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

Presented by

OSIsoft. EMEA USERS CONFERENCE 2017 LONDON

#OSISOFTUC ©2017 OSIsoft, LLC
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

**OSIsoft 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
What Does SBM Do?

- World’s largest FPSO fleet
  > 1 Million bbls/d oil

- Global span
  Gulf of Mexico, Brazil, West Africa and Southeast Asia.

- Clients
  Shell, Exxon, Petrobras, ENI

- 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

**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’**
  - Our common ‘world’

- **What Veolia doesn’t ‘know’**
  - Blind

- **What Customers ‘know’**
  - Concealed & Hidden

- **What Customers don’t ‘know’**
  - Unknown
By working as a team with our customers, in conjunction with an analytical system, and expert resources, further value is achieved:

- **What Veolia ‘knows’**
- **What Veolia doesn’t ‘know’**

**Our common ‘world’**
- Sharing & disclose
- Concealed & Hidden

**Openness & receptivity**
- Blind
- Collective potential

**What you ‘know’**

**What you don’t ‘know’**
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
The Solution: Why use a System Integrator?

Product Capabilities

Customer Expectations
# Data Analysis, before and after

<table>
<thead>
<tr>
<th></th>
<th>Previously</th>
<th>Now</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Data Collection</strong></td>
<td>Manual, Batch updates</td>
<td>Real-time using the PI System &amp; PI Cloud Connect</td>
</tr>
<tr>
<td><strong>Visualisation</strong></td>
<td>Standard Reports retrospectively</td>
<td>PI Vision displays in real time</td>
</tr>
<tr>
<td><strong>Notifications</strong></td>
<td>Not available</td>
<td>Notifications provides real-time updates on issues</td>
</tr>
<tr>
<td><strong>Monitoring and comparison of Key Processes</strong></td>
<td>Slow and manual, only completed on demand</td>
<td>Event Frames with extended functionality provides real-time event handling</td>
</tr>
<tr>
<td><strong>Manual Data Entry</strong></td>
<td>Sporadic and unorganised</td>
<td>Will be handled with PI Manual Logger</td>
</tr>
</tbody>
</table>
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.
Water Treatment Cleaning

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

<table>
<thead>
<tr>
<th>Train B</th>
<th>Dates</th>
<th>Feed Pressure (barg)</th>
<th>Feed Flow (m³/h)</th>
<th>DP (bar)</th>
<th>TMP (bar)</th>
<th>Norm TMP (bar)</th>
<th>Recovery (%)</th>
<th>Temp (°C)</th>
<th>Sulphates (mg/L)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>1st</td>
<td>2nd</td>
<td>1st</td>
<td>2nd</td>
<td>1st</td>
<td>2nd</td>
</tr>
<tr>
<td>Baseline</td>
<td>21-Jan-17</td>
<td>26.7</td>
<td>888.0</td>
<td>1.890</td>
<td>2.290</td>
<td>18.00</td>
<td>18.90</td>
<td>21</td>
<td>21.9</td>
</tr>
<tr>
<td>Current</td>
<td>07-Apr-17</td>
<td>27.6</td>
<td>888.4</td>
<td>2.290</td>
<td>2.286</td>
<td>20.64</td>
<td>21.02</td>
<td>24.29</td>
<td>24.67</td>
</tr>
<tr>
<td>Variation</td>
<td>77</td>
<td>3%</td>
<td>0%</td>
<td>21%</td>
<td>0%</td>
<td>15%</td>
<td>11%</td>
<td>16%</td>
<td>13%</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
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

<table>
<thead>
<tr>
<th>Attribute</th>
<th>Proposed Value</th>
<th>Override?</th>
<th>Override Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Conversion 1st stage Baseline</td>
<td>50 %</td>
<td>☑</td>
<td>99</td>
</tr>
<tr>
<td>Conversion 2nd stage Baseline</td>
<td>50 %</td>
<td></td>
<td></td>
</tr>
<tr>
<td>DP 1st stage Baseline</td>
<td>100 bar</td>
<td></td>
<td></td>
</tr>
<tr>
<td>DP 2nd stage Baseline</td>
<td>100 bar</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Normalized TMP 1st stage Baseline</td>
<td>99.9999739859365 bar</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Normalized TMP 2nd stage Baseline</td>
<td>99.9999739859365 bar</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Sulphates 1st stage Baseline</td>
<td>50 ppm</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Sulphates 2nd stage Baseline</td>
<td>50 ppm</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Accept Baseline Values
## Event Frames - Solution

