TREATMENT OF UPSTREAM OIL & GAS WASTEWATERS PRIOR TO DISPOSAL INTO A CLASS IID WELL – MARCELLUS & UTICA SHALE PLAY

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IWC 16-10

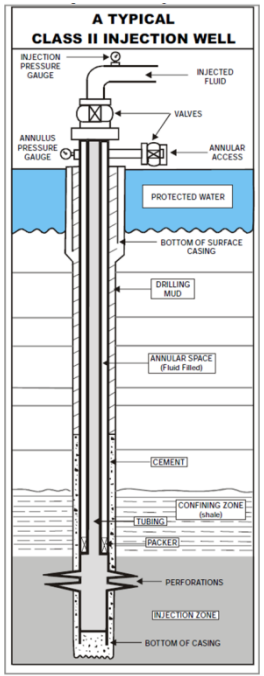
Introduction

- Sectors of O&G
  - Upstream / Midstream / Downstream
- Conventional vs. Unconventional
- Drilling Fluid Composition
  - WBM / OBM / SBM
- Flowback & Brine

Operational Mgmt. of Upstream Water

Class IID Injection Well

- Well Class Descriptions
  - I, II, III, IV, V, VI
  - State vs. Federal Regulated Program
- Operational Challenges
- Range of Cost
  - Industry Downturn



Recycle / Reuse

- Purpose for Recycle / Reuse
- Types of Systems

Operational Management…. Cont'd

Evaporation

- Designs
  - Falling Film / Plate / Forced Circulation Evaporators

- Technologies
  - Single or Multiple Effect Evaporation
  - Thermal or Mechanical Vapor Recompression

Photo Credit: Encon MVC 600 Evaporator

Typical Disposal Facility Design

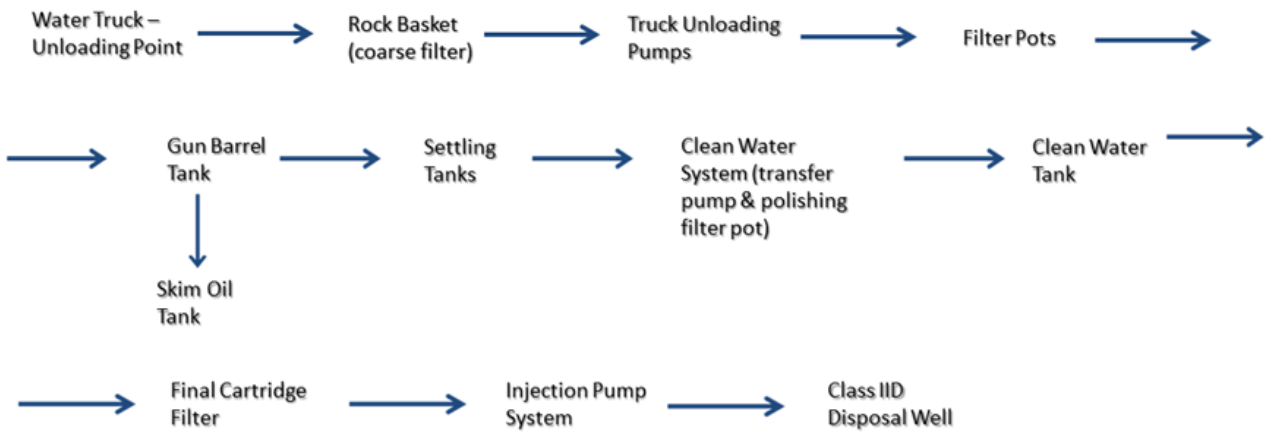


Figure 2: Process Flow Diagram of a Typical Saltwater Disposal Well Facility.

