly operate the assigned machine (i.e. an indication of the level of training, operating proficiency, awareness of surroundings, and ability to follow hand signals and safety rules);
- equipment condition, maintenance level, and protective equipment in place;
- a complete safety inspection is required prior to operating equipment/machinery;
- correct equipment and operation for the job (e.g. lifting capacity, boom positions, stabilizer use, load limitations).

4.4.5.6 Movement, Storage, and Inspection of Tools, Equipment, and Materials

It is a contractor's responsibility to inspect and maintain their equipment. Inspectors should be aware and observant of the movement, storage, condition, and inspection of tools, equipment, and materials being used in pipeline construction work, even though these materials may be owned and used by the construction contractor.

4.4.5.7 Confined Space Entry Requirements

Inspectors should be familiar with the confined space requirements for pipeline construction. A confined space is a space that can be bodily entered by an individual but is not designed for continuous occupancy and has a limited and restricted means of entrance or egress.

Inspectors should be aware of specific Operator or Contractor requirements for permits and plans related to confined space entry prior to commencing work. The Contractor should establish a plan for confined space entry (e.g. isolation of energy sources, required signage, means of access/egress), which is submitted to the Operator for review and, in some cases, approval for use on the project. Inspectors should participate in confined space safety planning and meetings.

Inspectors should also be aware that areas may contain an atmosphere that is hazardous (toxic, explosive, oxygen deficient, or otherwise harmful to personnel). Inspectors should be aware that permits are required for confined space entry when either a hazardous atmosphere exists, it contains material where an occupant could be engulfed, or is configured where an occupant could be trapped. Permit requirements for confined spaces are determined based on life critical safe work conditions.

Inspectors should confirm that a plan is in place to undertake a rescue from a confined space. This includes the required equipment, administration of first aid, and how to get medical treatment from a competent individual, if needed.

4.4.5.8 Atmospheric Testing

Inspectors should be knowledgeable about conditions that may require atmospheric testing. Atmospheric testing, particularly in cases involving confined spaces, hot work, and work in hazardous areas, is required to evaluate the hazards of a workspace. A hazardous atmosphere means an atmosphere that may be immediately dangerous to life and health (IDLH) or exceeds permissible exposure limits (PELs). Inspectors should also be aware of the time-weighted average exposure breathing hazards. Conditions that may require testing are included in Table 6.

Table 6—Potential Conditions for Atmospheric Testing

✓	Description
	Flammable gas, vapor, mist, or dust in excess of lower flammable limit (LFL)
	Hydrocarbon gas in excess of permissible lower explosive limit (LEL)
	Oxygen deficient/excess environments where oxygen levels are immediately dangerous to life and health (IDLH)
	Other atmospheric conditions or concentrations of toxic contaminants that may be IDLH, such as H ₂ S and benzene

Where atmospheric testing is relevant, Inspectors should be knowledgeable about the facets of atmospheric testing in Table 7.

Table 7—Facets of Atmospheric Testing

✓	Description
	Products and materials (e.g. HAZMAT) being used on the job site that could be exposed during work activities and create hazards to personnel safety
	Physical properties of toxins (e.g. lighter/heavier than air) and permissible exposure limits (PELs), including use of safety data sheets (SDS) information
	Measurement and monitoring techniques
	Use of testing equipment and procedures to calibrate this equipment, including calibration frequency and verification
	Precautionary measures to be taken (i.e. considering the findings from testing and monitoring) both prior to entry into, or work within, a hazardous atmosphere

4.4.5.9 Hot Work

Hot work is any task where the potential for a fire hazard is heightened (i.e. the presence of an ignition source as well as readily combustible material), requiring a permit prior to performing the work. Examples of hot work include, but are not limited to, welding, grinding, torch heating, and oxyacetylene cutting. Inspectors should be aware of permit requirements as well as potential mitigation measures associated with hot work.

4.4.5.10 Fall Prevention and Protective Systems

Pipeline construction work sites commonly have fall and tripping hazards primarily due to extensive excavations, rugged and varied terrain features, and the constant movement of the work. Inspectors should be aware of Operator requirements addressing these hazards.

Inspectors should observe, recognize, assess, and intervene based on:

- the nature and extent of fall hazards;
- fall protective systems such as barricades and guard rails, safety nets, fall prevention markers, limitations on access, and other protection systems in place (e.g. personal fall arrest systems) as well as construction personnel awareness of potential fall hazards;
- general housekeeping within the work area and adequacy of work site illumination to minimize fall and tripping hazards.

4.4.5.11 Scaffolding and Ladders

Scaffolding and ladders are occasionally used in pipeline construction. Inspectors should be familiar with scaffolding requirements, how it is to be used safely (e.g. scaffolds should be inspected before each shift), and proper erection, moving, dismantling, or alteration by competent/qualified scaffold erectors. Inspectors should be aware of Operator and Contractor requirements covering safe use of scaffolding.

Inspectors should be familiar with safe ladder use and ensure that the proper equipment is used for the work situation. Inspectors should be aware of Operator and Contractor requirements regarding safe use of ladders.

4.4.5.12 Protective Measures for Ionizing Radiation

Inspectors should be aware of valid certification and licensing requirements for nondestructive testing (NDT) personnel handling radioactive sources. Inspectors should also be aware of signage and safety monitoring rules and requirements, as well as the rules and regulations for the locality that they are working in.

Inspectors should be familiar with and inspect the NDT contractor's conformance with radiation exposure dosage limits, monitoring methods, precautions needed, and documentation of radiation exposure.

4.4.5.13 Protective Measures for Naturally Occurring Radioactive Material

Inspectors should be aware of Operator requirements for identification, monitoring, and mitigation of risk associated with a naturally occurring radioactive material (NORM). This includes awareness of radiation exposure dosage limits, monitoring methods, precautions needed (e.g. signage), and documentation of radiation exposure.

