



## **Operations II**

# **The Use of DP Assisted FPSOs for Offshore Well Testing Services**

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## The Use of DP Assisted FPSOs for Offshore Well Testing Services



# Background

PEMEX Exploración y Producción (PEP), as well as other oil companies World Wide, face close scrutiny from environmental agencies, civil organizations, fishing industry and tourism, amongst others.

Oil spills are penalized by government agencies, and have a very strong impact, including image towards society.

# Background

During well completion, repair, stimulation and measurement, the emanating flow is a mixture of products that may be highly polluting to both air and sea if not disposed adequately:

- Crude oil
- Water
- Solids
- Gas
- Chemical products used for well stimulation

## Background

Due to the need to characterize the product, all fluids are received by well testing equipment, in many cases through portable separators and test devices.

Whenever reception and/or storage facilities are not available, the fluids are flared.

## Background

This situation is mainly observed during the exploration and termination phases of a well, and complicated by an additional problem:

**The lack of export pipelines or facilities to receive and process fluids**

# Background

When fluids are flared, there are three main problems:

## **Environmental**

- Air pollution
- Sea pollution, when flaring is not 100 %

## **Commercial**

- Flaring a commercially valuable product
- Fines

## **Public Image**

# Background

To avoid flaring, wells are serviced by means of portable equipment, or equipment on the mobile unit.

In such case, the oil companies need:

- The portable test equipment
- A supply boat to transport
- In many cases the drilling unit/vessel has to remain in location
- A bar/tug to dispose to shore all products

**This traditional approach may take 10-12 days.**

# Solution

PEMEX proposed a solution to this problem by incorporating systems and services that would:

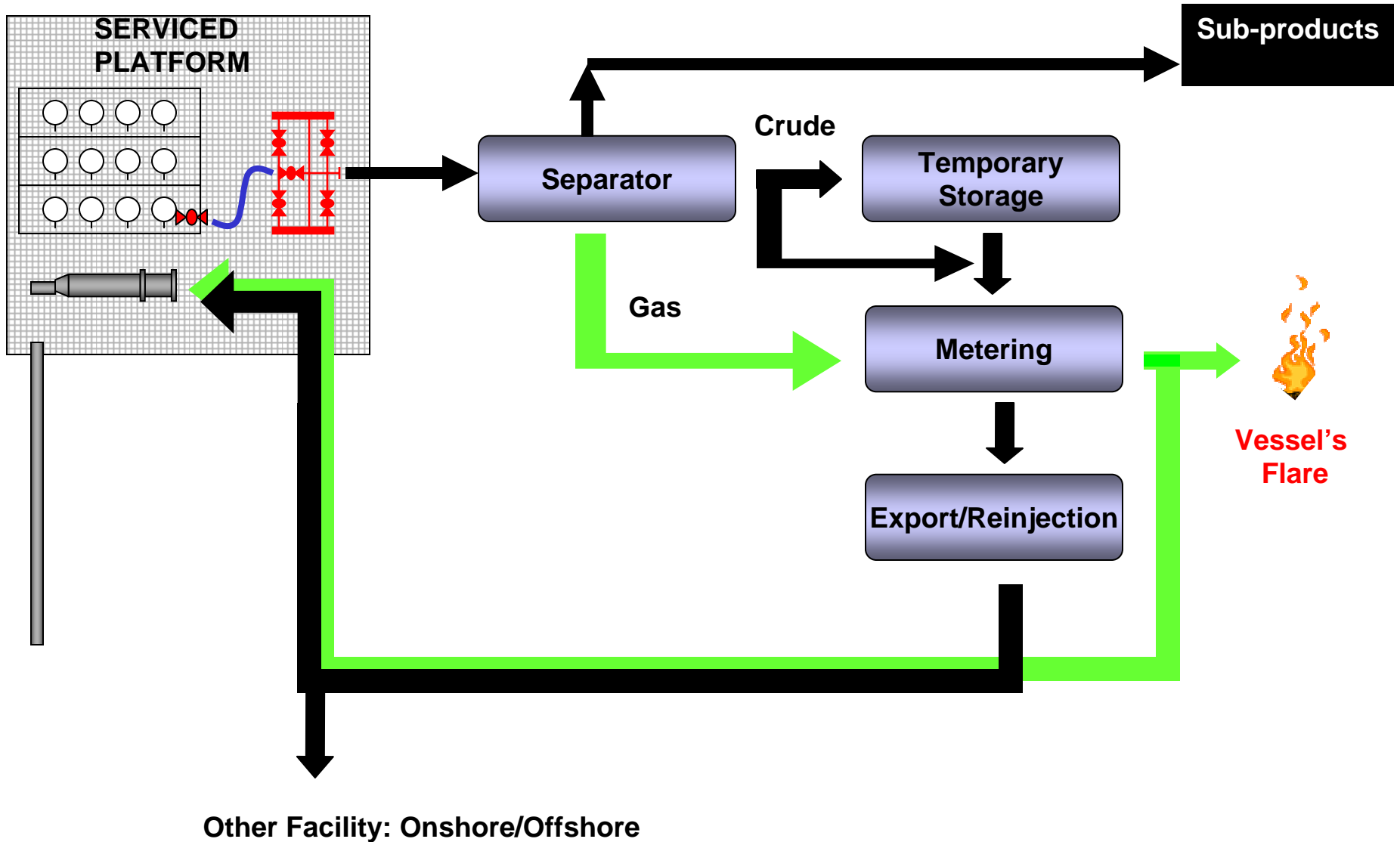
- Process and characterize production
- Minimize environmental damage
- Recover oil and gas (in particular situations)

