Asset Integrity Services for Water Injection by means of OSIsoft Connected Services

Presented by VEOLIA SBM OFFSHORE servelec controls

About Our Companies

VEOLIA

- Global leader in Resource Management Listed on Paris Euronext: VIE
- Veolia provides a complete range of services required to design, build, maintain and upgrade water treatment systems
- ~€20b Revenue
- VWS Westgarth a Veolia BU specialising in Upstream Water Treatment
- 165,000 employees globally

SBM OFFSHORE

- Market Leader providing floating production solutions to the offshore energy industry, over the full product life-cycle.
- Employs approximately 4,750 people spread over five regional centers, ten operational shore bases and offshore fleet of vessels
- Listed on Amsterdam Stock Exchange

servelec controls

- Market leading independent systems integrator, specialising in industrial control, safety and real-time information systems
- OSIsoft Select Partner with accredited OSIsoft specialists
- 600+ employees across Servelec Group
- Listed on the London Stock Exchange

OSIsoft Select Partner

What Does SBM Do?

Operation

14 FPSOs
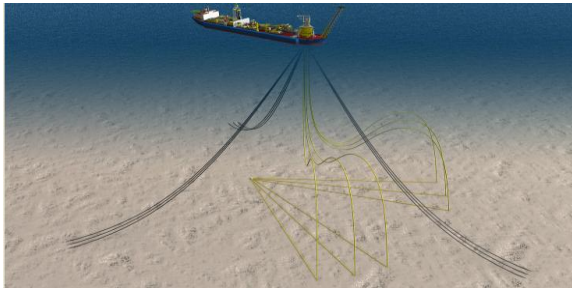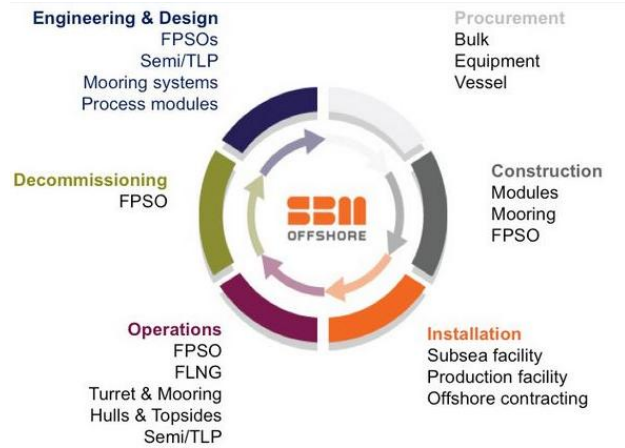
o **World's largest FPSO fleet**

> 1 Million bbls/d oil

o **Global span**

Gulf of Mexico, Brazil, West Africa and Southeast Asia.

o **Clients**

Shell, Exxon, Petrobras, ENI

o **Contractual quality / quantity**
 Oil, Gas, Water Injection Target

Seawater Treatment and WI Healthcare

Context

- Sulphate removal and solids removal to prevent reservoir souring and blockage
- Constant attention required for optimization of cleaning procedures and chemicals
- Good data + specialist input is critical

Traditional Veolia x SBM Models

- Offshore Representative else
- Onshore Support without RM&D

Modern Veolia x SBM Model

- Hybrid Onshore / Offshore Support with real-time information
- Enabled by PI Cloud Connect
- Started after OSIsoft UC 2015, today all units connected under new healthcare

