ENERGY TRANSFER

Hazardous Liquids Pipeline Shutdown and Startup

Standard Operating Procedures

Applicable to Hazardous Liquids Pipelines and Related Facilities

Code Reference :	**Procedure No.: HLI.01**	
49CFR: 195.402	***Effective Date: 04/01/18***	**Page 1 of 8**

1.0 Procedure Description

This Standard Operating Procedure (SOP) establishes requirements for starting up and shutting down any part of the pipeline in a manner designed to assure operation within the MOP limits prescribed by this SOP, plus the build-up allowed (110%) for operation of pressure-limiting and control devices.

2.0 Scope

The SOP includes procedures for startup and shutdown of liquid pipelines.

3.0 Applicability

This SOP applies to liquid pipeline facilities to assure operation within proper pressure ranges.

4.0 Frequency

As required: For the startup or shutdown of liquid pipeline facilities.

5.0 Governance

The following table describes the responsibility, accountability, and authority of the operations described in this SOP.

Function	Responsibility	Accountability	Authority
All Operations	Operations Personnel	Operations Manager	Director of Operations

6.0 Terms and Definitions

For general terms, refer to *SOP* HL*A.01 Glossary and Acronyms*.

7.0 Hazardous Liquids Pipeline Shutdown and Startup

Working closely with Liquids Control, Operations Personnel use this SOP to verify that startup or shutdown of a liquid pipeline does not result in pressures above Maximum Operating Pressure (MOP) plus the build-up allowed (110%) for operation of pressure-limiting and control devices. This procedure contains the following sections:

- Shutdown and Startup Plan
- Selection of Flare or vent location if applicable
- Shutdown Procedures
- Requirements for Controlled Intentional Releases
- Startup Procedures

NOTE: Document each occurrence when a pipeline segment MOP is exceeded as a result of a startup or shutdown activity using *SOP HLA.13 Recognizing and Responding to Abnormal Operations.*

7.1 Shutdown and Startup Plan

For normal operating conditions, Operations Personnel develop a pipeline shutdown and startup plan prior to depressurizing or pressurizing a pipeline segment.

NOTE: If the intention is to depressurize the pipeline, prior to shutdown **CONSULT** with Pipeline Integrity Group to review the anomaly data to determine whether smart tool indications that are scheduled for future remediation will be in the shutdown section, and if indication should be investigated, remediated, and/or repaired during the shutdown.

WARNING: Prevent pressures in a pipeline segment from exceeding its MOP during startup or shutdown. Take into account the variations in elevation for the length of the pipeline. Take immediate action to correct the situation if it does occur. Refer to *SOP HLA.12 Safety-Related Condition Reporting* and *SOP HLA.13 Recognizing and Responding to Abnormal Operations* for potential abnormal operations reporting requirements.

Step	Activity
1	**PREPARE** site-specific shutdown or start up work-plan when applicable, **VERIFY** liquids are sent to flare, recirculated back into the system, or vented within appropriate limits.
2	**VERIFY** that the work-plan has detail and contents adequate for the particular pipeline segment and operating conditions.
3	**BASE** the work-plan on maintaining pressures at or below the segment MOP. **REVIEW** input and delivery points to verify all sources of liquids have been considered.
4	**MAINTAIN** pipelines above vapor pressure of the product to prevent vaporization, unless the intent is to evacuate the pipeline.
5	**EVALUATE** complexity. **CONSIDER** such things as the number of people involved, sequence of valve operations and what effect the operation may have on customers. **INCLUDE** visual aids, such as maps, drawings or sketches, in the work-plan when helpful.

Step	Activity
6	**REVIEW** the work-plan with all personnel involved in the operation, including Liquids Control, prior to making any pressure changes and outages. **VERIFY** that each person involved knows their responsibility, who is in charge, and what to do if pressure limits are exceeded.
7	**VERIFY** valves to be used are in working condition.
8	**REVIEW** the work-plan with the Environmental Department as necessary to determine if federal or state reporting requirements apply or if there are environmental restrictions that may affect the operation.
9	If abnormal operations arises during implementation, **TAKE** corrective action. **REFER** to *SOP HLA.13 Recognizing and Responding to Abnormal Operations.*
10	**VERIFY** that Liquids Control is kept advised of progress or changes in schedule.

7.2 Selection of Flare or Vent Location

Use the table below to select a flare or vent location.

NOTE: Crude Oil Pipeline Operations will require drain lines to containment.

Step	Activity
1	When selecting flare / vent locations, consideration should be given to the safety of public and employees. **CHOOSE** a location suitable to minimize the impact to the environment and the public. **MONITOR** for flammable or toxic vapors as appropriate.
2	**TAKE** steps to prevent accidental ignition, noting especially the location of overhead power lines.
3	**CONSIDER** access for special equipment to be used such as flares, diffusers, liquid separators, and absorption units.
4	**CONSIDER** the possibility that liquids may be entrained in the vapors.

7.3 Shutdown Procedures

Once the work-plan has been prepared, Operations Personnel use the following guidelines to shutdown the pipeline segment.

Step	Activity
1	**MAKE** appropriate notifications.
2	**SHUTDOWN** pump stations or injections associated with the section to be shutdown according to local procedures.
3	**ISOLATE** section as appropriate, including tie-ins. **UTILIZE** Lockout Tagout Procedures as appropriate. Refer to *HLB.06 Hazardous Energy Control (Lockout Tagout)*

7.4 Requirements for Controlled Intentional Releases

Prior to flaring / venting of vapors, Operations Personnel should utilize the following guidelines:

NOTE: Crude is not considered a HVL according to PHMSA's definition.

Step	Activity
1	**NOTIFY** the following agencies, officials, and persons, if applicable, at least 24 hours in advance of the flare or venting. • Emergency coordinators which are located within a 10 mile radius of the flaring or venting site. • State police which are located within a 10 mile radius of the flaring or venting site. • Local fire officials (city and county fire departments). • Residents located within close proximity to the flaring or venting site (minimum of 300 ft.). • Aerial Patrol Pilot • The Federal Aviation Administration – see FAA contact list in Appendix B. Liquids Control will **NOTIFY** other pipeline companies in the general area.
2	**PROVIDE** information concerning the flaring or venting of vapors, such as location, time, product and duration in the notification.

7.5 Startup Procedures

Once the work that required the shutdown has been completed and the line is ready to be returned to service, follow the purge and pack procedures that were prepared during the planning of the job. Refer to *SOP HLB.03 Purging.*

- During the shutdown and startup, MONITOR pipeline pressure until steady state pressure and flow conditions are reached to assure operation within MOP limits.

Step	Activity
1	**MAKE** appropriate notifications. Before purging, once again make all the notifications required above in Section 7.4, Requirements of Liquid Releases
2	**PRIOR** to purging and/or packing, **CONSIDER** disarming automated shutdown controls to **PREVENT** unintentional errant valve closures.

NOTE: If the shutdown did not require evacuation of the liquids in the pipeline and the line was shut in with a positive pressure and that positive pressure was continuously maintained, purging will not be required prior to repacking the line.

Step	Activity
3	**PURGE** & **PACK** the line segment according to *HLB.03 Purging*
4	**REMOVE** lockout tagout, return all valves to their normal operating position per local procedures.
5	**STARTUP** pump stations or injections associated with the section to be started according to local procedures.
6	**RE-ESTABLISH** automated shutdown controls previously disarmed.
7	**NOTIFY** Liquids Control that the pipeline is back in normal operating configuration.

8.0 Documentation Requirements

Record data in electronic database or utilize the following form(s) as applicable:

A file for retaining records of pipeline startup and shutdown activities.
If there is a work-plan, retain a copy of the work-plan for three (3) years.
Use a Company approved application for documenting the activities

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9.0 References

HLA.12 Safety Related Condition Reporting
HLA.13 Recognizing and Responding to Abnormal Operations
HLB.03 Purging
HLB.06 Hazardous Energy Control (Lockout Tagout)

Appendix A: OQ Task Requirement

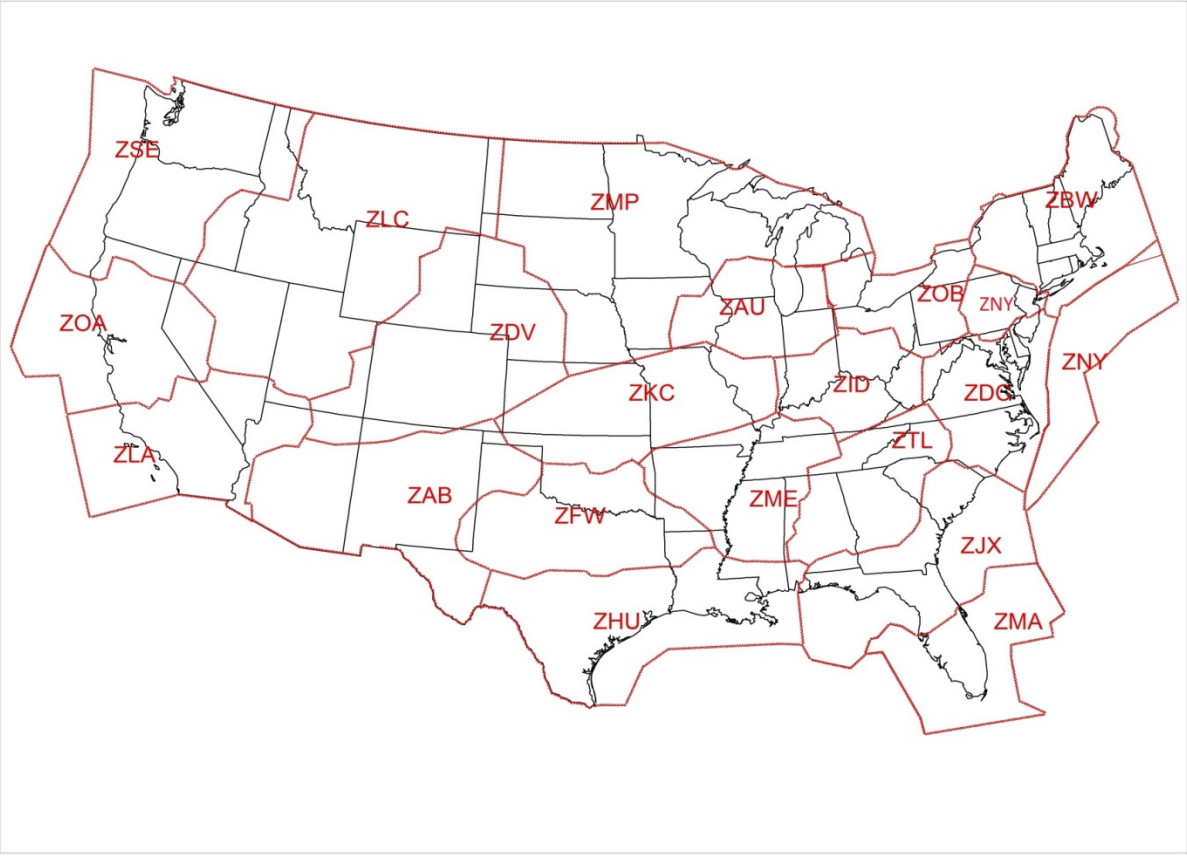
The table below identifies the Operator Qualification (OQ) task requirements.

Task Description	OQ Task
Operating Pipeline Valves	PLOQ007
Start-up / shutdown of pipeline / facilities to assure operation within MOP	PLOQ601

Appendix B: FAA Contacts

The table below identifies the Operator Qualification (OQ) task requirements.

FAA Air Traffic Control Center - Sectors and Contact #'s



	Air Traffic Control Center	**Contact #**
ZAB	Albuquerque	505-856-4500
ZAU	Chicago	630-906-8341
ZBW	Boston	603-879-6655
ZDC	Washington	703-771-3470
ZDV	Denver	303-651-4248
ZFW	Fort Worth	817-858-7504
ZHU	Houston	281-230-5560
ZID	Indianapolis	317-247-2242
ZJX	Jacksonville	904-549-1537
ZKC	Kansas City	913-254-8504
ZLA	Los Angeles	661-265-8205
ZLC	Salt Lake	801-320-2560
ZMA	Miami	305-716-1588
ZME	Memphis	901-368-8234
ZMP	Minneapolis	651-463-5580
ZNY	New York	631-468-1080
ZOA	Oakland	510-745-3331
ZOB	Cleveland	440-774-0312
ZSE	Seattle	253-351-3520
ZTL	Atlanta	770-210-7622

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Instructions/Guidelines

- Call the appropriate FAA/Air Traffic Control Center and ask that a Temporary Flight Restriction (TFR) be issued for a scheduled gas release. Recommend this to be a minimum of 1 mile radius and a minimum of 2000 feet above the ground if possible. Large gas releases may require larger TFR's.
- Provide GPS coordinates of the location in deg., min., and seconds (i.e. – N30 03 59, W095 32 51)
- Provide the date and estimated time frame for the TFR (i.e. – May 6 from 8:00 am – 3:00 pm local time). Recommend asking for enough time in case the gas release is delayed.

Standard Operating Procedures

Applicable to Hazardous Liquids Pipelines and Related Facilities

Code Reference :	**Procedure No.: HLI.05**	
49 CFR: 195.214, 195.228, 195.230, 195.234, 195.422	***Effective Date: 04/01/18***	**Page 1 of 17**

1.0 Purpose

This Standard Operating Procedure (SOP) establishes the requirements for repairing pipelines when the strength of the pipe has been reduced by corrosion, mechanical damage, weld defects, material defects, or other injurious defects per *SOP HLI.06 Evaluating Pipeline Defects*.

2.0 Scope

This SOP determines and describes the appropriate repair methods, based on pipeline defects, required to verify the continued integrity of the pipeline.

3.0 Applicability

This SOP applies to regulated company pipelines requiring repair.

4.0 Frequency

As required, including failures, leaks, pipeline damage, or wall loss without leaks are discovered.

5.0 Governance

The following table describes the responsibility, accountability, and authority of the operations.

Function	Responsibility	Accountability	Authority
All Operations	Operations Personnel	Operations Manager / Manager of Pipeline Integrity	Vice President of Pipeline Integrity

6.0 Terms and Definitions

Terms associated with this SOP and their definitions follow in the table below. Refer to *SOP HLI.06 Evaluating Pipeline Defects* for additional terms and definitions associated with this SOP not covered in the table below. For general terms, refer to *SOP HLA.01 Glossary and Acronyms*.

Terms	Definitions
Alternative Repair	Any method approved by the Pipeline Integrity Group or QA/QC Group that is not covered under a specific category. This may include new methods not known at the time the SOP was written, other repair methods not normally used except under special circumstances, or any method not specifically stated as acceptable for a given type of defect.

Terms	**Definitions**
Composite Sleeve	A full encirclement repair consisting of composite layers such as fiber glass or carbon fiber that adhere with an epoxy.
File Repair	Removal of a defect, or of the detrimental aspects of a defect, through the use of a hand held file.
Force Screw Type Leak Clamp	An apparatus consisting of a band that encircles the pipe and a cone point on a screw. The screw is tightened forcing the cone into the pipe, sealing a small leak.
Grind Repair	Removal of a defect, or of the detrimental aspects of a defect, through the use of an abrasive disc attached to a power tool.
Pressure Containing Type "B" Sleeve	A full encirclement repair consisting of steel sections designed to fit over the carrier pipe. The sections are welded to each other and the ends are then fillet welded to the carrier pipe such that the sleeve is capable of containing any material or pressure that leaks from the pipe.
Pressure Reinforcing Type "A" Sleeve	A full encirclement repair consisting of steel sections designed to fit over the carrier pipe. The sections are welded to each other on either side. The ends are not fillet welded to the carrier pipe.
Pumpkin (Type C)	A full encirclement repair consisting of steel sections designed to fit over the carrier pipe and a raised feature such as a weld or coupling. The sections are welded to each other and the ends are then fillet welded to the carrier pipe such that the sleeve is capable of containing any material or pressure that leaks from the pipe. This is one type of sleeve covered in Specialty Steel Sleeves.
Weld Reinforcement Sleeve	A full encirclement repair consisting of steel sections designed to fit over the carrier pipe and a raised feature such as a weld.
Split Sleeve Bolt-On Clamp	A full encirclement repair consisting of two steel halves held together with a series of bolts.
Stress Concentrator	Any sharp feature or linear indication that can increase the amount of stress at a localized point.
Weld Pad	A steel encirclement sleeve added at pipe supports to prevent vibrations and movements from damaging the carrier pipe.

7.0
Pipeline Repair

This SOP contains the following sections:

- Defect to Repair Correlation
- Replacement of Pipe Section
- Grinding and Filing
- Split Sleeve Type Bolt on Clamp
- Force screw Type Leak Clamp
- Repairs Using Welded Encirclement Sleeves
- Welded Encirclement Sleeves: Specialty Steel Sleeves
- Composite Reinforcement Repairs

WARNING: Operations Personnel shall take **IMMEDIATE** steps to protect the public from hazardous leaks or failures, and to repair any pipeline in which damage or imperfections are found that could affect the serviceability or safe operation of the pipeline.

CAUTION: If an immediate repair cannot be made, the segment of pipeline is to be removed from service, or the pressure reduced to a safe level based on the remaining strength of the segment until temporary or permanent repairs can be made.

NOTE:

- Follow all excavation and repair pressure reduction requirements per *SOP HLI.11 Pipeline Pressure Limit Criteria.*
- Conduct a pre-job safety meeting to discuss the work procedures prior to commencement of work.
- Refer to *Safety Procedure S-020 Asbestos Removal and Maintenance* before removing coating, if appropriate.
- Clean the pipe to bare metal in the area of repairs.
- Document the type, location, and size of all repairs in the Pipe Inspection Report or Maintenance Record.
- Clean and coat all bare surfaces prior to backfilling.
- Upon completion, Backfill per *SOP HLI.10 Excavation and Backfill* after the coating has cured.
- Submit the project documentation and as-built data to Engineering Records per *SOP HLB.11 Project Documentation and As-Built Process*

7.1 Defect to Repair Correlation

This SOP contains multiple repair types, each of which is applicable to a number of different defects. Each defect therefore can typically be repaired using one of several methods. The following table can be used to correlate the defects identified by *SOP HLI.06 Evaluating Pipeline Defects* to the correct repair.

WARNING:

- This procedure should only be used as a guideline in the field. If any abnormalities or questions arise, final repair type determination is the responsibility of the Pipeline Integrity Group.
- If multiple types of anomalies interact, confirm the repair methods with a Corrosion Specialist or a member of the Pipeline Integrity Group.
- Verify repairs made in the Company's pipeline systems are made in a safe manner and are made to prevent damage to persons or property.
- The Company may not use any pipe, valve, or fitting, for replacement in repairing pipeline facilities, unless it is designed and constructed as required by 49 CFR 195.

NOTE:

- Notify Liquids Control regarding all proposed repair work and follow excavation pressure reduction requirements per *SOP HLI.11 Pipeline Pressure Limit Criteria*.
- Only those repair methods listed can be used unless an exception is made by the Pipeline Integrity Group. The repair methods are listed in the order generally preferred by the company such that the first repair listed should be the first type of repair considered. However, this order is not firm and repair methods further down on the list may be used based on other factors and preferences so long as a defect is repaired to an acceptable level.

7.2 Replacement of Pipe Section

Operations Personnel or Company Approved Contractor follows this procedure, before a section of pipe is replaced. Refer to *SOP HLI.01 Hazardous Liquid Pipeline Shutdown and Startup* in conjunction with this SOP.

Step	Activity
1	Operations will **DEVELOP** and **IMPLEMENT** a project specific plan for the replacement of pipe.

7.3 Grinding or Filing

Operations Personnel follows the procedures below to make repairs by grinding or hand filing.

WARNING:

- Do not exceed 10% nominal wall thickness removal for the purpose of performing a repair by grinding unless further approval is given by the Pipeline Integrity Group.

CAUTION:

- Prior to performing any grinding, advise Liquids Control of the proposed repair work.
- This section is not intended to be used for weld repair. Refer to the Company's Engineering Standards-Welding, and any other requirements as specified by Integrity Management.
- Do not grind as a means of repair for the following defects:
  - Acetylene weld defect
  - Single submerged arc weld (SSAW) defect
  - Lap weld defect
  - Pre-1970 electric resistance weld (ERW) defect
  - Electric flash weld (EFW) defect that is deeper than the cap

NOTE:

- If there is a concern regarding the ability to accurately, measure the depth of a defect or the integrity of the pipe at the defect in consideration of a more stringent pressure reduction than outlined in *SOP HLI.11 Pipeline Pressure Limit Criteria* may be employed as directed by Pipeline Operations Specialist.
- Defect characteristics which may impair serviceability include but are not limited to:
  - Sharp edges
  - Stress concentrators
  - Surface breaking linear indications
  - Hard spots
  - Arc burns
  - Gouges

Step	Activity
1	**ESTABLISH** the actual wall thickness of the pipe in the area to be repaired prior to grinding by means of an ultrasonic procedure.
2	**VERIFY** the absence of laminations or internal corrosion pits with a compression wave ultrasonic procedure.
3	If in a weld cap, **CONSIDER** using shear wave ultrasonics to **VERIFY** the defect does not extend below the weld cap.
4	**USE** a power-driven coarse abrasive disk or a hand held file for grinding. Typical power equipment includes an angle grinder with a 40 to 80 grit flap or tiger style disc. A pencil-style grinder with ceramic tip may be allowed when access is limited.
5	Begin to **REMOVE** the defect by moving the grinder slowly across the impairing characteristic. Move back and forth in smooth even strokes to avoid digging into any localized area.
6	Periodically **STOP** and **DETERMINE** if the serviceability impairing characteristics have been removed or appear to be worsening. **USE** magnetic particle inspection (MPI) as necessary.
7	If repairing an arc burn or hard spot, **REFER** to that section at this time.
8	With an ultrasonic procedure, periodically **CHECK** the amount of metal removed during the process to ensure the limitation of a safe pressure has not been exceeded.
9	**VERIFY** that the serviceability impairing characteristics of the defect are completely removed.
10	**CONTOUR** the area around the defect to provide a smooth transition to meet the surrounding unaffected pipe surface.
11	**ORIENT** final scratch marks as nearly as possible in the circumferential direction.
12	**EVALUATE** the defect after grinding using a black-white, wet magnetic particle inspection (MPI) method to verify that no linear indications are present. If linear indications are discovered after reaching the maximum approved repair depth, **CONSULT** the Pipeline Integrity Group.

Step	Activity
13	**EVALUATE** the area repaired by grinding per *SOP HLD.47 Evaluation of Remaining Strength of Pipe with Metal Loss* in order to establish a safe operating pressure. For defects in dents and welds, **REFER** to *TABLE-01*.
14	If the safe operating pressure of the grind repair does not meet the required MOP of the pipeline section, **CONSIDER** additional pressure reduction and repair.
15	**CONSULT** the Technical Operations Group to determine any further pressure reductions and repairs per *SOP HLI.11 Pipeline Pressure Limit Criteria* and this procedure.

7.3.1 Arc Burns & Hard Spots

In addition to the repair guidelines of this procedure, Operations Personnel or Company Approved Contractor employs an additional inspection as outlined below for the repair of arc burns or hard spots.

CAUTION:

- Follow all Steps, Notes, Cautions, and Warnings in the Grinding and Filing section as appropriate in addition to those presented here.
- Ammonium Persulfate, when applied to pipe, leaves a salt residue that can be detrimental to the adherence of pipe coating systems.

Step	Activity
1	**EVALUATE** arc burns and hard spots periodically during repair with a 20 percent Ammonium Persulfate and distilled water etch.
2	**CONTINUE** the repair until no darkening occurs after the application of the etch solution or until the maximum depth of repair limits are reached.
3	**CLEAN** pipe surfaces that have been contaminated with Ammonium Persulfate either by scrubbing with soap and water or by applying an acid wash such as Oakite 33 or Oxalic acid.

7.4 Split Sleeve Type Bolt-On Clamp

Operations Personnel or Company Approved Contractor follows the procedure below for using a bolt on, full encirclement, split sleeve.

NOTE: Bolt-On split sleeve may be utilized on onshore pipelines as a temporary repair only until it is feasible to make a permanent repair.

Step	Activity
1	**SUPPORT** the pipe with sandbags within four (4) feet of each end of the clamp installation location.

2	**PLACE** the clamp around the pipe and tighten the bolts in accordance with the manufacturer's guidelines.
3	**RESTRAIN** the clamp against any movement or rotation until all bolts have been tightened.
4	**MAINTAIN** the support of the pipe with sandbags within 4 feet of each end of the clamp and **RESTORE** the pipeline to the original operating pressure once the repair has been completed.
5	For onshore applications, **SCHEDULE** for permanent repair.

7.5 Force Screw Type Leak Clamp

Operations Personnel or Company Approved Contractor follows the procedure below for using a force screw type leak clamp.

CAUTION: Do not use a mechanical leak clamp if the pipe section being repaired applies to any of the following locations unless it has been approved as temporary by the Pipeline Integrity Group :

- The repair is made within the right-of-way of a road.
- The pipe section is located in highly populated areas.
- The pipe is located in an HCA.
- The pipe section is located in a cultivated field with the potential for shallow cover.

Step	Activity
1	**VERIFY** the sealing surface of the clamp is not installed over an area of general wall loss
2	**MINIMIZE** the disturbance of the coating at the location of the leaking defect.
3	**CLEAN** the leak area thoroughly to determine the correct size and type of leak repair device and accessory to use on the leak.
4	**USE** a soapstone or paint stick, **MARK** the leak device and pipe with matching cross hair lines to **VERIFY** the leak device is centered over the leak.
5	**FOLLOW** manufacturer's recommended installation and testing procedures to insure the device is appropriately installed.

7.6 Repairs Using Welded Encirclement Sleeves

Operations Personnel or Company Approved Contractor shall follow the procedure below when making repairs using welded encirclement Type A or B sleeves.

WARNING:

- Do not weld sleeve ends to the carrier pipe if any evidence of linear indications, laminations, reduced wall thickness, or other defects are discovered at the weld positions.
- Consult with the Pipeline Integrity Group if a linear indication may be covered.

CAUTION:

- Prior to installation of welded encirclement sleeves, Liquids Control should be advised of the proposed repair work and in-service welding.
- Prior to performing in-service welding, contact the QA/QC Group to perform the appropriate analysis in order to minimize the risk of burn-through and / or hydrogen cracking.
- Take care to minimize pipe movement and ensure proper support since the stiffness of the sleeves concentrate any stresses at the ends of the sleeve, especially between sleeves.

