Well clean-up directly to the FPSO

- Changing mindset and reducing costs

Girassol & Dalia cases

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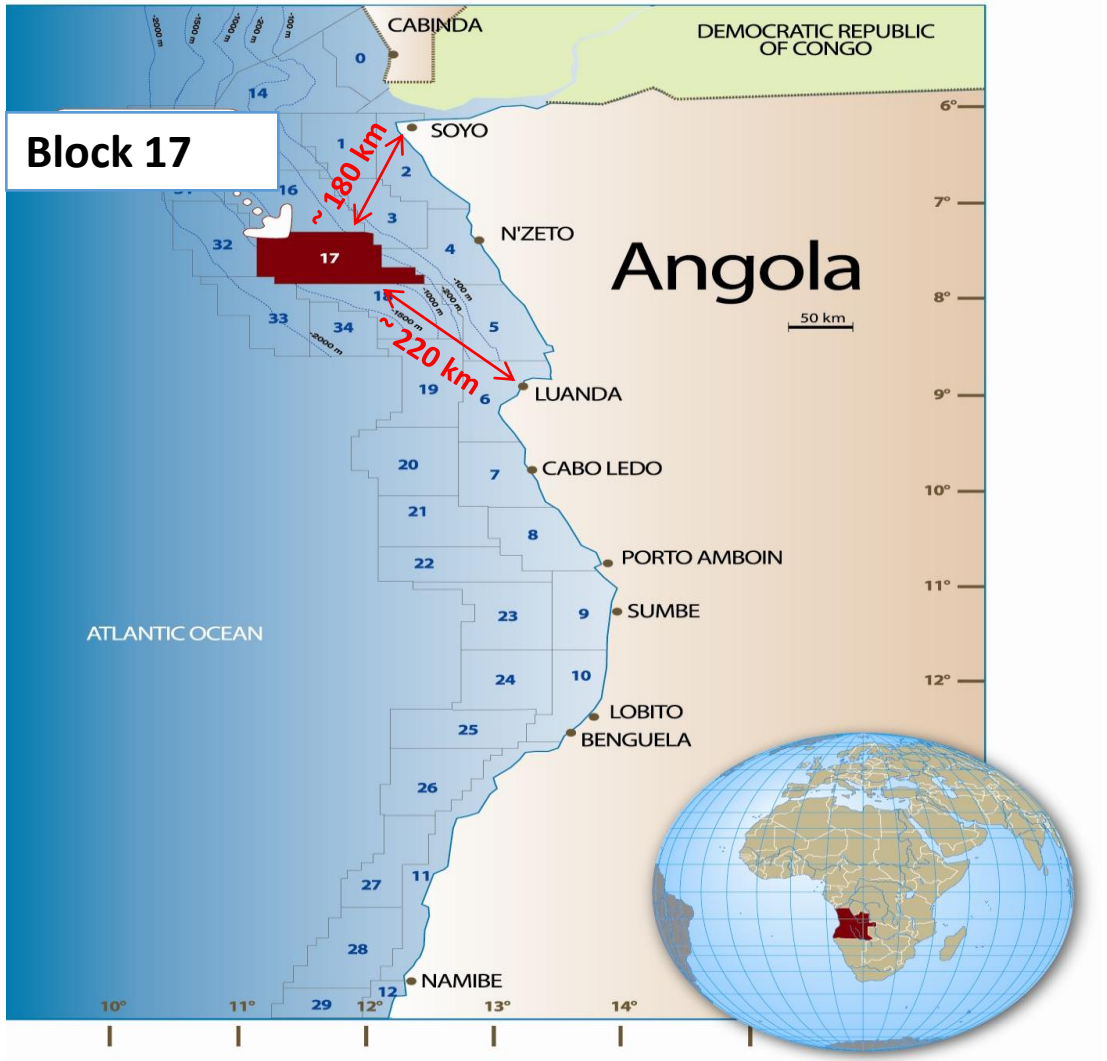
Rig versus well clean-up through FPSO

Conventional clean-up:

1. **Cost:**
   - Drilling rig
   - 3 to 5 days operation
2. **Environment:**
   - Effluent from well flared ➔ Carbon dioxide and methane emission
   - Risk of spill
3. **Weather (wind):**
   - extended operation duration
   - Impact on cost

