QA/QC of Data used for SGER GHG Emission Compliance and Offset Project Reporting

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Overview

- Major SGER principles (baseline)
- QA/QC items of significance
- Examples case discussions (offset wastewater treatment facility & emitting sour gas plant)
- Summary

Baseline Calculation Principle & Approach (SGER)

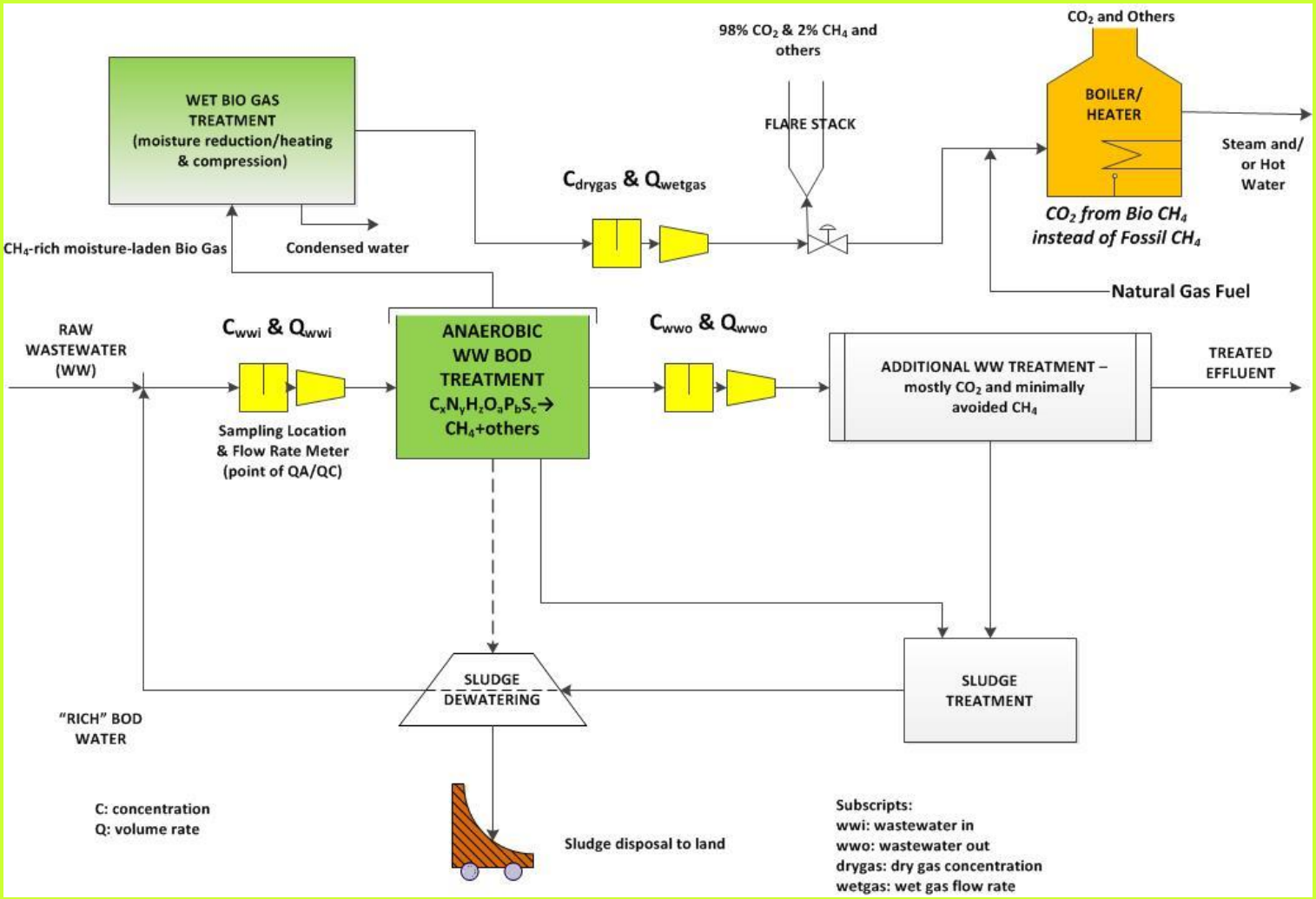
- As accurate as possible: approved baseline versus flexibility approaches, but thereafter documented consistent annual calculations and reporting
- Third-party verification (reasonable assurance) that asserted & calculated values are “reasonable” in all respects regarding QA/QC’ed data