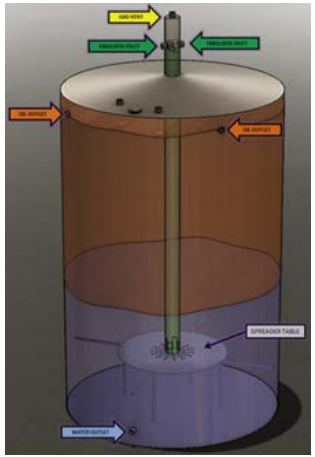


Figure 3: Diagram of a Typical Gun Barrel Tank. (Petrosmith, 2016)

Subsurface Wellbore Construction

Open Hole Well Bore Completion
- Define
- Most Typical for New SWD
- Increased inject-ability

Perforated Well Bore Completion
- Typical for converted production wells
- Challenges

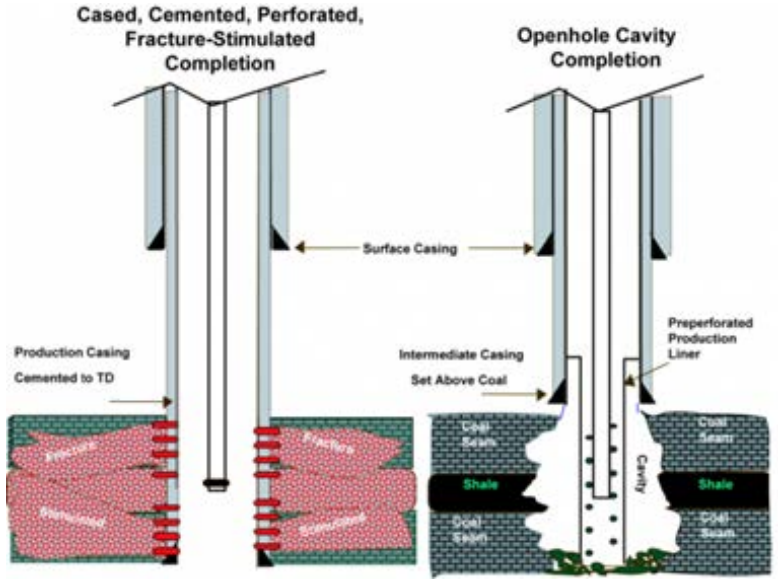


Figure 4: Example of Perforated Completion and Openhole Completion Methods for Production Wells. (PetroWiki, 2016)

Examination of Formational Water Chemistry

Water Quality

- Direction for Treatment Consideration
- Safe handling
- Costs to Treat

Success

- Qualified Lab!
- Testing Standard Parameters
- Modeling Software

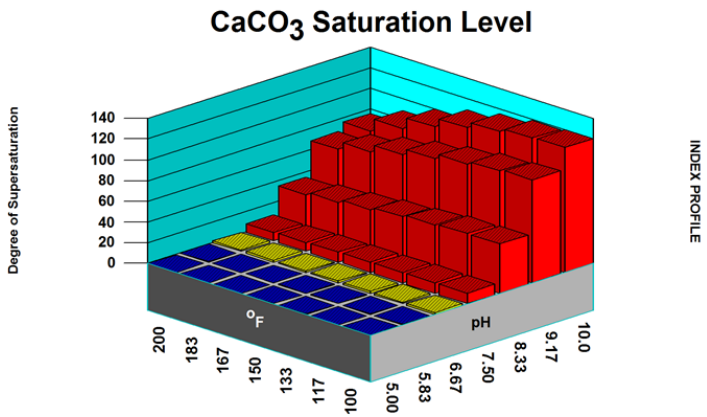
Evaluation:

Composite Sample of Influent Water

- Anion evaluation: P&M Alkalinity, Cl^-, SO_4^{2-}
- Cation evaluation: Ca^{2+}, Mg^{2+}, Ba^{2+}, Sr^{2+}, Fe^{2+}, Total Fe, B^{3+}
- pH, TDS, Viscosity, Specific Gravity, ATP, LSI
- Scale/Geochemical Modeling
- Microbiocide Efficacy Study
- Gel Break evaluation (if necessary)

Treatment Program Designs

Divalent Cation Precipitation Control



Scale Control

As Actives;