Fields introduction



GIRASSOL

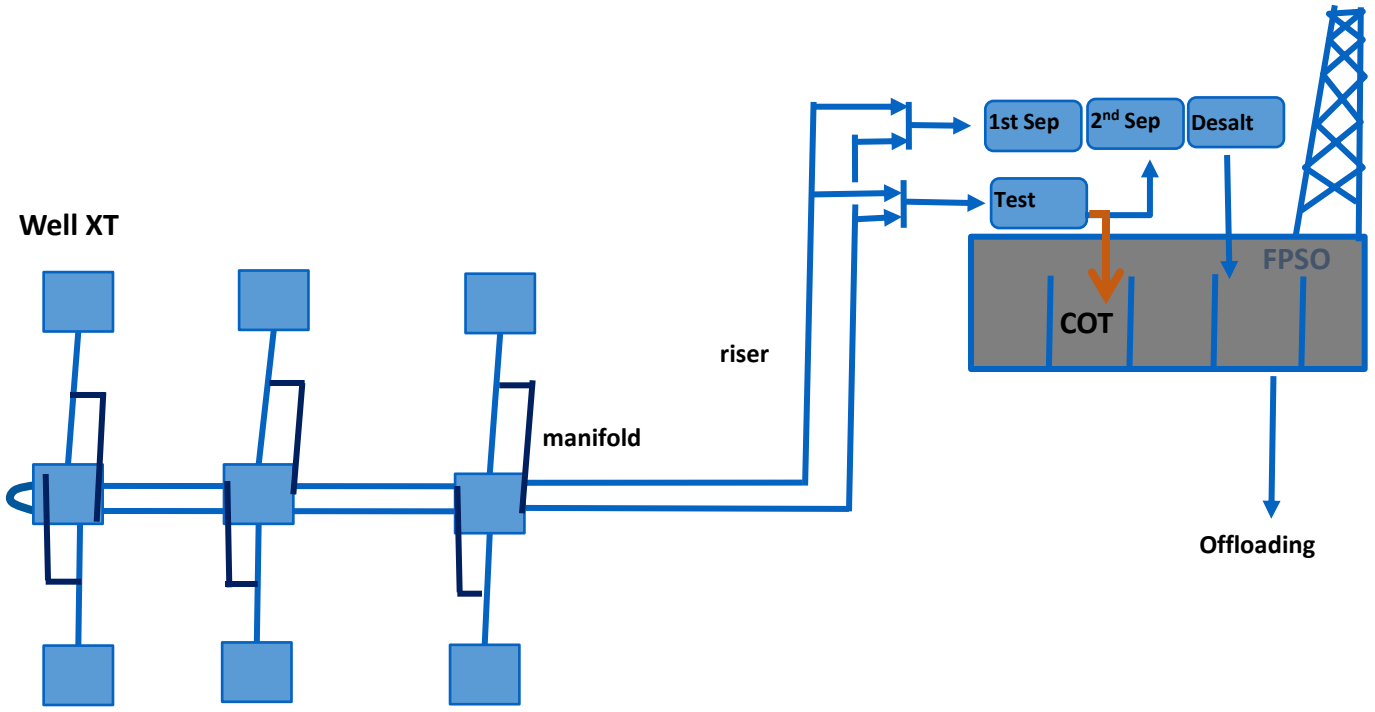
- **First oil:** 2001
- **Water depth:** 1250 m - 1400 m
- **Production wells:** 47
- **SPS:** Production loops and risers
- **Dimensions :** 300 m x 60 m x 31 m
- **FPSO Storage :** 12 COT's / 2.000 kbbl

DALIA

- **First oil:** 2006
- **Water depth:** 1300 m - 1500 m
- **Production wells:** 46
- **SPS:** Production loops and risers
- **Dimensions :** 300 m x 60 m x 31 m
- **FPSO Storage :** 12 COT's / 2.000 kbbl