NOTE:

- Butt Welded Seam Design–Type B Sleeve is designed with the sides of each sleeve beveled so they can be butt welded to join the two halves together. A groove is made beneath the bevel so that a 1/16” thick steel backing strip can be placed beneath the joint prior to welding while still allowing the sleeve to fit flush against the pipe on either side of the joint. The ends of the sleeve must be fillet welded to the carrier pipe.
- Sleeves made by the company, a contractor, or manufactured sleeves purchased from a third party can be used for this section so long as the integrity is verified and the design is consistent with the applicable Engineering Standard.
- Alternative cleaning methods may be employed with approval of Technical Operations Group.
- Minimum sleeve length is 6 inches unless approved by Technical Operations Group.
- Multiple sleeves may be installed adjacent to one another with the approval of Pipeline Integrity Group and Technical Operations Group. The sleeves must all fit tightly around the pipe, and each sleeve must be supported with sand bags. Type A sleeves do not need to be welded together; however, the sleeves may be welded by either using a butt weld with a backing strip or by fillet welding an external bar around the outer circumference of the sleeves.

- Do not install two sleeves, with the ends fillet welded, any closer than one pipe diameter from each other unless approved by the Pipeline Integrity Group or Technical Operations Group.
- Only allow 2 adjacent sleeves over a leaking defect, without approval of Pipeline Integrity Group and Technical Operations Group

Step	Activity
1	Prior to installation of welded encirclement sleeves, **ADVISE** Liquids Control of the proposed repair work and in-service welding.
2	**PROVIDE** proper support of sleeves and adjacent pipe using sandbags.
3	**VERIFY** that the encirclement sleeve is designed, tested, fabricated, and installed in accordance with Section ETWM-155 of the Company's Welding Procedures Manual, and any other requirements as specified by Integrity Management. **OBTAIN** mill test reports and company purchase order numbers for the sleeve material.
4	**VERIFY** that the sleeve is long enough to cover the defect and extends an additional 2 inches beyond each end of the defect, and the ends (including the HAZ) do not come within 2 inches of another anomaly or girth weld. **EXTEND** the sleeve as necessary. Refer to the diagram (Figure 1) at the end of this section for clarification.
5	For Type B sleeves, **PERFORM** magnetic particle inspection (MPI) and zero degree ultrasonic inspections for the full circumference, in a 4" wide strip centered at the proposed sleeve end locations. Refer to the diagram at the end of this section for clarification.
6	**REPAIR** the new anomaly with an alternate method per Table 1, if a sleeve repair is not sufficient.
7	If necessary **TEST FIT** the sleeve on the pipe if there are any concerns with proper alignment and fit up. **VERIFY** that the gaps between sleeve halves or sections are not situated over the defect area.
8	For pipe with a longitudinal seam with a raised weld cap that prevents tight fit-up, **REFER** to one of the methods listed in the following sub-sections.
9	**FILL** any deviations from pipe roundness (corrosion, dents, etc.) with a two-part, 100% solids epoxy filler material such as Armor Plate 360 or an approved equal. If a question regarding approved filler material arises, **CONSULT** with a Corrosion or Integrity Specialist.
10	**CONTOUR** the filler material to restore the original surface and roundness of the pipe, and to fill voids between the pipe and sleeve. **ENSURE** contact between the sleeve and defect area for good reinforcement.
11	**FIT** the sleeve over the pipe; **VERIFY** a tight fit up such that no unfilled voids are present. **TIGHTEN** the sleeve for welding using a jack and chains or other appropriate method.
12	**VERIFY** that any gap beneath the end of a sleeve to be fillet welded to the carrier pipe is no greater than 1/16-inch prior to welding. **ADD** a small amount of weld metal to the underside of the end of the sleeve prior to installing it on the pipe, if necessary, to obtain proper alignment.

Step	Activity
13	**GRIND** and **FIT** the extra weld material to minimize the gap beneath the end of the sleeve.
14	**WELD** sleeves in accordance with the company Welding Manual and Procedures.
15	**MAKE** in-service welding consideration in order to minimize risk of burn through and hydrogen cracking. **CONSULT** the QA/QC Group.
16	Fully **COMPLETE** the fillet welding of one of the sleeve ends prior to commencing the welding of the second end.

NOTE:

- For sleeve sizes 14” or larger, two or more welders are required.
- Any one or a combination of adverse conditions can result in an in-service weld susceptible to burn through or hydrogen cracking.

Step	Activity
17	**REMOVE** by grinding any lugs or attachments applied for lifting.
18	**INSPECT** all welds in accordance with the company Welding Manual.
19	For Type A Sleeves where seal welding is not performed, **APPLY** a two-part, 100% solids epoxy filler material to the ends of the sleeve, lap bar sides, and other abrupt edges such as Armor Plate 360 or an approved equal. If a question regarding approved filler material arises, **CONSULT** with the Corrosion or Integrity Specialist.
20	For leaks **ALLOW** the Type B sleeve to pressure up and check for leaks after installation and prior to capping the nipple and bottle. **SEAL** the nipple and bottle with a weld cap after allowing the sleeve to pressure up to test for leakage.
21	**VERIFY** proper support of sleeves and adjacent pipe using sandbags prior to backfill.

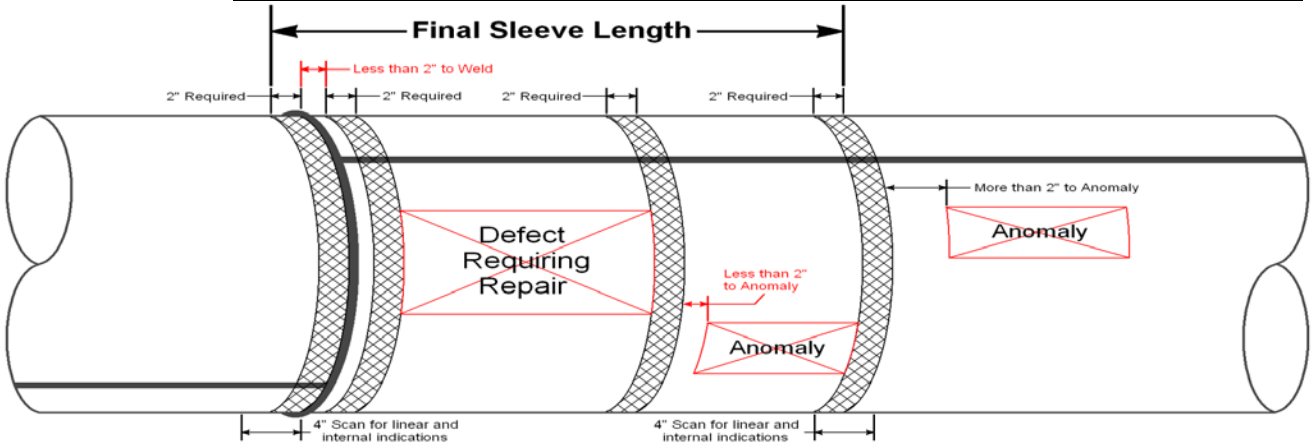


Figure 1

7.6.1 Installing Type "A" Sleeves Over Pipe Seams: Position the Sleeve with the Gap Over the Seam

Operations Personnel or Company Approved Contractor follows the procedure below when installing Type A sleeves over pipe seams by positioning the sleeve with the gap over the seam. Refer to *Step 17* in the table in *Section 7.6*.

CAUTION: This method can only be used when the defect is at least 3" away from the long seam.

Step	Activity
1	**INSTALL** a Type A sleeve with the gap between the two sleeve halves positioned along the longitudinal weld seam on the carrier pipe with the external bar spanning the gap. This positioning allows the sleeve to fit flush against the pipe on either side of the seam without having to grind the underside of the sleeve to fit over the weld.
2	**INSTALL** a three-part sleeve if necessary to ensure that the defect area is in contact with sleeve material. This ensures that the sleeve material, instead of the gap, covers a defect located 180° from the seam weld.

7.6.2 Installing Sleeves Over Pipe Welds and Seams: Grinding the Underside of the Sleeve

Operations Personnel or Company Approved Contractor follows the procedure below when installing sleeves over pipe girth welds and long seams by grinding into the sleeve.

NOTE: The QA/QC Group determines the acceptable depth to which a groove can be ground.

Step	Activity
1	**GRIND** a rounded groove in the inside surface of the sleeve to fit over a longitudinal seam, provided that sufficient sleeve wall thickness remains to meet the company sleeve design guidelines and no sharp corners are created. **FOLLOW** the acceptable methods described in the following diagram.

Step	Activity
2	**VERIFY** a smooth groove with a U-shaped profile has been created, See Figure 2. V-shaped profiles or any other profile with corners in it are not acceptable.
3	**USE** a two-part, 100% solids epoxy to **CONTOUR** the weld to the adjacent pipe, and to **VERIFY** that no voids will exist between the weld and the sleeve.

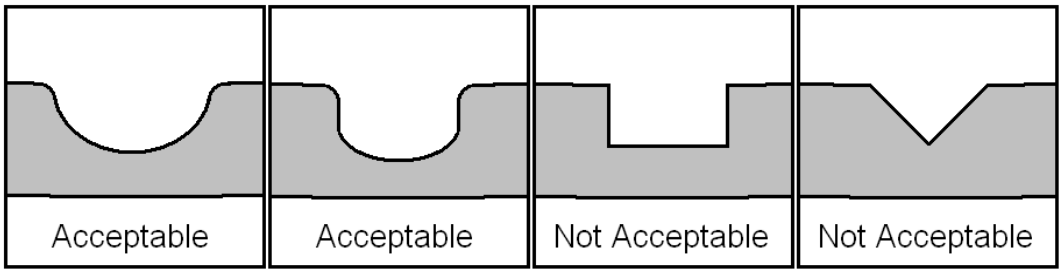


Figure 2: Acceptable Grooves

7.6.3 Installing Sleeves Over Pipe Welds and Seams: Grinding of the Cap

Operations Personnel or Company Approved Contractor follows the procedure below when installing sleeves over pipe girth welds, long seams or helical (spiral) seams by grinding the cap.

CAUTION:

- The Technical Operations Group must provide approval before removal of the weld cap for the purpose of fitting a sleeve.
- Do not grind the longitudinal seam weld on:
  - Pre 1970 or Low Frequency Electric resistance welded (ERW)
  - Single submerged arc welded (SSAW)
- Do not grind flush girth welds being spanned by a sleeve where the weld has not been X-rayed and the X-ray interpretation is acceptable per the latest edition of *API 1104* to verify its integrity. Never grind acetylene girth welds.

NOTE:

- Irregularities in the weld cap may be ground to a profile which is consistent with the remainder of the girth weld as long as the minimum weld cap height and smooth contour called for in the company welding procedures is maintained.
- When the integrity of the weld has been verified and the purpose of grinding is only for sleeve fit up, a more aggressive disc can be used. If preferred a solid ceramic "cutting" disc can be used.

Step	Activity
1	**VERIFY** the integrity of the seam using black and white magnetic particle inspection (MPI) and ultrasonic inspection prior to grinding.
2	**GRIND** the seam such that it is flush for approximately 2" beyond the end of the sleeve. Then angle the grind to reach the original weld cap profile. **CONTOUR** the weld to remove any sharp edges.

7.6.4 Installing Sleeves Over Helical (Spiral) Seams: Custom Manufactured Sleeve

Operations Personnel or Company Approved Contractor follows the procedure below when installing sleeves over spiral seams welds by using a custom manufactured sleeve.

NOTE: This method can result in a several day delay between the assessment and the repair while a sleeve is manufactured and delivered.

Step	Activity
1	**CONTACT** the Pipeline Integrity Group with the sleeve length, seam orientation, and outside diameter to find an acceptable sleeve manufacturer, if possible.
2	**VERIFY** the manufactured sleeve provides a tight fit-up over the defect area.

7.7 Welded Encirclement Sleeves: Specialty Steel Sleeves

Operations Personnel or Company Approved Contractor follows the procedure below when making repairs using a Specialty Steel Repair Sleeve.

STOP: Except for defects within 6 inches of a coupling, bend, or other oddity that prevents the installation of standard sleeves this section (and all "pumpkin" style sleeves) should not be used.

CAUTION:

- This section is limited to manufactured steel repair sleeves that do not adhere to the company standards for sleeve designs.
- Composite repair sleeves such as those made by Armor Plate® or Clock Spring® are covered in a separate section

NOTE:

- Consult with the Pipeline Integrity Group if any questions or concerns arise about the type of specialty sleeve being used.
- Examples of manufactured steel repair sleeves include, but are not limited to:
  - Pumpkins
  - Sleeves designed to fit over a coupling
  - Sleeves without a straight profile

Step	Activity
1	**FOLLOW** the steps, warnings, cautions, and notes to install a typical steel sleeve and any other manufacturer instructions.
2	If a coupling or other object is present **VERIFY** the sleeve has enough clearance to pass over the object and still fit tight at the ends.
3	**REFER** to any special instructions provided by the Director of Pipeline Integrity for the specific installation.

7.8 Composite Reinforcement Repairs

Operations Personnel follows the procedure below for performing Composite Reinforcement Repairs. Contact the Corrosion Specialists regarding Composite Sleeve repair option.

WARNING: Composite Repairs shall only be performed with approval from the Director of Pipeline Integrity and only approved manufacturers shall be utilized, which may include:

- Clock Spring Composite Sleeve by Clock Spring Company, L.P
- Armor Plate Pipe Wrap by Armor Plate, Inc.
- Aquawrap by Air Logistics Corporation
- PermaWrap by WrapMaster Inc.
- A+Wrap by Pipe Wrap, LLC

NOTE:

- All composite material repair sleeves are to be installed in accordance with the manufacturer's recommendation.
- All employees and or contractors which are directly participating in the installation of a composite material repair sleeve must be trained and certified by a composite material repair technique certified trainer.
- The composite repair must extend a minimum of two (2) inches beyond each end of the defective area.

Step	Activity
1	**FILL** all sharp geometry changes such as edges and lips with epoxy (as allowed by the manufacturer) to provide a smooth transition to the pipe and aid in coating.

2	**VERIFY** all composite repairs are appropriately identified with magnets or bands for ILI detection.

8.0 Documentation Requirements

Record data in electronic database or utilize the following form(s) as applicable:

Pipe Inspection Report or Maintenance Record
Project Book (Welding, NDE, Design, Inspectors notes, Etc.)
As-Built Drawings
I.05.D Pre-Job Safety Meeting;

9.0 References

HLB.11 Project Documentation and As-Built Process
HLD.47 Evaluation of Remaining Strength of Pipeline Metal Loss
HLI.06 Evaluating Pipeline Defects
HLI.10 Excavation and Backfill
HLI.11 Pipeline Pressure Limit Criteria
Safety Procedure S-020 Asbestos Removal and Maintenance
Coating Procedures Manual
Company Welding Procedures Manual

Appendix A: OQ Task Requirements

The table below identifies any Operator Qualification (OQ) task requirements for this SOP.

Task Description	OQ Task
Install mechanical clamps and sleeves -- bolted	PLOQ707
Apply Permanent field repair using composite materials - PermaWrap™ / WeldWrap™ (WrapMaster Products)	PLOQ706A
Apply Permanent field repair using composite materials - PipeWrap A+ Wrap™	PLOQ706B
Clockspring	PLOQ706C
Fabricate and fit-up repair sleeves	PLOQ708
Repair of steel pipe by grinding	PLOQ704
Visual Inspection of Welding and Welds	PLOQ203
Apply composite reinforcement products for repair of mechanically damaged or corroded pipe	PLOQ706

Appendix B: Company approved Permanent Repair method

DEFECT TYPE AND LOCATION		COMPANY APPROVED PERMANENT REPAIR METHODS (1) (8)					
		Repair By Grinding	Type A Sleeve (9) (11)	Type B Sleeve (10) (11)	Composite Reinforcement (12)	Mechanical Type B Sleeve	Mechanical Leak Clamp (12)
EXTERNAL METAL LOSS ≤ 80% W.T.	Pipe Seam	No	Yes (2)	Yes (2)	Yes (2)	Yes (3) (4)	No
	Girth Weld	No	Yes (2)	Yes (2)	Yes (2)	Yes (3) (4)	No
	Pipe Body	No	Yes (2)	Yes (2)	Yes (2)	Yes (3) (4)	No
	Pipe Bend	No	Yes (2)	Yes (2)	Yes (2)	Yes (3) (4)	No
EXTERNAL METAL LOSS > 80% W.T.	Pipe Seam	No	No	Yes (2)	No	Yes (3) (4)	No
	Girth Weld	No	No	Yes (2)	No	Yes (3) (4)	No
	Pipe Body	No	No	Yes (2)	No	Yes (3) (4)	No
	Pipe Bend	No	No	Yes (2)	No	Yes (3) (4)	No
INTERNAL METAL LOSS ≤ 80% W.T.	Pipe Seam	No	Yes (4)	Yes	Yes (4)	Yes (3) (4)	No
	Girth Weld	No	Yes (4)	Yes	Yes (4)	Yes (3) (4)	No
	Pipe Body	No	Yes (4)	Yes	Yes (4)	Yes (3) (4)	No
	Pipe Bend	No	Yes (4)	Yes	Yes (4)	Yes (3) (4)	No
INTERNAL METAL LOSS > 80% W.T.	Pipe Seam	No	No	Yes	No	Yes (3) (4)	No
	Girth Weld	No	No	Yes	No	Yes (3) (4)	No
	Pipe Body	No	No	Yes	No	Yes (3) (4)	No
	Pipe Bend	No	No	Yes	No	Yes (3) (4)	No
DENTS WITH STRESS CONCENTRATORS OR METAL LOSS	Pipe Seam	No	Yes (5) (2)	Yes (5)	Yes (5) (2)	Yes (3) (4) (5)	No
	Girth Weld	No	Yes (5) (2)	Yes (5)	Yes (5) (2)	Yes (3) (4) (5)	No
	Pipe Body	No	Yes (5) (2)	Yes (5)	Yes (5) (2)	Yes (3) (4) (5)	No
	Pipe Bend	No	Yes (5) (2)	Yes (5)	Yes (5) (2)	Yes (3) (4) (5)	No
PLAIN DENTS	Pipe Seam	No	Yes (2)	Yes (2)	Yes (2)	Yes (3) (4)	No
	Girth Weld	No	Yes (2)	Yes (2)	Yes (2)	Yes (3) (4)	No
	Pipe Body	No	Yes (2)	Yes (2)	Yes (2)	Yes (3) (4)	No
	Pipe Bend	No	Yes (2)	Yes (2)	Yes (2)	Yes (3) (4)	No
(GOUGES) MECHANICAL DAMAGE	Pipe Seam	Yes (13)	Yes (6) (2)	Yes (6)	Yes (6) (2)	Yes (3) (4) (6)	No
	Girth Weld	Yes (13)	Yes (6) (2)	Yes (6)	Yes (6) (2)	Yes (3) (4) (6)	No
	Pipe Body	Yes (13)	Yes (6) (2)	Yes (6)	Yes (6) (2)	Yes (3) (4) (6)	No
	Pipe Bend	Yes (13)	Yes (6) (2)	Yes (6)	Yes (6) (2)	Yes (3) (4) (6)	No
SURFACE BREAKING LINEAR INDICATIONS	Pipe Seam	Yes (13)	Yes (7) (2)	Yes	Yes (7) (2)	Yes (3) (4)	No
	Girth Weld	Yes (13)	Yes (7) (2)	Yes	Yes (7) (2)	Yes (3) (4)	No
	Pipe Body	Yes (13)	Yes (7) (2)	Yes	Yes (7) (2)	Yes (3) (4)	No
	Pipe Bend	Yes (13)	Yes (7) (2)	Yes	Yes (7) (2)	Yes (3) (4)	No
LEAKS	Pipe Seam	No	No	Yes	No	Yes (3) (4)	No
	Girth Weld	No	No	Yes	No	Yes (3) (4)	No
	Pipe Body	No	No	Yes	No	Yes (3) (4)	Yes (4) (14)
	Pipe Bend	No	No	Yes	No	Yes (3) (4)	Yes (4) (14)
WELD FLAWS	Pipe Seam	No	No	Yes	No	Yes (3) (4)	No
	Girth Weld	No	No	Yes	No	Yes (3) (4)	No
WRINKLES (1)	All	No	No	No	Yes	No	No
ARC BURN/HARD SPOT	Pipe Body	Yes (13)	Yes (5)	Yes	Yes (5)	Yes (3) (4)	No
OBSOLETE MATERIALS (1)	All	No	No	No	No	No	No
LAMINATION	Pipe Body	No	Yes	Yes	Yes	Yes (3) (4)	No
	Pipe Bend	No	Yes	Yes	Yes	Yes (3) (4)	No

Table-01 Company Approved Permanent Repair Method

Notes for Table-01

The following notes apply to the *Table 1*:

1. Pipe replacement should be performed whenever practical, other repairs may acceptable with approval from the Pipeline Integrity Group.
2. A hardenable, incompressible filler shall be used to fill the annular space between the anomaly and the sleeve.
3. Shall only be utilized offshore or within navigable waters.
4. May be utilized on onshore pipelines as a temporary repair until it is feasible to make a permanent repair.
5. Stress concentrators will be removed by grinding prior to installing the sleeve. If no grinding is performed or the stress concentrators are not completely removed, then a Type B sleeve shall be used.
6. The mechanical damage will be removed by grinding to a smooth contour prior to installing the sleeve. If the remaining thickness is less than 20% W.T. after removal, then a Type B sleeve shall be used. If no grinding is performed or the stress concentrators are not completely removed, then a Type B sleeve shall be used.
7. The SCC shall be removed by grinding. If the remaining thickness is less than 20% W.T. after removal, then a Type B sleeve shall be used.
8. Other repair methods may be used provided they are based on sound engineering practices and reviewed and approved by Pipeline Integrity prior to their use.
9. Type A repair sleeves are designed not to be pressure containing and shall only be used on non-leaking defects. The ends of the sleeve shall be sealed to prevent migration of water between the sleeve and the carrier pipe.
10. Type B repair sleeves are designed to contain pressure and/or carry substantial longitudinal stress imposed on the pipeline by lateral loads. The circumferential ends of the sleeve are fillet-welded to the carrier pipe.
11. The design of all Type A and Type B sleeves shall be reviewed by Engineering.
12. Only with approval from the Pipeline Integrity Group and only approved manufacturers shall be utilized.
13. With prior approval from the Pipeline Integrity Group, Grinding is permitted to a depth of 10% of the required wall thickness with no limit on length or; Grinding is permitted to a depth greater than 10% up to a maximum of 40% of the required wall thickness with metal removal confined to a length given by the equation in paragraph 851.42 of ASME B31.8-2003.
14. For isolated through wall pits only

ENERGY TRANSFER

Evaluating Pipeline Defects

Standard Operating Procedures

Applicable to Hazardous Liquids Pipelines and Related Facilities

Code Reference :	**Procedure No.: HLI.06**	
49 CFR: 195.452	***Effective Date: 04/01/18***	**Page 1 of 18**

1.0 Procedure Description

This Standard Operating Procedure (SOP) describes the steps required to consistently characterize and evaluate defects in a pipeline.

2.0 Scope

This SOP determines the characteristics of pipeline defects required to verify integrity and necessity for repair or replacement.

3.0 Applicability

This SOP applies to the characterization of any defect affecting the integrity of pipeline facilities.

4.0 Frequency

As required: Upon discovery of pipeline defects.

5.0 Governance

The following table describes the responsibility, accountability, and authority of the operations described in this SOP.

Function	Responsibility	Accountability	Authority
All Operations	Operations Personnel	Pipeline Integrity Personnel or Corrosion Specialist	Vice President of Pipeline Integrity

6.0 Terms and Definitions

Terms associated with this SOP and their definitions follow in the table below. For general terms, refer to *SOP* HL*A.01 Glossary and Acronyms*.

Terms	Definitions
Arc burn	A hard spot or gouge caused by the arc of a welding tool or any unknown source.
Constrained Dent	A dent that is not free to rebound or reround, because the indenter is not removed (a rock dent is an example of a constrained dent).
Crack	A fracture type discontinuity in the pipe wall with sharp tips.
Dent	Permanent deformation of circular cross section produces a decrease in diameter and is concave inward.

Terms	**Definitions**
Dent involving a weld	Any dent that involves either a longitudinal or girth weld.
Dent with metal loss	A dent with metal loss that is associated with; scratches, gouges, grooves, or corrosion.
Gouges and other metal loss	Scratches, gouges, mill pits, grinding marks
HAZ	Heat affected zone
Lamination	An internal metal separation that creates layers in the pipe wall which are generally parallel to the longitudinal axis of the pipe surface
Longitudinal seam weld anomaly	Any anomaly that is caused by, constrained to, or specific to, the longitudinal weld. Anomalies vary based on weld type but may result from manufacturing or be time dependent such as: Hook cracks, Inclusions, Lack of fill, Lack of fusion, Porosity, Selective seam weld corrosion, Toe crack, Undercut, or others.
Other defects	Any defect that doesn't meet the characteristics of the above referenced defects but may impact the serviceability of the pipeline
Ovality	A flattening of the pipe in which the circular cross section becomes elliptical (ovular); and where the length is typically significantly greater than the ovality percent. This is caused by outside forces and may be due to land movement or heavy loading across the line.
Plain Dent	A depression that produces a disturbance in the curvature of the pipe wall without reducing wall thickness that does not interact with any other anomalies such as corrosion, gouges, hard spots, or linear indications.
Stress Corrosion Crack (SCC)	A crack or colony of cracks in the pipe wall that are classified as being environmentally assisted. SCCs are generally, but not always, associated with piping that meets the criteria identified in ASME B31.8 S
Surface breaking linear indication	A linear accumulation of magnetic powder on the surface of the pipe body found using magnetic particle inspection in accordance with *SOP HLD.45 Wet Magnetic Particle Inspection*.
Weld defect	Weld defects are characterized as, but not limited to, the following: Porosity, wormholes, slag, inclusions, cavities, cracking, lack of fusion, or undercut.
Wrinkle	A circumferential pipe deformation found on the inside bend radius of a pipe caused during the construction process to obtain pipeline alignment.

