SOUTHERN STAR
CENTRAL GAS PIPELINE



GAS QUALITY SPECIFICATIONS

Proposed Tariff Changes

June 10, 2021



https://www.cdc.gov/headsup/images/infographics/concussion_infographic_helmets.jpg

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Component	Current Spec	Proposed Spec	Notes
Carbon Dioxide (CO_2)	≤ 1% by volume	≤ 2% by volume	Adjusted spec
Nitrogen (N_2)	-	-	
Oxygen (O_2)	≤ 2,000 ppm (0.2%)	≤ 10 ppm	Match current spec for Line Segments 315, 340, & 385
Total Inerts	-	≤ 4% by volume	New spec
Water/vapor Content (H_2O)	≤ 7 lbs/mmcf	≤ 7 lbs/mmcf	
Hydrocarbon Dewpoint (HCDP)	≤ 40 °F	≤ 25 °F	Adjusted spec
Heat Content (BTUs)	≥ 950 BTU/scf	≥ 950 BTU/scf ≤ 1100 BTU/scf	Added a max spec
Hydrogen Sulfide (H_2S)	≤ 0.25 grains/100cf	≤ 0.25 grains/100cf	
Sulphur (S)	≤ 20 grains/100cf	≤ 20 grains/100cf	
Wobbe Index (Interchangeability)	- -	1250 BTU/scf 1400 BTU/scf	New spec
Temperature	≤ 120 °F	≤ 120 °F	
RNG Specs	-	See Details	New specs

CARBON DIOXIDE (CO_2)

- Carbon Dioxide is a diluent gas that reduces the overall heating value of a fuel gas and can be chemically reactive.
- Southern Star's current limit is 1% by volume.
- Propose a limit of 2% by volume.
- Benefits:
  - Allows for more supply options by relaxing our limit.
  - In conjunction with a tighter Oxygen limit, will still protect pipe integrity.

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OXYGEN (O_2)

- Oxygen is a diluent gas that reduces the overall heating value of a fuel gas and can be chemically reactive.
- Southern Star's limit is 0.2% by volume except gas received on Line Segments 315, 340 and 385 shall not contain in excess of 10 PPM of oxygen.
- Propose a limit of 10 PPM.
- Benefits:
  - Minimize internal corrosion associated with O_2 (usually generates pitting and crevice corrosion).
  - O_2 acts as a corrosion accelerator causing the corrosion associated with CO_2 and H_2S to be more severe. A lower limit would allow our CO_2 limit to be raised and still protect pipe integrity.
  - Allow for consistent deliveries to pipelines with more stringent limits (KGST, NGPL, PEPL, QUESTAR, TIGT, TW).

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TOTAL INERTS (% BY VOLUME)

- Inert and diluent gases are non-hydrocarbons that reduce the overall heating value of a fuel gas. Inert gases (N_2) are not chemically reactive. Diluent gases (CO_2, O_2) can be chemically reactive.
- Southern Star currently doesn't have a specification.
- Propose a limit of 4% by volume.
- Benefits:
  - Minimize Quality variability for Power Gen and other susceptible industrial users.
  - Proposed limit is in-line with tariff specifications for many of our delivery interconnects with other pipelines (NGPL, NNG, TW, QUESTAR, OGT).

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HYDROCARBON DEWPOINT (HCDP)

- Hydrocarbon Dewpoint is the minimum temperature above which no condensation of hydrocarbons occurs at a specified pressure.
- Southern Star's limit is 40°F (750 psia)
- Propose a limit of 25°F
- Benefits:
  - Reduce hydrocarbon liquid dropout which can cause operational issues including increased pressure drop, reduced line capacity, and equipment problems such as compressor damage.
  - Proposed limit is more in-line with tariff specifications for many of our delivery interconnects with other pipelines (CIG, KGST, TIGT).

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MAXIMUM HEATING VALUE (BTU)

- The term "gross heating value" refers to the amount of heat (Btu's) produced by the combustion of one (1) cubic foot of gas at STP.
- Southern Star currently doesn't have a specification.
- Propose a limit of 1100 BTUs per cubic foot
- Benefits:
  - Minimize BTU swings for Power Gen and other susceptible industrial users.
  - For gas interchangeability: Per NGC+ White Paper interim guidelines, A limit of 1110 BTU/scf is recommended in conjunction with Wobbe number limits to maintain interchangeability.
  - Proposed limit is in-line with tariff specifications for many of our interconnects with other pipelines (EGT, KGST, NGPL, TIGT, TW, QUESTAR).

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WOBBE INDEX

- Wobbe Number is a single index parameter used for determining gas interchangeability. The Wobbe Number is based on the heating value and specific gravity of a gas and is related to the thermal input to a burner.
- Southern Star currently doesn't have a specification.
- Propose a limit of 1250 – 1400 BTU/scf.
- Benefits:
  - Most common and robust single index parameter for interchangeability.
  - Per NGC+ White Paper, establishing a maximum Wobbe Number can address yellow tipping, incomplete combustion, and potential for increased emissions of NOx and CO. Establishing a minimum can address lifting, blowout, and CO.

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Southern Star Central Gas Pipeline Renewable Natural Gas (RNG) Quality Specifications		
Component	**Current Spec**	**Notes**
Ammonia	< 10 ppmv	Includes Ammonia and Ammonia-based byproducts
Total Bacteria	≤ 0.2 microns	
Mercury	< 0.01 µg/m^3	Includes Mercury and Mercury-based derivatives
Volatile Metals	< 20 µg/m^3	Includes, but not limited to : lead, zinc, copper, chromium, manganese, and arsenic
VOCs and Semi-VOCs	≤ 350 ppmv	Includes, but not limited to : BTEX, phthalates, N-nitroso-di-n-propylamine, and benzyl alcohols
Siloxanes	≤ 0.1 mg of Si/Nm^3	
Halocarbons	< 0.1 ppmv	Includes, but not limited to: freons, chloroethane, and vinyl chloride
Aldehydes and Ketones	<10 ppbv	

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SILOXANES

- Siloxanes are organic compounds that contain silicon, oxygen, hydrogen, and carbon. Due to the increase in silicon-containing personal hygiene, health care, and industrial products, the presence of silicon in waste streams has increased. As the silicon-containing waste stream is anaerobically digested, the silicon converts to siloxane compounds that volatilize and become entrained in biogas.
- Southern Star currently doesn't have a specification.
- Propose a limit of ≤0.1 mg Si/m^3.
- Benefits:
  - Minimize formation of silica dust from combustion, which can damage internal combustion engines and turbines.
  - Protect customers with sensitive end-use equipment.
  - Allow for the comfortable pursuit of RNG supply sources.