

The background of the entire image is a dark blue gradient. On the left side, there is a faint, stylized illustration of a suspension bridge, likely the Golden Gate Bridge. On the right side, there is a faint silhouette of a city skyline, including the Transamerica Pyramid. The OSIsoft logo is positioned at the top center.

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PIMS Technology Refresh

Rethinking PIMS and Operational Intelligence Delivery in Vale Base Metals



Presented by **Norman Doucet**



Agenda

1. Vale Company Profile
2. Business Challenge
3. Problems Encountered
4. Process Improvement Initiatives
 - a. SAP Integration – (SAPIO)
 - b. Smelter – Converter Skimming
 - c. Mine Backfill Batch Reporting
 - d. Process Mimics
 - e. Mine Crusher KPI report

We are what we do

Mission

To transform natural resources
into prosperity and sustainable
development



Vision

To be the number one global
natural resources company in
creating long term value, through
excellence and passion for people
and the planet

Values

- 1 Life matters most
- 2 Value our people
- 3 Prize our planet
- 4 Do what is right
- 5 Improve together
- 6 Make it happen

In 1997, Vale was largely a Brazilian exporter with 10,865 employees, and an aggressive strategy to grow its business.



Today, Vale is active in over 35 countries around the world with over 85,000 employees. It is the leader in iron ore production and one of the top three nickel producers.



Vale Base Metals

- Vale's Base Metals Business consists of nickel, copper, cobalt, aluminum, precious metals and PGMs. Vale (through the former Inco), has been operating in Sudbury for more than a century.
- Headquartered in Toronto, Canada
- North Atlantic Operating Regions:
 - Manitoba (Thompson)
 - Ontario/UK (Sudbury, Port Colborne, Clydach & Acton)
 - Newfoundland/Labrador (Voisey's Bay & Long Harbour)
- Asia Pacific Regions
 - Indonesia
 - New Caledonia



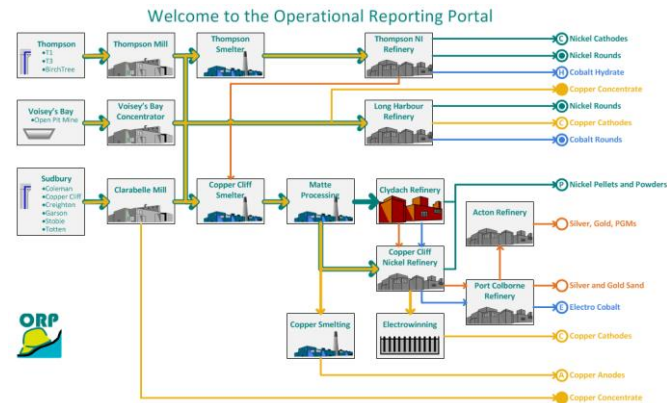


Business Challenge

PIMS Tech Program Architecture and Software Refresh

COMPANY and GOAL

In 2012, Vale Base Metals initiated a roadmap project to identify and scope opportunities to leverage Operational Intelligence capabilities



CHALLENGE

Aging infrastructure and software platforms limited ability to meet business needs for advanced reporting and analytics

- Improve PIMS Performance, Uptime and Reliability
- Simplify PIMS Use, Integration, support
- Reduce Time to Market
- Migrate required business reports and displays

SOLUTION

Three projects launched to address aging hardware, out of date PI software and PIMS Reporting Eco-system

- Physical Architecture (PA)
- Redundant Data Collection (RDC)
- Reporting and Analysis Framework (RAF)

RESULTS

New capabilities offered by Asset Framework, Event Frames, and SharePoint have provided insight into age old report challenges

- Improved performance, Uptime and reliability
- Shorter time to market through self serve tools
- Restored user confidence



Redundant Data Collection (RDC)

Redundant Data Collection

COMPANY and GOAL

At the foundation of any PIMS system, is the data collector (API node). We needed to improve data collection and reliability

CHALLENGE

Aging infrastructure and non redundant data collection threatened PIMS reporting

- Gaps in Data
- Loss of confidence in PIMS
- Interruptions to Analysis and troubleshooting

