Purpose: Characterize current produced water reuse practices and future opportunities in unconventional plays by the upstream oil and gas industry
Module 2 - Objectives

• Describe produced water management practices, especially reuse, in upstream unconventional oil and gas operations;
• Gather data on produced water volumes, produced water quality, and reuse volumes;
• Describe the challenges and limitations of reusing produced water;
• Describe stakeholder opportunities to encourage produced water reuse;
• Compare practices in top producing unconventional play regions;
• Highlight water management innovations and emerging trends using case studies.
Module 2 – Selected Regions

Regional Summaries

A. Permian
B. Appalachia
C. Eagle Ford
D. Oklahoma
E. Niobrara/DJ
F. Bakken
G. Haynesville
Regional Comparisons: Oil & Gas Production

US Onshore Oil Production by Basin
- Permian: 45%
- Niobrara: 8%
- Haynesville: 1%
- Bakken: 17%
- Eagle Ford: 19%
- Appalachia: 2%
- Central OK: 8%

US Onshore Gas Production by Basin
- Permian: 15%
- Niobrara: 7%
- Haynesville: 13%
- Eagle Ford: 10%
- Bakken: 3%
- Appalachia: 42%
- Central OK: 10%
Regional Comparisons: Water used & Rig Count

Water Used in Hydraulic Fracturing for Top Basins/Regions

- Marcellus/Utica: 14%
- Bakken: 7%
- Niobrara-DJ: 11%
- Haynesville: 5%
- Eagle Ford: 16%
- Delaware Basin: 16%
- Midland Basin: 24%
- Central Oklahoma: 7%

US Onshore Rig Count by Basin

- Central OK: 14%
- Appalachia: 9%
- Bakken: 6%
- Eagle Ford: 10%
- Haynesville: 6%
- Niobrara: 5%
Produced Water Quality

- Expect water quality data from API coordination
- Other public produced water quality data is limited
Regional Summaries Include:

- Brief history
- Recent production chart
- GIS of well locations
- Summary of regional discussions
- Summary of reuse projects
Water lifecycle
Operational Challenges & Opportunities

- Transportation is critical factor
- Storage rules and practices vary
- Disposal well capacity varies greatly
Environmental (Challenges & Opportunities)

- Minimizing spills and leaks
- Remediation of spills
- Residuals management
- Air Emissions
- Wildlife
Regulatory and Legal Challenges and Opportunities

- Water ownership
- Reuse water reporting/tracking
- Produced water storage facilities (impoundments, large capacity tanks)
- Pipeline transport
- Site remediation standards
- Bonding and insurance considerations
Current and Evolving Trends and Business Models

- Multi-Company sharing & Midstream
- Potential Basin-to-Basin Produced Water Transfer
- Interest in Reuse Outside of the Oilfield

Trends in Water Management

- **Sourcing**
  - Fresh (↓)
  - Brackish (↑)
  - Reuse (↑)

- **Treatment**
  - Mobile Unit
  - Fixed Plant
  - Wellsite bacteria only

- **Storage**
  - Frac Tanks (↓)
  - Impoundments (↑)
  - Above-ground Storage Tanks (ASTs)

- **Transport**
  - Trucking
  - Permanent Pipelines
  - Temporary Lines

- **Disposal**
  - Saltwater Disposal Wells (↓)
  - Reuse in new Frac Wells
  - Reuse outside oil & gas
Overview of Findings

- Reuse varies by Regions
- Cost is the Key Driver for Water Management and Reuse
- Water Management and Water Reuse are Evolving
- Risks in Water Management and Reuse
- Midstream Solutions and Producers Cooperating
- Data on reuse is not widely available
- State Regulation Variations Impact Reuse Practices