## Description of Service

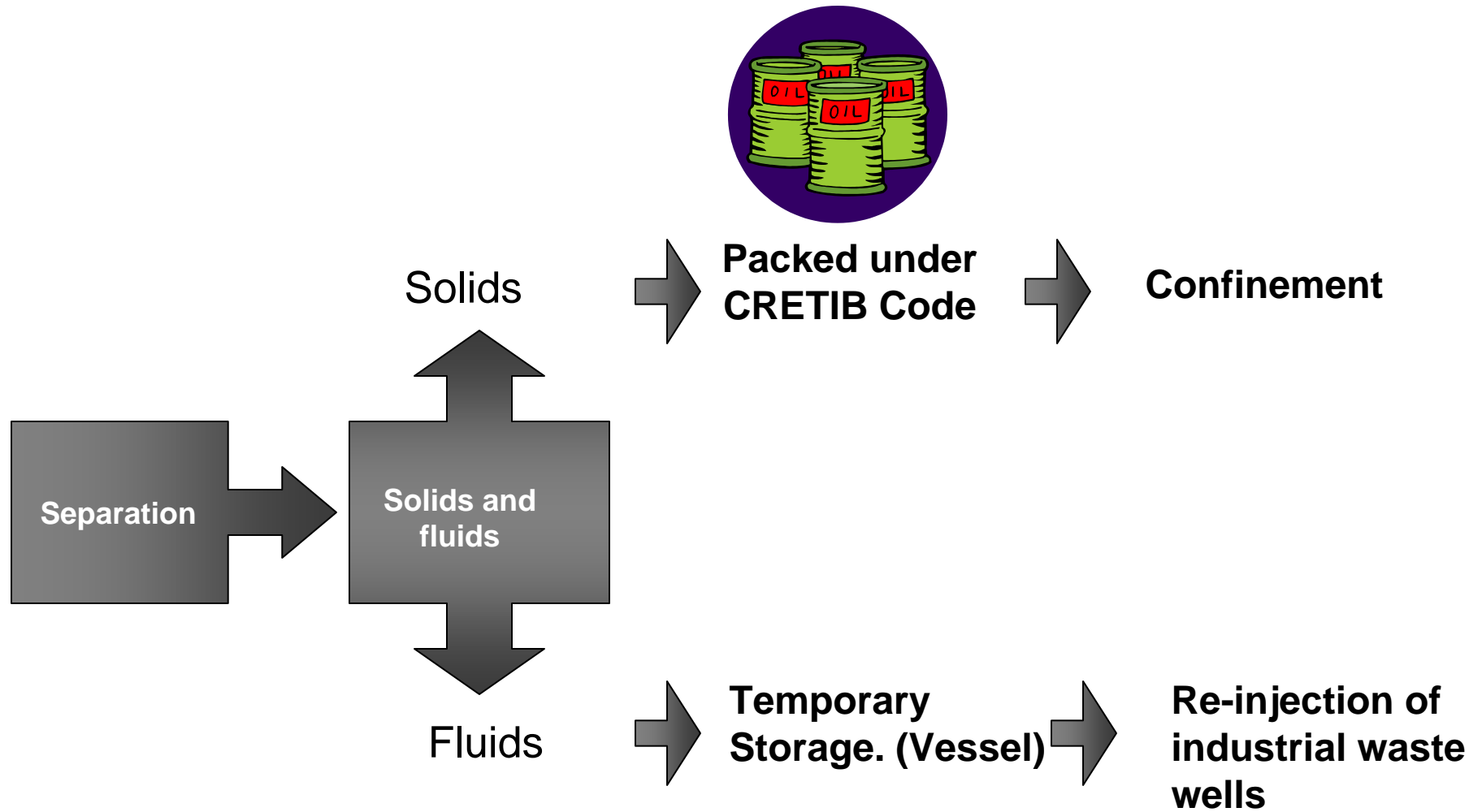
The idea was to incorporate a vessel to receive and process fluids from:

- a. Well repair, completion and stimulation (well induction and cleaning)
- b. Well measurement
- c. Provide service to water producing wells
- d. Provide production services during facilities maintenance
- e. Provide service to gas producing wells

# Simplified Flow Diagram



# Sub-Products



## Ecological Vessel “Cora”

In 1997 the first of these vessels, the “Cora”, began operations.

The vessel was characterized by PEMEX as an “Ecological Ship” and served them until the end of 2003.

# M/V "Cora"



It served PEMEX for Seven (7) years, attending more than 800 locations from 1997 to 2003.

It has been decommissioned

## Present Solution

To replace the Cora, and to improve the services, PEMEX awarded two-four year contracts for the following vessels:

**FPSO-DP2 Toisa Pisces**

**FPSO-DP2 Bourbon Opale**

Both contracts were awarded to Marecsa via International Public Tenders.

# Class and Service Requirements

## **Main requirements were:**

Classification from a member of the IACS:

- FPSO “Floating, Production, Storage and Offloading”
- Dynamic Positioning DP-2 or equivalent
- Certified helideck. Bell 412 or larger
- Double hull

Automation for the following systems (minimum)

- Engine Room
- Process Control (PCS)
- Fire and Gas (F&G)
- Emergency Shutdown (ESD)

# Product Characteristics

**Products to be returned to PEMEX must have the following characteristics:**

- **Crude Oil**
  - % Water: 2% Maximum
  - Salt in crude: 25.0 lb/MBbl
  - Sediments: 0.5 % in weight
- **Gas**
  - Separation for re-injection to process or flaring
- **Oily water/ chemical products**
  - pH: 6 – 8
  - Solids: smaller than a 100 Microns
- **Solids**
  - Storage to CRETIB Code and disposal to confinements

# FPSO – DP2 “TOISA PISCES”

Length:	103.50 m	Breadth:	23.20 m
Depth:	9.10 m	Autonomy:	40 days
Speed:	14.0 knots	L. Quarters:	70
Flag:	Liberia	Year:	1997/2004



# Production System. Toisa Pisces

- Production System: 20,000 BPD
- Gas: 36.00 MMSCFD
- Oily Water: 4,200 BPD
- Crude density range: 14 a 43<sup>o</sup> API
- Design: NACE (H<sub>2</sub>S)
- Max. Temperature: 130<sup>o</sup> C
- Max. Pressure at Wellhead: 10,000 psi
- Process Pressure: 1,412 psi
- Storage: 24,000 bbls

# Main Deck. Export and Re-injection Pumps



# FPSO-DP2 “Bourbon Opale”

Length:	90.70 m	Breadth:	18.80 m
Depth:	7.60 m	Autonomy:	40 days
Speed:	14.0 knots	L.Quarters:	54
Flag:	Mexico	Year Built:	2004



# Production System. Bourbon Opale

- Production System: 15,000 BPD
- Gas: 27.00 MMSCFD
- Oily Water: 2,800 BPD water
- Crude density range: 14 a 43<sup>o</sup> API
- Design: NACE (H<sub>2</sub>S)
- Max. Temperature: 130<sup>o</sup> C
- Max. Pressure at Wellhead: 10,000 psi
- Process Pressure: 1,412 psi
- Storage: 10,500 bbls