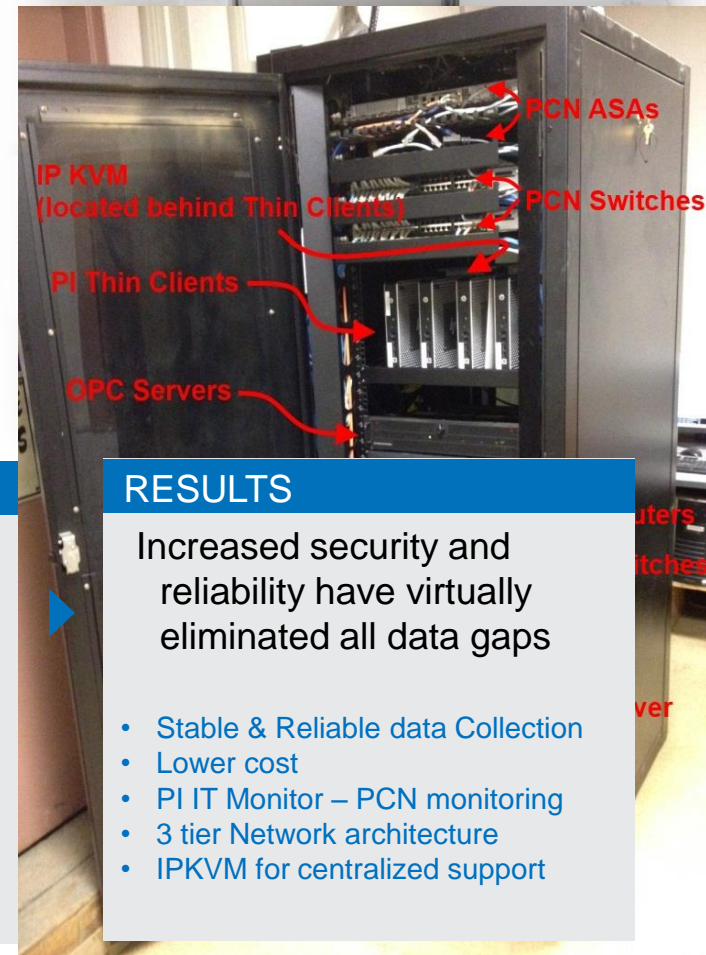
SOLUTION

Implementation of solid state redundant data collectors, data sources and network infrastructure

RESULTS

Increased security and reliability have virtually eliminated all data gaps

- Stable & Reliable data Collection
- Lower cost
- PI IT Monitor – PCN monitoring
- 3 tier Network architecture
- IPKVM for centralized support





Physical Architecture(PA) and Reporting and Analysis Framework (RAF)

Solution Architecture

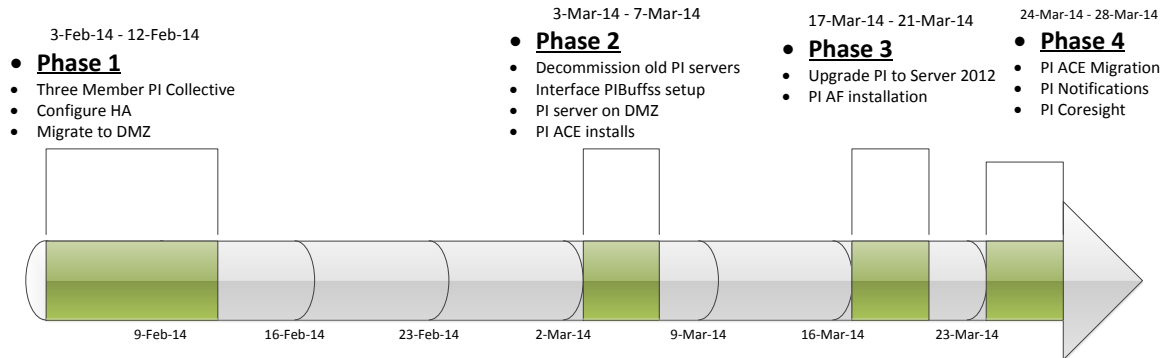
- Complete Refresh of all servers
- Latest OSIsoft software
- MS SharePoint – ORP
 - One “Stop Shop” for reports
 - Better Performance
 - Shorter “time to market”
 - Self serve report publishing
 - Sharepoint submission and workflow
 - Training sessions covering all plants in Canada and UK



PI Software installation and configuration - OSIsoft Field Service Engineers Key to success

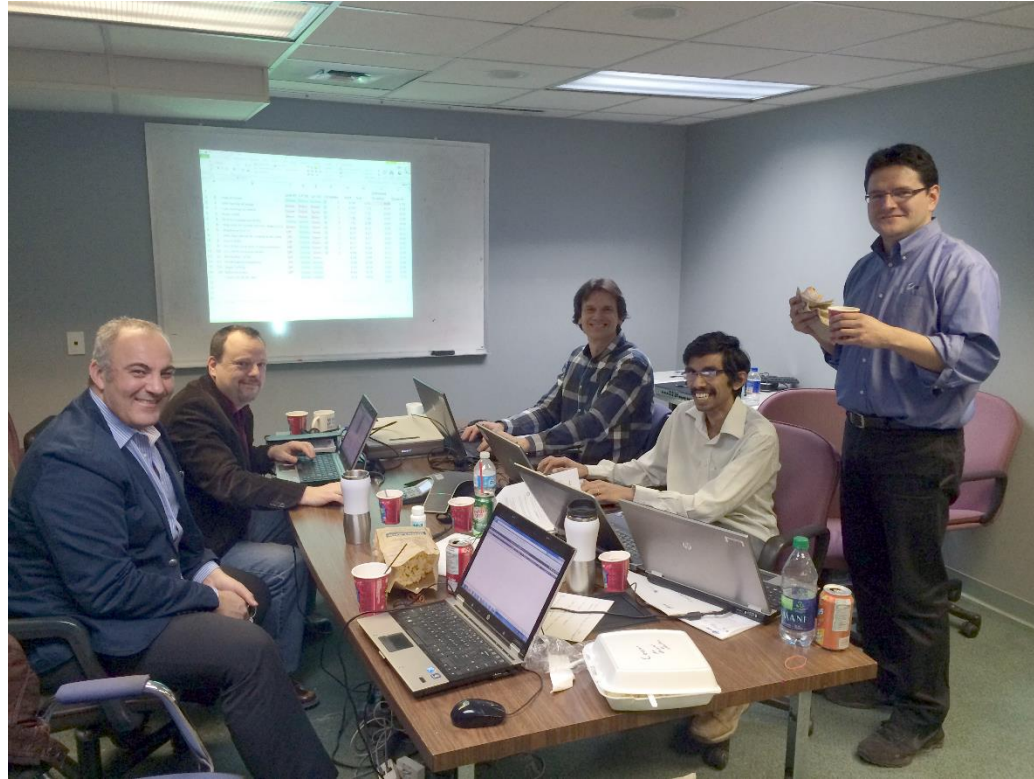
Challenge

- PI System Uptime of 99.99%
- Ensure that the Business impact was small to none
- Thorough Application Testing
- Upgrades done in off shift
- Staggered approach to allow for stabilization



