Electronic Compliance for critical infrastructure monitoring

AGENDA

- Credibility Introduction
- eCompliance Challenges
- Digital Infrastructure approach
- Customer Compliance Stories

Credibility Introduction

Who is OSIsoft?

A Pioneer for Digital Transformation

Bahrain* Beijing* Calgary Cleveland Dubai	Frykdek-Mistek* Frankfurt* Houston Johnson City* London*	Madrid* Mexico City* Montreal* Moscow* Paris*	Perth* Philadelphia* Phoenix **SAN LEANDRO*** Sao Paulo*	Seoul* Shanghai* Singapore* Sydney* Tokyo*

**Technical support available*

OSIsoft's Strategy: From Sensors to Community

Sensors	Assets	Plant	Enterprise	Community
				
Millions of Smart Devices	Multiple Sensors	Multiple Assets	Multiple Plants	Multiple Enterprises

OSIsoft Leads the Market in Critical Operations

Oil & Gas	Power & Utilities	Metals & Mining	Pharma & Life Science	Chemicals	Pulp & Paper
					
80% of the top companies globally	**1000+** utilities worldwide	**8** of the global Fortune top 10 companies	**24** of the top 25 pharmaceutical companies	**9** of the top 10 chemical companies rely on the PI System	**138.5M** meters per year of production monitored

The Unbeatable Value of OSIsoft's Data Infrastructure

BUILT FOR CRITICAL OPERATIONS

FOUNDATION FOR APPS & ANALYTICS

VENDOR AGNOSTIC

SELF-SERVICE INSIGHTS

VALUE NOW, VALUE OVER TIME

YOU OWN YOUR DATA

"Data has an extremely rare characteristic…
when more than one person consumes it,
it becomes **more valuable**."

–Dr. Patrick Kennedy, Founder & CEO | OSIsoft

eCompliance Challenges

Challenges of eCompliance

How to store data in it's original fidelity forever (decades) without data loss or worry of manipulation to ensure digital systems of records are not modified or changed to mislead regulators?

Need to Ensure:

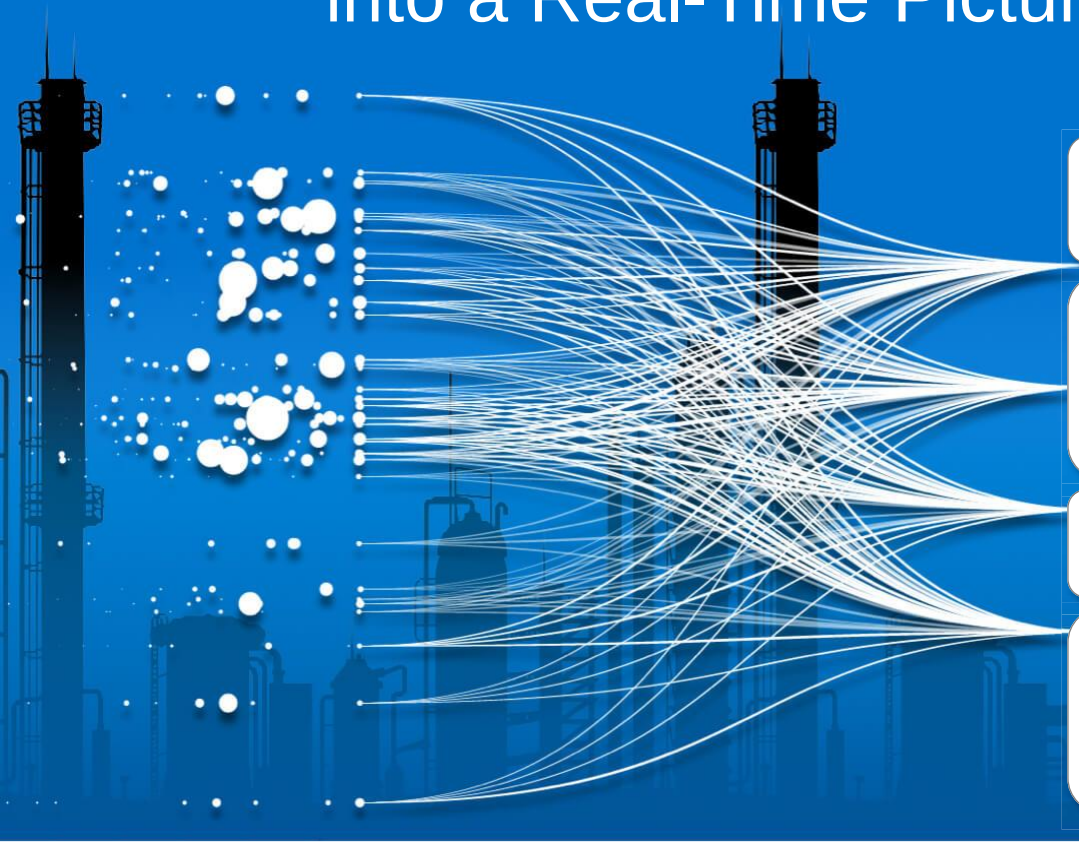
- Data can't be lost during collection or over time
- Data systems are future proof
- There is an audit trail of data changes
- Be able to track changes in equipment and process over time
- Reports cannot be edited or modified

Digital Infrastructure Approach

The Role of Infrastructure

Infrastructure delivers a critical resource in a **reliable** way to any **person** or application as **needed**

But First, You Need to Turn Vast Amounts of Data into a Real-Time Picture of Operations



DAILY PRODUCTION
Planned – 112.8 kbbl Forecast – 119 kbbl

CRUDE FURNACE
Draft Pressure: -0.5
WC Stack Temp: 316°F
Oxygen: 2.5%
Firebox Temp: 860°F
Outlet Temp: 840°F
Cold Oil Velocity: 6 ft/sec

ALERT!
Pump needs servicing in next 72 hours

WEATHER CONDITIONS
Relative Humidity: 34%
Current Temp: 85 °F High: 92 °F Low: 57 °F
Wind: 8 mph/N

And Make Operations Data an Asset Everyone Can Use in Real Time

Process Engineer
"Can we increase the overall yield?"

Control Room Tech
"The process is like a baby – you have to watch it."

Production Manager
"What is the forecast of productivity?"

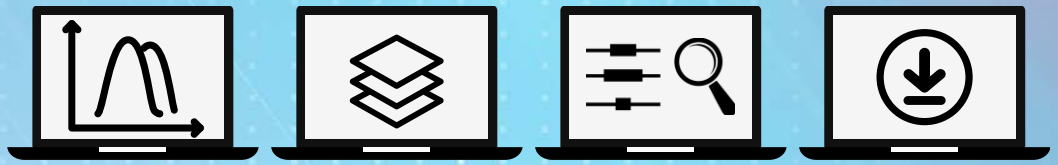
Data Scientist
"Can we find new savings with machine learning?"

Reporting Analyst
"I need to combine data from 3 sources in 1 report."

Maintenance Engineer
"I need to know the moment it goes out of tune."

The PI System is a Data Infrastructure for Critical Operations

APPLICATIONS & ANALYTIC TOOLS



Real-time Monitoring

Analytics, GIS, BIG Data

Specialized Applications

3rd Party Services

DATA SOURCES

- Automation Systems
- IoT Gateways
- Control Systems
- Remote Sensors & Assets

PEOPLE

- Process Engineer
- Production Manager
- Reporting Analyst
- Control Room Tech
- Data Scientist
- Maintenance Engineer

