

U.S. DEPARTMENT OF TRANSPORTATION
PIPELINE AND HAZARDOUS MATERIALS SAFETY ADMINISTRATION
SPECIAL PERMIT - Usage of Pressure Gradient

Special Permit Information:

Docket Number: PHMSA-2018-0105
Requested By: Gulfstream Management & Operating Services, LLC
Operator ID#: 31565
Date Requested: October 26, 2018
Issuance Date: May 19, 2020
Effective Dates: May 19, 2020 to May 19, 2030
Code Section(s): 49 CFR 192.195(a) and 192.619(a)

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),¹ grants this special permit to Gulfstream Management & Operating Services, LLC (Gulfstream)². This special permit waives compliance with 49 Code of Federal Regulations (CFR) 192.195(a) for overpressure protection (OPP) and 49 CFR 192.619(a) to allow utilization of a pressure gradient for pressure control on the Gulfstream ML 200 Pipeline (Gulfstream Pipeline), as described below.

The Federal pipeline safety regulation in 49 CFR 192.195(a) requires OPP through pressure control, pressure relieving, or a pressure limiting device where the maximum allowable operating pressure (MAOP) location changes, which for the Gulfstream Pipeline occurs at Mile Post (MP) 58.7 located

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 Gulfstream Natural Gas System, LLC is an interstate natural gas transmission pipeline system jointly owned by Williams and Enbridge and operated by Gulfstream Management & Operating Services, LLC (Gulfstream). The Gulfstream Pipeline is a portion of the Gulfstream Natural Gas System as defined in the Purpose and Need section of this special permit.

offshore in the Gulf of Mexico. Section 192.619(a) requires a natural gas transmission pipeline MAOP to be based upon the lowest or the weakest pipeline component or test pressure.

I. Purpose and Need:

On the condition that Gulfstream complies with the terms and conditions set forth below, this special permit waives compliance from 49 CFR 192.195(a) for OPP and 49 CFR 192.619(a) to allow utilization of a pressure gradient for pressure control upstream of a subsea mainline valve located at MP 58.7 on the Gulfstream Pipeline. The Gulfstream Pipeline is a 36-inch interstate natural gas pipeline, 427.8 miles in length, routed from near Coden, Mobile County, Alabama, across the Gulf of Mexico, to near Palmetto, Manatee County, Florida. The Gulfstream Pipeline also includes Compressor Station 410³ in Coden, Alabama and Compressor Station 420⁴ in Palmetto, Florida and all mainline valves, metering, flow control, and other components along the 427.8-mile ML 200 Pipeline.

Gulfstream's principal purpose is to increase the amount of natural gas supplied to Florida. The Gulfstream Project flow volume uprate consists of installing a new turbine compressor unit at Gulfstream Pipeline's Compressor Station 410, adding pressure safety controls, and replacing 3.9 miles of 36-inch diameter onshore pipeline with associated controls and appurtenances in Mobile County, Alabama, as required to meet a MAOP of 2,296 pounds per square inch gauge (psig). This additional piping and equipment, when operational, will increase flow by approximately 78,000 dekatherms per day⁵ through the existing 36-inch diameter pipeline, an approximate 6.5% volume increase through the Gulfstream Pipeline.

This special permit allows Gulfstream to increase the operating pressure of the Gulfstream Pipeline from the current 2,180 psig MAOP to a new MAOP of 2,296 psig from MP 0.0 to MP 58.7 (approximately 58.7 miles). This special permit allows Gulfstream to not install overpressure

³ Gulfstream Pipeline's Compressor Station 410 is an existing natural gas compressor station located in Mobile County near Coden, Alabama.

⁴ Gulfstream Pipeline's Compressor Station 420 is an existing natural gas compressor station located in Manatee County near Palmetto, Florida.

⁵ 78,000 dekatherms per day is equivalent to 76.4 million standard cubic feet per day with a Heating Value ~1,020 British Thermal Units per standard cubic feet (Btu/ft³).

control at MP 58.7. Gulfstream Pipeline MP 3.9 is located near the shoreline in Mobile County, Alabama and MP 58.7 is offshore in the Gulf of Mexico, Viosca Knoll, Block 82.

II. Special Permit Segment and Inspection Area:

Mobile County, Alabama through the Gulf of Mexico-Outer Continental Shelf to Manatee County, Florida

This special permit applies to the *special permit segment* defined as follows using the Gulfstream Pipeline survey station (SS) references:

- ***Special permit segment*** — Onshore SS 205+47 (MP 3.9) to Offshore SS 2892+77 (MP 58.7).
 - The Gulfstream Pipeline *special permit segment* begins in Mobile County, Alabama approximately 200 feet from the shoreline at approximate MP 3.9 (Onshore SS 205+47), enters the Gulf of Mexico in Alabama State waters and continues into Federal waters of the Gulf of Mexico to approximate MP 58.7 (Offshore SS 2892+77) immediately upstream of the West Subsea Tie In (WSSTI) (MP 58.7 or MP 58.7 WSSTI).⁶ The general location of the *special permit segment* is depicted in Attachment A - Gulfstream Pipeline – Special Permit Segment Overview Map.
- ***Special permit inspection area*** is defined to mean the area that extends 220 yards on each side of the centerline along approximately 427.8 miles of the 36-inch diameter Gulfstream ML 200 Pipeline from MP 0.0 to MP 427.8. The overall *special permit inspection area* includes the following:
 - ***Special permit inspection area A*** is from MP 0.0 through MP 3.9 Mainline Valve 200-1 (MLV 200-1);
 - ***Special permit segment*** is from MP 3.9 to MP 58.7 WSSTI; and
 - ***Special permit inspection area B*** is from the upstream side of MP 58.7 WSSTI to MP 427.8. MP 58.7 WSSTI mainline valves include 36-inch diameter MLV-200-2A, MLV-200-2B, and MLV-200-2C.

