



Digital Transformations for LNG Customers

Use Cases on MS Power BI, SAP HANA & RPA

LNG Solutions

01

Risk Analytics -
Accidents/Incidents/
Spills

02

ECM/ILM
Analytics

03

LNG Plant's
Performance
Forecasting

04

Risk Analytics -
Accidents/Incidents/
Spills

05

Predictive
Modelling/KPI
Dashboards

06

Auto Reporting for
Safety Incidents and
Non-Compliance

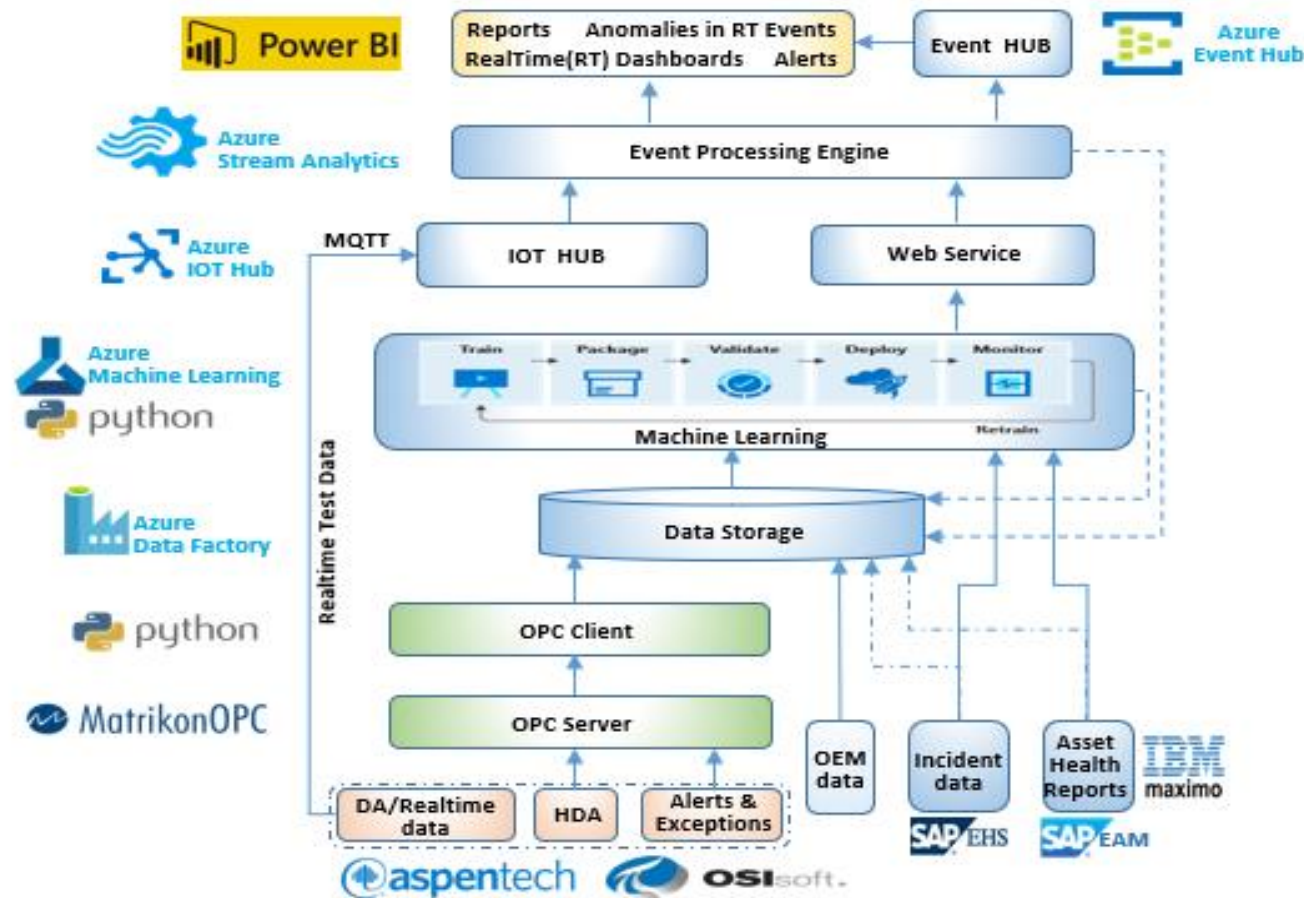


Engagement Area #1 – Microsoft Power BI

**Predicting Incidents,
ECM/ILM Analytics,
Plant's Performance (Alerts/Events) Forecasting**

LNG Incidents

Moving from GRC Reporting towards Predicting Incidents



Post Audits vs Pre-Audits

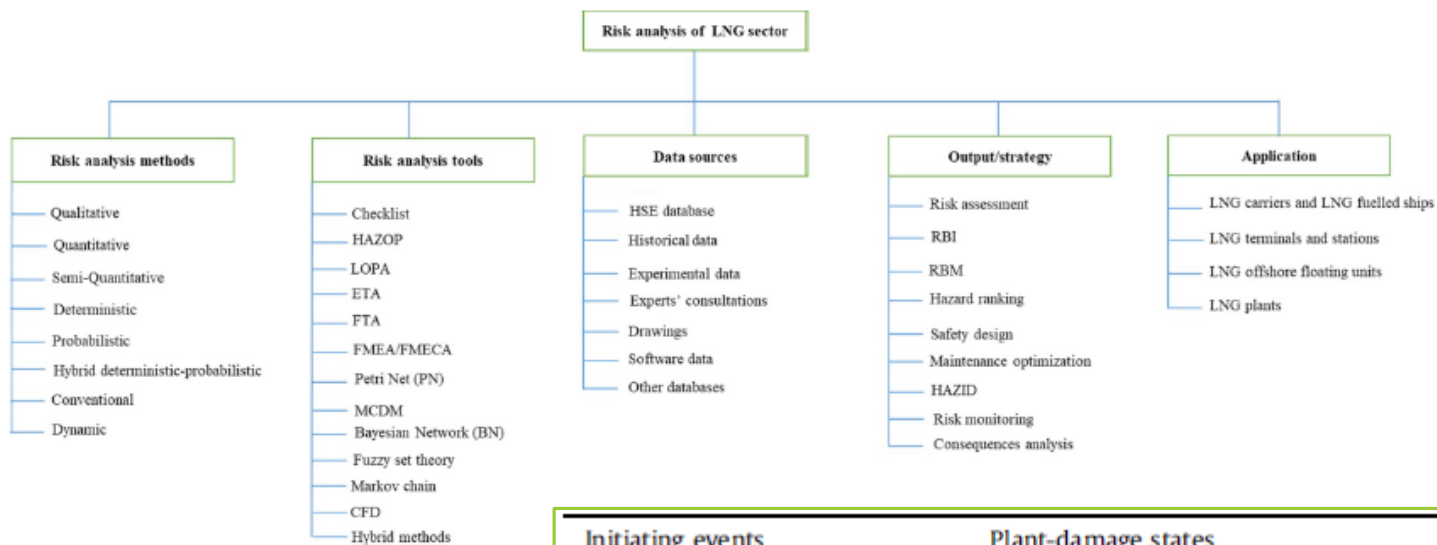
Incidents across LNG value chain need to be reported under -

- Natural Gas Distribution,
- Natural Gas Transmission and Gathering,
- Hazardous Liquid and Carbon Dioxide
- Liquefied Natural Gas (LNG)

Code of Federal Regulations (49 CFR Parts 191, 195) requires operators to submit incident reports within 30 days of an incident or accident

LNG Incidents

Moving from GRC Reporting towards Predicting Incidents



Initiating events of LNG terminals.