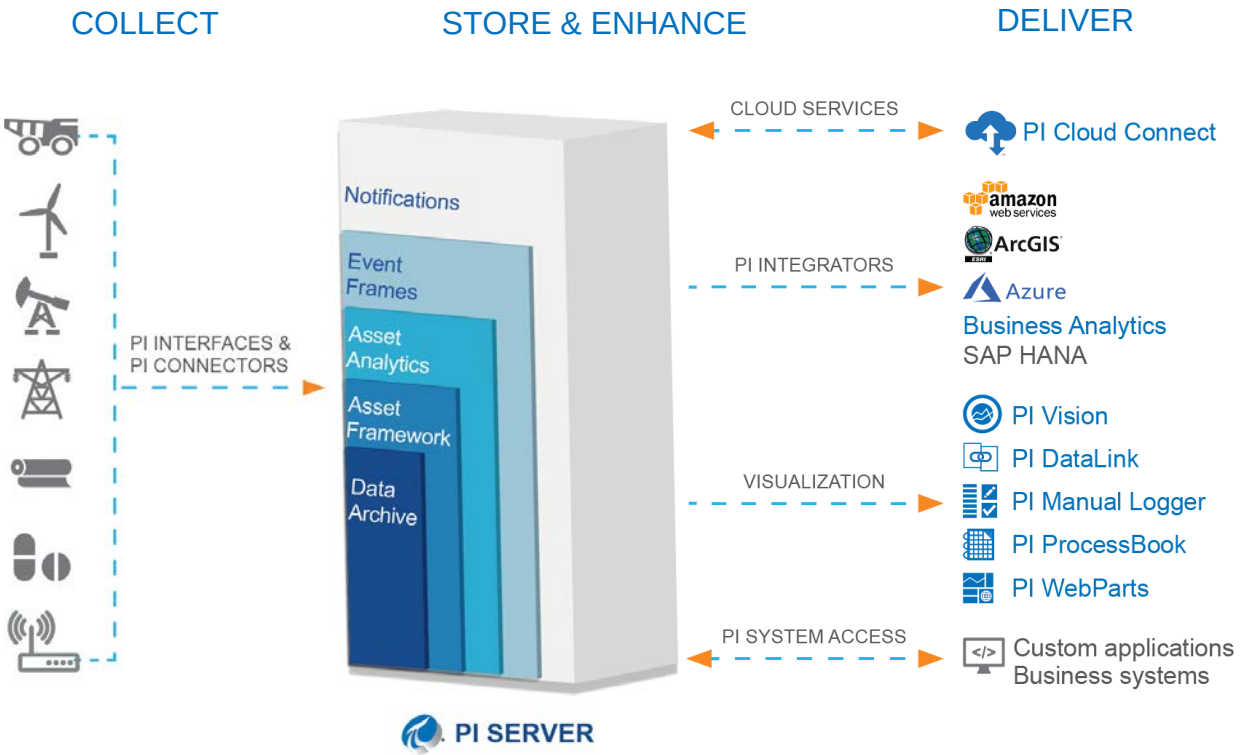
How Does the PI System Work?

Collect
- Complete Connectivity

Store
- High Fidelity Storage & Rapid Retrieval

Enhance
- Data with Context
- Automated Notifications
- Events in Data Streams

Deliver
- Self-Serve Visualization
- Integrations to Enterprise Systems



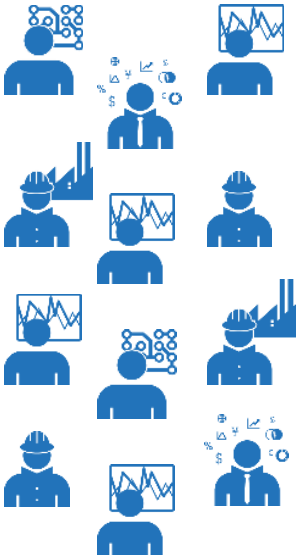
Key capabilities for compliance

Data Archive - Historian stores data in it original fidelity (efficiently) for long periods of time (decades)
Audit trail – tracks if the data is modified, by whom, when and the original data – flags are set to quickly identify modified data
Annotations can be made to data set in time to explain reason for changes (notes)
Asset Context AF- tracks asset changes over time in conjunction with the data
PI Cloud Connect shares data and context with stakeholders outside of operator
RtReports – provides a validate report with e-signitures for compliance

Secure Access to Operations Data

CRITICAL SYSTEMS

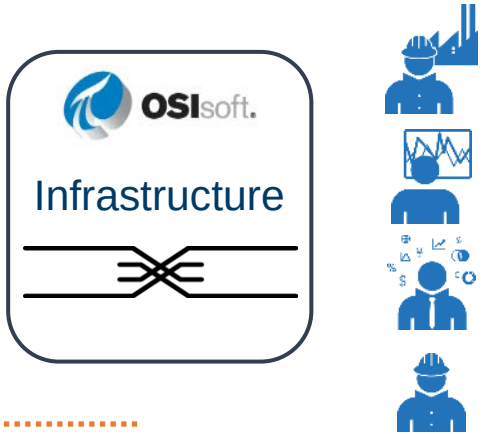
- Transmission & Distribution SCADA
- Plant DCS
- PLCs
- Environmental Systems
- Other critical operations systems



Limit direct access to critical systems while expanding the value use of information.

OSIsoft.

Infrastructure



Security Perimeter

The PI System and Security

DEFEND CRITICAL SYSTEMS

Provide secure access to Operational Data

IT-OT SECURITY CONVERGENCE

Value from partnerships and platforms

LEVERAGE STANDARD TECHNOLOGIES

Integrates with identity access management

SECURITY DEVELOPMENT LIFECYCLE

Security mindset is built in

ASSESSED AND VERIFIED

Years of Independent Assessments

The Future in the Cloud

OSIsoft Cloud Services

Compliance Cases

Regulatory Compliance

CHALLENGES

Preventing and responding to spills in ecologically sensitive environments

SOLUTION

Use pump data from the PI System and analytics in Seeq Workbench to identify potential sewage blockages

BENEFITS

Reduced blockage response time by up to 13 hours… and kept prized Tasmanian oysters safe.

> “We’re hopeful this program can be used wherever our assets are in high risk areas… and help TasWater work more responsively with shellfish growers for better outcomes.”
>
> Alexander Jovcic, Department Manager of Service Optimisation, TasWater

Regulatory Compliance

BARRICK

CHALLENGES

Tightening regulations at the Goldstrike Mine in Nevada. Air or water violations had the potential to lead to fines, closures and reputational damage

SOLUTION

Within the PI System create threshold alarms and deliver data to engineering and compliance

BENEFITS

The Goldstrike Mine reduced environmental deviations 45% and fan trips by 61%

> Asset Framework had astounding impacts. It created a culture shift in the organization
>
> Ted Olsen-Tank, Barrick Gold

Safety

Syncrude

CHALLENGES

- Mining trucks experiencing violent engine failures
- Accidents occurring in remote tundra

SOLUTION

Using the PI System and De, tracked 6600 data points from 131 trucks and processed 1716 values/second

BENEFITS

- Truck problem diagnosed, saving $20 million per year
- Reduced non-compliant dumping by 85%.

> We focused primarily on use cases that ensured business value. We weren't looking for this low-hanging fruit. We went for the expensive stuff at the top of the tree.

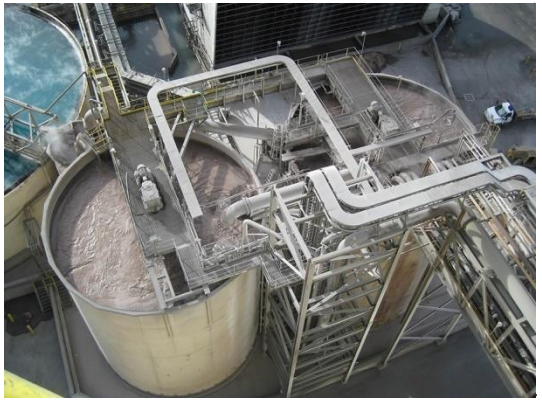
Peter Wright, Manager of Industrial Information, Dexcent (OSIsoft application partner)

Environmental Compliance Monitoring at the Goldstrike Mine

COMPANY and GOAL

Barrick Goldstrike Mine produces 1.2M ounces of gold annually, and needs to comply with strict environmental operating permits.

BARRICK



CHALLENGE

Deviations were not being identified by operators and thus were not being reported

Operators had to learn how to operate and maintain many new pieces of equipment in a new and complex project.