Typical controls that can be used as protective measures in the presence of NORM include:

- development of written NORM work plan (need for plan determined by hazard assessment, and approved work plan applies to work being performed where NORM is above the exemption limits);
- implementation of training (a NORM training program includes courses on NORM awareness, NORM surveying, and NORM radiation safety officer duties);
- use of engineering controls (preventing human exposure using equipment and systems, such as shielding from piping);
- minimizing exposure to be as low as reasonably achievable (ALARA) (e.g. limiting time spent near NORM, working at maximum possible distance);
- use of PPE.

4.4.5.14 Transportation, Use, and Storage of Flammable and Combustible Liquids

Inspectors should observe and confirm that contractors are complying with the requirements for the way flammable and combustible liquids are being used, moved, and handled, including use of approved storage.

- Flammable liquids—Liquids having a flashpoint below 100 °F (37.8 °C) are known as Class I liquids. The most common is gasoline.
- Combustible liquids—Liquids having a flashpoint at or above 100 °F (37.8 °C) and are known as Class II liquids. The most common are diesel fuel; Class III liquids include jet fuel and motor oil.

Inspectors should know how these liquids are used, transported, and stored, which requires ongoing observation and corrective action when safety is jeopardized. Additional areas of interest for Inspectors include fueling practices, condition of equipment, containers, signs, spillage, and grounding requirements (e.g. vehicles and equipment require ground straps when work is performed near power lines due to risk of static charge).

4.4.5.15 Transportation, Handling, Labeling, Storage, and Use of Compressed Gases

Inspectors should be aware of the proper use, movement, handling, and approved storage of pressurized gases.

Typical compressed gases used in pipeline construction include oxygen and acetylene for welding/cutting operations, nitrogen for purging, liquefied petroleum gas (LPG) for heating/drying, and compressed air for pneumatic tools, grit blasting, tire inflation, painting, etc. Inspector's knowledge of the properties of these gases aids in their safe handling, storage, and use.

All compressed gas cylinders and tanks should be properly secured and labeled when transported and stored with valve protective caps in place when cylinders are not in use. Cylinders, safety release devices, and piping should be regularly inspected to verify that the equipment and its appurtenances are in acceptable condition. For flammable compressed gas, vehicles and equipment require ground straps when work is performed near power lines due to risk of static charge.

Equipment used for nitrogen supplied from truck tanks (i.e. large cylinders) such as piping, connections, and appurtenances should be checked for compliance with design drawings and specifications, proper installation, and be periodically inspected and tested.

Compression equipment should be in serviceable condition for the service needed with operable safety devices in place. Hoses, piping, and connections should be checked for suitability for service and safe placement to prevent damage or rupture. Use of compressed air should follow established safety practices.

4.5 Quality, Deficiencies, and Nonconformance Procedures

4.5.1 General

The Inspector plays a critical role in managing the quality of work performed and materials used during pipeline construction. Work performed with an inspector present strengthens quality assurance (QA) and quality control (QC). The Inspector monitors adherence to the requirements as well as the critical elements of the Operator's Quality Management System (QMS). Items that are typically relevant to Quality Documentation for an Inspector are listed in Table 8.

Table 8—List of Typical Operator Quality Documentation

✓	Description
	QMS Manual
	Activity Quality Plan (AQP)
	Inspection and Test Plan (ITP)
	Orientation with approved and current Operator-specific requirements, processes, procedures, contract documents, and drawings relevant to their role

Any questions that may arise regarding quality and acceptability of work, materials furnished, and services provided are decided upon by the Inspector, inspection team, and/or Operator. As the Inspector identifies any deviations, Operator-specific escalation processes shall be followed.

4.5.2 Escalation Processes

Since the Inspector monitors pipeline construction activities and operations for safety, stewardship of the environment, as well as compliance to project specifications and pertinent regulations, the Operator may have an escalation process in place to deal with any identified deficiencies (an isolated deviation from requirements that does not impact safety, environment, structural integrity, cost, or schedule) that may require elevation to a nonconformance (a recurring deficiency or major deviation from regulation or Operator specification such that safety, environment, structural integrity, cost, or schedule could be impacted). Any identified nonconformance(s) shall be addressed.

Specific processes vary from Company to Company and Inspectors should familiarize themselves accordingly. Escalation processes are typically structured as follows:

- 1) stop work as per 4.2.2;
- 2) verbal discussion with third-party representative;
- 3) verbal warning with notification;
- 4) escalation of corrective actions.

Inspectors are required to reject work, materials, and services that do not meet the standards, contract terms, specifications, drawings, or other requirements of the project. Decisions by the Inspector, inspection team, and/or Operator regarding quality, acceptability, and materials provided are final and conclusive.

4.5.3 Personal Violations

The Inspector should observe and report individuals for personal violations. The typical examples of personal violations are included in, but not limited to, the items identified in Table 9.

Table 9—Examples of Personal Violations

Type	Description	Potential Consequence/ Outcome
Conduct	Not wearing appropriate PPE	Removal of worker from worksite
	Wearing incorrect attire (e.g. muscle shirts, shorts, or clothes made of synthetic fibres)	
	Using headphones for radio/MP3 devices while on duty	
	Roughhousing on the worksite	
	Not wearing seatbelts	
	Not respecting environment or historical resources	
	Being under the influence of drugs or alcohol	Permanent removal of worker from worksite
	Harassment in the workplace	
	Disregard for health, safety, and environmental procedures	
	Insubordination	
	Behaving in a manner that can cause serious harm or injury	
Worksite	Not having proper guards or shrouds	Stopping use of or removing the vehicle or equipment from the worksite
	Not maintaining “safety zones” (i.e. fenced or otherwise marked areas based on the specifics of the project) at hazardous locations	
	Nonfunctional backup alarms on tracked equipment and rubber-tired vehicles	
	Not having canopies for clear operator vision on machinery	
	Not having fire extinguishers or other required safety equipment	
	Using defective tools or inappropriate use of tools	
	Equipment leaking fluids	
	Any unsafe condition or practice, as determined by Operator or Inspection Resources	Construction shutdown
	Construction activities not compliant with applicable safety, contract, procedural, and regulatory requirements	

4.5.4 Regulatory Agency Inspections

Inspectors should follow pipeline Operator procedures in handling regulatory inspection of pipeline construction activities. These agencies have the authority to come on the job site to inspect activities and documents/records. Inspectors should be able to determine the agency involved, determine their objectives, verify credentials, and know the requirements set forth by the Operator on providing information and safe job site access to the agency conducting the inspection. All persons and visitors onsite are subject to the relevant safety and PPE requirements.

