

What to do with Produced Solids after Separation: Dewatering, Transport, and Disposal (D-T-D)

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Top 5 Technology Needs

- Seabed separation & disposal
- Integrated subsurface/surface
- Sand cleaning
- More case studies/examples
- Instrumentation

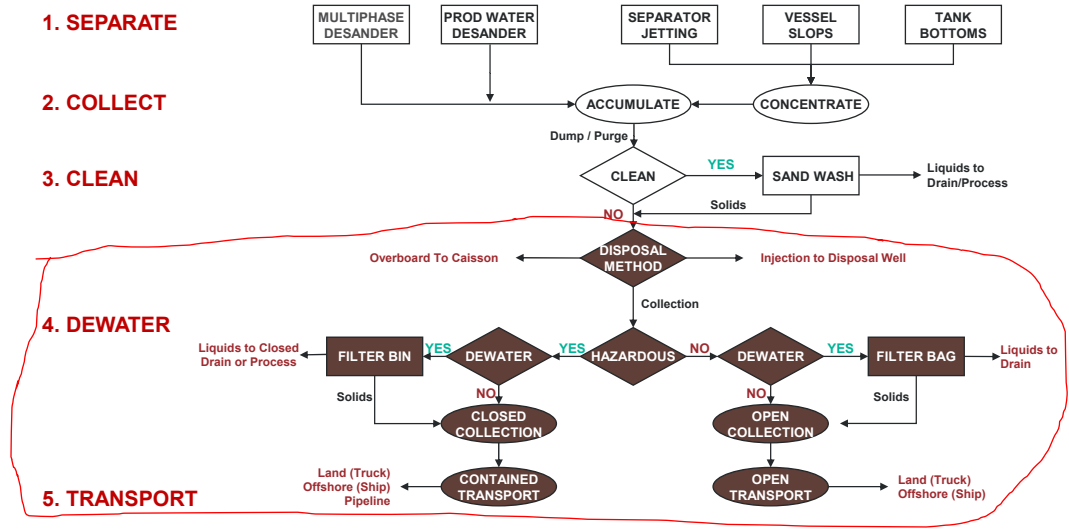
Facilities Sand Management

- Facilities:** surface/subsea equipment for separation, cleaning, and energy addition (e.g., wellhead to transfer)
- Sand:** tiny loose pieces of rock
- Management:** to handle or direct with a degree of skill

Not simply a waste stream treatment exercise
 ...it is a critical facilities flow assurance Issue

Objective of increasing / maximizing hydrocarbons production
 ...while reducing / minimizing operating costs

Solids Handling Methodology





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80/20 Rule for FSM Design

Primary goal: remove solids from the facility and properly dispose – without interrupting production

Improperly designed dewatering/transport/disposal (D-T-D) will congest the entire solids handling system

80/20 Rule

- 80% of the FSM system cost is the separation equipment
- 80% of the operation of FSM is the D-T-D method

All solids handling systems should be designed starting with identification of the proper disposal route



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Questions to Ask During D-T-D Design

Is the facility onshore or offshore?

Is the facility manned or un-manned?

If offshore, can the solids be disposed overboard?

Are hazardous contaminants present in the system?

- Gas: H₂S, BTEX
- Liquid: Mercury
- Solid: NORM

Are solids, such as drill cuttings, already being handled at facility?

What is the level of automation required?

- Fully automated systems can be designed, but with added price

How will solids be transported from separation to the disposal system?

What are similar facilities in the company or area already doing?

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D-T-D Definitions

Dewater: Remove free liquids (water) to minimize disposal volume

- Reduce the disposal volume by 90% and produce sand with <10 wt.% water
- Hanging mesh bags, screen lined bins, decanted drain box, etc.

Transport: Bring solids to disposal location

- Dependent on the facility location and disposal requirements
- Options: piping, transport skip/container, ship, truck, caisson, etc.