Attachment B - Gulfstream Pipeline – Overview Map shows the 36-inch diameter Gulfstream Pipeline from Mobile County, Alabama through the Gulf of Mexico and to Manatee County, Florida.

⁶ Gulfstream Pipeline MP 58.7 is where the 36-inch “West Subsea Tie In” mainline valves – MLV-200-2A, MLV-200-2B, and MLV-200-2C are located. Note, the Gulfstream special permit application of October 26, 2018, indicated the subsea mainline valves were located at MP 59, but the Gulfstream pipeline drawings show their location at MP 58.7 located offshore Alabama in Viosca Knoll, Block 82.

PHMSA grants this special permit based on the findings set forth in the “*Special Permit Analysis and Findings*” and “*Final Environmental Assessment and Finding of No Significant Impact*” documents, which can be read in their entirety in Docket No. PHMSA- 2018-0105 in the Federal Docket Management System located on the internet at www.Regulations.gov.

III. Conditions:

PHMSA grants this special permit to Gulfstream subject to Gulfstream implementing the following conditions on the Gulfstream Pipeline as detailed below:⁷

1. **Operating Procedures and Documentation:** All procedures, records, and documentation used for implementing these special permit conditions must be included in the Gulfstream Pipeline Operations and Maintenance (O&M) Procedures to meet 49 CFR 192.605 and 49 CFR 192.603(a) for the life of the special permit.
2. **Maximum Allowable Operating Pressure:**
 - a) The pipe, fittings, flanges, fabrications, and other components upstream of and including Mainline Valve 200-1 (MLV 200-1) in the *special permit inspection area A* must be designed, constructed, pressure tested, and operated at a MAOP of 2,296 psig to meet 49 CFR Part 192.
 - b) The *special permit segment* must be operated at or below an MAOP of 2,296 psig, using a pressure gradient to 2,180 psig or below at MP 58.7.
 - c) The *special permit inspection area B* must be operated at or below its MAOP of 2,180 psig. The subsea mainline valves at MP 58.7 are ANSI 900 rated valves (2,180 psig) and are the pressure rating change-over location for the MAOP.⁸

Note: For **Conditions 2(a), (b) and (c)** above, Attachment C - Gulfstream Pipeline – Special Permit – Operating Conditions and Attachment D - Gulfstream Pipeline – Special Permit – Operating Scenario show the MAOPs for different pipeline segments and operating pressures along the Gulfstream Pipeline.

⁷ All special permit conditions that are applicable to the *special permit inspection area* are applicable to the *special permit segment*, *special permit inspection area A*, and *special permit inspection area B*. Special permit conditions that are applicable to the individual *special permit segment*, *special permit inspection area A*, and *special permit inspection area B* are not applicable to the *special permit inspection area*.

⁸ The minimum hydrostatic test pressure for the *special permit segment* and *special permit inspection area* was 2,879 psig.

3. **Integrity Management Program:**

- a) The *special permit inspection area* must be included in the Gulfstream Pipeline written integrity management program as a “covered segment” in a high consequence area in accordance with 49 CFR 192.903, except for the reporting requirements contained in 49 CFR 192.945.
- b) Gulfstream must require in its O&M Procedures the usage of inline inspection (ILI) tools within the *special permit inspection area* for pipeline inspection and reassessments to meet 49 CFR 192.917 for threats and 49 CFR 192.939 for reassessment intervals. Gulfstream must use high resolution ILI tools that are capable of detecting features for the identified threats.

4. **Flow Model Validation:**

- a) Gulfstream must complete the “Active” flow model validation and both the “Active” and “Operational” flow models must be installed and operating prior to uprating the MAOP of the Gulfstream Pipeline. Attachment E - Gulfstream Pipeline Hydraulic Flow Modeling and Operator Training describes the “Active” and “Operational” models used for the pipeline system operation.
- b) Gulfstream must revalidate the “Active” model within six (6) months of the initial validation and then revalidate the model on an annual basis, not to exceed 15 months, based upon real-time pressure and flow readings upstream and downstream of the Gulfstream Pipeline Station 410 (located in Alabama) and upstream of Compressor Station 420 (located in Florida). If the “Active” model results are over +/- 1% of actual operating pressures, Gulfstream must decrease the operating pressure to 2,180 psig or below at MP 0. Before Gulfstream increases the operating pressures, the “Active” model must be retuned and revalidated to show that the MAOP of 2,180 psig is not exceeded at MP 58.7. Gulfstream must maintain documentation of the “Active” model validation for the life of the special permit.
- c) Gulfstream must report to the Director, PHMSA Southern Region, the events with a monthly maximum operating pressure over the 2,180 psig MAOP (based upon the “Active” model calculations) at MP 58.7 or misalignment of the pressures (model versus actual pressures at