4.6 Environmental Considerations

4.6.1 General

The Operator views compliance with applicable environmental regulations as a priority and is committed to constructing project facilities in compliance with environmental permit requirements. The Operator is responsible for identifying environmental and pollution control requirements prior to initiating work activities and communicating these requirements to the Inspectors.

One individual may be assigned the role of Environmental Inspector; all parties share a responsibility for stewardship of the environment including, but not limited to, those items detailed in Table 10.

Table 10—List of Typical Environmental Activities

✓	Description
General	
	Inform and instruct all personnel of environmental concerns, special conditions, regulations, Operator specifications, and specific permit conditions applicable to the construction area and the work itself
	Maintain contact with the project lead/manager
	In case of unanticipated disturbance or damage caused by construction activities, contact the Operator and mitigate as soon as possible to restore affected areas to their original condition (to the extent possible) in a manner satisfactory to the Operator, Landowners, Land Holder, and regulatory authorities
	Report all environmental nonconformances and unexpected environmental findings (e.g. unexpected soil contamination) to the Operator
	Confirm Contractor's personnel conform to applicable environmental requirements
Air	
	Confirm that disturbance or damage to the environment is minimized (e.g. air pollution, noise pollution)
Water	
	Confirm that disturbance or damage to the environment is minimized
	Confirm that dewatering is performed in accordance with Operator procedures
	Confirm that equipment is not fueled or serviced within specified distances of water bodies
	Confirm that HAZMATs are stored away from specified distances of water bodies
	Confirm all specified vehicles have a minimum specified amount of commercial sorbent material to address spills on water
	Confirm that construction activities avoid interference with the normal flow of water in any natural or man-made watercourse (outside of permitted activities)
	Be aware of constraints to construction work due to water-based migratory species restrictions
	Be aware of procedures for handling encounters with water-based endangered species and/or their residences
	Visually monitor for water contamination (e.g. sheen appears on surface of a water body)
Land	
	Confirm that disturbance or damage to the environment is minimized (e.g. uncontrolled fires, soil erosion, habitat damage or loss)
	Confirm that construction entrances are maintained to prevent tracking mud and debris onto public roadways
	Confirm that all construction debris (e.g. rags, oil cans) and garbage are collected and disposed of to an approved facility off the ROW
	Observe for persons feeding or harassing livestock or wildlife; if observed, report incident immediately
	Report all wildlife deaths and nuisance animals
	Confirm that all specified vehicles have the required amount of commercial sorbent material to address spills on land
	Confirm that Fire Prevention and Firefighting Plans are updated, including details of monitoring, prevention, and response concerning: — ROW preparation — Manpower and equipment — Training of personnel — Emergency procedures
	Be aware of constraints to construction work due to land-based migratory species restrictions
	Be aware of procedures for handling encounters with land-based endangered species and/or their residences
	Confirm methods for establishing safety zones and associated mitigation (e.g. fences) address mechanisms for animals entering the construction area, where required
	Be aware of possible soil contamination (e.g. unusual discoloration or smell)
	Be aware that erosion control measures are installed properly and maintained

4.6.2 Permits

Operators are responsible for verifying that environmental permits have been granted prior to commencing work and transmitting permits to inspectors and contractors. Inspectors shall confirm that permit conditions are met.

Inspectors should be familiar with and knowledgeable of the types of permits applicable to the project and the governmental agencies overseeing these permits. Typical regulatory and jurisdictional permits issued or applied for by the Operator (in some cases some of these would be obtained by the Contractor) may include:

- Work Permits on Public Land;
- Work Permits on Private Land;
- Fenced Enclosure Permits;
- Encroachment Permits;
- Water Crossing Permits;
- Water Use Permits.

Inspectors should be knowledgeable of Operator procedures and expectations for inspections by responsible agencies, including determining the objective of the inspection, checking credentials, and knowing who should handle escorting the inspection personnel and answering their questions.

Inspectors should also be knowledgeable of permit documentation requirements and closeout procedures, including any deadlines.

4.6.3 Site-specific Concerns

Operators conduct examinations of the job location for potential environmental concerns, which can include issues of cultural importance, endangered species, and resource use. The results of these examinations are communicated to the Inspector and the Contractor.

Contract provisions generally highlight those statutes that were considered during the project planning phase. They may be incomplete, and Inspectors should use their judgment to determine the presence or potential of hazards that were not identified to them by the Operator.

4.6.4 Cultural and Heritage Concerns

Operators should communicate local cultural and heritage concerns to the Inspector. Inspectors should be familiar with procedures regarding cultural and heritage concerns and the appropriate course of action following their identification. Various regulatory guidelines seek to avoid, minimize, or mitigate adverse effects on historic sites or properties and often set out the archeological issues relating to economic development and the resultant construction activity. Inspectors should be familiar with Operator plans related to cultural and heritage artifacts. In the case of an unanticipated discovery, construction work may be paused per 4.2.2.

NOTE In many jurisdictions, a plan for unanticipated cultural resources and human remains is required during the permitting process.