SOLUTION

Environmental monitoring points connected to a PI System in real-time

AF analysis along with Notifications were used to identify deviations and email responsible parties

RESULTS

Total number of environmental deviations decreased by 45%

Reduced the time to identify, react, and correct deviations

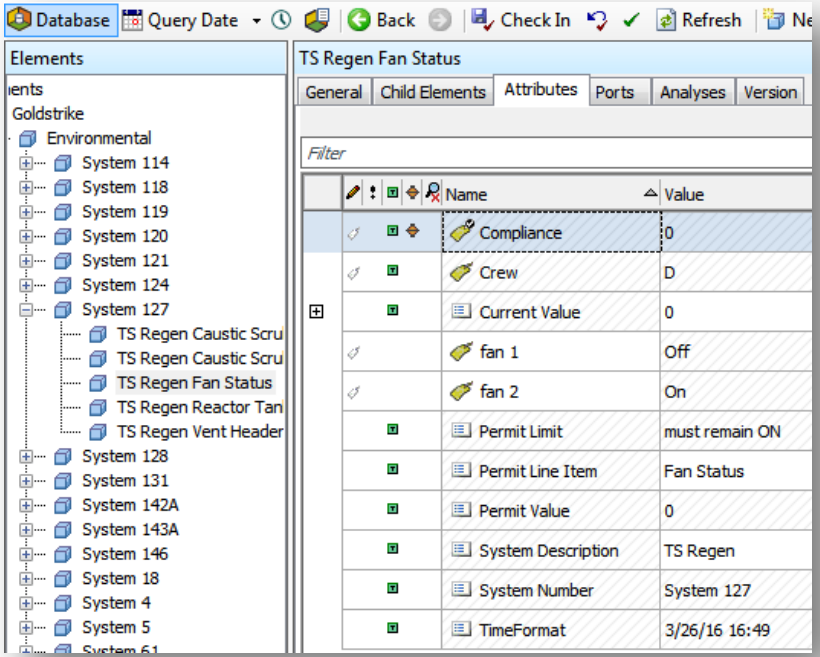
Increased reporting standards

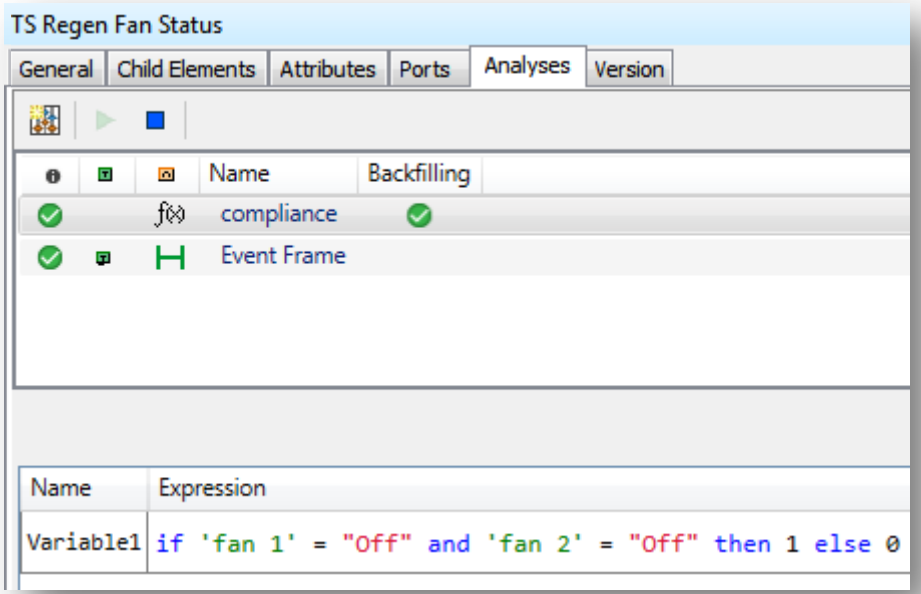
Ensured License to Operate

Barrick Environmental Compliance Monitoring

AF was used to continuously monitor compliance points

Analysis results triggered customized Notifications





Streamlining Air Compliance Reporting with Asset Framework

COMPANY and GOAL

Barrick Goldstrike operates one of the largest Title V Air Permits in Nevada and needed a more efficient way to generate compliance reports.

BARRICK

CHALLENGE

Existing reporting framework was complex, redundant, and time-consuming.

- Delays in data collection
- Difficult to track or make changes
- Numerous interdependent spreadsheets

SOLUTION

Leverage the real-time data infrastructure and implement AF and Analytics to automate the reports.

- **Asset Analytics**
- Data Archive
- Notifications
- PI DataLink
- PI Coresight
- PI System Explorer

RESULTS

Centralized data and analytics allows decisions to be made with greater speed, precision, and productivity.

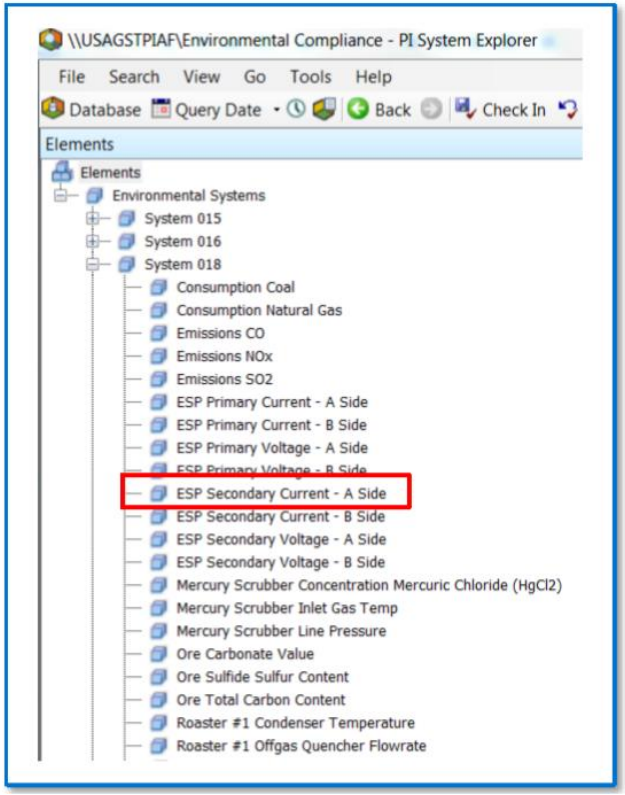
- Added real value to the company; able to analyze data
- Intermediate spreadsheets eliminated
- AF model returns the max or min hourly average

Report Preparation is Extensive and Inefficient

1. **140+ Systems** in the Title V Permit
2. Numerous complex interdependent, **intermediate spreadsheets** currently used to generate compliance logs

- Preparation of monthly compliance logs requires one full-time position

Dynamic Structure that grows and adapts with the permit



Title V Permit Line Items

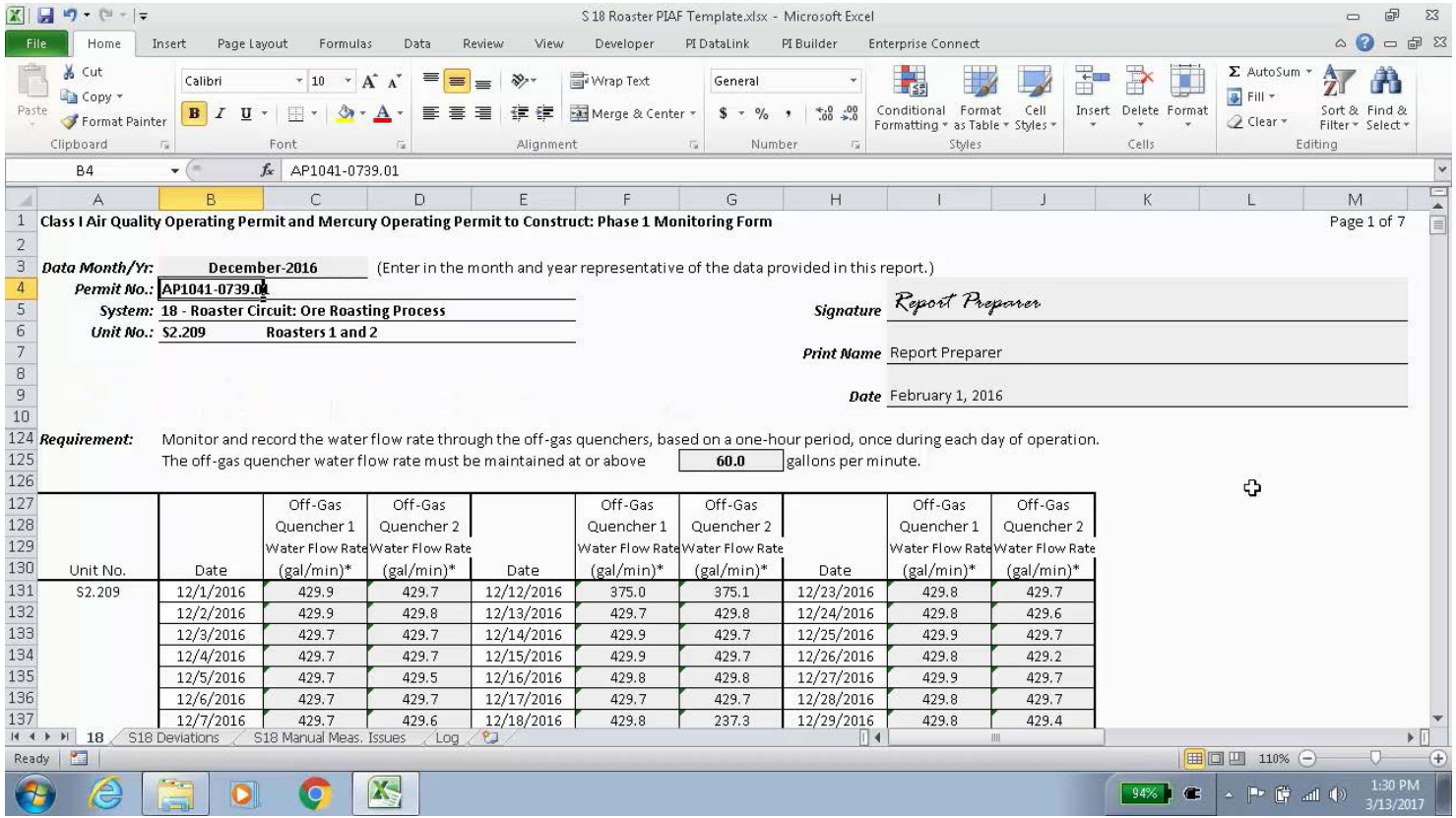
General | Table | Define Table | Version

