U.S. DEPARTMENT OF TRANSPORTATION
PIPELINE AND HAZARDOUS MATERIALS SAFETY ADMINISTRATION
Strain Based Design
Special Permit Analysis and Findings

Special Permit Information:

Docket Number:	PHMSA-2017-0044
Requested By:	Alaska Gasline Development Corporation
Operator ID#:	40015
Original Date Requested:	April 14, 2017
Original Issuance Date:	September 9, 2019
Effective Dates:	September 9, 2029
Code Section(s):	49 CFR 192.103, 192.105, 192.317, and 192.620

Purpose:

The Pipeline and Hazardous Materials Safety Administration (PHMSA)[1] provides information to describe the facts of the subject special permit application submitted by the Alaska Gasline Development Corporation (AGDC), owner and operator of the Alaska LNG Pipeline,[2] to discuss any relevant public comments received with respect to the application for a special permit, to present the engineering/safety analysis, and to make findings regarding whether the requested special permit should be granted and if so under what conditions. AGDC requested a special permit for the Alaska LNG Pipeline to waive compliance from 49 Code of Federal Regulations (CFR) 192.103, 192.105, 192.317, and 192.620 to allow strain-based design (SBD) in seven (7) Class 1 location segments in Alaska.

[1] Throughout this special permit the usage of "PHMSA" or "PHMSA OPS" means the U.S. Department of Transportation's Pipeline and Hazardous Materials Safety Administration Office of Pipeline Safety.

[2] Alaska LNG Pipeline refers to the approximately 807 miles of 42-inch natural gas transmission pipeline. The special permit owner, operator, and applicant/permittee name is Alaska Gasline Development Corporation. Please note that this pipeline does not transport liquefied natural gas (LNG). It will supply natural gas to a LNG facility for further transportation as LNG.

Pipeline System Affected:

The Alaska LNG Pipeline will be approximately 807 miles of 42-inch-diameter steel pipe for transporting natural gas from AGDC's gas treatment plant (GTP) on Alaska's North Slope to the liquefaction facility on the eastern shore of the Cook Inlet near Nikiski, Alaska. The pipeline will be mostly onshore, with a segment of offshore pipeline crossing the Cook Inlet (Figure 1 – Alaska LNG Pipeline Route). The onshore portion of the pipeline will be a buried pipeline except for short, above-ground special design segments, such as aerial water crossings and aboveground fault crossings. The Alaska LNG Pipeline's design has a maximum allowable operating pressure (MAOP) of 2,075 pounds per square inch gauge (psig).

A special permit was granted to AGDC to waive the requirements of 49 CFR 192.103 in regions of discontinuous permafrost. Time-dependent ground movement exists in this region, which will require the pipe to be built with heavy wall pipe with sufficient thickness to withstand the external forces of ground freezing and thawing, otherwise known as frost heave and thaw settlement, respectively.

This special permit allows usage of SBD in pipeline segments, which will be buried in permafrost or potentially permafrost soils, shown in the following Table 1 (the "Summary of SBD Segments").

Table 1: Summary of SBD Segments

SBD Segment	Start Milepost	End Milepost	Strain Demand Mitigation
1	194	196	Frost Heave
2	227	230	Frost Heave
3	257	262	Potential Frost Heave
4	270	276	Potential Frost Heave
5	429	440	Potential Thaw Settlement
6	541	544	Frost Heave
7	559	563	Frost Heave

Special Permit Request:

AGDC requested using SBD for seven (7) discrete segments along the pipeline with the potential for frost-unstable soils or ground movement where longitudinal pipe strains may be greater than 0.5

percent. SBD employs advanced metallurgy, engineering, construction, and maintenance to allow the pipe to deform in the longitudinal direction and better maintain its integrity and safety.

PHMSA is the regulating agency for 49 CFR Part 192, which includes the applicable code sections and specific regulatory requirements for the design, construction, operation, and maintenance of natural gas pipelines to maintain safety. PHMSA determined that 49 CFR 192.103, 192.105, 192.111, 192.317, and 192.620 require that pipe "must 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." The current MAOP allowed in 49 CFR Part 192 is based on hoop strength and internal pressure, but has no provisions for the material, design, operations and maintenance, or integrity management aspects of SBD. Other standards for natural gas pipelines referenced in 49 CFR 192.7, such as those developed by the American Petroleum Institute (API) and American Society of Mechanical Engineers (ASME)/American National Standards Institute (ANSI), do not contain specific provisions for the usage of SBD for pipeline manufacturing, design, construction, operations, or maintenance.

Based on soil mapping and geotechnical borings conducted by AGDC, the presence of permafrost along the planned pipeline route is limited to ***special permit segments*** noted in Table 1. Additional, isolated pockets of permafrost may occur on other segments of the pipeline and would typically be addressed via alternative engineering and construction techniques, including horizontal directional drilling, heavier-wall pipe, or the excavation of frozen material below the pipe. These techniques, which will comply with 49 CFR Part 192, are designed to mitigate the potential for high longitudinal pipe strains due to thaw settlement.