4.6.5 Environmental Contamination

Operators should communicate environmental contamination concerns to the Inspector. Inspectors should be familiar with procedures regarding environmental contamination and the appropriate course of action following its identification.

Inspectors should strive to prevent environmental contamination. In the event of an incident, Inspectors should immediately report the incident to the Operator and be aware of Operator's mitigation procedures. Inspectors should have a basic awareness of how to identify contamination and who to contact in an event of an incident. Inspectors should:

- know the procedures to obtain samples, request analytical work, and recognize, handle, and monitor contaminated substances such as soil, pipe coating, fuels, solvents, and other waste and/or contaminants;
- confirm that waste generation and disposal activities related to the pipeline project are performed in accordance with Operator expectations as well as regulatory and permit requirements;
- check the plan of action for the remediation of suspected or actual contamination; Inspectors should have knowledge of who to contact and what response, if any, the Inspector may need to take in the event of an incident;
- monitor good housekeeping practices to collect and remove waste, including those classified as hazardous, from the work site at regular intervals.

4.6.6 Use of Natural Water Sources

Inspectors should be knowledgeable of the rules governing water withdrawal from and discharges to any natural water sources for water used on the ROW including for hydrostatic test medium.

- Inspectors should be knowledgeable of withdrawal and/or discharge/disposal requirements within permits and Operator procedures, including limitations on amounts of water used or discharged and the measurement of those quantities.
- Inspectors should be knowledgeable of discharge velocity, turbidity, and other restrictions, including, but not limited to, sediment and other foreign substances, control and planned treatment, filtration, or other methods needed to meet water quality provisions.
- Inspectors should be familiar with sampling methods, procedures, and protocols to comply with permit and/or regulatory provisions.

4.6.7 Erosion, Sediment, and Runoff Control on the Pipeline Right-of-Way

Inspectors should have knowledge of excavation work, earthmoving, clearing, and other similar activities associated with pipeline construction that have the potential to impact the environment. Inspectors should be observant of these activities to avoid incidents. Inspectors should be familiar with key practices that aid in safeguarding the environment:

- the installation, uses, and maintenance of erosion, sediment, and runoff controls, such as diversion devices, silt fences, and other equipment for control of surface water;
- familiarity with stormwater pollution prevention plans (SWP3), including federal and state plans (where construction is taking place);
- local revegetation requirements, water body bank restoration requirements, and pipeline Operator practices consistent with the needs of the ROW, landowners, and local practices should be reviewed by the inspection team.

4.6.8 Flora and Fauna Concerns

Operators should communicate flora and fauna of concern to the Inspector and Contractor. Inspectors should be familiar with procedures regarding the identification of flora and fauna of concern and the appropriate course of action following that identification.

4.6.9 Solid and Hazardous Waste Concerns

Operators should communicate solid and hazardous waste concerns to the Inspector and Contractor. Inspectors should be familiar with procedures regarding solid and hazardous waste concerns and the appropriate course of action following their identification.

4.6.10 Hazardous Materials

Inspectors should have a general understanding of the following:

- designation of HAZMAT;
- identification and listing of hazardous waste per local jurisdictional requirements;
- HAZMAT table, HAZCOM, and emergency response information.

4.7 Execution of Work

4.7.1 General

Monitoring work for conformance to Operator specifications is critical for meeting safety and environmental expectations. It is critical for ensuring quality of construction that is necessary for long-term safety, environmental, and cost-effectiveness of the pipeline asset.

Recommended practices relevant for each phase of construction are identified in the following sections in significant detail; additional activities that the Inspector may undertake include:

- disseminate and explain Operator specifications and project-specific documentation to other Inspectors (where required); it is key that the latest construction drawings and specifications are utilized;
- advance planning and organization of all construction activities, including inspection, survey, and radiographic duties; materials availability; tie-ins and service disruptions; and commissioning and start-up;
- maintain lines of communication with key stakeholders as appropriate, including, but not limited to:
 - 1) Construction Manager/Chief Inspector (or designate);
 - 2) Contractors and Subcontractors;
 - 3) Landowners;
 - 4) Land Agents;
 - 5) Third-Party Owner Representative (where applicable);
 - 6) Pipeline System Operations Personnel;
 - 7) Project Managers and Engineers;
- follow site-specific communications protocol as defined in the project.

4.7.2 Management of Change

Management of change (MOC) is a method of controlling risks (e.g. safety, health, environmental) associated with temporary or permanent changes to factors such as design, technology, materials, equipment, physical configuration/layouts, site conditions, procedures, personnel, or organizational structure. Inspectors should understand Operator MOC requirements, including documentation, approvals, and communication of changes, and why adherence to them can prevent incidents.

4.7.3 Media Relations

Inspection personnel do not interact with representatives of newspapers, TV, or other media seeking information, unless expressly allowed to do so by the Operator. Inquiries from the media should be received in an open, honest way but referred to project management, public relations staff, or others designated by the Operator to handle these situations.

4.8 Administration of Contractual Obligations

4.8.1 General

It is part of the Inspector's role to confirm that the Contractor is carrying out construction activities/operations according to contractual obligations. The Inspector's role in the administration of contractual obligations is summarized in Table 11, and may include the need to be knowledgeable of the types of agreements and contracts issued or applied for by the Operator as detailed in Table 12.

