**U.S. DEPARTMENT OF TRANSPORTATION**

**PIPELINE AND HAZARDOUS MATERIALS SAFETY ADMINISTRATION**

# SPECIAL PERMIT

## Special Permit Information:

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| **Docket Number:** | PHMSA-2016-0149 |
| **Requested by:** | Donlin Gold Limited Liability Corporation |
| **Date Requested:** | November 11, 2016 |
| **Original Issuance Date:** | June 5, 2018 |
| Effective Dates: | June 5, 2018 |
| **Code Section(s):** | 49 CFR 192.103, 192.105, 192.111, 192.317, and 192.619 |

## Grant of Special Permit:

By this Order, subject to the terms and conditions set forth below, the Pipeline and Hazardous Materials Safety Administration (PHMSA) Office of Pipeline Safety (OPS) grants a special permit (PHMSA-2016-0149) to Donlin Gold Limited Liability Corporation (DGLLC) waiving compliance with 49 Code of Federal Regulations (CFR) 192.103, 192.105, 192.111, 192.317, and 192.619. This permit implements strain-based design (SBD) conditions within the design, construction, operations, and maintenance procedures for the subject special permit segments within the 315-mile, 14-inch-diameter natural gas transmission pipeline, as described in this special permit.

## Purpose and Need:

The DGLLC pipeline is proposed to be 315-miles of 14-inch-diameter pipeline for transporting natural gas from the Cook Inlet in Alaska to a DGLLC mine site in Western Alaska. PHMSA is the pipeline safety regulating agency for this pipeline and requires compliance with specific regulatory requirements under 49 CFR Part 192 for the design, construction, operation, and maintenance of natural gas pipelines. DGLLC anticipates there will be areas along the pipeline with potentially frost-unstable soils or ground movement, and plans to use SBD for these special segments of the pipeline. SBD involves advanced metallurgy, engineering, construction, and maintenance to allow the pipe to deform in the longitudinal direction and to better maintain its integrity and safety. PHMSA issues special permits only when consistent with pipeline safety. The conditions in this special permit are designed to assure safety and environmental protection in accordance with 49 CFR 190.341.

This special permit will allow DGLLC to design, construct, operate, and maintain the special permit segments of the pipeline using SBD. The special permit includes conditions to ensure the pipeline has safety equal to or greater than a pipeline constructed in accordance with 49 CFR Part 192.

## Background and Site Description:

The 315-mile, 14-inch-diameter pipeline route is from the Cook Inlet to the DGLLC project mine site located approximately 10 miles north of the village of Crooked Creek on the Kuskokwim River, as shown in Figure 1 – DGLLC Pipeline Route.

The 14-inch-diameter pipeline will originate at the west end of the Beluga Gas Field, approximately 30 miles (48 kilometers) northwest of Anchorage at a tie-in near Beluga located in the Matanuska-Susitna Borough. The pipeline will run to the DGLLC mine located about 10 miles (16 kilometers) north of the village of Crooked Creek.

The pipeline will traverse areas potentially subject to geotechnical hazards (geo-hazards). The particular geo-hazard of interest for the DGLLC pipeline is thaw settlement due to surface disturbance from construction. Thaw settlement may occur when ground temperatures rise because of the disturbance of the surface vegetative mat, causing the ice present in the soil to melt. The melting of previously permanently frozen (permafrost), ice-rich (i.e., contains ice more than the volume required to fill the pore space in an unfrozen state) soils results in soil consolidation or settlement, the magnitude of which is dependent on the type of soil. The amount of settlement divided by the initial thickness of the frozen soil layer is known as "thaw strain." Differing amounts of settlement along the pipeline's alignment may cause longitudinal bending in the pipe resulting in strains in excess of 0.5% (the pipe material's yield strength, which is defined at 0.5% strain), and thereby prompt the need to address thaw strain with the use of SBD, heavier-walled pipe, or an above-ground pipeline. Soils that are only seasonally frozen (the near-surface soil layers freeze during winter along the entire pipeline alignment) will not cause displacement of the bottom of the pipe ditch and thus will not affect pipe longitudinal bending.

Other geo-hazards such as frost heave and fault displacement are not expected to be of concern due to the pipeline's operating conditions (the pipeline will transport gas at the ambient ground temperature in the permafrost areas and, therefore, will not generate a permanent frost bulb around the pipe, precluding frost heave) and the design and construction approach (the active fault on the pipeline alignment will be crossed via an aboveground mode designed to allow for fault displacement).

Based on soil mapping and geotechnical borings conducted by DGLLC the presence of permafrost in significant quantities is limited to the area from mile post (MP) 100 near Puntilla Lake to MP 215 near the Tatlawiksuk River crossing. Additionally, isolated pockets of permafrost may occur on other segments of the pipeline. Isolated pockets of permafrost would typically be addressed using alternative engineering and construction techniques (such as horizontal directional drilling (HDD), heavier-walled pipe, or excavation of frozen material that is below the pipe) in these areas to mitigate the potential for high longitudinal pipe strains due to thaw settlement. These techniques will comply with 49 CFR Part 192.

DGLLC has confirmed the presence of discontinuous permafrost between MP 173 through MP 189, MP 192 through MP 196, MP 201 through MP 209.5, and MP 213 through MP 215 (see Figure 2 – DGLLC Strain-based Design Segments) that could potentially result in thaw settlement causing longitudinal pipe strains in excess of 0.5%. Part 192 requires pipe to be "designed with sufficient wall thickness, or must be installed with adequate protection, to withstand anticipated external pressures and loads that will be imposed on the pipe after installation."[1] Because buried pipe in permafrost conditions would need to be exceptionally thick-walled to withstand the forces and strains due to thaw settlement, DGLLC will design, construct, operate, and maintain the pipeline between MP 173 through MP 189, MP 192 through MP 196, MP 201 through MP 209.5, and MP 213 through MP 215 using an SBD approach. The SBD approach would account for external pressures and loads imposing strains on the pipeline in

[1] Code of Federal Regulations. (2011). *49 CFR Part 192.103 – Transportation of Natural and Other Gas by Pipeline: Minimum Federal Safety Standards; Subpart C – Pipe Design; General.* U.S. Government Publishing Office. Retrieved from: https://www.gpo.gov/fdsys/pkg/CFR-2011-title49-vol3/pdf/CFR-2011-title49-vol3-part192.pdf.

excess of 0.5% from soil consolidation and settlement using alternative strategies, mitigation, and conditions in lieu of a heavy-walled pipe. Regulatory requirements do not presently exist for the use of SBD. SBD includes factors and conditions to ensure the design and safety considerations described under 49 CFR 192.103, 192.105, 192.111, 192.317, and 192.619.

PHMSA and DGLLC recognize that additional areas of permafrost that could potentially result in thaw settlement causing longitudinal pipe strains in excess of 0.5% may be identified at any point between MP 0 and MP 315 as project engineering and construction advances. If such areas are identified and cannot be addressed using the alternative engineering and construction techniques (such as HDD, heavier-walled pipe, or excavation of frozen material that is below the pipe), the change process established in Appendix B of the Special Permit may be utilized (DGLLC would design, construct, operate, and maintain these additional areas using an SBD approach). The environmental analysis presented in Enclosure B and the DGLLC Environmental Impact Statement (EIS) address the entire pipeline from MP 0 through MP 315 (defined as the **SBD Segments Permit Area**).

## Special Permit – SBD Segments and SBD Segments Permit Area:

### State of Alaska

***SBD Segments*** consist of the portions of the DGLLC pipeline from MP 173 through 189, 192 through 196, 201 through 209.5, and 213 through 215 (see Figure 2 – **DGLLC Strain-Based Design Segments**, page 58 of 58.

***SBD Segments Permit Area***[2] consists of the DGLLC pipeline from MP 0 through 315 (see Figure 1 – **DGLLC Pipeline Route**, page 57 of 58).

Any changes to the ***SBD Segments*** during design and construction must be in accordance with the design change process in Appendix B and must be within the ***SBD Segments Permit Area***[3] which extends from MP 0 through 315. The conditions as set forth below (the ***SBD Conditions***) must be implemented for all ***SBD Segments.***

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[2] The ***SBD Segments Permit Area*** consists of the DGLLC pipeline milepost areas reviewed in the project EIS.

[3] The ***SBD Segments Permit Area*** consists of the DGLLC pipeline milepost areas reviewed in the project EIS.

On the condition that DGLLC complies with the terms and conditions set forth below, this special permit waives compliance with 49 CFR 192.103, 192.105, 192.111, 192.317, and 192.619 for the ***SBD Segments***. This special permit allows DGLLC to continue to operate each ***SBD Segment*** at its current listed maximum allowable operating pressure (MAOP).

DGLLC must apply SBD methodology to the design, construction, operation, and maintenance of certain pipeline segments (the ***SBD Segments***).

PHMSA hereby grants this special permit for the DGLLC pipeline ***SBD Segments and SBD Segments Permit Area*** based on the implementation of the below ***SBD Conditions***, ***Appendix A – Pipe***, and ***Appendix B – Design Change Process***. The DGLLC pipeline special permit application, submittals, Federal Register notice, draft environmental assessment, finding of no significant impact (FONSI), and special permit conditions can be read in their entirety in Docket No. PHMSA-2016-0149 in the Federal Docket Management System (FDMS) at: www.Regulations.gov.

## Conditions:

PHMSA grants this special permit to DGLLC subject to the following ***SBD Conditions*** as presented under the following titles below:

- Overview – Conditions 1 through 3
- Design and Materials – Conditions 4 through 7
- Construction – Conditions 8 through 14
- Operations and Maintenance – Conditions 15 through 23
- Reporting and Certification – Conditions 24 through 26
- Nomenclature – Condition 27
- Proprietary Data – Condition 28
- Limitations
- Appendix A – Pipe
- Appendix B – Design Change Process
- Figure 1 – DGLLC Pipeline Route
- Figure 2 – DGLLC Strain-based Design Segments

DGLLC and PHMSA agree that certain ***SBD Conditions*** are necessary for the safe design, construction, and operation of the ***SBD Segments***. DGLLC may propose changes to these ***SBD Conditions***, review dates, or timing to PHMSA and receive a "no objection" response before proceeding. Any proposed changes to ***SBD Conditions*** (Conditions 1 through 27) by DGLLC must maintain equivalent/acceptable levels of safety. PHMSA will determine whether substantive changes to ***SBD Conditions*** require a modification or public notice of this special permit. PHMSA will provide DGLLC with notice of its decisions and an opportunity to respond to any proposed changes, in accordance with 49 CFR 190.341 and the Limitations section of this special permit. Any submittal timing, review timing, or completion timing in these ***SBD Conditions*** can be modified by PHMSA upon request by DGLLC and with a "no objection" response from PHMSA[4] to DGLLC.

## Overview:

1) **Maximum Allowable Operating Pressure (MAOP):** DGLLC must operate the 14-inch-diameter pipeline (DGLLC Pipeline) at or below a MAOP of 1,480 pounds per square inch gauge (psig). The ***SBD Segments*** must be designed for operation at a hoop stress of 72% of specified minimum yield strength (SMYS) or less but allow for pressure build-up and overpressure protection, in accordance with 49 CFR 192.605(b)(5) and 192.201(a)(2).

2) **Applicable Regulations:** The ***SBD Segments*** must be designed, constructed, operated and maintained in accordance with 49 CFR Part 192; including, but not limited to, those requirements that are stated as pertaining to alternative MAOP (192.112, 192.328, and 192.620). In addition to Part 192 conformance, the ***SBD Segments*** must also be designed, constructed, operated, and maintained in accordance with these ***SBD Conditions.*** In the event of a conflict between these ***SBD Conditions*** and the applicable requirements under 49 CFR Part 192, the ***SBD Conditions*** shall control.

3) **Strain-based Design Plan (*SBD Plan*):** DGLLC shall develop a plan (the ***SBD Plan***) that describes the SBD methodology that will be implemented. The ***SBD Plan*** shall address

[4] DGLLC must submit any proposed changes to the ***SBD Conditions*** to PHMSA's Director or Project Designee for review and receive a response of "no objection" prior to proceeding.

the lifecycle of the ***SBD Segments,*** including design, materials, construction, and operations and maintenance (O&M). This ***SBD Plan*** will be submitted to PHMSA OPS[5] for review. The ***SBD Plan*** will consist of three Elements (Design and Materials, Construction, and Operations and Maintenance) and must be developed for all line pipes, girth welds, and pipeline components subject to a longitudinal strain with a projected magnitude[6] greater than 0.5%. The influence of adjacent pipes (including field bends) experiencing longitudinal strains greater than a magnitude of 0.5% on the integrity of hot bends, tees, valves, and other fittings must be examined through analysis and testing. Strain concentrations may occur at pipeline locations associated with transitions from thinner to thicker wall pipe (such as transition pups). The girth welds in these regions must be qualified and the destructive tests and documentation materials must be reviewed by DGLLC to ensure their integrity is in accordance with Conditions 7, 8, and 9.

a) The three Elements of the final ***SBD Plan*** (Design and Materials, Construction, and Operations and Maintenance) must be submitted to PHMSA in accordance with the following schedule:
   i) Element I: Design and material specifications and procedures for SBD must conform to Conditions 4 through 7 and must be submitted to PHMSA for review at least three (3) months prior to rolling steel for pipe. DGLLC may submit specification revisions at least one (1) month prior to rolling steel for pipe if DGLLC arranges for an independent third-party review during the development of this Element.
   ii) Element II: Construction specifications and procedures for SBD must conform to Conditions 8 through 14 and must be submitted to PHMSA for review at least three (3) months prior to the beginning of pipeline construction. DGLLC may submit specifications revisions at least one (1) month prior to

[5] Throughout these ***SBD Conditions***, where documents must be submitted to PHMSA and no contact is named, DGLLC must submit the project documents to the PHMSA Director or Project Designee.