7.0 Evaluating Pipeline Defects

This section describes these procedures for evaluating pipeline defects:

- Evaluation
- Corrosion, general metal loss, and wall thickness deviations
- Gouges and other metal loss
- Plain Dents
- Dents with metal loss
- Dents involving welds
- Inclusions
- Laminations
- Surface breaking linear indications
- Stress corrosion cracks
- Longitudinal seam weld defects
- Wrinkles
- Internal metal loss
- Obsolete materials or installations, and other defects
- Arc burns
- Ovality

7.1 Evaluation

Perform the following process in order to evaluate defects in pipelines.

Step	Task
1	**CHARACTERIZE** defects in the pipeline in order to determine the extent to which the serviceability of the pipeline has been impaired.
2	**ESTABLISH** inspection pressure reduction per *SOP HLI.11 Pipeline Pressure Limit Criteria*. **CONFIRM** pressure reductions required for all pipeline segments.
3	If there is a question regarding the characterization of a defect, **CONSULT** with the Pipeline Integrity Group
4	**EVALUATE** defects based upon one or a combination of the methods described in this SOP.
5	**CONFIRM** all evaluations of pipeline corrosion, damage, or other defects.

NOTE: Establish a safe excavation per *SOP HLI.10 Excavation and Backfill*.

7.2 Corrosion, General Metal Loss, and Wall Thickness Deviations

Operations Personnel or Company Approved Contractor / Pipeline Integrity Group follows the steps below to evaluate corrosion, general metal loss, and wall thickness deviations.

Step	Activity
1	**CHARACTERIZE** a defect with the single characteristic of a measurable reduction in wall thickness as "corrosion or general metal loss."
2	**EVALUATE** external corrosion and general metal loss defects in the pipe wall, girth welds, and longitudinal seams in accordance with *SOP HLD.47 Evaluation of Remaining Strength of Pipe with Metal Loss.*
3	**CONFIRM** defect characterization and evaluation with Corrosion Specialist.
4	**REPAIR** external corrosion and general metal loss if required per *SOP HLI.05 Pipeline Repair*.

NOTE: For pre-1970 Electric Resistance Welded (ERW) pipe confirm that the corrosion is not in the seam, use Ammonium Persulfate to identify the seam if necessary. Pre-1970 ERW and Electric Flash Welded (EFW) pipe with corrosion damage interacting with the seam or HAZ and penetrating deeper than the pipe wall cannot be assessed using remaining strength calculations and must be repaired.

7.3 Gouges and Other Metal Loss

Operations Personnel or Company Approved Contractor / Pipeline Integrity Group follows the steps below to evaluate gouges and other metal loss.

Step	Activity
1	**INSPECT** and **EVALUATE** metal loss defects in the pipe (i.e., scratches, gouges, mill pits, grinding marks, etc.) to determine the extent of damage.
2	If the extent of the damage is limited to a general reduction in wall thickness, **CHARACTERIZE** the defect as "corrosion or general metal loss," and **EVALUATE** the defect per *SOP HLD.47 Evaluation of Remaining Strength of Pipe with Metal Loss*.
3	If any of the following characteristics exist that may impair the serviceability of the pipe, **CHARACTERIZE** the defect as a "gouge or other metal loss defect": • Sharp defect edges • Stress concentrators • Hard spots • Cracking • Plastically deformed material
4	**CONSIDER** using Ammonium Persulfate to **INSPECT** for a hard spot.
5	**USE** magnetic particle inspection (MPI) to inspect for linear indications according to *SOP HLD.45 Wet Magnetic Particle Inspection*. Dye penetrant inspection (DPI) or other NDE Methods may be permitted as directed by Corrosion Specialist or Pipeline Integrity Group.

Step	Activity
6	**CONFIRM** defect characterization and evaluation with company Corrosion Specialist.
7	**REPAIR** defect per *SOP HLI.05 Pipeline Repair*.

NOTE: If mechanical damage involving a dent or gouge is suspected, take a pressure reduction according to *SOP HLI.11 Pipeline Pressure Limit Criteria*.

7.4 Plain Dents

Operations Personnel or Company Approved Contractor follows the steps below to evaluate plain dents.

Step	Activity
1	**CHARACTERIZE** a depression that produces a disturbance in the curvature of the pipe wall without reducing the pipe wall thickness as a "dent with no metal loss."
2	**MEASURE** the depth of a dent from the lowest point of the depression to a straight line representing the original contour of the pipe.

CAUTION: Do not use MFL data to determine the depth of a dent.

Step	Activity
3	**INSPECT** for hard spots using Ammonia Persulfate or other acid etching method.
4	**INSPECT** and **EVALUATE** all excavated dents with magnetic particle inspection (MPI) for the presence of linear indications. Dye penetrant inspection (DPI) or other NDE Methods may be permitted as directed by Corrosion Specialist or Pipeline Integrity Group. If linear indications are evident or if there is a concern that the dent has been prestrained or has "re-rounded," **REPAIR** the section of pipe containing the dent per *SOP HLI.05 Pipeline Repair*.
5	For all dents in pipe containing a dent that measures more than ¼ inch deep in pipe less than or equal to 12 inches diameter, or which measures more than 2% of the nominal pipe diameter in pipe over 12 inches diameter, **REPAIR** pipe per *SOP HLI.05 Pipeline Repair*.
6	**DETERMINE** if the dent was constrained prior to excavation. **REPAIR** all constrained dents per *SOP HLI.05 Pipeline Repair* regardless of depth.
7	**DOCUMENT** characterizations and evaluations in the Pipe Inspection Report or Maintenance Record.

NOTE: If mechanical damage involving a dent or gauge is suspected, take a pressure reduction according to *SOP HLI.11 Pipeline Pressure Limit Criteria*.

7.5 Dents with Metal Loss

Operations Personnel or Company Approved Contractor follows the steps below to evaluate dents with metal loss.

NOTE: Dents containing metal loss include those that are scratched, gouged, grooved, or corroded.

Step	Activity
1	**MEASURE** the depth of a dent from the lowest point of the depression to a straight line representing the original contour of the pipe.
2	**EVALUATE** metal loss in accordance with *SOP HLD.47 Evaluation of Remaining Strength of Pipe with Metal Loss*
3	**CHARACTERIZE** a depression that produces a disturbance in the curvature of the pipe wall and has reduction the pipe wall thickness as a "dent with metal loss."
4	**INSPECT** for hard spots using Ammonia Persulfate or other acid etching method.
5	**INSPECT** and **EVALUATE** all excavated dents with magnetic particle inspection (MPI) for the presence of linear indications. Dye penetrant inspection (DPI) or other NDE Methods may be permitted as directed by Corrosion Specialist or Pipeline Integrity Group.
6	**DOCUMENT** characterizations and evaluations in the Pipe Inspection Report or Maintenance Record.
7	**REPAIR** defect per *SOP HLI.05 Pipeline Repair*.

7.6 Dents Involving Welds

Operations Personnel or Company Approved Contractor follows the steps below to evaluate dents involving welds.

Step	Activity
1	**MEASURE** the depth of a dent from the lowest point of the depression to a straight line representing the original contour of the pipe.
2	**INSPECT** for hard spots using Ammonia Persulfate or other acid etching method.
3	**INSPECT** and **EVALUATE** all excavated dents with magnetic particle inspection (MPI) for the presence of linear indications. Dye penetrant inspection (DPI) or other NDE Methods may be permitted as directed by Corrosion Specialist or Pipeline Integrity Group.
4	**REPAIR** any pipe with a dent involving a longitudinal seam or girth weld,

Step	Activity
	per *SOP HLI.05 Pipeline Repair*.
5	Each weld that is repaired must have the defect removed down to sound metal and the segment to be repaired must be preheated if conditions exist which would adversely affect the quality of the weld repair. After repair, the segment of the weld that was repaired must be inspected to ensure its acceptability.
6	**DOCUMENT** characterizations and evaluations in the Pipe Inspection Report or Maintenance Record.

7.6.1 Dents with Linear Indications

Operations Personnel or Company Approved Contractor follow the steps below to evaluate dents that have been further characterized as dents with linear indications.

Step	Activity
1	**INSPECT** and **EVALUATE** all excavated dents with magnetic particle inspection (MPI) for the presence of linear indications. Dye penetrant inspection (DPI) or other NDE Methods may be permitted as directed by Corrosion Specialist or Pipeline Integrity Group.
2	**CHARACTERIZE** a depression that produces a disturbance in the curvature of the pipe wall and that has a linear indication (as found with Magnetic Particle Inspection) as a "dent with linear indication."
3	**EVALUATE** and **CONFIRM** if the linear indication can be removed by grinding in accordance with *SOP HLI.05 Pipeline Repair*. If removed, **TREAT** the remaining dent as a dent with metal loss.
4	**REPAIR,** per *SOP HLI.05 Pipeline Repair*, any pipe with dents containing a linear indication (that cannot be removed by grinding).
5	**DOCUMENT** characterizations and evaluations in the Pipe Inspection Report or Maintenance Record.

7.7 Inclusions

Operations Personnel or Company Approved Contractor follows the steps below to determine and evaluate inclusions.

WARNING:	An inclusion does not normally affect the integrity of the material. However, do not perform welding on an area of material with known inclusion defects.

Step	Activity
1	**CHARACTERIZE** a metallic or non-metallic solid material trapped within the wall of the pipe or weld metal as an inclusion
2	**EVALUATE** inclusions thoroughly using ultrasonic inspection or other methods.

Step	Activity
3	**COORDINATE** the determination of the evaluation method with the QA/QC Group.
4	**DOCUMENT** characterizations and evaluations in the Pipe Inspection Report or Maintenance Record.

7.8 Laminations

Operations Personnel or Company Approved Contractor / Pipeline Integrity Department follows the steps below to determine, evaluate and repair laminations.

Step	Activity
1	**CHARACTERIZE** an internal metal separation creating layers generally parallel to the pipe surface as a lamination.
2	**EVALUATE** material adjacent to a lamination to verify that no additional defects exist. **MEASURE** the dimensions of the lamination using *SOP HLI.34 Use of Ultrasonic Thickness Equipment for Measurement of Wall Thickness*.
3	**CHARACTERIZE** a lamination that is greater than 12 square inches in total area as potentially impairing the serviceability of the pipeline. **CONTACT** the Pipeline Integrity Group if this criteria is met.
4	**REPAIR** laminations that may impair the serviceability of the pipeline per *SOP HLI.05 Pipeline Repair*.
5	**DOCUMENT** characterizations and evaluations in the Pipe Inspection Report or Maintenance Record.

CAUTION: Welding and flame cutting should not be performed on areas of material with known laminations.

7.9 Surface Breaking Linear Indications

Operations Personnel or Company Approved Contractor follows the steps below to determine, evaluate, and repair linear indications.

Step	Activity
1	**CHARACTERIZE** a fracture type discontinuity with sharp tips as cracking linear indication.
2	**MEASURE** and **EVALUATE** the length of cracks with wet magnetic particle inspection (MPI) or dye penetrant inspection (DPI) as directed by Corrosion Specialist or Pipeline Integrity Group.
3	**REPAIR** cracks that threaten the serviceability of the pipeline per *SOP HLI.05 Pipeline Repair*.
4	**DOCUMENT** characterizations and evaluations in the Pipe Inspection Report or Maintenance Record.

NOTE: A crack in an existing girth weld can be repaired provided the length of the crack is less than 8% of the weld length.

7.10 Stress Corrosion Cracks (SCC)

Operations Personnel or Company Approved Contractor / Pipeline Integrity Group follows the steps below to determine, evaluate, and repair stress corrosion cracks.

Step	Activity
1	**IDENTIFY** a group of linear indications as suspected Stress Corrosion Cracking (SCC).
2	**CONTACT** Pipeline Integrity Group when evidence of Stress Corrosion Cracking (SCC) is discovered.
3	**EVALUATE** stress corrosion cracks with a wet magnetic particle inspection (MPI) or dye penetrant inspection (DPI) as directed by Corrosion Specialist or Pipeline Integrity Group.
4	**REPAIR** stress corrosion cracks per *SOP HLI.05 Pipeline Repair*.
5	**DOCUMENT** characterizations and evaluations in the Pipe Inspection Report or Maintenance Record.

7.11 Longitudinal Seam Weld Defects

Operations Personnel or Company Approved Contractor / Pipeline Integrity Group follows the steps below to characterize and evaluate longitudinal seam weld defects.

Step	Activity
1	**CHARACTERIZE** and evaluate weld defects with appropriate visual and Non-Destructive Testing (NDT) inspection. **REFER** to Appendix C for seam type clarification. For girth weld indications **REFER** to the welding manual.
2	**EVALUATE** long seam indication in accordance with API5L.
3	**CONTACT** the Pipeline Integrity Group for acceptance criteria and repair methods for weld defects found in specific types of longitudinal welds.
4	**REPAIR** in accordance with *SOP HLI.05 Pipeline Repair*.
5	**DOCUMENT** characterizations and evaluations in the Pipe Inspection Report or Maintenance Record.

7.12 Wrinkles

Operations Personnel or Company Approved Contractor / Pipeline Integrity Group follows the steps below to characterize and evaluate wrinkles.

Step	Activity
1	**CHARACTERIZE** an irregular waiver in the pipe with a ripple height (d) to

Step	Activity
	pipe diameter (D) ratio <= 0.01 when measured with a 6” long straight edge oriented longitudinally, as a wrinkle.
2	**NOTIFY** the Pipeline Integrity Group
3	**REPAIR** defect in accordance with *SOP HLI.05 Pipeline Repair*.
4	**DOCUMENT** characterizations and evaluations in the Pipe Inspection Report or Maintenance Record.

7.13 Internal Metal Loss

Operations Personnel or Company Approved Contractor / Pipeline Integrity Department characterizes the location where internal metal loss is discovered or an anomaly is indicated by inline inspection tool.

Step	Activity
1	**EVALUATE** the defect in accordance with *SOP HLD.47 Evaluation of Remaining Strength of Pipe with Metal Loss* as directed by Pipeline Integrity Department.
2	**REPAIR** defect in accordance with *SOP HLI.05 Pipeline Repair*.
3	**DOCUMENT** characterizations and evaluations in the Pipe Inspection Report or Maintenance Record.

7.14 Obsolete Materials or Installations & Other Defects

Operations Personnel or Company Approved Contractor follows the steps below to evaluate obsolete materials or installations, or other defects that do not fall under a standard category.

NOTE:

- Examples may include miter welds greater than 3 degrees, branch tees with weld pads, patches, and orange peel.
- An existing facility that was constructed using materials or methods that are no longer considered acceptable practice may need to be replaced.

Step	Activity
1	**CONTACT** the Pipeline Integrity Group or QA/QC Group
2	**DEVELOP** repair plan in accordance with *SOP HLI.05 Pipeline Repair*.
3	**DOCUMENT** characterizations and evaluations in the Pipe Inspection Report or Maintenance Record.

7.15 Arc Burns

Operations Personnel or Company Approved Contractor / Pipeline Integrity Group follows the steps below to evaluate arc burns.

Step	Activity
1	**CHARACTERIZE** a hard spot or a hard spot and gouge caused by the arc of a welding tool or any unknown source as an "arc burn."
2	**INSPECT** and **EVALUATE** the area visually for metal damage and signs of significant metallurgical changes at the location of the arc burn.
3	**CONTACT** Corrosion Specialist or Pipeline Integrity Group for an Ammonium Persulfate etch procedure and criterion for arc burn assessment if needed. If necessary, **USE** a 20% Ammonium Persulfate etch to assess the metallurgical effects of an arc burn.
4	As directed by Corrosion Specialist or Pipeline Integrity Group, **EVALUATE** an arc burn with magnetic particle (MP) in order to inspect for cracking. **USE** wet magnetic particle inspection (MPI) to verify the presence of potential cracking due to hardness. Dye penetrant inspection (DPI) or other NDE Methods may be permitted as directed by Corrosion Specialist or Pipeline Integrity Group.
5	If visual and magnetic particle inspection determines the arc burn to be non-injurious, **CONSULT** with the Pipeline Integrity Group to determine if the defect can be removed by grinding or filing.
6	If an arc burn has caused apparent damage that could be detrimental to the integrity of the pipe, **REPAIR** the arc burn per *SOP HLI.05 Pipeline Repair*.

NOTE: Arc burn damage that may be detrimental to the integrity of the pipe includes but is not limited to:

- Cracking
- Metal loss
- Hardness levels
- Stress concentrators

7.16 Ovality

Operations Personnel or Company Approved Contractor / Pipeline Integrity Group follows the steps below to evaluate ovalities.

Step	Activity
1	**CHARACTERIZE** ovality as any flattening of the pipe that occurs on opposite sides of the circumference in a relatively uniform manner over a long distance. (I.e. The pipe is flattened at 12:00 and 6:00, and expanded at 3:00 and 9:00, for an entire joint.)
2	**CONTACT** the Pipeline Integrity Group to determine if it needs to be repaired in accordance with *SOP HLI.05 Pipeline Repair*.
3	**DOCUMENT** characterizations and evaluations in the Pipe Inspection Report

	or Maintenance Record.

8.0 Documentation Requirements

Record data in electronic database or utilize the following forms as applicable:

Pipe Inspection Report or Maintenance Record; retain on location for the life of the facility.

9.0 References

HLD.47 Evaluation of Remaining Strength of Pipe with Metal Loss
HLD.45 Wet Magnetic Particle Inspection
HLI.05 Pipeline Repair
HLI.10 Excavation and Backfill
HLI.11 Pipeline Pressure Limit Criteria
HLI.34 Use of Ultrasonic Thickness Equipment for Measurement of Wall Thickness

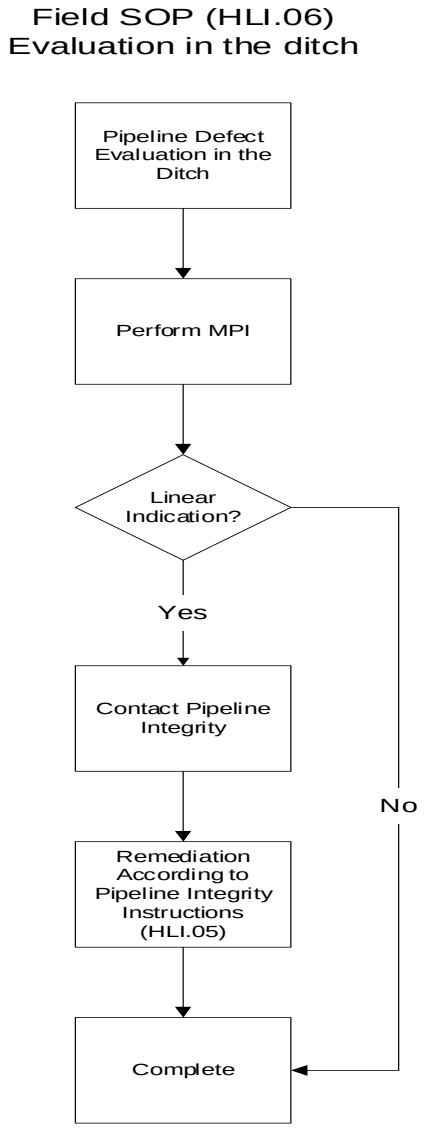
Appendix A: OQ Task Requirements

The table below identifies the Operator Qualification (OQ) task requirements for this SOP.

Task Description	OQ Task
Measure and evaluate pipeline defects.	PLOQ418A
Demonstrate proper use of Pipe Thickness Gauge (Ultrasonic)	PLOQ008
Visual Inspection of Welding and Welds	PLOQ203
Utilize Wet Mag Particle Inspection to identify cracks	PLOQ205
Visual Inspection for Internal Corrosion	PLOQ401
Visual Inspection for Atmospheric Corrosion	PLOQ414
Demonstrate the use of a pit gauge	PLOQ421

Appendix B: Flow Chart for Linear Indications in the Ditch

The figure below identifies the process for evaluating linear indications in the Ditch.



Appendix C: Longitudinal Seam Identification

This appendix should be used to identify longitudinal welds in the field and determine anomalies specific to each type of weld.

Double Submerged Arc Welding (DSAW) – formed through the deposition of a weld metal on both the outside and inside surface. Single Submerged Arc Welding (SSAW), where the pipe is only welded from the outside surface, is almost never used for longitudinal seams. Typical anomalies include (but are not limited to) lack of fusion, toe cracks, HAZ cracks, porosity, inclusions, and lack of fill.

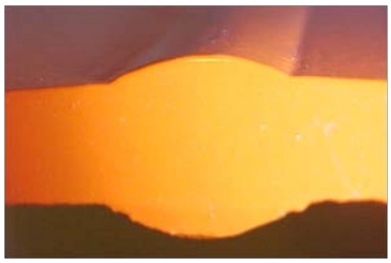


Figure 1. Actual DSAW Long Seam

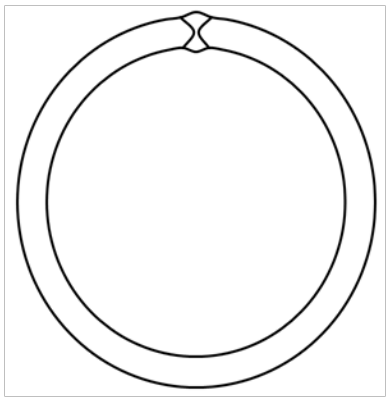


Figure 2. DSAW Profile

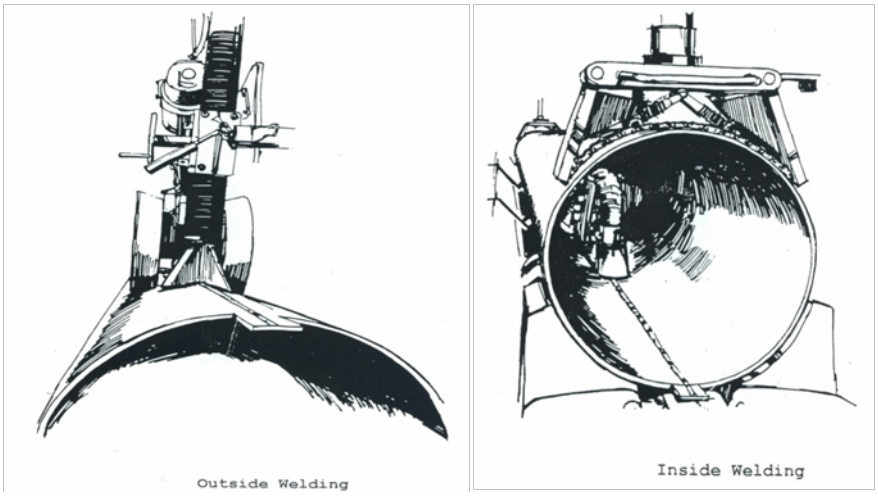


Figure 3. Manufacturing Process for Lap Weld

(Image from History of Line Pipe Manufacturing in North America)

Electric Resistance Welding (ERW) – formed by passing a current through the pipe effectively melting the two sides together without the use of any additional weld material. Any cap or excess metal resulting from the process is trimmed flush with the pipe making identification difficult in the field. Typical anomalies include (but are not limited to) lack of fusion, HAZ cracks, and contact marks.

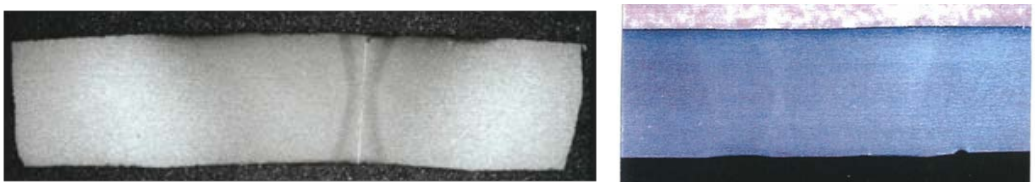


Figure 4. Actual ERW Long Seams

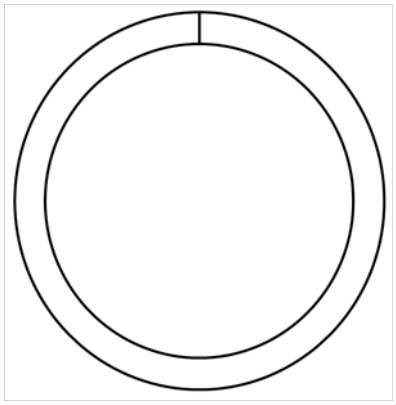


Figure 5. ERW Profile

Electric Flash Welding (EFW) – formed similarly to ERW by passing a current through the pipe effectively melting the two sides together without the use of any additional weld material. This was only produced by the A.O. Smith Company and is characterized by a cap that is trimmed squarely. Typical anomalies include (but are not limited to) lack of fusion, HAZ cracks, and selective seam corrosion.

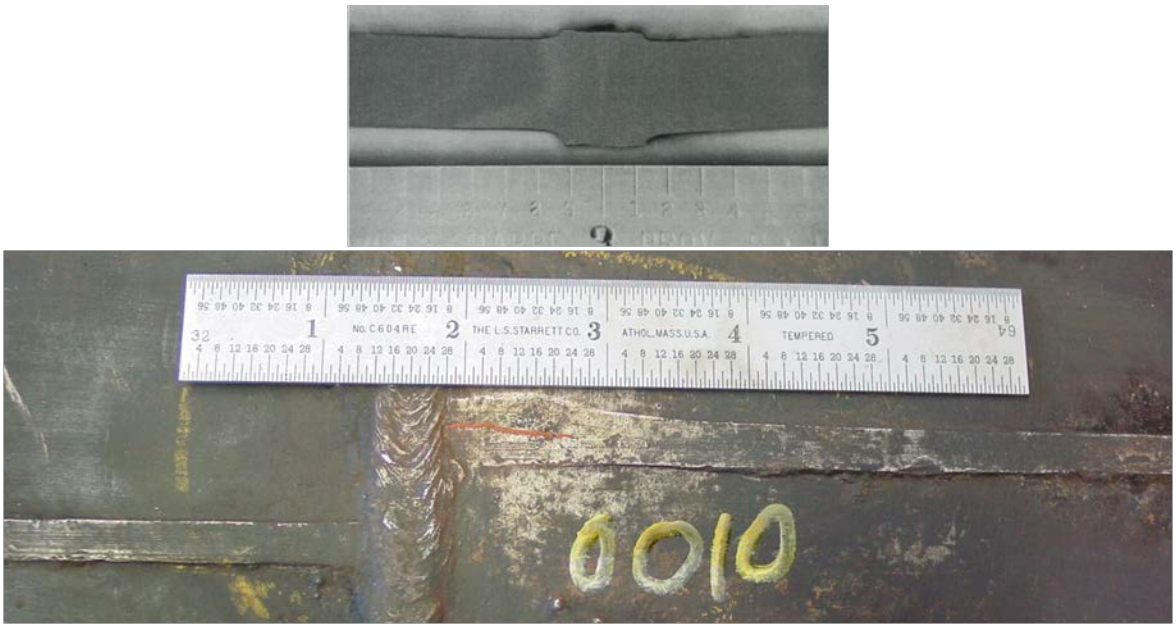


Figure 4. Actual EFW Long Seams

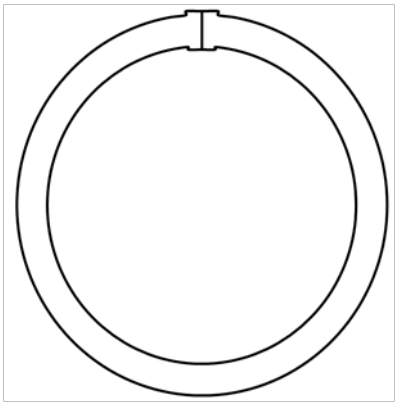


Figure 5. EFW Profile

Lap Welding – formed by trimming the edges of the plate at an angle and then overlaying them, this provides for a larger surface area to be welded. No additional weld material is used and the weld is formed by heating the entire plate and forcing it between rollers that press it together. Typical anomalies include (but are not limited to) lack of fusion.