Business Drivers for SBM

BALANCING CONFLICTING DRIVERS

- **Cost** — • Optimized Vendor Healthcare Cost
- **Revex** — • Meet Contractual Water Injection Targets
- **HSSE** — • Remoting – minimise offshore personnel
- **People** — • Leverage external expertise
- **Client** — • Enhanced Oil Recovery
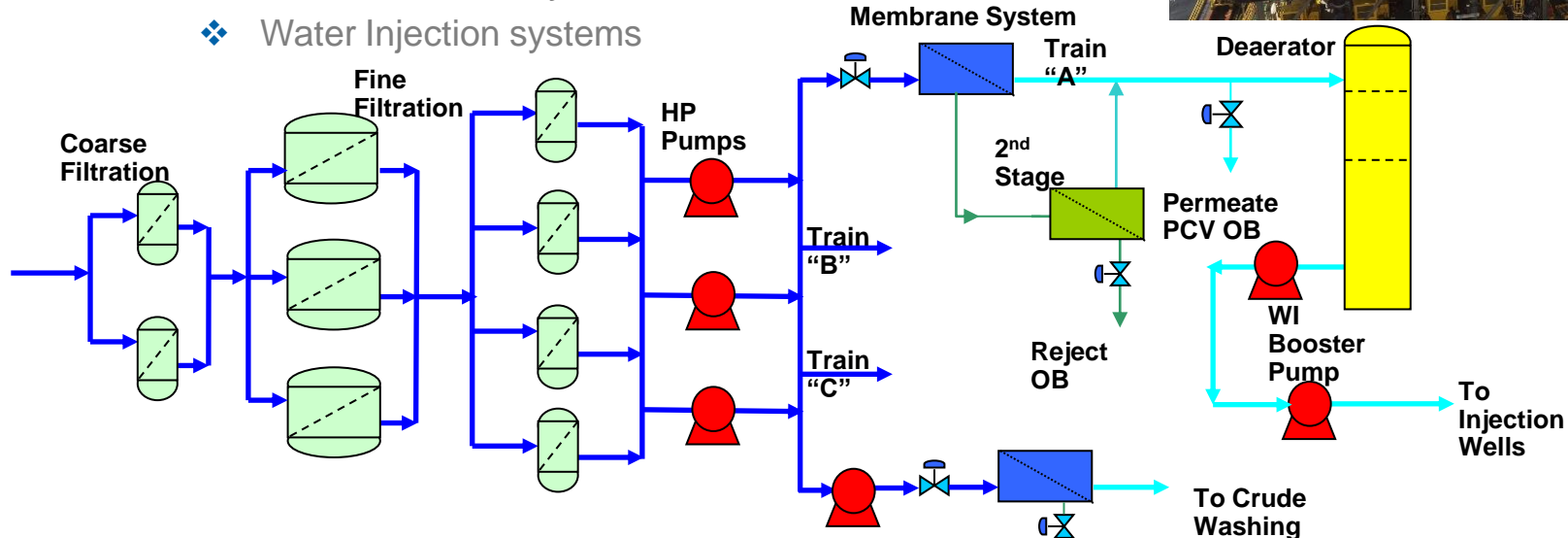- **Sustainability** — • Feedback to the product lifecycle

Veolia in the Upstream O&G Market

FPSO topside Water Treatment Modules:

- ❖ Pre- Filtration systems
- ❖ Sulphate Removal Membrane Systems
- ❖ SWRO Membrane Systems
- ❖ CIP system
- ❖ Produced Water systems
- ❖ Water Injection systems

Why the need for membrane processes offshore?

Reservoir Specific

- Injection / Water Flooding with low sulphate seawater (scale limitation)

- Injection / Water Flooding with low salinity seawater (polymer flood)

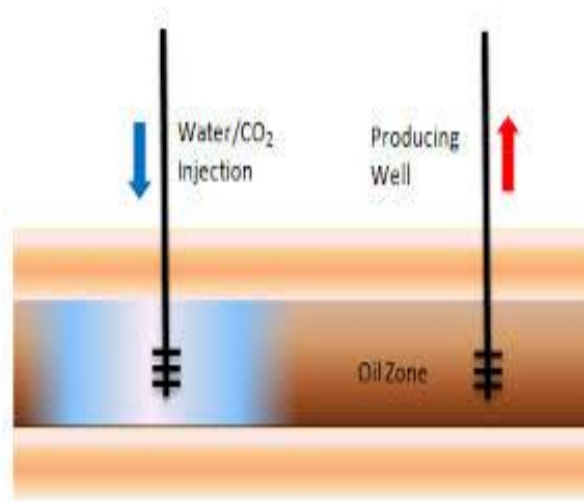- Demanding reservoirs with tight injectivity requirements

SEAWATER INJECTION

Scales (e.g. Barium Sulphate)

Other Precipitates

Souring Potential

Contributors of water injection losses:

KEY FACTORS:

❖ High levels of crew changes on-board (loss of knowledge retention)

❖ No dedicated / trained personnel for the water treatment systems

❖ Highly complex water chemistry knowledge required for optimum efficiency of water injection production, which correlates to **OIL** production.

❖ Nanofiltration membranes should be operated per recommended guidelines

❖ Maintenance required for assurance of availability.