[6] This projection will be performed by DGLLC, as it is a necessary requirement to determine the ***SBD Segment*** mileposts. Only the ***SBD Segments*** identified within the Special Permit can utilize these ***SBD Conditions*** for continued operation beyond 0.5% axial strain. In accordance with Appendix B, DGLLC must submit the locations of the mileposts for the ***SBD Segments*** to the PHMSA Director or Project Designee for this project and receive a response of "no objection" prior to proceeding.

commencement of pipeline construction if DGLLC arranges for independent third-party review during the development of this Element.

iii) Element III: O&M specifications and procedures for SBD must conform to Conditions 15 through 23 and must be submitted to PHMSA for review at least three (3) months prior to placing the pipeline into natural gas service. DGLLC may submit specification revisions at least one (1) month prior to placing the pipeline into natural gas service if DGLLC arranges for independent third-party review during the development of this Element.

iv) After placing the pipeline into natural gas service, DGLLC must meet with PHMSA to review the ***SBD Plan*** for O&M (Conditions 15 through 23) each year for the first two (2) years after initial operation, and every second year thereafter,[7,8] or as otherwise required by these ***SBD Conditions*** or requested by PHMSA. DGLLC must review compliance with the ***SBD Plan*** in the annual DGLLC Integrity Management Plan report submitted to PHMSA. This review must include Condition 24 and, at a minimum, contain the following:

1. A notation of any ***SBD Segments*** that exhibit longitudinal strains with magnitudes in excess of 0.5% ("high strains");
2. A notation of all ongoing monitoring of ***SBD Segments*** that exhibit high strains;[9]
3. A plan for maintenance of SBD Segments that exhibit high strains, or SBD segments where high strains are anticipated; and
4. An analysis of the strain change in high-strain regions, including estimation (based upon geotechnical and operational data) of expected strain for the next annual cycle.

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[7] DGLLC may request a change of these meetings from every second year up to every fourth year, but this meeting date change would require a response of "no objection" from PHMSA's Director or Project Designee.

[8] PHMSA must reply to a "request for change" from DGLLC within 60 days of its receipt. DGLLC cannot proceed with the change if it does not receive a "no objection" response from PHMSA's Director or Project Designee.

[9] Monitoring is required for all ***SBD Segments*** in this special permit.

b) Each Element set out in Condition 3(a)(i) through (iii) of the ***SBD Plan*** must be reviewed and certified for compliance[10] with these Conditions by an independent third-party engineering expert/firm. The independent third-party engineering expert/firm must be retained by DGLLC in advance of DGLLC's submittal to PHMSA[11] for review. The independent third-party engineering expert/firm must be approved by PHMSA. The role of the independent third-party engineering expert/firm is to ensure the ***SBD Plan*** Elements are consistent with the applicable ***SBD Conditions***.

   i) In advance of submittal of the final ***SBD Plan*** Elements set out in Condition 3(a)(i) through (iii), DGLLC, PHMSA, and DGLLC's independent third-party engineering expert/firm must undertake joint technical review meetings to discuss the draft ***SBD Plan*** Elements and relay their respective comments. To the extent practicable, the joint technical review meetings must be scheduled at least 60 days prior to submittal of the final ***SBD Plan*** Elements set out in Condition 3(a)(i) through (iii). Prior to the joint technical review meeting, DGLLC must submit the respective draft ***SBD Plan*** Elements to PHMSA.

   ii) Comments must be resolved in joint technical meetings of DGLLC, PHMSA, and DGLLC's independent third-party engineering expert/firm.

   iii) This review process can be adjusted with the mutual consent of DGLLC and PHMSA.

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[10] The term "certified for compliance" means that a technical analysis and/or testing has been conducted to demonstrate the factors listed in Condition 3(a)(i) through (iii) will not impact the integrity of tensile strain capacity (TSC) and compressive strain capacity (CSC).

[11] In situations where PHMSA determines that referenced conditions or a portion of the referenced conditions do not require an independent third-party engineering expert/firm review, and with a written substantiated request by DGLLC, PHMSA may issue a response of "no objection" to not require an independent third-party engineering expert/firm review.

## Design and Materials:

4) **Material Specifications:** The DGLLC pipe material specifications for the ***SBD Segments*** must include the requirements in Appendix A.[12] The DGLLC pipe material specifications must be consistent with the requirements in Conditions 5 and 6. These specifications must also stipulate that the pipe is manufactured to achieve a sufficient level of strain capacity, as discussed in Conditions 6 and 7, while accommodating variations in yield/tensile (Y/T) ratio, elongation, and tensile strength in the hoop and longitudinal directions, pipe chemical composition, microstructures, and steel rolling and cooling practices. The material test and analysis results and any acceptable variations in these results must be technically considered in Conditions 6 and 7. Any material test reports required by the DGLLC pipe material specifications and submitted to DGLLC must also be made available to PHMSA upon request.

5) **Material Testing:** In conjunction with Conditions 6, 7, and 8, DGLLC must implement a process to determine the longitudinal-tensile and compressive strain capacity of pipe and girth welds, representing all reasonably anticipated operating and environmental conditions the ***SBD Segments*** will be subjected to during their lifecycle. The process must explicitly account for all parameters appropriate to the pipeline's design and operational lifecycle, including, but not limited to, pipe diameters, wall thicknesses, grades, girth weld flaws (type and size), and internal and external loading. The effects of corrosion and mechanical damage (such as dents and gouges) on the longitudinal tensile and compressive strain capacity of pipe and girth welds must be addressed as part of the O&M requirements in Condition 16. The cyclic and static stresses from environmental loading (such as frost heave, ground thawing, and earthquake ground motions), operational parameters (pressure, temperature, etc.) and static stresses (thermal expansion and the potential for upheaval buckling) must also be technically considered. The material testing process must include analyses that are or have been validated by testing, using appropriate finite element analysis, small-scale testing, medium-scale testing (e.g. curved wide plate testing), and/or

[12] References to industry standards, such as the American Petroleum Institute (API) 5L, must be to the edition incorporated by reference in 49 CFR § 192.7. If there is a conflict between these conditions and a referenced standard, the more stringent conditions must be used. If industry standards are used that are not referenced in 49 CFR Part 192 and not expressly included in these ***SBD Conditions***, DGLLC must obtain a response of "no objection" from the PHMSA Director or Project Designee for usage of the industry standard and edition.

full-scale testing, as appropriate. The need for medium- and large-scale testing must be determined based on the parameters being evaluated.

a) The DGLLC Material Testing Program must perform tests to address the pipe material properties of Condition 4 and Appendix A. The variations of pipes and girth welds being tested and technically analyzed must represent those of expected production pipe, double-jointing welds, field welds, tie-in welds, repair welds, and their variations, as provided in the pipe specifications of Condition 4 and Appendix A. The tests and technical analysis must validate that the pipes have the necessary properties to achieve the tensile and compressive strain capacity under combined loadings for field installation, operations, and environmental conditions.

b) DGLLC must conduct tests and analyses to address the appropriate range of material characteristics, including: chemical compositions, microstructures, manufacturing variables, manufacturers, and girth-welding procedures. The tests and analyses must include, as appropriate, finite element analyses, small-scale testing, medium-scale testing, and full-scale testing.

c) The DGLLC Material Testing Program must address, as a minimum, the following parameters:

    i) Source and type of pipes (e.g. U-ing, O-ing, and Expanding (UOE); J-ing, C-ing, and O-ing (JCOE); etc.), steel chemical composition, and rolling practice;

    ii) Range of mechanical properties, including continuous stress-strain curves, strength, strain hardening rate (e.g., Y/T ratio), and effects of strain aging;

    iii) Girth welding process (mainline welds, double-joint welds, tie-in welds, repair welds, and welds to fittings);

    iv) Girth weld mechanical properties (including strength, toughness, and ductility);

    v) Girth weld high-low misalignment;

    vi) Pipe material design conditions (e.g., diameter/wall thickness (D/t) ratio, design factor, and pipe wall thickness variations);

    vii) Construction conditions (i.e., temperature during installation and construction backfill);

    viii) Operational pressure;

ix) Operational temperature;

x) Girth weld flaw (flaw type, flaw location (i.e., surface-breaking),[13] flaw length, flaw depth, flaw height, and weld metal versus heat-affected zone (HAZ)); and

xi) Wall thickness and pipe grade differences across the weld, if included as part of the design.

When appropriate, the conditions corresponding to the maximum, nominal, and minimum values of those parameters must be technically considered and tested.

d) Full-scale testing must be performed to validate the strain capacity of critical project operational conditions.[14] If full-scale testing of a critical condition is deemed not feasible, the validation of the strain capacity must be conducted through a combination of small-scale testing, medium-scale testing, or numerical analysis by qualified labs and technical analyses. DGLLC must technically justify why the full-scale testing is not feasible, submit an alternative plan to PHMSA's Director or Project Designee for review, and receive a response of "no objection" prior to proceeding.

e) For tests where standardized procedures sanctioned by standard-making organizations do not exist, or standardized procedures do not cover key elements affecting the outcome of the tests,[15] DGLLC must develop test procedures[16] for material test laboratories to use throughout the project to obtain consistent results.

  i) The following test procedures must be technically considered:

    a. Tensile test of pipe hoop and longitudinal properties;

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[13] The impact of embedded flaws must be technically considered, including, but not limited to, re-characterizing embedded flaws as surface-breaking flaws. Testing of embedded flaws is not required if it is technically demonstrated that they can be conservatively treated with the same acceptance criteria as surface flaws.

[14] Prior to submittal of the draft and final ***SBD Plan*** Elements, DGLLC may conduct such material testing as it deems necessary for the development of the ***SBD Plan*** Elements. Prior to conducting such material testing, DGLLC must coordinate and consult with PHMSA on such material testing. DGLLC may incorporate the material testing and results into the draft and final ***SBD Plan*** Elements.

[15] For instance, tensile tests of round-bar specimens are covered by several standardized test procedures. However, procedures of specimen extraction (e.g., specimen position relative to the pipe wall, specimen dimensions) from pipes and girth welds may not be covered by those test procedures.

[16] Material test labs must have procedures for calibration and a quality program in place to ensure quality and repeatability of the test results.

b. Tensile test of all-weld metal;

c. Charpy test of pipe;

d. Charpy test of girth weld HAZ and weld metal; and

e. Crack tip opening displacement (CTOD) test or single-edge notched bending (SENB) test of girth weld HAZ and weld metal.

ii) The following test procedures must be evaluated unless DGLLC can technically justify why a test procedure is not feasible:

a. Single-edge notched tensile (SENT) test of girth weld HAZ and weld; and

b. Full-scale test.

f) Each of the test procedures must include the following parameters, as appropriate for the type of test:

i) Specimen removal from pipe or weld:

a. Specimen orientation (longitudinal or hoop direction);

b. Specimen position (e.g., o'clock around the circumference, thickness position);

c. Method of removal, including the possible effects of cutting and machining heat on the materials being tested;

ii) Specimen dimensions, including tolerance;

iii) Specimen machining, including tolerance;

iv) Placement of notch, including the process of locating the notch with respect to the target microstructure and notch front acuity;

v) Electrical discharge machining (EDM) notching of flaws;

vi) Instrumentation plan;

vii) Calibration of instruments;

viii) Calibration of the test machine;

ix) Test temperature and uniformity of the test temperature throughout tests;

x) Loading procedure, including internal pressure, if applicable;

xi) Data collection rate;

xii) Acquisition and storage of raw test data;

xiii) Data processing procedure and possible corrections to machine compliance, if applicable;

xiv) Post-processing of raw data;

xv) Data reporting, including raw data, processed data, and fracture surfaces, if applicable;

xvi) Verification of test data;

xvii) Validity criteria of flaw dimensions, if applicable;

xviii) Validity criteria of test data, if applicable; and

xix) Verification of the notch location, if applicable.

Parts of the test procedures may be referenced from published test standards. Parts of the test procedures not covered by the published test standards must be supplemented by the project test procedures. A document containing all test procedures must be provided to PHMSA prior to commencement of the test.

g) A fracture control plan must be developed to determine the fracture arrest for pipe from each unique combination of steel mill,[17] pipe diameter, wall thickness, and grade to meet 49 CFR 192.112(b).[18]

h) Destructive tests must be used to determine the ability of all crack arrestor designs used to stop and arrest an operational pipe fracture to meet 49 CFR 192.112(b). DGLLC must justify the selection of an appropriate test matrix that is conservatively representative of pipeline conditions. The worst-case fracture propagation driving force (highest pressure, worst-case gas composition) must be technically considered and the ability of the crack arrestor to function under these conditions must be demonstrated. However, it is not necessary to test all combinations of diameter and wall thickness. Tests on larger-diameter, thinner-wall pipe may be used to demonstrate the function of arrestors for heavier-wall and smaller-diameter pipe operated at the same design pressure.

[17] A steel mill must use the same rolling parameters throughout the steel making process. If rolling parameters and steel compositions materially change during the manufacturing process, additional small-scale destructive tests must be conducted as if the steel was rolled by another manufacturer. DGLLC has the option to submit to PHMSA documentation of why rolling parameters, steel composition, and manufacturer changes would not affect pipe fracture arrest; however, such changes must receive a response of "no objection" from PHMSA's Director or Project Designee prior to implementation.

