

The Twelve Golden Rules of Chemical Treatment for High Volume Fracturing

A Chemistry Perspective

by

Ron Bosch

Background

- Fracturing at low volumes will not support the overhead for third party chemical treatment
 - This is a shame, as it would provide the same benefits
 - Champion has done some Squeeze on Completion™ programs

Background

- The service companies do a good job at any chemistry that can be standardized across a formation and support varying water quality
 - Biocides, scale inhibitors, surfactants, and possibly very high TDS friction reducers can benefit from individual selection on a well by well program based on water source
 - Surfactants are most economically applied by standardizing a set for the formation, and then adding a small amount specified for the water used in addition to the surfactant supplied by the completion provider

Background

- The vast majority of fracs are completed without third party chemical supply
 - Most slick water fracs are completed without third party chemical supply
 - Individual selection of chemistries by each frac will cost less than a standardized approach over the life of the well
 - This requires a proactive management approach to well completion by both the chemical company, and the producer

Golden Rule 1

- The interests of the service companies involved in a well completion are often misaligned
 - The frac company needs to make sure the frac will be successful, addition of any chemistry they do not control presents a risk to them getting paid
 - The chemical company needs to ensure the chemistry applied will prevent MIC, souring, scaling, and maximize production from the well

Golden Rule 2

- The more control you have over the biology and chemistry of the source water for the frac, the more gas (or oil) will be produced from well over it's lifetime
 - Prevent MIC
 - Prevent souring
 - Prevent formation scaling
 - Optimize fluid flow

Golden Rule 3

- Any water exposed to atmosphere for enough time to chemically stabilize will establish a biochemical profile
 - Bacteria will colonize
 - Chemistry will change as a function of bacterial processes
 - This applies to both surface and produced waters
 - Biocide application only delays this effect. The more persistent the biocide, the longer the delay

Golden Rule 4

- It is not possible to differentiate organics in a water matrix analytically
 - You can know most of the species of chemicals are there (this will be a very high number of different molecules)
 - You can know how much total organics are there
 - You can not know both (can get very close for ~\$50,000 per sample)

Golden Rule 5

- The EH&S consequences of not treating fresh water introduced to oil and gas formations are likely to be much more severe than the consequences of treating them over the life of a field
 - This is the basis of a 4 ppm limit on H₂S in gas transport

Golden Rule 6

- The chemical cost of not treating the water initially used will be significantly higher than the chemical cost of the initial treatment
 - This is not just in H₂S scavenging and control of MIC
 - The highest costs will be in eventual treatment costs of treating the produced water for re-use or disposal

Golden Rule 7

- Flow back is an engineering term, not a chemical one
 - The reason flow back water is black has more to do with the material in the formation, and very little to do with the chemicals added for the frac
 - Kerogen is the primary component of black flow back water
 - High molecular weight functionalized polymeric material will elute from the formation over the life of the well

Golden Rule 8

- Processing issues associated with produced water from tight gas formations have more to do with filterability than they have to do with particle size
 - Most PSD analyses relate PSD to filterability based on mineral solids, not organics
 - HMW organics in water change this relationship fundamentally
 - SDI measures filterability

Golden Rule 9

- The produced water associated with tight gas and oil formations is significantly harder to treat than it's appearance suggests
 - This effect is related to Rule 8
 - The fundamental design of produced water handling systems assumes water has a viscosity of 1
 - This is not necessarily true of produced water from systems that have used high volumes of water for fracs

Golden Rule 10

- Most standard analytical testing for oilfield produced water does not provide the data necessary to design efficient systems for treating this water
 - The closest analogue in industry is sewage treatment

Golden Rule 11

- Most of the issues with chemically treating water for use, re-use, or disposal relate to assumptions about the characteristics of water that are based on surface water for human consumption, not industrial application
 - Thus there are actually design considerations that are not taken into account in most system designs

Golden Rule 12

- There are no technical problems that can not be solved by the efficient application of effective resources.

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