Project Team

- Chris Bertrand-
(Program Manager)
- Khaled Elsharkawi-
(Project Manager)
- Norm Doucet-(Technical Lead)
- Joy Lobo-(PI Support)
- Alejandro Molano-(OSIsoft)





Problems Encountered

Software Related Issues

- IE8 on Vale standard desktop
 - No HTML5 support
 - IE11 through Citrix (Slow due to aging Citrix architecture)
- In-House applications that were not HA friendly
 - Application design assuming non buffered single PI Server
 - Custom SDK applications throwing errors, required code modification
- Ability to trend relational data (LIMS) in PI Coresight
 - Legacy in house application had the ability to trend all assays in the LIMS system
 - In PI Coresight we are able to trend defined assays through RDBMS

Hardware-Solid State Drive Failures

Challenge

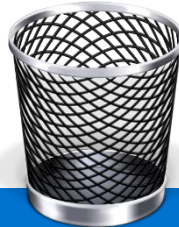
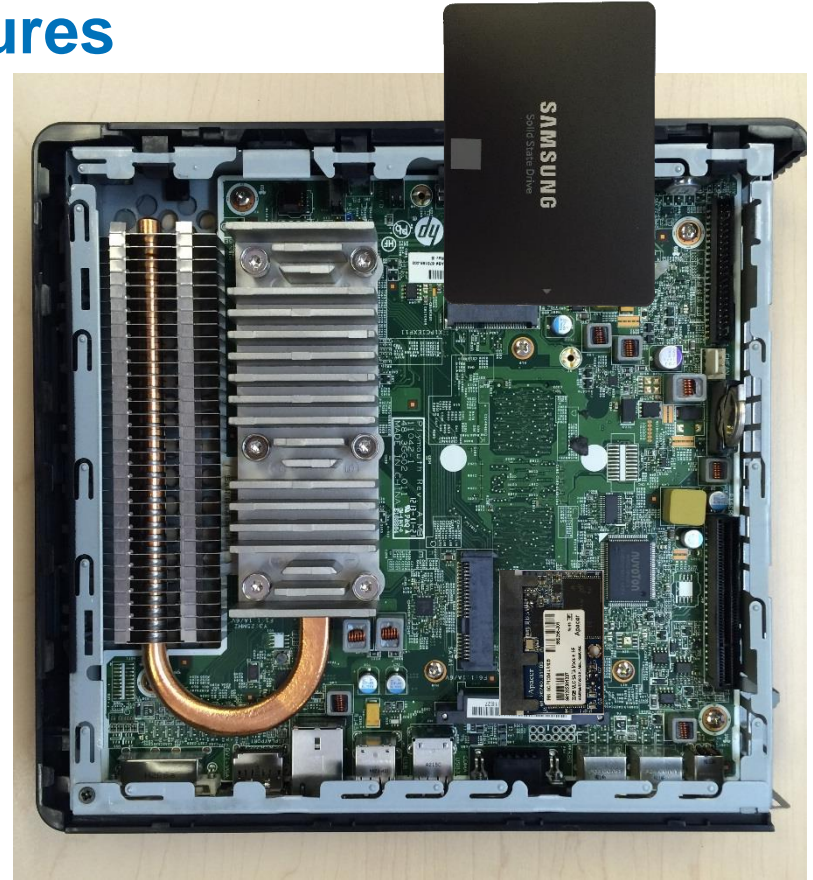
- After two years of service, Solid state drives began to fail

Solution

- Upgrade failed 32GB MLC SSD's
- Replace with 120GB 3D V-NAND drive

Results

- Extend Drive life to ~10years
- Reduce risk of data loss



Hardware-Ground loop interference

Challenge

- Multiple IPKVM failures
- PC's have external DC Power supply with "floating" ground and IPKVM has reference ground
- Electromagnetic interference in the data signal

Solution

- Ground all PI Interface nodes to same ground potential as IPKVM

Result

- IPKVM software glitches and lock-ups eliminated





Process Improvements

Applications and Use Case

SAP Integration – (SAPIO)

•Challenge

- New Global SAP implementation
 - Required PI data to support SAP Maintenance module

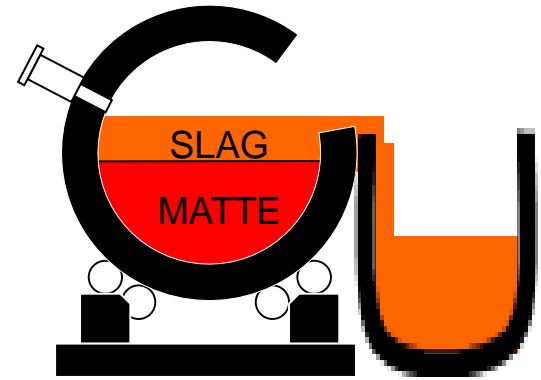
•Solution

- TIBCO middleware (Global Standard)
- PI System 2012
 - PI Asset Framework to structure our information
 - Notifications & Asset Analytics
 - Custom delivery channel to create Event Frames
 - Event Frames to keep track of events

Smelter - Converter Skimming

What is Skimming?