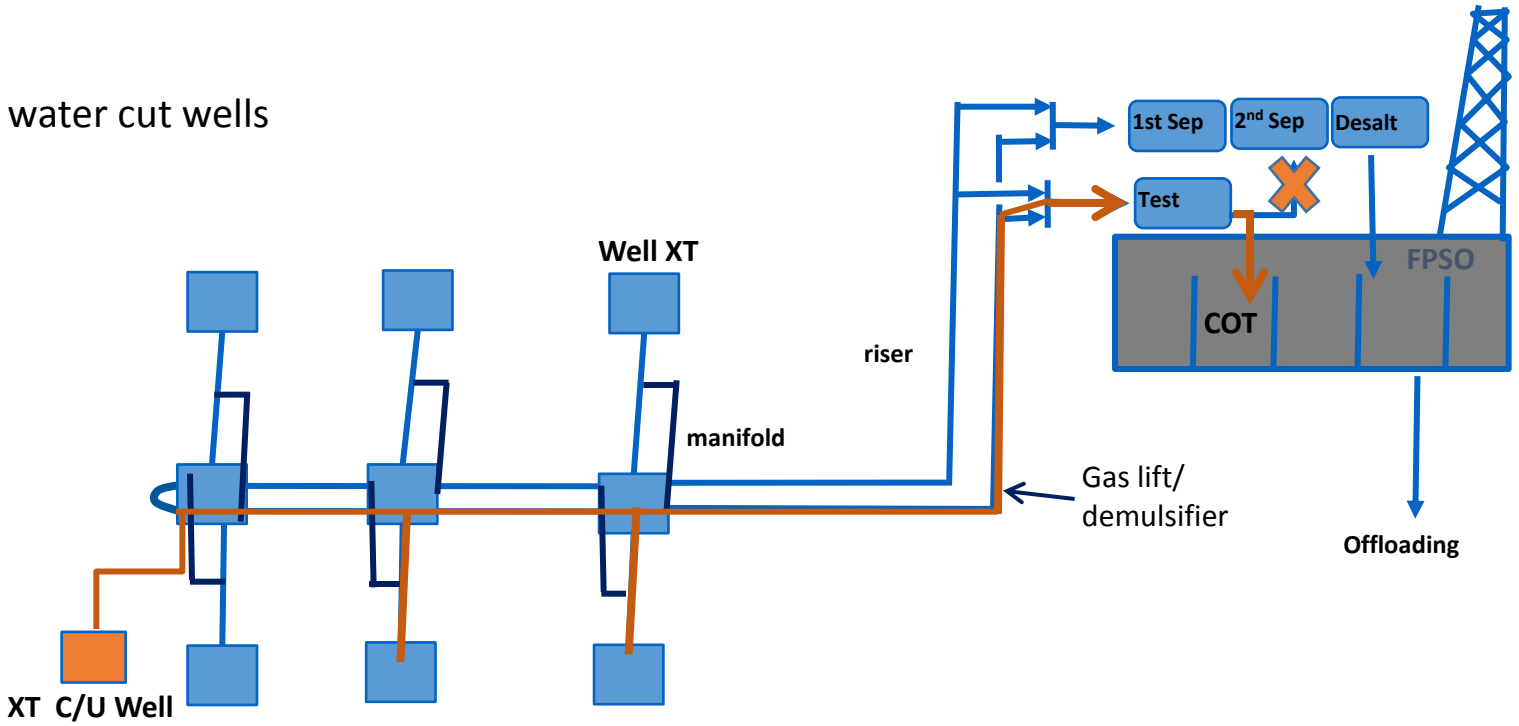
Well stream routing

- Wells ➔ Right or left riser
- Risers ➔ Main production header or test header
- Test separator ➔ Oil processing chain or directly to COT

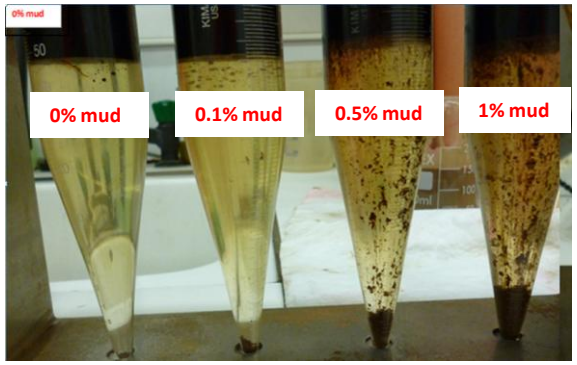


Well clean-up through FPSO

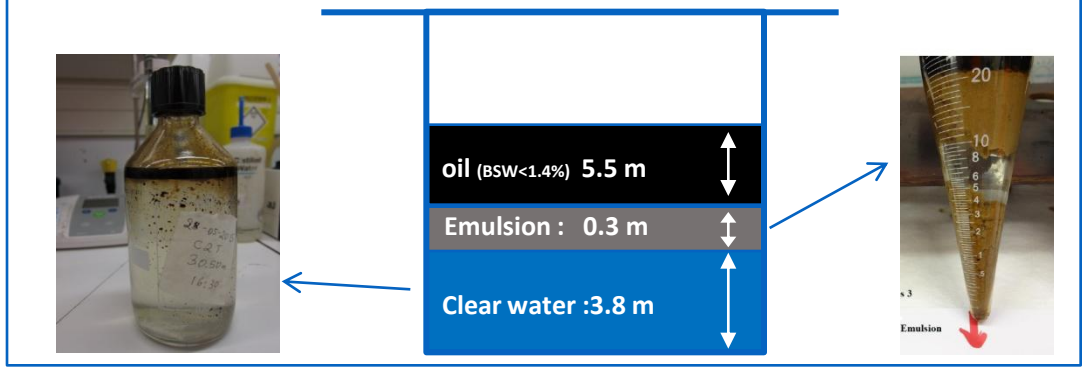
1. Subsea Flow assurance:
   - Commingle clean-up well clean-up with high water cut wells
   - Continue demulsifier injection
2. Production stability:
   - Topsides production segregation
   - Dedicated storage tank
3. Crude Oil specification:
   - Good settling
4. COT overpressure
   - Controlled flow / Minimized degassing



Lab tests



COT management



Results and conclusions

1. **Feasibility of well clean-up through the FPSO successfully Proved:**

   ➔ 12 wells have been cleaned

   ➔ Topside segregation is key for successful clean-up operation

2. **Environment impact reduced:**

   - Mitigated carbon dioxide and methane emission
   - Risk of spill minimized

3. **Cost saving:**

   - Above 50 M$ saved since 2014

4. **Earlier income (production availability):**

   - Not depend on rig availability
   - Duration of clean-up operation optimized. ➔ 2 days instead of 3–5 days with rig
   - Not dependent of weather (wind)