QA/QC Significant Items

- Baseline calculation approach scientifically correct regardless of SGER baseline principles?
- All used data need “reasonable assurance back-tracking” verification, e.g. QA/QC related to expected correct:
  - Sampling & sample preservation methods
  - Sample analysis methods
  - Laboratory analyzing device calibrations
  - Facility instrument meter (and analyzing device) calibrations
  - Overall data used in calculated values of asserted GHG emissions

GHG Offset Emission Project - Example Case

Anaerobic Wastewater Treatment Plant



GHG Offset Emission Project – Broad QA/QC Items

Anaerobic Wastewater Treatment Plant

1. SGER protocol is COD-based - yet most measured data are BOD-based, because it is a biological oxidation process (not entirely a complete chemical oxidation process)
2. Three key locations of metering, sampling and sample analysis for data used in GHG emission calculations – raw data subject to QA/QC
3. Mass rate calculations (M=QC) for annual GHG emission rates are only as "good" as the raw data is QA/QC'd, and data appropriately applied in the calculations:
   - Wet Q data versus dry C data for gaseous methane stream?
   - Unknown ignored (not ever measured) stream moisture content regarding wet gaseous Q data (flexibility)?
   - Is a Protocol-conservative 2.4 mass COD per mass BOD conversion factor scientifically acceptable, regardless of IPCC, AESRD, etc.?
   - Good science versus regulatory conveniences?

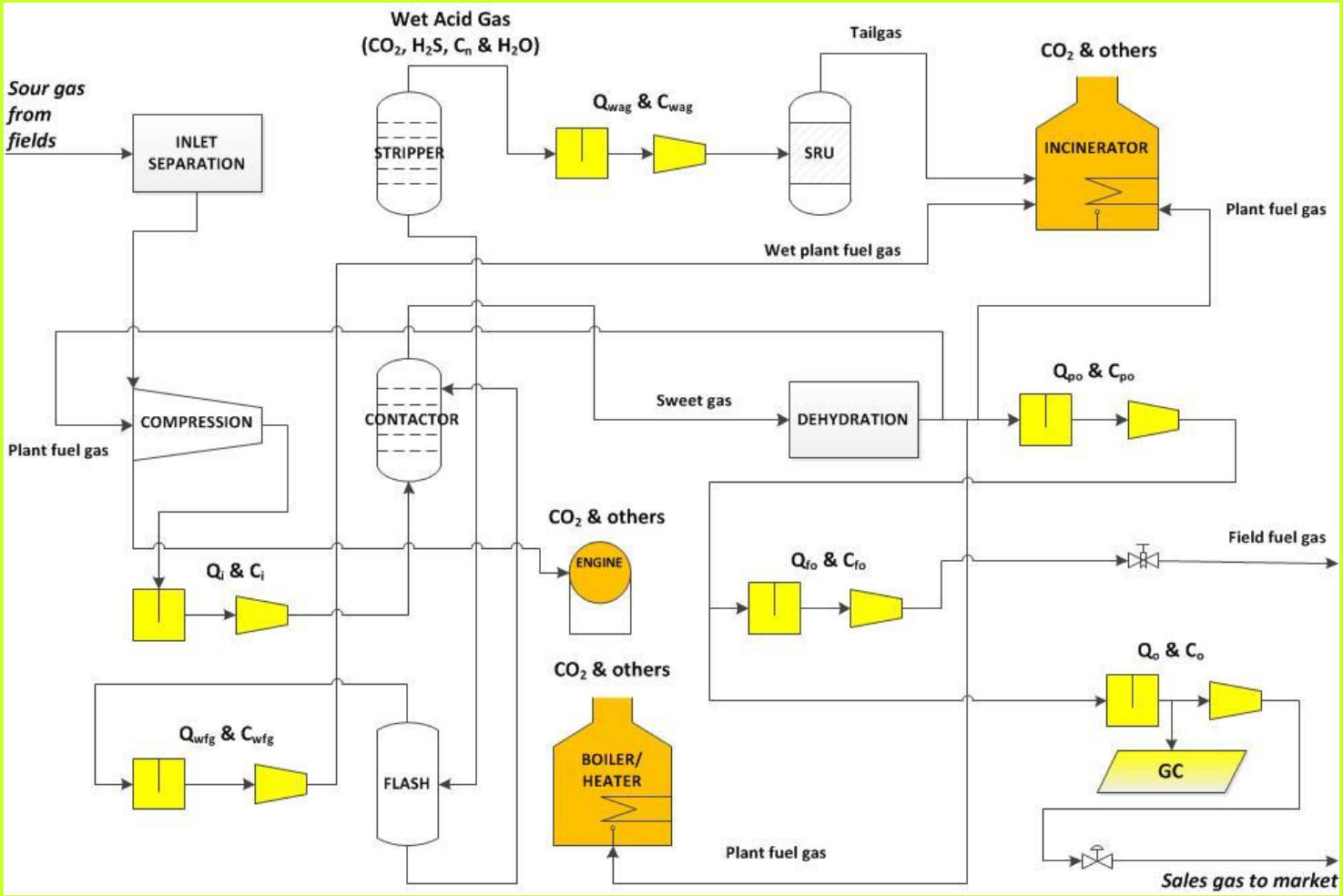
GHG Offset Emission Project – Specific QA/QC Items