Table 11—Inspector Role in Administration of Contractual Agreements

✓	Description
	Maintain documentation, communicate progress, and provide schedule updates per Operator requirements
	Confirm that Operator agreements [e.g. Crossing (Encroachment) agreements, third-party utilities agreements, Landowner agreements], based on the line list, are executed
	Verify, approve, and forward Contractor work items and materials daily to the Operator's authorized representative
	Perform material take-off and ascertain status of all materials
	Obtain approval from the Operator's authorized representative or designee prior to commencing any extra work activities
	Confirm that only the most current revision of Issued for Construction drawings, approved contract documents, and specifications are referenced for construction
	Confirm that all proposed deviations from specifications, design changes, or material substitutions are discussed and approved by the Operator's authorized representative or designee prior to proceeding with the work
	Communicate lessons learned and foster an environment of continuous improvement, including participating in post-job review meetings

Table 12—Typical Agreements/Contracts Issued or Applied for by Operator

Type	Description
Agreements	Railroad Crossing Agreements—These agreements are needed to cross any operating or abandoned railroad tracks along the proposed pipeline route
	Pipeline Crossing Agreements—These agreements are needed to cross any existing operating or abandoned underground and aboveground pipelines along the proposed pipeline route
	Utility Crossing Agreements—Needed to cross any operating or abandoned underground utilities along the proposed pipeline route
	Power Line Crossing Agreements—Needed to cross any overhead power lines along the proposed pipeline route
	Road Use Agreements—Needed to use applicable public roads during construction to access pipeline construction sites
	Road Crossing Agreements—Required to construct pipeline under public or private roads during construction along the proposed pipeline route
	Land Use Agreement—Land use type of agreements, which may include provisions for: — Pipeline Lease Agreement — Pipeline Installation Lease Agreement — Pipe Stockpile Site — Camp Site — Approved Working Hours
Contracts	Pipe Stockpiling
	Construction Survey
	Emergency Medical Service
	Clearing/Grading
	Pipeline, Facility, or Integrity construction activities
	Nondestructive examination (NDE)
	Caliper Pigging
	Fabrication
	Compaction Testing
	Trenchless Crossings
	Contracts associated with (small) miscellaneous reclamation activities

4.8.2 Road and Highway Use

Inspectors should have knowledge of permit requirements and restrictions for transportation of dangerous goods, heavy equipment, stringing trucks, and tracked equipment as to any size and weight restrictions relative to the roads and bridges being used by these types of vehicles.

4.9 Records Management

A critical element of the Inspector's role is to support Operator record keeping, which is critical to the long-term management of the pipeline. Details captured during the construction phase can be critical pieces of information when maintaining the pipeline's long-term structural integrity. While specific record keeping requirements are identified within each section, general requirements are listed in Table 13. Where record keeping is incomplete, poor, or absent, construction inspector duties shall be deemed to be incomplete.

Table 13—Typical Activities Associated with Supporting Records Management

✓	Description
General	
	Monitor for timely completion and submission of all required documentation
	Confirm that all forms, reports, and submitted data are as complete and accurate as possible
	Record all as-built information pertaining to the construction progress
	Provide information on an ongoing basis that assists in closing Contractor claims
	When Contractor deficiencies and/or nonconformances have been identified, monitor, document, and follow-up on Operator agreed-to actions until closed
	Coordinate project data collection and provide reports to the Operator's authorized representative or designee as per specific timelines
	Gather data to support a post-construction evaluation and lessons learned document
	Review base scope and schedules to actual work performed and provide feedback
	Complete production-related information on inspection forms and reports, and note: — Equipment and consumables used by the Contractor — Contractor personnel present onsite
	Confirm that Near Miss Reports are completed and submitted
	Confirm that Incident Reports are completed and submitted
	Obtain formal approval and written agreement from the Operator's authorized representative or designee prior to commencing any extra work activities
Daily	
	Complete Inspection reports (e.g. materials, workmanship, areas, survey stations inspected)
	Complete Construction Progress reports (e.g. materials, workmanship, and areas inspected)
	Review daily time sheets, where applicable (e.g. typically required on Time and Materials projects)
Weekly	
	Confirm that Weekly Progress reports identify potential cost and schedule issues as well as safety, environmental, progress, and QC issues
	Maintain, coordinate, and communicate weekly progress and schedule on survey activities to the Operator's authorized representative or designee
Project End	
	Prepare an end of project report if required
	Identify lessons learned and/or participate in sessions in support of lessons learned

4.10 Personnel Qualifications and Certifications

4.10.1 General

Confirming the qualifications of individuals allowed onsite is an important element of ensuring a safe construction operation as well ensuring that the work meets an acceptable level of quality. For example, welding operations have specific requirements for the qualification of welders and the work they undertake. These personnel qualifications/certifications are identified in the following sections where relevant and completed prior to construction unless there are onsite changes. The Inspector is typically responsible for the items in Table 14.

Table 14—Typical Activities in Support of Confirming Qualifications/Certifications

✓	Description
	Engage with supervisor to confirm specified training
	Confirm training certificates, as appropriate
	Confirm qualifications for covered tasks as appropriate
	Intervene per detailed checklists in this document where symptoms of incorrect training are manifested

Qualifications and certifications should also comply with applicable regulatory requirements. Compliance with Operator Qualification (OQ) Plans is required in the United States. Where applicable, Inspectors should use the following to facilitate their verification process for key personnel performing work on the project.

4.10.2 Operator Qualification

Inspectors in the United States should be knowledgeable about OQ, including, but not limited to, covered tasks and evaluation of qualifications. The Operator is responsible for communicating the OQ requirements to the Inspector and Contractor. Inspectors should know which tasks related to their purview are covered tasks and the required documentation (e.g. inspection activities for tie-ins, application and repair of external coating, line locating, excavation of foreign utilities, backfilling a trench). Inspectors should be aware of Operator procedures related to new and/or short service employees.

4.10.3 Verification of Construction Personnel Qualifications

Assurance of certification and/or qualification is a necessary step in achieving proper performance and project quality objectives. Inspectors should be prepared to check and verify the certifications and/or other qualification documentation of certain crucial pipeline construction personnel and technicians performing specialized work, including quality and materials examination and testing. The key areas to verify certification and qualification include, but are not limited to, those shown in Table 15.