MP 0.0 and MP 427.8) at MP 0.0, MP 58.7, or MP 427.8 for varying flow rates where the maximum operating pressure at MP 58.7 can be exceeded. Gulfstream may be required to retune and revalidate the “Active” model, if requested by the Director, PHMSA Southern Region.⁹

5. **Operator Training**: Gulfstream must complete operator training for this special permit prior to uprating the Gulfstream Pipeline. Operator training must include training on normal operating conditions and upset conditions. All training must be in accordance with 49 CFR 192.631(h).
6. **Pipeline Pressure Control**:
 - a) Gulfstream must install an active logic algorithm system for pressure control and a station control panel to monitor pressures at Compressor Station 410 and Compressor Station 420 with real time modeling to ensure the pressure remains at or below 2,180 psig at MP 58.7 WSSSTI. Compressor Station 410 must be pressure controlled and monitored to not exceed the uprated 2,296 psig MAOP in *special permit inspection area A* and the *special permit segment*. Attachment E - Gulfstream Pipeline Hydraulic Flow Modeling and Operator Training describes the requirements that must be followed for the active logic algorithm.
 - b) The “Active” model must utilize real-time Gulfstream Pipeline pressures, temperatures, flow rates, and gas composition to provide a detailed picture of current operations. The “Active” model must continuously compute a pressure for MP 58.7 by reading real-time flow rates and pressures at Compressor Station 410 and Compressor Station 420.
 - c) If the “Active” model is not online, the discharge pressure at Compressor Station 410 must be maintained at or below 2,180 psig. Gulfstream must maintain documentation of this changed condition.
 - d) The Gulfstream Pipeline must have an operational supervisory control and data acquisition (SCADA) system, 24-hours per day and 7-days per week, for the *special permit inspection area* to be operated over a 2,180 psig MAOP. The SCADA system must be operated in accordance with 49 CFR 192.631 and must receive pressure data from Compressor Station 410, Compressor Station 420, incoming gas receipt pipelines, and outgoing gas delivery pipelines. If the Gulfstream Pipeline SCADA system becomes non-operational, Gulfstream must notify the Director, PHMSA Southern Region within 48 hours of the event or the next

⁹ Upon notice by the Director, PHMSA Southern Region to Gulfstream, PHMSA may have the Gulfstream Pipeline assigned to another PHMSA Region.

working day, and must provide 24-hour per day operational coverage or communications with Compressor Station 410, Compressor Station 420, gas receipt points, and gas delivery points for pipeline operating pressures.

- e) The Gas Control Center for the Gulfstream Pipeline must control pressures entering and leaving the *special permit inspection area*, so that the 2,180 psig MAOP at MP 58.7 and throughout the *special permit inspection area B* will not be exceeded.
- f) In the event that the pressure reduction requirements in **Condition 6** need to be modified for up to a seven (7) day interval due to the model or the SCADA system is out of service, Gulfstream must send a notice letter to the Director, PHMSA Southern Region, stating the proposed modification, and must receive a letter of “no objection” from the Director, PHMSA Southern Region prior to the pressure reduction requirements being implemented by Gulfstream.

7. **Overpressure Protection:**

- a) A minimum of two (2) OPP devices must be installed at Compressor Station 410 for any compressor or pipeline flowing gas into the Gulfstream Pipeline.
- b) The Station or Pipeline Control Panel set points for compressors or pipelines flowing gas into the Gulfstream Pipeline must be 2,321 psig or less to activate the emergency shutdown device (ESD), and a hard-wired ESD switch must be set at 2,341 psig or less.¹⁰ These ESDs must ensure the Gulfstream Pipeline overpressure events remain below the allowable overpressure limit of 2,267 psig at MP 58.7.¹¹
- c) Gulfstream must conduct annual flow model validation that ensures the OPP set point at Compressor Station 410 maintains an OPP limit of 2,267 psig or less at MP 58.7. Gulfstream must maintain documentation of the validation for the life of the special permit.
- d) Within six (6) months after installation of the Gulfstream Project to expand flow volumes, Gulfstream must conduct 30 days of pressure monitoring at MP 58.7 WSSTI to confirm the “Active” flow model for modeling pressure gradients on the Gulfstream Pipeline. If less than 30 days of pressure monitoring is conducted at MP 58.7 WSSTI, Gulfstream must obtain a

¹⁰ OPP set points at Compressor Station 410 or pipelines flowing gas into the Gulfstream Pipeline must be 2,341 psig or less (2,296 psig times 1.02). Gulfstream must have flow models on the Gulfstream Pipeline to show that a 2,341 psig OPP at Compressor Station 410 will not overpressure MP 58.7 mainline valves beyond 2,267 psig.

¹¹ The OPP set point at MP 58.7 must not exceed 2,180 psig times 1.04 (MAOP times 1.04), which is 2,267 psig.

letter of “no objection” from the Director, PHMSA Southern Region. Gulfstream must document and submit the results to the Director, PHMSA Southern Region, within 60 days of completion of the pressure monitoring.