❖ NF membrane CIP procedures need to vary per membrane aging and fouling

❖ Impact of chemical product degradation, once offshore

❖ Demand for POB reductions

❖ Demand for SMARTroom operation onshore

Seawater Treatment for Water Injection, can be problematic and cause reduced oil recovery over time!

CRITICAL NEED TO OBTAIN LIVE DATA AND UTILISE THE DATA TO PROVIDE A SERVICE SOLUTION

Why Veolia needed to change Service support to a digital platform:

Historic Issues:

- *Obtaining data from offshore assets, as a time frame (per month)*
- *Loss of time to bring the data packet onshore*
- *Register the data input in our doc control system*
- *Convert the data into Microsoft Excel format*
- *Issue data in Excel to Process support team*
- *Manipulate data in Excel and run macros to establish monthly data charts*
- *Produce Microsoft Word reports and insert graphs*
- *Internal approval of reports*
- *Issue report to doc control*
- *Publish performance reports to clients*

**Time frames were up to 8 weeks from initial data point!**

Water Injection Asset Integrity - Collaboration

Traditional Customer / Contractor Engagement, does not provide the most effective knowledge sharing:

	What Veolia 'knows'	What Veolia doesn't 'know'
What Customers 'know'	Our common 'world'	Blind
What Customers don't 'know'	Concealed & Hidden	Unknown

Water Injection Asset Integrity - Collaboration

By working as a team with our customers, in conjunction with a analytical system, and expert resources, further value is achieved:
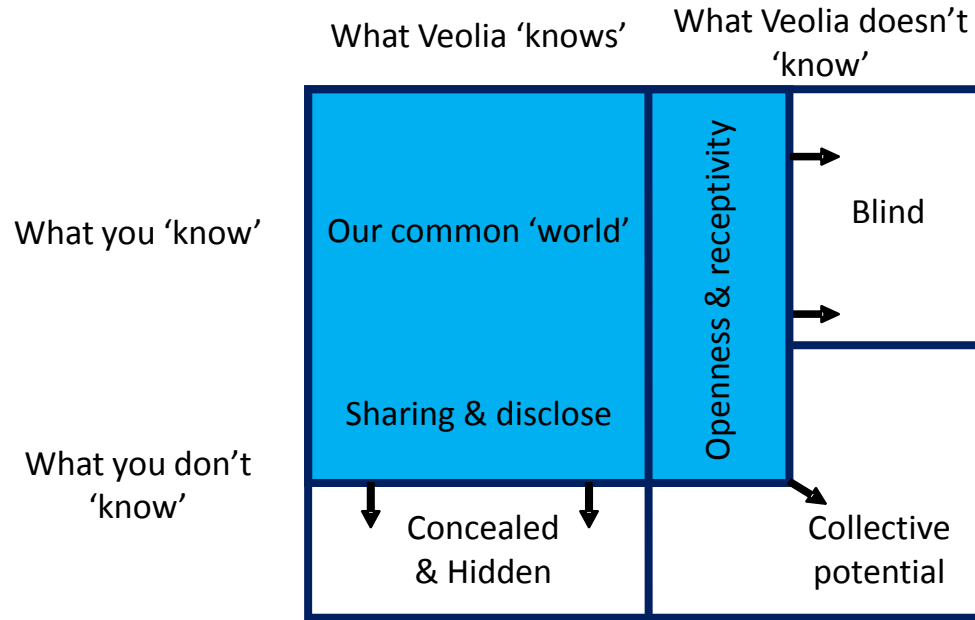
DIGITAL: Why OSIsoft PI System?

- Industry leader, used by the Oil majors
- 95% of our client base utilise the system
- True Historian Data Acquisition system
- Veolia Group already have the system, so commonality within Group
- One System with one version of the truth across our regional teams