# Process Deck



# Results to Date “Toisa Pisces”

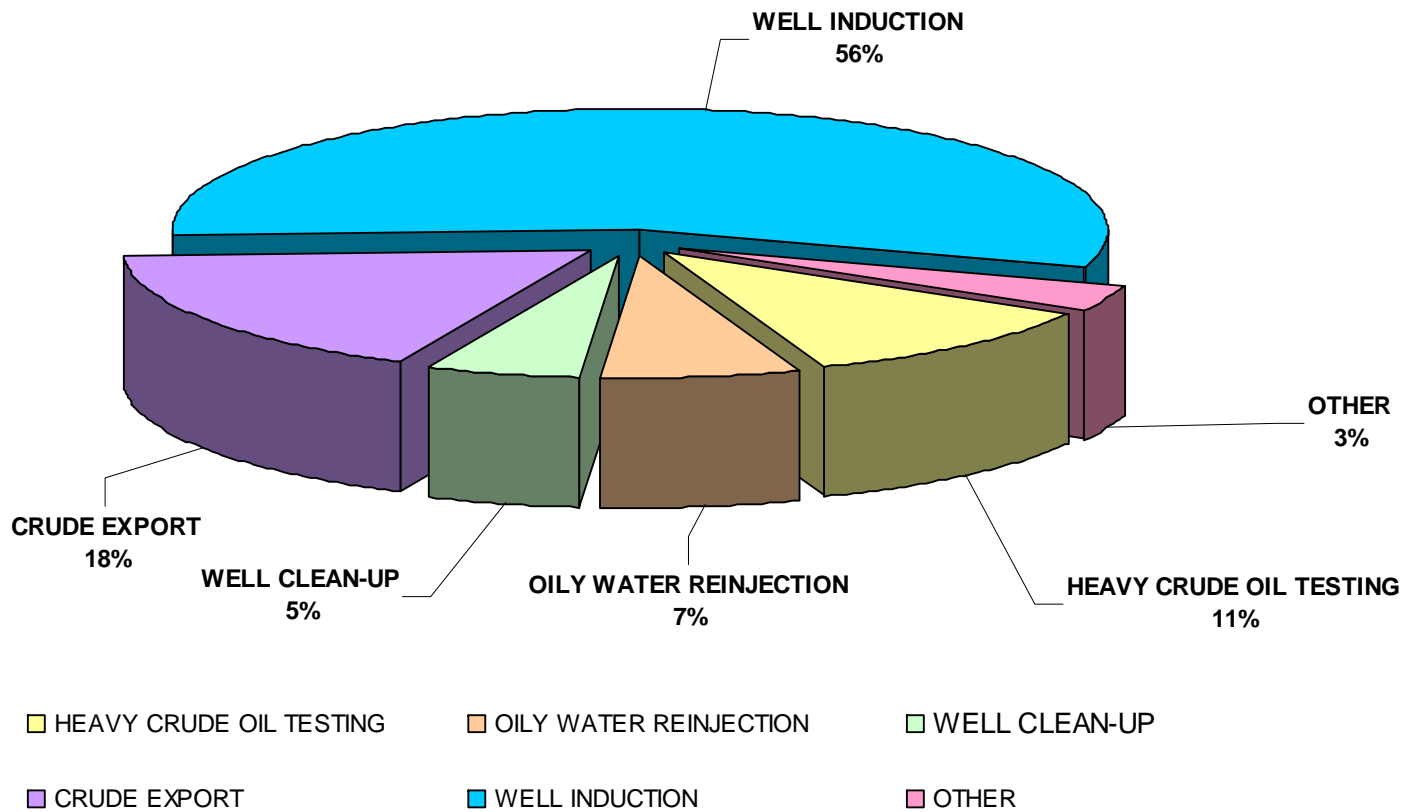
Results: March 2004 – September 2005

<b>TYPE OF SERVICE</b>	<b>TOTAL NUMBER</b>
HEAVY CRUDE OIL TESTING	23
OILY WATER REINJECTION	14
WELL CLEAN-UP	11
CRUDE EXPORT	36
WELL INDUCTION	114
OTHER	7
<b>TOTAL INTERVENTIONS</b>	<b>205</b>

# Results to Date: "Toisa Pisces"

## SERVICES PROVIDED BY THE VESSEL " TOISA PISCES "

Period: March-04 to September-05



## Results to Date "Toisa Pisces"

<b>Comissioned:</b>	<b>March 2004</b>
<b>Operations :</b>	<b>99.0%</b>
<b>Down time due to weather:</b>	<b>6.2 %</b>
<b>Average time per location/service:</b>	<b>3.5 days</b>
<b>Crude oil recovered:</b>	<b>218,000 bbls</b>
<b>Oily water recovered/reinjected:</b>	<b>75,000 bbls</b>