- e) Gulfstream must record the maximum operating pressures at MP 0.0 (Compressor Station 410 discharge side) and MP 427.8 (Compressor Station 420 suction side) for each month during the year. The “Active” model pressure must be used to calculate the maximum pressures at MP 58.7, and either at MP 0.0 (Compressor Station 410 discharge side) or MP 427.8 (Compressor Station 420 suction side) based upon the actual maximum operating pressures at the other Compressor Station.

Note: A monthly maximum operating pressure above the 2,180 psig MAOP (based upon the “Active” model calculations) experienced at the Gulfstream Pipeline MP 58.7 is an event that Gulfstream must report to the Director, PHMSA Southern Region and may require Gulfstream to retune and revalidate the “Active” model, if requested by the Director, PHMSA Southern Region, see **Condition 4(b)**.

- f) In the future, if Gulfstream expands the Gulfstream Pipeline facilities beyond what has been certificated by the Federal Energy Regulatory Commission in the Gulfstream Project (Purpose and Need section page 3), Gulfstream must contact the Director, PHMSA Southern Region, to determine if pressure monitoring at MP 58.7 WSSTI is required to revalidate the model described in Attachment E - Gulfstream Hydraulic Flow Modeling and Operator Training.

8. **Pipeline Operational Controls**: During any possible upset operational conditions, Gulfstream must install pipeline operational controls to temporarily reduce the 2,296 psig Compressor Station 410 discharge pressure to 2,180 psig, by shutting down the Unit 5 Booster Compressor. Any possible upset operational conditions are defined as follows:

- a) In-line inspection or other pigging of the Gulfstream Pipeline;
- b) Compressor Station 410, Compressor Station 420, or any portion of the Gulfstream Pipeline that lies between or falls within the 3-day “cone of uncertainty” for a track projection of a named tropical storm or hurricane identified by the National Hurricane Center. The “cone of uncertainty” represents the range of possibilities for the storm's center and extends up to five days into the future;

- c) Disruption of flow into or out of Compressor Station 420 with any inadvertent or intentional mainline valve closure¹² that may cause upstream pressure increases; or
- d) Extended low flow demand of 337 million cubic feet per day or less in Florida, lasting for 72-hours or more, caused by seasonal or abnormal conditions.

Should any of the pressure reduction requirements in **Condition 8** need to be modified for up to a seven (7) day interval, Gulfstream must send a notice letter stating the proposed modification to the Director, PHMSA Southern Region, and must receive a letter of “no objection” from the Director, PHMSA Southern Region, prior to Gulfstream implementing the modification.

- 9. **Pipeline Patrols and Surveys**: Gulfstream must perform aerial patrols from the Gulfstream Pipeline MP 0 to MP 58.7 in Alabama and from MP 406 (Egmont Key - Offshore SS 21438 +16) to MP 427.8 in Florida on a quarterly basis, not to exceed 75 days, in accordance with 49 CFR 192.705.
- 10. **Annual Offshore Leakage Survey**: Gulfstream must perform an offshore leakage survey by aircraft from Gulfstream Pipeline MP 3.9 to MP 427.8 on an annual basis, not to exceed 15 months, in accordance with 49 CFR 192.706.
- 11. **Shallow Water Surveys**: Gulfstream must develop procedures for performing shallow water depth of cover surveys and remediation based upon survey findings for the Gulfstream Pipeline. The procedures must require shallow water depth of cover surveys a minimum of every five (5) years, not to exceed 66 months, in accordance with 49 CFR 192.612.
- 12. **Annual Report to PHMSA**: Annually,¹³ after the grant of this special permit, Gulfstream must submit an annual pipeline integrity report¹⁴ to the Director, PHMSA Southern Region, with a copy to the Director, PHMSA Engineering and Research, summarizing any significant integrity threats or pressure modeling issues and the following:

¹² Examples of inadvertent or intentional mainline valve closures that would disrupt flow and cause mainline pressures to increase would be the closure of the 36-inch mainline valves, where the Gulfstream Pipeline reaches the Florida coast and would include the 36-inch diameter mainline valve MLV-200-10 located near the Florida Sunshine Skyway Bridge, the 36-inch diameter mainline valve MLV-200-11 located where the pipeline comes onshore in Florida, and 36-inch diameter mainline valve GF-200-S1 located at the inlet of Compressor Station 420 near the incoming pig receiver.

¹³ Annual reports must be received by PHMSA by the last day of the month in which the special permit is dated. For example, the annual report for a Special Permit dated July 2020, must be received by PHMSA no later than July 31, each year beginning in 2021.

¹⁴ Gulfstream must submit a copy of each Gulfstream Pipeline annual report on the PHMSA docket, PHMSA-2018-0105, at www.Regulations.gov.

- a) Any new integrity threats identified during the previous year in the *special permit inspection area*, and the results of any ILI or direct assessments performed (including any un-remediated anomalies over 30% wall loss, cracking found in the pipe body, weld seam or girth welds, and dents with metal loss, cracking or stress riser) during the previous year in the *special permit inspection area*. Gulfstream must include the respective survey station and MP, failure pressure ratio, anomaly depth and length, and class location;
- b) The maximum operating pressure reached at MP 0.0 (Compressor Station 410 discharge side) and MP 427.8 (Compressor Station 420 suction side) for each month during the year with the corresponding “Active” flow model pressure at MP 58.7 based upon these maximum operating pressures at MP 0.0 and MP 427.8;
- c) Any reportable incident, any leak normally indicated on the DOT Annual Report, and all repairs on the pipeline that occurred during the previous year in the *special permit inspection area*;
- d) Any on-going damage prevention initiatives affecting the *special permit inspection area* and a discussion of the success of the initiatives including findings and any remediation actions; and
- e) Any mergers, acquisitions, transfer of assets, or other events affecting the regulatory responsibility of the company operating the pipeline.