Table 15—Key Areas to Verify Certification and Qualification

✓	Description
	Welding personnel
	Heavy equipment operators
	Blasting/explosive personnel
	Excavation (competent personnel)
	Nondestructive examination (NDE)/nondestructive testing (NDT) technicians
	Coating personnel
	Corrosion control technicians
	Safety professionals
	Environmental specialists
	Pipeline inspectors

Pipeline regulation, code, standard, and practice references contain various provisions for use of certified, qualified, and/or competent personnel, including pipeline construction inspectors.

4.11 Equipment Calibration

Often activities during pipeline construction require specialized equipment for measurement. For example, coating holiday testing equipment (used to detect coating film discontinuities that may compromise pipe integrity) is a critical part of ensuring long-term safety of the pipeline. In these situations, the Inspector should confirm that only properly calibrated test equipment is used onsite and supporting calibration records are available. Based on the equipment, there may be daily, monthly, and/or annual calibration requirements per Manufacturer and/or Operator specifications.

The Inspector should also confirm that the Contractor's operators are properly trained and knowledgeable with application and operation techniques, their equipment, and materials as per 4.10.

4.12 Incident Reporting

Should an incident occur, the Inspector is expected to assist the Operator (and where necessary, the local authorities) in conducting a formal and objective Incident Report. The Inspector should keep in mind the items identified in Table 16.

Table 16—Typical Incident Considerations

✓	Description
	Take immediate action to attend to injuries and/or contact emergency services
	Stop work as appropriate
	Immediately report all injuries, vehicle incidents, near misses, and any unsafe conditions
	Confirm that site evidence is preserved, pictures are taken, and documentation and witness statements are gathered and retained as soon as practical
	Participate in incident investigations as required
	If site shutdown occurs, obtain authorization from Operator when site can be returned to services

4.13 References—Foundational Information

NOTE The reference information provided in Table 17 is intended as a guide only (i.e. the list is not exhaustive); documents of this nature are updated frequently, and it remains the responsibility of the user to reference the correct, and most current, documents as appropriate.

Table 17—List of References—Foundational

Document No.	Type	Title
American Petroleum Institute (API)		
API 1104	Standard	Welding of Pipelines and Related Facilities
API 1161	Recommended Practice	Recommended Practice for Pipeline Operator Qualification (OQ)
API 1173	Recommended Practice	Pipeline Safety Management Systems
API 1177	Recommended Practice	Recommended Practice for Steel Pipeline Construction Quality Management Systems

Table 17—List of References—Foundational *(continued)*

Document No.	Type	Title
American Society of Mechanical Engineers (ASME)		
ASME B31Q	Standard	Pipeline Personnel Qualification
ASME B31.4	Standard	Pipeline Transportation Systems for Liquids and Slurries
ASME B31.8	Standard	Gas Transmission and Distribution Piping Systems
Canadian Federal Regulations		
N/A	Regulation	Canadian Environmental Protection Act
N/A	Regulation	Fisheries and Oceans—Land Development Guidelines for the Protection of Aquatic Habitat
N/A	Regulation	Canada Water Act
N/A	Regulation	Migratory Birds Convention Act
N/A	Regulation	Canada Occupational Health and Safety Regulations
N/A	Regulation	Transport Canada—Transportation of Dangerous Goods Regulations
N/A	Regulation	Navigation Protection Act
N/A	Regulation	Species at Risk Act
Canadian Standards Association (CSA)		
CSA Z662	Standard	Oil and Gas Pipeline Systems
Code of Federal Regulations (CFR)		
29 CFR Part 172	Regulation	Hazardous Materials Table
29 CFR Part 1910	Regulation	Occupational Safety and Health Standards
29 CFR Part 1926	Regulation	Safety and Health Regulations for Construction
33 CFR Part 321	Regulation	Permits for Dams and Dikes in Navigable Waters of the United States
40 CFR Part 300	Regulation	National Oil and Hazardous Substances Pollution Contingency Plan
49 CFR Part 192	Regulation	Transportation of Natural and Other Gas by Pipeline: Minimum Federal Safety Standards
49 CFR Part 195	Regulation	Transportation of Hazardous Liquids by Pipeline
50 CFR Part 21	Regulation	Migratory Bird Permits
50 CFR Part 402	Regulation	Interagency Cooperation—Endangered Species Act of 1973, as Amended
Common Ground Alliance (CGA)		
CGA Best Practices	Guideline	Chapter 3, One Call Center
Federal Energy Regulatory Commission (FERC)		
18 CFR 380.12 (i)	Regulation	Upland Erosion Control, Revegetation, and Maintenance Plan
18 CFR 380.12 (d)	Regulation	Wetland and Waterbody Construction and Mitigation Procedures

Table 17—List of References—Foundational *(continued)*

Document No.	Type	Title
Interstate Natural Gas Association of America (INGAA)		
N/A	Report	Safety Every Step of the Way
INGAA Foundation		
CS-G-01	Guideline	Construction Safety & Quality Consensus Guidelines—Basic Personal Protective Equipment (PPE)
CS-H-03	Guideline	Construction Safety & Quality Consensus Guidelines—Naturally Occurring Radioactive Material (NORM) and Technologically Enhanced Naturally Occurring Radioactive Material (TENORM) Safety Guidelines
Report 2013.01	Report	Building Interstate Natural Gas Transmission Pipelines: A Primer
N/A	Report	Overview of Quality Management Systems—Principles and Practices for Pipeline Construction
CS-R-16	Guideline	Construction Safety & Quality Consensus Guidelines—Steep Slope Construction
National Energy Board (NEB)		
OPR-99	Regulation	National Energy Board Onshore Pipeline Regulations ¹
United States Code (USC)		
16 USC Chapter 35	Regulation	Endangered Species
33 USC Chapter 9	Regulation	Protection of Navigable Waters and of Harbor and River Improvements Generally
¹ OPR-99 is the overarching Canadian regulation, but does not include specific instructions for the typical Pipeline Inspector; rather, it incorporates through reference of other documents that are directly relevant.		