LNG tank

1. Boil-off removal malfunction, during unloading
2. Boil-off removal malfunction, during storage
3. High temperature in LNG, coming from ship
4. Excess external heat in storage tank area
5. Level rise beyond safety height, or overfilling
6. Rollover during unloading
7. Rollover during storage
8. Inadvertent starting of additional compressors
9. Continuation of unloading beyond lower safety level
10. Increase of send out rate from tank

Unloading section (from ship to tank)

11. Excess external heat in jetty area
12. Water hammer in loading arm, due to inadvertent valve closure
13. Inadequate cooling of loading arm
14. High winds during unloading

Sendout section

15. Inadvertent closure of valve in send out

Recondenser

16. Inadvertent start of compressor
17. Booster pump malfunction
18. External fire

Outlet pipeline

19. Vaporiser failure leading to pipebreak owing to low temperature of line
20. Strong waves during unloading (only for offshore plant)
21. Strong waves during storage (only for offshore plant)

Damage states of LNG terminals.

LNG tank

1. Tank rupture (roof failure) owing to overpressure
2. Tank rupture (roof failure) owing to overfilling
3. Tank rupture owing to underpressure

Loading section

4. Pipe rupture (tank to pumps)

Unloading section

5. Pipe rupture (ship to tank)

Outlet pipeline

6. Full bore

Initiating events

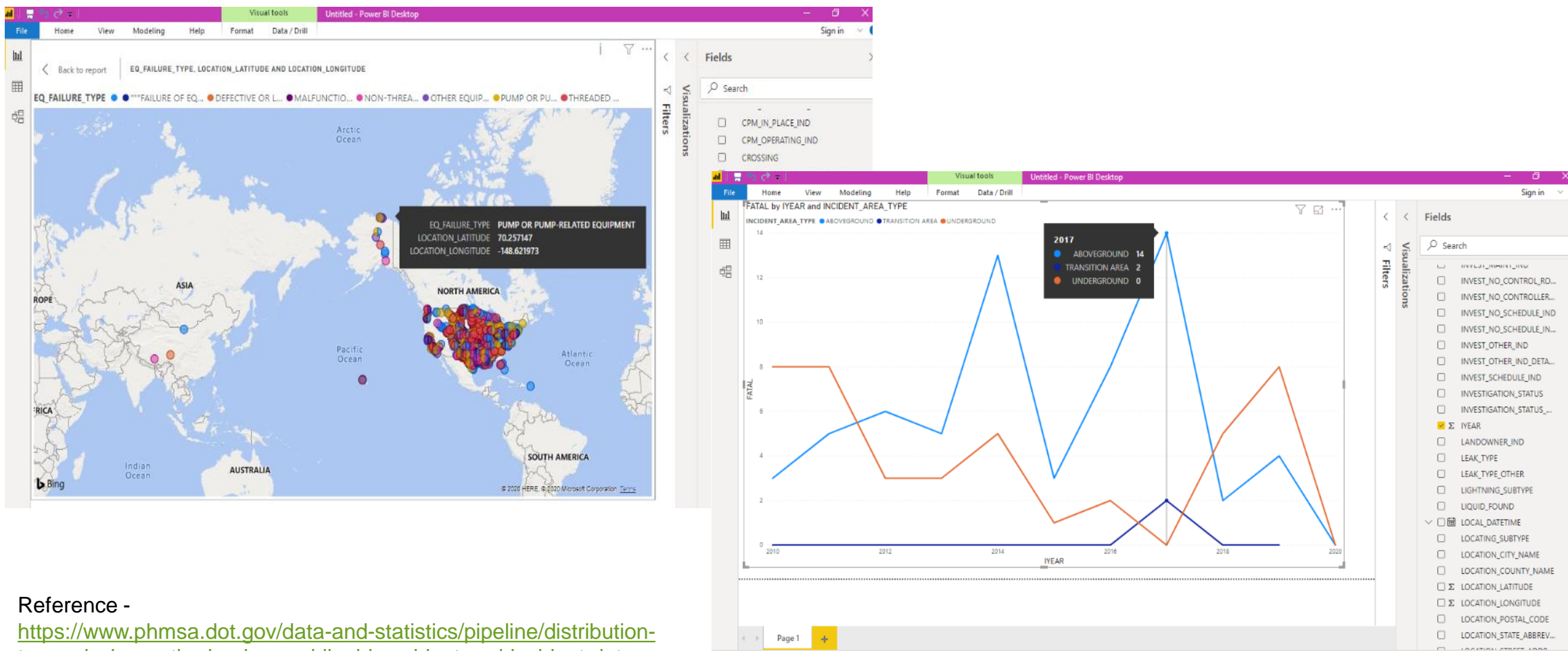
1. Corrosion
2. Boil-off removal malfunction during storage
3. Excess external heat during storage
4. Rollover
5. Earthquake
6. Snow, ice
7. Floods
8. Extra loads
9. Valve left open
10. Containment bypass during storage

Plant-damage states

- Hole in tank, equivalent to 1 inch
- Tank rupture (roof failure) owing to overpressure
- Tank rupture (roof failure) owing to overpressure
- Tank rupture (roof failure) owing to overpressure
- Catastrophic rupture of tank
- Catastrophic rupture of tank
- Catastrophic rupture of tank
- Catastrophic rupture of tank
- Exit of LNG through 1 inch drainage valve
- Exit of LNG through 1 inch drainage valve

LNG Incidents

Moving from GRC Reporting towards Predicting Incidents



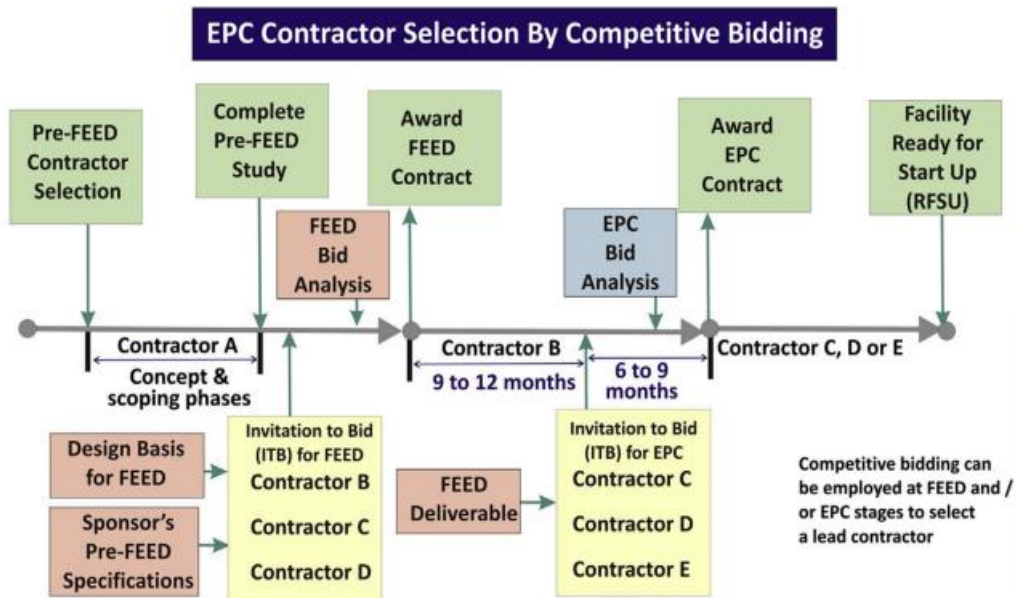
Reference -

<https://www.phmsa.dot.gov/data-and-statistics/pipeline/distribution-transmission-gathering-lng-and-liquid-accident-and-incident-data>

