

EMPOWER YOUR ANALYTICS WITH OPERATIONAL DATA

# Design Excursion Monitoring

*Franco Branca, Snr Process Engineer,  
Methanex NZ*

*1 October 2019*

Organiser



Co-host



# Presenter



Franco Branca

Senior Process Engineer at Methanex New Zealand  
Based in New Plymouth Taranaki.

Degree in Chemical Engineering, University of Pretoria

Operations support Petrochem and Gas Production  
Engineering Project support  
Design and Governance  
Energy Efficiency



# Team



**IT manager:**

Ngaio Crook

**IT expert:**

Gavin Aspeling

**Engineers:**

Franco Branca  
Ama Wickramanayake  
Nick Hornby

**Maximo Database:**

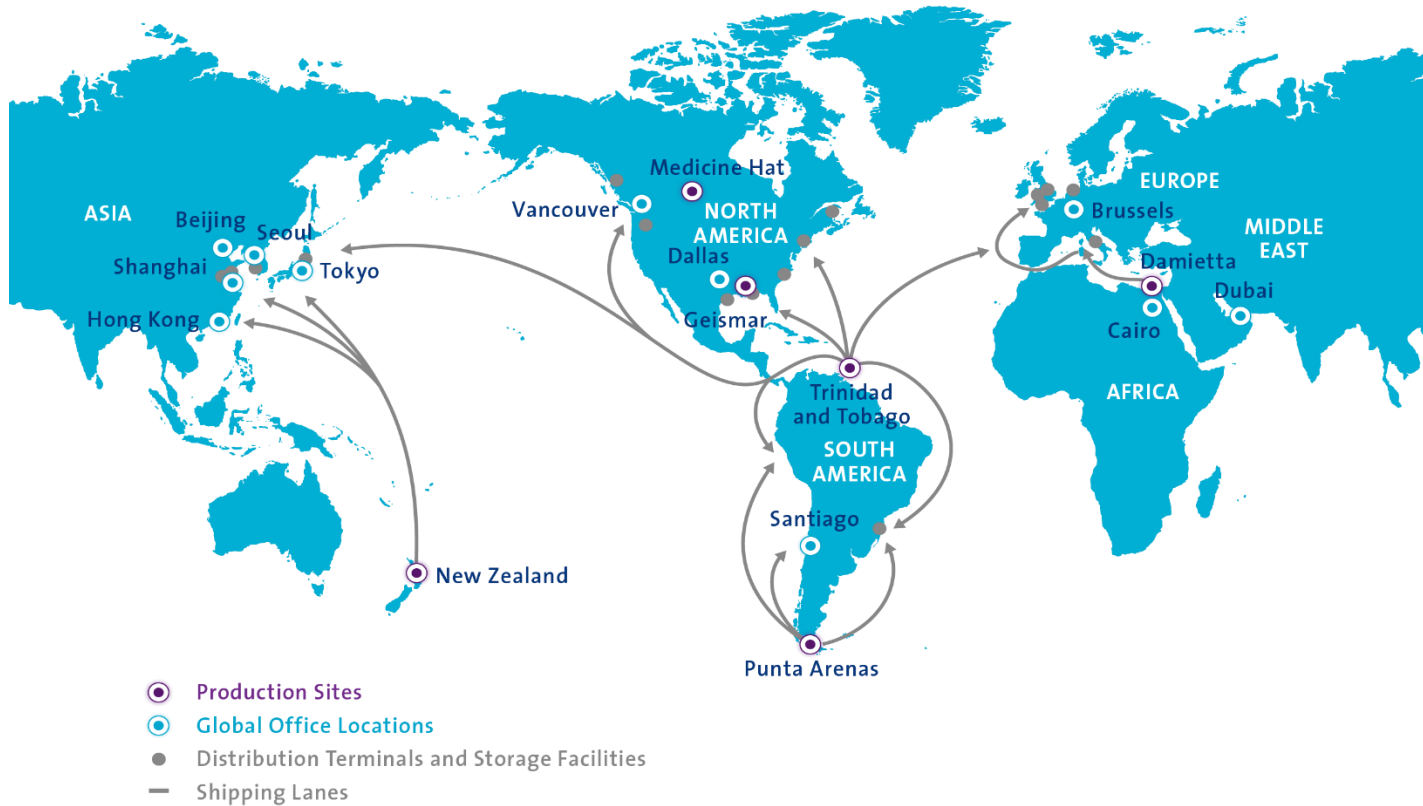
Jamie Booker

**Dimension Software:**

David Barker  
Tom Buznik



# Methanex



# Methanex



We employ over

270 jobs directly & 3,000 jobs indirectly



Our contributions to the economy total

**8%** of Taranaki GDP

**\$834m** Nationally

Methanex is New Zealand's **only** methanol producer, exporting up to **2.4 million tonnes per year** from our two sites in Taranaki.

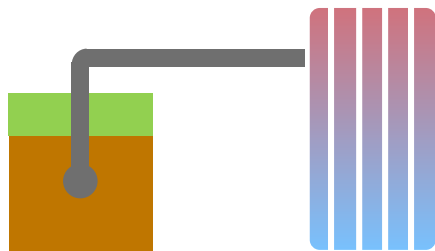


Our **key** markets in New Zealand are **China**, **Japan** and **Korea**.

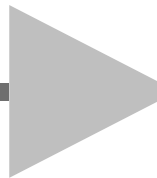


# How we make methanol

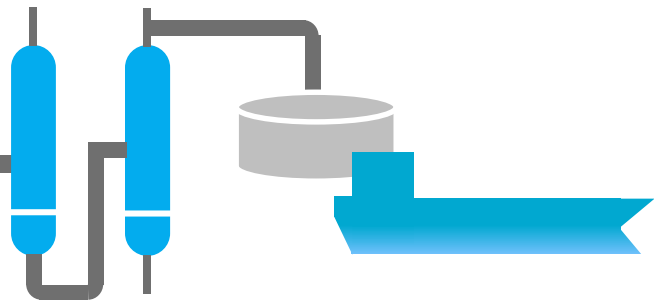
Natural gas and steam combined under heat to make Synthesis gas.



Synthesis gas compressed and converted to Methanol with some water by-product.



Methanol separated through distillation and piped or shipped to our customers





# Safety at Methanex

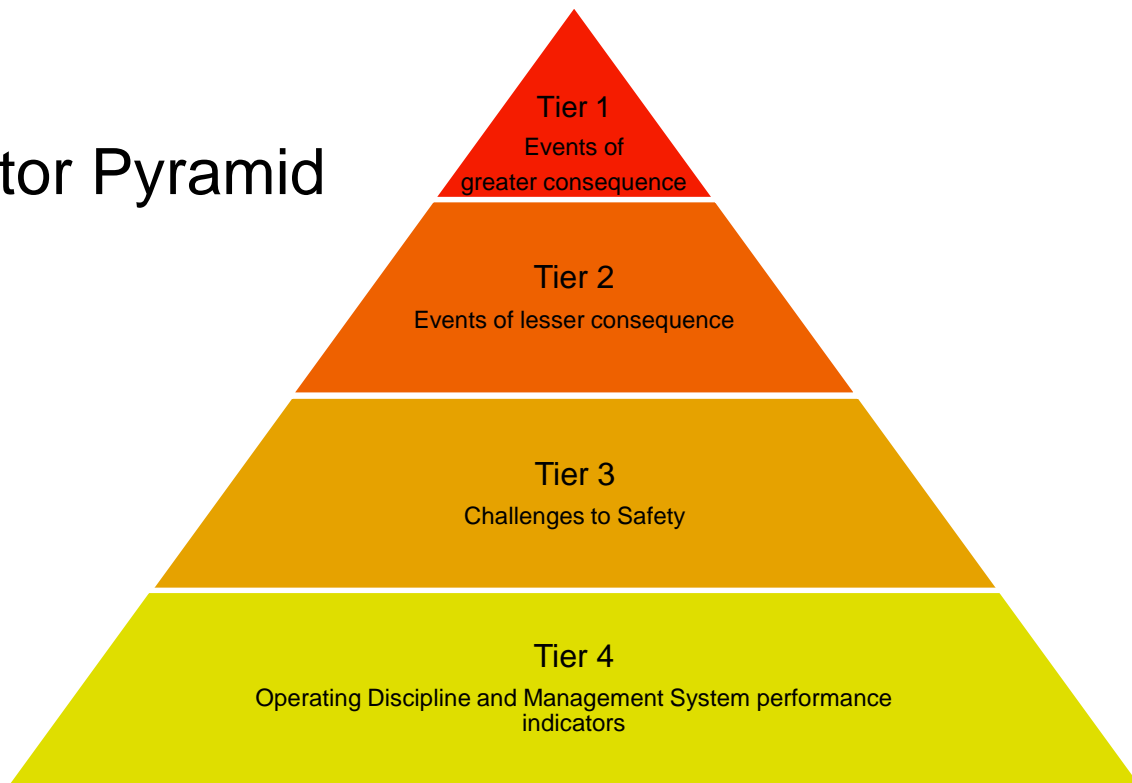


“The safety and well-being of our employees, contractors and the communities in which we do business is our number one priority”



