

Natural Gas Star Annual Implementation Workshop

**Evaluation of Casing Gas
Recovery Options in China**

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12–14 May 2014

San Antonio, Texas



Basic Casing-Gas Control Strategy

- Use what you can on site or at other nearby facilities (especially where this reduces reliance on offsite fuel and other supplied energy).
- Transport the gas to market by gaining access to a nearby gathering system or convert it to an alternative energy form that can be more readily transported to market (e.g., LNG, LPG or electricity).
- Dispose of the gas that cannot be conserved or utilized in in a manner that minimizes GHG emissions (i.e., flare rather than vent).

Challenges

- Most large and medium scale opportunities already addressed:
 - Recovery of condensable hydrocarbons.
 - Electric power generation.
- Individual site opportunities generally $<1000 \text{ m}^3/\text{d}$.
- Flows from individual wells range from 0 to 20.6 m^3/h or (0 to 494.4 m^3/d).
- Lack of site-specific measurement data to evaluate opportunities.
- Reliable gas analyses generally unavailable.

Challenges

- One surveyed oilfield in China comprised several thousand widely dispersed wells (primarily in mountainous terrain).
 - Difficult pipelining conditions.
 - Limited opportunities to cluster wells.
- In older development areas:
 - Casing gas flows have declined.
 - Local residents have begun using the waste gas for domestic needs and flare the balance.

Oilfield Terrain



Approach Being Taken

- Measurement program to identify practicable casing-gas recovery opportunities.
- Application of small-scale solutions:
 - Small Scale Power Generators.
 - Micro-condensers.
 - Micro-LNG Plants.