PI System Infrastructure

PI Interfaces & PI Connectors

PI Notifications
PI Event Frames
Analytics
PI AF
PI Data Archive

PI Server

PI System Access
PI Cloud Services
PI Integrators
PI Visualization

Line of Business Systems
PI Cloud Connect
esri ArcGIS
PI Manual Logger
PI Coresight
PI ProcessBook
PI DataLink
PI WebParts
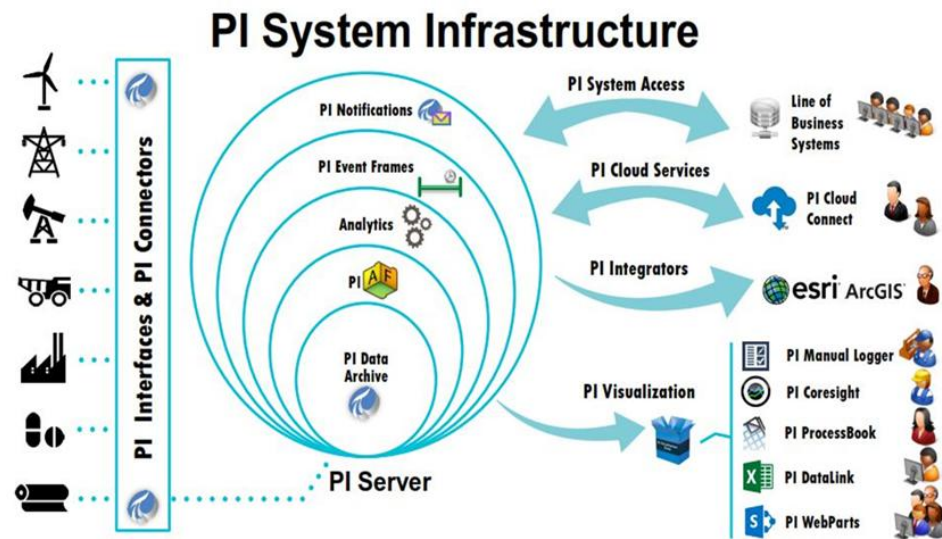
The Solution: Why use a System Integrator?

Product Capabilities

Customer Expectations

Data Analysis, before and after

	Previously	Now
Data Collection	Manual, Batch updates	Real-time using the PI System & PI Cloud Connect
Visualisation	Standard Reports retrospectively	PI Vision displays in real time
Notifications	Not available	Notifications provides real-time updates on issues
Monitoring and comparison of Key Processes	Slow and manual, only completed on demand	Event Frames with extended functionality provides real-time event handling
Manual Data Entry	Sporadic and unorganised	Will be handled with PI Manual Logger

PI System Overview
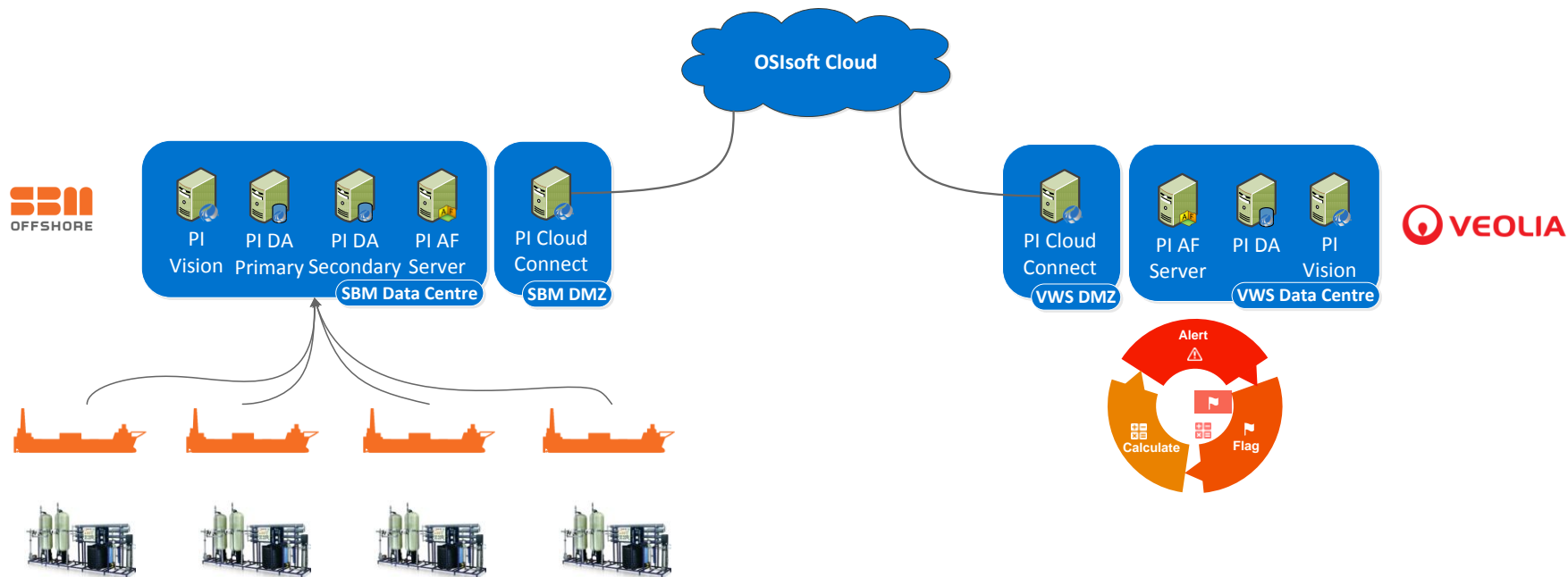
PI Cloud Connect / PI Connected Services