LNG ECM/ILM - Information Lifecycle Management

Moving from ECM Controls towards ECM Analytics

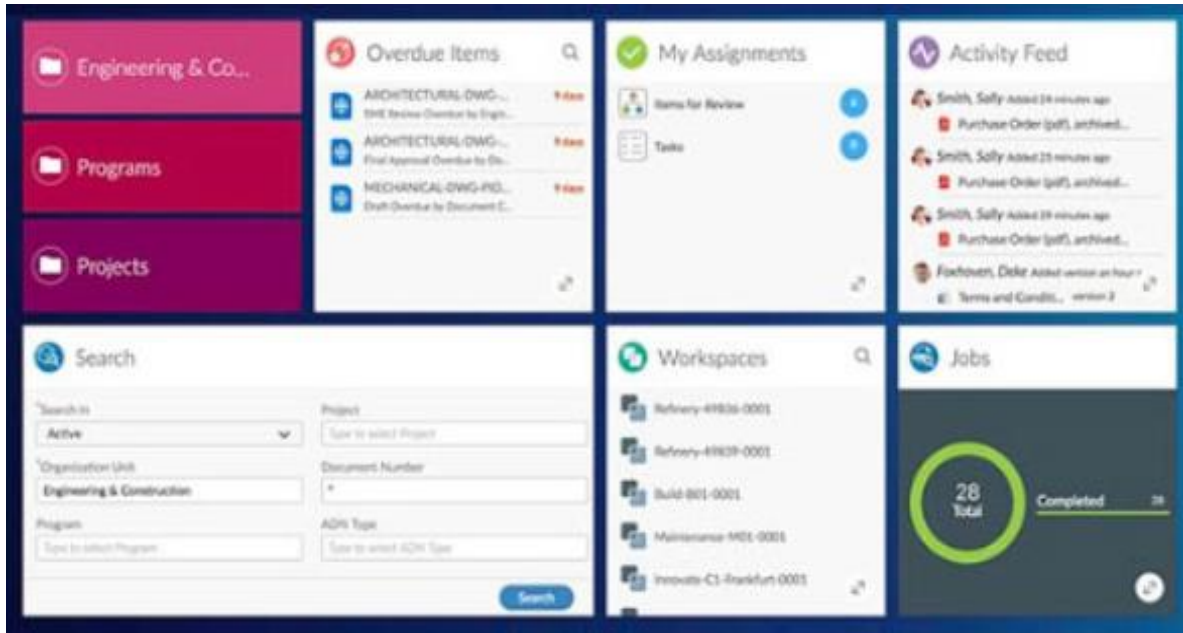
ECM/ILM Controls vs ECM/ILM Analytics



Capital Project Life Cycle Stages	Mapping to O&G Capital Projects	Core Project Members	Support Project Members	Key Documents	Projects/ Depts.	ILM Project Objectives	Technology Challenges
Project Definition	Concept/Pre-FEED, Select EPC, FEED	OpCo	Specialized Vendors/Suppliers of OpCos (if required)	Project Documents	Project, Engineering, Asset,	Collaborative Project Management	Integration with Project Management
Engineering Design	Detailed Design	OpCo	Specialized Vendors/Suppliers of OpCos (if required)	Engineering Drawings, Design Documents	Engineering, Asset	Approved Engineering Documents to guide Operations - as and when any design gets updated	Integration of Engineering Drawings System with a Document Management System(DMS)
Project Procurement	Procurement	EPC Contractor, OpCo	3rd party Vendors/Suppliers of EPC Contractors	Contracts, Sourcing Documents	Contracts, Legal	Effective control on contracts and compliance with regulation and HSSE requirements	Integration with Contract Management System + Project Information Controls
Construction Hook-up and Commissioning	Construct, Commission and Start Up	EPC Contractor, OpCo	3rd party Vendors/Suppliers of EPC Contractors	Project Commissioning Documents	Operations, Project	Suppliers to submit the information (vendor documents) associated with their contracts for checking and acceptance by the EPC contractor and/or the owner operator	Interfaces with external vendors/suppliers to manage the EPC contracts + Project Information Controls
Asset Management	Asset Management	EPC Contractor, OpCo	3rd party Vendors/Suppliers of EPC Contractors	Asset Related Documents	Asset	Asset information to be imported into the systems operators use to operate and maintain the facility.	Data Migration and Integration with OpCo's Asset Management with EPC Contractor's Asset Management Systems
Decommissioning and Dismantling	Custody Transfer/Handover	EPC Contractor, OpCo	3rd party Vendors/Suppliers of EPC Contractors	Handover Documents	Operations	Engineering drawings, layouts, equipment, and infrastructure information are handed over to the operator for effective operations and maintenance of the site.	Data Migration and Integration with OpCo's DMS with EPC Contractor's DMS