### Event Frames for SBM Ilhabela SRUB CIP Performance

**Pre Performance**
- **Date/Time:** 10-Jan-2017 23:30:00

**Post Performance**
- **Date/Time:** 31-Jan-2017 22:45:00

### Event Data Table

<table>
<thead>
<tr>
<th>Category</th>
<th>Event Name</th>
<th>Value</th>
<th>Time Stamp</th>
<th>Description</th>
<th>Unit Of Measure</th>
</tr>
</thead>
<tbody>
<tr>
<td>Baseline</td>
<td>BF End</td>
<td></td>
<td>01/01/2017 23:40:00</td>
<td>01/01/2017 01:05:00</td>
<td>Percentage</td>
</tr>
<tr>
<td></td>
<td>BF Start</td>
<td></td>
<td>01/01/2017 23:30:00</td>
<td>01/01/2017 01:05:00</td>
<td>Percentage</td>
</tr>
<tr>
<td></td>
<td>Entire Event Duration</td>
<td>25.98375</td>
<td>01/01/2017 23:30:00</td>
<td>01/01/2017 01:05:00</td>
<td>Day</td>
</tr>
<tr>
<td>Baseline</td>
<td>1st Stage Trans-Membrane Pressure Baseline</td>
<td>18.30981</td>
<td>01/01/2017 23:30:00</td>
<td>01/01/2017 00:32:00</td>
<td>Bar</td>
</tr>
<tr>
<td></td>
<td>2nd Stage Trans-Membrane Pressure Baseline</td>
<td>19.11543</td>
<td>01/01/2017 23:30:00</td>
<td>01/01/2017 00:32:00</td>
<td>Bar</td>
</tr>
<tr>
<td></td>
<td>Baseline Accepted</td>
<td>Yes</td>
<td>01/01/2017 23:30:00</td>
<td>01/01/2017 00:32:00</td>
<td>Yes</td>
</tr>
<tr>
<td></td>
<td>Conversion 1st stage Baseline</td>
<td>51.2678323379021</td>
<td>01/01/2017 23:30:00</td>
<td>01/01/2017 00:32:00</td>
<td>Percentage</td>
</tr>
<tr>
<td></td>
<td>Conversion 2nd stage Baseline</td>
<td>51.2678323379021</td>
<td>01/01/2017 23:30:00</td>
<td>01/01/2017 00:32:00</td>
<td>Percentage</td>
</tr>
<tr>
<td></td>
<td>BF 1st stage Baseline</td>
<td>1.9633936434862</td>
<td>01/01/2017 23:30:00</td>
<td>01/01/2017 00:32:00</td>
<td>Bar</td>
</tr>
<tr>
<td></td>
<td>BF 2nd stage Baseline</td>
<td>2.27332213153889</td>
<td>01/01/2017 23:30:00</td>
<td>01/01/2017 00:32:00</td>
<td>Bar</td>
</tr>
<tr>
<td></td>
<td>BF Feed Pressure Baseline</td>
<td>26.9272470776741</td>
<td>01/01/2017 23:30:00</td>
<td>01/01/2017 00:32:00</td>
<td>Bar</td>
</tr>
<tr>
<td></td>
<td>Normalized TMP 1st stage Baseline</td>
<td>22.29540074204</td>
<td>01/01/2017 23:30:00</td>
<td>01/01/2017 00:32:00</td>
<td>Bar</td>
</tr>
<tr>
<td></td>
<td>Normalized TMP 2nd stage Baseline</td>
<td>23.0881297863003</td>
<td>01/01/2017 23:30:00</td>
<td>01/01/2017 00:32:00</td>
<td>Bar</td>
</tr>
<tr>
<td></td>
<td>BF Sodiums 1st stage Baseline</td>
<td>Bad</td>
<td>01/01/2017 23:30:00</td>
<td>01/01/2017 00:32:00</td>
<td>Bad</td>
</tr>
<tr>
<td></td>
<td>BF Sodiums 2nd stage Baseline</td>
<td>Bad</td>
<td>01/01/2017 23:30:00</td>
<td>01/01/2017 00:32:00</td>
<td>Bad</td>
</tr>
</tbody>
</table>
Benefits from CIP Event Frames –

• Quantifiable Effectiveness of each clean
• Identify Efficiencies
  o Different Chemicals
  o 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.

Catches
• 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

- PI Notifications and Event Frames
- Data patterns
- Model based analytics
- Predictive analytics

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

Platform used: OSIsoft PI System
### 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
David Lothian
david.w.lothian@veolia.com
Head of Upstream Services
Veolia (VWT Westgarth)

Anthony Teodorczuk
Anthony.Teodorczuk@sbmoffshore.com
Process E I & Control Manager
SBM Offshore

Alexander Dixon
Alexander.Dixon@Servelec-controls.com
Principal Systems Engineer
Servelec Controls
Questions

Please wait for the microphone before asking your questions

State your name & company

Please remember to…

Complete the Online Survey for this session

Download the Conference App

- View the latest agenda and create your own
- Meet and connect with other attendees

Search OSIsoft in the app store
Thank You

감사합니다
Danke
Merci
謝謝
Gracias
Спасибо
Obrigado
ありがとうございます