Title V Permit Line Items

Filter

System Number	Permit Line Item	Permit Limit	Permit Value
System 018	Consumption Coal	must remain below 6.8 tons/hr	6.8
System 018	Consumption Natural Gas	must remain below 40,000.0 ft3/hr	40000
System 018	Consumption Natural Gas Heat Input	must remain below 40.0 MMBtu/hr	40
System 018	Emissions CO	must remain below 47.08 lbs/hr based on 3-...	47.08
System 018	Emissions CO	must remain below 185.7 ton per 12-month...	185.7
System 018	Emissions NOx	must remain below 36.81 lbs/hr based on 3-...	36.81
System 018	Emissions NOx	must remain below 145.2 ton per 12-month...	145.2
System 018	Emissions SO2	must remain below 44.9 lbs/hr based on 3-h...	44.9
System 018	Emissions SO2	must remain below 196.7 ton per 12-month...	196.7
System 018	ESP Primary Current - A Side	must remain at or above 2 amps	2
System 018	ESP Primary Current - B Side	must remain at or above 1 amp	1
System 018	ESP Primary Voltage - A Side	must remain at or above 110 volts	110
System 018	ESP Primary Voltage - B Side	must remain at or above 110 volts	110
System 018	ESP Secondary Current - A Side	must remain at or above 8 milliamps	8
System 018	ESP Secondary Current - B Side	must remain at or above 3 milliamps	3
System 018	ESP Secondary Voltage - A Side	must remain at or above 7 kilovolts	7
System 018	ESP Secondary Voltage - B Side	must remain at or above 3 kilovolts	3

Automated conformity reports generated in a few minutes



S 18 Roaster PIAF Template.xlsx - Microsoft Excel

Class I Air Quality Operating Permit and Mercury Operating Permit to Construct: Phase 1 Monitoring Form Page 1 of 7

Data Month/Yr: **December-2016** (Enter in the month and year representative of the data provided in this report.)

Permit No.: **AP1041-0739.01**

System: **18 - Roaster Circuit: Ore Roasting Process**

Unit No.: **S2.209** **Roasters 1 and 2**

Signature *Report Preparer*

Print Name Report Preparer

Date February 1, 2016

Requirement: Monitor and record the water flow rate through the off-gas quenchers, based on a one-hour period, once during each day of operation. The off-gas quencher water flow rate must be maintained at or above **60.0** gallons per minute.

Unit No.	Date	Off-Gas Quencher 1 Water Flow Rate (gal/min)*	Off-Gas Quencher 2 Water Flow Rate (gal/min)*	Date	Off-Gas Quencher 1 Water Flow Rate (gal/min)*	Off-Gas Quencher 2 Water Flow Rate (gal/min)*	Date	Off-Gas Quencher 1 Water Flow Rate (gal/min)*	Off-Gas Quencher 2 Water Flow Rate (gal/min)*
S2.209	12/1/2016	429.9	429.7	12/12/2016	375.0	375.1	12/23/2016	429.8	429.7
	12/2/2016	429.9	429.8	12/13/2016	429.7	429.8	12/24/2016	429.8	429.6
	12/3/2016	429.7	429.7	12/14/2016	429.9	429.7	12/25/2016	429.9	429.7
	12/4/2016	429.7	429.7	12/15/2016	429.9	429.7	12/26/2016	429.8	429.2
	12/5/2016	429.7	429.5	12/16/2016	429.8	429.8	12/27/2016	429.9	429.7
	12/6/2016	429.7	429.7	12/17/2016	429.7	429.7	12/28/2016	429.8	429.7
	12/7/2016	429.7	429.6	12/18/2016	429.8	237.3	12/29/2016	429.8	429.4

Using PI System for Real-Time Haul Truck Health Monitoring

COMPANY and GOAL

Barrick Gold Pueblo Viejo, the largest producer of gold in the Caribbean, wanted to improve the Asset Health Monitoring system for the Haul Truck fleet using real-time information to Improve Maintenance Efficiency and Costs.

CHALLENGE

To provide real-time information of 34 Haul Truck using the installed systems & minimum Investment.

- Reliability, Monitoring Condition, Maintenance and Planners often relied on incomplete or delayed information to make decisions rather than on real time data.

SOLUTION

On-board sensor information of haul truck are processed in real-time Using PI System, notifying about potential failures in real-time .

- "We used to use the in-vehicle sensors to investigate, post-mortem, why a truck failure had happened"
- “Now We can be one step ahead of a failure and be more proactive”

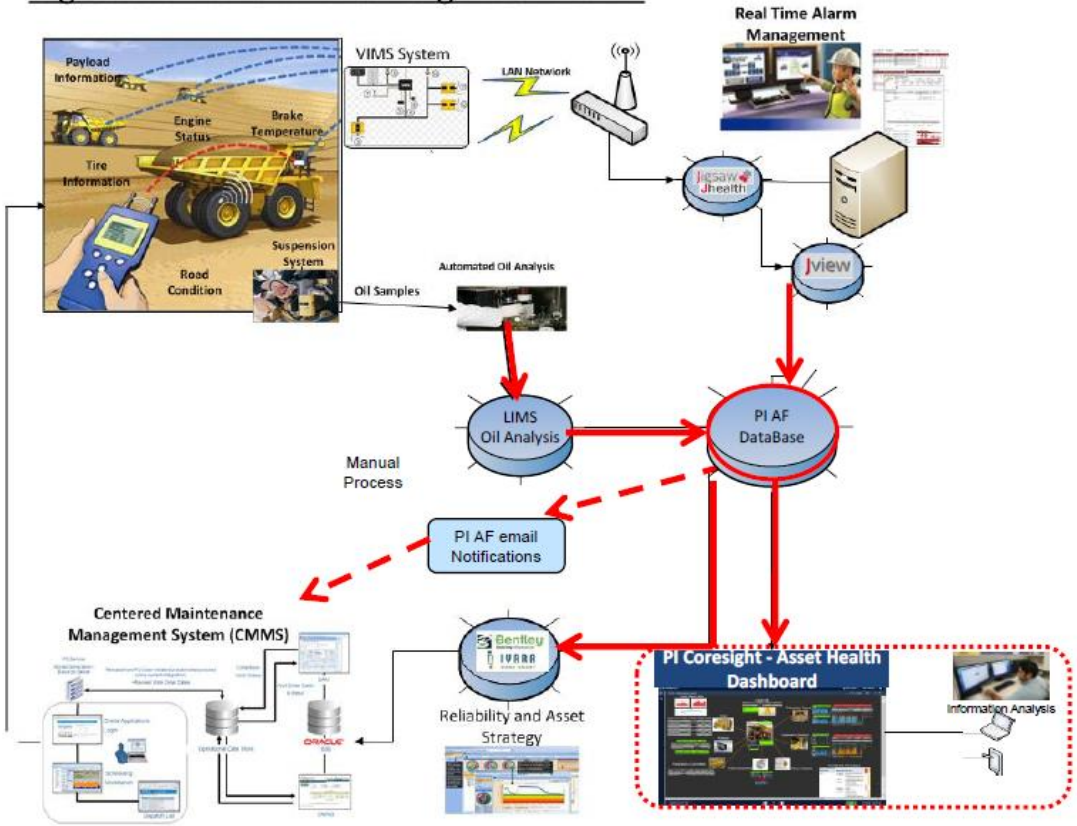
RESULTS

Reliability was increased, maintenance and availability were optimized and capacity to detect potential failures was improved.