- 5-10 ppm phosphonate for carbonate based scale prevention
- 5-10 ppm PAA (3000 MW) for sulfate based scale control
- 5-10 ppm 60:40 AA/AMPS Copolymer for iron control

Treatment Program Designs… Cont'd

Microbiological Control

Microbiological Control

Efficacy Study;

- Sodium Hypochlorite
- DBNPA
- Glut/Quat
- Quat
- THPS
- TTPC

Application of Treatment Programs…Con’td

Emulsion Breakers

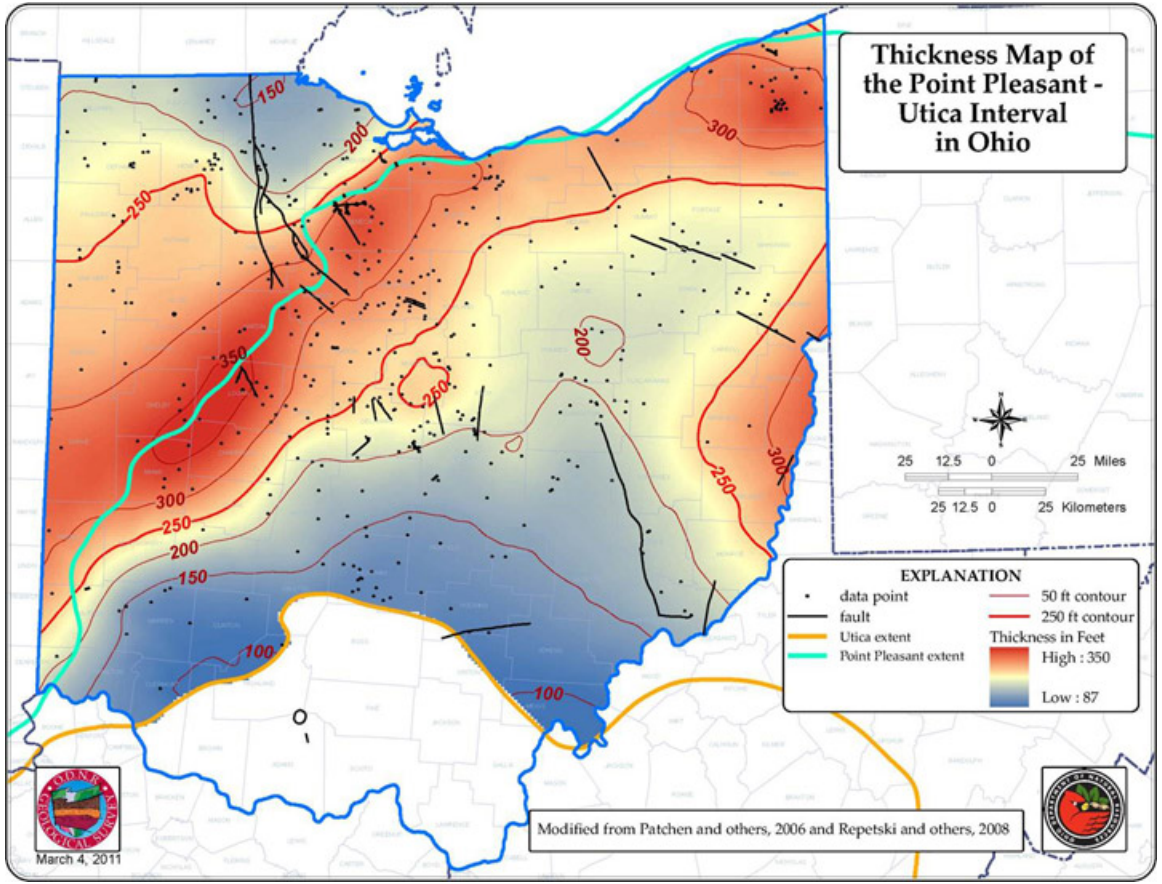
When the influent contains sufficient amounts of emulsified oil to collect and sell more oil and to protect the formation