Advantages

- No VPN complexity

- End to end security

- Simple Control

Expand your expertise

PI Cloud Connect (n):
Moves data between PI Systems via the cloud.
Destinations may be within or outside your company.

Your Vendors

Your Business Centers

Your Joint Ventures

Your Operational Sites

PI Interfaces
PI Server
PI Tools

Water Treatment Cleaning

- Each time a water treatment skid is cleaned several steps are completed.

CIP			
Pre CIP Performance	Clean	Settling	Post CIP Performance
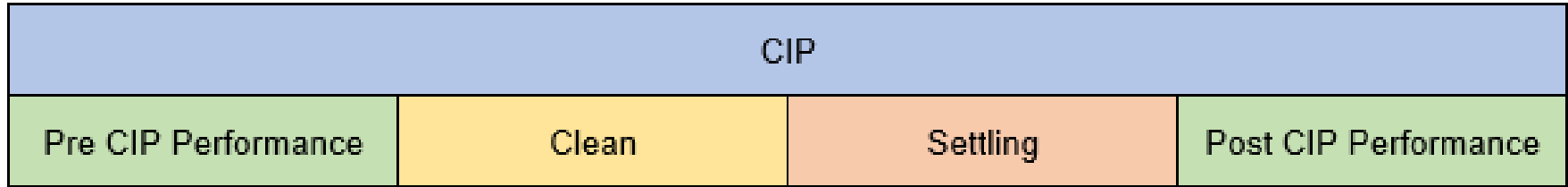
Train B	Dates	Feed Pressure (barg)	Feed Flow (m³/h)	DP (bar)		TMP (bar)		Norm TMP (bar)		Recovery (%)		Temp (°C)	Sulphates (mg/L)		
				1st	2nd	1st	2nd	1st	2nd	1st	2nd		1st	2nd	Comb
Baseline	21-Jan-17	26.7	888.0	1.890	2.290	18.00	18.90	21	21.9	50.2	49.8	26.2	1	8	5
Current	07-Apr-17	27.6	888.4	2.290	2.286	20.64	21.02	24.29	24.67	50.6	49.4	27.5	0	10	6
Variation	77	3%	0%	21%	0%	15%	11%	16%	13%	1%	-1%	5%	-100%	25%	20%

Event Frames - Solution

- Configuration driven by PI AF structure

- User Interface to capture start and end time

- Sequence of individual, but related Event Frames created

Accept Baselines

Attribute	Proposed Value	Override?	Override Value
Conversion 1st stage Baseline	50 %	☑	99 ✕
Conversion 2nd stage Baseline	50 %	☐	
DP 1st stage Baseline	100 bar	☐	
DP 2nd stage Baseline	100 bar	☐	
Normalized TMP 1st stage Baseline	99.9999739859365 bar	☐	
Normalized TMP 2nd stage Baseline	99.9999739859365 bar	☐	
Sulphates 1st stage Baseline	50 ppm	☐	
Sulphates 2nd stage Baseline	50 ppm	☐	

Accept Baseline Values

Event Frames - Solution

Benefits from CIP Event Frames –

- Quantifiable Effectiveness of each clean
- Identify Efficiencies
  - Different Chemicals
  - Process Changes
- Identify degradation over time from the baseline

Notification Case Study

- Example shown where the operator was notified that an offline system was not adequately flushed bringing a high scaling risk

- Events missed by standard control system are captured by applying analytics to attributes within the PI AF structure