- Able to detect & address failures
- Scalability to other fleet and sites
- Cost avoidance over $ 500,000 (Estimate in 2nd half of 2017)
- Reduce # of failures by 30% in Engine, Suspensions and Brakes

Solution

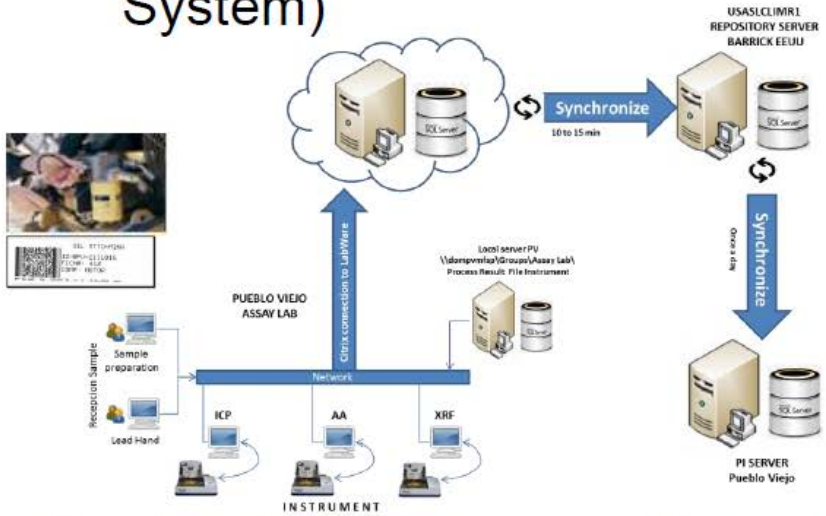
Digitization Model for Mining Mobile Fleet



- Interface Jhealth & LIMS to PI System
- Develop calculations for predictive analytics
- Create dashboards
- Convert Analyses into Action, sending Notifications to end users.
- Trigger Work Orders in CMMS

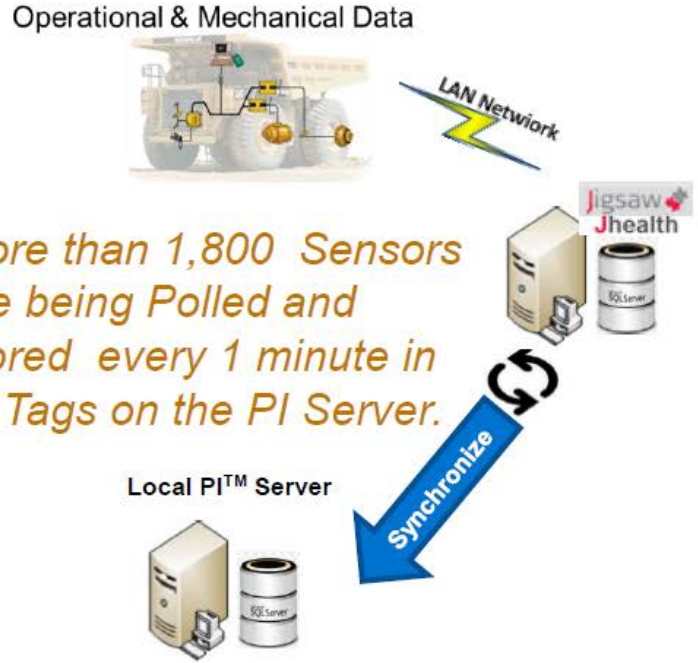
Interfaces

- LIMS - PI System™ (Laboratory Information Management System)

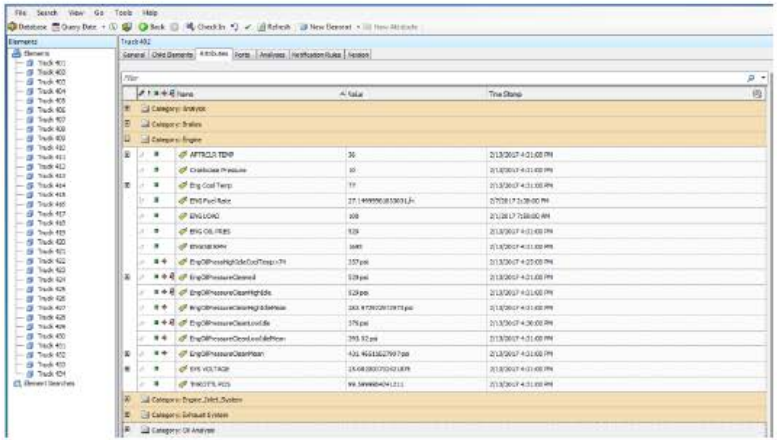


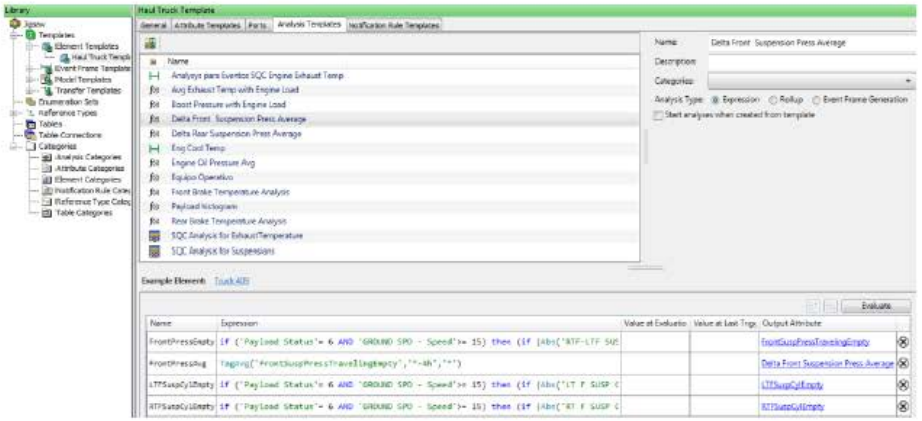
More than 3,000 PI tags are collecting Oil data to do Analysis of Information of the haul truck