# Process Safety Metrics

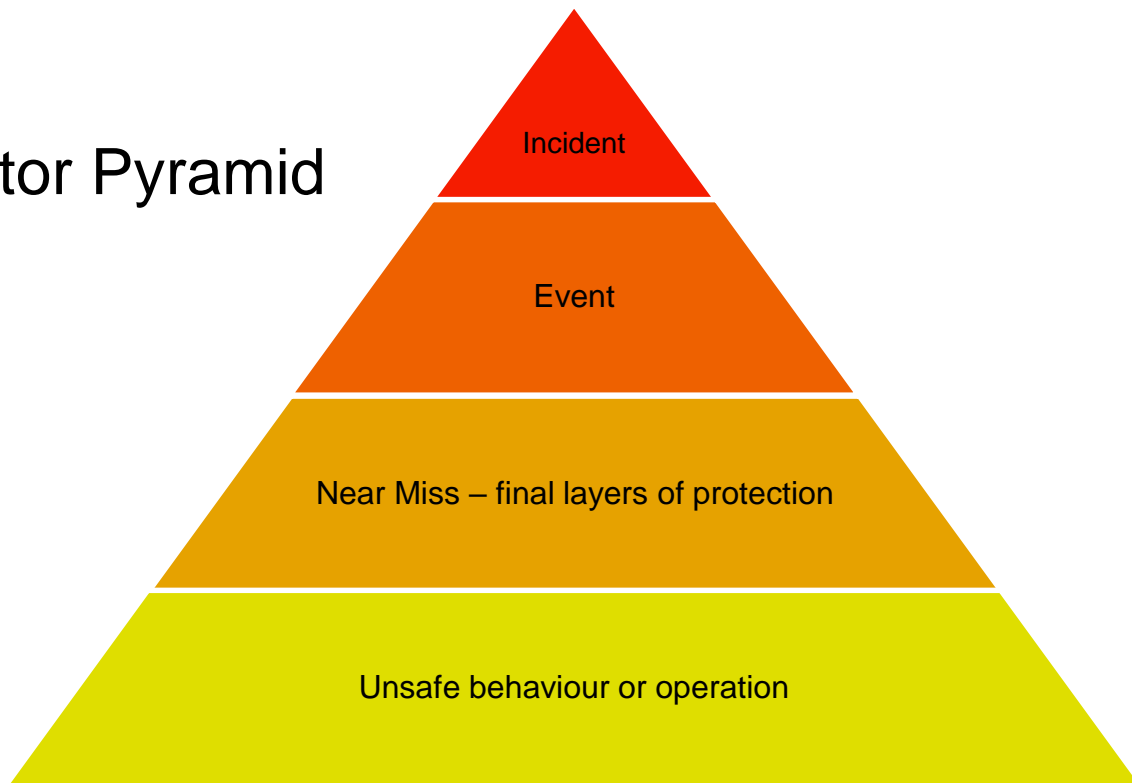
## API RP-754 Process Safety Indicator Pyramid





# Process Safety Metrics

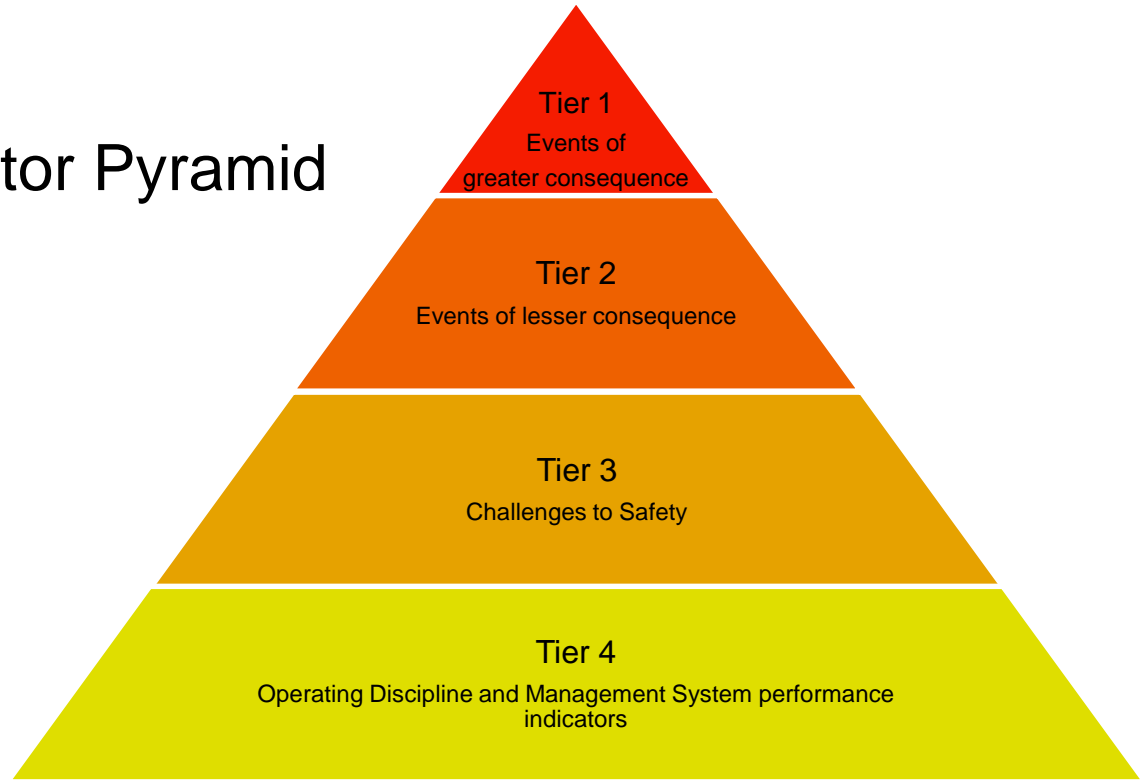
## API RP-754 Process Safety Indicator Pyramid