- Allows pre-emptive response to evolving issues on sites reducing or avoiding economic impact
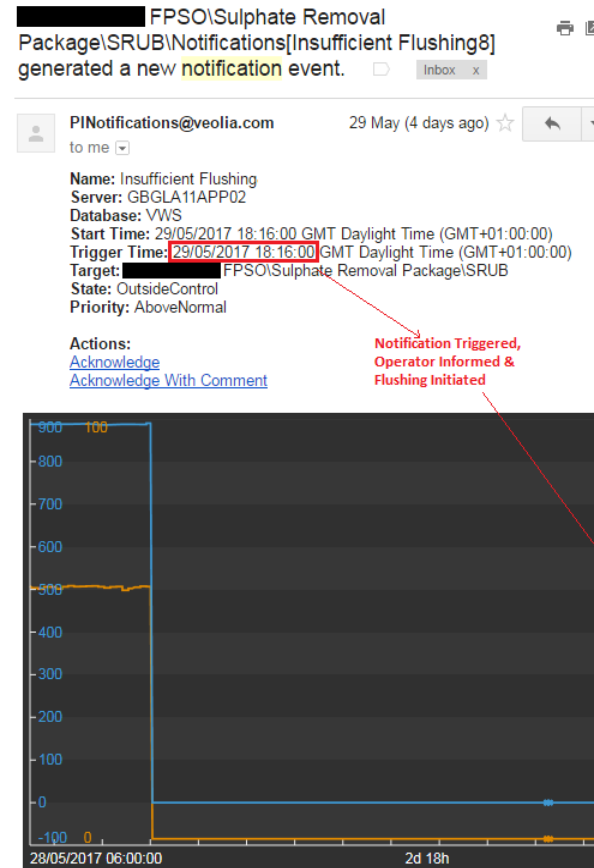
Technical Challenges

- Complex rules for cleaning could not be replicated simply in Event Frames.
  Standard capabilities enhanced with the PI AF SDK

- Historical Data Recovery
  Cloud Connect Initial 30 days max

- PI Vision Multi Tenancy
  Sharing a common view of the data is difficult
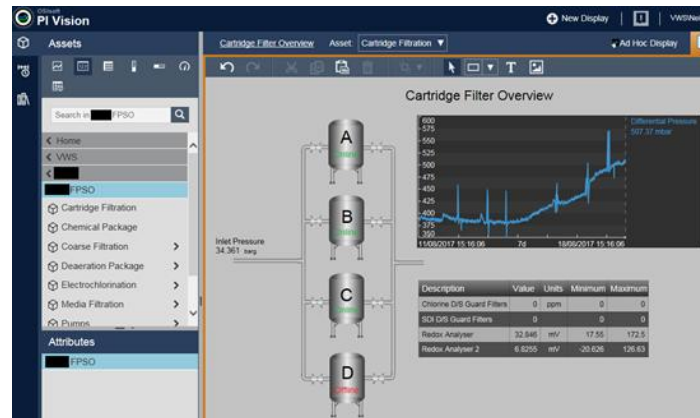
Business Benefits

Focus
- For business decision making & planning – alignment through the organization via consistent performance KPI reports. Examples: consumables ordering, CIP event timing, injection target setting.

