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Enhanced Production Through Surface Facilities Sand Management

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Technical Director
Sand Management Options
Facilities Sand Management

Five-Steps of Sand Management
1. Separation
2. Collection
3. Cleaning
4. Dewatering
5. Transport

The One Slide to Stay Awake For Tech Paper References...
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Solids Production

All oil & gas wells produce sand.
• Now or at some point in future
• Especially with water breakthrough
• Small or large amounts and sizes

Know what comes out of your well.
What are Produced Solids?

Inorganic, Insoluble Particulate Material
- Not asphaltene, paraffin, wax, hydrate, or resin (organic)
- Not precipitates (soluble) or scale (non-particulate)
- Natural solids: from reservoir material
- Artificial solids: corrosion debris, proppant, junk, etc.

Primarily “sand” by classification
- ISO/Wentworth “sand” from 63-2000 microns
- Practical separation limit is 10 microns

Solid particles separable in facilities equipment
Sand Management Options

Don’t minimize production.

Cost (CAPEX + OPEX)

Facilities Sand Management

Maintenance “not a shovel”

Production Limits “moving target”

Completions “not complete”

Inclusionary

Exclusionary
Facilities Sand Management

Facilities: Surface/subsea equipment for separation and energy addition
Sand: Tiny loose pieces of rock
Management: Handle with a *degree of skill*

Not a waste stream exercise…
… but a critical Flow Assurance issue
Effects on Facilities

**Erosion**
- High velocity zones
- Chokes, pipe, valves, deoilers, etc.

**Collection/Filling**
- Low velocity zones
- Vessels, tanks, separators, float cells, etc.
- Creates corrosion zones where solids collect

**Interference**
- Instruments plugged, valve range of motion, seals, swivels, any small orifices or gaps

**Oil-in-Water (OIW) Content**
- Increases OIW concentration
- Stabilizes emulsions

Define what problem sand causes.
Where to Remove Sand?

Solve the right problem.

Wellhead Desanding

Wellstream Desanding

Solids Jetting

Produced Water Desanding

Cleaning, Dewatering & Transport

Node 1

Node 2

Node 3

Node 4
Five-Steps of Sand Management

1. **Separate**
   - Remove particles from fluid stream

2. **Collect**
   - Centralize and remove from process

3. **Clean**
   - Remove oil from sand

4. **Dewater**
   - Remove free liquids

5. **Transport**
   - Bring to disposal

Follow all the steps.
Step 1: Separate

Remove particles from fluid stream
- Dilute, dispersed particles in fluid (oil + water + gas)
- Solids must be separable
- Continuous flow process

Enhanced Separation
- Cyclonic: Multiphase (Wellhead) or Produced Water Desander
- Impact w/ Retention: Filters or Screens
- Flotation: Attached to oil droplets

Low Velocity Zones
- Bottom of production separator

Sand separation equipment is the smallest...
- ...compared to oil-water-gas separation

Focus on the methodology – not a piece of equipment.
Unit Process: Separation

Sand Filter
API 10K
Australia 2013

Wellhead Desander
API 5K
Malaysia 2012

PW Desander
ASME 150#
US GoM 1999
Step 2: Collect

Gather separated solids to central location
- Isolate from pressure and flow
- Minimize letdown points
- Remove from process without interrupting production

Minimize volume of fluids with solids
- Desander accumulator minimizes hydrocarbon ingress
- Jetting systems: large amounts of process fluids

Any vessel/tank - isolated, vented, and flushed
- Batch process
- Fill with clean water to aid cleaning and prevent packing/plugging
Unit Process: Collection

Wellhead Desander Acc.  
ASME 1500#, 600 liter  
Malaysia 2011

Wellstream Desander Acc.  
ASME 900#, 108 liter  
Turkmenistan 2011

PW Desander Acc. (integral)  
ASME 150#, 65 liter  
(Graphic)
Step 3: Clean

Remove adsorbed oil from surface of particle
  • Not H₂S, pyrophoric material, heavy metals, or NORM

Clean to meet offshore discharge
  • <1 weight% oil-on-dry solids (OSPAR spec)
  • Offshore cleaning systems use batch cyclone-recirculation loop
  • Specialized systems use chemicals, heat, and/or biological agents

Integrate cleaning action in all areas
  • Separation, collection, and transport
  • May eliminate need for specific cleaning station