Annex A (informative)

Pipeline Construction Inspector

Organization of This Annex

With an eye to practicality and ease of use, this annex is organized to reflect the typical construction process for transmission pipelines. Foundational information common to all aspects of construction is presented in Section 4, with sections specific to each phase of construction detailed in this annex. Within each section in this annex, five main headings are used consistently.

- Overview—A brief description of the specific activities in the construction phase.
- Inputs—Detailed information regarding typical information the Inspector requires.
- Execution—Detailed information regarding items the Inspector should typically watch for; for ease of use, items are typically formulated as actions using verbs such as monitor, confirm, check, etc.
- Outputs—Detailed information listing typical information the Inspector will be required to produce for the Operator (Operator has plan that identifies inspection requirements for the project).
- References—List of key relevant reference documents for those seeking additional information for each phase of construction.

“Inputs” within each section is intended to clearly identify the types of documents, specifications, and other information the Inspector would likely need to reference in that phase of construction. “Execution” within each section provides detailed checklists, often grouped by major topic, identifying items that Inspectors should monitor in that construction phase. Finally, “Outputs” within each section then articulates items that the Inspector is typically expected to produce or report on as it relates to that phase of the construction project.

A.1 Surveying

A.1.1 Overview

Surveying is an integral part of pipeline construction and refers to the installation of visual reference points and markers (e.g. stakes, pins, lath, and hubs) that will define the ROW limits and guide the construction of the pipeline and necessary appurtenances according to the Issued for Construction drawings. The references also mark the safe limits of ROW work areas.

If the area for the approved pipeline route is forested, Construction Surveyors are commonly the first to arrive to flag trees so Clearing Contractors can cut them down and establish the ROW for pipeline construction. The Inspector is the technical liaison for survey information between the Operator's authorized representative, Survey Contractor, and other onsite Contractors.

Inspectors should be familiar with basic land surveying terminology and definitions, including:

- section, range, and township references;
- legal property descriptions;
- metes and bounds descriptions;
- fee property details;
- color coding of flagging;
- other basic Public Land Survey System information.

A.1.2 Inputs

As part of preparing for inspection during the surveying process, the Inspector should continually familiarize themselves with relevant aspects of key documents, drawings, and Operator technical specifications as identified in Table A.2.

A.1.3 Execution

Typical items that the Inspector should monitor for during the surveying process are identified in a series of checklists as detailed in Table A.1.

Table A.1—Monitoring Requirements for Survey Inspection

Item	Description	Reference
Prior to Commencing Work	Confirm that key issues that have been identified are detailed and addressed	Table A.3
Safety	Monitor the operations for adherence to relevant Operator- and project-specific safety requirements	Table A.4
Environmental Considerations	Identify specific items that should be monitored throughout surveying operations that relate specifically to the Operator- and/or project-specific Environmental Protection Plan (EPP)	Table A.5
General	Identify general items that should be monitored throughout the construction surveying process	Table A.6
Buried Facilities Location	Identify specific survey items that should be monitored at buried facilities locations	Table A.7
Right-of-Way (ROW)	Identify specific survey items that should be monitored for at ROW boundaries	Table A.8
Ditch Line	Identify specific survey items that should be monitored along the ditch line	Table A.9
Crossings	Identify specific survey items that should be monitored at crossing locations (e.g. roads, powerlines)	Table A.10
Appurtenances	Identify specific survey items that should be monitored at appurtenance locations	Table A.11
As-Builts	Identify specific information that should be monitored for collection in support of completing as-builts	Table A.12
Pilings	Identify specific survey items that should be monitored for piling locations	Table A.13
Caliper Pigging	Identify specific survey items that should be monitored in support of caliper pig runs	Table A.14

A.1.4 Outputs

Report requirements and reporting processes are Operator and project specific; recommended practices for reporting requirements for survey inspection appear in Table A.15.

A.1.5 Typical Input Requirements for Survey Inspection

Table A.2—Information Requirements for Survey Inspection

✓	Description
	All designs, drawings, and specifications developed by the Operator and Contractors related to surveying, such as: — Access Road Drawings — Line List (e.g. special concerns for each Landowner) — Issued for Construction Drawings
	Contracts and agreements related to: — Road Use — Crossing for Buried Facilities — Construction Survey — Landowner Agreements — Third-Party Crossing Agreements
	Permits related to: — Environmental — Road Use — Third-Party Crossing Permits
	Operator-specific Safety Plan, including, but not limited to: — Traffic Control Plan — Requirements for Personal Protective Equipment (PPE) — Emergency Medical Services (EMS)
	Project-specific Environmental Protection Plan (EPP) detailing surveying requirements for the following, but not limited to: — Watercourses — Wetlands — Wildlife habitats — Migratory routes — Permafrost areas
	Other project-specific Plans, which may include: — Fire Prevention/Firefighting Plan — Survey Plans — Horizontal Directional Drilling (HDD) Plan

A.1.6 Items for Inspecting Typical Surveying Operations

Table A.3—Prior to Commencing Work

✓	Description
	Participate in daily meetings to address: — Job safety and/or hazard identification issues — Environmental concerns — Duties of Inspector(s) — Pipeline Contractor's tailgate meetings (as required) — Ad-hoc meetings with Contractors to discuss and clarify questions or concerns
	Confirm Survey crew credentials/qualifications per Operator requirements
	Review all available drawings with Surveyors to verify no facilities or features (including existing facilities such as taps and abandoned pipelines) are overlooked in the current project drawings
	Confirm the Survey Contractor has contacted One Call
	Confirm that impacted landowners have been contacted prior to surveying and marking activities
	Verify that the Survey Party Chiefs possess a copy of the survey requirements, and have the proper materials and equipment to perform the work as per survey contract
	Confirm that Surveyor's equipment is calibrated
	Confirm that Surveyors have set up their equipment to use the Operator's naming convention