[18] It is not necessary to consider the effects of strain on the fracture arrest behavior of pipe. Ground movements apply bending strains only to short lengths of pipe (in most cases less than a joint in length) and any fracture initiated within a strained region would be arrested by adjacent unstrained pipe or crack arrestors that meet the requirements of 49 CFR 192.112(b).

6) **Design Procedures:** Based upon the findings from the DGLLC Material Testing Program and analysis, as required in Condition 5, DGLLC must develop and implement written material, design, construction, and O&M specifications and procedures in accordance with these ***SBD Conditions***. These specifications and procedures must prevent the strain demand for pipe and girth welds from exceeding the defined strain demand limits under operational conditions for the ***SBD Segments***. The construction and O&M specifications and procedures are to be included in Element II and Element III, respectively, of the ***SBD Plan***. Specifications and procedures must be based upon the Condition 5 test and analysis results and engineering critical assessment, as specified in Condition 7. The specifications and procedures must be refined as construction and operational history becomes more developed.

   a) Tensile and compressive strain-demand limits must be established as follows:

      i) The tensile strain-demand limit for the ***SBD Segments*** must be the tensile strain capacity calculated using the procedures, predictive equations, and models in accordance with Condition 7[19] divided by 1.667.[20]

      ii) The compressive strain-demand limit for the ***SBD Segments*** must be the compressive strain capacity calculated using the procedures, predictive equations, and models in accordance with Condition 7[21] divided by 1.25[22] in Class 1, 2, 3, and 4 locations. For Class 1 locations that (a) are not in the right-

[19] The procedures, predictive equations, and models described in Condition 7 may be reviewed and technically adjusted to incorporate the results of the DGLLC Material Testing Program, as described in Condition 5. A document detailing the review and technical adjustment process (including how any new models produce the same or better consistency and accuracy in predicting tensile strain capacity) must be submitted for independent third-party review and to PHMSA for review and a response of "no objection." If DGLLC adjusts the predictive equations and models described in Condition 7 after obtaining a response of "no objection" from PHMSA, the review and technical adjustment process must be incorporated into the draft and final ***SBD Plan*** Elements.

[20] An alternative equivalent method of determining the tensile strain-demand limit would be 0.60 times the tensile strain capacity in Condition 7.

[21] The procedures, predictive equations, and models described in Condition 7 may be reviewed and technically adjusted to incorporate the results of the DGLLC Material Testing Program, as described in Condition 5. A document detailing the review and technical adjustment process (including how any new models produce the same or better consistency and accuracy in predicting tensile strain capacity) must be submitted for independent third-party review and to PHMSA for review and a response of "no objection." If DGLLC adjusts the predictive equations and models described in Condition 7 after obtaining a response of "no objection" from PHMSA, the review and technical adjustment process must be incorporated into the draft and final ***SBD* Plan Elements**.

[22] An alternative equivalent method of determining the compressive strain-demand limit would be 0.80 or 0.90 times the compressive strain capacity in Condition 7.

of-way (ROW) for an above-ground pipeline, (b) are not in the ROW for a designated interstate, freeway, expressway, or other principal four-lane arterial roadway, or (c) contain fewer than two buildings within a potential impact circle, as defined in 192.903, and that have human occupancy of less than 50 days in a 12-month period, a 1.11 factor may be used in-lieu of 1.25. DGLLC can propose an alternate safety factor in Element I for independent third-party review and to PHMSA for review and a response of "no objection" that is supported by project-specific data and analysis.

iii) The tensile and compressive strain-demand limits for the ***SBD Segments*** must not exceed 2%.

b) The strain demand for the ***SBD Segments*** must be technically based upon and technically account for:

i) Field conditions: above-ground, below-ground, seismic, permafrost, soil loads, settlement, or movement along the pipeline;

ii) Different operational pressures: maximum to minimum;

iii) Pipe temperatures, which include contributions from both operational and environmental heat sources/sinks: maximum to minimum; and

iv) Seasonal changes in operational and environmental conditions.

c) The strain capacity for the ***SBD Segments*** must be technically based upon, and technically account for:

i) Variations in pipe tensile properties, pipe diameter, wall thickness, ovality, and out-of-roundness;

ii) Flaws in girth welds that account for welding procedures used, high-low misalignment, engineering critical assessment as specified in Condition 7, construction and operational loads, and girth weld flaw sizes, girth weld variability, and repair limits; and

iii) Pipe strain aging and hardening effects on the pipe properties, including pipe strength, Y/T ratios, and pipe elongation from the pipe coating heating effects during external or internal coating applications.

7) **<u>Engineering Critical Assessment:</u>**

a) Part I – Tensile Strain Capacity[23]

Engineering Critical Assessment (ECA) procedures, predictive equations, and models for calculating tensile strain capacity in the ***SBD Segments*** during their lifecycle must adequately address the following parameters:

i) The operation of materials (pipes and girth welds) on the upper shelf[24] (i.e., exhibiting ductile behavior) of the brittle-ductile transition;

ii) Combined loading effects from longitudinal stress, hoop stress, and environmental loads;

iii) Geometric pipe parameters, including, but not limited to:

a. Pipe geometry, including wall thickness;

b. Girth weld high-low misalignment; and

c. Type of joints, including pipe to pipe, pipe to bend, pipe to fitting, and pipe to valve.

iv) Pipe material and girth weld property parameters that are necessary inputs to the model, including:

a. Y/T ratio;

b. Uniform strain;

c. Weld strength mismatch at ultimate tensile strength (UTS);

d. Flaw size (height and length);

e. Flaw location (weld metal or HAZ);

f. Flaw geometry (surface-breaking, embedded, etc.);

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[23] The procedures, predictive equations, and models described in Condition 7 may be reviewed and technically adjusted to incorporate the results of the DGLLC Material Testing Program, as described in Condition 5. A document detailing the review and technical adjustment process (including how any new models produce the same or better consistency and accuracy in predicting tensile strain capacity) must be submitted for independent third-party review and to PHMSA for review and a response of "no objection." If DGLLC adjusts the predictive equations and models described in Condition 7 after obtaining a response of "no objection" from PHMSA, the review and technical adjustment process must be incorporated into the draft and final ***SBD Plan*** Elements.

[24] The brittle-ductile transition behavior must be established by conducting one or more of the following tests: (1) Charpy impact, (2) drop weight tear test (DWTT), or (3) full-scale. The effects of specimen size and flaw-tip constraint conditions must be technically considered and accounted for in predicting materials' full-scale behavior. When ductile shear area can be determined, a result of 85% shear area may be viewed as achieving ductile behavior. If the ductile shear area cannot be determined, a full transition curve based on total energy must be used to determine the attainment of the ductile behavior.

g. HAZ hardening or softening;

h. Weld toughness properties for weld centerline and HAZ, including CTOD, SENT resistance curves (R-Curves), Charpy transition curves, curved wide plate, or other tests with pre-approved qualified test procedures; and

i. Flaw interaction rules suitable for SBD.[25]

v) The predictive equations or models for tensile strain capacity must evaluate the possible failure modes and locations for tensile strain capacity, including, but not limited to, crack initiation, ductile tearing, plastic collapse in the pipe and weld, and the possibility of brittle failure. The predictive equations must be validated by the tests specified in Condition 5.

a. DGLLC may use the tensile strain capacity predictive equations in published references[26,27] subject to review of the ***SBD Plan***, in accordance with Condition 3(b). DGLLC must demonstrate that these equations account for physical parameters that affect tensile strain capacity, such as those specified in Conditions 7(a)(i) through 7(a)(iv).

b. If the DGLLC project-specific predictive equations cannot meet Conditions 7(a)(i) through 7(a)(iv) above, no tensile strain capacity greater than those from the PHMSA/Pipeline Research Council International

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[25] Flaw interaction rules must cover all possible scenarios that can occur in the field, including, but not limited to, interaction of stacked flaws at weld starts and stops and interaction of surface-breaking and embedded flaws. API 1104, Appendix A, provides examples of various possible scenarios. Flaw interaction rules for strain-based design conditions are not well developed. Methodology in the following references can be used as a guide to develop flaw interaction rules: (1) Wang, Y.-Y., Liu, M., Long, X., Stephens, M., Petersen, R., and Gordon, R. (August 2, 2011). *Validation & Documentation of Tensile Strain Limit Design Models for Pipelines*. PRCI Project ABD-1, U.S. DOT Agreement DTPH56-06-T000014, final report. Retrieved from: http://primis.phmsa.dot.gov/matrix/PrjHome.rdm?prj=200; and (2) Tang et. al. ISOPE 2014-1-14-556. Retrieved from: http://www.isope.org/publications/proceedings/ISOPE/ISOPE%202014/index.htm. Flaw interaction rules must be submitted to PHMSA for review and a response of "no objection" prior to implementation.

[26] Tang, H., Panico, M., Fairchild, D.P., Crapps, J.M., and Cheng, W. (2014). *Strain Capacity Prediction of Strain-Based Design Pipelines*. Proceedings of 10th International Pipeline Conference in Calgary, Alberta, Canada.

[27] Tang, H., Fairchild, D.P., Cheng, W., Kan, W., Cook, M.F., and Macia, M.L. (2014). *Development of Surface Flaw Interaction Rules for Strain-based Design Pipelines*. Proceedings of the 24th International Society of Offshore and Polar Engineers Conference in Busan, South Korea.

(PRCI) predictive equations[28] can be used in the design, construction, and O&M.

b) Part II – Compressive Strain Capacity[29]

The predictive equations or finite element analysis (FEA) models for calculating compressive strain capacity in the ***SBD Segments*** during their lifecycle must adequately address the following parameters:

i) Pipe diameter;
ii) Pipe wall thickness;
iii) Pipe imperfections;
iv) Field cold bending and its impact on material properties;
v) Material grade;
vi) Material strain hardening rate (Y/T ratio);
vii) Internal pressure;
viii) Weld metal strength of girth weld;
ix) Girth weld misalignment;
x) Presence of a girth weld; and
xi) Girth weld transitions between different wall thicknesses.

c) Part III – Interaction of hoop strain and longitudinal strain: in addition to technically considering the strain capacity that is measured in the pipe longitudinal direction in Part I and Part II above (Condition 7(a) and (b)), the interaction of hoop strain and seam weld must be technically considered.

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[28] Wang, Y.-Y., Liu, M., and Song, Y. (July 31, 2011). *Second Generation Models for Strain-Based Design*. PRCI Project ABD-1, U.S. DOT Agreement DTPH56-06-T000014, final report. August 30, 2011. Retrieved from: http://primis.phmsa.dot.gov/matrix/PrjHome.rdm?prj=201.

[29] The procedures, predictive equations, and models described in Condition 7 may be reviewed and technically adjusted to incorporate the results of the DGLLC Material Testing Program, as described in Condition 5. A document detailing the review and technical adjustment process (including how any new models produce the same or better consistency and accuracy in predicting tensile strain capacity) must be submitted for independent third-party review and to PHMSA for review and a response of "no objection." If DGLLC adjusts the predictive equations and models described in Condition 7 after obtaining a response of "no objection" from PHMSA, the review and technical adjustment process must be incorporated into the draft and final ***SBD Plan*** **Elements**.

## Construction:

8) **Girth Welding Procedure Qualifications:** Girth welding procedures developed for 49 CFR 192.225 requirements must also address:

   a) Weld procedure tests:

      i) The preferred all-weld metal tensile tests are described in Appendix C of the report titled, "Background of All-Weld Metal Tensile Test Protocol, Final Report 277-T-02."[30] However, this test specimen may not be suitable for all weld bevel geometries. The largest practical diameter round-bar tensile specimen that fits inside the weld cross-section may be used as an alternative to the weld metal strip tensile specimen.[31] DGLLC must submit its all-weld metal testing procedure and justification as part of Element II. Plastically deforming the pipe segment (e.g. flattening) before removal of the tensile test specimen is not allowed.

      ii) Hardness test.

      iii) Weld tensile strength overmatch (minimum weld metal strength must ensure tensile strength overmatch).

      iv) Weld metal/HAZ fracture toughness tests, such as, where appropriate: Charpy V-Notch (CVN) impact, CTOD, SENB, SENT, curved wide plate, and full-scale tests. The tests must be conducted in groupings in accordance with the essential variable requirements of the American Petroleum Institute (API) 1104 Annex A,[32, 33] including possible variations of welding

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[30] Wang, Y-Y., Zhou, H., Liu, M., Tyson, B., Gianetto, J., Weeks, T., Richards, M., McColskey, J.D., Quintana, M., and Rajan, V.B. (December 20, 2011). *Background of All-Weld Metal Tensile Test Protocol.* Final Report 277-T-02. Retrieved from: http://primis.phmsa.dot.gov/matrix/PrjHome.rdm?prj=225.

[31] As described in the referenced report, the all-weld metal strip specimen is not considered suitable for testing of tie-ins with an open bevel. Further, fewer labs capable of testing this specimen may be available. Tensile property data based on round-bar specimens was used in the development and validation of the strain capacity models referenced in Footnote 24. Tensile property data based on round-bar specimens has been observed to be suitable for predicting strain capacity.

[32] The API. (September 2013). *Standard 1104: Welding of Pipelines and Related Facilities.* 21st edition, including errata 1 (April 2014), errata 2 (June 2014), errata 3 (July 2014), and addition 1 (July 2014).