Cleaned sand is easier to dewater and transport
Unit Process: Cleaning

Attrition Scrubbing System
Floating Barge
Venezuela 1997

Attrition Scrubbing System
Deepwater Spar
Malaysia 2014

Attrition Scrubbing System
Fixed Platform
Malaysia 2015
Step 4: Dewater

Removing free liquids associated with sand
  • Minimizes disposal volume
  • Up to 90% reduction in volume

Open (non-hazardous) dewatering
  • Liquids to open drain, sand/vapors open to atmosphere
  • Hanging dewatering bag

Closed (hazardous) dewatering
  • Liquids captured to closed drain, vapors captured to vent system,
    and solids not exposed to atmosphere or personnel
  • Screen-lined bin

Dewatering bag/bin also transport device
  • Combined step with transport
Unit Process: Dewatering

- Two-Stage System (Open): Desilter & Dewatering Bag, Malaysia 2011
- Enclosure System (Open): Dewatering Bin, Austria 2006
- DNV Transport (Closed): Dewatering Bin, Saudi Arabia 2013
Step 5: Transport

Disposal site determines route & method

Overboard discharge:
• Transported by pipe as a slurry to caisson

Landfill disposal:
• Transported in dewatering bag or bin to landfill

Slurry injection:
• Transported by pipe as a slurry to injection pump

Unique methods:
• Add sand to road surface mix
• Add sand to existing drill cuttings disposal
• Grind smaller size prior to injection disposal
• Bioremediation

Know where to put the sand.
Unit Process: Transport

- Slurry Injection Disposal Sand from PW System Australia 2007
- Dewatering Bag to Skip Transport Wellhead Desander System Malaysia 2011
- Dewatering Bin Transport Sand Jetting System Malaysia 2015
Collapsed Expandable Screens
Completion and FSM Approach

Separation

Collection

10 Wellhead Desanders
Retrofit into Well bay of Spar
Three-year Re-completion Work

Wellhead Desander, 1500#
Solids D98 = 16 micron
600 liter Accumulator

Piping header from Accumulators
Transport Slurry to Dewatering
Or to Cleaning Station
Continued (OTC-24705)

Cleaning

Recirculation Scrubbing
Design: 32 tons/day
<1 wt. % oil on sand

Dewatering

Four-Place Layout
Desilter – Bulk Removal
Dewater Bag – Final Removal

Transport

Piping header from Accumulators
Transport Slurry to Dewatering
Or to Cleaning Station
Do You Know Sand Production?

START HERE

• Sample Flow Stream
• Physical Analysis

Remove Sand upstream of choke?

NO

Remove Sand before separator?

NO

Remove Sand in separator?

NO

Remove Sand from Produced Water?

NO

Use Other Means

YES

Remove Sand before separator?

YES

Remove Sand before separator?

YES

Cyclonic Jetting

YES

Produced Water Desander

Disposal:
• Overboard
• Landfill
• Injection
• Other

Accumulator

Sand Cleaning (Optional)

Slurry Dewatering

Wellhead Desander

Wellstream Desander
The One Slide to Stay Awake For

All oil and gas wells produce sand.
1. Know what comes out of your well.
2. Don’t minimize production.
4. Solve the right problem.
5. Follow all the steps.
6. Focus on the methodology – not a piece of equipment.
7. Know where to put the sand!

Facilities Sand Management into initial system
• Add taps and blinds (and space) for future equipment
• Add place for sand to go – don’t choke system
• Ensure parts can have material upgrade in future
• Spares management can be a philosophy but not the best
1. SPE-27797: “Fluid Production Enhancement by Exploiting Sand Production”
2. SPE-63235: “How Can Sand Production Yield a Several-Fold Increase in Productivity: Experimental and Field Data”
3. SPE-28815: “The Separation of Solids and Liquids With Hydrocyclone-Based Technology for Water Treatment and Crude Processing”
8. SPE-72999: “Design and Installation of a Sand Separation and Handling System for a Gulf of Mexico Oil Production Facility”
9. OTC-24705: “Upgrade of Spar Topsides with Comprehensive Facilities Sand Management System”
10. SPE-56812: “Generalization of API RP 14E for Erosive Service in Multiphase Production”
11. SPE-66577: “E&P Waste Management in the Orinoco Delta”
Where to get more info?

Connect on LinkedIn

• Publish a FSM article each week on Tuesday (60+ so far)
• Material taken directly from FSM training course

Check out company website (www.eprocess-tech.com)

Get articles from OnePetro (www.onepetro.org)

Email me (hrawlins@eprocess-tech.com)

Take Facilities Sand Management two-day training course
Your Feedback is Important

Enter your section in the DL Evaluation Contest by completing the evaluation form for this presentation

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