Table A.4—Safety Concerns for Surveying

✓	Description
	Confirm that Contractors are not encroaching with construction equipment into the survey work area
	Review and accept the Working Alone Policy for the Survey Contractor
	Confirm that all personnel are trained in hand tree-felling activities, including chainsaw usage
	Confirm that all personnel have certification and PPE for use of all-terrain vehicles (ATVs) and/or snowmobiles

Table A.5—Typical Monitoring Requirements for Environmental Considerations

✓	Description
	Advise the Environmental Inspector and/or the Operator's authorized representative before Construction Surveyors staking (marking of proposed pipelines, equipment, or features required for construction operations in a consistent manner) environmental and archaeological sites

Table A.6—Typical Monitoring Requirements—General

✓	Description
	Confirm that survey monuments are not impeding construction flow
	Confirm that survey proceeds in accordance with the contract requirements and Operator-provided Work Plans
	Observe and report any discovered or potential pipeline route selection deficiencies or obstacles (e.g. terrain features, landowner issues, road/railroad/waterway crossings, environmental features, cultural features, protected resources such as drinking water and proximity to occupied facilities)
	Confirm that Construction Surveyors are continually updating all construction drawings with red pens (redline drawings)
	Confirm compliance and operation solely within ROW and on approved access roads as outlined within the ROW line list and/or as directed by an authorized Land Agent
	Monitor that all legal survey monuments are not disturbed, defaced, altered, destroyed, or removed
	Confirm that damage or obliteration of any survey references is reported per Operator processes and treated as a safety concern
	Confirm that Contracted Surveyors are the only personnel re-establishing obliterated, missing, or damaged survey stakes, markings, and flagging
	Confirm that all stakes and flags remain visible for the duration or intended use
	Confirm that Construction Surveyors have clearly staked all underground facilities
	Confirm that Construction Surveyors collect all data [e.g. mill test reports (MTRs)] from pipe as well as valves/fittings nameplates
	Confirm that Construction Surveyors have created the final survey drawings for the hydrostatic testing process
	Check that Construction Surveyors have signed and dated the final survey drawings

Table A.7—Typical Monitoring Requirements for Buried Facilities Location

✓	Description
	Confirm that the Construction Surveyor coordinated with the Operator and/or third parties with specific knowledge so that buried facilities along the ROW were located and appropriately marked
	Confirm that personnel locating buried facilities are trained in a recognized line locating program and are using accepted procedures and techniques and are qualified
	Confirm that all line locating equipment have current calibration certificates
	Confirm that Construction Surveyors identify and document any facility that is shown on drawings but cannot be located
	Confirm all buried facilities (e.g. pipelines or cables, drainage systems, and irrigation systems) have been located, identified by type (e.g. pipe diameter, pipe coating, year installed), have adequate depth of cover, and are staked accurately (showing all angular deflections) so that there is no chance of disturbing the facility during pipeline construction
	Confirm that all Third-Party pipeline, utility crossings, and centerlines of new and Third-Party pipelines are staked by Surveyors as specified in alignment sheets
	Confirm that the point of crossing between the proposed centerline of the new pipeline and the existing facility is marked with a cross lath of stakes with Operator-specific color codes showing the name of the Operator and the facility size
	Confirm that all offset requirements from engineering or crossing agreements are staked and clearly labeled
	Confirm that buffer stakes are placed at all Third-Party facilities and expected new facilities

Table A.8—Typical Monitoring Requirements for Right-of-Way

✓	Description
	Confirm that the Surveying Contractor will advise when stakes and marks need to be re-established
	Confirm that Surveyors are staking as per Operator-specific color codes and obtaining approval from the Operator's authorized representative if any additional color codes are required
	Monitor on an ongoing basis that all stakes/markers are collected by the Contractor after that section of work has been completed
	Confirm that Surveyors are staking the pipeline route, valves, and other appurtenances as shown on the drawings
	Confirm that Surveyors have correctly labeled all the stakes, and these are visible from the work side or within the work area of the ROW
	Confirm that the boundaries of the ROW or temporary workspace (TWS) are staked as per survey specifications
	Confirm that Surveyors are using frost pins or similar tools in hard or frozen ground when securing survey markers
	Confirm that taller stakes are installed in high crop areas or snow to maintain visibility, and hub staking (a means of staking that is resistant to being knocked down) is used in livestock pastures
	Confirm that watercourse crossings have the appropriate riparian zone (interface between land and a river or stream) buffers starting from the top of the bank, unless otherwise shown on drawings
	Confirm that progress stakes are placed along the edge of the ROW or TWS at specified intervals, so they are visible on the work side or within the work area
	Confirm that flagging is placed more frequently in heavier vegetated and treed areas to provide better visibility for clearing equipment operators

Table A.9—Typical Monitoring Requirements for Ditch Line

✓	Description
	Confirm that the centerline of the proposed pipeline ditch is staked at specified intervals, except at bends and crossings where the intervals should be more frequent
	Confirm that Surveyors are breaking down large angle bends at points of intersection (PI) into a series of smaller bends when the PI angle exceeds bending specifications (done so that the bends fit the ROW)
	Confirm that angles of deflection are recorded at all pipeline deflection points
	Confirm that Surveyors are using chainages/station numbers (an imaginary line used to measure distance that corresponds to the centerline of, for example, a pipeline or a fence), for example: — In Canada, use metric chainages with 3 digits and 1 decimal point (e.g. 2+145.1 = 2145.1 m) — In the United States, use imperial station numbers (e.g. 10,000 ft would be 100+00)
	Document and inform the Operator's authorized representative of any major deviations or necessary changes in chainage/station equations