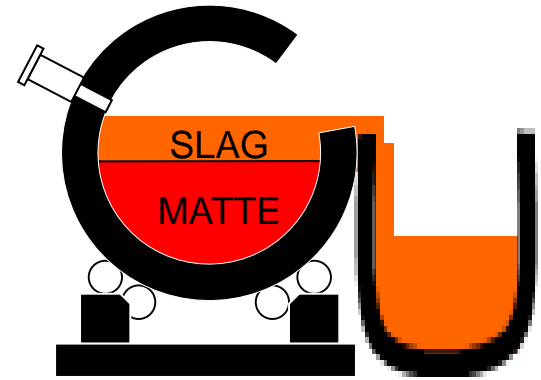
- The process of removing slag from the converters.
- This is done to reduce iron (Fe) in the Matte.
- Slag rises to the top of the converters and can be skimmed (decanted) by rotating the converter.
- A skim cycle (at least 4) in a converter charge (batch) can either be “Skimming” or “Reverse Skimming”.
- “Reverse Skimming” increases Cobalt yield.



Smelter - Converter Skimming

Challenge

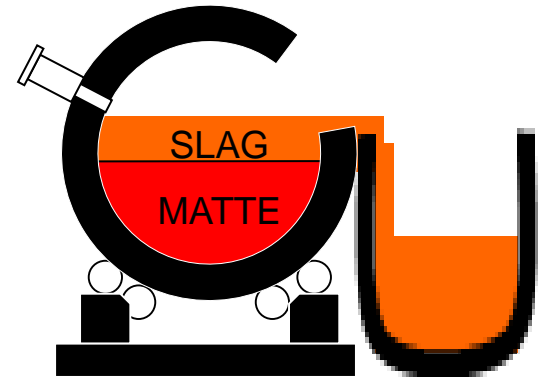
- Operator favoring “Skimming” rather than “Reverse Skimming”
 - Significant loss in Cobalt recovery
- Adherence to “Reverse Skimming” tracked manually
 - Complexity of rules and multiple control variables
- Too difficult with PIMS technology before PIMS Tech Program refresh
 - (PI Server, Module Database, ACE)



Smelter - Converter Skimming

Solution

- Build AF model and Event Frames to detect “Skims” & “Reverse Skims” based on several criteria.
- Automatic Compliance tracking
 - Successful “Reverse Skim”
 - Missed Opportunities to perform a “Reverse Skim”
 - No Opportunity to perform a “Reverse Skim”