Figure 6. Manufacturing Process for Lap Weld

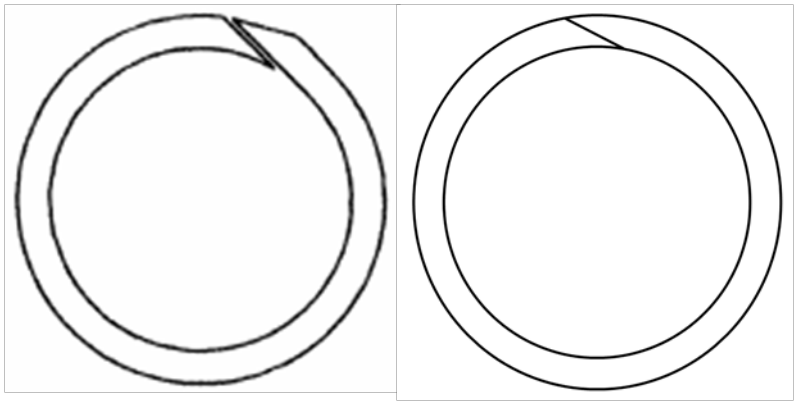


Figure 7. Lap Weld Profile Before and After Forming

Hammer Welding – formed by heating and overlaying the ends of the plate and then beating them down to the wall thickness of the pipe. This provided for a larger surface area to be welded. No additional weld material is used. Typical anomalies include (but are not limited to) lack of fusion.

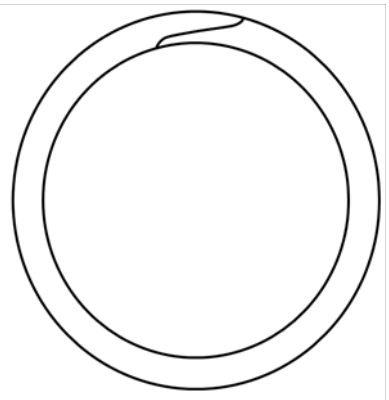


Figure 8. Hammer Weld Profile

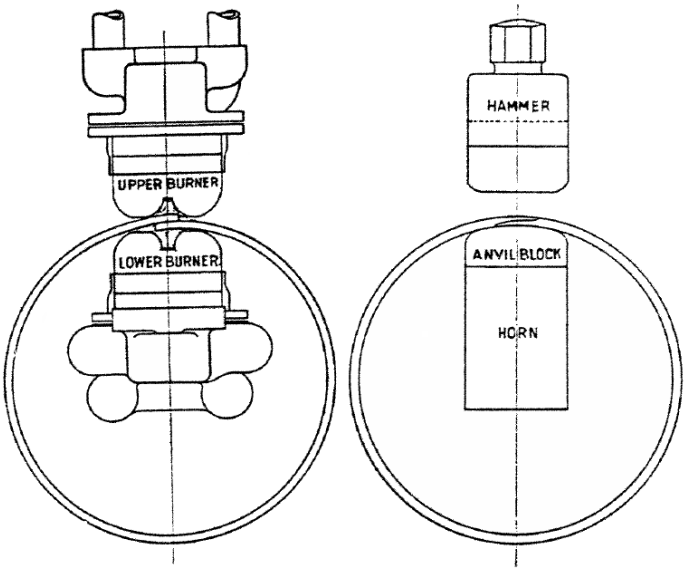


Figure 9. Manufacturing Process for Hammer Weld

(Image from History of Line Pipe Manufacturing in North America)

ENERGY TRANSFER

Lowering or Raising In-Service Pipelines

Standard Operating Procedures

Applicable to Hazardous Liquids Pipelines and Related Facilities

Code Reference :	**Procedure No.: HLI.08**	
49 CFR 195.424, API 1117	***Effective Date: 04/01/18***	**Page 1 of 25**

1.0 Procedure Description

This Standard Operating Procedure (SOP) describes how to lower or raise, a liquids pipeline due to soil erosion, road crossings, cultivation, shorted casings, subsidence, or other reasons. This SOP also establishes guidelines to prevent over-stressing operating pipelines when lifting.

2.0 Scope

This procedure satisfies the requirement for lowering and raising in-service pipelines in a safe manner.

3.0 Applicability

This SOP is utilized during pipeline lowering or raising operations to minimize stresses and protect pipe and coating from damage.

4.0 Frequency

As required for lowering and/or raising in-service pipelines.

5.0 Governance

The following table describes the responsibility, accountability, and authority of the operations described in this SOP.

Function	Responsibility	Accountability	Authority
All Operations	Operations Personnel	Operations Manager	Area Director

6.0 Terms and Definitions

Terms associated with this SOP and their definitions follow in the table below. For general terms, refer to *SOP HLA.01 Glossary and Acronyms*.

Terms	Definitions
Strain Gauge	Instrument used to monitor stress induced by pipeline movement.

7.0 Lowering or Raising In-Service Pipelines

The following procedures are described in this section:

- Evaluating the Potential for Lowering a Pipeline
- Developing a Lowering Plan and Profile
- Excavation of the Pipeline
- Inspecting the Exposed Pipeline
- Final Preparations for Lowering the Pipeline
- Performing the Lowering Operation
- Lifting Pressurized Pipelines Using Air Bags

7.1 Evaluating the Potential for Lowering a Pipeline

Operations Personnel use the following procedure to evaluate the potential for lowering a pipeline.

CAUTION:

A. No movement of any line pipe may be performed unless the pressure in the line is reduced to not more than 50% of the MOP.

B. No operator may move any pipeline containing highly volatile liquids where materials in the line section involved are joined by welding unless:
   1. Movement when the pipeline does not contain highly volatile liquids is impractical
   2. The procedures of the operator under 195.402 contain precautions to protect the public against the hazard in moving pipelines containing highly volatile liquids, including the use of warnings, where necessary, to evacuate the area close to the pipeline; and
   3. The pressure in that line section is reduced to the lower of the following: (Note: If this requirement cannot be achieved the line shall be removed from service)
      i. 50% or less of the MOP; or
      ii. The lowest practical level that will maintain the highly volatile liquid in a state with continuous flow but not less than 50 psig above the vapor pressure of the commodity

C. No operator may move any pipeline containing highly volatile liquids where materials in the line section involved are not joined by welding unless:
   1. The operator complies with the paragraph B 1 & 2 above.
   2. The line section is isolated to prevent the flow of highly volatile liquid

Step	Activity
1	**ANALYZE** various considerations carefully to determine whether this type of modification is appropriate.
2	**UNDERSTAND** the special considerations for coupled pipelines, including allowable length of line where overburden may be removed and sleeving unreinforced couplings U/S and D/S of the work location.
3	If the stress levels are expected to exceed the allowable stresses, **CUT** and

Step	Activity
	LOWER the pipeline, or **REPLACE** the pipe section in accordance with *SOP HLI.01 Pipeline Shutdown and Startup*.

NOTE:	By cutting the pipe, the elongation stress and possibly some of the thermal stress is removed; however, the bending and other remaining stresses should still be analyzed.

Step	Activity
4	**CONSULT** Pipeline Integrity, Liquid Technical Operations, or Engineering Department to **PERFORM** a structural evaluation of the section to be lowered as outlined Section 7.2 below or other literature on lowering pipelines such as API 1117.
5	If the pipeline is located in hilly terrain, **CONDUCT** a survey of the existing profile.

NOTE:	In flat areas, a USGS quadrangle map is sufficient with field verification.

Step	Activity
6	**LOCATE** skids, pre-tested repair pipe, river weights, and other materials. **VERIFY** that these are available for the lowering project.
7	**CONSULT** Pipeline Integrity, Liquid Technical Operations, or Engineering to determine a safe operating pressure for the lowering or raising or horizontal adjustment of the pipeline.

7.2 Developing a Lowering Plan and Profile

The Operations Personnel uses the following procedure to develop a lowering plan and profile.

Step	Activity
1	**DEVELOP** a final “Lowering Profile” and “Lowering Plan” after the proposed lowering is evaluated and a decision is made to lower the pipeline while in service.
2	**DETERMINE** the strain levels in the “Lowering Plan” for lowering associated with mining subsidence or for other lowering projects where strain gauges are installed.
3	**REVIEW** anomaly data for any anomalies that would be adversely affected if not repaired and/or removed.
4	**OBTAIN** written approval of these plans prior to any lowering related activities from an Engineer from Pipeline Integrity, Engineering, or Liquid Technical Operations.

7.3 Excavation of the Pipeline

Operations Personnel use the following procedure to excavate the pipeline for the purpose of lowering or raising in-service pipelines.

Step	Activity
1	**EXCAVATE** the full length of pipe to be lowered, plus a minimum of 25 feet on either end in accordance with *SOP HLI.10 Excavation and Backfill* with the ditch sloped properly for personnel working in the ditch.
2	**CONSIDER** the support of heavy equipment working on the ditch bank.

CAUTION: Do not lower an in-service coupled pipelines without a detailed work plan considering pressure reduction and reinforcing mechanical couplings

Step	Activity
3	**EXCAVATE** the trench to at least the ditch depth required for the "Lowering Profile."
4	**PERFORM** additional excavation beyond the "Lowering Profile" to allow for the following: • Placement of sandbags per "Supporting the Final Lowered Profile" below to obtain the final profile elevation • A pad dirt allowance in rocky areas • Room for the soil from beneath the pipeline to be cleared out after the cribbing supports are installed
5	**PLAN** the initial excavation to permit the line to be lowered with no further digging.

7.3.1 Cribbing

Operations Personnel use the following procedure to perform cribbing while excavating the pipeline.

Step	Activity
1	**SUPPORT** the pipeline firmly as it is excavated by cribbing in such a way that the pipeline stays at its original elevation.
2	**PLACE** tires, carpet, sandbags, or other padding between the pipe and cribbing to prevent coating damage.
3	**SPACE** the cribbing supports at maximum intervals of 25 feet unless otherwise specified in the "Lowering Plan."
4	**INSTALL** the supports as far as practical from, and never directly beneath any girth welds since bending stresses can be much higher at the support points than at mid-span and girth welds have additional residual stresses and variable material properties.
5	**MONITOR** the cribbing daily and **REPLACE** or **REPAIR** as necessary.
6	**SUPPORT** the pipeline so that settlement or thermal expansion and

Step	Activity
	contraction will not force the pipeline off of the cribbing.
7	When pipe operating temperatures are known to be changing or the pipeline is taken out of service for lowering, **CHECK** the cribbing to verify that it remains stable or is adjusted accordingly.

CAUTION: Personnel working in the ditch should be especially alert to possible side movement of the pipe due to thermal expansion or contraction.

Step	Activity
8	**MAINTAIN** the cribbing to prevent the pipe from shifting during the lowering operation.

WARNING: If the pipe were to slip off of one of the cribbing supports, the entire section could jump the supports and fall into the ditch.

7.3.2 Drainage Ditches

Operations Personnel use the following procedure to create drainage ditches.

Step	Activity
1	**PROVIDE** adequate drainage so that the pipeline ditch will not fill with water causing the pipe to float.
2	If this is not possible, **OPERATE** pumps which have adequate flow capacity to keep the pipeline from floating.

7.3.3 Initial Elevation Profile

Operations Personnel use the following procedure to create an initial elevation profile when excavating the pipeline.

Step	Activity
1	**TAKE** an initial elevation profile of the top of the pipe at maximum intervals of 25 feet after the excavation is complete.
2	**IDENTIFY** the midpoint of the section to be lowered.
3	**VERIFY** the accuracy of the original “Lowering Profile.”

7.4 Inspecting the Exposed Pipeline

Operations Personnel use the following procedure to inspect the exposed pipeline.

Step	Activity
1	**INSPECT** the pipeline visually for coating damage, gouges, corrosion, dents, arc burns, and wrinkles per *SOP HLD.35 Buried Pipe Inspection and Evaluations.*
2	**CONSIDER** the possibility of any anomalies causing complications, stress concentrations, or buckling in the lowered pipeline.
3	**REPORT** pipe defects to the Pipeline Integrity Department for consideration in the lowering plan.
4	If anomalies are found which are not acceptable by company standards, **REPAIR** them per *SOP HLI.06 Evaluating Pipeline Defects* before the line is lowered, and **CONSIDER** the need to continue with this procedure.
5	**DOCUMENT** pipe inspection on Pipe Inspection Report or Maintenance Record.

7.4.1 Evaluation of Circumferential Defects

Operations Personnel uses the following procedure to evaluate circumferential defects.

Step	Activity
1	**EVALUATE** the circumferential extent of corrosion or other defects in addition to the conventional evaluation of longitudinal defects.

NOTE:	This is required because the lowering section will be subjected to axial bending stresses.

Step	Activity
2	If a defect is found that could reduce the bending strength of the pipe, **EVALUATE** the defect in developing the lowering plan.
3	If necessary, **MOVE** the lowering bend location to position the defect in an area of straight pipe.

NOTE:	The bending, which occurs during the lowering operation, must still be considered.

7.4.2 Inspecting and Repairing Welds

Operations Personnel use the following procedure for inspecting and repairing welds.

Step	Activity
1	Visually **INSPECT** all circumferential welds in the lowering section. Acetylene welded lines require particular attention to ensure lowering stresses to do not affect integrity of the weld. Acetylene welds shall be reinforced prior to initiating lowering activities.
2	**VERIFY** that they are 100% NDE inspected by radiography or other approved NDE methodology such as MPT and/or LPT, unless weld inspection records are available or as noted under "Welds Which Do Not Require NDE" below.
3	**USE** the applicable form(s) for *NDE Inspection Report of Field Girth Welds*.
4	**REMOVE** the pipe coating (except FBE coating) from the weld area prior to inspection.
5	**INSPECT** the welds visually for cracks, arc burns, or external undercutting that may be detrimental to the integrity of the weld or pipe.
6	**PERFORM** the radiographic inspection, **INTERPRET** the radiographs per API 1104, and **DETERMINE** if any welds do not meet the current code limitations.
7	**BE AWARE** that the bending of the pipe, which results from the lowering operations, is more likely to affect certain types of weld defects.
8	If any welds are interpreted as having cracks, **BLOW DOWN** the section and **REPLACE** the pipe containing the cracked weld.

NOTE Do not perform radiographic inspection for welds that are not located in the area of the final lowering bends if the longitudinal stresses from bending and axial tension during the lowering operations are calculated to be less than the Poisson effect of the hoop stress under normal operating conditions. This applies where approved by Pipeline Integrity.

Step	Activity
9	**CONSIDER** the need to continue with this procedure.
10	**HANDLE** welds that fail to meet the code limitations regarding "Inadequate Penetration," "Inadequate Penetration Due to High-Low," or "Incomplete Fusion" (in the bead or cap) as follows: • **REPAIR** defects in the top or bottom quadrant of the pipe except as allowed for in company lowering guidelines. • **EVALUATE** defects in the side quadrants of the weld that are in the neutral axis of the lowering bends per "Analysis of All Other Weld Defects" immediately below.
11	**PERFORM** an analysis of the remaining defects.

NOTE: This analysis establishes whether the discontinuities are excessive to the extent that they could be adversely affected by the movement of the pipe during the lowering or subsidence.

Step	Activity
12	**DETERMINE** the action required for each weld.
13	**DOCUMENT** the justification for the action planned for each weld.
14	If the length of a defect or the accumulation of defects is only a moderate amount in excess of the API 1104 limitation, **EVALUATE** the defect per the alternate criteria in the Appendix to API 1104.
15	**CONSULT** Pipeline Integrity Department regarding defects accepted based upon the alternate criteria.
16	If the size of defect or length of accumulation is significant, and/or the overall appearance of the weld is questionable, **REPAIR** or **CUT OUT** the weld unless sufficient justification can be made to leave the weld as is.
17	**PAY** special attention to the evaluation of welds in areas where the highest stresses are anticipated (e.g., the edge of mining panels, areas where bends will be induced, areas where deflections will be the greatest, bends in existing pipe, etc.).
18	If the pipeline must be removed from service to make a repair, **CONSIDER** cutting the pipe and performing the lowering at the same time to eliminate the elongation stress component.
19	**CONSIDER** the final stress produced by bending, temperature differences, and other factors if permanent lowering bends are not installed as part of the lowering plan.

7.5 Final Preparations for Lowering the Pipeline

Operations Personnel use the following procedure to make final preparations for lowering a pipeline.

Step	Activity
1	**TAKE** the following final preparations prior to commencing the lowering operation.
2	**ADVISE** Pipeline Integrity or Liquid Tech Ops Department of any circumstances, which should be considered in establishing the need for an additional pressure reduction during the lowering operation.

NOTE:

- It may be necessary to reduce the operating pressure when excavating a section of pipe with known defects. Refer to *SOP HLI.05 Pipeline Repair*.
- A reduced operating pressure may also be required during the lowering operation based upon the calculations performed in developing the lowering plan.

Step	Activity
3	**ADVISE** Liquid Control to reduce the pipeline operating pressure at the location to the pressure approved by Management.
4	**CONSIDER** evacuating the area near the pipeline when necessary unless conditions from the analysis in the Lowering Plan indicate that there is no need for concern.
5	If feasible **MAN** the mainline valves immediately upstream and downstream of the excavation while the lowering operations are in progress.
6	**POST** an observer for the purpose of maintaining communication with people manning valves and with Liquid Control

7.6 Performing the Lowering Operation

Operations Personnel use the following procedure to perform the lowering operation.

Step	Activity
1	**ADHERE** to the following guidelines and the site specific "Lowering Plan" strictly.

CAUTION: Adherence to the following is critical to the safety of the pipeline lowering since a considerable amount of the allowable axial and bending stresses can be consumed by the handling of the pipe during the lowering operation.

Step	Activity
2	**HOLD** a pre-job safety meeting to discuss the sequence of events for the lowering operation.
3	**COMPLETE** the applicable form(s) for *Pre-job Safety Meeting*.
4	**VERIFY** that the pipeline lowering is supervised by a person knowledgeable of the procedures and methods necessary to successfully perform the work, and that the personnel performing the work are properly trained and are familiar with the requirements.
5	**ALIGN** the lifting equipment directly above/below the pipe to minimize any lateral movement.
6	**LIFT** the pipe the minimum amount necessary to remove skids. **DO** this slowly and to no more than a few inches.
7	**REMOVE** the first layer of skids from the first cribbing support and **REBUILD** the support if necessary. **REFER** to "Using Shims" below.
8	**LOWER** the pipe slowly back down to the shortened cribbing support.

NOTE: The lowered distance will be approximately one skid thickness.

Step	Activity
9	**REPEAT** the above four steps at the second cribbing support.
10	**CONTINUE** from one end of the lowering section to the other until the first row of skids has been removed from each crib support for the entire lowering length.
11	**REPEAT** the above sequence one layer at a time until the pipeline meets the final elevation profile.
12	**MINIMIZE** any bouncing or other movement of the pipe.
13	**ALLOW** any pipe movement to stop between each lifting and lowering step during the lowering operation.

CAUTION:

- Handle the pipe carefully to maintain control of the lowering activities and to verify that the pipe is not dropped or left unsupported.
- Do not lower the pipeline to an elevation below that established in the "Lowering Profile."

Step	Activity
14	**USE** shims or other support methods at crib supports where the final required elevation falls between two successive layers of skids.
15	**PERFORM** the lowering operation by one of the following methods, or as approved by Pipeline Integrity or Liquid Tech Ops Department: • **USE** conventional pipeline equipment. • **USE** pressurized air bags to support and lower the pipe. **REFER** to Section 7.8, Lifting Pressurized Pipelines Using Air Bags, and Appendix B. • **PLACE** beams across the ditch and **LOWER** the pipe using a winch. **VERIFY** the beams are adequately designed to carry the weight of the pipe.
16	If a valve or other heavy component is included in the lowering section, **SUPPORT** it directly.

CAUTION: Do not lift the pipe on both sides of the ditch.

Step	Activity
17	**MAINTAIN** adequate support beneath the pipe as it is lifted to remove skids and as it is lowered back down to the shortened crib support during each successive pass to remove another layer of skids.

NOTE: A pipeline larger than 4 inches in diameter will probably not sag down far enough under its own weight to rest on the next skid using the cribbing spacing under the "Spacing of Cribbing" subsection above until the skids have been removed from several consecutive supports.

Step	Activity
18	**REFER** to Appendix C for the initial unsupported span length required to lower the pipe down to the elevation required by the "Lowering Profile" or down to the shortened cribbing support (whichever comes first).

NOTE: As the lowering progresses, the required span length is reduced. Support requirements are illustrated in Appendix D.

Step	Activity
19	**VERIFY** that equipment supporting the pipe during the lowering operation is not spaced more than 50 feet apart.
20	**REFER** to the company lowering guidelines for the stresses induced by the above span lengths.
21	If a span fails to reach one of the cribbing supports after the specified span length is achieved, **SUPPORT** the pipe and **CONTACT** Pipeline Integrity Department.

NOTE: This may be a result of wall thickness variations or higher than anticipated axial stresses being present in the pipe prior to the start of the lowering operation.

Step	Activity
22	**REDUCE** the operating pressure temporarily, or **REDUCE** the axial stress from other sources to offset the lowering stresses until the work can be completed, if necessary.

CAUTION: Do not place the lifting and support points for lowering the pipe beneath or near the pipeline girth welds. This is the same as for cribbing placements as described above.

Step	Activity
23	**LOWER** the pipeline under its own weight.

CAUTION: If the pipeline does not readily lower to the intended elevation, do not force it.

Step	Activity
24	**NOTIFY** Pipeline Integrity Department to analyze the original and current profiles to determine the required action.

CAUTION: Do not change the configuration of any original pipe bends except as indicated in the lowering plan. This applies during the lowering process and in the final placement of the pipe.

Step	Activity
25	**REMOVE** the remaining skids.
26	**DETERMINE** the final lowered elevation and **CHECK** it against the "Lowering Profile."
27	**MAKE** adjustments as necessary to match the lowering profile.

CAUTION:	Do not allow final strain levels to exceed the maximum allowable value provided by Pipeline Integrity or Liquid Tech Ops Department where strain gauges have been installed.

Step	Activity
28	**REPORT** excessive strain values to Pipeline Integrity Department, who will analyze the profile and provide instructions to correct the problem.
29	**DOCUMENT** the evaluations under *Section 7.1*, Evaluating the Potential for Lowering a Pipeline; *Section 7.4.2*, Inspecting and Repairing Welds; and *Section 7.6*, Performing the Lowering Operation; as well as the initial profile, profile calculations supporting the final profile, the final profile, and the final stress levels per *Section 7.2*, Developing a Lowering Plan and Profile.
30	**DOCUMENT** all work, and **KEEP** the records in the project file and **RETAIN** for the life of the facility. **SUBMIT** project file to Engineering Records Group per requirements of *SOP HLB.11 Project Documentation and As-built Process*
31	**BACKFILL** the pipeline per *SOP HLI.10 Excavation and Backfill.*

7.8 Lifting Pressurized Pipelines Using Air Bags

Operations Personnel use the following procedure to lift or move pressurized pipelines using air bags. This method helps prevent over-stressing operating pipelines.

NOTE:

- Pipe of any size, other than at casings, can be lifted by this method. However, for the tables in Appendix B to apply, it must be unrestrained for approximately 80 feet in length, and the lifting should take place within 15 feet of the midpoint.
- For pipeline diameters less than 20" or greater than 36", create a work plan to determine appropriate number of bags, bag size and maximum bag pressure.
- For use of airbag other than this, a specific study must be made. Contact Pipeline Integrity Department to determine the applicability of the raising criteria if a bend is present.

Step	Activity
1	**EQUIP** air bags with 125-150 psig gauges that are accurate to the nearest one

	pound.
2	**VERIFY** that there is a solid base under the air bag to determine the actual lifting force.
3	**ESTABLISH** a fixed reference point for measuring the deflection of the pipe.

NOTE: Do not use pipe casing as a reference since it may move along with the pipe.

Step	Activity
4	If there are different wall thicknesses of pipe inside the casing and in the excavated area, **USE** the values in the tables in Appendix B for the lighter wall pipe to determine the allowable lifting force and deflection.
5	**POSITION** air bag(s) under the pipe as close together as possible so the center of the lifting area is approximately 6 feet from the end of the casing.
6	**PROVIDE** a smooth, flat surface for the air bag(s) to rest on, such as ¾ inch or 1 inch plywood.
7	**PLACE** a piece of heavy canvas or rock shield between the pipe and the air bag to help protect the bag from any sharp protrusions in the coating.
8	**CONNECT** the air source to the bags and slowly **INFLATE** while watching the pipe deflection and bag pressure.

CAUTION: Do not exceed the elevation change specified by the pipeline raising plan developed by Pipeline Integrity Department.

Step	Activity
9	**MONITOR** the shorted casing to the pipe potential and when the shorted condition is eliminated and there is clearance enough between the bottom of the pipe and the casing, **STOP** pressuring the air bag(s).
10	**INSTALL** insulating material between the pipe and casings.
11	**RELEASE** pressure and **CHECK** that the shorted condition does not recur.
12	If an adequate pipe deflection is not obtained with the force listed in the tables in Appendix B for existing conditions, or the conditions do not match model conditions outlined in the Note following Step 13 below, **CONTACT** Pipeline Integrity Department.