LNG ECM/ILM - Information Lifecycle Management

Moving from ECM Controls towards ECM Analytics



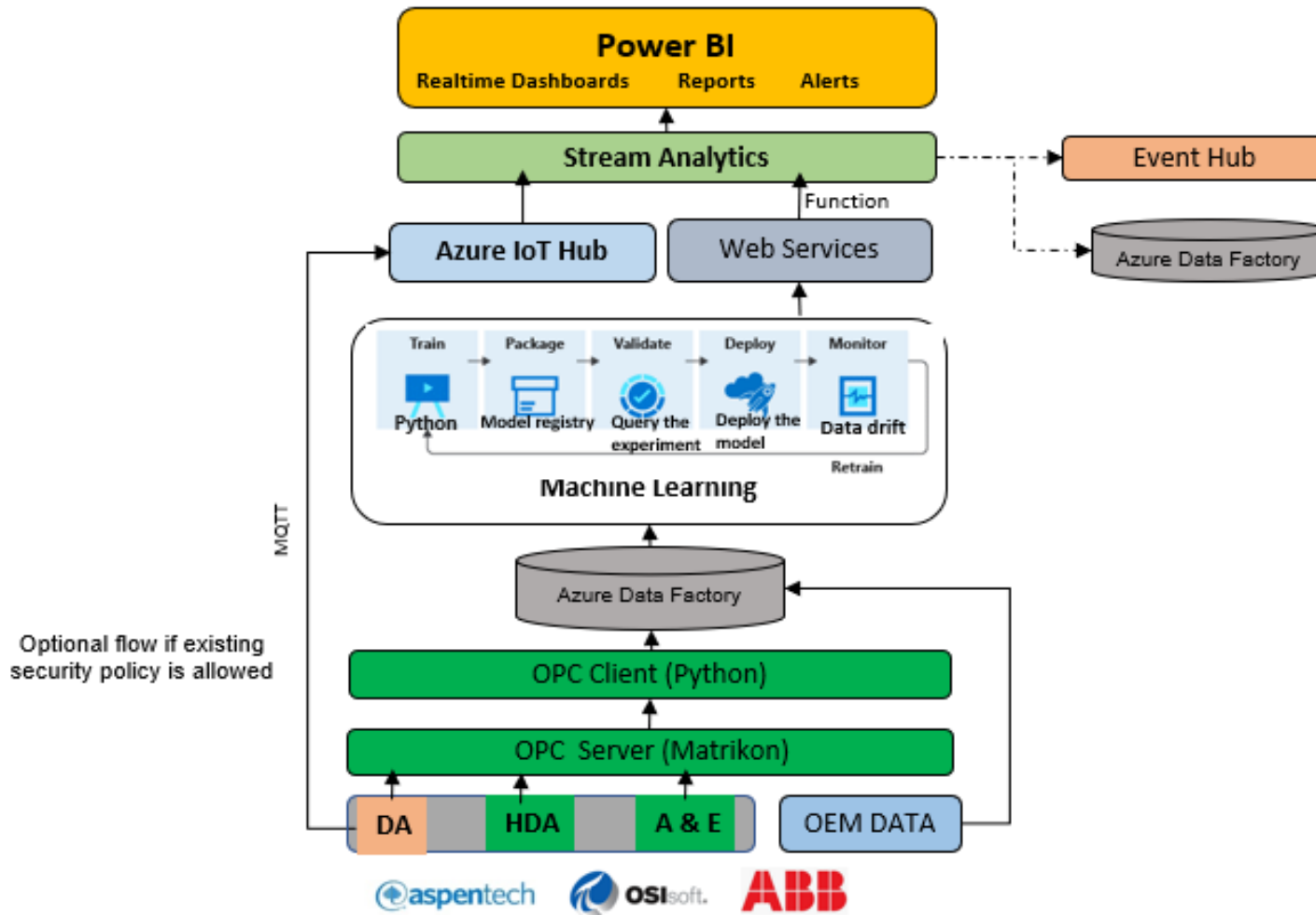
The dashboard includes sections for:

- Engineering & Co...** (Navigation)
- Programs** (Navigation)
- Projects** (Navigation)
- Overdue Items** (List of items with status icons)
- My Assignments** (List of tasks and assignments)
- Activity Feed** (Recent activity log)
- Search** (Filters for Active, Organization Unit, Program, Project, Document Number, AGM Type)
- Workspaces** (List of workspace IDs)
- Jobs** (Summary: 28 Total, Completed)



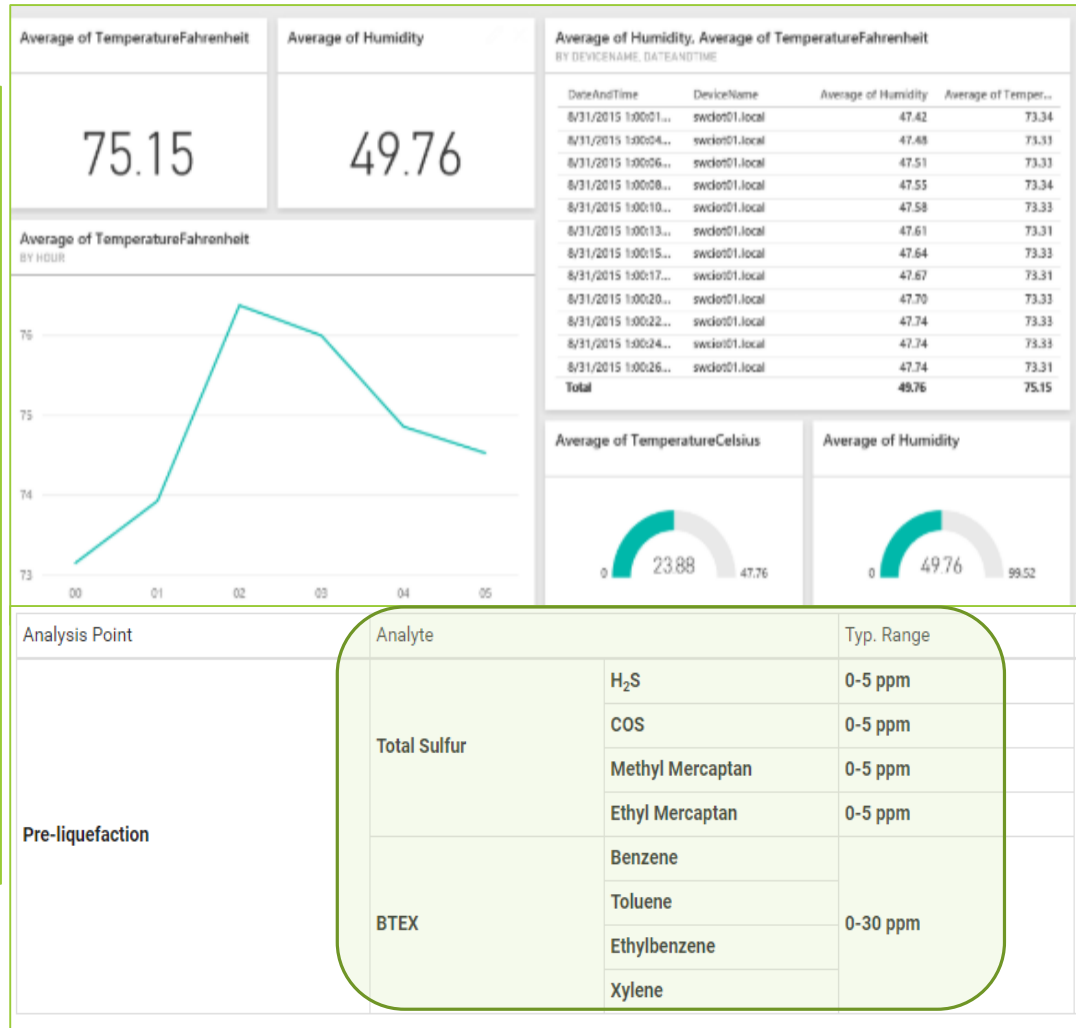
Leverage MS Power BI for ECM or Project Management or Contact Analytics

Liquefaction Plant's Alerts & Events Forecasting



- Benzene, toluene and xylenes (BTEX) in pre-liquefied natural gas readily freezes at the cold temperatures required in the liquefaction process. The liquefaction equipment can become blocked or coated by these solids which requires shut down for maintenance. **Validation of the BTEX concentration in pre-liquefied natural gas ensures efficient BTEX removal to protect downstream equipment.**
- **GRC reporting regulations** and tariffs on the sulfur content of sales quality natural gas has boosted the need for analyzers with multi-component measurement capabilities.