Smelter Reverse Skimming Report

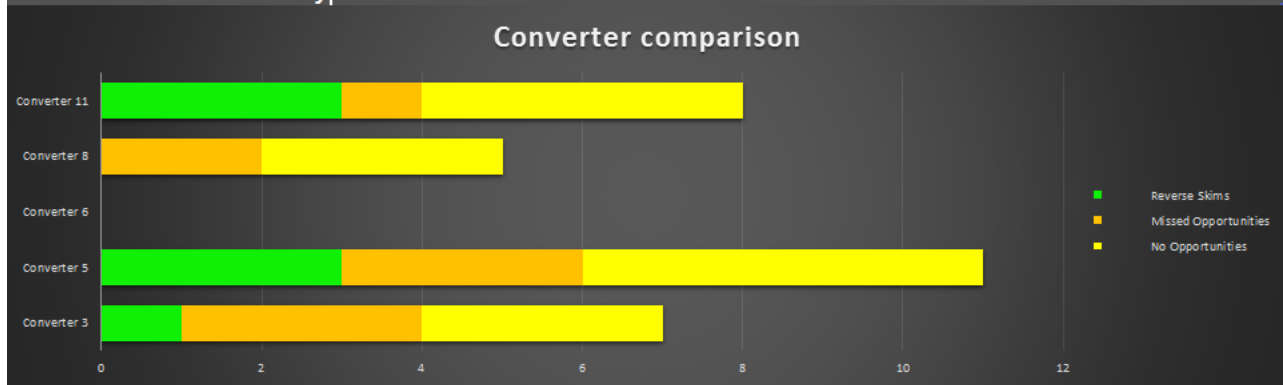
--> SELECT REPORT CRITERIA

Start Time
End Time

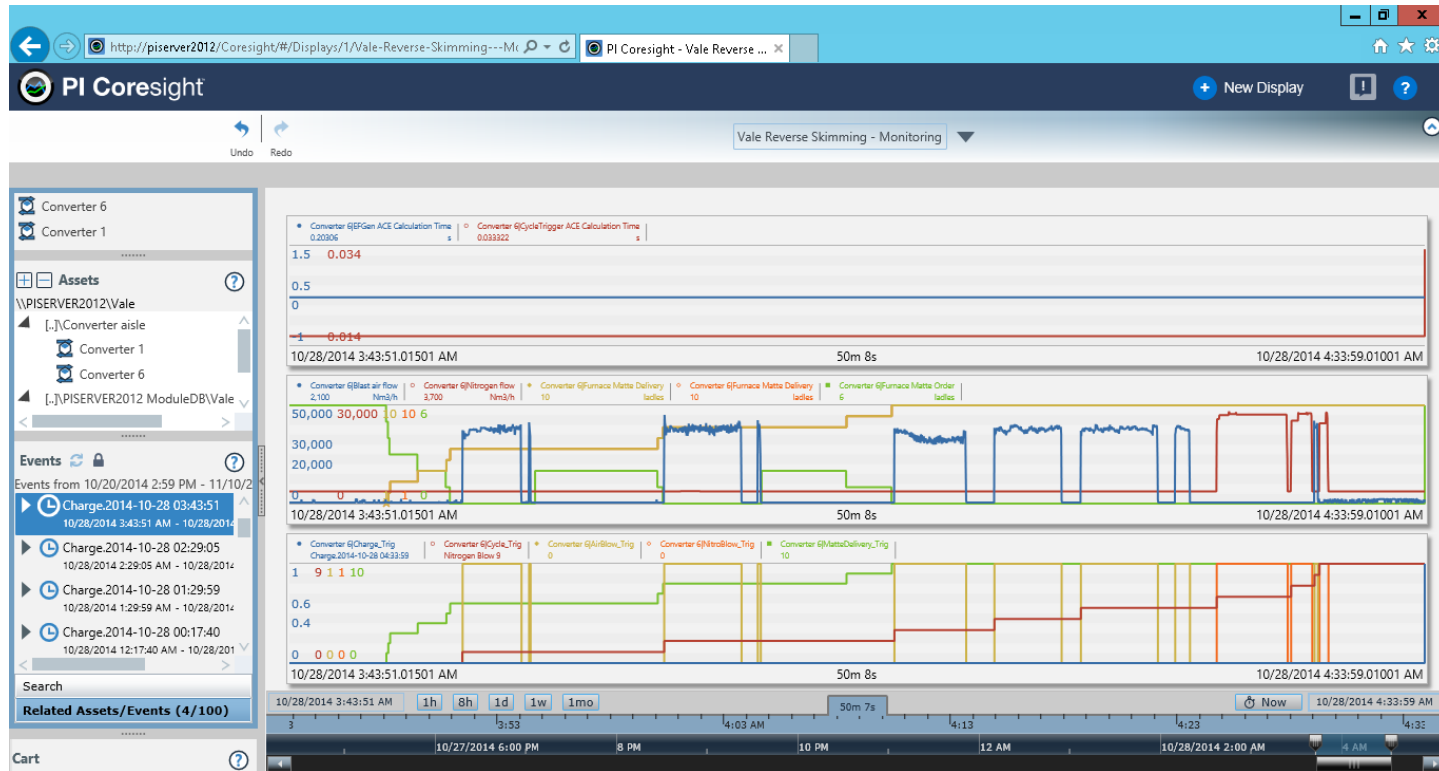
9/29/2015 13:44

10/6/2015 13:44

Event	Converter 3	Converter 5	Converter 6	Converter 8	Converter 11	TOTAL
Charges	1	2	0	1	2	6
Cycles	25	22	0	42	19	108
Regular Blows	7	11	0	5	8	31
Reverse Skims	1	3	0	0	3	7
Missed Opportunities	3	3	0	2	1	9
No Opportunities	3	5	0	3	4	15
Matte During AirBlow	4	2	0	5	1	12
% of Blows with Matte Delivery	100.00%	33.33%		250.00%	25.00%	



Sample Display in PI Coresight – Event Selection Zooms on Data



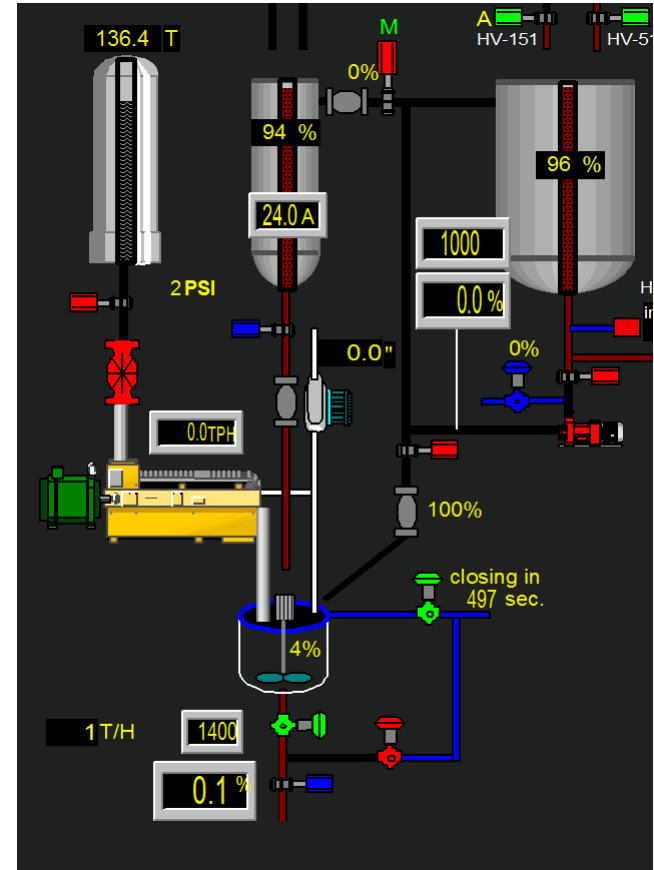
Mine Backfill Batch Reporting

Challenge

- Backfilling is a process used to fill voids after extraction of minerals underground is completed
 - Plugging of pipe line
 - Pipe line burst due to high pressures
 - Pipe line burst due to line deterioration
 - Liquefaction of the backfill
 - Equipment failure

Solution

- Model process with Event Frames
- Provide Sharepoint DataLink Reports
- Provide visualization through PI Coresight