# Results to Date “Bourbon Opale”

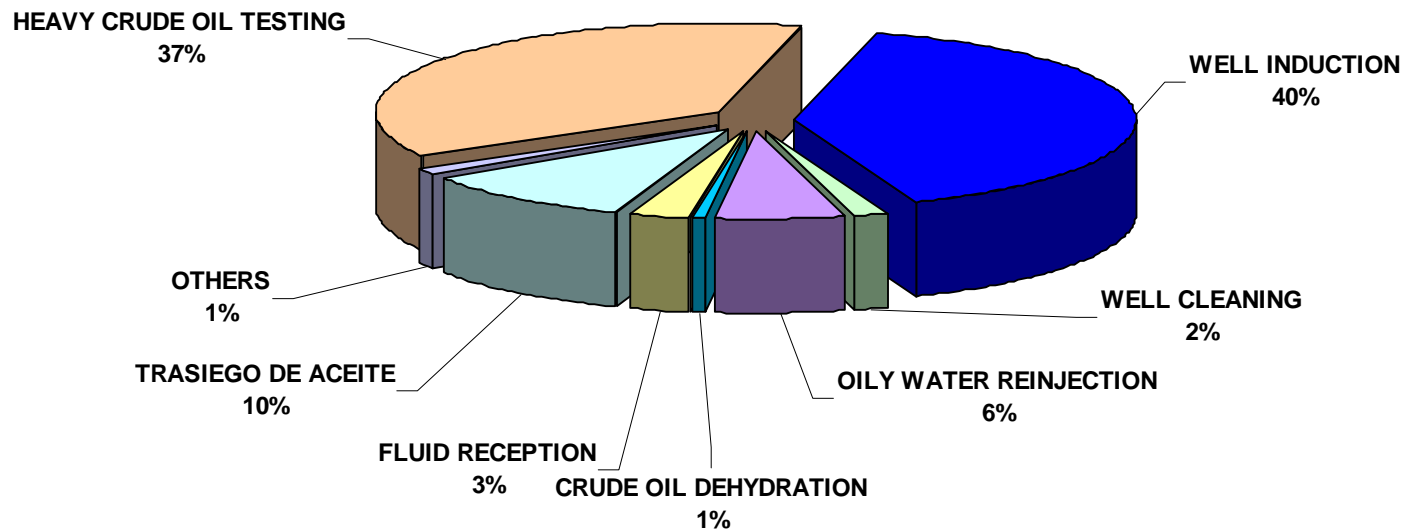
**Results: July 2004 – September 2005**

<b>TYPE OF SERVICE</b>	<b>TOTAL NUMBER</b>
HEAVY CRUDE OIL TESTING	71
WELL INDUCTION	77
WELL CLEANING	3
OILY WATER REINJECTION	12
CRUDE OIL DEHYDRATION	1
FLUID RECEPTION	5
CRUDE OIL EXPORT	20
OTHERS	2
<b>TOTAL INTERVENTIONS</b>	<b>191</b>

# Results to Date: Bourbon Opale

## SERVICES PROVIDED BY THE VESSEL " BOURBON OPALE "

Period: July-04 to September-05



HEAVY CRUDE OIL TESTING

WELL INDUCTION

WELL CLEANING

OILY WATER REINJECTION

CRUDE OIL DEHYDRATION

FLUID RECEPTION

TRASIEGO DE ACEITE

OTHERS

## Results to Date “Bourbon Opale”

<b>Comissioned:</b>	<b>July 2004</b>
<b>Operations :</b>	<b>99.0%</b>
<b>Down time due to Weather:</b>	<b>6.8 %</b>
<b>Average time per location/service:</b>	<b>2.5 days</b>
<b>Crude oil recovered:</b>	<b>215,000 bbls</b>
<b>Oily water recovered/reinjected:</b>	<b>79,000 bbls</b>

# Results

**The average time for well service/testing has been 3.0 days.  
Equivalent to 10-12 services/month/vessel**

**The average on the traditional approach would be 10-12  
days/service. Equivalent to 3 services/month**

**Contracts will end in 2008, and the vessels are expected to  
provide repeated service to PEMEX**

# Results

**Vessel cost: \$ 2.50 US/barrel of Installed capacity/day**

**Considering a 3 days average for a well test, service, including fluid reception would be in the order of 150,000 USD/Service**

**Traditional approach, including the Mobile Unit, tug-barge for product disposal, portable test equipment, etc., may be in the order of 600,000 USD/Service.**

# The Future

**In addition to the well service presently provided, these units may be used for the production at marginal or remote fields**

**It is expected a larger demand of these type of vessels for the offshore production services.**

**As the field decline, the advantage of DP assisted FPSO will become even more evident.**

**The cost per barrel, compared to the installation of expensive sub-sea pipelines will show further benefits**

# Questions?

## Contact

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