Liquefaction Plant's Alerts & Events Forecasting

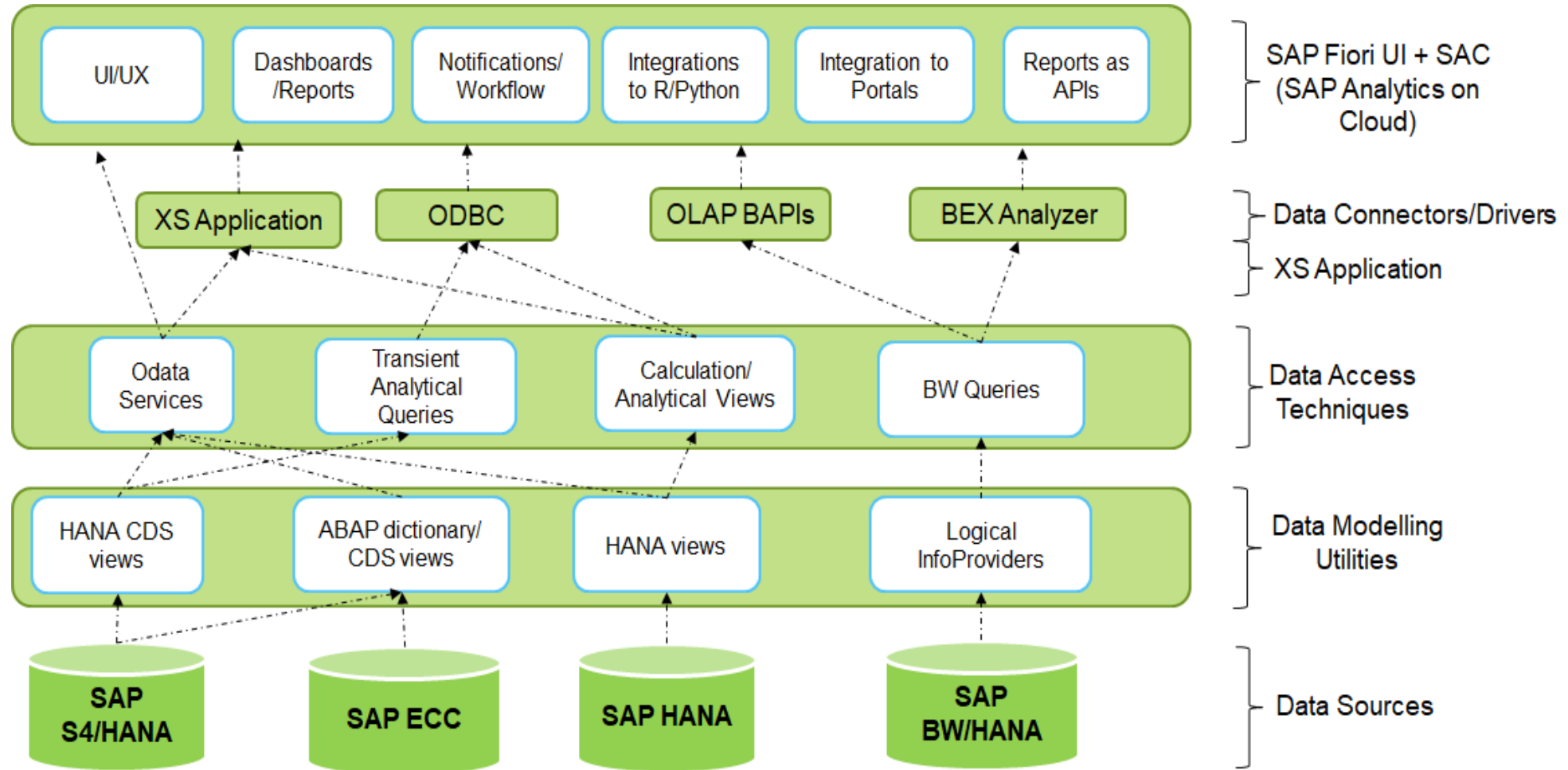


Engagement Area #2 – SAP HANA

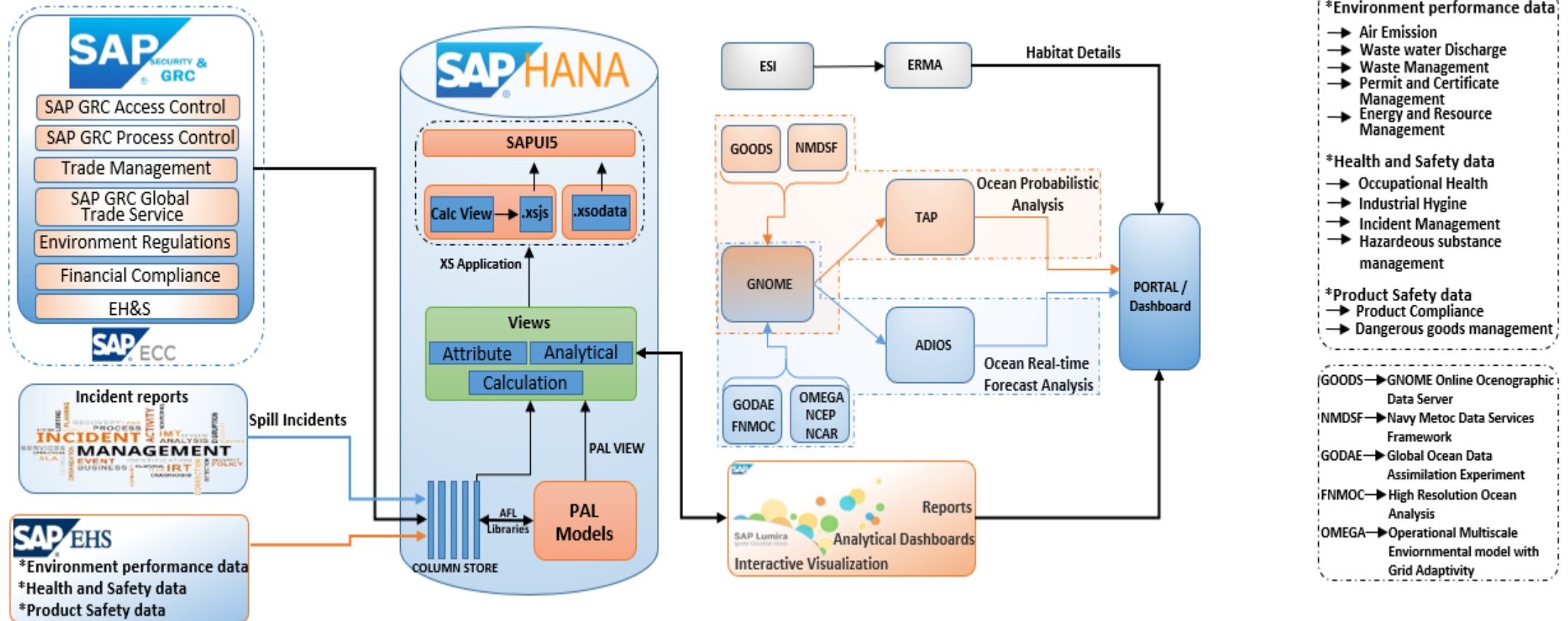
**Spill Analysis,
Predictive Modelling,
Logistics KPI Dashboards**