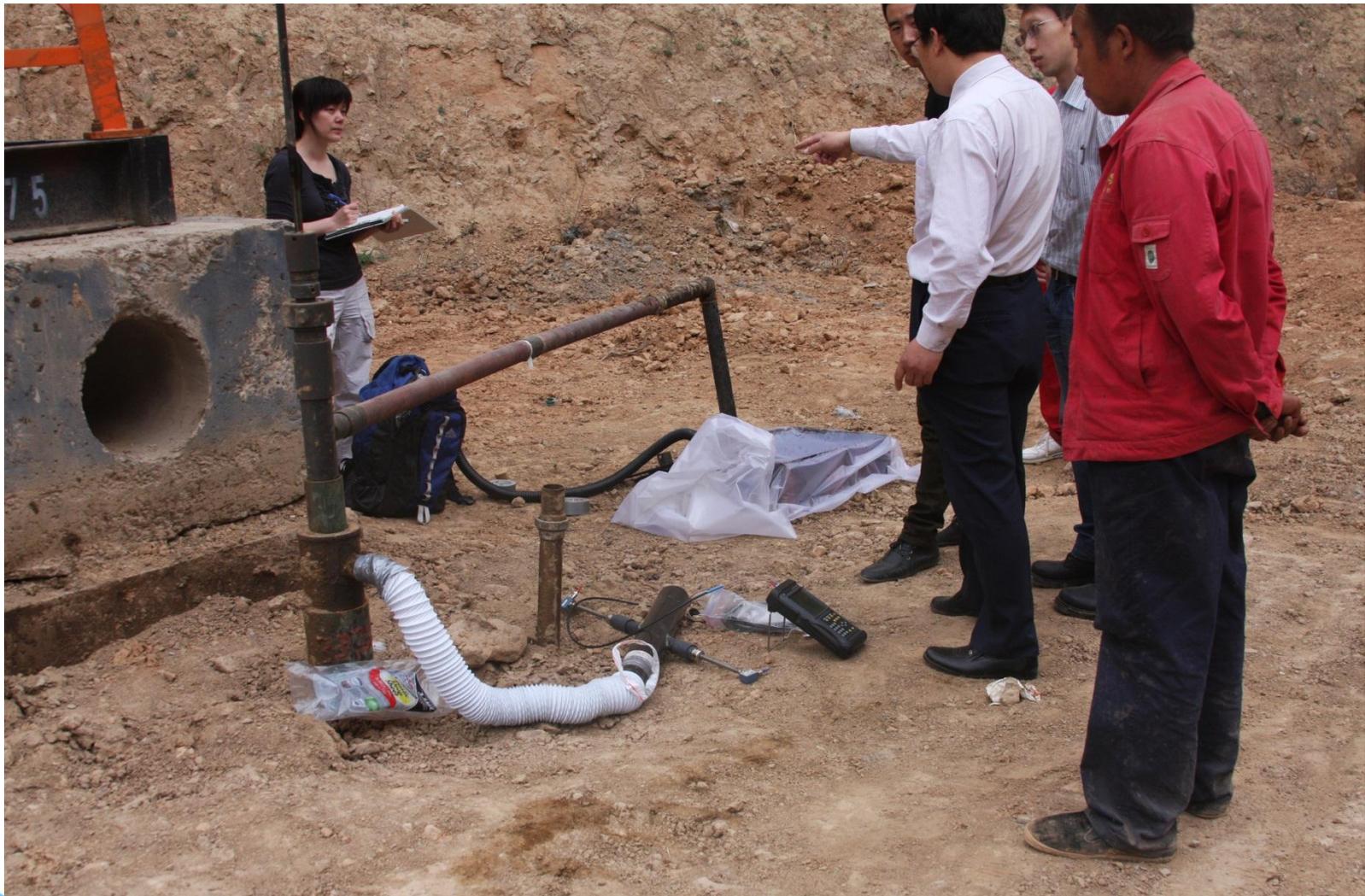
Measurements

- Continuous data logging of vent gas flows using ultrasonic flow meter:
 - Zero back pressure & easy to install.
 - Tolerant of some condensation or aerosols.
 - Composition independent.
 - Excellent range ability (2000:1).
 - Good accuracy ± 2 to 5%.
 - Determination of gas MW from sound speed.

Casing-Gas Flow Measurement



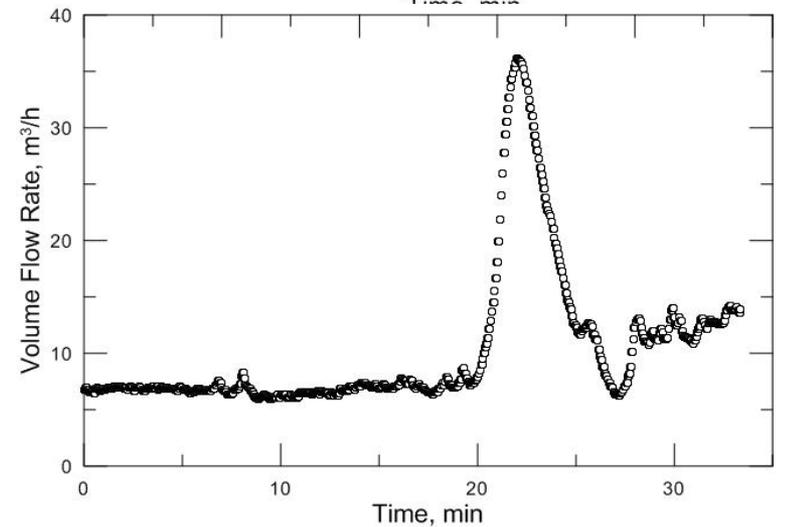
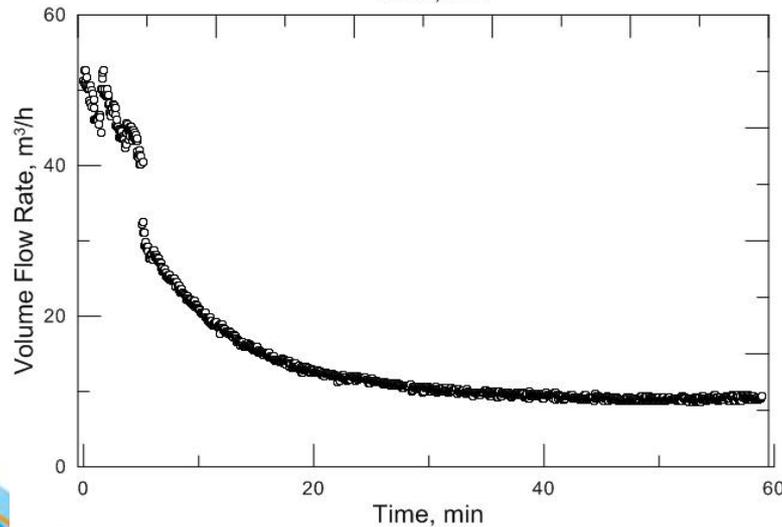
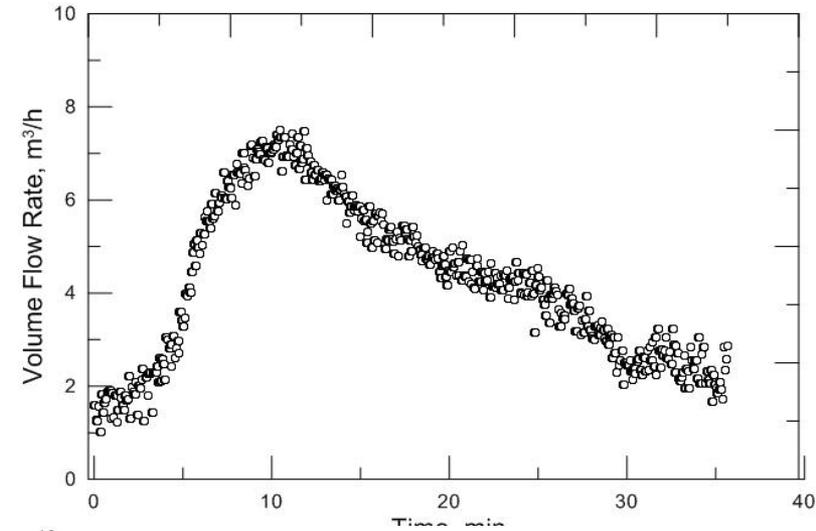
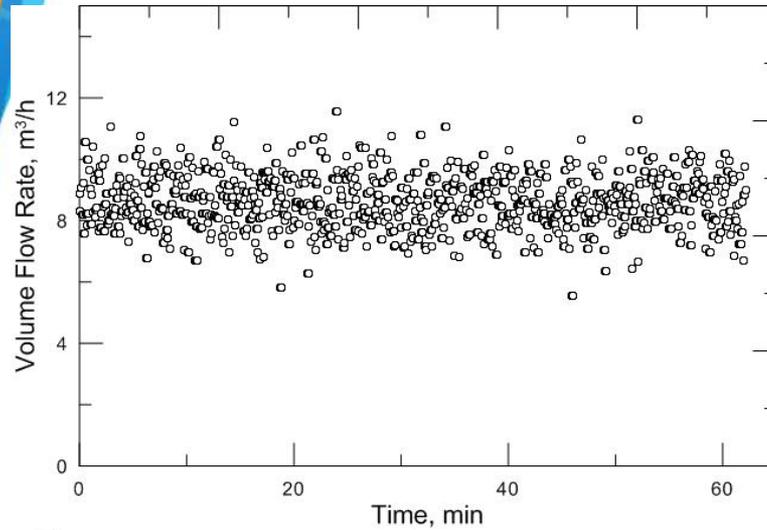
Casing-Gas Flow Measurement