- Jigsaw-JHealth™ – PI System™



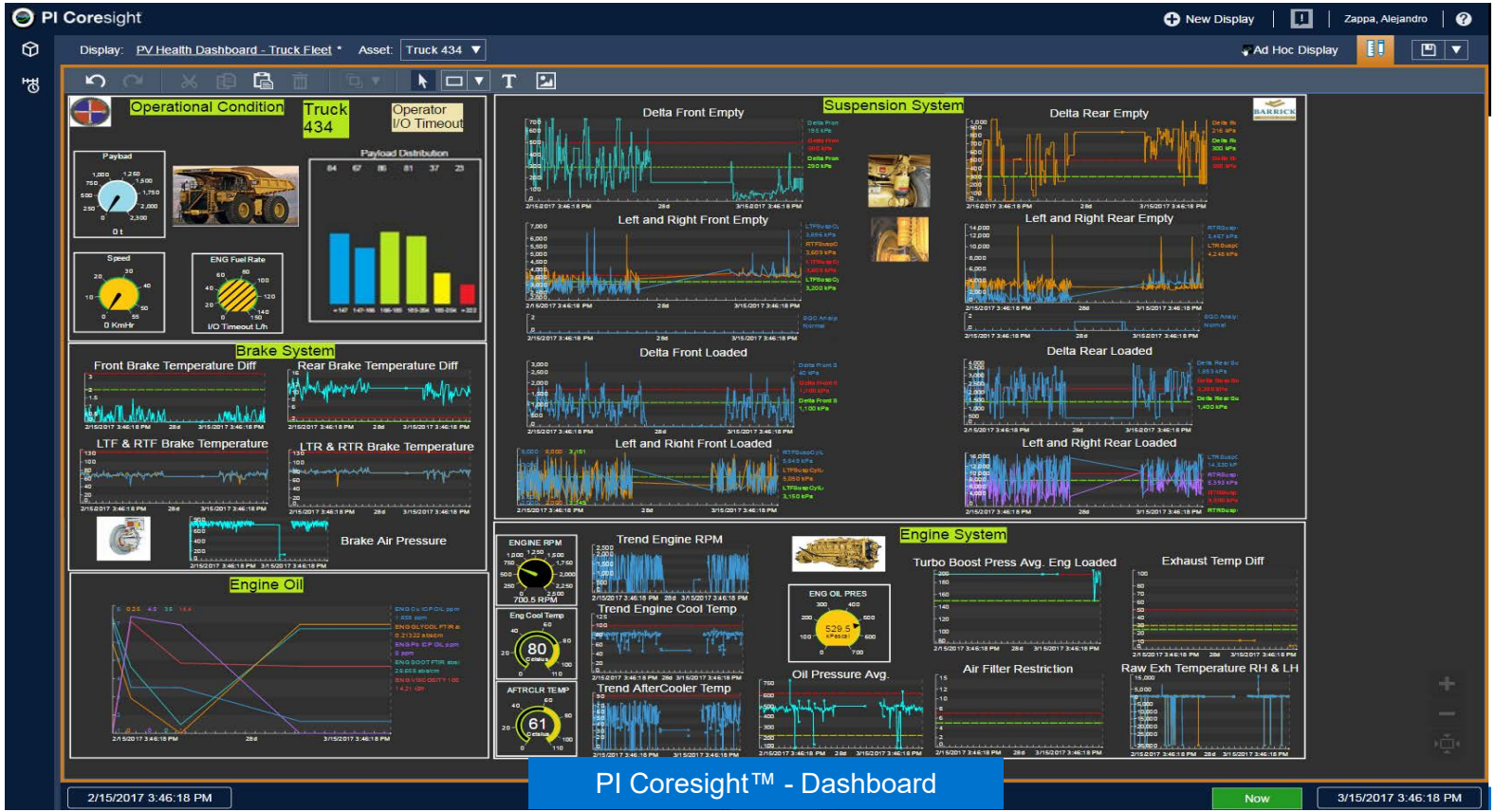
Asset Framework™ Structure





Predictive analyses and calculations are performed on the PI Server, in Real Time for all 34 Trucks

Displaying the data



PI Coresight™ - Dashboard

Mining Equipment Event Synthesis:
Early Intervention for Increased Efficiency

COMPANY and GOAL

Apply event synthesis for early intervention to reduce operating costs of mining equipment.

Syncrude
Securing Canada's Energy Future

CHALLENGE

Manual analysis of truck sensor dataset too cumbersome for timely analysis and intervention

Data stream and connectivity challenges

Require integration into existing workflows

SOLUTION

Create a Mobile Equipment Event Synthesis for the reporting of mechanical events that occur on mobile equipment

Optimize and streamline calculations, integrate with notification systems, validate, and tune performance.

RESULTS

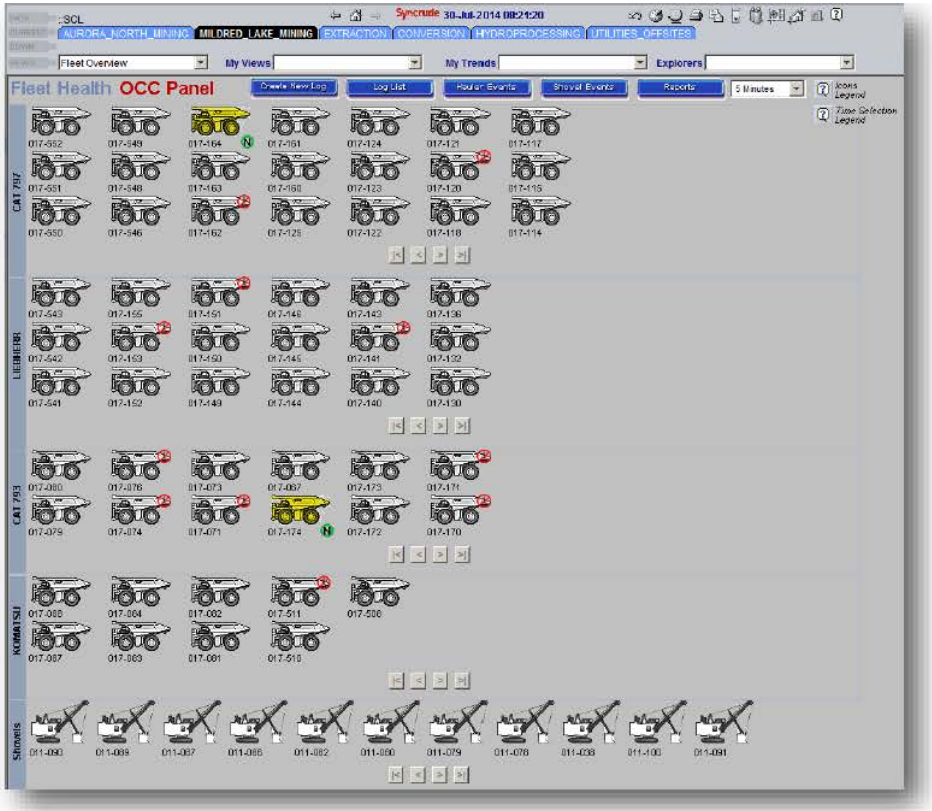
Calculated fleet savings of **$20 million** in annual operating cost avoidance

Over 6600 data points collected and analyzed from 131 heavy haul trucks and 5 shovels

Operator Control Panel

Control Panel

- Asset Health
- Log access
- Event access
- Notifications
- Report access



Syncrude

Proactive Logistics, Lifecycle and Asset Maintenance

Caterpillar

Delivering the lowest possible Total Cost of Ownership (TCO) for customers of heavy equipment through predictive monitoring services

CHALLENGES

To maintain its competitive edge, CAT improvement programs deliver through customer focused services and supplier collaboration.

- Storing streams of high fidelity mobile equipment data
- Characterize asset performance
- Aggregating and analyzing data across fleets

SOLUTION

CAT used high resolution, real-time data to assess operational performance, lifecycle predictions and future designs.

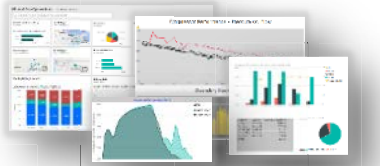
- Connect to mobile assets
- Implement cloud-based asset recommendations and reporting
- Customize analytics and alerts to initiate targeted workflows

RESULTS

Build continuous improvement processes using data to provide higher availability at the lowest cost.

- Forecast persistent issues and avoid “break-fix” conditions
- Optimize supply chain logistics
- Design teams use actual use data
- Communicate with dealers and customers

Proactive Logistics, Lifecycle and Asset Maintenance



Azure

python smartsignal

+ a b | e a u

etc.

Real-time Monitoring

Analytics/ GIS/BIG Data

ERP and IT Integration

CAT Analytics

Spec
Fleet
Global

OSIsoft.

Enterprise Operations Infrastructure

CAT CONNECT

CAT Equipment

CAT Technology

Other Equipment

Other Technology

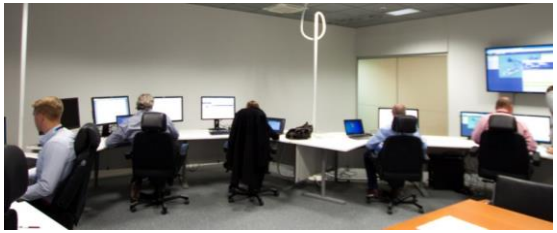
Plant Automation Control Systems

CAT/Other Global Equip Population

PI System As A Core Of Outotec's Remote Services

Outotec

Outotec is a global process and technology provider operating in minerals, metals and energy field. The goal is to improve customer value and productivity via developing data driven services.