# Process Safety Metrics

## API RP-754 Process Safety Indicator Pyramid

### Swiss Cheese

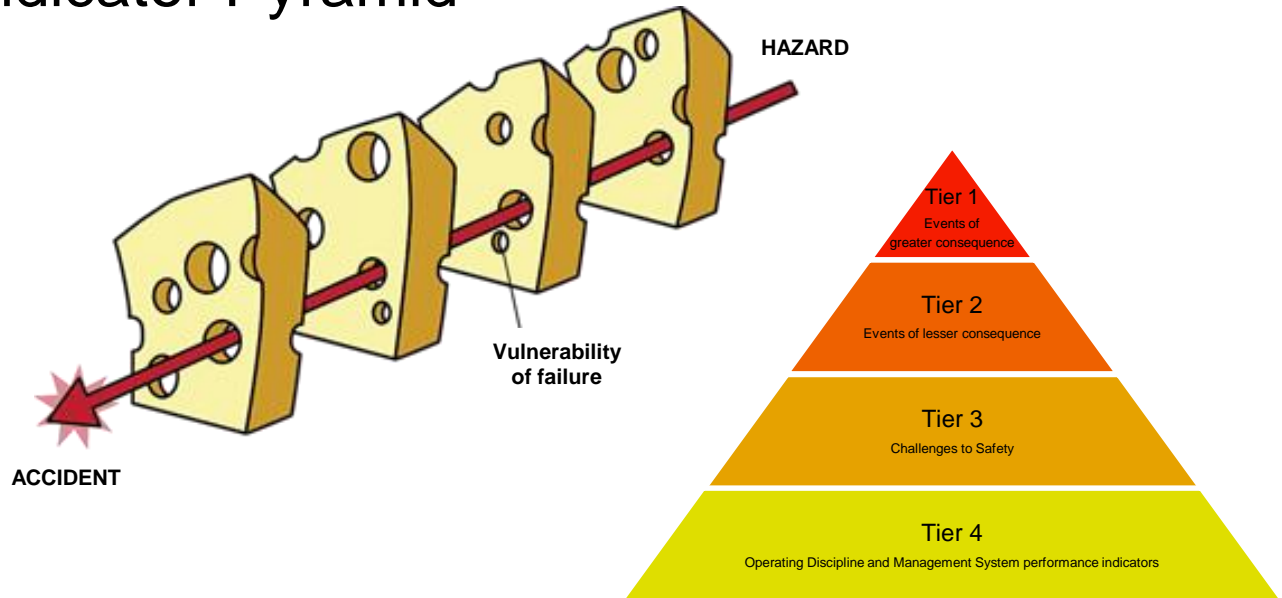


# Process Safety Metrics

API RP-754

Process Safety Indicator Pyramid

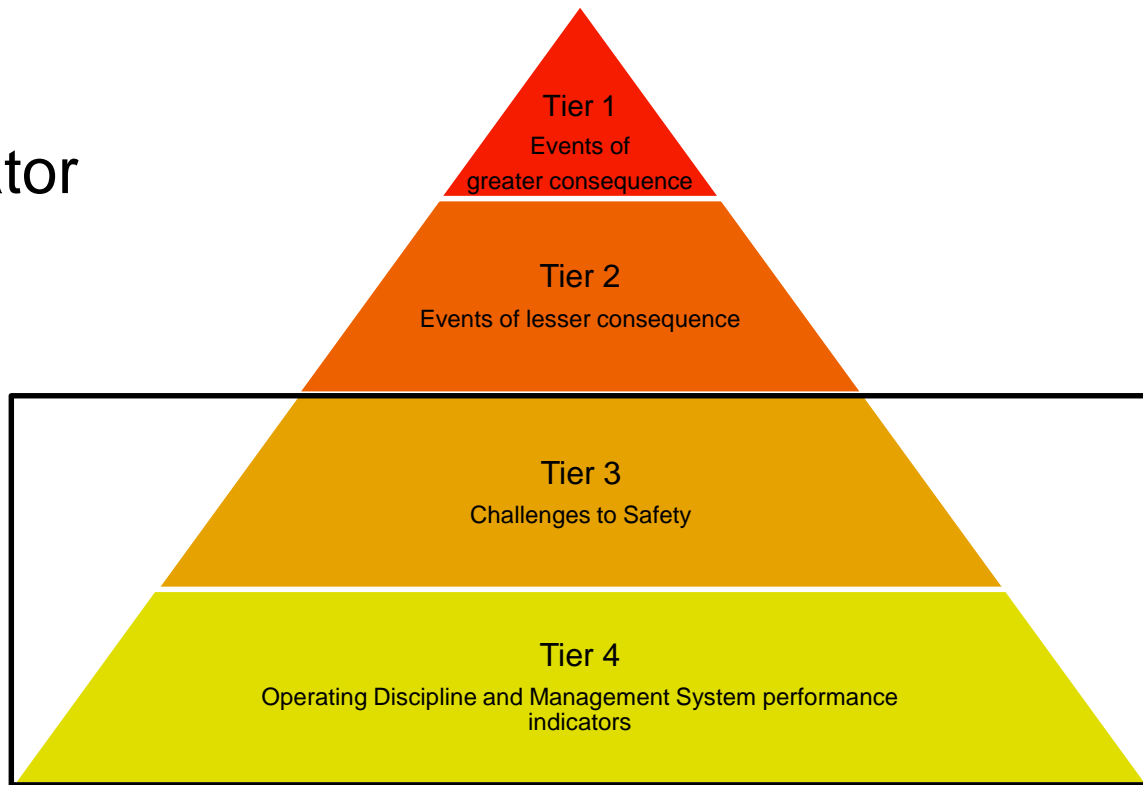
Swiss Cheese



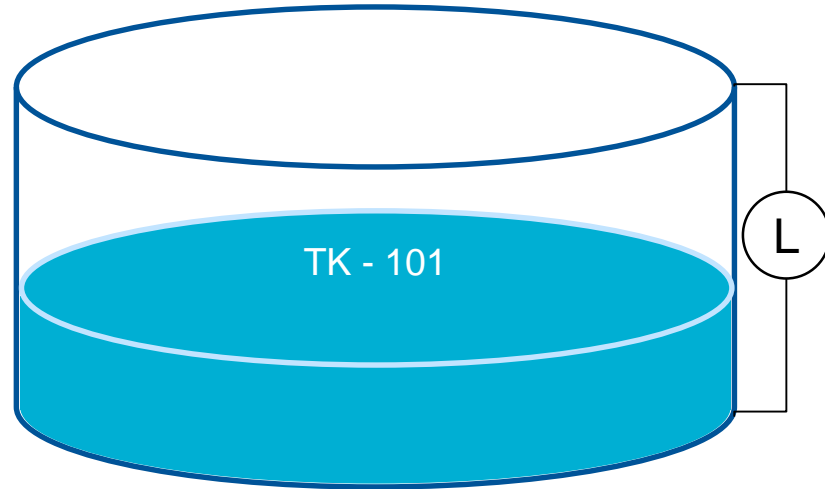
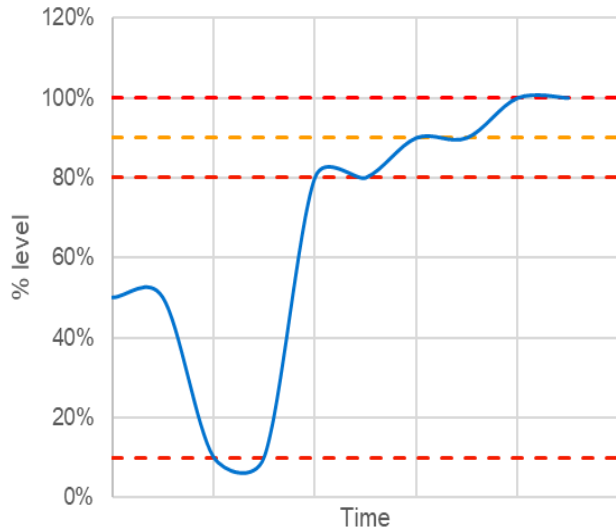
# Process Safety Metrics

## API RP-754 Process Safety Indicator Pyramid

Tier 3 and 4 indicators provide information about the strength (or lack thereof) of barriers and weaknesses in the equipment and hazard control systems.



# Process Safety Metrics

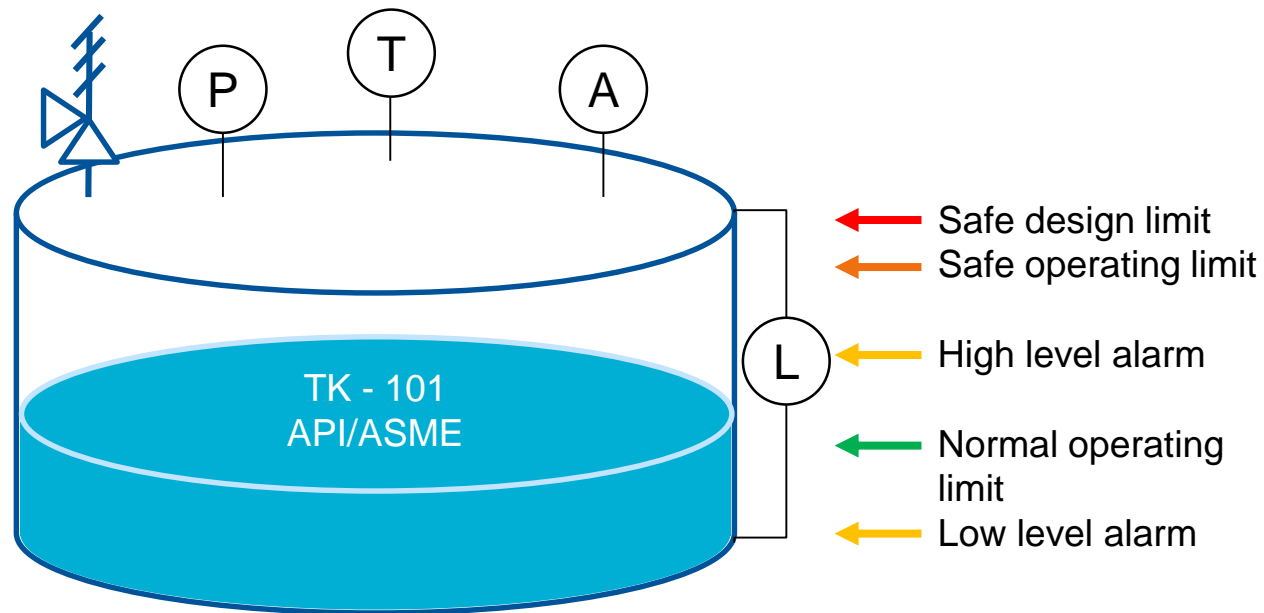


- ← Safe design limit
- ← Safe operating limit
- ← High level alarm
- ← Normal operating limit
- ← Low level alarm

# Process Safety Metrics

## Asset Information

- Equipment name
- Design Code
- Protection systems
- Max/Min Level
- Max/ Min Pressure
- Max/Min Temperature
- Max/Min Concentration