NOTE: Pipeline Integrity Department calculates a safe lifting force and maximum deflection from the existing conditions.

Step	Activity
13	**REFER** to the following for a discussion of this method and a description of model conditions.

NOTE:

- A typical shorted casing repair was used as a model for making the pipe stress calculations. This model consists of 40 feet of straight pipe excavated from the end of the casing, 40 feet of free pipe inside the casing and the air bag lifting the pipe at a point approximately 6 feet from the end of the casing. The maximum stress level used in the calculations was 75% of Specified Minimum Yield Strength (SMYS).

- For Appendix B, the bag pressure to be used was determined by dividing the force on the pipe by the area of the "foot print" on the bag for each diameter of pipe 20" through 36". In all cases, the primary air bag used was the larger size bag of 30" x 30" nominal size. Those situations where the tables in Appendix B indicate a second or third bag is to be used, the bag sizes are footnoted as to size, either the 24" x 24" or 30" x 30" nominal size. Where more than one air bag is required, the bag pressure in the table in Appendix B is for each bag. The additional bags should be placed under the pipe as close to the first bag as possible. It is important to keep the lifting point approximately 6 feet from the end of the casing. The table values for bag pressure and pipe deflection at the end of the casing are maximum values. If a casing short can be cleared using lower values, use only the bag pressure or deflection necessary to accomplish the task. For pipeline diameters less than 20" or greater than 36", create a work plan to determine appropriate number of bags, bag size and maximum bag pressure.

- Possible existing conditions that have not been considered in the stress calculations are:
    - Corrosion (internal or external)
    - Acetylene welds
    - Condition of un-x-rayed welds
    - Unreinforced couplings
    - Stresses (resulting from tie-ins, settlement, bends, construction damage, lamination, etc.)
    - If it is determined that any of these conditions exist, consult Pipeline Integrity Department.

- In the event an adequate pipe deflection cannot be obtained with the force listed for the conditions, contact Pipeline Integrity Department. Be prepared to give the details of the situation, i.e. length of excavation, pipe size, wall thickness, grade, heavy and light wall lengths in the excavated area, existing line pressure, area of contact between bag and pipe, deflection obtained at the listed pressure, obstructions in casing, or any other condition that could affect the situation. From this information, a recalculation can be made that will better fit the conditions and possibly result in the attainment of the required deflection.

8.0 Documentation Requirements

Record data in electronic database or utilize the following forms as applicable:

- Pipe Lowering Profile
- Pipe Lowering Plan
- I.05.A NDT Report of Field Girth Welds (or Equivalent Contractor Form)
- I.05.B NDT Report of Field Girth Welds – Overflow (or Equivalent Contractor Form)
- I.05.D Pre-Job Safety Meeting Form
- Pipe Inspection Database

9.0 References

HLI.01 Pipeline Shutdown and Startup
HLI.05 Pipeline Repair
HLI.06 Evaluating Pipeline Defects
HLI.10 Excavation and Backfill
HLI.26 Mining, Subsidence, and Soil Slippage
HLB.11 Project Documentation and As-built Process

Appendix A: OQ Task Requirements

The table below identifies the Operator Qualification (OQ) task requirements.

Task Description	OQ Task
Visual Inspection of Buried Pipe and Components When Exposed	PLOQ401
Measure and Evaluate Pipeline Defects	PLOQ418A
Backfilling – Pipe and Coating Protection	PLOQ404
Damage Prevention During Excavation/Encroachment Activities	PLOQ607
Visual Inspection of Welding and Welds	PLOQ203

Appendix B: Air Bag Tables The tables below define the maximum allowable bag pressures, pipe deflections and force on pipe for each diameter 20" through 36" , wall thickness, SMYS and line pressures.

20 INCH PIPE

LARGE BAG - 303 SQ. IN.

Pipe Diameter (Inches)	**Wall Thickness (Inches)**	**SMYS**	**Line Pressure (psig)**	**Maximum Allowable**		
				Bag Pressure (psig)	**Pipe Deflection (Inches)**	**Force on Pipe (Lbs.)**
20	0.281	4200	200	59.5	3.05	18020
20	0.281	4200	400	44.7	2.30	13554
20	0.281	4200	600	30.0	1.54	9089
20	0.281	4200	400	51.4	2.64	15566
20	0.281	4200	600	36.6	1.88	11101
20	0.281	4200	800	21.9	1.12	6636
20	0.281	4400	400	54.5	2.80	16507
20	0.281	4400	600	39.7	2.04	12042
20	0.281	4400	800	25.0	1.28	7577
20	0.312	2500	200	38.2	1.78	11573
20	0.312	2500	400	23.5	1.09	7129
20	0.312	26900	200	41.5	1.93	12561
20	0.312	26900	400	26.8	1.25	8117
20	0.312	26900	600	12.1	0.56	3672
20	0.312	28200	200	43.7	2.03	13237
20	0.312	28200	400	29.0	1.35	8793
20	0.312	28200	600	14.4	0.67	4348
20	0.5	24000	200	65.7	1.96	19911
20	0.5	24000	400	51.5	1.54	15591
20	0.5	24000	600	37.2	1.11	11270

AIR BAG TABLES

22 INCH PIPE

LARGE BAG - 374 SQ. IN.

Pipe Diameter (Inches)	**Wall Thickness (Inches)**	**SMYS**	**Line Pressure (psig)**	**Maximum Allowable**		
				Bag Pressure (psig)	**Pipe Deflection (Inches)**	**Force on Pipe (Lbs.)**
22	0.281	43600	400	48.7	2.31	18201
22	0.281	43600	600	32.7	1.55	12235
22	0.281	43600	800	16.8	0.80	6269
22	0.281	46700	400	53.4	2.53	19973
22	0.281	46700	600	37.5	1.78	14007
22	0.281	46700	800	21.5	1.02	8040
22	0.312	31300	200	52.5	2.25	19619
22	0.312	31300	400	36.6	1.57	13678
22	0.312	31300	600	20.7	0.89	7737
22	0.312	32200	200	54.0	2.32	20188
22	0.312	32200	400	38.1	1.63	14247
22	0.312	32200	600	22.2	0.95	8306
22	0.312	40000	200	67.2	2.88	25117
22	0.312	40000	400	51.3	2.20	19176
22	0.312	40000	600	35.4	1.52	13235
22	0.312	40800	200	68.5	2.94	25623
22	0.312	40800	400	52.6	2.26	19682
22	0.312	40800	600	36.7	1.58	13740
22	0.312	52000	200	87.4	3.75	32700
22	0.312	52000	400	71.5	3.07	26759
22	0.312	52000	600	55.7	2.39	20818
22	0.375	32200	200	67.6	2.43	25285
22	0.375	32200	400	51.9	1.87	19395
22	0.375	32200	600	36.1	1.30	13505
22	0.375	42000	200	87.3	3.15	32664
22	0.375	42000	400	71.6	2.58	26774
22	0.375	42000	600	55.8	2.01	20884

Pipe Diameter (Inches)	**Wall Thickness (Inches)**	**SMYS**	**Line Pressure (psig)**	**Maximum Allowable**		
				Bag Pressure (psig)	**Pipe Deflection (Inches)**	**Force on Pipe (Lbs.)**
22	0.375	46000	400	79.6	2.87	29786
22	0.375	46000	600	63.9	2.30	23896
22	0.375	46000	800	48.1	1.73	18006
22	0.375	52000	200	60.7	3.87	40194
22	0.375	52000	400	51.8	3.30	34304
22	0.375	52000	600	42.9	2.74	28414
22	0.375	60000	200	69.8	4.45	46218
22	0.375	60000	400	60.9	3.88	40328
22	0.375	60000	600	52.0	3.32	34438
22	0.5	42000	200	67.7	3.29	44845
22	0.5	42000	400	59.0	2.87	39055
22	0.5	42000	600	50.2	2.44	33265
22*	0.5	46000	400	65.0	3.16	43003
22*	0.5	46000	600	56.2	2.73	37213
22*	0.5	46000	800	47.5	2.31	31423

* Use two (2) air bags, one (1) 30” x 30” and one (1) 24” x 24” (662 sq. in.)

AIR BAG TABLES

24 INCH PIPE

LARGE BAG - 428 SQ. IN.

Pipe Diameter (Inches)	**Wall Thickness (Inches)**	**SMYS**	**Line Pressure (psig)**	**Maximum Allowable**		
				Bag Pressure (psig)	**Pipe Deflection (Inches)**	**Force on Pipe (Lbs.)**
24	0.281	45000	400	48.7	2.03	20860
24	0.281	45000	600	30.6	1.27	13089
24	0.281	45200	400	49.1	2.05	20996
24	0.281	45200	600	30.9	1.29	13225
24	0.281	47400	400	52.6	2.19	22497
24	0.281	47400	600	34.4	1.43	14727
24	0.281	47400	800	16.3	0.68	6956
24	0.281	60000	400	72.7	3.03	31095
24	0.281	60000	600	54.5	2.27	23324
24	0.281	60000	800	36.3	1.52	15554
24	0.312	43700	400	55.6	2.10	23814
24	0.312	43700	600	37.6	1.42	16073
24	0.312	43700	800	19.5	0.73	8333
24	0.375	43700	400	73.7	2.33	31539
24	0.375	43700	600	55.7	1.76	23859
24	0.375	43700	800	37.8	1.19	16179
24*	0.5	46000	400	65.7	2.77	49256
24*	0.5	46000	600	55.6	2.35	41696
24*	0.5	46000	800	45.5	1.92	34136
24*	0.5	52000	400	75.1	3.17	56344
24*	0.5	52000	600	65.0	2.75	48784
24*	0.5	52000	800	55.0	2.32	41224

* Use two (2) air bags, one (1) 30” x 30” and one (1) 24” x 24” (750 sq. in.)

AIR BAG TABLES

26 INCH PIPE

1 LARGE BAG & 1 SMALL BAG - 737 SQ. IN.

Pipe Diameter (Inches)	**Wall Thickness (Inches)**	**SMYS**	**Line Pressure (psig)**	**Maximum Allowable**		
				Bag Pressure (psig)	**Pipe Deflection (Inches)**	**Force on Pipe (Lbs.)**
26	0.271	60000	500	37.5	2.19	27629
26	0.271	60000	700	24.0	1.40	17711
26	0.271	60000	900	10.6	0.62	7792
26	0.281	57830	500	37.8	2.13	27846
26	0.281	57830	700	24.3	1.37	17939
26	0.281	57830	900	10.9	0.61	8033
26	0.312	52000	400	45.2	2.30	33303
26	0.312	52000	500	38.5	1.96	28367
26	0.312	52000	600	31.8	1.62	23432
26	0.312	52000	700	25.1	1.28	18496
26	0.312	52000	800	18.4	0.94	13560
26	0.312	52000	900	11.7	0.60	8625
26	0.375	52000	500	52.7	2.25	38834
26	0.375	52000	700	39.4	1.68	29034
26	0.375	52000	900	26.1	1.11	19235
26	0.375	60000	400	70.8	3.02	52214
26	0.375	60000	600	57.5	2.46	42414
26	0.375	60000	800	44.3	1.89	32615
26	0.375	65000	500	71.4	3.05	52614
26	0.375	65000	700	58.1	2.48	42815
26	0.375	65000	900	44.8	1.91	33015
26	0.5	40000	500	57.6	1.87	42469
26	0.5	40000	700	44.5	1.45	32811
26	0.5	40000	900	31.4	1.02	23152
26	0.5	42000	400	68.0	2.21	50084
26	0.5	42000	600	54.9	1.78	40426
26	0.5	42000	800	41.7	1.36	30768

Pipe Diameter (Inches)	**Wall Thickness (Inches)**	**SMYS**	**Line Pressure (psig)**	**Maximum Allowable**		
				Bag Pressure (psig)	**Pipe Deflection (Inches)**	**Force on Pipe (Lbs.)**
26	0.5	45000	500	67.1	2.18	49434
26	0.5	45000	700	54.0	1.75	39776
26	0.5	45000	900	40.9	1.33	30118
26	0.5	47000	400	77.4	2.51	57050
26	0.5	47000	600	64.3	2.09	47391
26	0.5	47000	800	51.2	1.66	37733
26	0.5	52000	500	80.3	2.61	59186
26	0.5	52000	700	67.2	2.18	49527
26	0.5	52000	900	54.1	1.76	39869

AIR BAG TABLES

30 INCH PIPE

1 LARGE BAG & 1 SMALL BAG - 768 SQ. IN.

Pipe Diameter (Inches)	**Wall Thickness (Inches)**	**SMYS**	**Line Pressure (psig)**	**Maximum Allowable**		
				Bag Pressure (psig)	**Pipe Deflection (Inches)**	**Force on Pipe (Lbs.)**
30	0.312	52000	500	41.2	1.41	31624
30	0.312	52000	700	21.3	0.73	16386
30	0.312	60000	500	53.6	1.84	41132
30	0.312	60000	700	33.7	1.16	25894
30	0.312	60000	900	13.9	0.48	10657
30	0.325	42000	500	28.7	0.95	22077
30	0.325	52000	500	44.8	1.48	34441
30	0.325	52000	700	25.0	0.83	19224
30	0.344	60000	500	64.0	2.00	49117
30	0.344	60000	700	44.2	1.38	33929
30	0.344	60000	900	24.4	0.76	18740
30	0.361	52000	500	55.1	1.65	42350
30	0.361	52000	700	35.4	1.06	27187
30	0.361	52000	900	15.7	0.47	12025
30	0.375	52000	500	59.2	1.70	45452
30	0.375	52000	700	39.5	1.14	30311
30	0.375	52000	900	19.8	0.57	15170
30	0.406	52000	500	68.0	1.81	52197
30	0.406	52000	700	48.3	1.29	37103
30	0.406	52000	900	28.7	0.76	22009
30	0.406	60000	500	83.9	2.24	64454
30	0.406	60000	700	64.3	1.71	49360
30	0.406	60000	900	44.6	1.19	34265
30	0.5	42000	500	69.9	1.53	53721
30	0.5	42000	700	50.5	1.10	38769
30	0.5	42000	900	31.0	0.68	23817

Pipe Diameter (Inches)	**Wall Thickness (Inches)**	**SMYS**	**Line Pressure (psig)**	**Maximum Allowable**		
				Bag Pressure (psig)	**Pipe Deflection (Inches)**	**Force on Pipe (Lbs.)**
30	0.5	47000	500	82.1	1.79	63066
30	0.5	47000	700	62.6	1.37	48114
30	0.5	47000	900	43.2	0.94	33162
30	0.5	52000	500	94.3	2.06	72412
30	0.5	52000	700	74.8	1.63	57459
30	0.5	52000	900	55.3	1.21	42507

AIR BAG TABLES

30 INCH PIPE

2 LARGE BAGS - 884 SQ. IN.

Pipe Diameter (Inches)	**Wall Thickness (Inches)**	**SMYS**	**Line Pressure (psig)**	**Maximum Allowable**		
				Bag Pressure (psig)	**Pipe Deflection (Inches)**	**Force on Pipe (Lbs.)**
30.125	0.375	60000	500	64.7	2.11	57091
30.125	0.375	60000	700	47.3	1.54	41757
30.125	0.375	60000	900	29.9	0.98	26424
30.175	0.375	60000	500	64.8	2.11	57204
30.175	0.375	60000	700	47.3	1.54	41793
30.175	0.375	60000	900	29.9	0.97	26382
30.313	0.469	60000	500	91.8	2.37	81062
30.313	0.469	60000	700	74.3	1.92	65581
30.313	0.469	60000	900	56.7	1.47	50100
30.375	0.5	46000	500	70.4	1.70	62129
30.375	0.5	46000	700	52.8	1.28	46599
30.375	0.5	46000	900	35.2	0.85	31070
30.375	0.5	60000	500	100.8	2.44	88970
30.375	0.5	60000	700	83.2	2.01	73441
30.375	0.5	60000	900	65.6	1.59	57911

AIR BAG TABLES

36 INCH PIPE

2 LARGE BAGS - 968 SQ. IN.

Pipe Diameter (Inches)	**Wall Thickness (Inches)**	**SMYS**	**Line Pressure (psig)**	**Maximum Allowable**		
				Bag Pressure (psig)	**Pipe Deflection (Inches)**	**Force on Pipe (Lbs.)**
36	0.375	60000	500	71.3	1.49	69008
36	0.375	60000	700	44.1	0.92	42680
36	0.375	60000	900	16.9	0.35	16351
36	0.5	60000	500	116.6	1.84	112871
36	0.5	60000	700	89.7	1.42	86816
36	0.5	60000	900	62.8	0.99	60762
36.25*	0.5	60000	500	78.4	1.82	113908
36.25*	0.5	60000	700	90.2	1.40	87298
36.25*	0.5	60000	900	62.7	0.97	60698
36.25*	0.562	65000	500	104.8	2.15	152209
36.25*	0.562	65000	700	86.3	1.77	125458
36.25*	0.562	65000	900	102.0	1.40	98707

* Use three (3) air bags - 30” x 30” (1453 sq. in.)

Appendix C: Maximum Span Length

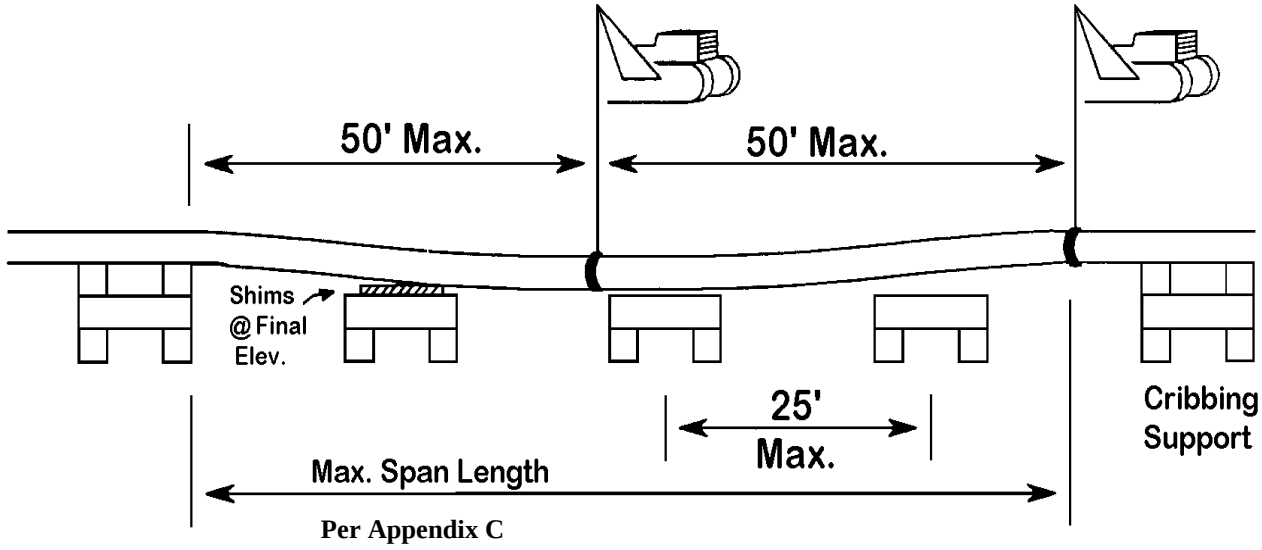
The table defines the maximum span length of unloaded pipelines prior to lowering the pipe down to the elevation required by the Lowering Profile or down to the shortened cribbing support, whichever comes first.

Pipe Diameter	**Maximum Span Length**
4”	50’
6”	60’
8”	70’
10”	78’
12”	85’
14”	92’
16”	99’
18”	105’
20”	112’
24”	125’
26”	132’

30”	145’
36”	160’

NOTE: These lengths vary slightly with pipe wall thickness and are not applicable for pipe with weight coating, liquids, or other heavy components.

Appendix D: Figure 1 The figure below defines the maximum span length for cribbing at the final lowering profile elevation.



Standard Operating Procedures

Applicable to Hazardous Liquids Pipelines and Related Facilities

Code Reference :	**Procedure No.: HLI.10**	
49 CFR 195.402, 195.248, 195.252	***Effective Date: 04/01/18***	**Page 1 of 15**

1.0 Procedure Description

This Standard Operating Procedure (SOP) describes how to provide adequate support and protection of company pipeline facilities during excavation and backfilling activities.

2.0 Scope

This SOP establishes requirements to be followed prior to, during and post any excavation and backfilling activities on or around company pipeline facilities. This SOP also protects company personnel who are required to work in or around excavations and trenches by establishing excavation procedures to help prevent the hazards of cave-in or asphyxiation in trenches, under embankments, and in holes.

3.0 Applicability

This SOP applies to any excavation and backfilling activities on or around company pipeline facilities performed by Company employees or authorized contractors.

4.0 Frequency

As required: All excavations and backfilling on or around company pipeline facilities.

5.0 Governance

The following table describes the responsibility, accountability, and authority of the operations described in this SOP.

Function	Responsibility	Accountability	Authority
All Operations	Operations Personnel	Operations Manager	Director of Operations

6.0 Terms and Definitions

Terms associated with this SOP and their definitions follow in the table below. For general terms, refer to *SOP HLA.01 Glossary and Acronyms*.

Terms	Definitions
Bell-Hole	An excavation where the width is typically greater than the depth and access routes are cut along the sides of the excavation to form an approximate bell shape.
Competent Person	One who is qualified, capable of identifying existing and predictable hazards in the surroundings, or working conditions which are unsanitary, hazardous, or dangerous to employees, and who has authorization to take prompt corrective measures to eliminate them.
Trench	A long, narrow excavation where the width of the excavation is less than the depth.

7.0 Excavation and Backfill

The following procedures are described in this section:

- Prior to Excavation
- Requirements for New Pipeline Installation
- Excavation of Existing Company Pipeline Facilities
- Safety Precautions
  - Hazardous Atmospheres
- Using Explosives
- Excavation of Company Pipelines by a Contractor
- Sloping and Shoring
  - Sloping Requirements
  - Shoring Requirements
- Inspecting Excavations
- Backfilling
  - Erosion Control

7.1 Prior to Excavation

Operation Personnel perform the following procedures prior to excavation.

Step	Activity
1	**DESIGNATE** and **VERIFY** a qualified competent person will be on site to supervise all excavation work performed by company personnel.
2	**REVIEW** the terms of the easement for the tract(s) of land where the excavation is to be conducted**.**
3	**LOCATE** and **MARK** company pipeline facilities per *SOP HLB.04 Pipe Location and Marking.* **VERIFY** the proposed excavation limits are marked to assist local One-Call responders in identifying the limits of excavation activities.

NOTE: Indicate the depth of cover of company pipeline facilities on each marking when the excavation limits will be 75 ft. or greater.

CAUTION: When excavating existing company pipeline facilities for maintenance, where shallow cover is discovered, **DEVELOP** an excavation and backfill plan prior to excavation to confirm the safety and integrity of the company pipeline facility. Methods include but are not limited to:

- Additional soil combined with grading and contouring to re-establish adequate cover.
- Installation of erosion control and mechanical protection (e.g., revetment mats, concrete slabs, and rip-rap).
- Pipeline lowering
- Installation of box sag bends
- Installation of warning tape to alert future excavators

4	**CONTACT** the local One-Call system and **REQUEST** a notification be sent out for the proposed excavation. **NOTIFY** all utilities not participating in the One-Call system in the area of the proposed excavation.
5	If necessary, **REQUIRE** utilities to move any overhead hazards. If below-ground utilities present a hazard, **DISCUSS** work with the utility representative**.**
6	**ENCOURAGE** affected utility owners to have a representative at the site during excavation and backfilling operations.
7	**CONSIDER** traffic and/or any material, structures, or equipment which could be present near the edge of the excavation.
8	**DEPLOY**barricading, signal guards, stop logs, or other warning systems needed when mobile equipment is used around the excavation.
9	**DEPLOY** proper barricading, plating and other warnings on excavations left open after working hours or left unattended.

NOTE: Secure all necessary permits and observe barricading/signage rules of the local governing authorities when excavations cross or affect roads.

10	**CONSULT** with Pipeline Integrity Department to review the anomaly data to determine whether smart tool indications will be exposed during the excavation.

11	**CONFIRM** if any additional pressure reductions are required prior to starting excavation activities. Refer to *SOP HLI.11 Pipeline Pressure Limit Criteria*
12	**NOTIFY** Liquids Control.

7.2 Requirements for New Pipeline Installation

Operation Personnel perform the following procedure when excavating for new company pipeline facility installation.

Step	Activity
1	**DETERMINE** the dimensions of the ditch for new company pipeline facility installations based on the size of the pipeline.
2	**REFER** to the following table for: • The minimum width at the bottom of the ditch • Minimum cover as measured from the top of the pipe to the average level of the ground on both sides of the ditch.

Nominal Pipe Size (Inches)	**Minimum Ditch Width (Inches)**		
4	22		
6	26		
8	26		
10	26		
12	30		
14	32		
16	36		
18	38		
20	40		
22	42		
24	44		
26	46		
30	50		
36	52		
42 & Larger	56		

Location	**For Normal Excavation (inches)**	**For Rock Excavation (Inches)**
Industrial, Commerical, and residential areas	36	30
Crossing of inland bodies of water with a width of at least 100 feet from high water mark to high water mark	48	18
Drainage ditches at public roads and railroads	36	36
Deepwater port safety zones	48	24
Any other area	30	18

NOTE:

- These depths of cover are applicable for new installations in soil.
- Rock excavation is any excavation that requires blasting or removal by equivalent means.

7.3 Excavation of Existing Company Pipeline Facilities

Operation Personnel performs the following procedure to excavate existing company pipeline facilities.

Step	**Activity**
1	**CLASSIFY** the soil in each section of the excavation. **DETERMINE** appropriate sloping, shoring, or shielding per *Section 7.7 below*.

CAUTION: When conditions change, reclassify soil and modify sloping, shoring, or shielding requirements as necessary before entry.

2	**VERIFY** excavation equipment (e.g., backhoe, track hoe) has the side cutters detached with a plate welded over the teeth or the bucket teeth removed unless otherwise permitted by Operations Management.
3	**POSITION** a spotter to watch for unmarked lines, probe company facilities when required, and to stop the excavation equipment (e.g., backhoe, track hoe) operator if a foreign object is observed.
4	**EXCAVATE** on both sides parallel to the marked location of the company pipeline facility to minimize the danger of contact.

CAUTION: A minimum of 24” of separation between company pipeline facilities and any mechanized excavating equipment will be maintained unless otherwise permitted by Operations Management. At no time shall the separation be less than 12”.