Analytics powered by SAP Stack

Common Design Model



Oil Spill Analysis in SAP SAC/Lumira

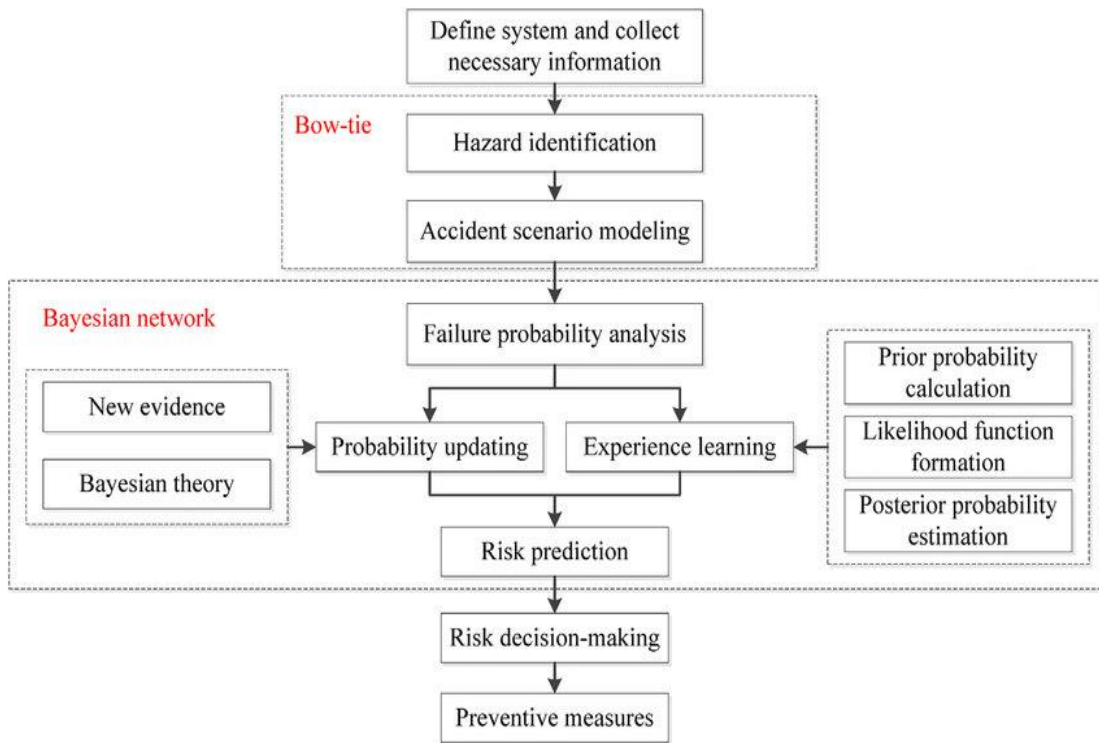


- *Environment performance data
 - Air Emission
 - Waste water Discharge
 - Waste Management
 - Permit and Certificate Management
 - Energy and Resource Management
- *Health and Safety data
 - Occupational Health
 - Industrial Hygiene
 - Incident Management
 - Hazardous substance management
- *Product Safety data
 - Product Compliance
 - Dangerous goods management

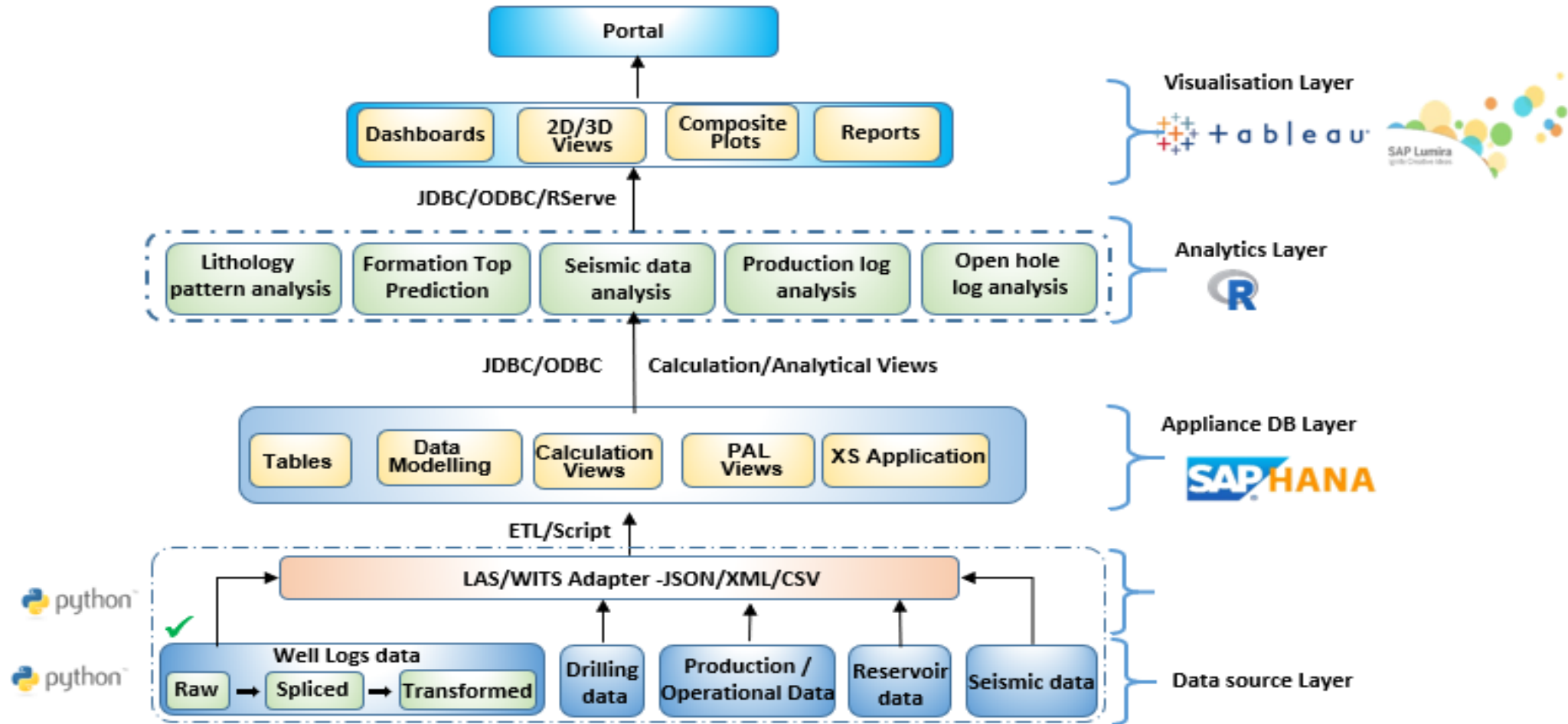
- GOODS → GNOME Online Oceanographic Data Server
- NMDSF → Navy Metoc Data Services Framework
- GODAE → Global Ocean Data Assimilation Experiment
- FNMOE → High Resolution Ocean Analysis
- OMEGA → Operational Multiscale Environmental model with Grid Adaptivity