[33] DGLLC must use the latest 49 CFR Part 192-approved edition of API Standard 1104 after obtaining a response of "no objection" from PHMSA's Director or Project Designee.

parameters. Possible variations include heat input in field welding and material property variations resulting from all pipe sources, including, but not limited to, chemical compositions and steel rolling temperatures, including their effects on yield and tensile strengths and elongations. Toughness tests must include initiation resistance and/or ductile tearing resistance, ductile-to-brittle transition temperature of the weld metal and HAZ.[34]

b) Weld high-low misalignment parameters must be defined and addressed in full-scale tests, finite element models, or a combination of the two methods.

c) Weld flaw acceptance criteria and nondestructive testing (NDT) criteria:

   i) Weld flaw acceptance criteria listing imperfection sizes, lengths, and depths using automated ultrasonic testing (AUT), which includes sizing error allowance and flaw interaction rules.

   ii) The flaw acceptance criteria must be consistent with the requirements of weld strain capacity in the lifecycle of the pipeline and Conditions 5, 6, and 7.

d) Procedures for repair welding must be developed in accordance with the requirements of API 1104[35] and the strain capacity during the entire lifecycle of the ***SBD Segments***. The impact of repairs on material properties—such as tensile, toughness, and ductility—from repair thermal cycles must be technically considered. The post-repair properties must be used in evaluating the girth weld strain capacity if those properties are inferior to the properties of the original welds. For instance, possible toughness degradation in the HAZ of the repair weld in the original girth weld and base metal must be technically considered. Limits on repairs must be specified and technically justified.

e) Expanded Weld Procedure Qualification (WPQ) requirements for SBD:

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[34] Temperatures for field joint coating are much lower than the temperatures experienced by the weld and HAZ during girth welding. Because these temperatures are lower, no effect of field joint coating temperatures on properties is expected. Additionally, the field joint coating thermal cycle has the potential to improve toughness by allowing the diffusion of hydrogen out of the girth welds.

[35] The API. (September 2013). *Standard 1104: Welding of Pipelines and Related Facilities.* 21st edition, including errata 1 (April 2014), errata 2 (June 2014), errata 3 (July 2014), and addition 1 (July 2014).

i) All SBD welding procedures (pipeline procedures, tie-in procedures, and repair procedures) must be subject to expanded WPQ testing over the range of welding parameters expected during construction to demonstrate procedure robustness and consistency.

ii) Mechanized weld procedures must be qualified and have tensile and toughness tests performed on both high-heat input and low-heat input welds.

iii) Manual weld procedures must be qualified over the full range of heat inputs anticipated during construction. During WPQ, the average voltage and current must be measured. The number of weld passes must also be recorded.

f) WPQ Consistency Program:

i) As part of the WPQ, a consistency program must be conducted for all mechanized weld procedures in which a minimum of five (5) consecutive girth welds must be made to SBD ECA flaw acceptance criteria or workmanship criteria, whichever is more restrictive.

ii) The girth welds fabricated for the consistency program must be made with parameters within the qualified ranges.

g) Welder training:

i) Mechanized welding: every welder/pair of welders must be permitted a minimum of three (3) welds for training. Following training, the welder/pair of welders must make a test weld that meets the SBD ECA flaw acceptance criteria or workmanship criteria, whichever is more restrictive.

ii) Manual Welding: every welder must be permitted a minimum of one (1) practice weld followed by a single test weld. The testing must include Non-Destructive Examination (NDE) and API Standard 1104 destructive tests. Retests may be permitted for nick break tests.

iii) Welder training (mechanized and manual welding) must be performed after a break of six (6) months or more from welding with project welding procedures.

9) **Construction Quality:**

a) The spacing between any two girth welds must not be smaller than one pipe diameter (1D) for pipeline welds and not smaller than 1D for transition welds in bends.[36]

b) No welded sleeve or composite sleeve repair is permitted during new pipe construction.

c) A measurement and monitoring system must be developed and implemented to quantify the pipe ovality, out-of-roundness, and pipe wall thickness at the pipe mill. DGLLC must document procedures for pipe handling, storage, transportation, and visual inspection of pipe for transportation damage. Dimensions must be measured on any pipes suspected of being damaged or deformed. During each construction season, verification must be made on at least 10 pipes that the pipe still meets the dimensional requirements after being transported to the ROW.

d) Each girth weld must be inspected for misalignment to ensure that the maximum misalignment has not been exceeded. Inspection may be performed visually with the use of appropriate tools or with a measuring system that measures misalignment around the circumference. Procedures for remediating girth welds outside specified misalignment limits must be developed. Alternatively, if misalignment is greater than the maximum allowed, the weld must be cut out or the strain capacity of the pipe segment where the subject weld is located must be lowered based upon the measured misalignment using the ECA approach of Condition 7.

e) Longitudinal stress and strain during construction must be calculated based upon the anticipated pipe ditch installation procedure. Pipe lifting and lowering-in practices, ditch depths, lift heights, number of lift points, and spacing between lift points must be specified.

    i) Pipe lowering-in stress and strain analysis must consider the total transition length, defined as all pipe joints between the touch-down point at the bottom of the trench and the touch-down point on the leading end of the pipe string. Both vertical profile and horizontal offset from pipe support to the center of the ditch must be technically considered.

[36] DGLLC has the option of submitting to PHMSA a procedure for minimum pipe length for girth welding to take the place of this condition. This procedure must receive a response of "no objection" from PHMSA's Director or Project Designee prior to implementation.

ii) Lifting practices must assure that the radius of curvature of the pipe during lifting will not overstress the pipe and girth welds.

10) **Girth Weld Testing During Production Welding:** DGLLC must implement a program to confirm ongoing quality of girth weld testing during production welding for application of SBD. The program, which must be addressed in Element II, must receive an independent third-party review and a response of "no objection" from PHMSA, in accordance with Condition 3(b). The program must include:

a) Increased quality assurance/quality control (QA/QC).

i) Production welding must be performed within the range of welding parameters of those qualified.

ii) A comprehensive QA/QC program must be established to record and monitor the welding parameters during production welding on a real-time basis to ensure that production welds are made within the welding parameter tolerances qualified during WPQ.

a. Any weld that is made outside of the range of qualified parameters, such as those made outside of the qualified heat input range (as measured by the electronic recording equipment), must be rejected and cut out.

b. Electronic measurement spikes, while not common, do occur; however, these anomalous spikes will not automatically trigger a cut out. The spikes must be evaluated on a case-by-case basis.

iii) QA/QC staff and independent inspectors must be trained and qualified prior to performing production welding inspections.

b) Start-up weld consistency requirements that must be met prior to full production.

i) Weld consistency during start-ups, including seasonal start-ups and shutdowns due to high repair rates, must consider staggered production where weld quality is evaluated over a limited number of welds.

ii) The contractor can only resume full production when weld repair rates achieve an acceptable level.[37]

[37] If the weld repair rate is greater than 10% for a rolling average of 200 consecutive mainline welds, DGLLC must perform a root cause analysis and take remedial action.

11) **Girth Weld Identification:** Each girth weld and pipe joint must be uniquely identified, traceable to, and include information on:

a) Weld history records including, but not limited to:

i) Weld procedure used;

ii) Weld repair procedure used;

iii) Weld identification;

iv) Welder(s) name(s);

v) Weld rod or wire; and

vi) Date of weld;

b) Identification of weld procedure specifications (WPS) and procedure qualification records (PQR);

c) NDT history including, but not limited to, the:

i) NDT procedure used;

ii) Weld/NDT identification;

iii) Results of NDT;

iv) NDT technician (Level II);

v) NDT technician (Level III); and

vi) Date of the NDT; and

d) Coatings and any other post-weld processes applied to the weld.

12) **Deformation Tool:** DGLLC must run a high-resolution deformation tool through all ***SBD Segments*** not later than the end of Pipeline Start-up (see Condition 27, "Nomenclature") and remediate, as required, all expanded pipe in accordance with PHMSA's Interim Guidelines for Confirming Pipe Strength in Pipe Susceptible to Low Yield Strength, dated September 10, 2009.[38]

13) **Grounding and Cathodic Protection:** Interference current protection and cathodic protection (CP) must be provided for all buried ***SBD Segments*** within one (1) year of installation of the pipeline in the ditch (including backfill) to meet 49 CFR 192.328(e), 192.620(d)(5) through (8) and Condition 19. Interference currents to be mitigated include:

[38] PHMSA's Interim Guidelines for Confirming Pipe Strength in Pipe Susceptible to Low Yield Strength, dated September 10, 2009 can be retrieved from PHMSA's Pipeline Technical Resources website section on Low Strength Pipe: https://primis.phmsa.dot.gov/lowstrength/documents.htm.

a) Induced alternating current (AC) and fault current protection from overhead AC transmission lines;
b) Telluric currents (geomagnetic earth currents); and
c) All other sources of direct current (DC) earth currents.

During the commissioning of the CP systems and the annual CP surveys, DGLLC must test for the presence of interference currents and for insufficient levels of CP. Should such conditions be detected, DGLLC must take remedial action within one (1) year of detection, whether through effective CP or some other means. The interference current protection and CP system may be temporary or permanent, but in all cases one or more of the applicable criteria contained in Appendix D of Part 192 must be achieved and maintained. At a minimum, both the interference protection and CP systems must include provisions for testing and monitoring the performance of the systems, including AC coupons and measuring polarized pipe-to-soil potentials.

14) **Right-of-Way (ROW) Construction Monitoring Program:** A ROW monitoring program must be developed and implemented for all pipeline ***SBD Segments*** during all construction phases based upon the progress of construction. The ROW construction monitoring program must include provisions for:

a) Periodic collection of soil and groundwater samples to test for chemical and electrical properties related to pipe corrosion, where technically applicable;
b) Quality assurance for bedding and backfill materials;
c) Quality assurance for main line pipe and girth weld coatings (above-ground and below-ground), including HDD coating quality; and
d) Where the pipeline is parallel to overhead AC transmission lines, AC pipe-to-soil potentials and AC current densities must be measured periodically and supplemental grounding provided, where necessary, to assure safe conditions.

Observed field conditions that can have an integrity impact on pipeline operations and integrity management plans must be documented during construction.

## Operations and Maintenance (O&M):

15) **Conditions for Start of Service:** Conditions 4 through 14 above (except Condition 12) must be implemented prior to placing the pipeline into natural gas service. The implementation of Conditions 4 through 14 must be included in the DGLLC O&M Procedures if they apply to O&M.

16) **O&M Procedures:** In addition to the O&M procedures otherwise required by 49 CFR Part 192, the DGLLC O&M procedures must technically consider all operating parameters that have an effect on the implementation of or compliance with any of these ***SBD Conditions***; including, but not limited to, maximum and minimum pressures, pipe corrosion, gas and environmental temperatures, gas quality, and the following:

   a) The effects of corrosion anomalies (defects) and mechanical damage (such as dents and gouges) on the strain capacity of the pipe and girth welds. A procedure to evaluate the effect of anomalies on tensile and compressive strain capacity must be developed and used as part of the O&M plan to assess pipeline integrity and fitness for service. The anomaly interaction criteria of a minimum of 6t (where t is the pipe wall thickness) must be used for longitudinal and circumferential wall loss.[39]

   b) Interaction of pipe anomaly and longitudinal strain. In addition to technically considering the strain capacity, which is measured in the pipe longitudinal direction in Condition 7(a) and (b), the interaction of pipe anomalies and hoop strain must be technically considered.

      i) The hoop strain limit must be maintained to a safe level when the interaction of hoop strain and longitudinal strain is technically considered in the presence of metal wall loss or other anomalies.

      ii) Unless justified by research,[40] as provided in Section iii below, metal loss must be maintained below 20% of the pipe wall thickness (see Condition

[39] Other anomaly interaction criteria may be used if they are more conservative than the required criteria.

[40] PHMSA has an ongoing research project on the effects of anomaly wall loss under combined pipeline loadings. The project is titled "Strain-Based Design and Assessment of Segments of Pipelines with and without Fittings" and is being conducted by the Center for Reliable Energy Systems. The project web link is: https://primis.phmsa.dot.gov/matrix/PrjHome.rdm?prj=556/. DGLLC may need to conduct additional tests on the effects of anomalies on longitudinal strain capacity.

18) and pressure failure ratios maintained in accordance with Condition 23 when the longitudinal strain magnitude exceeds 0.5%.

iii) Anomalies exhibiting wall loss greater than 20%, but not greater than 40%, may be allowed in ***SBD Segments*** with longitudinal strains over 0.5% strain, but must be evaluated with O&M procedures that are based upon:

a. A destructive test program;

b. Finite element analysis; or

c. A combination of the two methods that validates the procedures.

DGLLC must develop O&M procedures based upon the results of the DGLLC Material Testing Program, as described under Condition 5, and PHMSA research[40] with anomalies simulating wall loss under combined longitudinal and hoop loadings.

c) Determination of the nature, growth parameters, and location of all strain demand events (e.g., frost heave, thaw settlement, seismic, geologic fault areas, soil liquefaction areas, or soil movement areas).

d) Determination of strain capacity and strain demand along the ***SBD Segments***, in accordance with design and material specifications and tests for key parameters (determined in Conditions 5, 6 and 7), including, as appropriate:

i) Pipe wall thickness;

ii) Pipe tensile properties;

iii) Weld tensile properties;

iv) Weld hardness, including weld metal and HAZ;

v) Weld toughness;

vi) Pipe dimensional tolerance;

vii) Girth weld high-low misalignment;

viii) As-built girth weld NDT acceptance flaw size;

ix) Allowance for flaw growth if the ductile tearing limit state is used in determining the tensile strain capacity;[41]

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[41] The O&M plan must ensure that the flaw growth in the lifecycle of the pipeline is less than the critical flaw growth in the ductile tearing limit state. It is necessary to demonstrate that the flaw growth can be accurately and consistently measured if the allowance for flaw growth is given.

x) Manufacturing, construction, and operational inspection plan for ***SBD Segments***; and

xi) O&M procedures and lifecycle implementation plan for ***SBD Segments.***

e) Develop and implement strain demand monitoring systems, including in-line inspection tools, as specified in Condition 17, to verify the reliability and accuracy of these procedures. The strain demand monitoring systems must be technically justified for estimation of actual strain demand levels (tensile, compressive, and combined). The strain demand from the monitoring systems must have the comparable level of accuracy and resolution as the strain capacity so the strain demand can be compared consistently to the strain demand limit. When strain demand magnitude greater than 0.5% is determined, the pipeline must be monitored or remediated in accordance with integrity remediation measures specified in Condition 17.

f) Develop and implement material properties surveillance procedures for any time-dependent degradation mechanisms found during material testing, construction, or ongoing operations that may affect SBD.