Gels

Typically unbroken guar or FR (polyacrylamide). Citric acid or a ferrous iron source are suggested to be on location

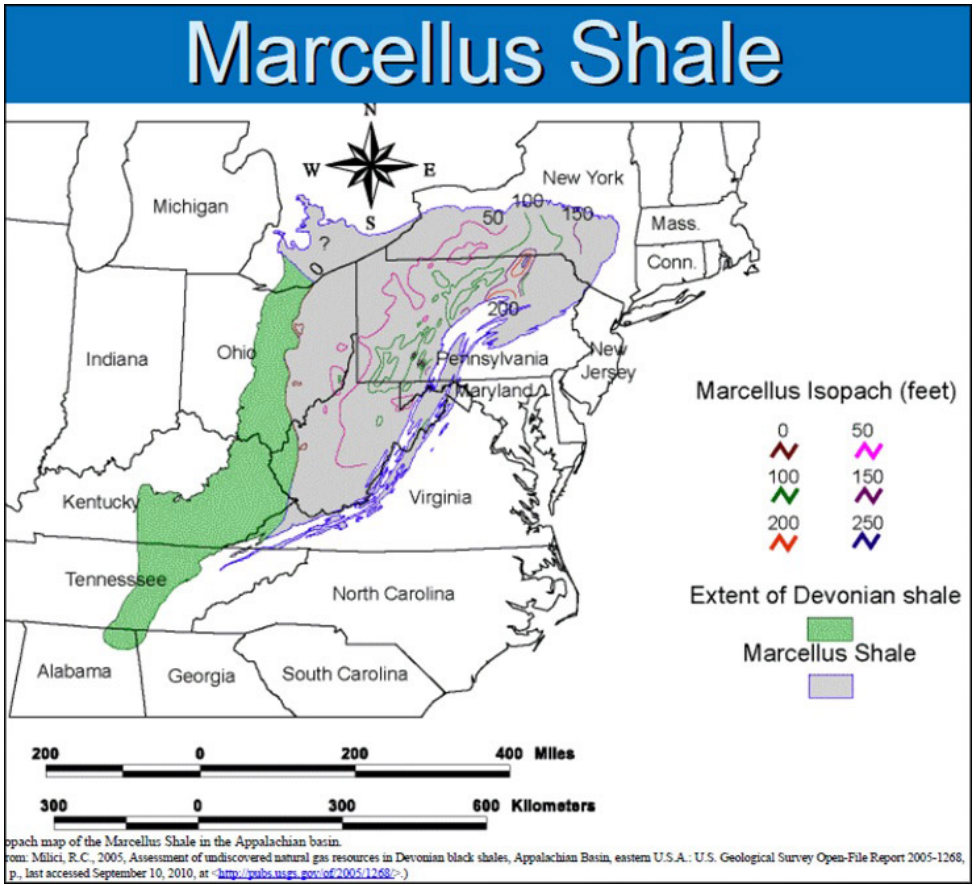
Case Study #1 – Utica Shale

- Flowrate – 3,000 BPD
- Influent water from conventional & unconventional wells
- Changed the feed point to below the oil layer on the receiving tank
- Automated biocide feed
- On-going influent water analyses
- Biocide efficacy
- Operator Training
- Citric acid back up