CHALLENGE

No or poor visibility to online/history data

- Remote or isolated site locations
- Long response times to service requests

SOLUTION

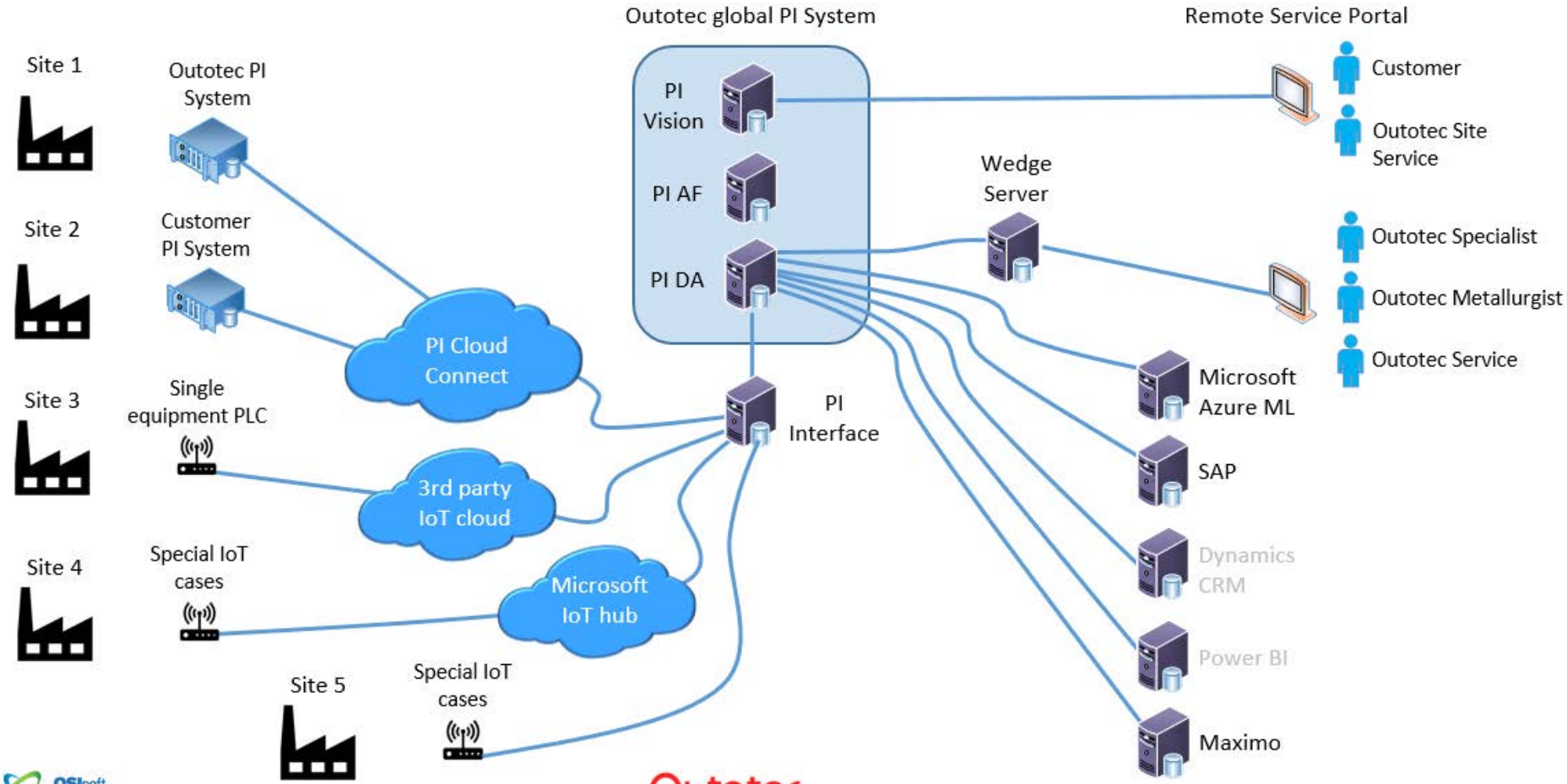
Globally centralized database with online process data. One truth!

- Full PI system taken into operation
- Remote Service Portal available
- Advanced analytics based on process data

RESULTS

Faster response and recovery times. Improved operational capability

- Reduced need to travel on site
- Shorter operation downtime during process issues
- Fast deployment of service



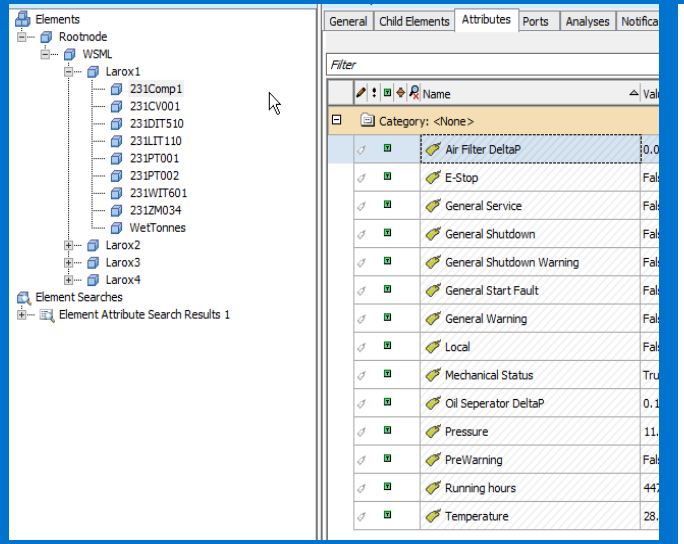
Remote Service Portal

Shared insights and tools for day-to-day operations

- Process Book and Coresight dashboards published via web browser
- Fast deployment of recurring projects
- User role based dashboards
- Manual data entry forms
- Reporting
- Logbook functionalities
- Selected customer reference:
  - Anglo Platinum South Africa

Asset Framework Enabling fast Deployment

Customer template

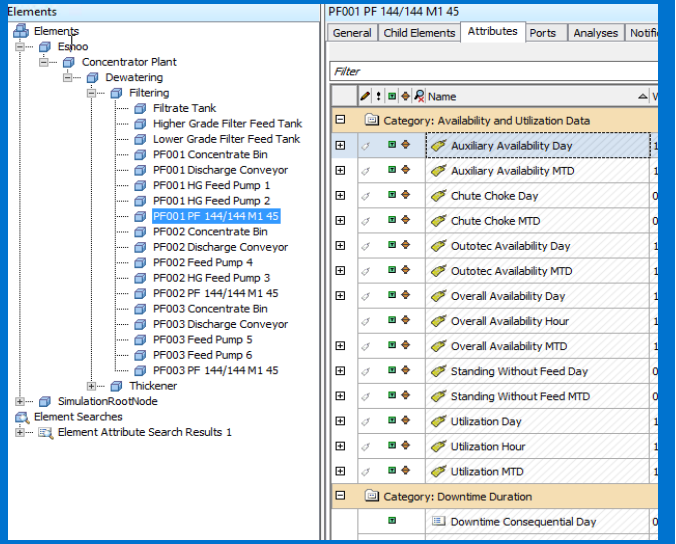


vs.

- Different raw data templates from different sites
- **Outotec template enabling fast deployment**
- Universal naming
- KPI's calculated the same way between sites

Outotec

Outotec Template



Environmental Site Monitoring

BNSF – US Class 1 Railway

Ensure its **commitment to environmental health** is met by monitoring and reporting on station fuel delivery and operational waste remediation sites.

(Source: OSIsoft)

CHALLENGES

Old sites in agricultural areas posed runoff risks, with no way to verify environmental compliance

- Better manage fuel utilization and purchases
- Identify equipment problems before they lead to non-compliance
- Reduce manual oversight and reporting

SOLUTION

Reporting from 17 sites are centralized and automated to deliver compliance and real-time awareness.

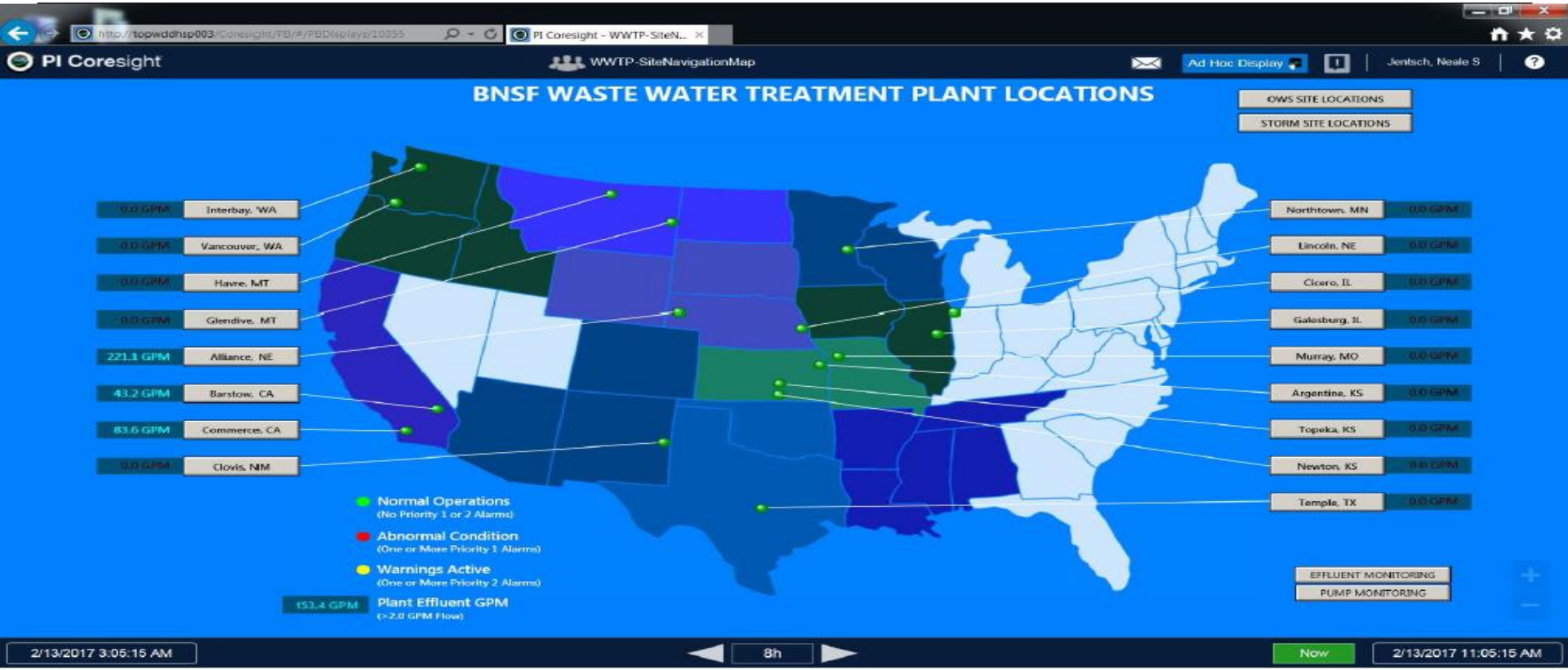
- Monitoring of all fueling sites
- Consistent environmental compliance reporting
- Real-time notice of non-compliance
- Leverage investment in fuel site automation