Disposal: Transfer custody of solids to another entity or location

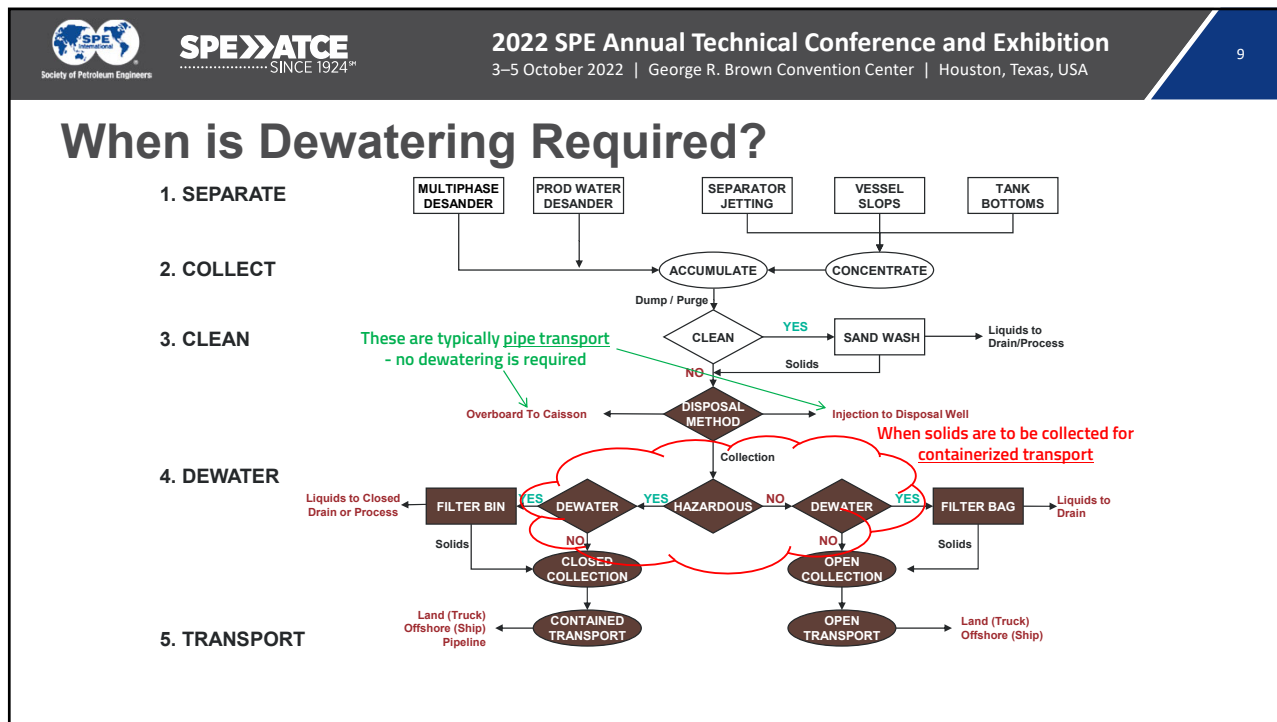
- Options: Overboard discharge, landfill, ship-to-shore, slurry injection, etc.

Slurry Sources: desander accumulator, filter backflush, separator jetting, sand cleaning system, or tank flush out

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Dewatering





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Transport



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Transport to Disposal

Final disposal site determines transport method

- Know where to put the sand

As slurry in piping

- To caisson for overboard discharge or to pump for slurry fracture injection
- Distance may be 3-100 meters

As dewatered sand in bin/bag

- To crane, fork truck, skip, ship, or transport vehicle
- Distance may be many miles

Commonly batch transport – even as slurry

- Match timing with transport of other solids/waste such as from drilling
- Match timing for ship-to-shore so some storage may be required

Transport Methods (examples)



2007 Chevron
Barrow Island Australia
Pipe to Slurry Injection




2011 Murphy
Kikeh Spar Malaysia
Dewatering Bag to Skip



2005 R.A.G.
GA Field Austria
Dewatering Bag to Truck

Disposal



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Solids Disposal Overview


Four main groups of disposal locations

- Landfill disposal
- Overboard discharge
- Slurry fracture injection (SFI)
- Unique methods

Regulations for specific contaminants is primary factor in route

- Oil: <1 wt. % oil-on-dry-solids for overboard discharge, but hydrocarbon level not critical for most landfill or SFI
- Heavy metals: requirements for overboard discharge and landfill but not a factor in SFI
- NORM: requirements for overboard discharge and landfill but not a factor in SFI

Determine environmental regulations for disposal as first step in design of solids handling system




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Transport Methods (examples)



2007 Chevron
Barrow Island Australia
Slurry Injection

Williston Basin E&P Landfill

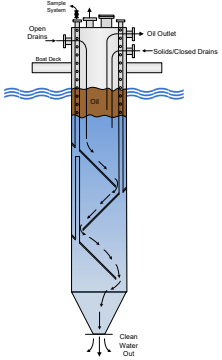
- Must be solid enough to walk on!
- No free liquids (paint filter test)
- <50 ppm Benzene
- <5 pCi/gm total Radium 226 & 228
- <5 pCi/gm Lead 210
- Any waste not meeting the RCRA E&P exemption is subject to testing - may include TCLP, BTEX, DRO, GRO, flashpoint, corrosivity and reactivity characteristics

Overboard Discharge

- Via sump caisson or skim pile
- Produced solids rarely covered
- No discharge in U.S. GoM
- OSPAR allows <1% oil on solids

Unique Methods

- Cold mix asphalt
- Add to drill cuttings
- Grind and inject
- Biodegradation





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D-T-D Key Items

1. Solids handling systems should start with identification of the proper disposal location
2. Dewatering is removal of free liquids from slurry to minimize disposal volume
3. Final disposal site determines transport method
4. Disposal in four main groups of locations – landfill, overboard, SFI, and unique
5. Environmental regulations concerning specific contaminants governs disposal route



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FSM Training (www.eprocess-training.com)

Module	Title
FSM-M1	Introduction to Facilities Sand Management
FSM-M2	The Nature of Solids
FSM-M3	Solids Handling
FSM-M4	Liquid Desander
FSM-M5	Multiphase Desander
FSM-M6	Wellhead Screen-Filters
FSM-M7	Separator Solids Removal and Cyclonic Jetting
FSM-M8	Sand Cleaning
FSM-M9	Solids Dewatering, Transport, and Disposal
FSM-M10	Subsea Sand Management
FSM-M11	Heavy Oil & Viscous Fluid Sand Management



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