Sandfill Plant

Mine Backfill Operator HMI input screen

Bridging the divide on IT/OT convergence

Select Location

- 1000L-2040L 601
- 1040L -1060L 601
- 2060L -3060L 704
- 2080L -3060L 701
- 5000L-6000L 800
- Other/Maint

Edit/Delete Selected

Create New

Select Pour Type

- Cap
- Body
- Plug

1000L-2040L 601
Estimated fill values

Cap fill: 50

Body fill: 100

Body rock: 75

Plug fill: 25

CAP

BODY

PLUG

System Control

Zero Tags

Close Valve

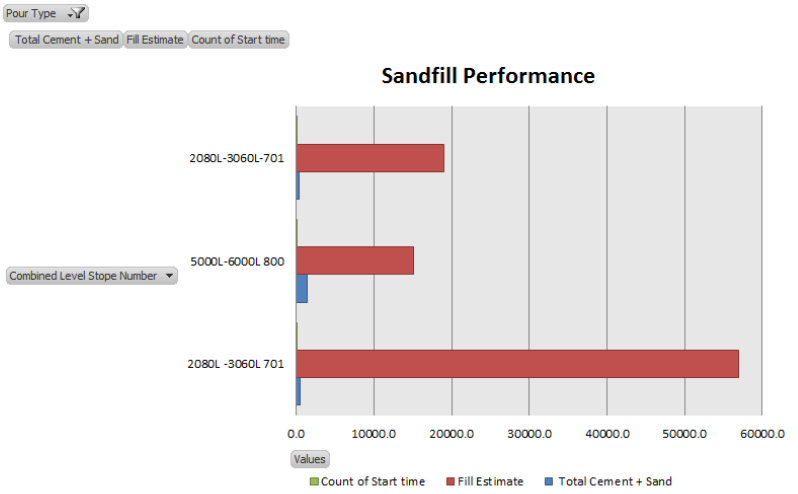
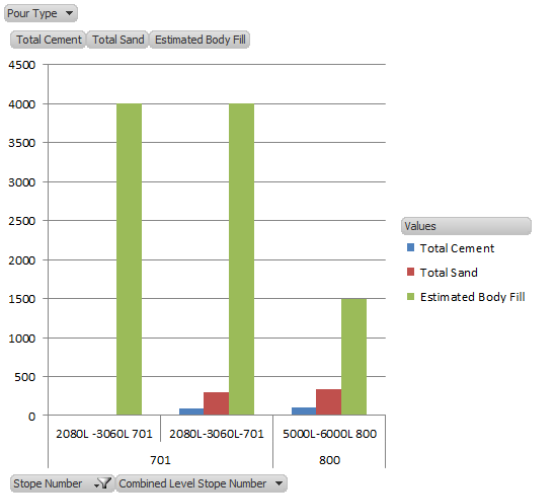
Open Valve

Cancel

Mine Backfill Report

Start Time 9/6/2015 0:00
End Time 9/20/2015 0:00

Slope Number	Pour Type	Bottom Sill		Start time	End time	Estimated		Estimated		Estimated		
		Level	Top Sill Level			Cap	Estimated Plug	Estimated Body Rock	Body Fill	Total Cement	Total Sand	Total Rock
701												
	Body	3060	0	26-May-15 12:58	27-May-15 11:21	5000	7000	3000	4000	138.2	455.7	0
	Cap	3060	0	28-May-15 13:37	28-May-15 13:38	5000	7000	3000	4000	1.1	3.5	0
	Plug	3060	0	26-May-15 11:08	26-May-15 11:59	5000	7000	3000	4000	57.8	188.2	0
800												
	Body	6000	0	26-May-15 10:28	27-May-15 12:57	100	175	750	1500	262.1	860.9	0
	Cap	6000	0	28-May-15 13:35	28-May-15 13:37	100	175	750	1500	1.8	5.9	0
	Plug	6000	0	26-May-15 09:41	26-May-15 10:27	100	175	750	1500	52.6	171.5	0



Mine Backfill Analysis using PI Coresight

The screenshot displays the PI Coresight web interface. At the top, the header includes the PI Coresight logo, a search bar labeled 'Search All Displays', and a 'New Display' button. Below the header, the left sidebar contains navigation links: 'ALL DISPLAYS' (highlighted), 'FAVORITES', 'MY DISPLAYS', 'RECENT', and 'FOLDER HOME'. Under 'FOLDER HOME', a list of mine displays is shown, including '8346 - ON - Clarabelle Mill', '8322 - ON - Copper Cliff Mine', '8473 - MB - Thompson Nickel Refinery', '8355 - ON - Energy and Power', '8310 - ON - Coleman Mine', '8338 - ON - Totten Mine', '8361 - ON - CC Smelter', '8362 - ON - Matte Processing', '8363 - ON - Oxygen and Utilities', '8375 - ON - CC Nickel Refinery', and '8572 - VNL - Long Harbour Refinery'. The main area, titled 'All Displays (574)', shows a grid of 12 display thumbnails. Each thumbnail includes a title, a subtitle, and a small icon representing the display type. The displays shown are: '8338-TottenOverview', '8338-SUP-MECHL-Fuel_Delivery', '8338-SUP-VENTI-Ventilation_Fans', '8338-SUP-SAFETY-Stench_Injection', 'NorthMine Sandfill Process', '8322 - Sandfill Batch Analysis', '8338-SUP-MECHL-Backup Diesel Gene', '8338-SUP-VENTI-Rar-Network Temp', and others. Each display thumbnail shows a preview of its content, which includes various charts, graphs, and data tables.