17) **<u>Monitoring and Determination of Pipeline Strain Demand:</u>**

a) When locations of high strain are anticipated before a pipeline is put into service and/or discovered after a pipeline is put into service, strain demand monitoring processes or devices must be installed or implemented. The processes or devices must be installed or implemented, as applicable, either during construction (e.g., fiber optical cable) or during operation (inertial measurement unit (IMU), ground surveys, and aerial surveys). When the monitoring system is not directly on the pipeline, appropriate soil and pipe interaction models must be used to calculate the strains imposed on the pipe.

b) The resolution of the strain demand monitoring processes and devices must be consistent with that required to accurately determine strains up to the magnitude of the strain capacity, as determined in Condition 7. Tool inaccuracy is addressed in Condition 17(g)(iii) and must be technically considered.

c) DGLLC strain demand monitoring procedures must consider the limitations, accuracy, strain demand seasonal variability, and measurement intervals of the strain measurement. If monitoring devices have directional or accuracy limitations that cannot be offset through tolerances and safety factors in the procedures, multiple devices or processes for monitoring must be used. Unless the ILI is performed during the time of year when the peak strain is expected, the procedures must also account for potential seasonal variation in strain demand.

d) Data acquisition and analysis must be performed frequently enough to ensure the strain demand limit is not exceeded before mitigation measures can be implemented. The frequency of monitoring may be adjusted based on the site-specific strain growth rate calculations with safety factors using procedures that have been reviewed by PHMSA and received a response of "no objection." PHMSA may require an independent third-party review of the procedures and findings.

e) Whenever high strain conditions are identified, DGLLC must evaluate the site-specific strain demand limit. For the strain demand limit evaluation, the site-specific data must include actual pipe geometry, stress-strain data, Y/T ratios, construction weld records, NDE results, and other recorded data that affects the strain capacity, as given in Condition 7. The appropriate safety factor, as given in Condition 6, must be applied to obtain the site-specific strain demand limit from the site-specific strain capacity. In lieu of site-specific data, the strain demand limit can be established based on the conservative values from the material, geometry, and weld records of the ***SBD Segment*** containing the identified high-strain condition.[42]

f) Whenever high strain conditions are identified, DGLLC must evaluate the site-specific strain demand. For the strain demand evaluation, the site-specific geotechnical data must include burial depth, soil type, subsurface temperature information, water table height, and other recorded data that contributes to the evaluation and understanding of strain demand and strain growth at this location. If site-specific geotechnical data is not available, conservative assumptions must be

[42] Procedures using conservative values must receive a response of "no objection" from PHMSA's Director or Project Designee prior to implementation.

used to assess future strain demand growth.[43] The site-specific strain demand model must be calibrated to the pipeline strain measured at the high-strain location.

g) The conditions for geospatial mapping are given below as an example of a strain demand monitoring method. The principles of mapping are applicable to other monitoring methods, when appropriate.

   i) Geospatial Pipeline Mapping: Multi-dimensional geospatial pipeline mapping ILI (Mapping ILI) tools must be run through all ***SBD Segments***. The Mapping ILI tools (e.g. IMU) must be capable of mapping the pipeline location based upon its: plan, elevation, and distance. The Mapping ILI tools must be capable of mapping such features as: pipeline alignment and the direction and orientation of horizontal and vertical with respect to angle, radius, direction, and location. To allow for accurate usage of ECA and to ensure O&M procedures for SBD that can identify and locating high-bending strain conditions associated with the strain demand in Condition 17, the Mapping ILI tool must be able to meet the performance parameters listed in Table 1: Summary of Bending Strain ILI Tool Performance. Conditions that can cause additional stresses or strains on girth welds, but that are not measurable from geospatial mapping tools, must be technically considered in the weld integrity evaluation.

**Table 1: Summary of Bending Strain ILI Tool Performance**

| | **Bending Strain[1]** |
|---|---|
| **Detection Threshold – Probability of Detection (POD) 90%** | 0.1% maximum |
| **Accuracy** | +/- 0.05% |
| **Reporting Threshold** | 0.125% strain |

**Notes:**
1. All values given for 80% certainty.
2. For maximum reported strain values ≤ 2%.

[43] Procedures using conservative values must receive a response of "no objection" from PHMSA's Director or Project Designee prior to implementation.

ii) The Mapping ILI tool must be run not later than the end of Pipeline Start-up and once each calendar year, not to exceed fifteen (15) months thereafter. Alternatively, DGLLC can propose a substitute schedule in Element III or later, sending it to an independent third-party engineering expert/firm for review and to PHMSA for review and a response of "no objection" prior to implementation. After start-up, the justification for any alternative interval must be provided to the PHMSA Director or Project Designee for review and must receive a response of "no objection" prior to extending the Mapping ILI tool run interval.

iii) All Mapping ILI tool measurements must have a tool inaccuracy (tolerance) factor, as appropriate for the ILI tool, added to all strain demand calculations.

h) DGLLC must report and remediate high-strain conditions, as specified in Table 2: Pipeline Segment Strain Demand Monitoring.[44] Alternatively, DGLLC can propose a strain-demand monitoring approach either in Element III or later. The justification for any alternative strain demand monitoring approach must be sent by DGLLC to an independent third-party engineering/expert firm for review and to the PHMSA Director or Project Designee for review and DGLLC must receive a response of "no objection" prior to implementation.

[44] This table, titled "Pipeline Segment Strain Demand Monitoring," assumes the strain demand limit is no less than 0.67%. If the strain demand limit is less than 0.67%, the ***SBD Plan*** must be reviewed jointly by DGLLC, PHMSA, and independent third-party engineering experts. Monitoring levels must receive a response of "no objection" from the PHMSA Director or PHMSA project designee.

| Table 2: Pipeline Segment Strain Demand Monitoring | | |
|---|---|---|
| **Strain Demand Magnitude that Triggers Action** | | **Action Required**[45] |
| ***Level*** | ***Strain Demand*** | |
| 1 | Greater than 0.5% longitudinal strain and less than 75% of the strain demand limit | Monitor. |
| 2 | Equal to or greater than 75% of the strain demand limit and less than 90% of the strain demand limit[46] | Monitor. Develop a site-specific strain growth rate and corresponding remediation plan to ensure the strain demand limit is not reached during the pipe's operational life. The remediation plan must be implemented within one (1) year of the date of discovery or prior to the date when the strain demand limit is expected to be exceeded, whichever is sooner. |
| 3 | Equal to or greater than 90% of the strain demand limit | Report strain findings to the PHMSA Regional Director or Project Designee within 5 days of discovery. Develop a remediation plan and submit it to PHMSA within 30 days of discovery. The remediation plan is to be implemented within one (1) year of the date of discovery or 90 days prior to the date when the strain demand limit is expected to be exceeded, whichever is sooner. |

18) **Coating Disbondment and Cathodic Protection (CP) Current:** Within an ***SBD Segment*** where ILI results indicate wall loss greater than 20%[47] and the strain exceeds a magnitude of 0.5%, DGLLC must take remedial action to address the condition of the coating system, the level of CP, and to mitigate the corrosion that has occurred. Within one (1) year of the ILI tool run and subsequent data analysis identifying the wall loss, DGLLC must:

a) Remediate areas with greater than 20% wall loss[48] or

[45] DGLLC must submit the Level 2 and 3 monitoring procedures and plans to the PHMSA Director or Project Designee and receive a response of "no objection." PHMSA may also require an independent third-party engineering expert/firm review.

[46] The strain demand limit used in this table must have a safety factor, as defined in Condition 6. Level 2 and 3 evaluations can be based upon the site-specific strain demand limit for the pipeline section.

[47] Anomalies exhibiting greater than 20% wall loss but up to 40% wall loss may be allowed in ***SBD Segments*** with strains over 0.5% strain, but must be evaluated with O&M procedures that are based on a destructive test program and finite Element evaluation that validates the procedure.

[48] Anomalies exhibiting greater than 20% wall loss but up to 40% wall loss may be allowed in ***SBD Segments*** with strains over 0.5% strain, but must be evaluated with O&M procedures that are based on a destructive test program and finite Element evaluation that validates the procedure.

b) Use technologies to demonstrate that adequate levels of CP are being afforded to the pipeline and that coating degradation or disbondment is limited to the area in question. Further, an evaluation must be performed to ensure that the detected wall loss, combined with the detected strain levels, will not reduce the pipe hoop strength capacity below that required for pressure containment (see Condition 7).

19) **Interference Currents Control:** DGLLC must address induced AC from parallel electric transmission lines, foreign or nearby pipelines, telluric currents, and other interference issues—such as DC in the ***SBD Segments***—that may affect the pipeline. An induced AC or DC monitoring program and remediation plan to protect the pipeline from corrosion caused by stray or interference currents must be in place within one (1) year of the ***SBD Segment*** pipe being installed in the ditch (including backfill).

a) DGLLC must take readings at each AC mitigation test coupon location once every calendar year throughout the life of the pipeline. DGLLC must also take 24-hour recordings of AC interference voltages at 20% of the AC interference coupon test stations each calendar year. If there are any significant changes in the amount of electrical current flowing in any of the co-located high voltage AC power lines, such as from additional generation, a voltage uprating, additional lines, or new or enlarged substations, DGLLC must perform an AC interference survey along the entire co-located pipeline ROW within twelve (12) months of such change. DGLLC must evaluate interference areas where AC current discharge is greater than 20 amperes per meter squared with the most recent metal loss ILI tool results to determine if remediation measures are warranted. DGLLC must remediate any interference causing AC current discharge greater than 50 amperes per meter squared of pipe surface within twelve (12) months of the AC interference survey.

b) At least once every seven (7) calendar years, but not exceeding 84 months, DGLLC must perform an engineering analysis on the effectiveness of AC, DC, telluric current, and other electrical interference mitigation measures. DGLLC must also evaluate any AC interference causing AC current discharge greater than 20 amperes per meter squared of surface area. In evaluating such interference, DGLLC must integrate AC and all other electrical interference data with the most recent metal loss ILI tool results to determine remediation measures.

c) Within twelve (12) months of the results of the interference engineering analysis, DGLLC must remediate any AC interference causing an AC current discharge greater than 50 amperes per meter squared of surface area. Remediation means the implementation of performance measures including, but not limited to, additional grounding along the pipeline to reduce interference currents. Any DC interference that results in CP levels that do not meet the requirements of 49 CFR Part 192, Subpart I, must be remediated within 12 months of this evaluation.

d) Electrical interference mitigation and CP systems and equipment must comply with Condition 13.

20) **<u>Data Integration</u>:** DGLLC must create a data integration plan to integrate and analyze data pertaining to the integrity of the ***SBD Segments***. The data integration plan must define the integrity management data elements required for integrity management of the ***SBD Segments***, strain capacity assessment, determination and forecast of strain demand, and monitoring and remediation.

a) At a minimum, the data integration plan must reflect the information in Table 3: Data Integration Plan Information, in addition to the requirements in Table 1 of the American Society of Mechanical Engineers (ASME) B31.8S-2004.

b) Data integration must be outlined on pipeline route sheets (example: scale of 1 inch = 100 up to 500 feet on D- (24 inches x 36 inches) or E- (36 inches x 42 inches) size drawings or similar size drawings) or in an electronic geographic information system (GIS) with parallel sections for each integrity category and recent aerial photography or satellite imagery (recent photography means within 24 months of initial filing and every seven (7) years thereafter). Data integration must be capable of being updated on a continuing basis, in accordance with 49 CFR Part 192.

| Table 3: Data Integration Plan Information | | |
|---|---|---|
| **Language from ASME B.318S – 2004, Table 1** | | **SBD Condition Language** |
| ***Category*** | ***Data*** | ***Data Element*** |
| Attribute Data | Material Properties | Line pipe mechanical properties on a per-heat basis, to include:<br>- Tensile: UTS, Uniform Elongation (UEl), Y/T; and<br>- Compressive: full stress-strain curve.<br>Weld properties on a per WPS/PQR basis to include:<br>- All weld metal UTS; and<br>- Weld Metal (WM) SENT |
| Construction | Depth of Cover | Depth of cover surveys. |
| | Crossings/Casings | Location of casings and highway/railroad crossings. |
| Operational | Normal Maximum and Minimum Operating Pressures | MAOP, including normal, maximum, and minimum operating pressures.<br>Operating temperatures based upon seasonal, through-put, and normal, maximum, and minimum operating pressures. |
| | Leak/Failure History | Any in-service ruptures or leaks. |
| | CP System Performance | Rectifier voltage and current outputs over the past 7 years, CP test point survey readings over the past 7 years, AC and DC interference surveys, and telluric current surveys. |
| | Other (not included in B31.8S) | High consequence areas (HCAs), including boundaries on aerial photography or satellite imagery. |
| | | Class location, including boundaries on aerial photography or satellite imagery. |
| Inspection | Pressure Tests | Hydrostatic test pressure, including any known hydrostatic test failures or leaks. |
| | In-line Inspections (ILI) | ILI tool results, including high-resolution (HR) metal loss ILI tools, HR-deformation tools, coating disbondment tools and/or CP current measurement, and mapping ILI tool results. |
| | CP Inspection | Close interval survey (CIS). |
| | Coating Condition Inspections (DC voltage gradient) | Pipe coating surveys and pipe coating and anomaly evaluations from pipe excavations. |
| | Other (not included in B31.8S) | Stress corrosion cracking (SCC) excavations and findings. |
| | | Pipe exposures for any reason. |
| | | Geotechnical locations where strain monitoring is ongoing and is periodically measured. |
| | | Each high-strain location identified in accordance with Condition 17(e). |