5	**CONTINUE** the excavation adjacent to the company pipeline facility with a hand shovel until the side wall of the company pipeline facility is exposed.
6	**PUSH** the dirt directly above the company pipeline facility into the adjacent ditch with hand shovels.
7	**PLACE** the excavated material at least two (2) feet from the edge of the excavation. **SEPARATE** the topsoil and fill material for later use in the backfill operation.
8	When excavation is to take place within the specified tolerance zone of company pipeline facilities, an excavator must exercise such reasonable care as may be necessary for the protection of any underground pipeline in or near the excavation area **(Sections A. through C. shall be exercised in Texas).** A. "Tolerance zone" is defined as half the width of the underground pipeline plus a minimum of eighteen inches (18”) on either side of the outside edge of the underground pipeline on a horizontal plane. The tolerance zone shall not be less than twenty-four inches (24”) on either side of the pipe. B. Unless approved by the underground utility operator, excavation within the “Tolerance Zone” shall only be performed by non-mechanical means. Certain climate or geographical conditions may require a specific method of excavation such as hand digging, soft digging, vacuum excavation, or pneumatic hand tools. Other mechanical or technical methods developed may be used with the approval of the underground pipeline operator. C. Hand digging and non-invasive methods are not required for pavement removal.

NOTE: When excavation activity occurs on company pipeline facilities and is complete by Operations Personnel, or Company Contractors, sections A. through C. above are not required, but should be considered.

9	**IF** it becomes necessary to operate excavation equipment over company pipeline facilities, **VERIFY** there is adequate stable cover and **DETERMINE** per *SOP HLI.27 Abnormal Loading_External Loads_Hwy_RR* if external loading from excavation equipment is within acceptable limits.
10	**COMPLETE** a Pipe Inspection Report upon exposing company pipeline facilities designed for below grade service. Refer to *SOP HLD.35 Buried Pipe Inspection and Evaluations.*

7.4 Safety Precautions

Operation Personnel follow the safety procedures below when working in a trench, ditch, or hole.

CAUTION: Reference *Safety Procedure S-130 Excavation and Trenching* for additional requirements.

Step	Activity
1	**VERIFY** all personnel who are exposed to public vehicular traffic during excavation activities are provided and wear suitable warning vests or garments.
2	**EXCAVATE** the area in a careful and controlled manner.
3	**PLACE** excavated material at least two (2) feet from the edge of the ditch to avoid impeding the use of ramps, ladders, or steps. **ADHERE** to OSHA Subpart P guidelines for the placement of the soil.

WARNING: Prohibit any entrance into the excavation until approval of all sloping, shoring, shielding, and means of egress has been granted by the designated excavation competent person.

4	**PROVIDE** ramps, ladders, or steps on both sides of the company pipeline facility to provide escape routes for personnel in the event of an emergency.
5	**VERIFY** the area of exit from ramps, ladders, or steps is not obstructed.
6	**VERIFY** ladders are in good condition, extend from the floor of the excavation to three (3) feet above the top of the excavation, and are secured at the top.
7	For excavations of greater than four (4) feet in depth: • **PROVIDE** means of egress/exit so no more than 25 feet of lateral travel is necessary from any point in the ditch. • **VERIFY** the slope of exit runways does not exceed a one (1) feet rise over a three (3) feet run, or **PROVIDE** cut in steps.. • **REFER** to *Section 7.8* below for sloping and shoring requirements. • **PROVIDE** walkways with standard guardrails when employees are required to cross over excavations where the walkways are four feet or more above the lower levels.

4	**PROVIDE** ramps, ladders, or steps on both sides of the company pipeline facility to provide escape routes for personnel in the event of an emergency.
8	**INSPECT** the work area daily before work, during each shift, and under any circumstance making the work area unsafe.
9	**COMPLETE** a hot work permit/hazardous operations plan when performing welding, cutting, heating, or other maintenance activities where liquid or vapors might be present in the trench.
10	**TEST** excavations for any possible accumulation of dangerous fumes or oxygen deficient atmospheres. **DIRECT** employees to report any signs of fume accumulation or oxygen depletion.

NOTE:

- Hazardous liquids or vapors are not generally expected in the excavation of company liquid pipeline facilities. However, when hazardous liquids or vapors are expected or known to be present adequate precautions shall be taken to protect personnel.
- Direct reading instruments will be utilized to determine whether hazardous, vapors or inadequate oxygen levels exist prior to personnel entering excavation, or a confined space. Personnel will not enter excavation where hazardous vapors, or insufficient oxygen levels are found without appropriate personal protective equipment and training.
- Training in the use of hazardous vapor detection devices will be in accordance with manufacturer's recommended procedures.

11	**MONITOR** water control and removal equipment. **DIRECT** employees to report accumulations of water or other material that might weaken the excavation or make escape difficult. **DISCONTINUE** work if water in the trench impedes safe egress.
12	**DIRECT** employees to watch for evidence of cracks, slumping, slides, caving in soil, and signs of stress or failure in shoring or shielding.
13	**STORE** any materials at least two (2) feet from the edge of the excavation.
14	**IF** a welder or other worker is required to lie down in a trench over 3½ feet deep, **WIDEN** and **SLOPE OUT** the trench at the elevation the worker is present.
15	**VERIFY** bell-holes are large enough in all dimensions for safe and easy working conditions.

7.4.1 Hazardous Atmospheres

Operation Personnel are responsible for the following procedures when individuals work in the trench and there is an unsafe accumulation of vapor or gas.

WARNING: No personnel will be allowed to enter any excavation, regardless of depth, until the area is made safe from the presence of a hazardous atmosphere.

Step	Activity
1	**TAKE** adequate precautions to prevent employee exposure to hazardous atmospheres and atmospheres containing less than 19.5% oxygen. **PROVIDE** respiratory protection or ventilation, if appropriate.
2	**IF** hazardous vapors are being vented in trench excavations out of a company pipeline facility during maintenance functions, **INSTRUCT** employees working in close proximity to venting vapors to position themselves in such a way to not be inhaling fumes. **USE** approved monitors to verify air quality.

CAUTION: Hazardous vapors accumulate in low lying areas and do not dissipate quickly and have a tendency to accumulate in the trench.

Step	Activity
3	**MONITOR** trenches and bell-holes where vapors are venting for any unsafe accumulation of vapors using portable gas detection.
4	If distillate or some other condition causes an unsafe accumulation of vapor in the trench or bell-hole, **PROVIDE** the appropriate emergency rescue equipment, including a breathing apparatus and a rescue harness and line.

NOTE: Excavations may be considered confined spaces and require permit entry. Refer to *Safety Procedure S-370 Work Permits*.

7.5 Using Explosives

Operation Personnel perform the following procedure where explosives are used to assist in excavations near existing company pipeline facilities.

WARNING: Reference *SOP HLI.23 Protection of Pipeline Facilities From Blasting Operations* for the requirements of a blasting plan, the evaluation of the plan, and any actions to be taken.

CAUTION: When the use of explosives is necessary and approved for assisting in excavations, the utmost care must be taken to not endanger life or adjacent property and maintain the safety and integrity of company pipeline facilities. In addition, all use of explosives must be witnessed by a company representative

Step	Activity
1	**SECURE** all necessary permits required for the transportation, storage, and use of explosives.
2	**FOLLOW** all laws, rules, and regulations governing the storing, handling, and use of such explosives.

CAUTION: Do not permit blasting within or near stream channels without prior consultation with federal or state conservation authorities to determine what protective measures to take to minimize damage to fish and other aquatic life.

Step	Activity
3	**PROVIDE** a blasting plan the Pipeline Integrity Department, who will evaluate and approve the plan prior to blasting.
4	**NOTIFY** building owners prior to blasting and **PERFORM** a pre-blast survey, including photos.
5	If buildings or other structures are located within 200 ft. of company pipeline facilities, **USE** seismic equipment and **MONITOR** each of these locations during blasting.

NOTE: Seismographic monitoring criteria, such as peak particle velocity, give a very poor correlation with the stress imposed on pipelines from blasting. Where the company's guidelines for blasting near pipelines are used to evaluate blasting plans, seismographic equipment is not necessary and is not used for monitoring the pipeline.

Step	Activity
6	**USE** mats and/or backfill over the blast area and **TAKE** all other possible precautions to prevent damage to livestock and other property and to avoid inconvenience to the property owner or tenant during blasting operation.
7	**HAUL** any rock scattered outside the right-of-way by blasting operations to the right-of-way.

7.6 Excavation of Company Pipeline Facilities by a Contractor

In addition to the requirements set forth in this SOP, Operation Personnel or a qualified Company Inspector follow the procedures below and are responsible for overseeing the excavation of company pipeline facilities when performed by a contractor or other parties.

Step	Activity
1	**VERIFY** a Operation Personnel or Company Inspector is on site at all times while the contractor is excavating within company right-of-way to watch for unmarked lines, probe company facilities when required, and to stop the excavation equipment (e.g., backhoe, track hoe) operator if a foreign object is observed.

WARNING: Operation Personnel or Company Inspector has full authority to stop the work if he/she determines the work is being performed unsafely, if a foreign object is spotted, or if the guidelines set forth in this procedure are not properly followed.

2	**VERIFY** excavation equipment (e.g., backhoe, track hoe) is maintained, serviced, and in good working order allowing it to be operated safely and having the ability to maintain depth and offset specifications.
3	**VERIFY** the excavation equipment (e.g., backhoe, track hoe) is operated by a skilled and experienced operator.
4	**COMPLETE** work permits as necessary considering scope of work.

7.7 Sloping and Shoring

All Sloping and Shoring should be done when directed by and in accordance with the current *Safety Procedure S-130 Excavation and Trenching.*

Step	Task
1	**CONSULT** Operations Manager or Project Manager of proposed excavations which may require sloping and shoring.
2	**INSPECT** all sloping, shoring, or shielding as required.

7.7.1 Sloping Requirements

Operation Personnel equipment operator uses the following procedure when required by the current *Safety Procedure S-130 Excavation and Trenching.*

Step	Activity
1	**DETERMINE** the angle of repose for the walls of the excavation per *Safety Procedure S-130 Excavation and Trenching* based on the type of soil, water conditions, and previous soil disturbances.
2	**SLOPE** the ditch by stair-stepping/benching or cutting back the ditch walls to an appropriate angle of repose.
3	**FLATTEN** the angle of repose when the excavation has water conditions, silty material, loose boulders, and areas where erosion, deep frost action, or slide planes appear.

7.7.2 Shoring Requirements

Operation Personnel qualified as an OSHA competent person uses the following procedure when the appropriate angle of repose cannot be achieved and required by the current *Safety Procedure S-130 Excavation and Trenching*.

Step	Activity
1	**SHORE** the trench for additional protection using timbers and trench jacks, sheet piling, or manufactured hydraulic shoring systems. **INSTALL** shoring from the top down.
2	**REMOVE** shoring from the bottom up after work has been completed on excavations.
3	**TAKE** precautions in the release of shoring jacks and braces. In unstable soil, **USE** ropes to remove jacks and braces.

7.8 Inspecting Excavations

Operation Personnel Competent Person uses the following procedure to inspect an excavation.

Step	Activity
1	**INSPECT** the shoring system, soil conditions, and construction methods daily to detect unsafe conditions.
2	**NOTE** the condition of the soil and shoring materials.
3	**IDENTIFY** existing and potential hazards in the surrounding working conditions. **TAKE** prompt corrective action to eliminate hazards.
4	**INSPECT** excavations after rain storms or other hazard-increasing occurrences.
5	**COMPLETE** the applicable form(s) for *Safety Procedure S-130A Excavation Report*
6	**PROVIDE** additional protection against slides or cave-ins, if necessary.
7	**ADHERE** to local highway department requirements while on a highway right-of-way.

7.9 Backfilling

Operation Personnel or a qualified Company Inspector follow the procedures below when backfilling company pipeline facilities or are responsible for overseeing backfilling operations of company pipeline facilities when performed by a contractor or other parties.

NOTE: The backfilling operation is critical for providing support around and beneath company pipeline facilities.

Step	Activity
1	**REPAIR** probe marks and damaged coating in accordance with *Engineering Standard HL6.0306 Coating of Field Joints, Valves, Tie-Ins, Girth Welds and Short Sections of Pipe Using Two Part Epoxy* or *HL6.0306 Wax Coating for Buried or Submerged Fittings, Valves, Tie-Ins, & Repairs to Linepipe Coating*.
2	**FOLLOW** the coating manufacturer's recommended cure time prior to backfilling.
3	**VERIFY** the company pipeline facility rests on the bottom of the ditch/trench.
4	**PREPARE** a dirt cushion of at least six (6) inches prior to laying company pipeline facility in solid or loose rock. **CONSIDER** using approved rock shield.
5	**REMOVE** bottom trench supports first. **RELEASE** trench jacks slowly.
6	**PLACE** additional pad dirt around the company pipeline facility to a minimum elevation of six (6) inches above the top of the pipeline.

NOTE: Rock, two (2) inches in diameter and larger, or like materials shall not be backfilled directly onto company pipeline facilities. Where such materials are encountered, sufficient earth or sand shall be used to backfill around and over company pipeline facilities to form a protective padding or cushion as

specified in step 6 above.

Large rock or boulders shall not be backfilled into the ditch and shall be disposed of properly.

CAUTION: Exercise care when backfilling to assure rocks of significant size (rocks large enough to penetrate the padding and damage the coating and/or the pipeline) are not backfilled immediately on top of the padding.

Step	Activity
7	**IF** backfilling in cultivated lands, **REPLACE** the original depth of surface soil.
8	**VERIFY** no foreign or refuse material is included in the backfill. **DO NOT USE** contaminated fill. These materials include, but are not limited to: • Skids • Welding rods • Pipe rings • Trash • Tree and shrubbery limbs **REMOVE** all such materials from the job site.

CAUTION:
- Do not stand in excavation when mechanical back filling is underway.
- In unstable soil, clear all employees from trench and use ropes to remove the trench jacks.

Step	Activity
9	**RESTORE** any fences, culverts, or markers.
10	**SPREAD** soil which has been excavated during construction and not used evenly onto the cleared areas or **REMOVE** it from the site.
11	**GRADE** the topsoil to conform to the adjacent terrain. **MAKE** an allowance, such as a crown over the ditch, for the natural settlement of the soil.
12	**IF** excavating existing company pipeline facilities, **RETURN** the grade to its original condition.
13	**COMPLETE** the applicable form(s) for inadequate cover or **ENTER** data in electronic database for all company pipeline facilities excavated with less than 24 inches of cover. Refer to *SOP HLI.24 Management of Depth of Cover and Evaluation*.
14	**REMOVE** excess construction material and other debris from the right-of-way.
15	**REMOVE** rock brought to the surface by excavation and remaining after backfilling from the property unless approved by management.
16	**SEED** and **FERTILIZE** the right-of-way or otherwise return it to approximately the original condition.
17	**VERIFY** the replacement of earth adjacent to water crossings is at slopes equal to or less than the normal angle of repose for the soil type involved.
18	**ACCOMPLISH** sandbagging, seeding, or other methods of soil stabilization without undue delay.

Step	Activity
19	**FOLLOW** any special and reasonable considerations requested by the landowner and approved by the company Right-of-Way Representative and Operations Management regarding the clearing and restorations activities.
20	**VERIFY** that the depth of cover is in accordance with the permit or easement requirements, the latest revision of the company drawing standards and the requirements of applicable jurisdictional government agencies.

7.9.1 Erosion Control

During the backfill operation, Operations Personnel follow this procedure to prevent subsurface soil movement and subsequent erosion in hilly or mountainous terrain.

Step	Activity
1	**CONSTRUCT** an interceptor dike with compacted earth or earth filled burlap bags extending completely across company right-of-way at a minimum height and width of 18” x 36”.
2	**POSITION** each dike to divert water downhill at a 2% slope toward a well vegetated area, if possible.
3	**INSTALL** permanent interceptor dikes after the final grading and prior to reseeding. As a general rule, interceptor dikes are not used in cultivated lands (except as a field boundary) or in residential or landscaped areas.
4	**SPACE** interceptor dikes as follows: Right-of-Way Slope — Interceptor Dike Spacing < 5% — No structure 5 to 15% — 150 ft. 15 to 30% — 100 ft. 30% — 50 ft.
5	**INSTALL** trench plugs after the company pipeline facility has been laid in the ditch and prior to backfilling.

NOTE: Trench plugs are composed of earth filled sacks packed tightly around company pipeline facilities.

Step	Activity
6	**SPACE** trench plugs as follows: Right-of-Way Slope — Trench Plug Spacing < 5% — No plugs required 5 to 15% — 300 ft. (150 ft.) 15 to 30% — 200 ft. (100 ft.) 30% — 50 ft.

NOTE: Values in parentheses indicate required spacing on slopes with highly erodible soils.

Step	Activity
7	**DETERMINE** whether trench plugs or interceptor dikes are appropriate for

Step	Activity
	company pipeline facility replacements and installations less than 50 feet in length.

8.0 Documentation Requirements

Record data in the electronic database or utilize the following form(s) as applicable:

- S-130A Excavation Report
- I.10.C Pipeline Inadequate Cover Notification
- I.10.D Rights-of-Way and Other Property Damage Reports
- Shallow Cover Database
- Pipe Inspection Database

The following table describes the documentation reporting requirements of this SOP.

Activity	Reporting
Acknowledge the requirements as outlined in the SOP have been completed. Record exceptions, if any, in the comments section.	EAM Unplanned Pipeline Work Order or appropriate maintenance record; retain for the life of the facility.

9.0 References

- E.S. HL6.0306 Wax Coating for Buried or Submerged Fittings, Valves, Tie-Ins, & Repairs to Linepipe Coating
- E.S. HL6.0306 Coating of Field Joints, Valves, Tie-Ins, Girth Welds and Short Sections of Pipe Using Two Part Epoxy
- HLA.01 Glossary and Acronyms
- HLB.04 Pipe Location and Marking
- HLD.35 Buried Pipe Inspection and Evaluations
- HLI.11 Pipeline Pressure Limit Criteria
- HLI.23 Protection of Pipelines Facilities from Blasting Operations
- HLI.24 Management of Depth of Cover and Evaluation
- HLI.27 Abnormal Loading of External Loads / Highway and Railroad Crossings
- Safety Procedure S-370 Work Permits
- Safety Procedure S-130 Excavation & Trenching

Appendix A: OQ Task Requirements

The table below identifies the Operator Qualification (OQ) task requirements.

Task Description	OQ Task
Backfilling Pipe and Coating Protection	PLOQ404
Underground Pipeline – locate and temporarily mark	PLOQ605
Damage Prevention During Excavation/Encroachment Activities	PLOQ607

ENERGY TRANSFER

Pipeline Pressure Limit Criteria

Standard Operating Procedures

Applicable to Hazardous Liquids Pipelines and Related Facilities

Code Reference :	**Procedure No.: HLI.11**	
49 CFR: 195.406, 195.424	***Effective Date: 04/01/18***	**Page 1 of 7**

1.0 Procedure Description

This Standard Operating Procedure (SOP) describes the scenarios and guidelines used when a pressure reduction is required prior to excavating a pipeline or prior to making a repair. This SOP establishes maximum pressures at which a pipeline is operated during maintenance and repair projects.

2.0 Scope

This SOP establishes maximum pressures at which a pipeline is operated during maintenance and repair projects.

3.0 Applicability

This SOP applies to pressure limits for damaged pipe at company facilities. The operating pressure limits for excavation activity apply when using powered equipment. Refer to *Appendix B: Operating Pressure Limitations*.

4.0 Frequency

As required: During damage assessment, excavation, maintenance, and repairs.

5.0 Governance

The following table describes the responsibility, accountability, and authority of the operations described in this SOP.

Function	**Responsibility**	**Accountability**	**Authority**
All Operations	Operations Personnel	Operations Manager	Director of Operations

6.0 Terms and Definitions

Terms associated with this SOP and their definitions follow in the table below. For general terms, refer to *SOP HLA.01 Glossary and Acronyms*.

Terms	**Definitions**
Damaged Pipeline	Pipe with a defect, which requires an evaluation and repair according to *SOP HLI.06 Evaluating Pipeline Defects*. If a damaged pipeline is identified, it retains this classification until it is repaired per *SOP HLI.05 Pipeline Repair*.
Pipeline Anomaly	An unexamined and unevaluated deviation from the norm in pipe material identified through ILI data.
Pipeline Defect	A physically examined and evaluated deviation from the norm in pipe material with dimensions or characteristics that exceed

Terms	**Definitions**
	acceptable limits.
Operating Pressure	For the purpose of this specification, the operating pressure is defined as the highest pressure experienced in the pipeline at the excavation location during the 60 days prior to discovery.
Pipeline Condition	The condition of the segment of the line in the immediate surroundings where the activities are taking place or are expected to take place. (Refer to Table 1 in Appendix B)
Undamaged Pipeline	No defect exceeding the limits of *SOP HLI.06 Evaluating Pipeline Defects* is found or after all known defects are repaired.
Unknown Damage	Damage identified through ILI data or third party notification that has not been measured or cannot be accurately measured using approved methods and that represents a possible safety and integrity hazard.

7.0 Pipeline Pressure Limit Criteria

The pressure criteria in this SOP are based upon company and industry experience as opposed to mathematical analysis or empirical expressions predicting pipeline behavior. Pressure reduction decreases the stress in the pipe and lowers the probability of failure. Consequently, performing activities at the lowest practical operating pressure maximizes the reduction of risk.

The following procedures are described in this section:

- Pressure reduction assessment
- Notification of pressure reduction
- Pressure reduction
- Durations of pressure reductions for defects
- Pressure reduction exception

WARNING: Verify HVLs remain at the appropriate pressure to ensure liquid state. If this cannot be accomplished the line shall be removed from service per *SOP HLI.01 Hazardous Liquid Pipeline Shutdown and Startup*

7.1 Pressure Reduction Assessment

Operations Personnel follow the steps below to determine if a pressure reduction is required during or prior to damage assessment, repair, construction, or maintenance activities

Pressure reduction is not necessary if there are no known defects and no additional factors regarding the pipeline section to be excavated.

Step	Activity
1	**DETERMINE** if one of the following is required during or prior to damage assessment, repair, construction, or maintenance activities: • Pressure reduction not required • Pressure reductions corresponding to metal loss defect • Pressure reductions corresponding to a leaking defect, unknown damage, alternative factors • Pressure reductions prior to pipeline repair
2	**IDENTIFY** if any of the following factors or conditions exist influencing the decision to restrict the pipeline pressure. Factors and or pipeline conditions include but are not limited to: • Operating and construction history of the pipeline: o Type of girth weld/coupling o Type of seam weld o Pipe vintage o Expected manufacturing, construction, or operation defects o History of stress corrosion cracking • Type of work to be done: o Lowering/raising of the pipeline o Inducing pipeline stresses o Welding for Sleeve or Appurtenance Installation • Anomaly/defect characteristics: o Known - Defect o Unknown - Anomaly • Percentage of specified minimum yield strength (SMYS) at which the pipeline operates • Poor site conditions • Characteristics of the product

WARNING: Any one or combination of factors or conditions may warrant a more severe pressure reduction than outlined in this SOP at the discretion of the Qualified Operations Personnel, including a complete reduction in line pressure if it is deemed at any time necessary in order to maintain safety and integrity of the pipeline.

7.1.1 Prior to Excavation

When a pipeline with a leaking defect, known or unknown damage, or pipeline anomaly will be exposed by excavation, Operations Personnel perform these steps to reduce the operating pressure.

Step	Activity
3	When excavating a damaged pipeline due to a leaking defect or unknown damage from second or third parties, **REDUCE** the operating pressure to 80% of the operating pressure from the last 60 days at a minimum (see Definitions in *Section 6.0*, Terms and Definitions)
4	When excavating a pipeline due to a pipeline anomaly, **CONSIDER** reducing the operating pressure to the one of the following: • The safe pressure determined by Engineering Analysis from Technical Operations or Pipeline Integrity Department considering anomaly location and distance from pressure source, or • 80% of the operating pressure (see Definitions in *Section 6.0*, Terms and Definitions) The Pipeline Integrity Department will determine necessary pressure reductions for Immediate Conditions.
5	If there are alternative factors that warrant pressure reduction, **REDUCE** the operating pressure to a safe pressure determined by Engineering Analysis from Technical Operations or Pipeline Integrity Department.
6	**MAINTAIN** pressure reductions per Section 7.4 requirements.

NOTE:	Consider a pressure reduction when excavating on any section with a history of stress corrosion cracking until it is verified that no crack-like defects are present. Consult the Pipeline Integrity Department to determine the appropriate pressure reduction if necessary.

7.1.2 During Evaluation of Pipeline Defects

During the evaluation of pipeline defects (metal loss or damage) the Qualified Operations Personnel performs the steps below. Refer to Section 6.0 for a definition of unknown defect and suspected damage.

Step	Activity
1	**EVALUATE** external corrosion and general metal loss defects detected during any damage assessment, repair, construction, or maintenance activities per *SOP D.47 Evaluation of Remaining Strength of Pipe with Metal Loss*.

2	**VERIFY** pressure is below the "Max Safe Pressure" results determined by *SOP D.47 Evaluation of Remaining Strength of Pipe with Metal Loss* and **ADJUST** pressure reduction accordingly.
3	After characterization of an unknown or newly discovered defect, if this pressure is less than 80% of the most recent operating pressure or highest known pressure from the last 60 days, **ADJUST** the pressure reduction to the safe operating pressure as defined in *SOP HLD.47 Evaluation of Remaining Strength of Pipe with Metal Loss*.
4	Accordingly, upon characterization of the defect, if the safe operating pressure as defined in *SOP HLD.47 Evaluation of Remaining Strength of Pipe with Metal Loss* is greater than 80% of the most recent operating pressure, **OBTAIN** approval from the Director of Operations to **ADJUST** the pressure reduction to the higher pressure.
5	**EVALUATE** other metal loss or damage defects (i.e. scratches, gouges, mill pits, grinding marks, etc.) per *SOP HLI.06 Evaluating Pipeline Defects.*
6	**ADJUST** the pressure reduction if there are defect characteristics identified that may impair serviceability of the pipeline. **REDUCE** the pressure to a safe pressure determined by Engineering Analysis from Technical Operations or Pipeline Integrity Department. Defect characteristics that may impair serviceability include but are not limited to: • Sharp defect edges • Stress concentrators • Cracking • Hard spots • Arc burns
7	**MAINTAIN** pressure reductions per Section 7.4 requirements.

