	MEASUREMENT POLICIES	
	SAMPLING AND ANALYSIS	MP - 9
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POLICY OBJECTIVE & SCOPE

The results of Sampling and Analysis procedures impact the compressibility factors used in the volume calculations as well as the allocation of products in the production accounting models.

Significant and costly volume measurement uncertainties and losses can result from improper and infrequent sampling and analyses of fluids from the well head to the allocation sales point. Measurement errors can be significantly reduced and mitigated through proper management of sample points, sample procedures, sampling conditions and analysis management.

This Policy is intended to provide direction in conducting fluid samples, managing sample conditions, reducing the risk of contaminated samples, provide guidance on the frequency of samples, and define roles and responsibilities related to sampling and analysis of fluids for both AltaGas meters and situations where the customer meter is the AltaGas system receipt point meter.

REFERENCES

1. ERCB Directive 017 Measurement Requirements for Upstream Oil and Gas Operations (S.8 Gas and Liquids Sampling and Analysis)

REQUIREMENTS

Sampling Processes:

- Sampling shall be conducted in accordance with documented laboratory practices.
- When the hydrogen sulphide (H₂S) content exceeds 0.5%, an on-site tutweiler test shall be conducted as per the laboratory requirements. When the hydrogen sulphide content is less than 0.5%, a length of stain test (GPA 2377) shall be used to determine the H₂S content. For extremely low concentrations (<20 ppm) a sample shall be collected and analyzed off site using sulphur chemiluminescence chromatography.
- If the Analysis does not meet the validation criteria setout by the Laboratory Company or the AltaGas Meter Hub a resample must be taken and the Analysis should not be published or used in the gas volume calculation systems, field data capture programs, allocation models, Electronic Field Measurement (EFM) configuration files or in any other business process.

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- Sampling conditions must be controlled to prevent erroneous results due to:
 - Liquid slugs in the sample stream
 - Abnormal ambient conditions which affect the sample point. Winter is the best season to avoid temperature fluctuations between annual samples from liquid-rich streams
 - Poor sample point location – ERCB Directive 017 requires at least five pipe diameters of straight, undisturbed flow prior to sample points
 - Incorrect sample point identification on the sample tag or in the analysis header
 - Liquid carry-over from a separator into a sample point located in a gas stream
 - Contamination from well stimulation treatment fluids, air, unclean sample container or leakage
 - Incorrect on-site H₂S determination or degradation in the sample container

- The scheduling of Samples is to be managed using pre-scheduled and re-occurring Work-Orders (Maximo or Salomon) based on the frequency requirements outlined below.

- Sample points are to be clearly tagged in facilities with resilient, non-burnable sample tags. Samples are to be taken from sample points clearly tagged in plant sites and identified on meter schematic diagrams.

Sampling Conditions

Operating conditions must be stable for representative samples. Wells recently stimulated with a fracture stimulation treatment or workover using nitrogen or CO₂ require repeat samples a month apart until trending shows stable component levels.

Sampling conditions for temperature, pressure and on-site H₂S determination are to be recorded on the sample tag with the sample point identification code and cost centre code, then turned in to the lab with the sample. Representative daily average well gas, condensate and water production rates are to be supplied with the sampling conditions for mathematical recombination. Sample updates are required annually (more frequently for high volume sites), whenever process conditions change substantially and during the first month of flow from a new or recompleted/commingled production zone. When a new well comes on stream, both the well and group sales streams are to be sampled.

Wells that produce volumes of condensate in excess of 1 bbl/mmcf = 0.006 m³/E³m³ through a wet meter are to be tested and sampled using a portable separator under the direction of a qualified consultant or technician.

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Sample Points

Sample Points must be selected properly and tagged for consistent trending with representative results.

Industry Recommended Practices require sample points which should be identified using non-burnable tags for consistent trending with representative results from the following process locations:

Produced Substance	Best Sample Point	Optional Location	Do NOT Sample Here
Oil or emulsion	After mixing in the meter, upstream of dump valve	As close as possible to but not on the separator, upstream of the dump valve	Anywhere on the wellhead, separator or downstream of the dump valve where flashing can occur
Gas	Sample probe in the middle of straight pipe more than 5 diameters downstream from any flow restriction	Using a sample valve installed with a ball valve in the gas meter 5-way manifold vent line after purging	Anywhere on the separator, after a flow restriction where flashing can occur or where temperature swings are significant
Propane, Butane, NGL or Condensate	Through a probe on the side of a horizontal line as close as possible to the vessel upstream of the meter	The side of a vertical line with probe tip sloping 45° downward, upstream of the dump valve	Anywhere on the depropanizer or where vapor breakout can occur downstream of restrictions or where stream temperature increases

Sample points must be located to provide representative results. Errors in analysis composition as small as +/- 1% can exceed \$10,000/year in a 30 E³m³/day gas stream and should be minimized with attention to the following selection criteria:

1. Gas samples must be taken from a section of piping that is in the mainstream flow (not stagnant).
2. For sampling applications where the gas is at or near its hydrocarbon dew point, a sample probe must be used (e.g., separators where gas production exceeds 30 E³m³/day and where hydrocarbon liquids are present).
3. The preferred location for gas sample probes is the top of horizontal lines. An optional location is the side of vertical lines with probe tip sloping 45° downward. Sample probes should be located at least 5 diameters downstream of any piping disturbances, such as bends, elbows, headers and tees.
4. Separator gas sample points should be located as close as possible to the vessel, but not on the vessel.
5. The location of the sample point must be such that phase changes due to changes in pressure and/or temperature are minimized. Specifically, for gases at or near their hydrocarbon dew point, sample points must not be located downstream of pressure-reducing components, such as control valves, flow conditioners and regulators or long lengths of un-insulated piping or within 5 diameters of an orifice plate.
6. Orifice meter impulse lines or transmitter manifold lines and sight glass valves should be considered as least preferred sample points.

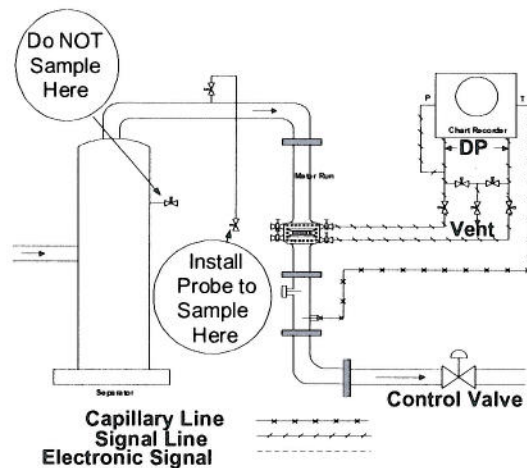
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7. If sample transfer tubing is to be used, its length must be minimized. The sample transfer tubing must be oriented to minimize the potential to trap liquids in gas samples and water in condensate samples. A means must be provided to safely purge sample transfer tubing between the sample point and the connection point of the sample cylinder.
8. Liquid samples are best taken in a vertical section of pipe with upward flow direction. In a horizontal flow, the sample point should be from the side of the pipe.

Inappropriate Sampling Locations

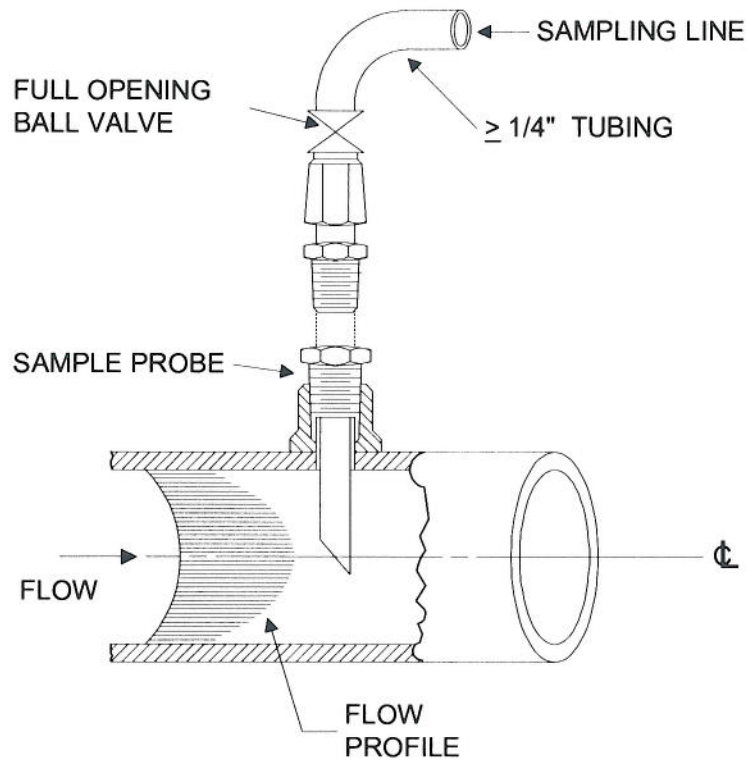



9. Probes must be installed on high-volume lines and for critical samples, extending into the center of flow.
10. The tubing from the sample point to the container must be no smaller than $\frac{3}{8}$ " diameter, sloped downward and short. For sour streams and streams under pressure greater than 1000 psig, stainless steel tubing is required.
11. Full port ball valves must be used on sampling lines.

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Sample Probe

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Quality Management

The selection of a lab for routine analytical work requires consideration of many factors for Quality Assurance. A periodic check of Quality Control methods is essential and should be conducted by a stakeholder team led by the AltaGas Purchasing Group with guidance from third party consultants as necessary.