13. **Certification:** A Gulfstream senior executive officer, vice president or higher, must certify in writing the following:

- a) The *special permit inspection area* meets the conditions described in this special permit.
- b) The written manual of O&M Procedures required by 49 CFR 192.605 for the Gulfstream Pipeline has been updated to include all requirements of this special permit; and
- c) Gulfstream has implemented all conditions required by this special permit, prior to uprating the *special permit inspection area*, for the Gulfstream Pipeline and any future special permit condition requirements are included in the Gulfstream Pipeline O&M Procedures for future work.

Within 60 days after installation of the Gulfstream Project, Gulfstream must send the certifications required in **Condition 13(a) through (c)** with special permit condition status and procedure completion date, compliance documentation summary, and the required senior executive signature and date of the signature to the PHMSA Associate Administrator for Pipeline Safety with copies to

the Director, PHMSA Southern Region; and to the Federal Register Docket (PHMSA-2018-0105) at www.Regulations.gov.

IV. Limitations:

This special permit is subject to the limitations set forth in 49 CFR 190.341 as well as the following limitations:

- 1) PHMSA has the sole authority to make all determinations on whether Gulfstream has complied with the specified conditions of this special permit. Failure to comply with any condition of this special permit may result in revocation of the permit.
- 2) Any work plans and associated schedules for the *special permit inspection area* are automatically incorporated into this special permit and are enforceable in the same manner.
- 3) Failure by Gulfstream to submit the certifications required by **Condition 13 (Certification)** within the time frames specified may result in revocation of this special permit.
- 4) As provided in 49 CFR 190.341, PHMSA may issue an enforcement action for failure to comply with this special permit. 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.
- 5) If Gulfstream sells, merges, transfers, or otherwise disposes all or part of the assets known as the Gulfstream Pipeline *special permit segment*, Gulfstream must provide PHMSA with written notice of the change 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 underlying the permit.
- 6) PHMSA grants this special permit to limit it to a term of no more than ten (10) years from the date of issuance. If Gulfstream elects to seek renewal of this special permit, Gulfstream must submit its renewal request at least 180 days prior to expiration of the ten (10) year period to the PHMSA Associate Administrator for Pipeline Safety with copies to the Director, PHMSA Southern Region; and to the Director, PHMSA Engineering and Research. All requests for a renewal must include a summary report in accordance with the requirements in **Condition 12 (Annual Report to PHMSA)** above and must demonstrate that the special permit is still

consistent with pipeline safety. PHMSA may seek additional information from Gulfstream prior to granting any request for special permit renewal.

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

Issued in Washington, DC on May 19, 2020

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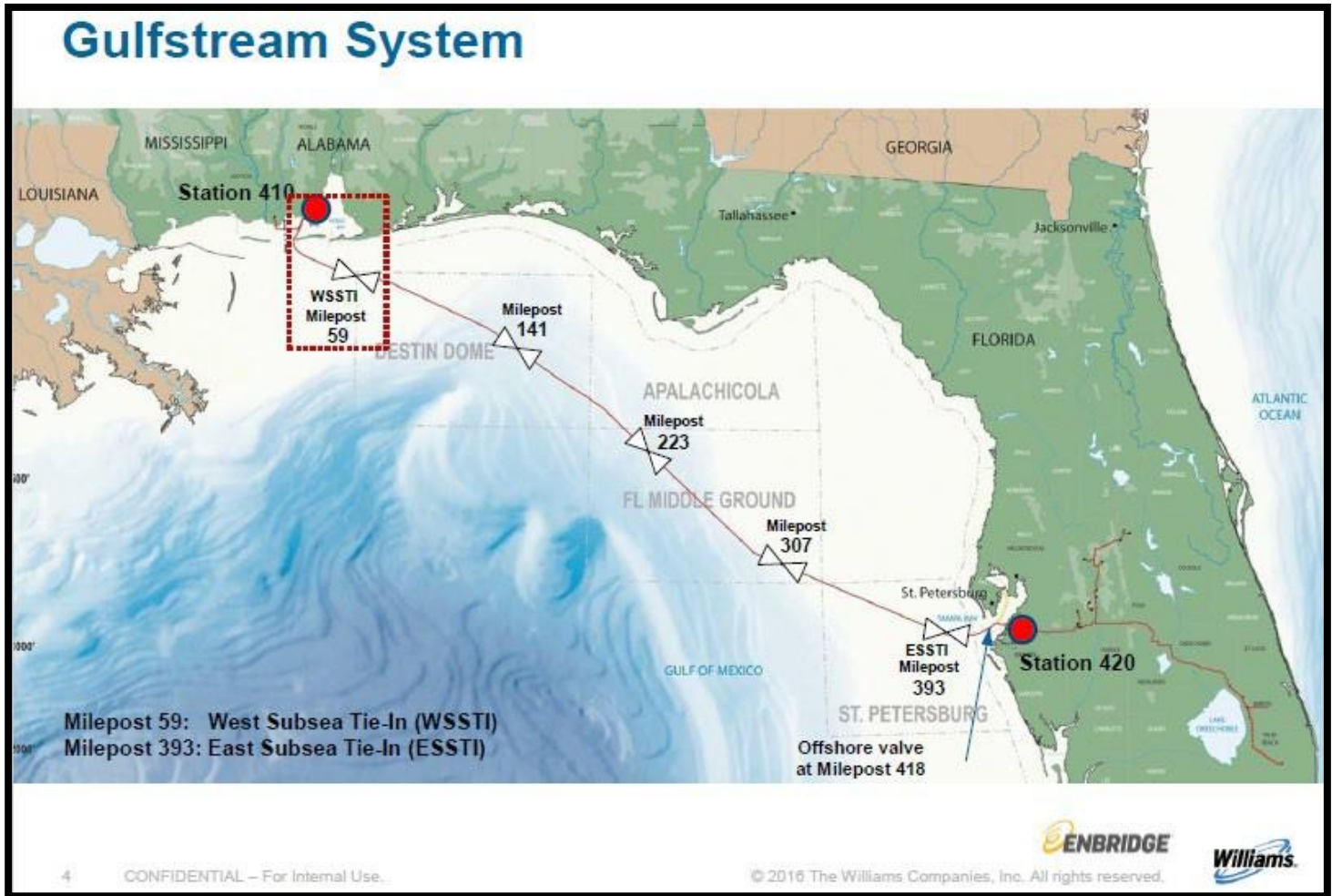
Associate Administrator for Pipeline Safety