PI Coresight

Search All Displays

Filter by Labels

ALL DISPLAYS

FAVORITES

MY DISPLAYS

RECENT

FOLDER HOME

8346 - ON - Clarabelle Mill

8322 - ON - Copper Cliff Mine

8473 - MB - Thompson Nickel Refinery

8355 - ON - Energy and Power

8310 - ON - Coleman Mine

8338 - ON - Totten Mine

8361 - ON - CC Smelter

8362 - ON - Matte Processing

8363 - ON - Oxygen and Utilities

8375 - ON - CC Nickel Refinery

8572 - VNL - Long Harbour Refinery

All Displays (574)

8338-TottenOverview
BULTINAdministrators

8338-SUP-MECHL-Fuel_Delivery
BULTINAdministrators

8338-SUP-VENTI-Ventilation_Fans
BULTINAdministrators

8338-SUP-SAFETY-Stench_Injection
BULTINAdministrators

NorthMine Sandfill Process
VALENETJ1LOBO

8322 - Sandfill Batch Analysis
VALENETJ1LOBO

8338-SUP-MECHL-Backup Diesel Gene
BULTINAdministrators

8338-SUP-VENTI-Rar-Network Temp
BULTINAdministrators

Process Mimics

Problem

- Business requires access to Process Graphics without negative impacts on PCN

Solution

- Create PI ProcessBook displays
- Host displays in Operational Reporting Portal and PI Coresight
- Displays available on Desktops, tablets, and smart phones on Wide Area Network, and Internet



Underground wireless access to PI Coresight displays

Process Mimic Demo

The screenshot shows the PI Coresight web interface. At the top, there's a header with the PI Coresight logo, a search bar, and a 'New Display' button. Below the header, the main content area is titled 'All Displays (574)'. On the left side, there's a sidebar with navigation options: 'ALL DISPLAYS' (selected), 'FAVORITES', 'MY DISPLAYS', 'RECENT', and 'FOLDER HOME'. Under 'FOLDER HOME', there's a list of displays categorized by location and process type, such as '8346 - ON - Clarabelle Mill', '8322 - ON - Copper Cliff Mine', '8473 - MB - Thompson Nickel Refinery', '8355 - ON - Energy and Power', '8310 - ON - Coleman Mine', '8338 - ON - Totten Mine', '8361 - ON - CC Smetter', '8362 - ON - Matte Processing', '8363 - ON - Oxygen and Utilities', '8375 - ON - CC Nickel Refinery', and '8572 - VNL- Long Harbour Refinery'. The main grid displays 12 individual process displays, each with a thumbnail image and a title. The titles are: '8338-SUP-VENTI-RAR', '8338-SUP-VENTI-Rar_VI101_Trend', '8338-TottenOverview', '8338-SUP-AIRSY-FAR_Overview', '8338-SUP-MNDWT-4000L', '8338-CCH-MUCIR-WASTE Passes', '8338-SUP-MUCIR-OreHandling Overvie', 'RAR_MixingTank', and three others that are partially visible. Each display has a set of icons (a group of people, a gear, and a star) at the bottom right. The bottom of the interface shows a URL bar with the address 'http://coresightcan/Coresight/#/P8Displays/2218'.