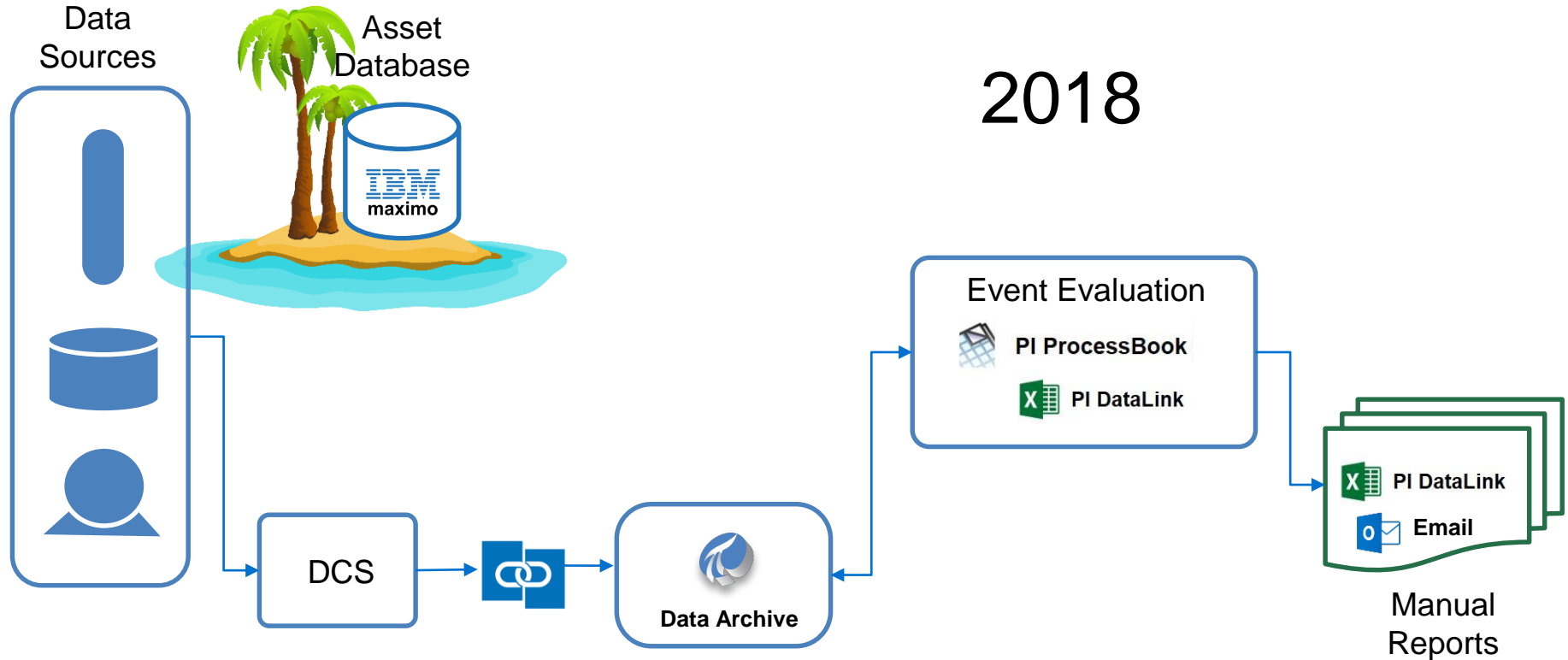


# 1985

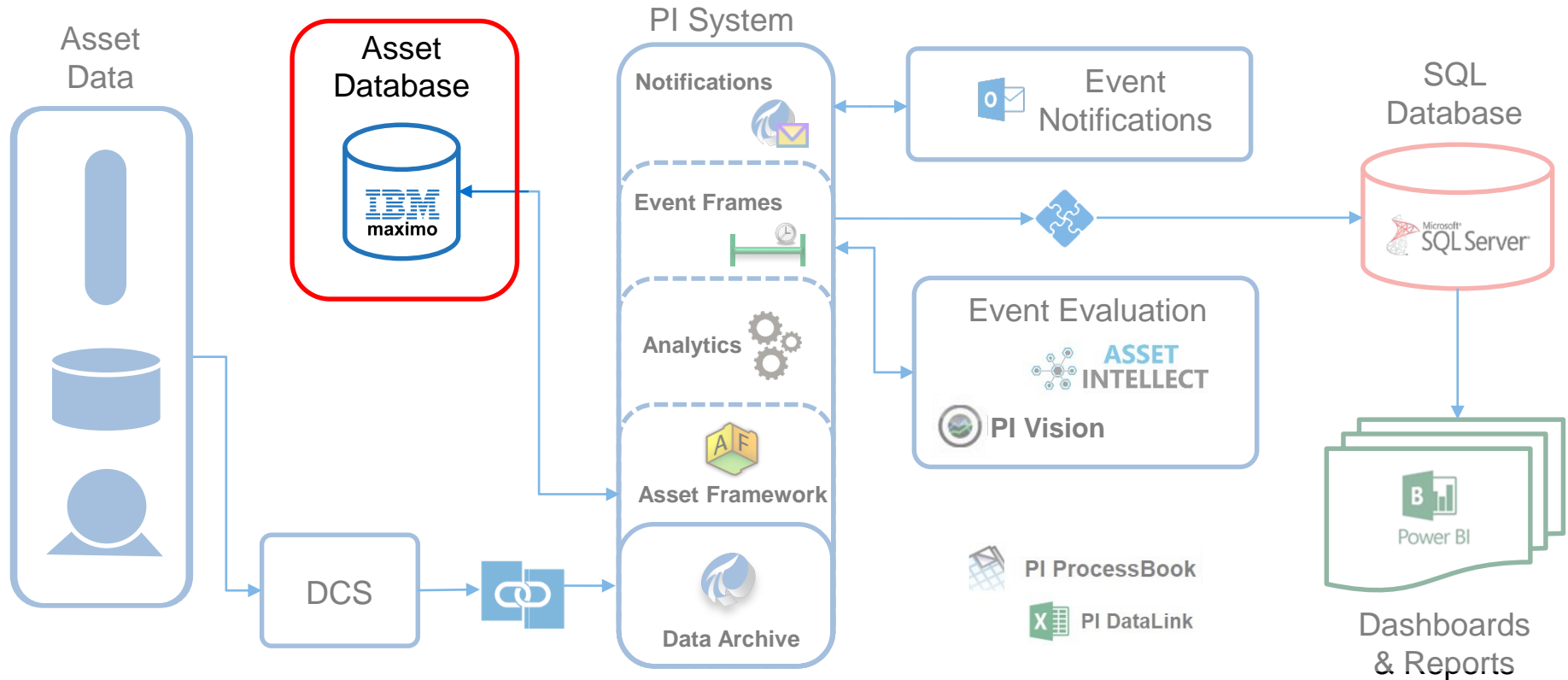




# System Framework – Old System



# System Framework – New System



# Maximo – Asset database

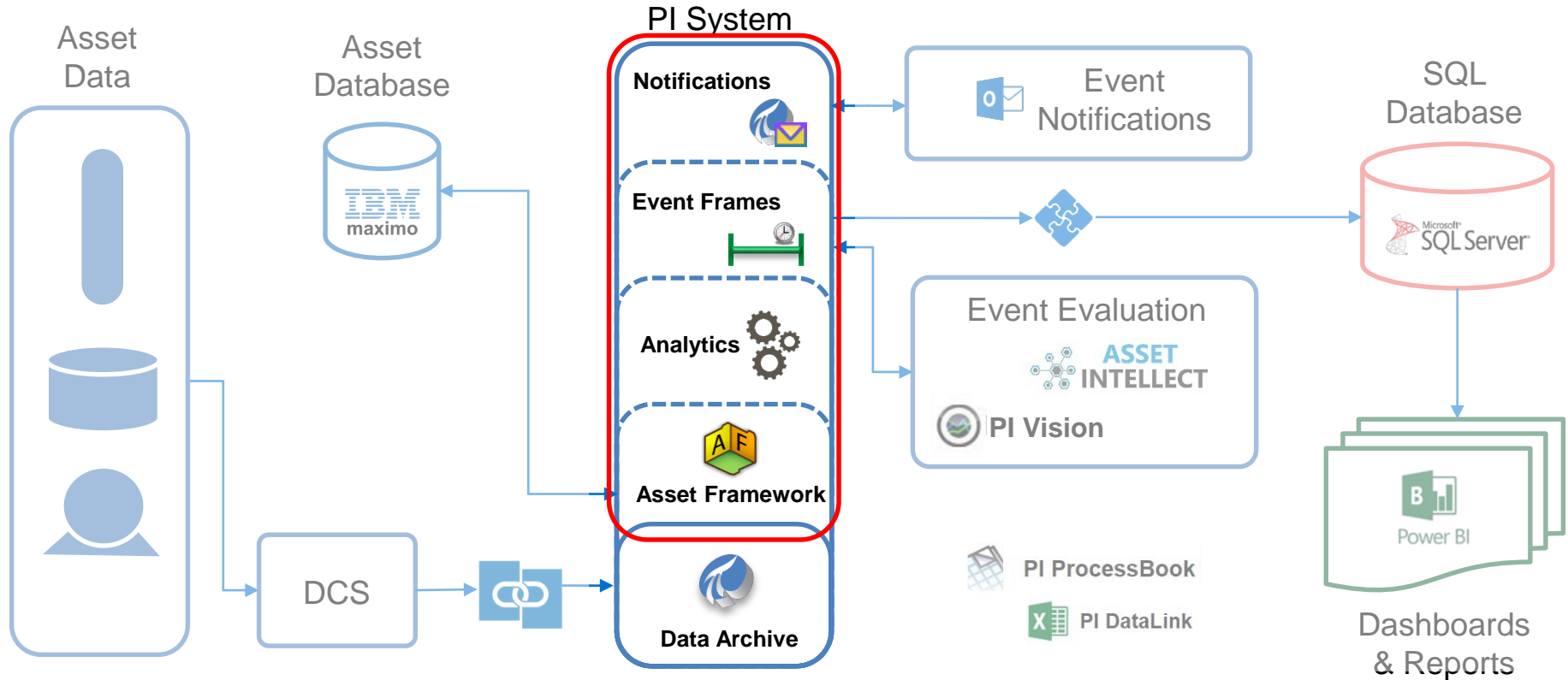


## Process Equipment

- Max/Min Design Temperature & Pressure
- Max/Min Operating Temperature & Pressure
- Design Code
- PSV's protecting equipment & Setpoints
- PI Tags for process variables
- RMS Risk of failure