21) **<u>Treatment of SBD Segments as Covered Segments under 49 CFR Part 192, Subpart O:</u>**

Notwithstanding the definition of a "covered segment" under 49 CFR Part 192, Subpart O, DGLLC must incorporate the ***SBD Segments*** in its written integrity management program

(IMP) and treat the ***SBD Segments*** as covered segments in an HCA, in accordance with 49 CFR Part 192, Subpart O, except for the reporting requirements contained in 49 CFR 192.945.

a) DGLLC must include the ***SBD Segments*** in its IMP baseline assessment plan, in accordance with 49 CFR 192.905.

b) DGLLC must perform ILI assessment along the entire length of the ***SBD Segments*** using ILI tools (e.g., high-resolution metal loss, high-resolution deformation and mapping) not later than the end of Pipeline Start-up.

c) DGLLC must perform ILI assessment using all ILI tools described in Condition 21(b) on a maximum interval of seven (7) calendar years. These ILI tools may be required to be run individually at more frequent intervals, as needed, to comply with all ***SBD Conditions***.

d) DGLLC must perform a CP assessment by a protective coating assessment of buried pipe by DC voltage gradient or AC voltage gradient, in accordance with 49 CFR 192.620, along the entire length of the ***SBD Segments***. This must occur after pipe construction backfill but within nine (9) months of placing the CP system in operation.

e) DGLLC must perform an External Corrosion Direct Assessment, in accordance with 49 CFR 192.925, on a maximum interval of seven (7) calendar years to evaluate and remediate external pipe coating and CP operational performance.

22) **Analysis of ILI Tool Data and Discovery of Actionable Anomalies:** In addition to the assessment and repair requirements contained in 49 CFR Part 192, Subpart O, DGLLC must account for ILI tool tolerance and corrosion growth rates in scheduled response times and repairs, documenting and justifying the values used. DGLLC must demonstrate ILI tool tolerance accuracy for each ILI tool run by use of calibration excavations or pre-built calibrated pipe segments[49] and, for each tool run, unity plots that demonstrate ILI tool detection accuracy for depth and length within ±10% for 90% of the time. The unity plots must show: a) the actual anomaly depth versus the predicted ILI tool depth and b) the failure pressure/MAOP for actual anomaly dimensions versus the ILI tool predicted failure

[49] Any pre-built calibrated pipe segments and procedures must receive a response of "no objection" from PHMSA's Director or Project Designee prior to implementation.

pressure/MAOP for ILI tool anomaly dimensions. The discovery date must be within 90 days of an ILI tool run for each ILI tool type (high-resolution geometry, high-resolution deformation, or high-resolution metal loss) unless that period is impractical,[50] in which case the discovery date must be within 180 days of an ILI tool run. ILI tool evaluations for metal loss must use "6t x 6t" interaction or more conservative criteria for determining anomaly failure pressures and remediation response timing.[51]

23) **Remediation:** In addition to all the assessment and repair requirements contained in 49 CFR Part 192, Subpart O, the following section provides requirements for excavation, investigation, and remediation of anomalies based on ILI tool data results, in accordance with 49 CFR 192.485 and 192.933. DGLLC must incorporate the appropriate Class location design factors in the anomaly repair criteria[52] for the ***SBD Segments***.

Reassessment by ILI tool must reset the timing for anomalies not already investigated and/or repaired. DGLLC must evaluate ILI tool metal loss data by using appropriate assessment analytical tools that incorporate the effects of longitudinal strain on the pressure containment capacity of the pipeline. Such tools may be developed by using three-dimensional finite element analysis with the full range of material properties, anomaly dimensions, and interaction of multiple anomalies; the final analytical tool may be a finite element procedure for use in ECA. Established tools, such as ASME Standard B31G: Manual for Determining the Remaining Strength of Corroded Pipelines (ASME B31G), the modified B31G (0.85dL) or R-STRENG[53] may be used, if (a) the effects of longitudinal strain are technically considered/implemented and (b) the safety of the tool is equivalent to or greater than that established for assessing pipelines under traditional

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[50] Discovery dates that are more than 90-days due to impracticality must be reported to PHMSA and receive a response of "no objection" from the PHMSA Director or PHMSA Project Designee.

[51] ILI tool metal loss interaction criteria of "6t x 6t" is based upon a length or width measurement of six times the pipe wall thickness (t).

[52] Anomaly repair methods (such as steel or composite sleeves) must consider their impact on longitudinal strain capacity at that location.

[53] Kiefner, John F., and Vieth, Pat H. Prepared for the Pipeline Corrosion Supervisory Committee Pipeline Research Committee of Pipeline Research Council International, Inc., by Battelle Memorial Institute. (December 22, 1989). *A Modified Criterion for Evaluating the Remaining Strength of Corroded Pipe.* Contract PR-3-805.

stress-based design (longitudinal strain magnitude of less than 0.5%). The ILI tool results must address ILI tool tolerances, unity charts findings, and corrosion growth rates of anomalies.

a) Immediate response: Any anomaly within an ***SBD Segment*** that meets either (a) an FPR[54] equal to or less than 1.1 or (b) an anomaly depth equal to or greater than 60% wall thickness loss.

b) One-year response: Any anomaly within an ***SBD Segment*** in a Class 1 location pipe that meets either (a) an FPR equal to or less than 1.39[55] or (b) an anomaly depth equal to or greater than 40% wall thickness loss.

c) Monitored response: Any anomaly within an ***SBD Segment*** in a Class 1 location pipe that meets both (a) an FPR greater than 1.39[56] and (b) an anomaly depth less than 40% and greater than 20% wall thickness loss. The schedule for the response must take tool tolerance and corrosion growth rates into account.

d) Anomaly Response for Class 2 and 3 locations: Anomaly response for Class 2 and 3 locations must use an FPR in Condition 23(b) and (c) of 1.67 for Class 2 locations and 2.0 for Class 3 locations.

If factors beyond DGLLC's control prevent the completion of any evaluation or implementation of remediation measures or plans required under either this Condition or Conditions 17 through 22 within the time specified, the completion of the evaluation or implementation of the remediation measure or plan must be completed as soon as practicable. Additionally, a letter justifying the delay and providing the anticipated date that the evaluation will be completed or remediation measure or plan implemented must be submitted to the PHMSA Director or Project Designee no later than one (1) month prior to the end of the time specified under the applicable Condition. Any extended evaluation or

[54] Failure Pressure Ratio (FPR) is defined as the predicted failure pressure divided by the MAOP.

[55] When the anomaly is in a Class 2 location, DGLLC must use an FPR of 1.67. When the anomaly is in a Class 3 or Class 4 location, DGLLC must use an FPR of 2.00.

[56] When the anomaly is in a Class 2 location, DGLLC must use an FPR of 1.67. When the anomaly is in a Class 3 or Class 4 location, DGLLC must use an FPR of 2.00.

remediation schedule submitted to PHMSA from DGLLC must receive a response of "no objection" from the PHMSA Director or Project Designee.

## Reporting and Certification:

24) **Reporting:** Within twelve (12) months following Pipeline Start-up, and annually[57] thereafter (except as noted herein), DGLLC must report the following to the PHMSA Director or Project Designee and provide copies to the PHMSA Engineering and Research Division Director and the PHMSA Standards and Rulemaking Division Director.[58]

a) In the first annual report, only, DGLLC must describe the economic benefits of the ***SBD Conditions***; subsequent reports must indicate any changes to this initial assessment;

b) In the first annual report, only, DGLLC must fully describe how the public benefits from energy availability; subsequent reports must indicate any changes to this initial assessment;

c) The number of public gathering areas, new residences, identified sites, or other structures intended for human occupancy built within an ***SBD Segment's*** potential impact radius, as defined in 49 CFR § 192.903;

d) Any integrity threats identified during the previous year and the results of any ILI or direct assessments performed during the previous year (such as strains over 0.5% and anomalies over 20% wall loss) in the ***SBD Segments***;

e) Any reportable incident or leak reported on the DOT Annual Report in the ***SBD Segments***;

f) All repairs that occurred during the previous year in the ***SBD Segments***;

g) Any ongoing damage prevention, corrosion, and longitudinal strain preventative initiatives affecting the ***SBD Segments***, as well as a discussion of the success of the initiatives;

h) Annual data integration information, as required in Condition 20: Data Integration for the ***SBD Segments***;

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[57] Annual reports and other reports submitted to PHMSA must be provided, as per regulations.

[58] Upon notice to DGLLC, PHMSA may update the reporting contacts for Condition 24.

i) All actual strain demand conditions that exceed the 0.5% Level 1 strain demand limit specified in Condition 17 in the ***SBD Segments***; and

j) Any mergers, acquisitions, transfers of assets, or other events affecting the regulatory responsibility of the pipeline operating company.

25) **Extension of SBD Segments:** At the request of DGLLC, and in accordance with the procedures under Appendix B: Design Change Process, PHMSA may expand the original ***SBD Segments*** to include new segments. PHMSA may also extend the original ***SBD Segments*** of the DGLLC pipeline up to the limits of the ***SBD Segments Permit Area***, as defined in the DGLLC EIS and pursuant to the following conditions.[59] To include new segments or extensions of the original ***SBD Segments***, DGLLC must:

a) Provide notice to the PHMSA Director or Project Designee, PHMSA Standards and Rulemaking Division Director, and PHMSA Engineering and Research Division Director of a requested new ***SBD Segment*** or extension of an original ***SBD Segment***[60] of the DGLLC pipeline, as well as the location of the new *SBD Segment* or extension of the original *SBD Segments*, based on any anticipated remedial or pipe replacement actions, including survey stationing. All requests for a new ***SBD Segment*** or extension of the original ***SBD Segments*** must be submitted to PHMSA's Director or Project Designee in advance of their implementation, follow the Appendix B: Design Change Process, include data integration (see Condition 20), and provide information on any potential environmental impacts of the new ***SBD Segment*** or extensions of the original *SBD Segments*.

b) Complete all inspections and remediation of the new ***SBD Segment*** or extensions of the original *SBD Segments* to the extent required for the original DGLLC pipeline ***SBD Segments***.

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[59] A milepost update that does not alter the geographical location and extent of an ***SBD Segment*** covered under this special permit requires notification only to PHMSA. For example, route milepost changes may be caused by route alignment changes outside the boundaries of the ***SBD Segment*** that lengthen or shorten the overall route, resulting in renumbering the mile posts without altering the geographical extent or location of the ***SBD Segments*** covered under this special permit.

[60] For a new ***SBD Segment*** or extension within the ***SBD Segments Permit Area*** to be considered by PHMSA, DGLLC must confer with PHMSA's Director or Project Designee to determine the need for any additional environmental review and obtain a response of "no objection" from PHMSA's Director or Project Designee prior to implementing the change.

c) Comply with all the special permit conditions and limitations included herein for all new ***SBD Segments*** and extensions.

d) Comply with all conditions of this special permit for the new ***SBD Segments*** and extensions required for implementation and certification, including submittal of documents to PHMSA required in Condition 27.

26) **Certification:** A **DGLLC** senior executive officer—vice president or higher—must certify the following in writing:

a) The ***SBD Segments*** of the DGLLC Pipeline meet these ***SBD Conditions***; and

b) The written manual of O&M procedures for the DGLLC pipeline includes all applicable requirements in 49 CFR Part 192 and the ***SBD Conditions***.

DGLLC must send the certifications required in Condition 26(a) and (b) with the completion date, compliance documentation summary, required senior executive signature, and date of signature to the PHMSA Associate Administrator for Pipeline Safety. Copies must also be sent to the PHMSA Director or Project Designee, PHMSA Standards and Rulemaking Division Director, and PHMSA Engineering and Research Division Director. These must be sent within three (3) months of placing the pipeline into natural gas service. DGLLC must provide a status update, including any proposed changes to the final ***SBD Plan***, as per Condition 3(a), within six (6) months after placing the pipeline into natural gas service.