PI Coresight

Search All Displays

Filter by Labels

ALL DISPLAYS

FAVORITES

MY DISPLAYS

RECENT

FOLDER HOME

8346 - ON - Clarabelle Mill

8322 - ON - Copper Cliff Mine

8473 - MB - Thompson Nickel Refinery

8355 - ON - Energy and Power

8310 - ON - Coleman Mine

8338 - ON - Totten Mine

8361 - ON - CC Smetter

8362 - ON - Matte Processing

8363 - ON - Oxygen and Utilities

8375 - ON - CC Nickel Refinery

8572 - VNL- Long Harbour Refinery

8338-SUP-VENTI-RAR

BUILTINAdministrators

8338-SUP-VENTI-Rar_VI101_Trend

BUILTINAdministrators

8338-TottenOverview

BUILTINAdministrators

8338-SUP-AIRSY-FAR_Overview

BUILTINAdministrators

8338-SUP-MNDWT-4000L

BUILTINAdministrators

8338-CCH-MUCIR-WASTE Passes

BUILTINAdministrators

8338-SUP-MUCIR-OreHandling Overvie

BUILTINAdministrators

RAR_MixingTank

VALENETM1NOLAN

<http://coresightcan/Coresight/#/P8Displays/2218>

Mine Crusher KPI Report

Problem

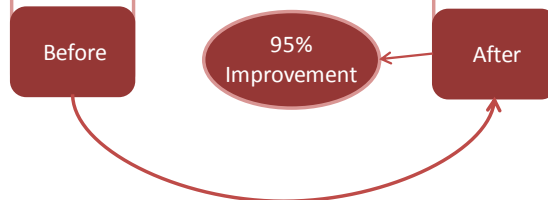
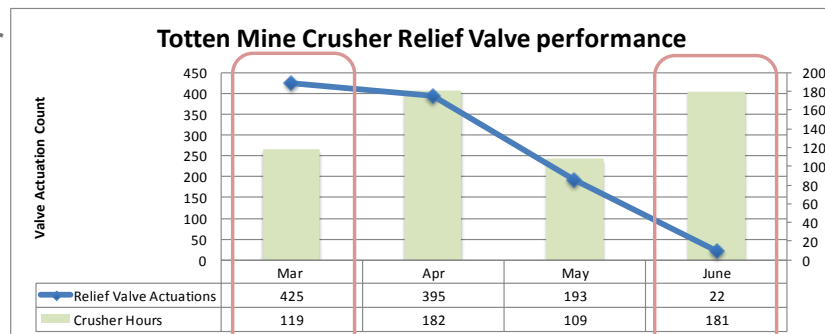
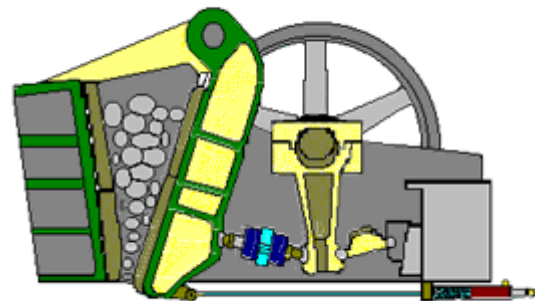
- Multiple Crusher failures
 - Bearings overheating
 - Hydraulic toggle relief valve actuations

Solution

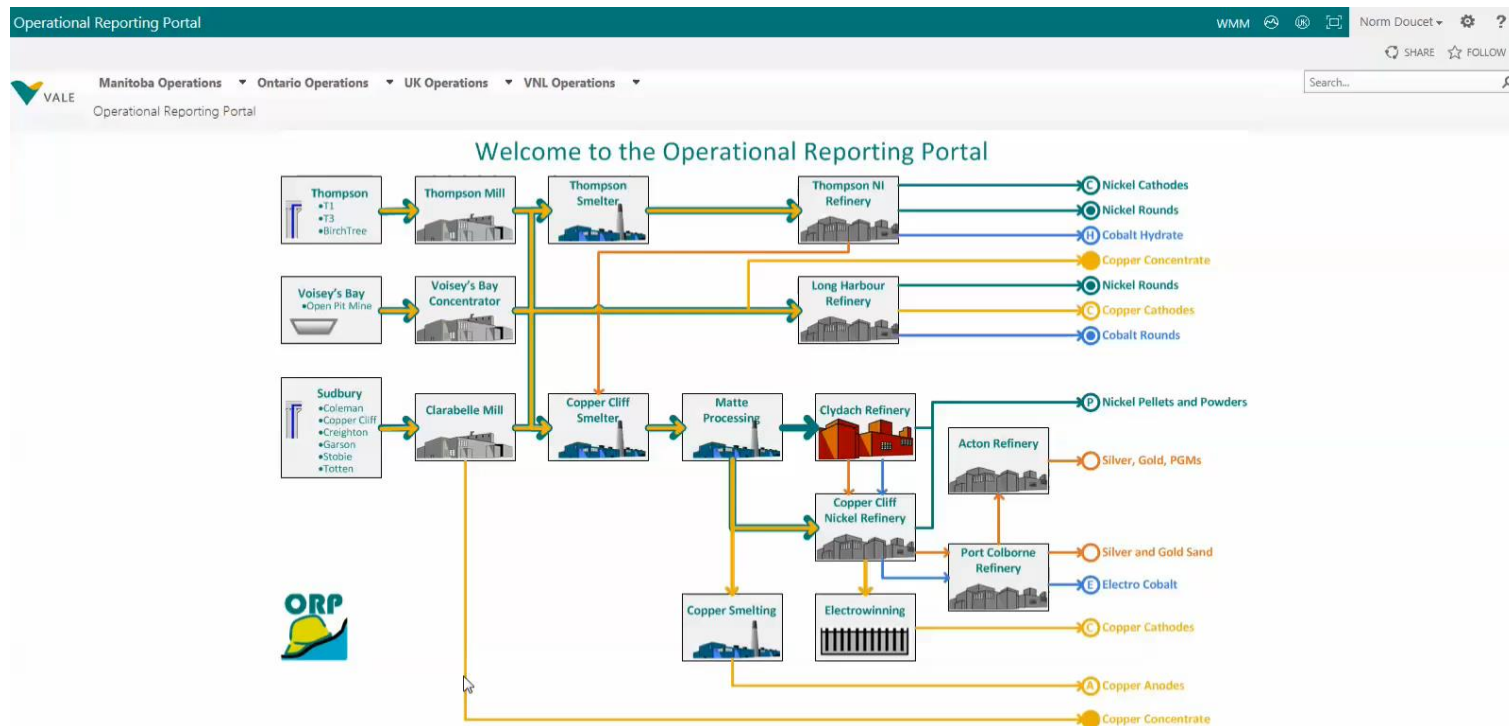
- Monitor bearing temp. to ensure operator adherence.
- Monitor Rollback time to indicate potential premature bearing failure
- Monitor Relief valve actuations

Results

- Plant Engineers quantified and justified liner redesign to avoid future failures
- Liner changed in May 2014
- Realized a drastic decrease in crushing forces at the hydraulic toggle



Crusher Report Demo – Webparts and Excel DataLink Server



Foundation Growth and Innovation Empowerment

Contact Information

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Vale



Questions

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

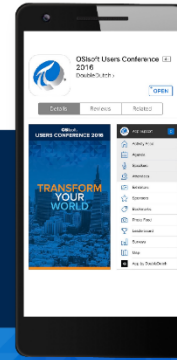


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谢谢

Danke

Merci

Gracias

Thank You

ありがとう

Спасибо

Obrigado

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