Attachment A – Gulfstream Pipeline Special Permit Segment Overview Map



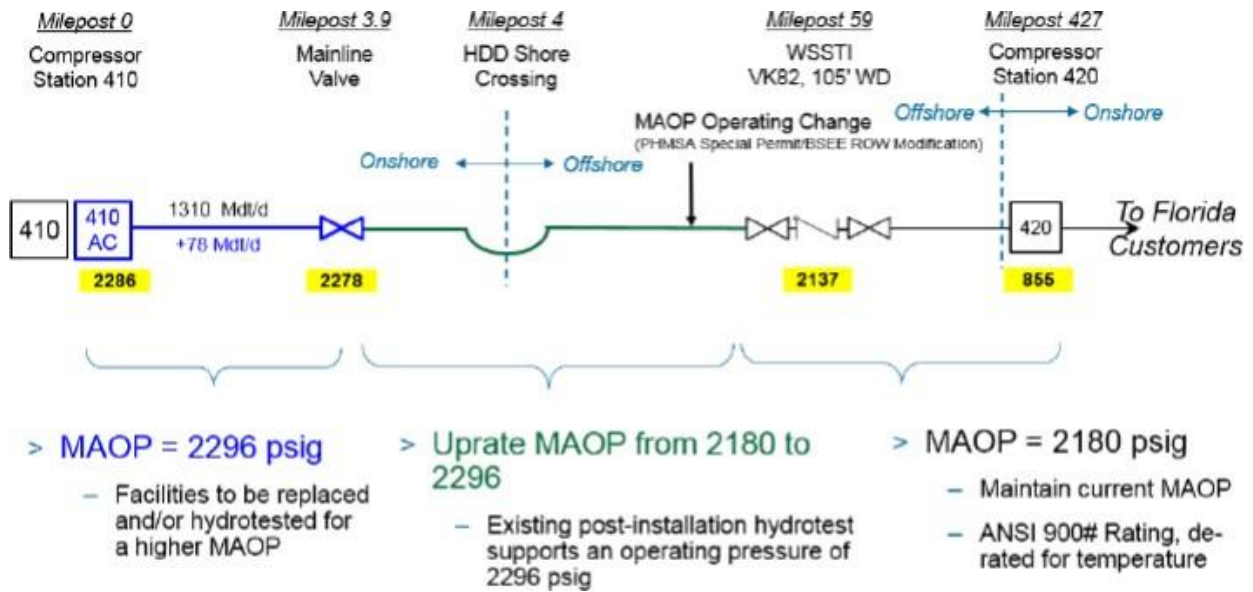
Note: MP 59 on the above map is rounded for MP 58.7. MP 58.7 is in the Gulf of Mexico, Viosca Knoll, Block 82.