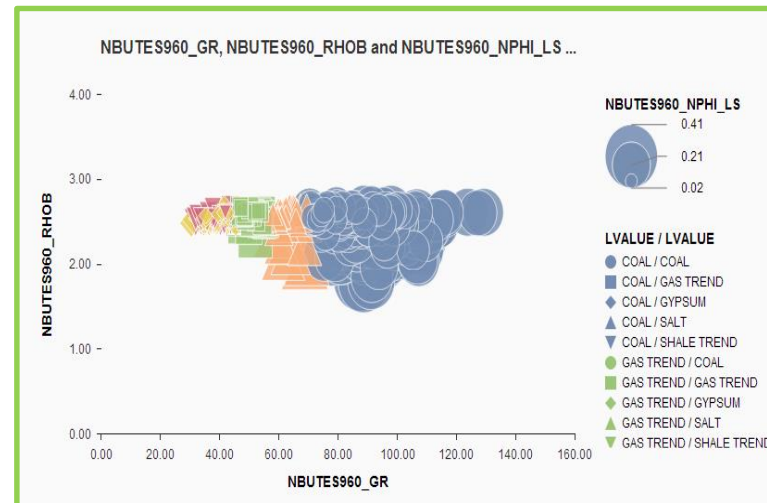
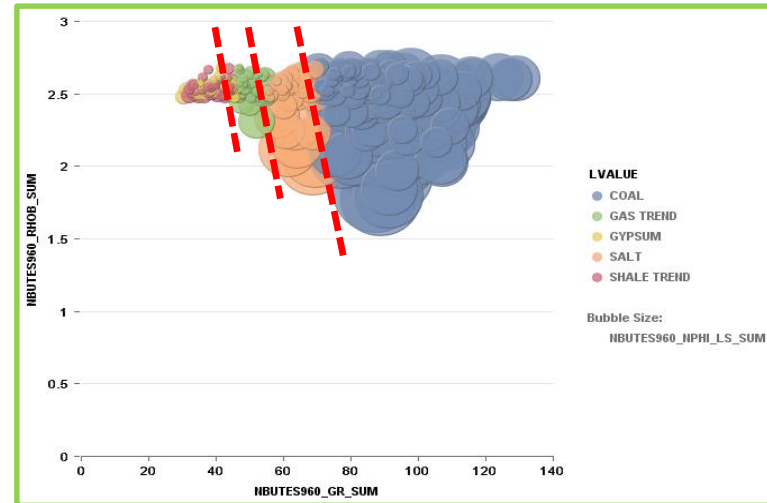
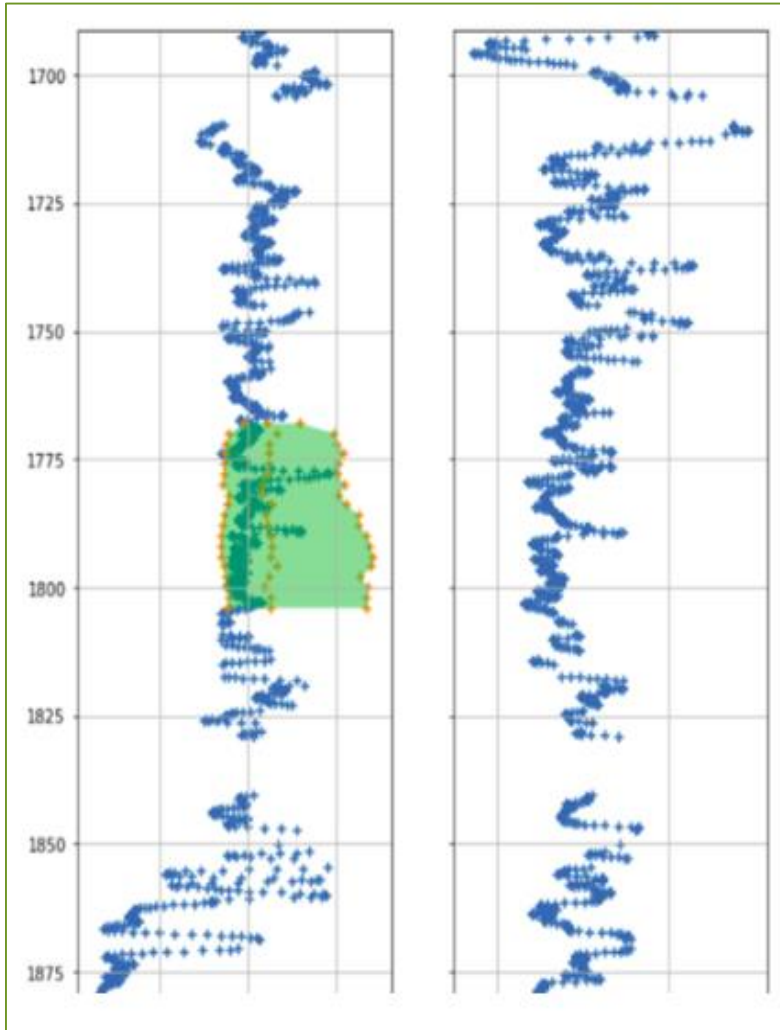
Oil Spill Analysis in SAP SAC/Lumira