7.1.3 Pipeline Repair by Grinding

Pipeline repairs made by grinding often requires a pressure reduction. Operations Personnel perform the following activities.

Step	Activity
1	**REDUCE** the pressure to the one of the following: • The safe operating pressure determined via *SOP HLD.47 Evaluation of Remaining Strength of Pipe with Metal Loss*, based upon the expected remaining wall thickness after the repair • 80% of the operating pressure from the last 60 days • Or a safe pressure determined by Engineering Analysis from Technical Operations or Pipeline Integrity Department considering defect location and distance from pressure source.
2	**CONSIDER** the following attributes/defects when determining a pressure reduction prior to grinding:

Step	Activity
	• Stress Corrosion Cracks (SCC) • ERW or EFW • Girth weld • Crack-like defect remaining in pipe body after initial 10% nominal wall thickness removal per *SOP I.05 Pipeline Repair* • Defect with unknown effects to the serviceability of the pipeline

7.2 Notification of Pressure Reduction

The following notifications of pressure reduction should occur as soon as possible, prior to excavation.

- Operations Personnel **NOTIFY** the Operations Manager or Director of Operations when a pressure reduction is required.
- Operations Manager or Area Director **NOTIFY** Liquids Control.

7.3 Pressure Reduction

Operations Personnel use the following steps to reduce operating pressures in pipelines before excavation and repairs.

Step	Activity
1	**CONDUCT** a pressure reduction assessment per Section 7.1.
2	**REDUCE** pressure.

WARNING: For cases when a pressure reduction assessment results in a pressure below a critical delivery pressure, a more detailed analysis of the planned work must be completed. Safety of Operations Personnel and the safety and integrity of the pipeline shall not be compromised. Any deviation from the required pressure reduction shall be obtained through the waiver process per *SOP HLA.03 Management of Change*.

Step	Activity
3	**REDUCE** the pressure to zero (atmospheric) in situations where pipe damage is from equipment impacting the pipe and that equipment remains in place or where the integrity of the pipeline is jeopardized.
4	Upon characterization of a defect, **DETERMINE** if the current pressure reduction is adequate or requires adjustment.

7.4 Durations of Pressure Reductions for Defects

An Operations Manager uses the following steps to determine duration of pressure reductions for defects.

Step	Activity
1	**CONTINUE** and **MAINTAIN** any pressure reduction until after the visual inspection and evaluation of the defect are complete and it is determined that a pressure reduction is not required or a repair is completed per *SOP HLI.05 Pipeline Repair*.
2	If the evaluation determines that a pressure reduction is no longer necessary, **LIFT** the pressure restriction.
3	For pressure reductions of a pipeline in a high consequence area (HCA) exceeding 365 days **NOTIFY** Regulatory Compliance Group for notification to PHMSA.

8.0 Documentation Requirements

There are no documentation requirements in this SOP.

9.0 References

HLA.03 Management of Change
HLD.47 Evaluation of Remaining Strength of Pipe with Metal Loss
HLI.01 Hazardous Liquid Pipeline Shutdown and Startup
HLI.05 Pipeline Repair
HLI.06 Evaluating Pipeline Defects

Appendix A: OQ Task Requirements

There are no Operator Qualification (OQ) tasks required for this procedure.

ENERGY TRANSFER

Pipeline Facilities Identification

Standard Operating Procedures

Applicable to Hazardous Liquids Pipelines and Related Facilities

Code Reference :	**Procedure No.: HLI.12**	
49CFR 195.434, 195.410, 195.438	***Effective Date: 04/01/18***	**Page 1 of 6**

1.0 Purpose

This Standard Operating Procedure (SOP) describes the various methods used to identify company pipelines and related facilities, as well as the activities involved with the placement and maintenance of the different types of identification markers.

2.0 Scope

This procedure describes the requirements for the type and placement of signs along the pipeline ROW as well as fenced or otherwise enclosed boundaries of company facilities to aid in their identification and alert the general public of potential hazards.

3.0 Applicability

This SOP applies to all regulated pipelines and facilities.

4.0 Frequency

As required: Install and maintain signs and markers.

5.0 Governance

The following table describes the responsibility, accountability, and authority of the operations described in this SOP.

Function	Responsibility	Accountability	Authority
All Operations	Operations Personnel	Operations Manager	Director of Operations

6.0 Terms and Definitions

For general terms, refer to *SOP HLA.01 Glossary and Acronyms*.

7.0 Pipeline Facilities Identification

The following procedures are described in this section:

- Placement of Pipeline Markers
- Aerial Markers
- Road and Blacktop Stencils and Decals
- Temporary Markers
- Painted Fence Posts
- Facility Signs
- Maintenance

7.1 Placement of Pipeline Markers

Operations Personnel follows the steps below for the placement of pipeline markers at the following locations:

- Stream crossings
- Both sides of public road crossings
- Other utility's right-of-way
- Both sides of railroad crossings
- Aboveground pipelines in areas accessible to the public
- Any other location where it is necessary to identify the pipeline location

Step	Activity
1	**PROVIDE** pipeline identification and warning information on casing vents or pipeline markers.
2	Markers **MUST** include the following written legibly on a background of sharply contrasting color: • OPERATING COMPANY NAME, • The words "WARNING", "CAUTION" or "DANGER", followed by the type of PRODUCT TRANSPORTED, (ei "HAZARDOUS LIQUIDS") "PIPELINE", all of which (except for markers in heavily developed urban areas) must be in letters 1" high by ¼" stroke • The appropriate 24-hour, toll free or emergency phone number, including area code.
3	**CONSIDER** placing markers at **LINE-OF-SIGHT** intervals where practical
4	**REFER** to alignment sheets for installation details.

7.2 Aerial Markers

Operations Personnel follows the steps below for installing aerial markers where applicable.

NOTE: Aerial markers may include mileposts, valve numbers, and other pipeline information visible by aerial patrol.

Step	Activity
1	**INSTALL** aerial patrol markers at frequent intervals and at all industrial sites only where necessary to assist the aerial patrol pilot in identifying locations along the pipeline ROW.
2	**VERIFY** that aerial patrol markers are maintained in good condition and are clearly visible from the air.
3	**VERIFY** that all aerial markers have clear bold letters and/or numbers.
4	**REFER** to appropriate company standard drawings for aerial markers.

NOTE: In lieu of aerial markers, GPS waypoints may be established at frequent intervals to enable the aerial patrol operator and Operations Personnel to locate the pipeline and associated facilities along the ROW. A master list of waypoints should be maintained for quick reference.

7.3 Road and Parking-lot Stencils and Decals

Operations Personnel follows the steps below to use stencils and decals to mark pipeline locations.

Step	Activity
1	**USE** decals, stencils or other appropriate markers to **MARK** the location of the pipeline where it is impractical to install a marker on company facilities, such as areas where the pipeline is located longitudinally within a road, and where the pipeline is located within parking areas.
2	**VERIFY** that the decals identify the company name, the appropriate signage (i.e. “Hazardous Liquid” or “Petroleum Pipeline”) that identifies the pipeline the 24 hour telephone number, and the orientation of the pipeline.

7.4 Waterway Warning Signs

Operations Personnel installs warning signs for waterway crossings.

Step	Activity
1	**POST** waterway warning signs at navigable inland waterway crossings where anchor damage to the pipeline is possible.
2	**VERIFY** that the decals identify the company name, the appropriate signage (ei “Hazardous Liquid” or “Petroleum Pipeline”) that identifies the pipeline the 24 hour telephone number, and the orientation of the pipeline.

NOTE: Consider boat traffic, flood zones, and high water areas when placing pipeline markers and water crossing signs.

7.5 Temporary Markers

Operations Personnel follows the steps below for installing temporary markers.

Step	Activity
1	**INSTALL** temporary markers where necessary to aid in preventing damage caused by short-term construction activities. Refer to *SOP HLI.28 ROW Encroachments* and *SOP HLI.30 Third Party Damage.*

NOTE: Temporary markers include stakes, flags, marker posts, signs, painted markings on paved surfaces.

7.6 Painted Fence Posts

Operations Personnel follows the steps below for painting fence posts if directed by the area Operations Management.

Step	Activity
1	**PAINT** the fence posts located within the pipeline ROW with high visibility paint, after **NOTIFYING** the landowner.
2	If the pipeline easement does not have a defined width, **EXTEND** the painted fence posts 25 feet out from the centerline of the outermost pipeline.
3	**PAINT** the fence posts unless forbidden by the landowner.
4	If the landowner forbids the painting, **NOTIFY** the ROW Representative.
5	**DOCUMENT** in *ROW Tract Files* that the landowner has forbidden the painting of fence posts.

7.7 Facility Signs

Operations Personnel places the following signs at the appropriate locations for the listed company facilities.

7.7.1 Pump Stations and Breakout Tanks

Smoking or an Open Flame is prohibited where there is a potential or presence of flammable vapors or liquids. Follow the steps below for the placement of signs at pump stations, breakout tank and DOT regulated sphere facilities, junctions and delivery facilities where there is a potential for the presences of flammable vapors or liquid.

Step	Activity
1	**PLACE** "No Trespassing" "Authorized Personnel Only" signs at or near each walk-in or drive-in gate.
2	**CONSIDER** placing "No Trespassing" "Authorized Personnel Only" signs at 100-foot intervals along the fence where appropriate.
3	**PLACE** line markers where liquid pipelines enter and exit the facility.
4	**PLACE** "Smoking in Designated Areas Only" signs at or near each walk-in or drive-in gate.
5	**PLACE** "Smoking in Designated Areas Only" signs between any smoking and non-smoking areas on the property. Add "No Open Flames" signs where smoking is prohibited.
6	**PLACE** signs including the company name, facility name and appropriate emergency telephone numbers at the main entrance to the facility or the entrance facing the public and around the facility fence.

7.7.2 Measuring Stations

Follow the steps below for the placement of signs at measuring stations.

Step	Activity
1	**PLACE** "No Trespassing" signs at or near each walk-in or drive-in gate, "Authorized Personnel Only".
2	**PLACE** company and facility name, and appropriate emergency telephone numbers at the main entrance to the facility or the entrance facing the public roadway.
3	**PLACE** line markers where liquid pipelines enter and exit the facility.
4	**PLACE** "No Smoking or Open Flames Signs" at or near each walk-in or drive-in gate.

7.7.3 Main/Lateral Line Valve Settings

Follow the steps below for the placement of signs at main/lateral line valve settings.

Step	Activity
1	**PLACE** "No Trespassing" signs at or near each walk-in or drive-in gate.
2	**PLACE** "No Smoking Signs" at or near each walk-in or drive-in gate.
3	**PLACE** sign on the facility fence including the name of the operator and the 24 hour emergency call number
4	**PLACE** line markers where liquid pipelines enter and exit the enclosed boundary.

NOTE:

- On facilities south of the Colorado River (in Texas) and at other locations where English may not be the predominant language, signs must be printed in English and the locally predominant language, or two signs must be used, one in English and the other in the locally predominant language.
- For small meter stations, especially in the gathering area, where there may be only a tap valve and Electronic Gas Measurement (EGM) (where the producer owns the meter run), or where there is a skid-mounted metering facility that may be on others' property, there may not be sufficient surface area or fence to install signs as on larger facilities.

Step	Activity
5	**INSTALL** an approved pipeline warning sign on the meter house door and/or at the tap valve in areas where the cases in the previous note are present.
6	For main/lateral line valve settings or measurement facilities where there is only a pipe-fence and no woven fence, **PLACE** signs inside the area as long as they are clearly visible at the property boundary and do not interfere with operations and maintenance activities.

NOTE: It is not the intent to install fencing in order to post signs.

7.8 Maintenance

Operations Personnel follows the steps below for maintenance.

Step	Activity
1	**REPAIR** or **REPLACE** damaged or missing markers in a timely manner.

8.0 Documentation Requirements

There are no documentation requirements for this SOP.

9.0 References

HLI.28 ROW Encroachments
HLI.30 Third Party Damage

Appendix A: OQ Task Requirements

The table below identifies the Operator Qualification (OQ) task requirements.

Task Description	OQ Task
Install and Maintain Pipeline Markers	PLOQ703

ENERGY TRANSFER

Inspection of Rights-of-Way & Crossings Under Navigable Waters

Standard Operating Procedures

Applicable to Hazardous Liquids Pipelines and Related Facilities

Code Reference :	**Procedure No.: HLI.21**	
49 CFR: 195.412	***Effective Date: 04/01/18***	**Page 1 of 6**

1.0 Purpose

This Standard Operating Procedure (SOP) establishes the requirements inspection of rights-of-way (ROW) and crossings under navigable waters. Methods of inspection include walking, driving, flying or other appropriate means of traversing the right-of-way.

2.0 Scope

This SOP describes the criteria for conducting and documenting pipeline inspections to verify the safety of the pipeline.

3.0 Applicability

This SOP applies to all regulated hazardous liquid facilities that are operated by the company.

4.0 Frequency

At intervals not exceeding 3 weeks, but at least 26 times each calendar year: Inspect the surface conditions on or adjacent to each pipeline right-of-way, including off-shore rights-of-way.

At intervals not exceeding 5 years: Inspect each crossing under a navigable waterway to determine the condition of the crossing, except for offshore pipelines.

5.0 Governance

The following table describes the responsibility, accountability, and authority of the operations described in this SOP.

Function	Responsibility	Accountability	Authority
Patrol Observations & Reporting	Contractor / Operator Performing Patrol / Inspection	Operations Manager	Director of Operations

6.0 Terms and Definitions

Terms associated with this SOP and their definitions follow in the table below. For general terms, refer to *SOP* HL*A.01 Glossary and Acronyms*.

Terms	Definitions
Navigable Waterway	As defined in Subpart 2.10-5 of 33 CFR where it states that "...navigable waters of the United States shall be construed to mean those waters of the United States, including the territorial seas adjacent thereto, the general character of which is navigable, and which, either by themselves or by uniting with other waters, form a continuous waterway on which boats or vessels may navigate or travel between two or more States, or to or from foreign nations...."

7.0 Inspection of Rights-of-Way & Crossings under Navigable Waters

Operations Personnel develop an inspection program to observe surface conditions on and adjacent to the facilities and/or pipeline right-of-way for indications of leaks, construction activity, and other factors affecting safety and operations.
Methods of inspection include walking, driving, flying, or other appropriate means of traversing the right-of-way.
The following procedures are described in this section:

- Aerial surveillance
- Observations during Inspection
- Inspection methods for crossings under navigable waterways
- Notification of encroachment problems
- Reporting and Investigating Patrol Observations
- Crossings Under Navigable Waterways Inspection Summary

7.1 Aerial Surveillance

Operations Personnel schedule aerial inspections.

In the event of a cancellation, the pilot documents the cancellation of a scheduled aerial inspection due to weather conditions, mechanical readiness of the aircraft or other conditions and notifies Operations Personnel. Consideration of alternative methods of inspection should be initiated to insure compliance with frequency requirements in Section 3.0.

Step	Activity
1	**VERIFY** personnel performing the inspections have adequate training and experience.
2	**CONSIDER** accompanying the pilot on the aerial inspections periodically.
3	**EVALUATE** construction activity to determine if more frequent flights are warranted.

7.2 Observations during Inspections

The operator performing an inspection keeps a log of the inspection, observing and documenting the following items:

- General conditions of the right-of-way.
- Indications of sink holes, sunken trenches, or exposed pipelines.
- Water erosion, bank erosion, soil slippage, or landslide areas.
- Indications of leakage such as blowing liquids / vapors, displaced backfill, discolored or wilted vegetation, oil sheen on water crossing areas or rights-of-way, bubbles in water puddles or water crossing areas, and/or ice formations over the pipeline.
- Fires on or adjacent to the right-of-way.
- The condition of pipeline markers. If they are found not to meet the requirements of SOP HLI.12 *Pipeline Facilities Identification,* correct that condition at this time.
- Damage to existing company facilities such as valves, pump stations and junctions, delivery facilities, loop terminals, or communications facilities.
- Construction or logging activity on, in the vicinity of, or progressing toward the pipeline right-of-way (including evidence of possible construction such as the presence of excavation equipment or evidence of disturbed earth that crosses the ROW.)
- Land leveling or grading activities.
- Excavation near the pipelines, including routine activities occurring within industrial properties.
- Installation of houses, mobile homes, businesses, churches, schools or other structures.
- Installation of parks, recreation areas, play grounds or other places of assembly on or adjacent to the right-of-way.
- Construction of irrigation or drainage canals, ponds, or swimming pools.
- Installation of irrigation piping systems, sprinkler systems, sewers, utilities, or other underground facilities or structures.
- Installation of telephone or power poles, fence posts, or guy wire anchors.
- Deep plowing operations
- Seismic geological survey activities, well logging operations, well drilling activities, or quarry and blasting work.
- Any unusual conditions or activities, which may have an effect on the pipelines.

7.3 Inspection Methods for Crossings under Navigable Waterways

Operations Personnel may use or select a Third Party to employ one of the following methods for inspection of crossings under navigable waterways:

- Sonar
- Physical Probing
- Acoustic Systems
- Magnetic Systems

7.4 Notification of Encroachment Problems

The patrol operator performs the following procedure when potential encroachments are identified during a patrol survey. Notify Operations Personnel in accordance with HLI.28 *Right-of-Way Encroachment.*

7.5 Reporting and Investigating Patrol Observations

Operations Personnel uses the following procedure for conditions identified by patrols.

Step	Activity
1	**DOCUMENT** the results of the Area's investigation and any other conditions found or reported that could adversely affect the safety, operation, or maintenance of the pipeline system on the applicable form(s) for *Encroachment, Foreign Line Crossing and Class Location HCA Report*. **INCLUDE** a description of conditions found and any remedial action required or taken.
2	**COMPLETE** the applicable form(s) for *Aerial Patrol Trouble Report* when the flight is completed. Include sketches, photos, or additional data to supplement reports where necessary.
3	**INCLUDE** on the applicable form(s) for *Aerial Patrol Trouble Report* a description of each activity on or adjacent to the pipeline right-of-way.

NOTE: Provide a distinct number for each individual report of activity documented on the applicable form(s) for *Aerial Patrol Trouble Report.*

Step	Activity
4	**INVESTIGATE** each activity reported using the applicable form(s) for *Aerial Patrol Trouble Report*
5	Operations Personnel **TAKE** immediate action if a condition is detected which could be a hazard to persons, environment or property in the area.
6	Operations Personnel **ADVISE** Director of Operations and/or Operations Manager and Integrity Department of the conditions, immediate actions taken and proposed future actions to resolve the condition. Integrity Department will inform the Director of Regulatory Compliance of these activities.
7	Operations Personnel **DOCUMENT** findings and actions taken on the applicable form(s) for *Line Patrol*.
8	Operations Personnel **COMPLETE** the process flow for an Abnormal Operation or Safety Related Condition, if applicable. REFER to SOP *HLA.12 Safety-Related Condition*, SOP *HLA.15 PHMSA / State Incident Reporting* and SOP *HLA.13 Response to Abnormal Operations*.
9	The Pipeline Integrity Department **INITIATES** through routine actions a program to recondition, replace, or abandon any line segment found to be in

Step	Activity
	unsatisfactory condition. Pipeline Integrity Department, Director of Regulatory Compliance, and Director of Operations shall approve this program prior to initiation.
10	If required, **INSPECT** the pipeline visually for coating damage, gouges, corrosion, dents per *SOP HLD.35 Buried Pipe Inspection and Evaluations.*
11	If anomalies are found which are not acceptable by company standards, **REPAIR** them per *SOP HLI.06 Evaluating Pipeline Defects.*
12	Operations Personnel **MAINTAIN** records for 2 years as required by the activity resolving an unsatisfactory condition.

7.6 Crossings under Navigable Waterways Inspection Summary

Operations Personnel uses the following for inspections of crossing under navigable waterways.

Step	Task
1	For Crossings Under Navigable Waterways, **OBTAIN** information pertaining to the current profile of the pipeline in relation to the bottom of the navigable waterway. **ADJUST** frequency of inspection based on the condition of the crossing to ensure integrity of pipe, prevent hazards to navigation and continuity of safe operations. **SCHEDULE** repairs as necessary.
2	**DOCUMENT** results of the inspection and **RETAIN** at the field office for at least 2 years or until the next inspection is performed, whichever is longer.

8.0 Documentation Requirements

Record data in electronic database or utilize the following form(s) as applicable:

- A.12.A Safety Related Conditions Report
- A.13.A Abnormal Operations
- B.13.A Encroachment, Foreign Line Crossing and Class Location HCA Report
- I.21.A Line Patrol
- I.21.B Aerial Patrol Report
- I.21.C Aerial Patrol Trouble Report

The following table describes the reporting requirements of this SOP for the electronic database.

Activity	Reporting
Acknowledge the requirements as outlined in the SOP have been completed. Record exceptions in	Electronic Maintenance Database

the description tab. Records of Patrols must be maintained for a minimum of 2 years. Inspections of Crossing under navigable waterways must be maintained for a minimum of 2 years or until the next inspection is performed, whichever is longer.	

NOTE: For Third Party Operators not using G-Forms, they should provide the applicable forms and be retained on file for the life of the facility.

9.0 References

HLD.35 Buried Pipe Inspection and Evaluations
HLI.06 Evaluating Pipeline Defects
HLI.12 Pipeline Facilities Identification
HLI.28 Right-of Way Encroachments

Appendix A: OQ Task Requirements

The table below identifies the Operator Qualification (OQ) task requirements.

Task Description	OQ Task
Pipeline Patrol	PLOQ701B
Install and Maintain Pipeline Markers	PLOQ703

ENERGY TRANSFER

Protection of Pipeline Facilities from Blasting Operations

Standard Operating Procedures

Applicable to Hazardous Liquids Pipelines and Related Facilities

Code Reference:	**Procedure No.: HLI.23**	
49 CFR: 195.442	***Effective Date: 04/01/18***	**Page 1 of 6**

1.0 Procedure Description

This Standard Operating Procedure (SOP) describes the steps and necessary precautions to be taken when blasting operations are to be conducted within 300 feet of the company's facilities.

2.0 Scope

The SOP provides the guidance necessary to perform adequate analysis of blasting plans for blasting near company facilities.

3.0 Applicability

This SOP applies when blasting operations occur within 300 feet of regulated company facilities.

4.0 Frequency

As required: When Blasting activity takes place near company facilities.

5.0 Governance

The following table describes the responsibility, accountability, and authority of the operations described in this SOP.

Function	Responsibility	Accountability	Authority
All Operations	Operations Personnel / Engineering	Operations Manager	Director of Operations

6.0 Terms and Definitions

For general terms, refer to *SOP HLA.01 Glossary and Acronyms*.

7.0 Protection of Pipeline Facilities from Blasting Operations

This SOP contains the following sections:

- Identify Potential Threats To Company Facilities
- Obtain Needed Information from the Parties Involved
- Analysis of the Proposed Blasting Plan
- Communicate Blasting Plan Requirements

7.1 Identify Potential Threats to Company Facilities

Operations Personnel follow these steps to identify potential threats to company facilities.

Step	Activity
1	**INVESTIGATE** any activity related to blasting or seismic operations that occur in the vicinity of the pipeline.
2	**CONFIRM** the limits of the blasting operation with the party performing the blasting.
3	**DOCUMENT** the results of the investigation on the applicable form(s) for *Encroachment, Foreign Line Crossing and Class Location HCA Reports.*

7.2 Obtain Needed Information from the Parties Involved

Operations Personnel follow these steps for obtaining needed information from the parties involved.

Step	Task
1	**OBTAIN** a detailed blasting plan from the party performing the blasting operations. The following information is required: • Date and time of proposed blasting operations • Location of blasting operations and distance from the nearest company facility • Rock configuration-degree of confinement, presence of free faces for rock to move toward, and relative elevations of pipe and blast holes • Hole size, spacing, burden, depth, and layout within drawing • Type of explosive, Energy Release Ratio (EER), and specific energy (calories per gram) • Total number of holes (charges) • Delay interval between charges • Maximum charge weight per delay • Drawing of the location depicting the relationship of the charges to company facilities (this drawing shall be provided by the party performing the blasting operations). • The blasting plan shall be provided by the party performing the blasting operations sufficiently in advance to allow for evaluation and to make arrangements for witnessing the operation. • Blasting permit and blaster license

Step	Task
	• Advise the company ROW Representative of the planned blasting operation
2	**DETERMINE** the characteristics of the pipeline in the area where blasting operations are planned. Information to be gathered includes the following: • MOP of the pipeline(s) • Pipe diameters • Pipe wall thickness • Pipe grade • Pipe depth • Type of joint (coupled, acetylene welded, etc.) • Type of longitudinal joint • Distance from the pipeline to the proposed blasting operations • Known defects in the pipeline (this information can be gathered from recent In-line inspection runs – discuss with the Pipeline Integrity Engineer). • Historical data such as leak history • Operational data (local knowledge of the pipeline)
3	**ADVISE** the party performing the blasting operation that no blasting may occur until the company has had an opportunity to review and approve the blasting operations plan.
4	**PROVIDE** a copy of the proposed blasting plan, and the pipeline characteristics to the Engineering Department, Liquid Technical Operations Group, and / or Geology Department for analysis and review.

7.3 Analysis of the Proposed Blasting Plan

Engineering Department, Liquid Technical Operations Group, and / or Geology Department performs the following steps for analysis of the proposed blasting plan

Step	Activity
1	**REVIEW** the characteristics of the pipeline facilities that may be affected.
2	**REVIEW** the blasting plan to determine the variables to be used in the evaluation.
3	**UTILIZE** a computer modeling program specifically designed to evaluate the effects of blasting on a pipeline (such as Pipeline ToolBox or other equivalent).

NOTE: The pipeline ToolBox program does not take delay between charges into account.

Step	Activity
4	To perform a proper evaluation of the blasting operation with delays between charges of 8 to 15 milliseconds, **CONSIDER** the charges as single individual point charges utilizing the nearest off-set distance from the pipeline as the off-set variable.
5	If adjustments are needed in the blasting plan regarding types of explosives, burden, hole spacing, hole size, charge weight per hole, number of charges in front row, number of rows in grid, stand-off distance, etc., **WORK** with the blasting operator to arrive at a mutually agreed-upon plan that will allow for blasting without compromise of pipeline integrity or safety of personnel. The approved blasting plan conveys the following information: • Acceptability of operating conditions for the approved blasting plan • Maximum allowable charge weight permitted if the pipeline operating pressure is to be maintained at its current level during blasting operations • Test blast requirements, number of seismographs required, and placement • Minimum required separation from blast source to the pipeline or facility • Highest safe operating pressure at which the pipeline may operate with the proposed blasting plan • What, if any, additional safety measures must be taken during or after blasting operations which may include manning of valves, reducing operating pressure, reinforcing couplings or acetylene welds, conducting post blast leakage surveys • Any other action felt to be prudent by the evaluator

CAUTION:	Blasting operations within the confines of the pipeline ROW will not be allowed unless it is being conducted for the benefit of the company and under the direct supervision of a company representative, unless otherwise approved by the Director of Operations / Engineering.