List	Asset	Spare Parts	Safety	Meters	Specifications	Work	Work Zones	S
Asset: D-0101A		DESULFURIZATION VESSEL						
Classification: VESSEL \ PRESSURE								>>
Specifications  Filter >    1 - 44 of 86								
Attribute		Description	Data Type	Published Text Value				
TMPND		TEMPERATURE INDICATOR	ALN	TI 129 DCS				
TMPI		TEMPERATURE PI TAG	ALN	T01129.PV				
PSV 1		PROTECTING PSV 1	ALN	PSV-01061				
PRSIND		PRESSURE INDICATOR	ALN	PI 608				
PRSPI		PRESSURE PI TAG	ALN	P01002.PV				
MANUF		MANUFACTURER	ALN	HITACHI				
FLUID		PROCESS FLUID	ALN	Feedstock gas				
DECODE		DESIGN CODE	ALN	ASME Sect VIII, Div 1, 1980				
PRSHYDTEST		HYDRO TEST F	ALN	82.9 barg				
RBIRISK		RISK OF FAILURE	ALN	806				
CORRALLHEAD		CORROSION ALLOWANCE HEAD	ALN	3mm				
CORRALLSHELL		CORROSION ALLOWANCE SHELL	ALN	3mm				
MINSP		M&I YEARLY INSPECTN DATE	ALN	30-SEP				
VOLMAXALLOW		VOLUME MAX ALLOWABLE	ALN	123 m3				
MINO		M&I OFFICIAL NUMBER	ALN	116355				

# System Framework – New System



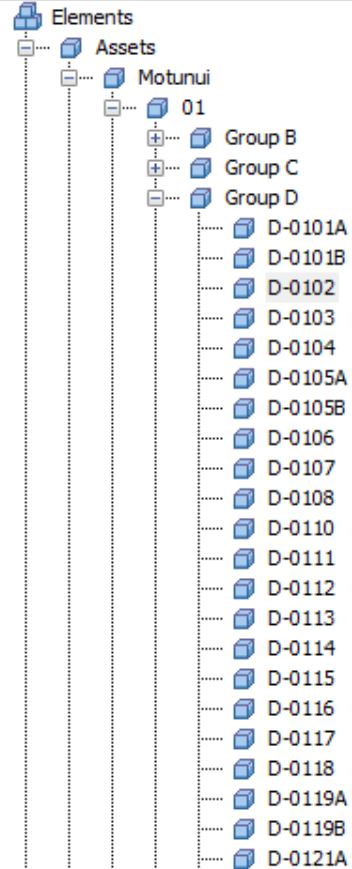
# PI Server Asset Framework



- Asset Framework



## Elements



# PI Server Asset Framework



- Asset Framework



- Asset Templates per type of asset

- Attributes



D-0102			
General Child Elements Attributes Ports Analyses Notification Rules Version			
Filter			
		Name	Value
		Category: <None>	
		Description	NO. 1 REFORMED GAS K.O. DRUM
		Equipment Number	D-0102
		Category: Design Data	
		Category: Equipment Properties	
		Design Code	ASME Sect VIII, Div 1, 1980
		Category: Operating Data	
		Max Operating Pressure	0 barg
		Max Operating Temperature	214 °C
		Min Operating Pressure	0 barg
		Min Operating Temperature	0 °C
		Operating Pressure	17.5 barg
		Operating Temperature	138 °C
		Category: Process Variable	
		% of Design Pressure	74.311857313198 %

# PI Server Asset Framework



- Asset Framework



- Asset Templates per type of asset

- Attributes



- Analysis Calculations

- Event Frame generation



- Event notifications

D-0102

General Child Elements Attributes Ports Analyses Notification Rules Version

		Name	Backfilling
✓	■	Max Design Pressure Excursion	
✓	■	Max Design Temperature Excursion	
✓	■	Min Design Pressure Excursion	
✓	■	Min Design Temperature Excursion	
✓	■	PRD 1 demand	
✓	■	PRD 2 demand	
✓	■	PRD 3 demand	
✓	■	PRD 4 demand	
!	■	PSV Set Pressure	

Generation Mode: Explicit Trigger Event Frame Template: Excursion

Add... ▾

Name	Expression
Start triggers	
StartTrigger1	'Max Design Pressure' <> 0 and BadVal('Current Pressure') <> T
Outputs at close	
Output1	// Event frames do not require end triggers to be specified, "Max Design Pressure Excursion"
Output2	"Pressure"
Output3	'Equipment Number'