Teamwork
- Veolia support is fully integrated & autonomous part of the WI improvement program. Efficient resource utilization, removal of data transfer requirement + rapid response. Connection established with offshore.
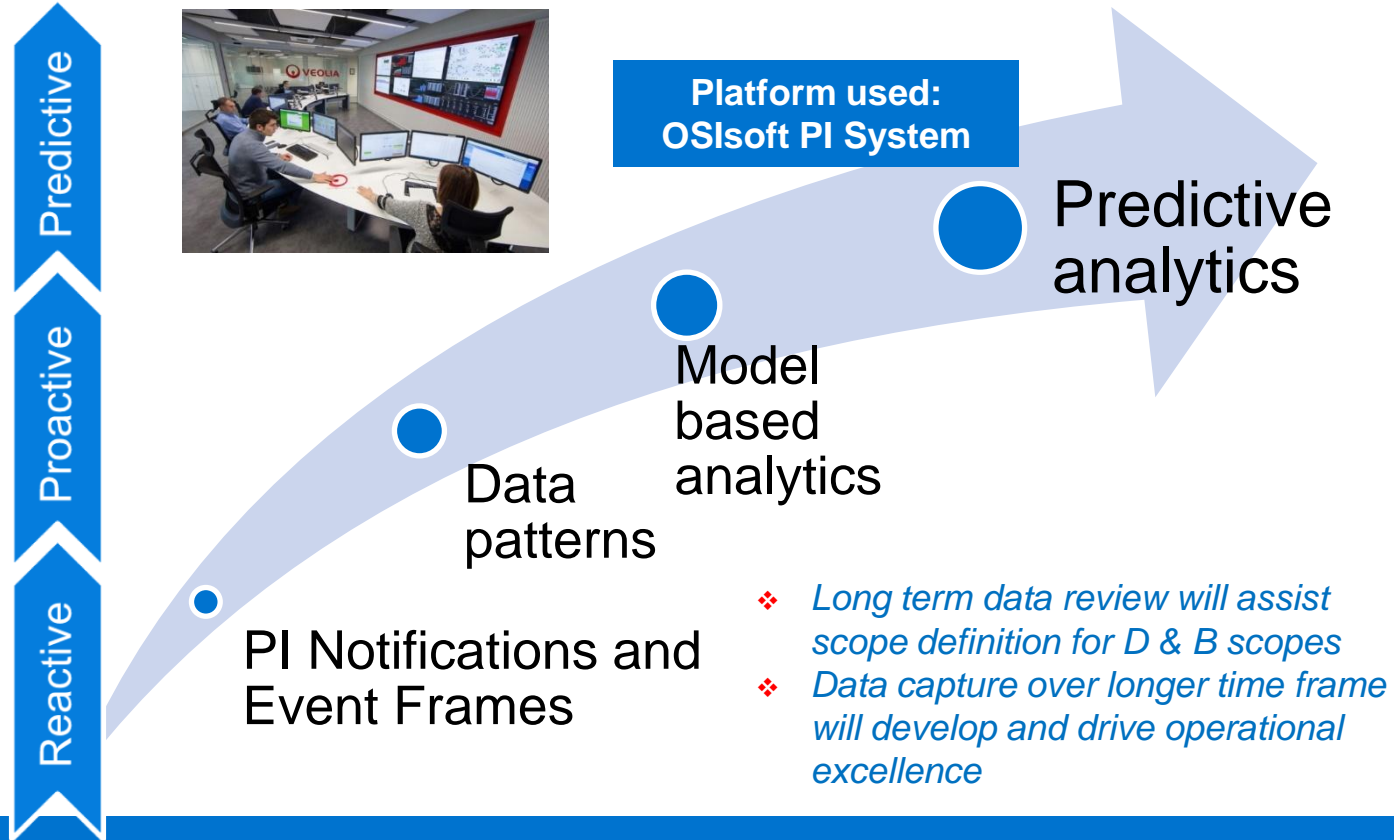
Catchs
- Proactive support & alerts leading to real business benefits shared through the fleet. Examples include membrane protection through control of scaling risk via flow optimization.

Future
- Complete the lifecycle loop generating data to drive design improvement studies. Application of OSI / connect concept for other vendors.

The future: from reactive to predictive

Predictive

Proactive

Reactive

Platform used:
OSIsoft PI System

Predictive analytics

Model based analytics

Data patterns

PI Notifications and Event Frames

❖ *Long term data review will assist scope definition for D & B scopes*
❖ *Data capture over longer time frame will develop and drive operational excellence*

Asset Integrity Services for Water Injection by means of OSIsoft Connected Services

COMPANY and GOAL

SBM operates FPSO fleets worldwide with water injection systems. Veolia challenged to deliver increased performance and uptime.

CHALLENGE

Timely ship to shore data transfer to technology provider for operational support

SOLUTION

A digital platform that Veolia can use in collaboration with SBM in Real Time

- Utilization of the PI System inc
- PI Cloud Connect
- PI Vision

RESULTS

Business and Performance KPI driven collaboration between Veolia and SBM in Real Time

- Increased Uptime of SBM Assets
- Increased Revenue through decreased penalties
- Reduced Costs

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Questions

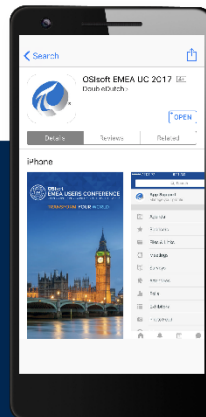Please wait for the **microphone** before asking your questions

State your **name & company**

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Danke

谢谢

Merci

Gracias

Thank You

ありがとう

Спасибо

Obrigado