Attachment B – Gulfstream Pipeline - Overview Map



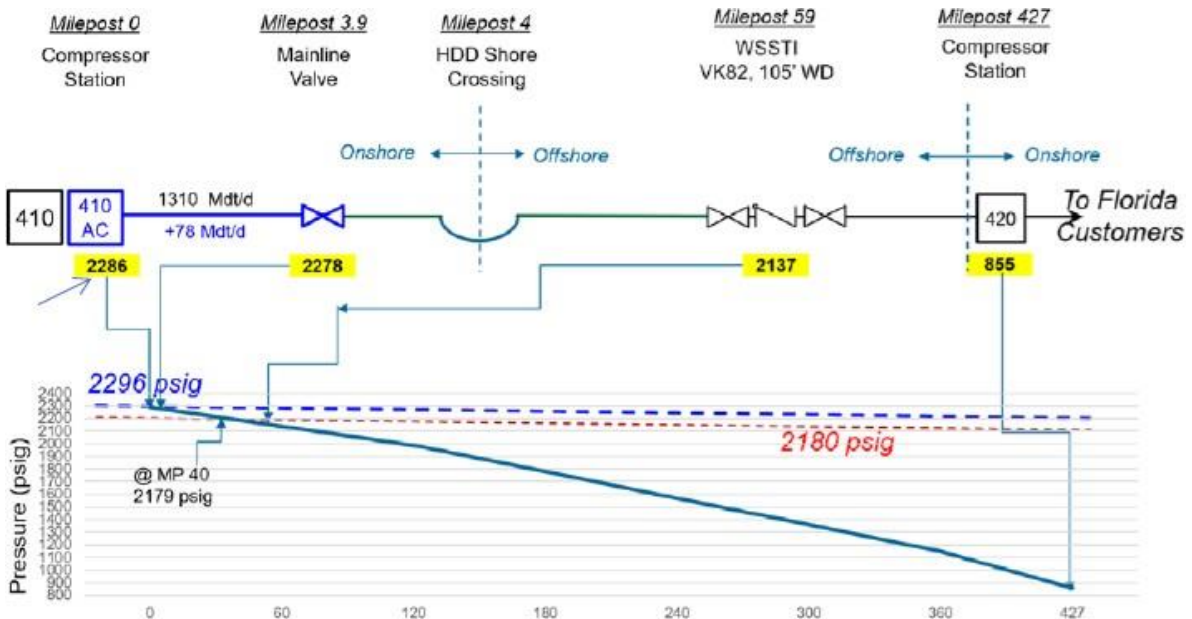
Note: MP 59 on the above map is rounded for MP 58.7. MP 58.7 is in the Gulf of Mexico, Viosca Knoll, Block 82. Compressor Station 420 is at MP 427.8.

Attachment C - Gulfstream Pipeline – Special Permit – Operating Conditions



Note: MP 59 on the above map is rounded for MP 58.7. MP 58.7 is in the Gulf of Mexico, Viosca Knoll, Block 82. Compressor Station 420 is at MP 427.8.

Attachment D - Gulfstream Pipeline – Special Permit – Operating Scenario



Note: MP 59 on the above map is rounded for MP 58.7. MP 58.7 is in the Gulf of Mexico, Viosca Knoll, Block 82. Compressor Station 420 is at MP 427.8.

Attachment E - Gulfstream Hydraulic Flow Modeling and Operator Training

E.1 Gulfstream Transient Model

The “Transient” model is a proven hydraulic model (model) used for planning system operating pressures. It will be used to set-up the “Active” model to calculate the pressure at MP 58.7 where the downstream specification break occurs from 2,296 psig to 2,180 psig MAOP. Based on these model calculations, using the most conservative expected operating conditions, the MAOP at MP 58.7 must not exceed 2,180 psig during operating flow conditions. The Gulfstream Pipeline controlling pressure set points established at Compressor Station 410 discharge side must provide pressure protection of the 2,296 psig MAOP for the *special permit segment* and must prevent any pressure excursion above 2,180 psig at or downstream of MP 58.7 (*special permit inspection area B*).

The “Transient” model is an industry-leading software used for single phase transient modeling. It offers the user the ability to match real world hydraulics by utilizing pipeline characteristics along with written code to mimic virtually any single-phase fluid system. Williams¹⁵ has successfully modeled every liquid pipeline system that Williams owns and/or operates, including the Gulfstream Pipeline and has tuned these systems to a high degree of accuracy. Although there are multiple software products used for gas pipeline modeling, Williams’ experience with the “Transient” model is that it is capable of modeling gas systems with the same efficacy as liquid systems.

The “Transient” model typically contains more detail than the “Active” model. This is due to the need of the “Transient” model to provide control and ESD set points for the system to prevent over pressuring any segment. Compressor details, ESD valve set points, and control valve logic are all coded to ensure the model behaves the same as reality.

Normal and abnormal operations are simulated, and set points are provided, to estimate system capacity and mitigate conservative surge scenario situations, respectively. Conservative surge scenarios are blockages that occur faster than one second (considered instantaneous in most cases) at locations where ESD valves or control valves exist. For special areas of interest, these blockages can be placed a mile or so downstream of MP 58.7 to simulate a stuck pig that blocks 100% of the flow rate. Conservative scenarios also consider inadvertent compressor station shutdowns.

E.2 Gulfstream Active Model¹⁶

The “Active” model software utilizes the PipelineManager™ program as developed by Energy-Solutions, Inc. under Emerson Automation Solutions. PipelineManager™ is the industry-leading solution for real-time pipeline monitoring for liquids and gas pipelines. It offers multiple leak detection technologies to find anything from leaks to ruptures. The “Active” model utilizes real-time pressure, temperature, flow rates and fluid composition to provide a detailed picture of current operations.

¹⁵ Williams’ gas control center conducts flow and pressure control functions on the Gulfstream Pipeline.

¹⁶ If a modification to the “Active” model is required, Gulfstream must notify the Director, PHMSA Southern Region within five (5) working days of the modification.