RESULTS

Remain in compliance with environmental agencies regulations.

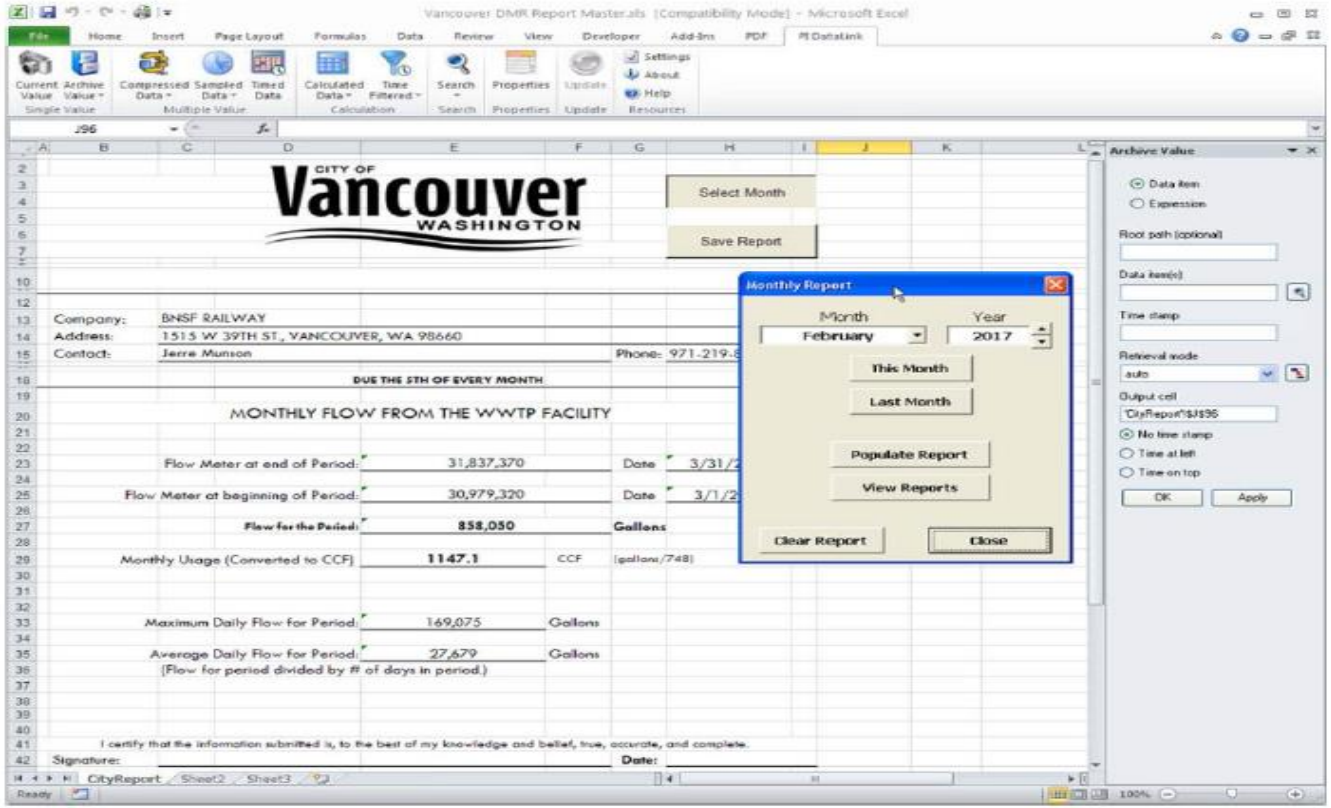
- Real-time connection to 17 remote sites with no data loss
- Auditable data storage and reporting for EPA & FRA compliance.
- Provided view into equipment and fuel usage
- Monitor effectiveness of fuel-water separators

Historian Dashboard – WWTP Overview



WWTP Historian – Seattle Interbay

PI Datalink - Custom Reports



Condition Monitoring

CHALLENGES

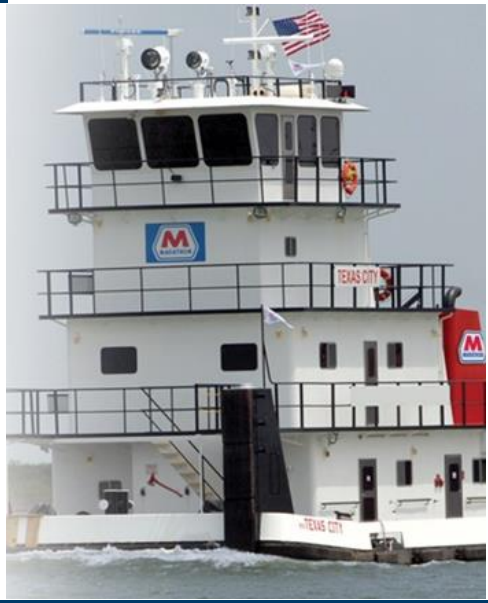
- Lack of visibility of assets
- Need to integrate data sources
- Slow reaction time to unplanned events

SOLUTION

PI System connects to wide range of sources on diverse fleet and provides remote monitoring of assets and real-time visibility into events

BENEFITS

- Secure wireless connection with no data loss
- Reduced repair and service costs across entire fleet
- Improved on-time arrival performance



> We were able to save a generator, which saved the company a lot of money. That was one of our first real-life scenarios of actually saving the company money through the PI System.
>
> Josh Schaublin, Marathon Petroleum Company

Vessel Training and Maintenance

CHALLENGES

- Fragmented data
- Needed a single platform to manage all data
- Desire for simulation functionality

SOLUTION

Use the PI System to create SHIPVIEW: a 3D Localized Multi Media Asset Manager

Use real-time data to create ship simulation

BENEFITS

- All asset information ready to use in one place.
- Multi-variable correlation analysis now available in real-time for quality technicians.

> “With OSIsoft, we...are now able to show also the real-time monitoring parameters. We reduce the training cost at scale because you can train different crews with the same tool, and now we have only one system to do a more effective training.”
>
> Lorenzo de Francesco, Marine Engineer, DELFI ILS Solutions

Self-service Advanced Analytics

DEME
Dredging, Environmental & Marine Engineering

CHALLENGES

- Dredging has high financial risk
- High hourly cost means a need to react quickly
- Decentralized operations and remote assets

SOLUTION

Real-time data visualization and asset analytics in the PI System

Robust data logging infrastructure with PI Vision screens available anywhere

BENEFITS

- Expects to save up to 400,000 Euros in predictive maintenance of one engine type

> We chose the PI System because it's something industry proven. It's complete and robust. It's the total package.
>
> Manu De Block, Data Engineer, DEME

How the PI System helps Sandoz to cope with regulatory compliance

In the regulated production environment, data are the evidence to your patients and health authorities that your products are safe and effective.

Therefore, IT-System are an integrated part for the development, release, production and post-market surveillance within a product life cycle.

SANDOZ
a Novartis company

Business Challenges

A. Continuous increase of regulation requirements, also for IT-Systems (e.g. Data Integrity).

B. Frequent and deep involvement of IT-Systems for production

Solution(s)

A. PI-System as the Data Historian implemented.

B. Defined data archive strategy.

Results and Benefits

- System with good standing within our GxP production environment.
- Standard for raw data archiving

THANK YOU