# PI Server Asset Framework



- Asset Framework



- Asset Templates per type of asset

- Attributes

- Analysis Calculations

- Event Frame generation

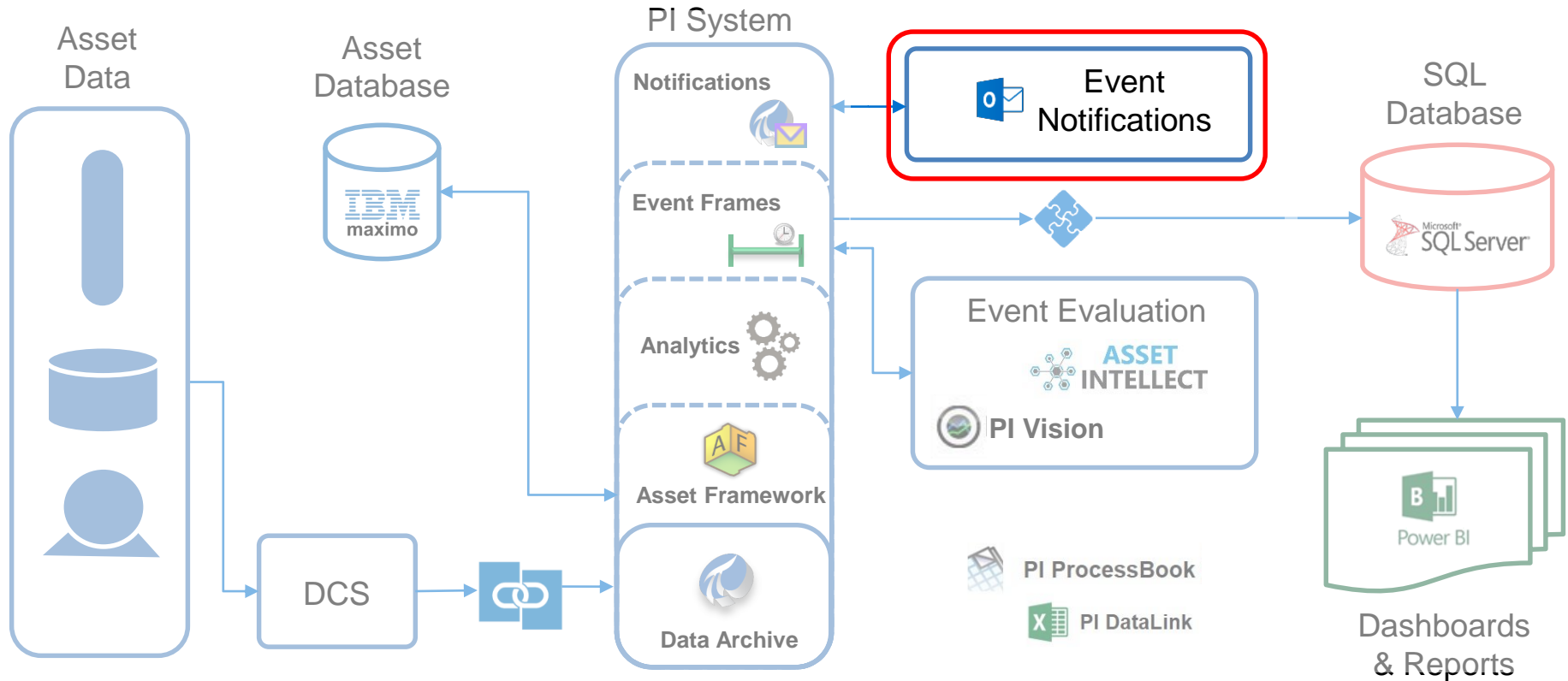
- Event notifications



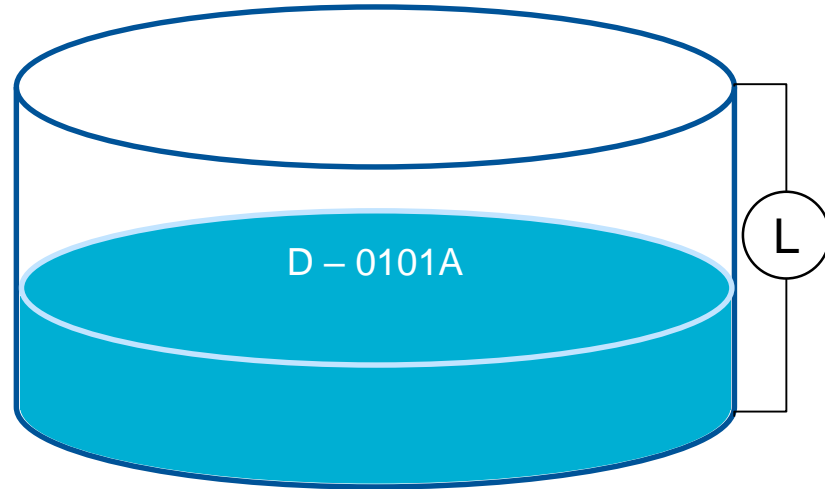
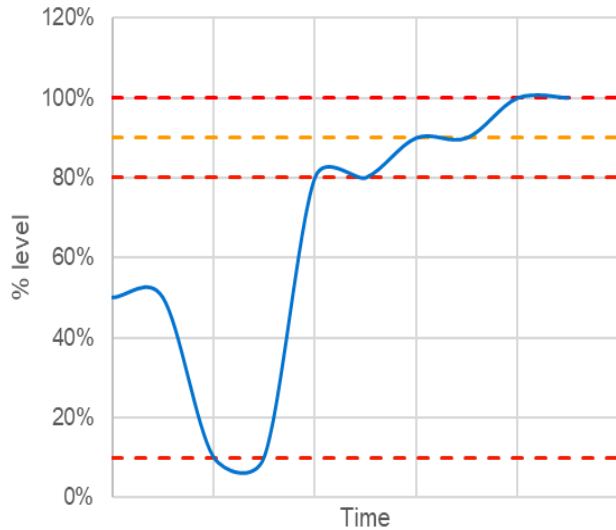
## Added to Asset Framework

Assets/Elements	581
Design Parameters	1111
PI Tags references	776
Templates	4

# System Framework – New System



# Event Notifications



- ← Safe design limit
- ← Safe operating limit
- ← High level alarm
- ← Normal operating limit
- ← Low level alarm

# Asset Framework

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**From:** mxnz\_pialerts@methanex.com <mxnz\_pialerts@methanex.com>  
**Sent:** Wednesday, 13 March 2019 9:32 PM  
**To:** Franco Branca <fbranca@methanex.com>  
**Subject:** MX NZ Design Excursion - Asset:

## Automatic Alert, Do Not Reply

A Methanex NZ Design Excursion has occurred, details below:

**Equipment:** D-0101A  
**Condition:** Overpressure

**Start Time:** 1/01/1970 12:00:00 AM New Zealand Daylight Time (GMT+13:00:00)  
**End Time:** 31/12/9999 11:59:59 PM New Zealand Daylight Time (GMT+13:00:00)

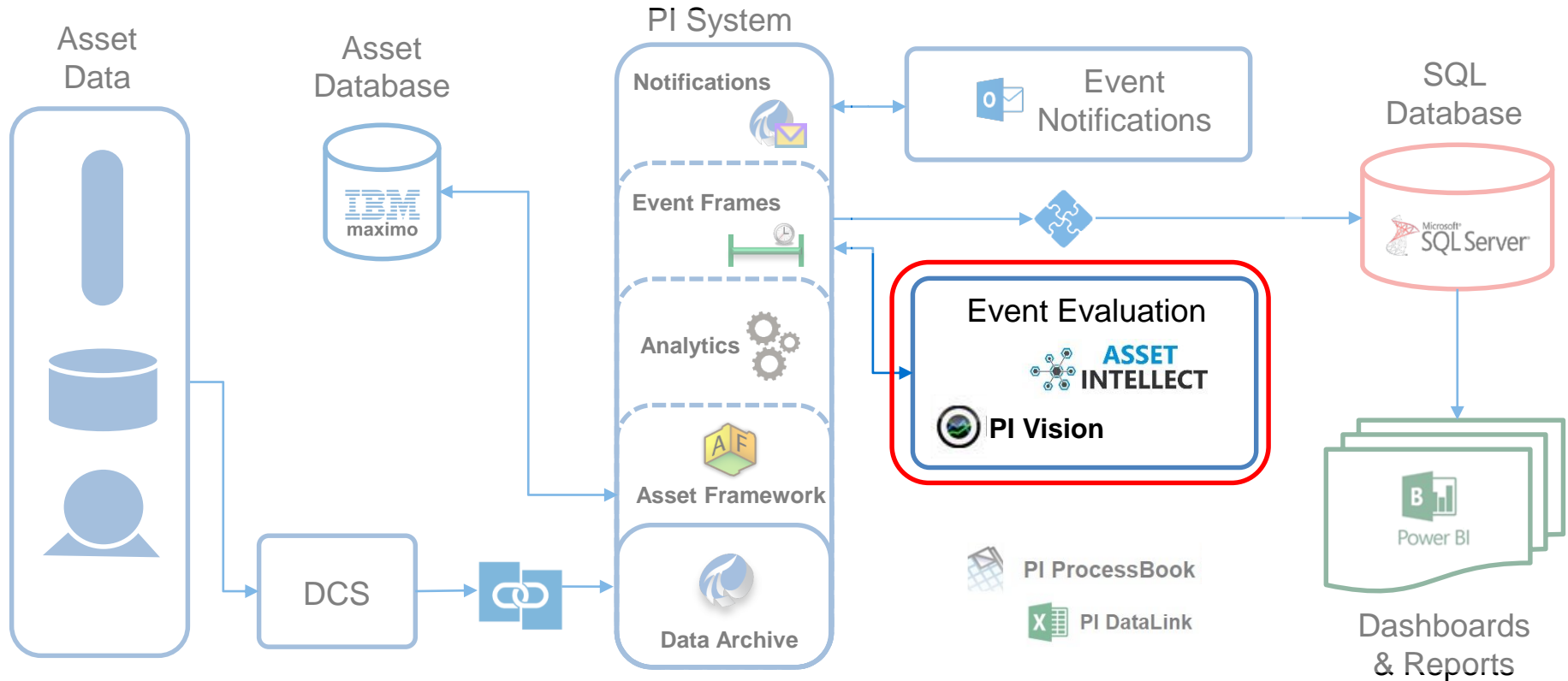
**Excursion Type:** Excursions  
**Max Design Pressure:** 35.6 barg  
**Max Pressure Reached:** 46 ~~barg~~  
**Max Design Temperature:** 428°C  
**Max Temperature Reached:** 70 °C  
**Protecting PSVs:** PSV-01061 Set @ 35.6barg

Please confirm this is a valid excursion event and follow the Mx NZ Process Safety reporting and plant monitoring guideline

Asset Intellect Link to review and update event frame

<<[<https://piportal-nz.methanex.com/AssetIntellect/Portal/Dashboard?elementpath=\\mxnzmotsv003\methanex%20nz\assets\motunui&TabID=6>>](https://piportal-nz.methanex.com/AssetIntellect/Portal/Dashboard?elementpath=\\mxnzmotsv003\methanex%20nz\assets\motunui&TabID=6)

# System Framework – New System



# Asset Intellect – Event Frame Explorer

ASSET INTELLECT

Search for:

Search the PI Asset Framework...

Methanex NZ

Assets

Motunui

Port

Waitara Valley

Efficiency

Production

Utilities

Methanex NZ > Assets > Motunui

BI Dashboard | Monthly Report | Design Excursions | Asset Heat Map

Start Time: \*-2y End Time: \*

New Edit Delete

Start Time	End Time	Duration	Element	Site	Equipment	Excursion	Max	% of	Max	% of Design	KMI Incident Number	Plant Status	Actual Event	Safety Critical	Operator Error	Process Engineering Comment	Evaluation User ID	Engineering Review Completed
15-Aug-2019 11:53	15-Aug-2019 11:55	2m 10s	35\Group CVC-3501	Motunui	C-3501	Temper					TAR-190812-3	Routine Operational Changes	true		false	On 15/08 at 11:55am, T35006.PV increased to 68C for approximately 2 minutes as part of nitrogen plant dry out/warm-up. Rectification column design temperature is 65C.	LMullineux	false
14-Aug-2019 21:18	15-Aug-2019 02:52	5h 33m 40s	35\Group CVC-3501	Motunui	C-3501	Temper					TAR-190812-3	Routine Operational Changes	true		false	On 14/08 21:30, T35006.PV increased to 72C for approximately 5 hours during nitrogen plant dry out/warm-up. Rectification column design temperature is 65C.	LMullineux	false
14-Aug-2019 13:26	14-Aug-2019 14:04	37m 40s	35\Group EIE-3515	Motunui	E-3515	Temper					TAR-190812-3	Routine Operational Changes	true		false	Nitrogen plant still offline due to suspected blockage of V-007 inlet to D3504 gel trap. Repeat nitrogen plant thaw for maintenance. On 14/08 13:30, T35009.PV increased to 89C for approximately 35mins during nitrogen plant turbine expansion thaw. Design temperature of shell is 65C.	LMullineux	false

Editing the selected item

Start Time: 15-Aug-2019 11:53

End Time: 15-Aug-2019 11:55

Element: 35\Group CVC-3501

Site: Motunui

Equipment: C-3501

ExcursionType: Temperature

Excursion\_Condition: Max Design Temperature Excursion

Max Pressure: NaN

% of Design Pressure: [object Object]

Max Temperature: 68

% of Design Temperature: 104.6

KMI Incident Number: IN-TAR-20190812-003

Plant Status: Routine Operational Changes

Actual Event: ☒

Safety Critical: ☐

Operator Error: ☐

Process Engineering Com...  
On 15/08 at 11:55am, T35006.PV increased to 68C for approximately 2 minutes as part of nitrogen plant dry out/warm-up. Rectification column design temperature is 65C.