An algorithm based on the “Active” model will be running in the Williams Pipeline Control for Gulfstream (Pipeline Control) and communicating with the SCADA system. The algorithm will continuously calculate the pressure at MP 58.7. The SCADA system will send the calculated value of this pressure to the Station Programmable Logic Controller, which can be viewed as a continuously updated reference value. This value will also be used for alarm purposes back to Pipeline Control. Pipeline Control will monitor the pressure calculated by the model algorithm and the SCADA system will trigger an alarm if the calculated pressure at MP 58.7 approaches 2,180 psig, allowing the operator to take appropriate actions to reduce the current set point of the booster compressor accordingly to avoid an overpressure scenario.

The “Active” model has been tuned using two (2) weeks of archived SCADA data for all available metering and field transmitters. The software will run and verify model-calculated pressures with actual pipeline pressures via SCADA and pressure recorder values. The model must be fine-tuned by conducting a statistical analysis of the difference between model calculated pressures and actual pressures.

Combining the use of “Transient” and “Active” models will provide more protection over and above the existing regulatory requirements.

E.3 Operational Model

The System Planning Operations group was tasked with tuning of the “Operational” model for Gulfstream. For this purpose, the model was curtailed to the Gulfstream Pipeline offshore portion between Compressor Station 410 and Compressor Station 420.

First the offshore pipeline “Operational” model was aligned with geographic information system (GIS) data for pipe lengths, pipe diameter, pipe wall thickness, elevations and valve locations and verified for accuracy. Then the Gulfstream Pipeline offshore pipe ambient temperature profiles were set up using the following third-party technical reports and papers:

- Analyses of near bottom temperatures near the Gulfstream Pipeline by Robert H. Weisberg, Professor of Physical Oceanography, University of South Florida and Lianyuan Zheng, Ph.D., Senior Associate in Research.
- PSIG 1212 - Tuning of Subsea Pipeline Models to Optimize Simulation Accuracy.

Next, the hourly average data was gathered from SCADA using the process history database and from measurement using the Flow Cal database for the 2017 calendar year. From SCADA, pressure and temperature data was pulled at the discharge side of Compressor Station 410, and suction side of Compressor Station 420 and at the Bartow Meter Station. Line pack data was gathered for all Pipes in Florida downstream of Compressor Station 420. From measurement, the inlet and outlet gas flows were gathered at all meter stations in Florida downstream of Compressor Station 420 and at the Bartow Meter Station.

The “Operational” model was developed using the Compressor Station 410 delivery pressure and temperature, the delivery flow at Bartow and the netted flow through Compressor Station 420. The model was run for the entire year, but the focus was kept on the summer months when Gulfstream experiences higher flow rates.

After each run the model calculated pressure and temperature at Compressor Station 420 and Bartow meter station were compared with the respective SCADA data using standard deviations. The pipeline roughness and thermal conductivity was adjusted, and the model was run again. This iterative process was repeated until the pipe roughness and heat transfer were adjusted to align the model calculated pressure and temperature with SCADA pressure and temperature accordingly.

The Gulfstream Pipeline roughness was adjusted from 350 to 175 micro inches while the heat transfer coefficient was adjusted from 0.50 to 1.25 Btu/hr-ft²-degree Fahrenheit. By completing this process, the “Operational” model was fine-tuned to improve accuracy.

E.4 Operator Training System:

The Operator Training System (OTS) is a full-scope pipeline trainer which provides a very realistic operator experience using a copy of the same SCADA screens as in the pipeline control room. The OTS can be used for any type of pipeline for simulating hydraulic behavior and the ability to model accurately the control logic associated with field devices and SCADA sequencing.

The OTS contains the following components:

- Virtual Pipeline Model to accurately replicate thermo-hydraulic pipeline transient behavior and to provide field data to the SCADA;
- Virtual Control System to simulate the major control loops, system interlocks, and other logical control behavior;
- Scenario Composer allows the instructor to create normal or abnormal scenarios;
- Scenario Navigator helps instructor in organizing, creating, scoring, and executing training scenarios;
- Qualification Information System is a database for managing the historical records related to operator training; and
- Copy of production SCADA system including same type of screens as operator would use on production SCADA.

Williams’ operators must be trained using the OTS. The OTS allows the training officer to define and impose specific normal or abnormal scenarios on which the pipeline control room operator is to be trained.

Currently, Williams utilizes a full-scope OTS on nine (9) liquid pipelines and one (1) gas pipeline each with four (4) scenarios: 1) Pipeline Startup; 2) Pipeline Shutdown; 3) Inadvertent valve closure/pipeline blockage; and 4) Pipeline leak. The scenarios are programmed to observe the trainee and monitor their actions against standard procedures for that pipeline system. Scoring and pass/fail criteria are predetermined by Pipeline Control Management.

As a part of the controllers’ on-the-job training, Williams Houston Pipeline Control schedules controllers to run through (and pass) each scenario for each pipeline system controllers in their area of responsibility. New controllers are required to run and pass each scenario before the Operator Qualification (OQ) exam. The OTS is also used as an environment for the OQ exam; it provides a way for the evaluator to observe the covered tasks performed by the controller.

Lastly, the OTS has been used to test and train controllers on major changes to operational conditions of a pipeline or SCADA system. These changes range from increased pipeline flow to a new safety critical alarm feature in SCADA.