Case Study #2
– Marcellus Shale

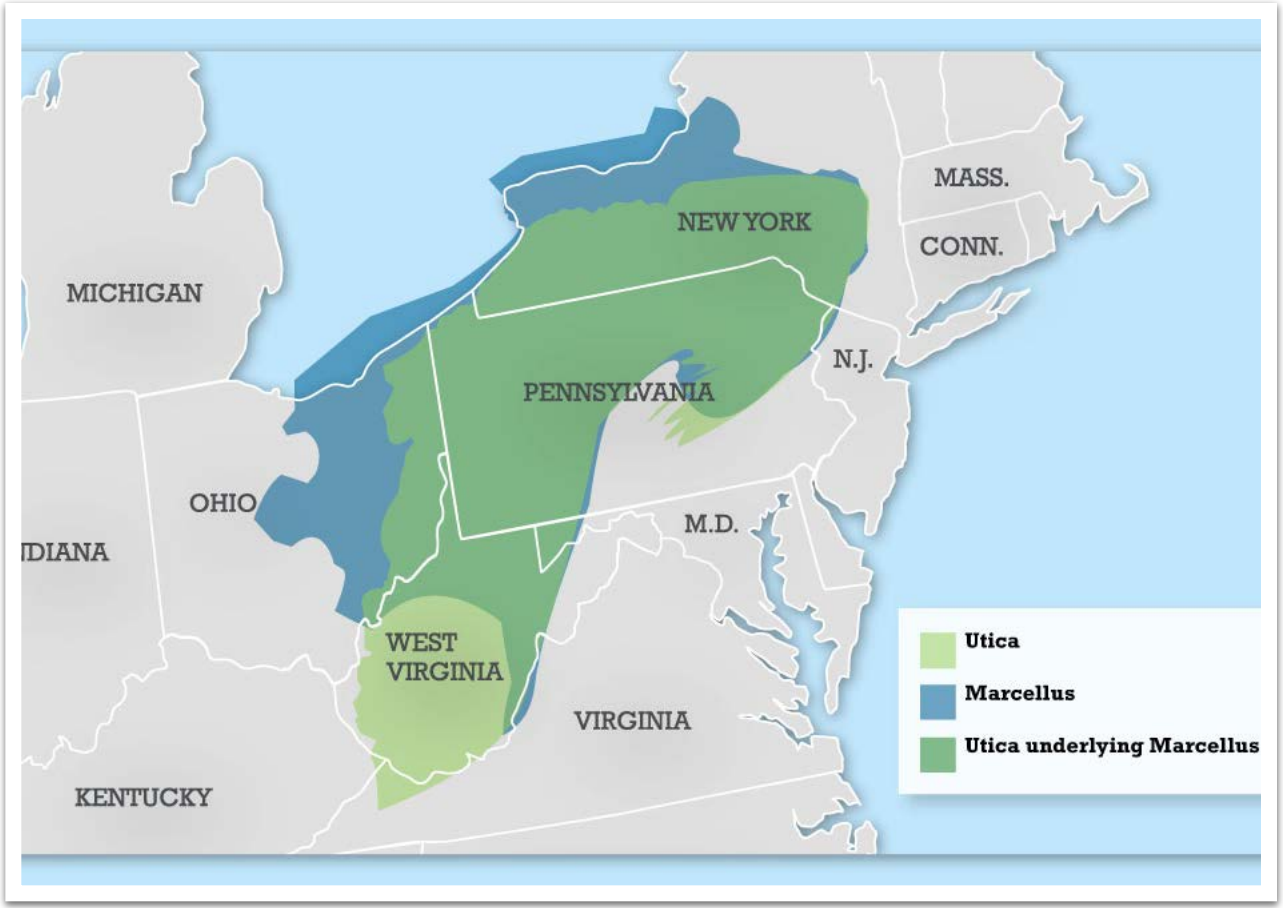
- Flowrate – 1,500 BPD
- Predominantly conventional wells
- Switched from slug to automation feed
- Changed feed points (biocide to influent and inhibitor to influent to the final injection pump
- On-going influent water analyses
- Biocide efficacy
- Operator Training
- Citric acid back up



opach map of the Marcellus Shale in the Appalachian basin.
rom: Milici, R.C., 2005, Assessment of undiscovered natural gas resources in Devonian black shales, Appalachian Basin, eastern U.S.A.: U.S. Geological Survey Open-File Report 2005-1268,
p., last accessed September 10, 2010, at <http://pubs.usgs.gov/of/2005/1268/>.)

Conclusion

- Variety of Treatment Schemes Available… Cost?
- Downhole reactions to the various treatment structures
- Treatment Scheme basis on shale play, O&G operator, and public optics



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Thank You – ANY QUESTIONS?