Anaerobic Wastewater Treatment Plant

1. COD-based SGER (IPCC) protocol value of 2.4 COD/BOD ratio appears way off other than for domestic wastewater (various food processing COD/BOD ratios ranging from 0.15 to 1.69) – flexibility versus good science and due diligence
2. WW sampling frequency (grab versus composite)
3. WW analysis method adherence (Winkler, refreshed lab normal solutions, calibrated DO meter, etc.)
4. Gas sampling method for stream moisture content by standard method
5. Volume meter calibration aspects (periodic accuracy tests for, and resetting of, pressure and temperature sensor drifts and changed composition & density characteristics)

GHG Emission Compliance Reporting - Example Case

Sour Gas Processing Plant



GHG Emission Compliance Reporting – Broad QA/QC Items
Sour Gas Processing Plant

1. Mass rate calculations (M=QC) for annual GHG emission rates are only as "good" as the raw data is QA/QC'd, and data appropriately applied in the calculations:
   - Wet Q data versus dry C data for gaseous streams high in moisture (Acid Gas)?
   - Unknown ignored (not ever measured) stream moisture content regarding wet gaseous Q data?
   - Good science versus regulatory conveniences?
2. Many stream meter values of QA/QC involved:
   - Wet Acid Gas (to calculate formation CO_2 mass rate)
   - Wet and dry plant Fuel Gas (to calculate combustion CO_2 mass rate)
   - Raw inlet sour gas, field fuel gas supplies & commercial sales gas (meter values of which are used in GHG emission and intensity calculations)
3. Some plant on-site sampled and GC-analyzed (C_n) streams – others sampled and GC-analyzed by outside laboratory

GHG Emission Compliance Reporting – Specific QA/QC Items
Sour Gas Processing Plant (1 of 2)

Most meters are of an orifice plate (OP) nature, basic volume rate calculation variables being the following (in bold symbol text):

- Q=**C**'*SQRT($\mathbf{h_w}$*$\mathbf{P_f}$) – $\mathbf{h_w}$ for continuously measured OP differential pressure drop and $\mathbf{P_f}$ for continuously measured absolute pressure
- C' constant includes a multiple product of various OP constants, two of which tend to temporally vary: $\mathbf{F_g}$ (stream fluid density related and intermittently reset) and $\mathbf{F_{tf}}$ (stream fluid temperature related, relative to a reference temperature, and temperature continuously measured)

GHG Emission Compliance Reporting – Specific QA/QC Items
Sour Gas Processing Plant (2 of 2)

- Hence QA/QC important for calibration checks on (and re-setting of) OP meter sensors for:
  - ✓ Differential pressure drop
  - ✓ Absolute pressure
  - ✓ Actual temperature
  - ✓ Fluid density (computer program data input)
- Also, QA/QC important regarding sampling and GC analyses for stream composition (C_n) and whether on dry or wet basis (occasionally sampling by recognized method for stream moisture content – or reasonably estimate same based on stream operating temperature and pressure)

Summary

- Many QA/QC items to attend to in SGER verifications
- SGER-based offset protocols and compliance baseline principles not completely scientifically sound, but live with them for a while yet after 10 years of trials and learnings
- What gets measured gets managed, eventually