During the construction phase, AGDC must complete comprehensive construction and weld procedure qualifications and non-destructive testing of all welds and an extensive Quality Assurance and Quality Control program for pipe installation, with emphasis on girth welds, 100 percent nondestructive examination (NDE) of all girth welds, and records of all field welding.

During the operational phase, AGDC will implement comprehensive monitoring to identify potential high strain conditions and implement appropriate corrective actions, as required, to ensure the safe operation of the pipeline.

AGDC is required to implement a set of special permit conditions in order to operate the 42-inch diameter pipeline with SBD. An overview of the special permit condition topics is in the Operational Integrity Compliance section of this document. The special permit conditions allow strains greater than 0.5 percent up through 2 percent levels in ***special permit segments*** and have conditions for the materials, construction, operational monitoring, and operational remediation when strains exceed 0.5 percent.

Special Permit Segment:

State of Alaska

The Alaska LNG Pipeline ***special permit segmen***t is defined as: approximately 807 miles of 42-inch diameter pipeline originating in the North Slope Borough, traversing the Yukon-Koyukuk Census Area, the Fairbanks North Star Borough, the Denali Borough, the Matanuska-Susitna Borough, and the Kenai Peninsula Borough. The ***special permit segment*** terminates at the liquefaction facility on the shore of the Cook Inlet near Nikiski, Alaska.

The special permit allows SBD in the seven (7) segments with the implementation of the special permit conditions.

Public Notice:

On May 28, 2019, PHMSA published a special permit request in the Federal Register (84 FR 24594) for public comment. The public comment period ended on July 29, 2019, with PHMSA reviewing and considering all comments received through July 29, 2019. The special permit application from AGDC, pipeline route maps, public comments, final environmental assessment and finding of no significant impact, and special permit conditions are available in Docket No. PHMSA-2017-0044 at: www.regulations.gov.

PHMSA Overall Response and Considerations of Public Safety Concerns:

PHMSA published a Notice of Availability in the Federal Register on May 28, 2019, for four (4) special permit requests for the line pipe of the Alaska LNG Pipeline (84 FR 24594, Docket Nos.: PHMSA-2017-0046, Usage of 3LPE Coating; PHMSA-2017-0044, Usage of Strain Based Design; PHMSA-2017-0045, Alternative Mainline Block Valve Spacing; and PHMSA-2017-0047, Usage of Crack Arrestor Spacing at www.Regulations.gov). PHMSA requested comment on the special

permit applications, the draft permit conditions, and the draft environmental analyses. The public notice comment period ended on July 29, 2019, with PHMSA reviewing and considering all comments received through July 29, 2019. PHMSA received one public comment concerning usage of fossil fuels, the building of the Alaska LNG Pipeline, and the building of a liquified natural gas (LNG) facility. PHMSA does not have siting authority over pipeline facilities. The public comment received did not submit concerns relative to the special permit, the environmental assessment, or the special permit conditions, which are the issues within PHMSA's decision making authority and the intent of the public notice.

Operational Integrity Compliance:

PHMSA has reviewed this special permit request to ensure that integrity threats to the pipeline in the ***special permit segments*** are addressed in the operator's operations and maintenance plan (O&M procedures and specifications) and is requiring AGDC to implement a set of conditions to operate the Alaska LNG Pipeline ***special permit segments*** with strains greater than 0.5 percent but less than 2 percent.

The full conditions can be reviewed in their entirety in the special permit, which can be reviewed on Docket PHMSA-2017-0044 at www.regulations.gov. The special permit conditions are summarized by topics in the below list.

1) Maximum Allowable Operating Pressure
2) Applicable Regulations
3) Strain-Based Design Plan (SBD Plan)
4) Material Specifications
5) Material Testing
6) Design Procedures
7) Engineering Critical Assessment
8) Girth Welding Procedures
9) Construction Quality
10) Girth Weld Testing During Production Welding
11) Girth Weld Identification
12) Deformation Tool
13) Grounding and Cathodic Protection

14) Right-of-Way (ROW) Construction Monitoring Program
15) Conditions for Start of Service
16) O&M procedures
17) Monitoring and Determination of Pipeline Strain Demand
18) Coating Disbondment and Cathodic Protection Current
19) Interference Currents Control
20) Data Integration
21) Treatment of SBD Segments as Covered Segments under 49 CFR 192, subpart O
22) Analysis of ILI Tool Data and Discovery of Actionable Anomalies
23) Remediation
24) Reporting
25) Extension of Special Permit Segments
26) Certification
27) Nomenclature
28) Changes to Special Permit Conditions
29) Limitations

Past Enforcement History:

AGDC has no gas transmission pipeline operating history or enforcement history with PHMSA.

Findings:

Based on the information submitted by AGDC and PHMSA's analysis of technical, operational, and safety issues, and given the conditions that are imposed in the special permit, PHMSA finds that granting this special permit to AGDC to operate the Alaska LNG Pipeline ***special permit segments*** using SBD with the special permit conditions will not be inconsistent with pipeline safety.

Completed in Washington DC on: September 9, 2019

Prepared By: PHMSA – Engineering and Research Division

Figure 1: Alaska LNG Pipeline Route