Analytical Considerations During Natural Gas Fracturing Activities

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Overview

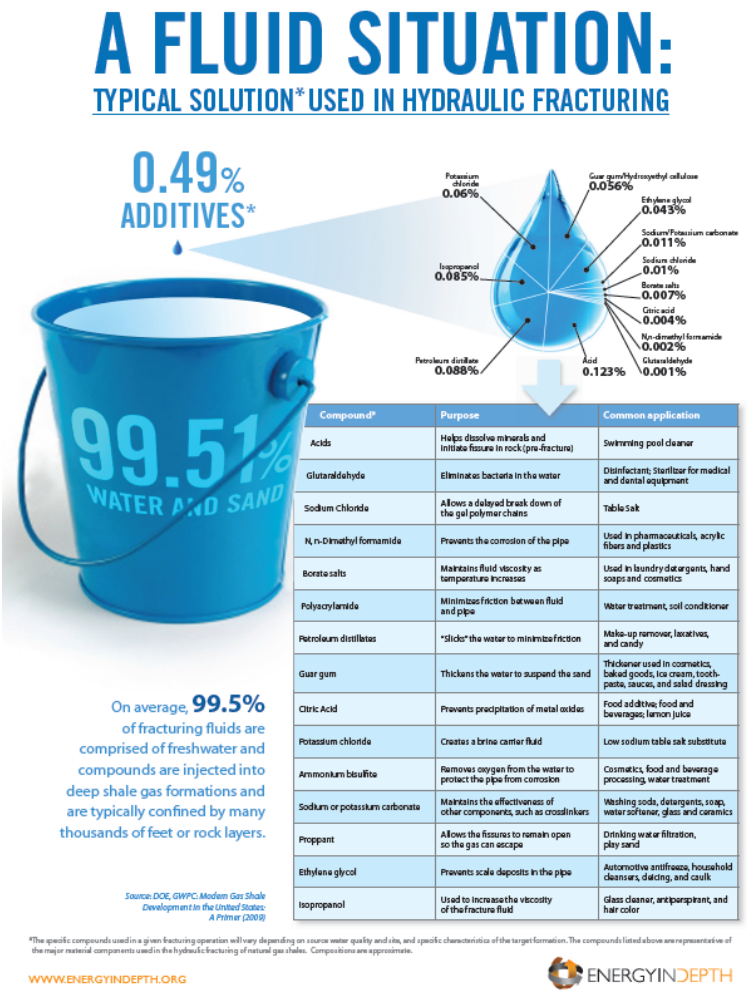
- Opening Comments
- Fracturing Fluid
- Bottleware and Preservatives
  - Case Study
  - Lesson Learned
- Method Development
  - Case Study
  - Lesson Learned

Opening Comments

- High-quality analytical data before, during, and after production processes increasingly important to document baseline and post-drilling groundwater and surface water quality
  - Thorough knowledge of the pre-existing conditions
  - Thorough documentation of S&A activities
    - bottleware, sampling and handling processes
    - sample preparation and instrumentation and methodology used for testing
- Equally important is the characterization and analysis of unusual analytes that may be present in fracturing solutions

Fracturing Fluids

- Typically - 98-99% water and 1% chemical additives (*e.g.,* dilute acids, bactericides, corrosion inhibitors, gelling agents, friction reducers, surfactants) and silica sand and man-made ceramics
- Many chemical additives are not routinely tested for by laboratories
  - Bottleware and preservatives are not certified for these non-routine parameters
  - For analytes that are not included on published method lists, a robust method development process is necessary to ensure a complete characterization, preferably *before* a release takes place.



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Case Study One: Overview

- Unknown amount of flowback water released
- Sampling program of 45 residential water wells
- Team chemists observed large number of glycol detections and suspected contamination given the similarity in concentrations
- Suspected contamination; investigation revealed
  - Field blanks not collected – no need for tap sampling?
  - Preserved vials used for sampling were not pre-tested
  - Vials used for lab method blank were not preserved
  - Analysis of vial lot # confirmed glycol contamination
  - Resampling using certified vials yielded ND for glycol

Case Study One: Lessons Learned

- Standard Operating Procedures including field QC must be in place
  - A single documented lot of bottleware and preservatives must be used for a sampling event
  - Field blanks must be collected using the same lot number of bottleware used for samples
  - Any bottleware/preservatives used for sample collection must be pre-tested prior to use for the analytes of interest to the reporting sensitivity
    - Do not assume the laboratory has already done this
  - Laboratory method blanks should be stored in the same type of preserved bottles used for samples
- Sampling teams should undergo periodic third-party field audits

Case Study Two: Overview

- Surface release of large volume of fracturing fluid
- Material Safety Data Sheets for the chemical additives revealed two compounds, directly indicative of the additives, are not routinely tested for by laboratories
- Emergency method development was required
  - Extraction and analysis techniques, including method detection limit (MDL) studies, precision and accuracy and definitive analytical finishes (one by LC/MS and one by GC/MS)
  - And we need it YESTERDAY

Case Study Two: Lessons Learned

- Analytical methods may not exist for the contingent characterization data needs of hydraulic fracturing activities
- It is prudent to have analytical methods on line for selected marker compounds being used during fracturing activities
- Time, cost, capacity, and TAT need to be considered when developing methods whether proactively or on an emergency basis in the event of a release

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