Analysis Checks for Validity Before Distribution

Analyses are to be validated within the AltaGas Meter Hub (PGAS) **before** distributed to production accounting allocation models, EFM configuration files, and chart integrators. Analysis that is rejected must be investigated and re-sampled or if accepted, the support for manually accepting and publishing must be documented.

A copy of the gas analysis is stored in PGAS as well as at the appropriate field location for the purpose of field audit evidence.


ADDITIONAL INFORMATION PERTAINING TO PGAS ANALYSIS VALIDATION METHODS

Validation steps for trending laboratory sampling and analysis data prior to distribution and publication shall include but is not limited to the following criteria:

- Check that the sum of all component mole percentages adds up to 100%
- Trend Relative Density to report on exceptions when differences exceed acceptable limits.
- Trend Heating Value against previous or comparable samples. Limits must be set for acceptable maximum and minimum Heating values and differences between samples.
- Trend Nitrogen and Carbon Dioxide content against previous comparable sample. Limits must be set for acceptable maximum component levels and differences between samples.

Exception reports are to be generated and unrepresentative analyses should be rejected for use in gas volume calculations, allocations and recombination. If sample are accepted after being rejected the reason for acceptance must be documented.

A decision to resample should follow shortly after exception reports are released.

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FREQUENCY


Analyses are required for accurate measurement and allocations for or all gas plants, compressor stations, batteries, satellites and wells. The frequency for sampling at receipt points as well as accounting and allocation meters may be increased depending on specific operating conditions at each facility. The frequency for a gas plant inlet may be quarterly or monthly depending on volumes and the number of producing zones entering the plant.

The following outlines the minimum frequency standards for AltaGas.

Facility Type	Frequency of Sample & Analysis
Gas Plants or Gathering Systems	Semi-annually (every six months)
Receipt Points and Compressor Stations	Annually
New/serviced/re-installed Meters	Immediately (within the first month)
Low Volume, Stable Receipt Point Streams that are Exempt from ERCB Sampling Requirements as per D-017 Section 8.4.2 or Section 8.4.4	Minimum every four years for < 16.9 E ³ m ³ /day from any Receipt Point

Wells completed in the Edmonton Sands, Horseshoe Canyon or in any lean, dry formation do not require repeat samples upon evidence of exceptions allowed by ERCB Directive-017 Sections 8.4.2 after the nitrogen or carbon dioxide content has stabilized following a fracture stimulation treatment or of Section 8.4.4 after the relative density stabilizes unless the stream(s) are directed through a custody transfer meter. Condensate-rich gas wells whose production is measured after gas and liquid streams are separated, then recombined, must be sampled to perform either a physical or mathematical recombination on a Fit For Purpose frequency for the purpose of estimating gas equivalent volumes of hydrocarbon liquids and their potential recovery volumes.

Custody transfer meter streams must be re-sampled immediately upon changes to process flow streams such as following the start-up of new wells from a different formation producing into an existing process inlet stream or a change in gas: liquid inlet volume ratio.

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ROLES & RESPONSIBILITIES	
	<p>PGAS Administrator – To manage AltaGas’ Meter Hub (PGAS software system) with rules to validate analyses with data checks and trending criteria so that unrepresentative analyses will be listed in an exception report and not published for use in gas volume calculations, recombination, allocations, chart integrations and Electronic Flow Measurement (EFM) configuration files. To advise Field Operators when a rejected sample should be resampled. To ensure that an audit trail is maintained with analysis updates as well as all necessary gas volume calculation parameters.</p>
	<p>Operations Accountants – To understand the need for analysis validation by a qualified and trained AltaGas specialist before using laboratory analyses for accounting, allocations and reporting purposes. To ensure that new, validated analysis updates are applied in the same reporting month by all chart integrators, pipeline companies, partners, third-party producers, accounting and allocations systems.</p>
	<p>Field Operators – Maintain appropriate level of details of meter sample points in the work order system to ensure all samples are taken at the appropriate frequency. Order laboratory sampling in accordance with the Requirements and Frequency outlined in this Policy. To order re-sampling and analysis when analysis have been rejected by PGAS.</p>
	<p>Operations Supervisors – To ensure Field Operators are appropriately trained and follow this policy. To ensure deficiencies are addressed through the close-out of work orders. To designate Operators who will work with sampling technicians to select and tag sample points. Tags must be checked during facility reviews and audits.</p>
	<p>Operations Engineers – Receive, review, follow-up, and ensure appropriate documentation for approval on PGAS exception reports to address potential analysis issues. Communicate with Field Operators when re-sampling is required.</p>
	<p>Manager Operations – To ensure compliance to this policy is supported and that appropriate training is provided for the Field Operations including the appropriate location and procedures for sampling.</p>
	<p>Measurement Program Steering Committee – To direct and approve measurement policies including this Sampling and Analysis Policy.</p>