7.4 Communicate Blasting Plan Requirements

Engineering Department, Liquid Technical Operations Group, and / or Geology Department follow the steps below once an approved blasting plan has been agreed upon to communicate requirements to the parties involved.

Step	Task
1	**COMMUNICATE** the requirements of the plan to Operations Personnel, Director of Operations, Operations Manager and the company ROW Representative.

Step	Task
2	**COMMUNICATE** the requirements of the blasting plan to the blasting company, and **CLARIFY** to the blasting operator that any changes to any variable in the blasting plan **MUST BE APPROVED** by the company approved representative prior to blasting operations.
3	**OBSERVE** blasting operations. If the approved blasting plan requires that a company representative be present during initial blasting operations, **MAKE** arrangements for Company personnel to be on-site prior to commencement of blasting.

7.5 Post-Blast Requirements

Operations Personnel follow these steps for observing and monitoring the pipeline following individual blasts or blasting activities.

Step	Task
1	**PERFORM** a post-blast leakage survey following blasting in the vicinity of the pipeline. This survey shall include: use of gas detection equipment to monitor the pipeline ROW for indications of leaking petroleum or crude oil, surveillance of the ROW for indications of surface cracks, liquid sounds, hydrocarbon odors and leaking hazardous liquids. **USE** a probing bar to create holes in the ground surface to assist with identifying subsurface conditions.
2	If there are indications of ROW surface cracks, blast craters or if seismograph readings have significantly exceeded limits, **EXPOSE** the pipeline to inspect for damage. Evaluate the pipeline for any defects per *SOP HLI.06 Evaluating Pipeline Defects* and repair any defects per *SOP HLI.05 Pipeline Repair*.
3	**MONITOR** the pipeline for pressure loss or leak conditions. Report any pressure loss or leak conditions to Operations Management per *SOP HLA.04 Initial Reporting and Investigating Events.*

8.0 Documentation Requirements

Record data in electronic database or utilize the following form(s) as applicable:

B.13.A Encroachment, Facility Crossing and Class Location HCA Reports
Copy of the approved blasting plan
Pipe Inspection Report or Maintenance Record

9.0 References

Pipeline Toolbox – PipeBLAST
HLI.05 Pipeline Repair
HLI.06 Evaluating Pipeline Defects
HLA.04 Initial Reporting and Investigating Events

Appendix A: OQ Task Requirements

There are no Operator Qualification (OQ) tasks required for this SOP.

ENERGY TRANSFER

Management of Depth of Cover and Evaluation

Standard Operating Procedures

Applicable to Hazardous Liquids Pipelines and Related Facilities

Code Reference :	**Procedure No.: HLI.24**	
49 CFR: 195.248, 195.401	***Effective Date: 05/01/17***	**Page 1 of 15**

1.0 Procedure Description

This Standard Operating Procedure (SOP) outlines activities directed at the management of depth of cover for the purpose of minimizing the possibility of damage to pipelines as a result of shallow cover or exposure.

2.0 Scope

This SOP establishes depth of cover guidelines with minimum requirements for the inspection, remediation, and monitoring of shallow and exposed pipe conditions, including unintended spans.

NOTE: For additional guidance and inspection requirements of river/waterway approaches and river/waterway crossings requiring Contract Assisted River Crossing Survey (CARCS), refer to SOP HLI.21 Inspection of ROW – Crossings Under Navigable Waters.

3.0 Applicability

This SOP applies to any regulated pipe segment where shallow cover and pipeline exposures can potentially occur.

4.0 Frequency

As required: Perform depth of cover surveys on regulated pipeline segments to determine pipe segments with existing shallow cover, exposures, or areas suspected of becoming shallow or exposed due to a threat from a weather, natural, or outside force.

As required at least once each calendar year at intervals not to exceed 15 months: Inspect all pipeline segments classified as **exposed**.

As required at least once every two calendar years, not to exceed 27 months: Inspect all pipeline segments classified as **elevated**.

As required at least once every three calendar years, not to exceed 39 months: Inspect pipeline segments classified as **monitored.**

As required: Develop a remediation action plan for pipeline segments classified as **immediate**.

As required: Inspect pipeline segments classified as **remediated**.

5.0 Governance

The table below identifies responsibility, accountability, and authority for this SOP.

Function	Responsibility	Accountability	Authority

Managing Depth of Cover	Operations Personnel	Operations Manager	Director of Operations
Locating Shallow and Exposed Company Pipelines	Operations Personnel	Operations Manager	Director of Operations
Site Evaluations	Operations Personnel	Operations Manager	Director of Operations
Pipe Inspections	Operations Personnel	Corrosion Specialist	Director of Operations
Develop Remedial Action Plans	Operations Personnel and Pipeline Operations Specialist	Operations Manager	Director of Operations
Implement Remedial Action Plan	Operations Personnel and Pipeline Operations Specialist	Operations Manager	Director of Operations
Aerial Patrol Observations & Reporting	Operator Performing Patrol	Operations Manager	Director of Operations
Legal Action and Right-of-Way	Right-of-Way Representative	Right-of-Way Representative	Manager Right-of-Way

6.0 Terms & Definitions

Terms associated with this SOP and their definitions follow in the table below. For general terms, refer to *SOP HLA.01 Glossary and Acronyms*.

Terms	Definitions
Exposed Pipeline	A pipe segment which was designed and constructed according to the pipeline safety regulations in place at the time of construction, with sufficient cover to minimize damage by outside or natural forces, but which has experienced deterioration in the amount of cover originally provided, resulting in exposure of the pipe to the atmosphere.
Shallow Pipeline	A pipe segment which was designed and constructed according to the pipeline safety regulations in place at the time of construction, with sufficient cover to minimize damage by outside or natural forces, but which has experienced deterioration in the amount of cover originally provided.
Unintended Span	A pipe segment classified as Exposed and due to additional loss of surrounding soil has resulted in an unsupported span. (360˚ exposure)
Immediate Classification	A Shallow or Exposed Pipeline Segment such that without further intervention, damage to the pipeline is likely and

Terms	Definitions
	remediation is warranted.
Elevated Classification	A Shallow pipeline segment in which an evaluation indicates a threat of becoming Exposed and due to the additional loss of cover, damage from outside or natural forces **IS** possible. Such a condition requires continued monitoring with no immediate action required.
Monitored Classification	A Shallow Pipeline Segment in which an evaluation indicates that the loss of cover does NOT increase the potential for damage or require remedial action to re-cover the pipe segment. Such a condition requires continued monitoring with no immediate action required.
Remediated	A Shallow or Exposed pipeline segment in which a remediation plan has been completed and the threat of a natural or outside force has been removed by either line lowering, additional soil, or structural protection.
Remediation Plan	A repair or mitigation activity used to reduce the likelihood of failure of the component being examined.

7.0 Management of Depth of Cover and Evaluation

This SOP contains the following sections:

- Depth of Cover Assessment – 7.1
- Location Description with Public Notification – 7.2
- Evaluation of Depth of Cover – 7.3
- Evaluation of Shallow Cover – 7.4
- Evaluation of Cultivated Lands with Shallow Cover – 7.5
- Evaluation of Exposed Pipeline Segments – 7.6
- Evaluation of Unintended Span – 7.7
- Monitored Conditions – 7.8
- Elevated Conditions – 7.9
- Immediate Conditions – 7.10
- Remedial Action Plans – 7.11
- Remediated Conditions – 7.12
- Reporting Requirements – 7.13

7.1 Depth of Cover Assessment

Operations Personnel, **REVIEWS** depth of cover information from multiple sources, **DETERMINES** additional areas needing depth of cover surveys to identify pipe segments with shallow cover and exposed conditions following the steps below.

Step	Activity

1	**REVIEW** collected depth of cover data. Data sources should include but not limited to the following: • 3rd Party Depth of Cover Survey • Construction As-Built • Pipe Inspections • Line locates/probing • Line Crossings • Right-of-Way Reclamation • Encroachments • CARC Survey • River Approach Inspection • Coupling locating
2	**DETERMINE** areas needing a depth of cover survey performed.
3	**IDENTIFY** and **DOCUMENT** pipe segments with shallow cover and exposed conditions from collected data and depth of cover surveys.

7.2 Location Description with Public Notification

Operations Personnel, upon initial investigation of pipe segments with shallow cover and or exposures will follow the steps below.

Step	Activity
1	**COLLECT** the following data on shallow and exposed pipe segments and document in the electronic Shallow Cover Database • Pipeline name • Begin Station and End Station Range • GPS coordinates from Pipeline Mapping System or approved handheld device • Upstream and Downstream Road Crossings • Area Pictures (Facing North, East, South, West) • Land Owner name, address, phone number • If applicable, Farmer/Tenant name, address, phone number • Legal Land Description (e.g. Section/Township/Range/Survey) • County
2	**WORK** with Right-of-way and make **NOTIFICATION** attempts to the Affect Public concerning shallow and exposed pipe segments. Refer to *SOP HLI.40 Public Awareness Plan*.
3	**RECORD** and **DOCUMENT** on form I.40A Public Awareness Contact Data
4	**ATTACH** a copy of form I.40A Public Awareness Contact Data to the electronic Shallow Cover Database Record

7.3 Evaluation of Depth of Cover

Operations Personnel, will evaluate pipe segments with depth of cover deficiencies by collecting data on the pipe segments affected and the surrounding area. To evaluate and classify pipe segments, use the steps below.

Step	Activity
1	**COLLECT** data on shallow and exposed pipe segments to allow for a potential damage evaluation. Dats should include the following: • Land use • Potential for third party damage • Potential for loading • Potential for additional loss of cover/erosion • Inadequate pipe support • Forces – Outside and Natural • Interacting threats (anomalies, low potentials, etc..) • Pipe properties (MOP, seam type, SMYS, w.t., O.D., etc..) • Water turbidity • Coating condition, if applicable • Soil Type • Slope Angle • Within an Identified HCA limit • Distance from structures or roadways • Extent of inadequate cover
NOTE: UTILIZE information from a variety of sources, including: • Construction activities • Landowner notifications • Depth of cover surveys • ILI data • GReporter Database • O&M Review • Encroachments • Corrosion surveys • Leakage surveys Make note of any pipe segments with shallow cover and exposures located on cultivated land, and in addition, follow Section 7.5 – Evaluatoin of Cultivated Lands with Shallow Cover.	
2	In creeks, rivers, waterways, drainage ditches, wet-lands, and bar ditches associated with shallow or exposed pipe segments **NOT** listed in SOP

	HL.I.21 **DETERMINE** the minimum amount of cover between the top of the pipeline and the water to soil interface.
WARNING: If a condition is encountered that results in doubt as to the safety of proceeding with obtaining depths for a creek, river, waterway, drainage ditch, wet-land, or bar ditch, consult the Operations Manager.	
3	**DETERMINE** the expected maximum depth of the water level. **CONSIDER** future changes in the waterway bottom or route (migrating head-cut, severe stream bank erosion, reels, etc.), allowing for further erosion and scour.
4	**RECORD** all information above using the electronic Shallow Cover Database Record
5	**COMPLETE** an electronic Pipe Inspection Report upon initial discovery of pipeline segments designed for below grade service exposed to the atmosphere. Refer to *SOP HL.D.35 Pipe Inspections and Evaluations.*. Exclude pipeline segments under flowing turbid (cloudy, opaque, or thick with suspended matter) water, and where the water cannot be diverted safely.

7.4 Evaluation of Shallow Cover

Operations Personnel, will evaluate Shallow Cover as follows:

Step	Activity
1	**USE** the data collected in Section 7.3 - Evaluation of Depth of Cover and **DETERMINE** the classification.
2	If **DETERMINED** Immediate, **DEVELOP** a remediation action plan.
3	**ATTACH** a copy of the remediation plan to the electronic Shallow Cover Database Record.
4	**COMPLETE** remediation plan promptly.
5	If immediate remediation is **NOT** necessary, schedule next inspection in Electronic Maintenance System per classification definition.
6	**SUBMIT** electronic Shallow Cover Database Record for approval.

7.5 Evaluation of Cultivated Lands with Shallow Cover

Operations Personnel will evaluate cultivated lands with shallow cover as follows.

Step	Activity
1	In cultivated lands **INCORPORATE** the information below into the evaluation:

Step	Activity
	• **VERIFY** external loading farming equipment does **NOT** exceed the safe limits. Refer to *SOP HL.I.27 Abnormal Loading_External Loads_Hwy_RR.* • **ADVISE** the entity responsible for operation and maintenance of the land of the company's damage prevention program. • **DISCUSS** farming methods and equipment utilized with the landowner/tenant/farmer. **DETERMINE** maximum anticipated plow depth.
NOTE:	See Appendix B for typical farm data regarding cultivated fields.
2	**PROVIDE** a minimum of 12 inches of cover between the maximum planned plow depth and the top of the pipeline in cultivated areas.
3	If **DETERMINED** the minimum distance between plow depth and the top of the pipeline cannot be provided, Classify as Immediate and **DEVELOP** a remediation action plan.
4	**NOTIFY** the Right-of-Way Department to advise them of the condition and involve them as necessary in the remediation plan.
5	**ATTACH** a copy of the remediation plan to the electronic Shallow Cover Database Record.
6	**COMPLETE** remediation plan promptly
7	If immediate remediation is **NOT** necessary, schedule next inspection in Electronic Maintenance System per classification definition.
8	**SUBMIT** electronic Shallow Cover Database Record for approval.

7.6 Evaluation of Exposed Pipeline Segments

Operations Personnel, will evaluate exposed pipe segments as follows:

Step	Activity
1	**USE** the data collected in Section 7.3 - Evaluation of Depth of Cover and **DETERMINE** the classification.
2	**PERFORM** an initial Atmospheric Pipe Inspection. Refer to *SOP HL.D.44 Atmospheric Pipe Inspection.* Reschedule pipeline segments under flowing turbid (cloudy, opaque, or thick with suspended matter) water, and where the water cannot be diverted safely to a time when water levels are lower.
3	If **DETERMINED** the pipe segment will remain exposed for any length of time, consider and implement one or more of the following:

	• Install a compatible and approved atmospheric coating over the existing underground coating. • Recoat the pipe segment with an approved coating system. Consider the conditions and the need to install both a below ground and above ground system. • Replace the underground coating systems with an atmospheric coating system. Refer to *Engineering Standard Volume HL6 – Corrosion Control* for the current procedure regarding above and below ground coating systems.
4	If **DETERMINED** Immediate, **DEVELOP** a remediation action plan.
5	**DOCUMENT** and **RECORD** remediation plan on form D.40.A Corrosion Control Remedial Action Report. Refer to *SOP D.40 Corrosion Control Remedial Action*.
6	**ATTACH** a copy of D.40.A Corrosion Control Remedial Action Report to the electronic Shallow Cover Database Record.
7	**COMPLETE** remediation plan promptly
8	If immediate remediation is **NOT** necessary, schedule next inspection in Electronic Maintenance System per classification definition.
9	**SUBMIT** electronic Shallow Cover Database Record for approval.
NOTE: In addition to inspections and documentation requirements of this SOP, exposed pipe segments with an atmospheric coating systems are subject to inspection and documentation in accordance with *SOP HL.D.44 Atmospheric Pipe Inspections*	

7.7 Evaluation of Unintended Span

- Operations Personnel, will evaluate Unintended Span pipe segments as follows:

Step	Activity
1	If an exposed pipe segment has become an Unintended Span, **DETERMINE** if the spanned pipe segment has adequate support upstream and downstream of affected area.
2	**CONSULT** with the Pipeline Operations Specialist to **DETERMINE** if pipe segment can remain a span.
3	**IF** evaluation allows being left a span **REFERENCE** *SOP HL.I.25 Aboveground Componenets – Overhead Crossings* for inspection requirements.
4	If **DETERMINED** Immediate, **DEVELOP** a remediation action plan.
5	**DOCUMENT** and **RECORD** remediation plan on form D.40.A Corrosion Control Remedial Action Report. Refer to *SOP D.40 Corrosion Control Remedial Action*.
6	**ATTACH** a copy of the D.40.A Corrosion Control Remedial Action Report

	to the electronic Shallow Cover Database Record.
7	**COMPLETE** remediation plan promptly
8	**SUBMIT** electronic Shallow Cover Database Record for approval.

7.8 Monitored Conditions

Operations Personnel, performs the following actions for each monitored condition identified. No remediation is required unless subsequent evaluation determines it to be an immediate condition.

Step	Activity
1	**DETERMINE** locations for shallow cover or exposed markers based on site specific conditions.
2	**VERIFY** pipeline identification/location markers are present. **MAINTAIN** markers and signs until shallow pipeline segment is remediated.
3	**CONSIDER** installation of warning style pipeline markers at the beginning and end of the shallow or exposed areas on land.
4	**INSPECT** per Section 4.0 Frequencies or as directed by the Pipeline Operations Specialist to verify the integrity of the segment and evaluate for changes in condition.

7.9 Elevated Conditions

Operations Personnel, performs the following actions for each elevated condition identified. No remediation is required unless subsequent evaluation determines it to be an immediate condition.

Step	Activity
1	**DETERMINE** locations for shallow cover or exposed markers based on site specific conditions.
2	**VERIFY** pipeline identification/location markers are present. **MAINTAIN** markers and signs until shallow pipeline segment is remediated.
3	**CONSIDER** installation of warning style pipeline markers at the beginning and end of the shallow or exposed areas on land.
4	**DETERMINE** and form a remedial action plan and **SUBMIT** into the budget process.
5	**ATTACH** a copy of the remediation plan to the electronic Shallow Cover Database Record.
6	**INSPECT** per Section 4.0 Frequencies or as directed by the Pipeline Operations Specialist to verify the integrity of the segment and evaluate for changes in condition until remediate through the budget process.

7.10 Immediate Conditions

For each identified Immediate Condition, Operations Personnel, performs the following actions in Section 7.11 Remedial Action Plan. Operations Personnel must consider and implement one or more of the remedial actions described, with the assistance of the Pipeline Operations Specialist. Appropriate remedial measures others than those listed, if required, are subject to company approval.

7.11 Remedial Action Plans

Operations Personnel, considers one or more of the remedial actions described in the following sub procedures for each pipeline segment with an Immediate or Elevated condition. Information documented in the remedial plan and in the shallow cover database include:

- Description of the situation
- Inadequate cover evaluation, such as a profile survey
- Remedial Action Plan
- Proposed schedule of submitting into budget
- Inspection interval

7.11.1 Remediation Priorities

Operations Personnel, prioritizes plans for remedial action for each shallow or exposed pipeline segment according to the following:

REMEDIAL ACTION PRIORITIZATION (AMAOP)

- Exposed pipe that operates at AMAOP
- Pipe that operates at AMAOP with less than 30” of cover
- Pipe that operates at AMAOP with 30” to 36” of cover (remediated by signage)

REMEDIAL ACTION PRIORITIZATION

1. Non-reinforced coupled pipe with unintended spans (360˚ exposure) with shallow cover extending over over-bends
2. Exposed pipe in cultivated lands
3. Non-reinforced coupled pipe with less than 24 inches of cover extending over over-bends
4. Exposed pipe in bar ditches parallel to roads
5. Pipe with less than 24 inches of cover in cultivated land
6. Pipe with 1 inch to 12 inches of cover in bar ditches parallel to roads (dirt and gravel roads)
7. Exposed pipe in creeks and river crossings
8. Exposed pipe in waterways, drainage ditches and wet-lands
9. Exposed pipe in non-cultivated land
10. Pipe with 1 to 12 inches of cover in creeks, rivers, waterways, drainage ditches

and wet-lands.

11. Pipe with less than 24 inches of cover in non-cultivated land
12. Pipe with 12 to 24 inches of cover in creeks, rivers, waterways, drainage ditches, wet-lands, and bar ditches
13. Offshore pipelines with less than 3 feet of cover in water less than 200 feet deep

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7.11.2 Negotiation of Plowing Risks

Operations Personnel is responsible for communications of the potential problems associated with plowing.

Step	Activity
1	**MEET** with the farmer and **EXPLAIN** the potential problems associated with damage to the pipeline.
2	**NEGOTIATE** with the farmer to plow at lesser depths.
3	**CONTACT** Right-of-Way Department and **CONSIDER** an agreement with the farmer for not cultivating above the pipeline.
4	**CONSIDER** lowering the pipeline. Refer to *SOPHL.I.08 Lowering or Raising In-Service Pipelines*
5	**CONSIDER** placing additional cover over the pipelines.
NOTE:	If future erosion, other plans to re-contour the field or field drainage is a concern, additional cover may not be a long term solution.

7.11.3 Pipeline Lowering

Operations Personnel is responsible for providing recommendation on lowering the pipeline, if required, to a depth that provides adequate depth of cover, or to a depth that provides sufficient cover in waterways and ditches. Future erosion and scour must be considered. Refer to *SOP HL.I.08 Lowering or Raising In-Service Pipelines*.

7.11.4 Additional Cover

Operations Personnel, can place additional cover over the pipeline segments. If future erosion, drainage etc. is a concern, additional cover may not be a long term solution.

NOTE:	Consider effects of addition weight on certain pipe seams and girth weld types.

7.11.5 Structural Protection

Operations Personnel provides recommendation on installing concrete slabs, mats, or blocks over the pipeline, if required, to achieve a barrier and protection from damage of outside or natural forces.

7.12 Remediated Conditions

Operations Personnel, will evaluate Remediated Conditions as follows:

Step	Activity
1	**CONSULT** with the Pipeline Operations Specialist to **DETERMINE** if continued inspections to verify the integrity of the depth of cover and evaluate for changes in condition are needed.
2	**INSPECT** per Section 4.0 Frequencies or as directed by the Pipeline Operations Specialist.
3	**CONSIDER** Aerial Patrol to **DOCUMENT** and **RECORD** inspections.
4	**IF** Aerial Patrol is used, **ATTACH** a copy of the Aerial Patrol report to the electronic Shallow Cover Database Record.

7.13 Reporting Requirements

To fulfill reporting requirements for this SOP, Operations Personnel uses the following steps:

Step	Activity
1	**TRACK**, at a minimum, the following items in the electronic Shallow Cover database: • Location Information • Depth of Cover evaluation • Changes from previous inspections • Dates of previous surveys • Who performed the previous surveys • Any problems discovered during previous surveys • Remedial actions taken • Remedial actions proposed
2	**USE** an electronic maintenance system for scheduling and permanently recording each inspection or survey to be done on a uniform recurring basis.
3	**RETAIN** the results of all surveys and outside consultant investigations for the life of the facility involved.
4	**RECORD** remediation information in the electronic Shallow Cover database.
5	If applicable, **RECORD** in electronic Pipe Inspection database**.**
6	If applicable, RECORD in electronic Corrosion Database

8.0 Documentation Requirements

Record data in electronic database or utilize the following form(s) as applicable:
Electronic maintenance system
Electronic Corrosion Database
Pipeline Inspection Database
Shallow Cover Database Record
I.40A Public Awareness Contact Data Form

9.0 References

HL.A.01 Glossary and Acronyms
HL.I.40 Public Awareness Plan
HL.D.35 Buried Pipe Inspection
Engineering Standard Volume HL6 – Corrosion Control
HL.I.27 Determination of Abnormal Loading
HL.D.44 Atmospheric Pipe Inspections
HL.D.40 Corrosion Control Remedial Action
HL.I.25 Aboveground Components – Overhead Crossings
HL.I.08 Lowering or Raising In-Service Pipelines

Appendix A: OQ Task Requirements

The table below identifies the Operator Qualification (OQ) task requirements.

Function	OQ Task
Underground Pipeline – Locate and Temporary Mark	**PLOQ605**
Pipeline Patrol	**PLOQ701B**
Install and Maintain Pipeline Markers	**PLOQ703**
Visual Inspection for Atmospheric Corrosion	PLOQ417
Visual Inspection of Buried Pipe and Components When Exposed	PLOQ401

Appendix B: Cultivated Fields

Reference this appendix for typical farm data regarding cultivated fields.

Erosion, leveling, terracing, changes in grade, or changes in land use can reduce the depth of cover above pipelines in cultivated areas where farm equipment could damage the pipeline.

TYPICAL PLOW DEPTHS
The following typical plow depths are based upon discussions with agricultural

agencies and farmers and are provided as a general guideline. However, actual depths may vary depending on the type of equipment used, soil conditions, type of crop, and individual farmer preferences. These depths are by no means an absolute limit on plow penetration.

CROP VARIATIONS

Some general differences in plow depth exist based upon the type of crops being planted. For instance, a rice farmer may not want to plow too deep so as to avoid breaking up the impervious soil layer that holds the water in the field; whereas, a cotton farmer may want to plow deep enough to break up a water holding layer. The following list of typical plow depths may be useful:

Crop	**Typical Maximum Plow Depth**
Cotton	18"
Wheat	12"
Peanuts	12"
Rice	10"
Soybeans	8"
Potatoes	8"
Milo	6"
Corn	6"
Grass	6"

PLOW METHODS

Provided below is a general outline of the frequency of use for various plowing methods and associated plowing depths.

Plow Method	Plow Depth	Frequency
Typical Plowing	< 12”	87%
Subsoiling*	12” – 18”	10%
Deep Subsoiling*	18” – 24”	3%
Custom Equipment*	24” – 30”	< ¼%

**NOTE*: Subsoiling equipment typically requires a heavy duty four-wheel-drive tractor, which makes it less common due to the investment required. However, this form of “no till” farming is being promoted for better productivity and is on the increase.

LIVE LOADS FROM FARM EQUIPMENT

Farm equipment is designed to exert low ground pressure to minimize soil compaction. As a result, the consideration of the live loads from farm equipment is typically not of concern in cultivated fields since the cover needed to protect the pipe from mechanical damage should also provide protection from the live loads.

However, in areas where the pipeline has less than 24 inches of cover in non-plowed

areas that may be crossed by heavy farm equipment, review the current procedure regarding pipeline road and rail crossings for live load considerations.