# Asset Intellect – Event Frame Explorer

ASSET INTELLECT

Search for:

Search the PI Asset Framework...

Methanex NZ

Assets

Motunui

Port

Waitara Valley

Efficiency

Production

Utilities

Methanex NZ > Assets > Motunui

BI Dashboard Monthly Report Design Excursions Asset Heat Map

Back

Name

Value

B-0102DescriptionRADIANT SHIELD BOILER STEAM GENERATOR

B-0102Design CodeASME Sect 1 1980 Ed incl 1980 summer add

B-0102Equipment NumberB-0102

Vessel Trends

% of Design Pressure

No Data %

Name	Value	Units	Minimum	Maximum
C-3501Max Design Pressure	11	barg	11	11
C-3501Current Pressure	No Data	barg	No Data	No Data
C-3501% of Design Pressure	No Data	%	No Data	No Data

Exchanger Trends

C-3501% of Shell Design P

No Data

Name	Value	Units	Minimum	Maximum
B-0102Max Shell Design Pressure	0	barg	0	0
B-0102Min Shell Design Pressure	0	barg	0	0
E-0115Shell Pressure	3.87	barg	3.87	3.87

PSV's Name and Settings

Name	Value	Units
C-3501Protecting PSV 1	PSV-34420	
C-3501PSV 1 Set Pressure	11	barg
C-3501Protecting PSV 2	No Data	
C-3501PSV 2 Set Pressure	No Data	barg
C-3501Protecting PSV 3	No Data	
C-3501PSV 3 Set Pressure	No Data	barg
C-3501Protecting PSV 4	No Data	
C-3501PSV 4 Set Pressure	No Data	barg
E-0101AProtecting PSV 5	PSV-01062 (Tube Side)	
E-0101APSV 5 Set Pressure	35.6	barg
E-0101AProtecting PSV 6	No Data	
E-0101APSV 6 Set Pressure	No Data	barg

08/08/2019 12:00:13

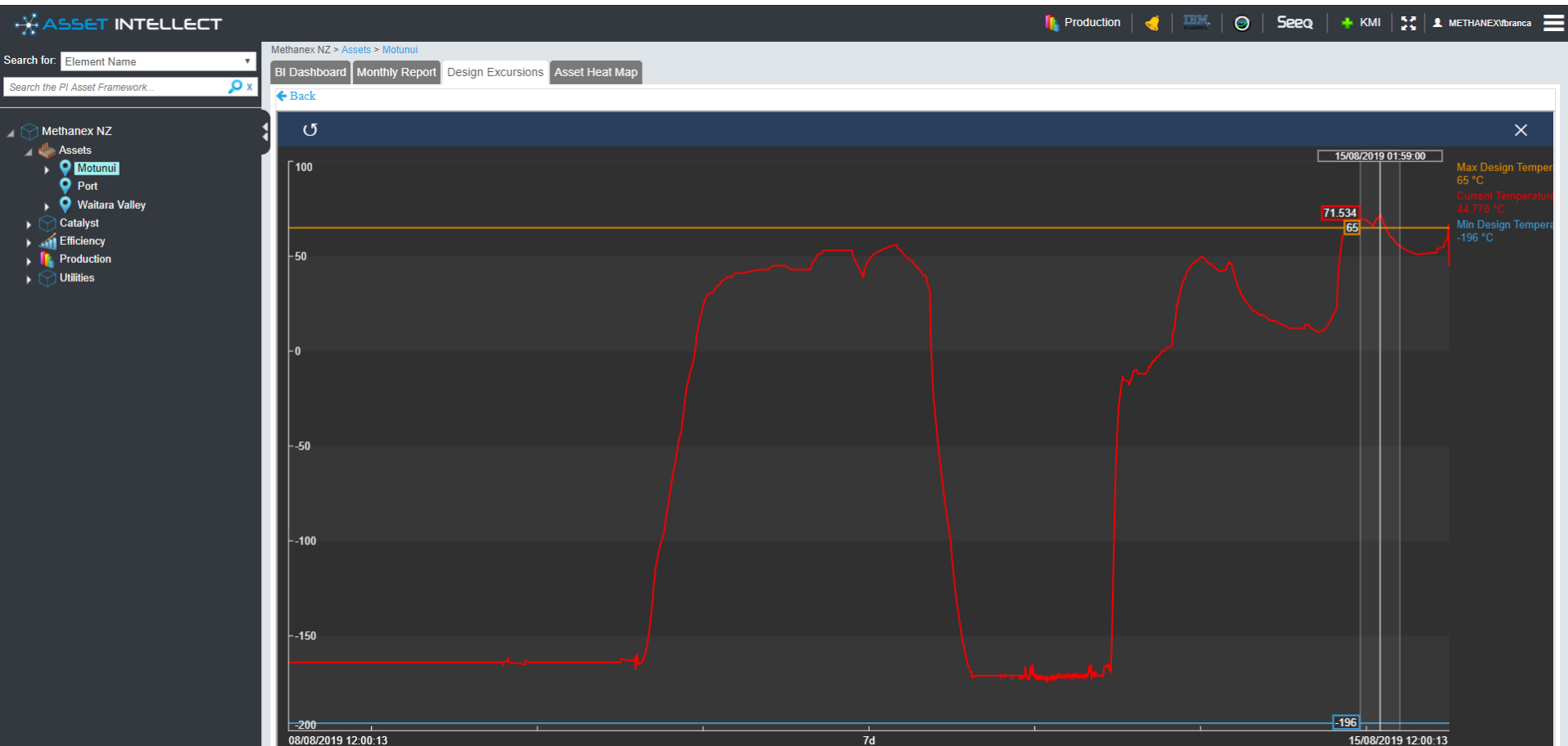
7d

Now

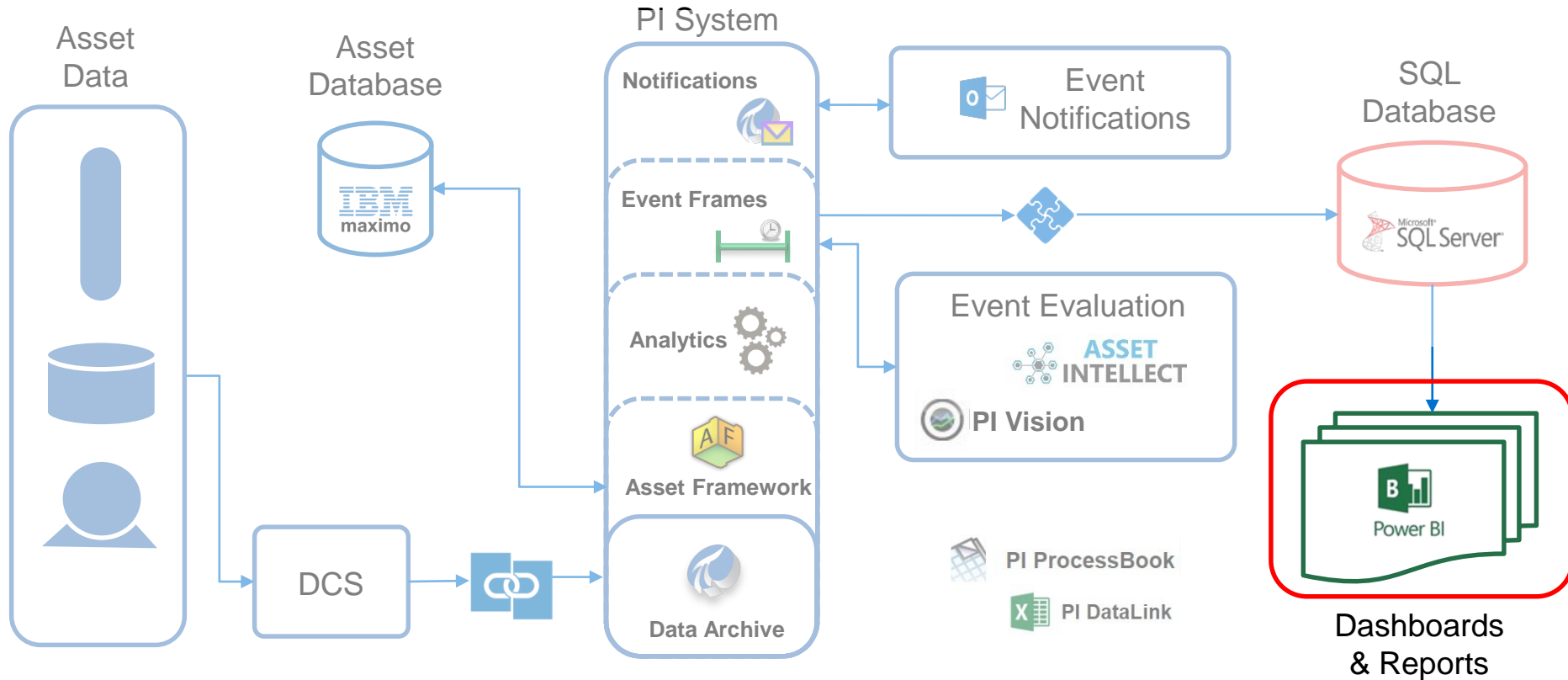
15/08/2019 12:00:13



# Asset Intellect – Event Frame Explorer



# System Framework – New System





# Methanex NZ : Monthly Design Excursion Summary



Year Month

2019 All

Excursion Type

All

Actual Event

True

Site

Multiple selecti...