Hi-Flow Sampler Measurement of Emissions from a Sump



Variations in Casing Gas Flows



Micro & Optical GCs: Technological Innovations

- Field analyses reduces or eliminates sample degradation and transportation issues.
- Micro-GCs offer stable and reliable performance in the field.
- Low power requirements.
- Optical GCs eliminate need for carrier or calibration gases in the field.



Micro-Condenser Units



Capacity: 282 to 2832 m³/d of waste gas

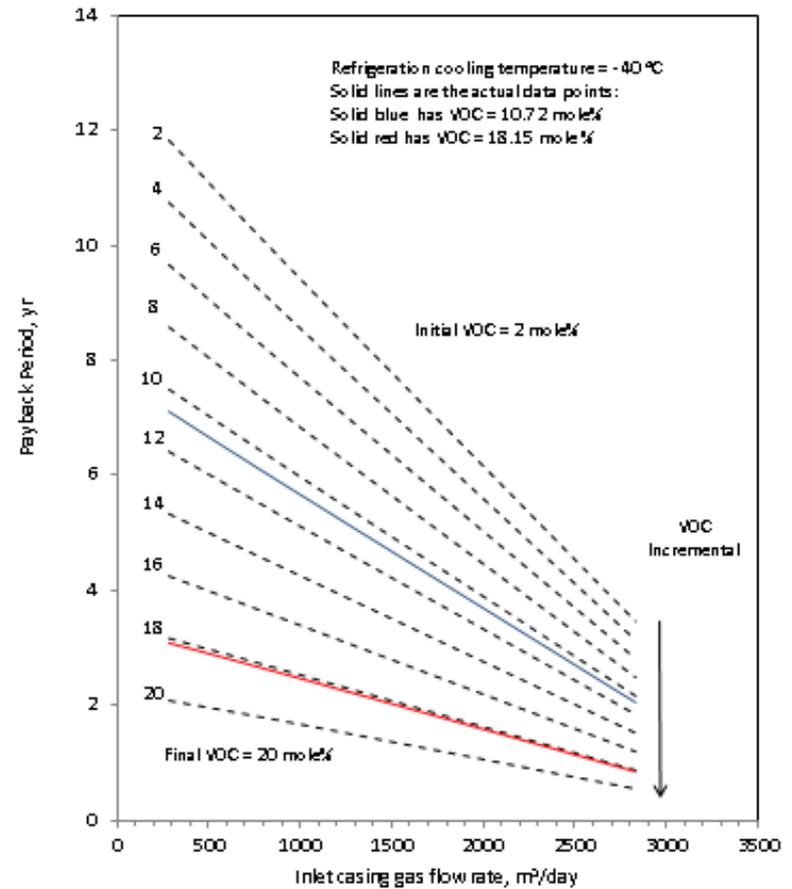


Figure B: Screening tool for site selection for refrigeration casing gas recovery system - pay out period as a function of casing gas flow rate and VOC concentration of casing gas for the generate and flare scenario.

Small-Scale Power Generators



Capacity: 10 to 117 kW (70 to 828 m³/d).

Micro-LNG Plant



Source: Kryopak Inc. (Texas)
Capacity: 50 tonnes/d (73,700 m³/d)

Key Findings

- Adequate time-series monitoring of casing-gas flows important for determining true production potential.
- For the cases investigated the casing gas comprised noteworthy amounts of non-methane hydrocarbons:
 - 5 times more valuable than methane fraction.
 - Greatly enhances feasibility of casing-gas recovery projects.

Thank you!

