

Method Development for Dissolved Gas Analysis of HTF Fluids



Ed Wolfrum, Darren Peterson
National Renewable Energy Laboratory
Golden, CO 80401

contact: ed_wolfrum@nrel.gov, 303-384-7705



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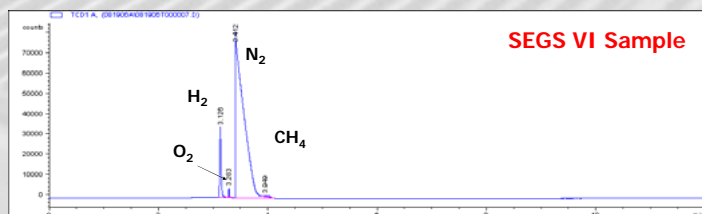
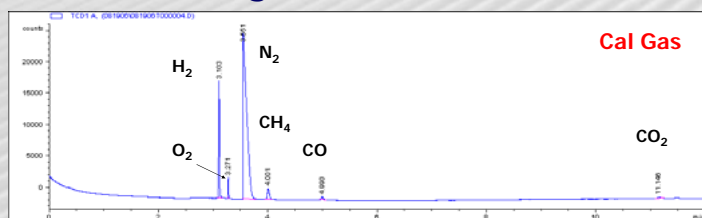
The Issue

- Dissolved hydrogen (H_2) in heat transfer fluid (HTF) can migrate into receiver vacuum and result in increased heat losses
- Can we develop sampling and analysis techniques required for the accurate measurement of dissolved gases in HTF?
- Can we collect data to understand how the amount of dissolved H_2 varies among the different SEGS plants and over time?

Experimental Approach

- Field Sampling technique taken from LUZ Engineering Specification "HTF Sampling Procedure and Analysis"; steel sample bombs returned to NREL laboratory for analysis
- Two-step gas chromatography (GC) method measures gases in both liquid and headspace fractions of sample bombs

GC Chromatograms

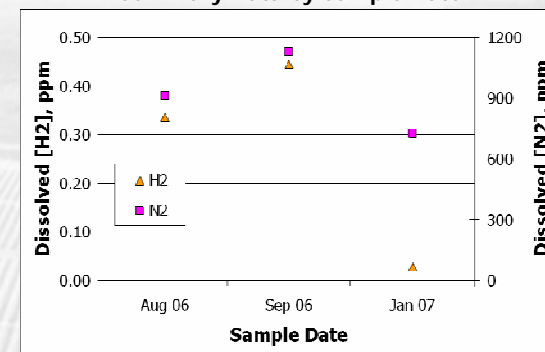


Representative GC chromatograms from GC/TCD detector using direct injection (no headspace analyzer). (TOP) direct injection of calibration gas (1% H_2 , O_2 , CH_4 , CO , CO_2 , balance N_2). (BOTTOM) SEGS VI sample. Note the much higher ratio of N_2 to H_2 in the SEGS sample. GC/FID detected other VOCs (e.g., benzene, phenol)

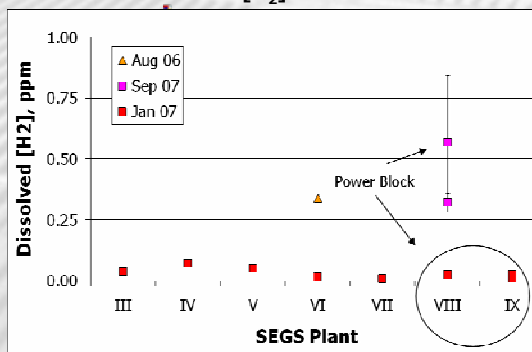
Results

- Sampling and analysis procedures appear to provide repeatable data;
- Two-step analysis (GC headspace autosampler and direct injection) necessary
- Dissolved H_2 and N_2 concentrations vary with time and location
- Cooler operating temperatures correspond to much lower dissolved H_2 concentrations; N_2 concentrations are less sensitive

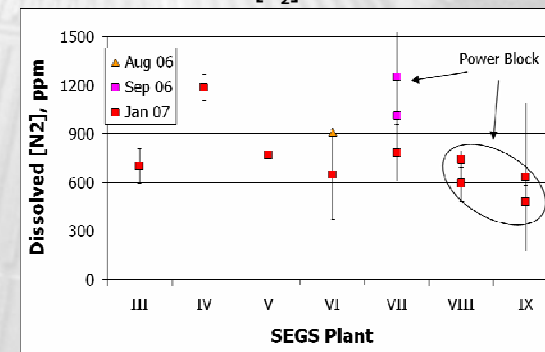
Summary Data by Sample Date



Dissolved [H_2] vs. Location



Dissolved [N_2] vs. Location



Conclusions

- We have developed sampling and analysis techniques required for the accurate measurement of dissolved gases in HTF
- Preliminary data indicate that the amount of dissolved H_2 in HTF appears to vary more over time than between plants

Future Work

- Examine effect of ullaging on dissolved gas concentrations
- Transfer and analytical procedures to a commercial analytical laboratory
- Investigate utility of measuring other dissolved species as measures of HTF condition
- Investigate in-situ measurement techniques