Nun

Number of Events

10

PRD Demands

TimeStamp Thursday, 15 August 2019

Count 2

First Excursion\_Condition Max Design Temperature Excursion

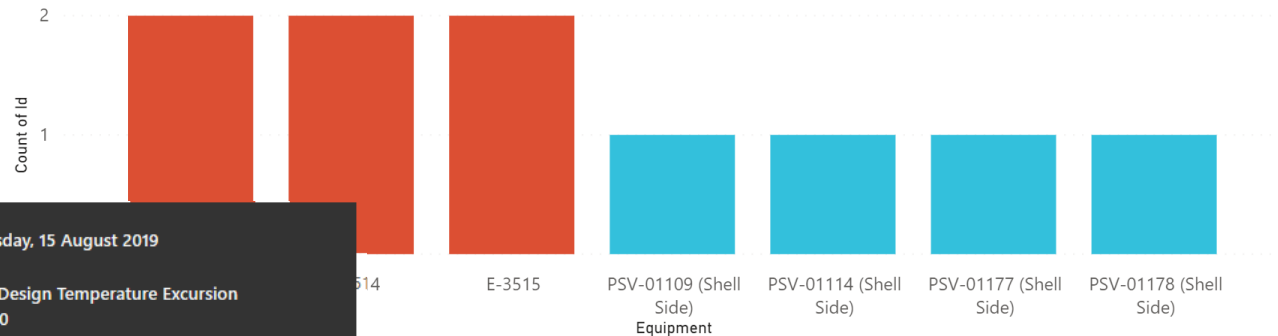
Max Temperature 140.00

MaxDesP 0.00

MaxDesT 130.00

First Process Engineering Comment On 14/08 21:30, T35006.PV increased to 72C for approximately 5 hours during nitrogen plant dry out/warm-up. Rectification column design temperature is 65C.

Number of Excursions



Date of Excursion Events



● Max Design Temperature Ex... ● PRD demand ● Max Shell Design Te...

Equipment	Excursion Condition	Design P	Max P	Design T	Max T	Site	Process Engineering Comment
C-3501	Max Design Temperature Excursion	0.00		65.00	72.00	Motunui	On 14/08 21:30, T35006.PV increased to 72C for approximately 5 hours during nitrogen plant dry out/warm-up.
C-3501	Max Design Temperature	0.00		65.00	68.00	Motunui	On 15/08 at 11:55am, T35006.PV increased to 68C for approximately 2 minutes as part of nitrogen plant dry out.

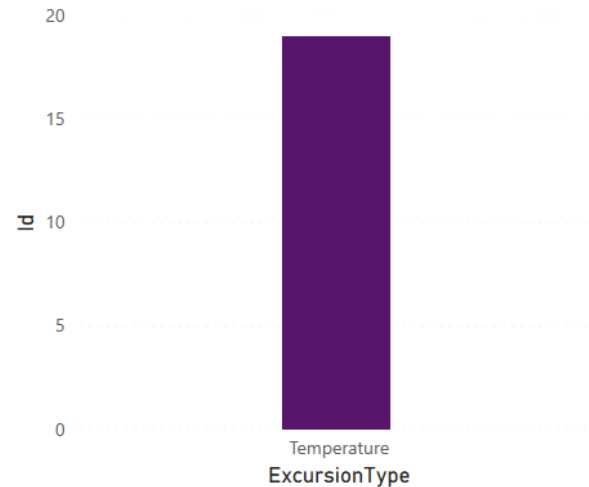


Equipment

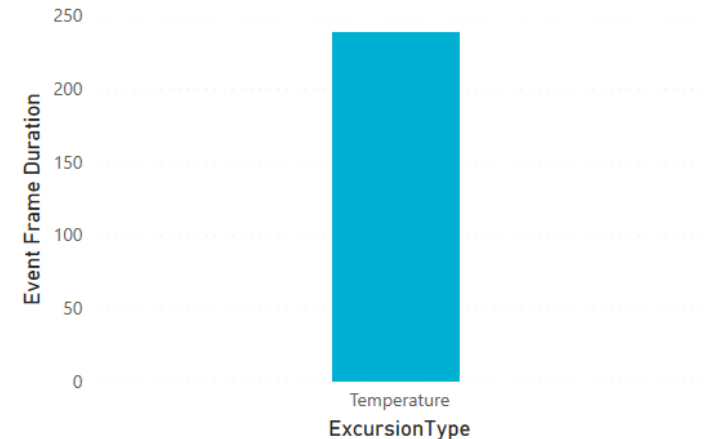
Event Date

<input type="checkbox"/> Select all	<input type="checkbox"/> Select all
<input type="checkbox"/> B-0105	<input checked="" type="checkbox"/> Wednesday, 11 April 2018
<input type="checkbox"/> C-0401	<input checked="" type="checkbox"/> Thursday, 12 April 2018
<input type="checkbox"/> C-0402	<input checked="" type="checkbox"/> Thursday, 3 May 2018
<input type="checkbox"/> C-0601	<input checked="" type="checkbox"/> Friday, 4 May 2018
<input type="checkbox"/> C-0602	<input checked="" type="checkbox"/> Thursday, 24 May 2018
<input type="checkbox"/> C-3501	<input checked="" type="checkbox"/> Saturday, 26 May 2018
<input checked="" type="checkbox"/> D-0102	<input checked="" type="checkbox"/> Monday, 28 May 2018
<input type="checkbox"/> D-0115	<input checked="" type="checkbox"/> Wednesday, 30 May 2018
<input type="checkbox"/> D-0135	<input checked="" type="checkbox"/> Thursday, 31 May 2018
<input type="checkbox"/> D-0136	<input checked="" type="checkbox"/> Friday, 1 June 2018
<input type="checkbox"/> D-0137	<input checked="" type="checkbox"/> Saturday, 2 June 2018
<input type="checkbox"/> D-0139	<input checked="" type="checkbox"/> Thursday, 7 June 2018
<input type="checkbox"/> D-0141	<input checked="" type="checkbox"/> Saturday, 9 June 2018
<input type="checkbox"/> D-0142	<input checked="" type="checkbox"/> Monday, 11 June 2018
<input checked="" type="checkbox"/> D-0202	<input checked="" type="checkbox"/> Saturday, 30 June 2018

## Excursion Events



## Excursion Time (minutes)



## Excursion Type Breakdown

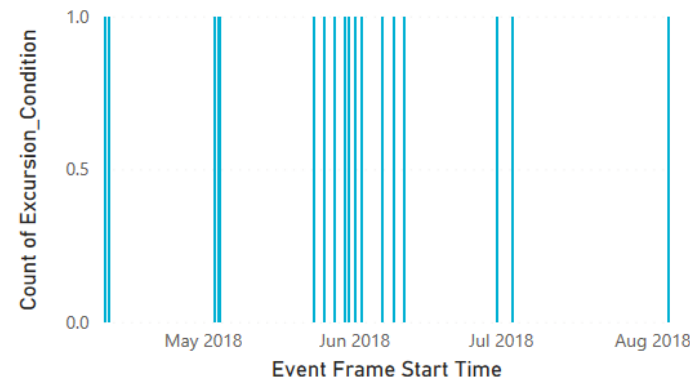
ExcursionType Id

<input checked="" type="checkbox"/> Temperature	19
<b>Total</b>	<b>19</b>

## Count of Event Frame Duration by Equipment



## Count of Excursion\_Condition by Event Frame Start Time



# Methanex New Zealand



## Optimised Process Safety Metrics: **Design Excursion Monitoring, AF Event Frames**

“Asset Framework Event Frame Analysis together with Asset Intellect and Power BI allows for accurate recording and reporting of asset excursions.”

Franco Branca, Senior Process Engineer, Methanex New Zealand



### CHALLENGES

Improve existing design excursion monitoring system with an automated system that allows for real time notification and recording of process safety metrics.

### SOLUTION

PI Event Frames were utilized to capture events using data from a IBM Maximo asset database. Event frames reviewed using Asset Intellect and PI Vision and reporting was completed using Power BI.

### RESULTS

An automated real time excursion recording, evaluation and reporting system with interactive dashboard and asset history.

#### Bonus

- Updated asset database
- Easy Access to asset data

# Thank You

PI Server AF and Asset Intellect removes the need for manual data collection by bringing the information to the end user.

Organiser



Co-host