## Nomenclature:

27) **Nomenclature:** This section defines technical terms used for SBD throughout these ***SBD Conditions***.

a) Actionable anomaly: Anomalies that may exceed acceptable limits based on the operator's anomaly and pipeline data analysis.

b) DGLLC Pipeline: The natural gas pipeline that extends from the connection to the Enstar Natural Gas 20-inch Beluga natural gas pipeline to the DGLLC mine site.

c) Compressive strain capacity:[61] Compressive strain capacity (CSC) is the maximum longitudinal compressive strain when the pipe segment reaches its maximum bending moment under lateral bending or its maximum compressive load under compression.

d) Full-scale testing: A full-scale test involves a full-size pipe with no portions of the pipe circumference cut out. The test may be performed with or without internal pressure. The pipe can be loaded in longitudinal tension, longitudinal compression, lateral bending, or a combination thereof.

e) High strain: Longitudinal strain with a magnitude greater than 0.5%.

f) Independent third-party engineering expert/firm: An engineering expert or firm that (a) is retained by mutual agreement between DGLLC and PHMSA and (b) commits to submitting reports and other forms of communication simultaneously to DGLLC and PHMSA.

g) Independent third-party review: A technical review carried out by an independent third-party engineering expert/firm.

h) Medium-scale testing: A typical medium-scale test is a curved wide plate (CWP) test. The test specimen is a curved piece of pipe with a nominal gauge width ranging from 200 millimeters (8 inches) to 450 millimeters (18 inches) and a nominal length of 4-5 times the gauge width. The specimen usually has a mid-length girth weld and is pulled in the longitudinal direction. A machined notch or fatigue-sharpened flaw is usually placed in the weld or HAZ to simulate welding defects.

i) Natural gas service: The date on which the first product gas is introduced into the pipeline.

j) Pipeline Start-up: An interval during which the pipeline system begins operations and throughput (product flow through the pipeline) is ramped-up to its commercial capacity. For the purposes of these ***SBD Conditions***, Pipeline Start-up is defined as a

[61] Reaching CSC generally does not lead to immediate loss of pressure containment if the pipe is restrained from further deformation. The consequence of exceeding CSC varies, depending on the mechanical properties of the pipe and welds, site-specific support conditions, and operational conditions of the pipeline. During the DGLLC Material Testing Program, the CSC will be reviewed and an alternative evaluation may be proposed by DGLLC. Any alternative definition of CSC must be reviewed with PHMSA and receive a response of "no-objection." Both immediate and long-term consequences of exceeding the CSC, as defined, must be evaluated and technically justified. Condition 23 has requirements for the assessment and remediation of dents and wrinkles, in accordance with 49 CFR § 192.933, Subpart O.

period of no more than one (1) calendar year after placing the pipeline into natural gas service.

k) Probability of Detection: Probability of a change in strain being detected by the ILI-IMU tool.

l) Site-specific strain demand: Site-specific strain demand is the strain demand specific to a particular pipeline site within the ***SBD Segment***. Site-specific conditions, including local operational parameters, local soil conditions, pipe material and geometric features, and pipe/soil interaction, contribute to the site-specific strain demand. The strain demand profile varies over the length of the strain feature and values can be established at distinct locations, e.g., pipe body and individual girth weld locations.

m) Site-specific strain demand limit: Site-specific strain demand limit is the strain demand limit specific to a particular pipeline site within the ***SBD Segment.*** Site-specific conditions, including material conditions and weld imperfections, contribute to the site-specific strain demand limit.

n) Small-scale testing: Typical small-scale testing includes uniaxial tension tests, uniaxial compression tests, SENB tests, SENT tests, and CVN impact tests. The dimensions of typical small-scale test specimens range from a few inches to tens of inches. The specimens are usually light enough that they can be handled without the use of lifting equipment.

o) Strain-based design (SBD): SBD is a pipeline design methodology with specific goals of providing safe and reliable service when a pipeline is subjected to longitudinal strains with magnitudes greater than 0.5%. It does not replace design requirements based on the maximum hoop stress criteria of 49 CFR Part 192.

p) Strain capacity: Strain capacity is the longitudinal strain limit of a pipe and/or girth weld at the point of an incipient failure event, such as a leak or rupture with accompanying loss of pressure containment, loss of structural stability, or features that have long-term negative consequences.

q) Strain demand: Strain demand is the longitudinal strain imposed on a pipeline by its surrounding environment (e.g., frost heave, thaw settlement, seismic, geologic fault areas, soil liquefaction areas, or soil movement areas), as outlined in Condition 6(b).

r) <u>Strain demand limit:</u> Strain demand limit is a specific longitudinal strain demand value that cannot be exceeded. The strain demand limit must be less than the strain capacity. The difference between the strain capacity and strain demand limit is a part of the safety margin in an SBD approach (see Condition 6(a)). The strain demand limit must be established for the ***SBD Segments***, in accordance with Condition 6.

s) <u>Technically considered:</u> A documented engineering and operational technical review of all findings and plans.

t) <u>Tensile strain capacity:</u> Tensile strain capacity is the maximum longitudinal tensile strain the pipe and/or girth weld can withstand without loss of pressure containment.

u) <u>Tensile strength overmatch:</u> The difference between the tensile strength of the girth weld and the pipe. For practical purposes, the tensile strength of the girth weld is measured in the hoop direction using an all weld metal specimen while the tensile strength of the pipe is measured in the axial direction.

v) <u>Uniform strain:</u> Uniform strain is the engineering strain corresponding to the ultimate tensile strength in an engineering stress vs. engineering strain plot.

## Proprietary Data:

28) **<u>Proprietary Data</u>**: DGLLC may request confidential treatment of the proprietary information it submits to PHMSA. If DGLLC wishes to request confidential treatment, please refer to 49 C.F.R. 190.343, which sets out the steps for making the request. If PHMSA receives a Freedom of Information Act request or otherwise determines a need for public disclosure of information designated as confidential commercial information (or where DOT has some other reason to believe it is confidential commercial information), PHMSA will consult with DGLLC, in accordance with 49 CFR 7.29.

## Limitations:

PHMSA grants this special permit subject to the following limitations:

1) PHMSA has the sole authority to make all determinations on whether DGLLC has complied with the specified conditions of this special permit.

2) Failure to submit the certifications required by Condition 26 within the timeframes specified may result in revocation of this special permit.

3) PHMSA may revoke, suspend, or modify a special permit based on any finding listed in 49 CFR 190.341(h)(1). As provided in 49 United States Code (U.S.C.) § 60122, PHMSA may also issue an enforcement action for failure to comply with this special permit.

4) Should PHMSA revoke, suspend, or modify a special permit based on any finding listed in 49 CFR 190.341(h)(1), PHMSA will notify DGLLC in writing of the proposed action and provide DGLLC an opportunity to show cause why the action should not be taken. In accordance with 49 CFR 190.341(h)(3), if necessary to avoid the risk of significant harm to persons, property, or the environment, PHMSA will not give advance notice and will declare the proposed action (revocation, suspension, or modification) immediately effective. Otherwise, in accordance with 49 CFR 190.341(h)(2)(i), DGLLC may provide a written response showing why the proposed action should not be taken within 30 days of the notice.

5) The terms and conditions of any corrective action order, compliance order, or other order applicable to a pipeline facility covered by this special permit will take precedence over the terms of this special permit, in accordance with 49 CFR 190.341(h)(4).

6) DGLLC may seek reconsideration of a decision made pursuant to 49 CFR 190.341(h) by submitting a petition to the Associate Administrator of Pipeline Safety, in accordance with 49 CFR 190.341(i). The Associate Administrator's decision made pursuant to 49 CFR 190.341(i) constitutes final administrative action. All final administrative actions are subject to juridical review under 49 U.S.C. § 60119.

7) If DGLLC sells, merges, transfers, or otherwise disposes of the assets known as the ***SBD Segments***, DGLLC must provide PHMSA with written notice of the transfer within 30 days of the consummation date. In the event of such transfer, PHMSA reserves the right to

revoke, suspend, or modify the special permit if the transfer constitutes a material change in conditions or circumstances, pursuant to 49 CFR 190.341(h)(1)(ii) or any other circumstances listed under 49 CFR 190.341(h)(1).

AUTHORITY: 49 U.S.C. Section 60118 (c)(1) and 49 CFR 1.97.

Issued in Washington, D.C., on JUN 05 2018.

Alan K. Mayberry,

Associate Administrator for Pipeline Safety

# Appendix A – Pipe

DGLLC must prepare material specifications, including requirements for qualification and production tests, and an Inspection and Test Plan using Appendix A.[62]

The ***SBD Segments*** of the DGLLC Pipeline will be constructed of line pipe that meets the requirements of API 5L Grade X52 PSL 2.

1) Materials specifications for the pipe:
   a. Hoop tensile properties must be established by testing round-bar specimens without flattening;
   b. Longitudinal tensile properties must be established by testing full thickness strap specimens without flattening and the gage length and width of the reduced section must comply with American Society for Testing and Materials (ASTM) A370 Section A.2.2.2 for longitudinal strip specimens for tubular products;
   c. For tensile tests for which a full stress-strain curve is required, the stress-strain curve must be recorded at least until the ultimate tensile strength and uniform elongation is reached; the extensometer may be removed after the load begins to decrease;
   d. Requirements that apply after simulated coating (the aged condition) must be performed for five (5) minutes on test specimens aged at a temperature equal to the lesser of 250 degrees Celsius or the maximum temperature experienced during fusion bonded epoxy (FBE) coating;
   e. The minimum longitudinal tensile yield strength in the aged condition, defined as 0.5% engineering strain, must be $\geq$ 90% of the SMYS in the hoop tension direction;[63]
   f. For longitudinal specimens, the maximum yield strength to UTS ratio must be $\leq$ 0.90 (both before and after simulated coating);

[62] Appendix A is intended to ensure consistent material properties are used throughout the DGLLC Pipeline ***SBD Segments*** for material testing, strain capacity modeling, welding procedures, and strain demand limits. Any changes to the material specifications used on the DGLLC ***SBD Segments*** that are not in accordance with this Appendix must be submitted to PHMSA's Director or Project Designee for review and receive a response of "no objection" prior to usage. Appendix A changes are not intended as changes that would subject the special permit to be publicly noticed.

[63] It is typical for UOE line pipe to exhibit strength anisotropy that results in the axial strength being less than the hoop strength. This is beneficial for SBD, since the weld metal overmatch, which is in the axial direction, will be greater.

g. Longitudinal compression tests must be conducted for information only and the longitudinal stress-strain curves in the "aged" condition must exhibit "round house" (continuous yielding) behavior, i.e., no Lüders plateau of more than 0.2% strain;

h. The longitudinal tensile stress-strain curves in the "aged" condition should ideally exhibit "round house" (continuous yielding), but if discontinuous yielding is exhibited the Lüders plateau elongation must be ≤ 0.5%, i.e., the length of the plateau from initial yielding must be ≤ 0.5%;

i. The longitudinal tension specimen must exhibit uniform strain (elongation at maximum load) of ≥ 6%;

j. The maximum longitudinal tensile yield strength must not exceed SMYS + 20.3 kilopounds per square inch (ksi), which converts to 140 megapascals (MPa);

k. The maximum longitudinal UTS must not exceed SMYS + 35 ksi (240 MPa);

l. The drop weight tear test (DWTT) specimens taken 90 degrees from the weld must exhibit an average shear area ≥ 85% at the lowest temperature under normal operations or the Lowest Anticipated Service Temperature (LAST);

m. The Charpy energy for samples taken at mid-thickness and 90 degrees from the weld must be specified at LAST and shear area must be reported for information;

n. CTOD R-curves must be reported for information only;

o. The pipe must be resistant to HAZ softening—the minimum HAZ hardness in the seam weld heat affected zone must be ≥ 160 $H_V10$; and

p. The maximum tolerances on pipe diameter, ovality, and wall thickness must be in accordance with API 5L PSL 2. The average wall thickness for the quantity of pipe on the purchase order must not be less than the specified wall thickness. The minus wall thickness tolerance at any location must be 0.8 millimeters (0.031 inches), except in localized areas where grinding is required to remove surface imperfections. Such localized areas must meet a minimum tolerance equal to 95% of specified wall thickness.

2) Manufacturing Procedure Qualification Test (MPQT):

The pipe manufacturer must produce a minimum of two heats to demonstrate compliance with the specification. A change in any of the essential variables listed in Table A-1 below must require requalification. Alternatively, each time the actual value for the considered parameter is outside of the defined range, the plate will be declared as "out of process plate" and will be individually mechanically tested to confirm compliance with specification requirements.

a) For longitudinal seam line pipe, one plate from each heat must be tested on each corner of the plate. For manufacture of helical seam line pipe, coils from each heat must be tested on both edges and at the extreme head and tail of the coil. The data developed during prequalification must be used to establish the appropriate test locations during production. As an option, testing of plate/coil may be performed after pipe forming to account for changes in pipe properties due to forming.

**Table A-1: Line Pipe Manufacturing Essential Variables**

| Essential Variables | Parameters |
|---|---|
| Chemistry | A change in chemistry outside the limits in Table A-2 |
| Steelmaking Method | Electric Arc Furnace (EAF) or Basic Oxygen Furnace (BOF) |
| Refining Process | LMF and/or Vacuum Treatment |
| Casting | Ingot or continuous casting |
| Slab Reheating Temperature | +/– 40 degrees Celsius |
| Slab Reheating Time | Minimum reheating time |
| Rolling Practice | Air or Water Cooling; Thermo-Mechanical Control Process (TMCP) |
| Total Rolling Reduction | + Unlimited, –15% |
| Finishing Reduction | + Unlimited, –15% |
| Finish Rolling Temperature | +/– 45 degrees Fahrenheit (+/–25 degrees Celsius) |
| TMCP Water Start Temperature NOTE 1 | +/– 63 degrees Fahrenheit (+/–35 degrees Celsius) |
| TMCP Water Stop Temperature NOTE 1 | +/– 90 degrees Fahrenheit (+/–50 degrees Celsius) |
| TMCP Cooling Rate NOTE 2 | +/– 25% |
| Plate Manufacturer | Any change in manufacturer or manufacturing location |
| Change in the Pipe Making Process | From JCOE to UOE to Three Roll Bending or Spiral, etc. |
| Expansion Ratio | +/– 0.3% |
| Coating Temperature | + 36 degrees Fahrenheit (+ 20 degrees Celsius), - Unlimited |

NOTE 1 Applicable only if accelerated cooling is used.
NOTE 2 Cooling rate is the average cooling rate between the water start temperature and the water finish temperature.

| Table A-2: Allowable Chemistry Variation | |
|---|---|
| Carbon | +0.02, –0.03% |
| Manganese | +/– 0.20% |
| Phosphorus | +0.010%, –no limit |
| Sulfur | +/– 0.005% |
| Silicon | +0.15%, –no limit |
| Copper | +/– 0.15% |
| Nickel | +0.50%, –0.15% |
| Chromium | +/– 0.10% |
| Molybdenum | +0.04%, –0.06% |
| Niobium | +/– 0.010% |
| Titanium | +/– 0.010% |
| Aluminum | +/– 0.025% |
| Vanadium | +/– 0.02% |
| Boron | +/– 0.0005% (+/–5 parts per million (ppm)) |
| Nitrogen (total) | +0.0025%, –0.0045%(+25 ppm, –45 ppm) |
| Carbon Equivalent (CE - IIW) | +0.02, –0.03 |
| CE - Pcm | +0.02, –0.03 |

b. Two (2) pipes from each heat must be tested for items (i) through (ix) below, while one (1) pipe from each heat must be tested for items (x) and (xv):[64]

i. Chemical analysis;

ii. Longitudinal and hoop tensile tests of pipe body in the as-received condition (provide full stress-strain curves) on three specimens per pipe for each orientation;

iii. Longitudinal tensile tests of pipe body in the aged condition (provide full stress-strain curves), on three (3) specimens per pipe; the sampling position for the strain ageing test specimen is the same as that of non-aged specimens;

iv. Longitudinal compression tests of pipe body in the aged condition (provide full stress-strain curves) on three (3) specimens per pipe; the sampling position is the same as for longitudinal tensile test specimens;

[64] If API 5L requires additional testing, the more stringent requirements must apply.

v. Tensile testing of seam weld in the as-received condition, which must be performed on three (3) round bar specimens representing all pipe seam weld metal; full stress-strain curves must be provided;

vi. Charpy impact test (pipe body, weld, and HAZ) at the specified temperature;

vii. DWTT, at the specified temperature;

viii. Vickers Hardness traverse across seam weld;

ix. Guided bend test;

x. Metallography of the pipe body;

xi. Visual inspection and dimensions;

xii. Nondestructive inspection;

xiii. Hydrostatic test—one (1) pipe from each heat must be tested hydrostatically at an applied hoop stress corresponding to 100% SMYS;

1. The pressure must be calculated using specified outside diameter and minimum wall thickness. For mills with an end-sealing ram that produces a compressive longitudinal stress, the applied hoop stress must correspond to 100% SMYS after provisions for end-loading per API 5L, Paragraph 10.2.6.6, are applied.
2. If the dimension of pipe fails to conform to the requirements of this specification after the hydrostatic test, two additional pipes from the same heat must be selected to perform the same hydrostatic test.

xiv. SENT tests or CTOD tests of pipe body to measure CTOD R-curves; and

xv. For information only, a Charpy transition curve of the pipe body in the aged condition. The complete fracture shear area percentage and Charpy absorbed energy transition curves for transverse Charpy impact tests must be provided. Tests must be performed on three specimens per test temperature at a minimum of five (5) test temperatures that cover the ductile to brittle transition temperature range.

3) Production Testing of Mechanical Properties:

a. Tests and Requirements: The tests and requirements are shown in Table A-3.

b. QA/QC: Manufacturing QA/QC of pipe production must be conducted in accordance with an Inspection and Test Plan approved by DGLLC.

| Table A-3: Test and Requirements | | | |
|---|---|---|---|
| **Items** | | **Frequency** NOTE 3 | **Number, Location and Orientation of the Specimen (See NOTE 4)** |
| Pipe Body NOTE 1 | Chemical composition product analysis | 1/heat | 1 |
| | Pipe body transverse tensile | 1/lot NOTE 2 | 1 |
| | Pipe body longitudinal tensile (aged) | 1/lot | 1 (90 degrees, longitudinal) |
| | Charpy impact – pipe body transverse | 1/lot | 1 set of 3 specimens |
| | DWTT | 1/lot | 2 |
| Weld | Welded joint tensile | 1/lot | 1 |
| | Guided root bending | 1/lot | 1 |
| | Guided face bending | 1/lot | 1 |
| | Charpy impact – weld | 1/lot | 1 set of 3 specimens |
| | Charpy impact – HAZ | 1/lot | 1 set of 3 specimens |
| | Macro | 1/lot | 1 |
| | Vickers Hardness | 1/lot | Per API 5L |
| Hydrostatic pressure test | | Each pipe | |
| Visual | | Each pipe | |
| Dimension | | Each pipe | |
| NDT | | Each pipe | |

**NOTE 1:** For helical seam pipe, the samples must be taken midway between the weld seam.
**NOTE 2:** A lot is defined as 100 pipes, or per heat, or as per API 5L, whichever is less.
**NOTE 3:** Testing frequency and test type must meet both Table A-3 and API 5L criteria.
**NOTE 4**: Location and orientation must comply with API 5L, if not specified otherwise.

## Appendix B – Design Change Process

If required, DGLLC must implement a design change process (***DCP***) to address how the ***SBD Segments*** in the special permit will be extended or new ***SBD Segments*** added as engineering or construction of the pipeline progresses and conditions are found to be changed from the design basis parameters. The ***DCP*** must be submitted to the PHMSA Director or Project Designee for a response of "no objection."[65]

The Special Permit requires milepost boundaries to be identified for pipeline segments that will be covered by the ***Conditions***. There are several factors that could cause a change of the ***SBD Segments*** along the route after the time of initial submittal of the special permit application and issuance of a special permit. These factors include: reroutes such as those due to physical, environmental, or regulatory determinations, additional subsurface information gathered from field geotechnical confirmation studies, changes in pipeline system design, changes in pipe or ditch design, and changes in construction planning.

The ***DCP*** will describe the process and procedures by which such changes are evaluated for their effect on the ***SBD Segments*** and, when an extension to an ***SBD Segment*** or new ***SBD Segments*** is identified, will specify the additional process of review for those ***SBD Segment*** changes. The ***DCP*** will also demonstrate adherence to QA/QC processes and procedures and will be part of the ***SBD Plan***, including applicable review under Condition 3(b).

1) At a minimum, the ***DCP*** content must include:
    a. Reason for change;
    b. Authority for approving changes;
    c. Analysis of implications;
    d. Acquisition of required work permits;
    e. Any required environmental reviews and permits;
    f. Documentation;
    g. Communication of change to affected parties;
    h. Time limitations;

[65] The ***DCP*** must be submitted to the PHMSA Director or Project Designee and must receive a response of "no objection" from PHMSA prior to implementation.

i. Qualification of staff; and

j. A description of the data analysis procedure that impacts the determination of ***SBD Segment*** boundaries during the design and construction of the pipeline.

2) Review and approval of updates to ***SBD Segment*** mileposts or new ***SBD Segments***:

a. The beginning and ending mileposts of all ***SBD Segments*** are included in the Special Permit.

b. DGLLC must provide updates to the ***SBD Segment*** mileposts or new ***SBD Segments*** when each SBD Plan Element described in Condition 3(a) is submitted to PHMSA. For SBD Plan Element I: Design and Materials Specifications and Procedures, updates to ***SBD Segment*** mileposts or new ***SBD Segments***, if any, must be based on new data or project changes since issuance of the Special Permit, such as those listed below:

i. Additional geotechnical information;

ii. Route alignment changes;

iii. Design changes such as pipe wall thickness, grade, and burial depth; and

iv. Changes in system design, e.g., changes in compressor station locations/designs.

For ***SBD Plan*** Element II: Construction Specifications and Procedures, updates to ***SBD Segment*** mileposts or new ***SBD Segments***, if any, would be based on new data or project changes, as detailed in Paragraph 2 (b) of this Appendix.

For the ***SBD Plan*** Element III, Operations and Maintenance Specifications and Procedures, updates to ***SBD Segment*** mileposts or new ***SBD Segments***, if any, would be based on changes during construction that were made in accordance with the ***DCP***.

c. After the start of Operations, new ***SBD Segments*** or additional updates to the ***SBD Segment*** mileposts may be proposed by DGLLC. DGLLC must submit the new ***SBD Segments*** or updates to the ***SBD Segment*** mileposts to the PHMSA Director or Project Designee for a response of "no objection" prior to implementing.

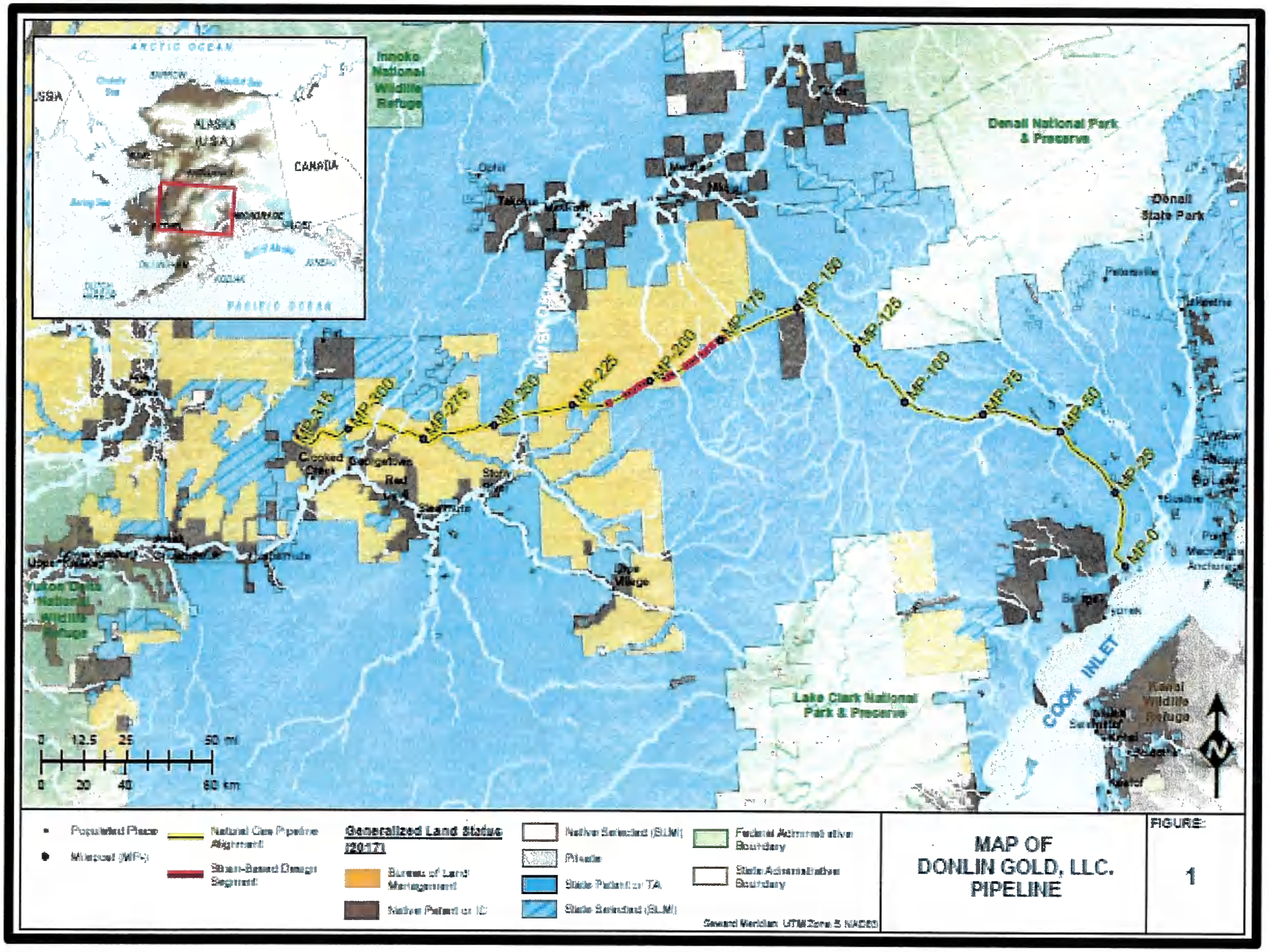
d. Any changes that add to the ***SBD Segment*** mileposts must be reviewed by

PHMSA and an independent third-party engineering expert/firm, in accordance with the approval process in Condition 3. Any additional ***SBD Segment*** lengths must comply with all of the ***SBD Conditions***. If the extension or the new ***SBD Segment*** was not initially built with pipe, welds, and procedures compliant with the ***SBD Conditions***, replacement of the segment with compliant materials and procedures will be required.

3) Non-SBD Segments:

If DGLLC pipeline segments that are not included in the ***SBD Segment*** mileposts are found to experience axial or longitudinal strains in excess of 0.5%, DGLLC must present an assessment of the suitability for continued operations. DGLLC must also submit a remediation plan to PHMSA including a schedule for these pipeline segments for a determination of the appropriate processes and procedures to be implemented, including any additional special permit notices and environmental assessments. Any non-***SBD Segments*** found with strains in excess of 0.5% must be reported by DGLLC to the PHMSA Director or Project Designee within five (5) business days of discovery.

# Figure 1 – DGLLC Pipeline Route



## Figure 2 – DGLLC Strain-Based Design Segments

**MP 173 through MP 189, MP 192 through MP 196, MP 201 through MP 209.5, and MP 213 through MP 215**