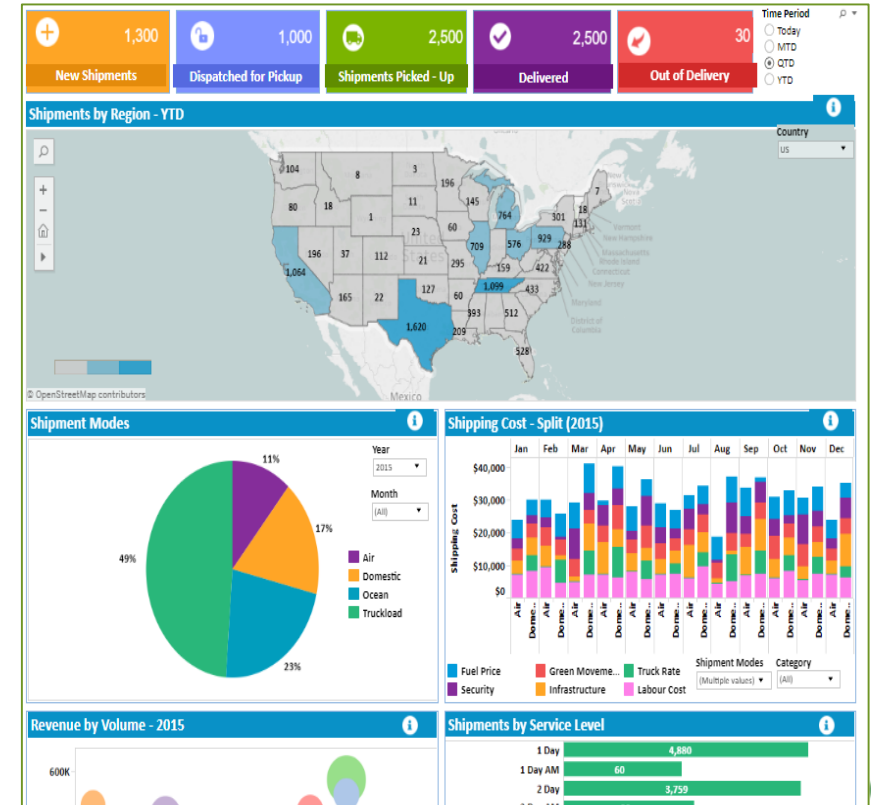
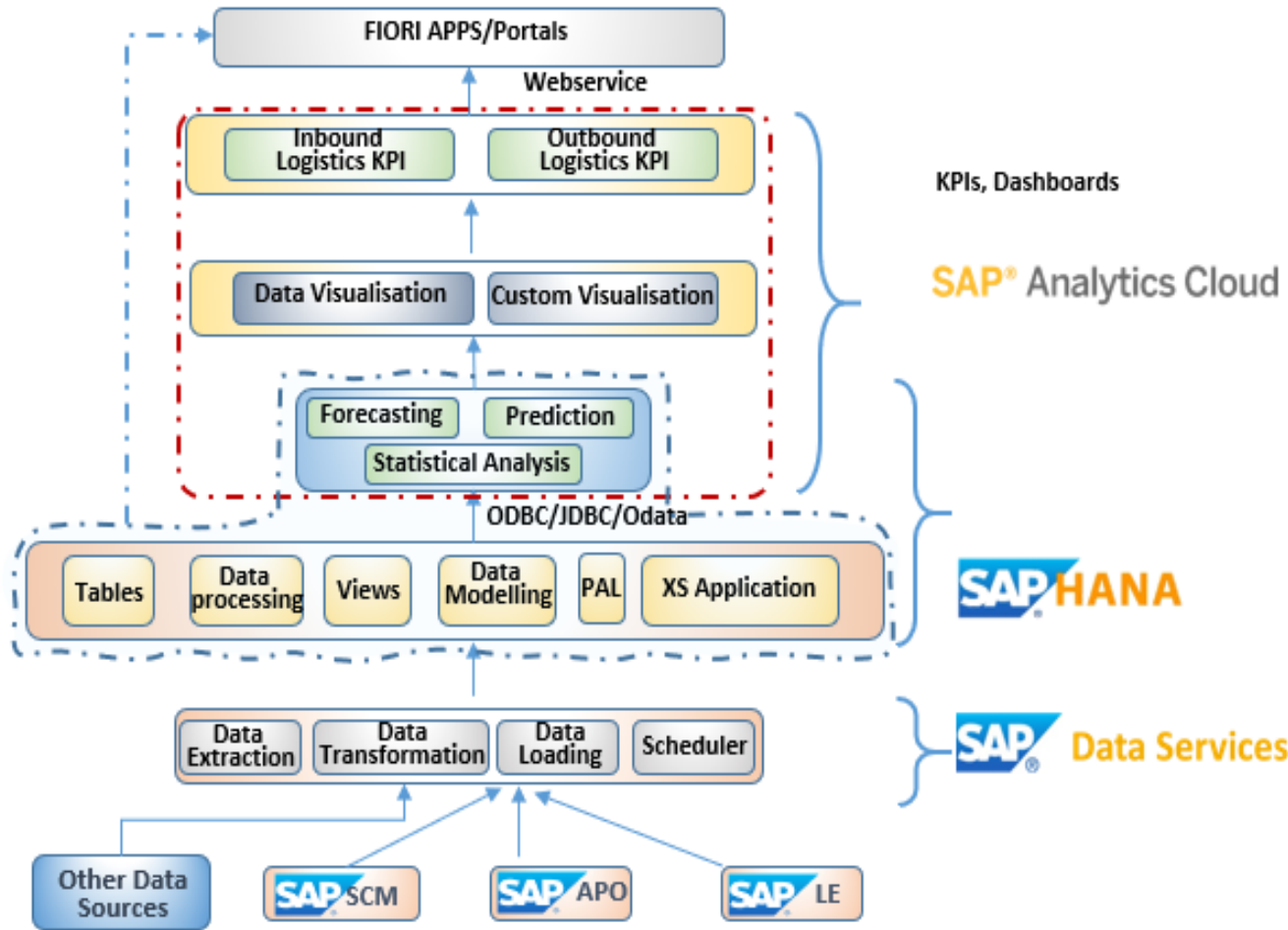
Predictive Modelling in SAP HANA



Predictive Modelling in SAP HANA



Inbound/Outbound Logistics KPI Dashboards

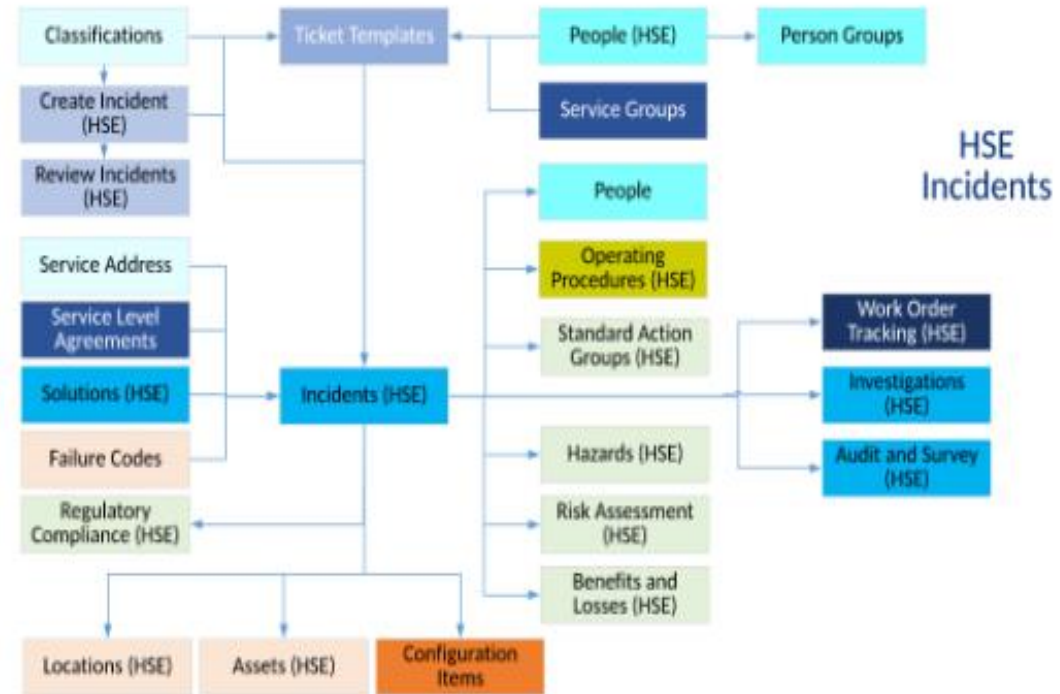


Engagement Area #3 – RPA

**Safety/HSE Incidents Auto Reporting,
Plant's Non-Compliance Auto Reporting**

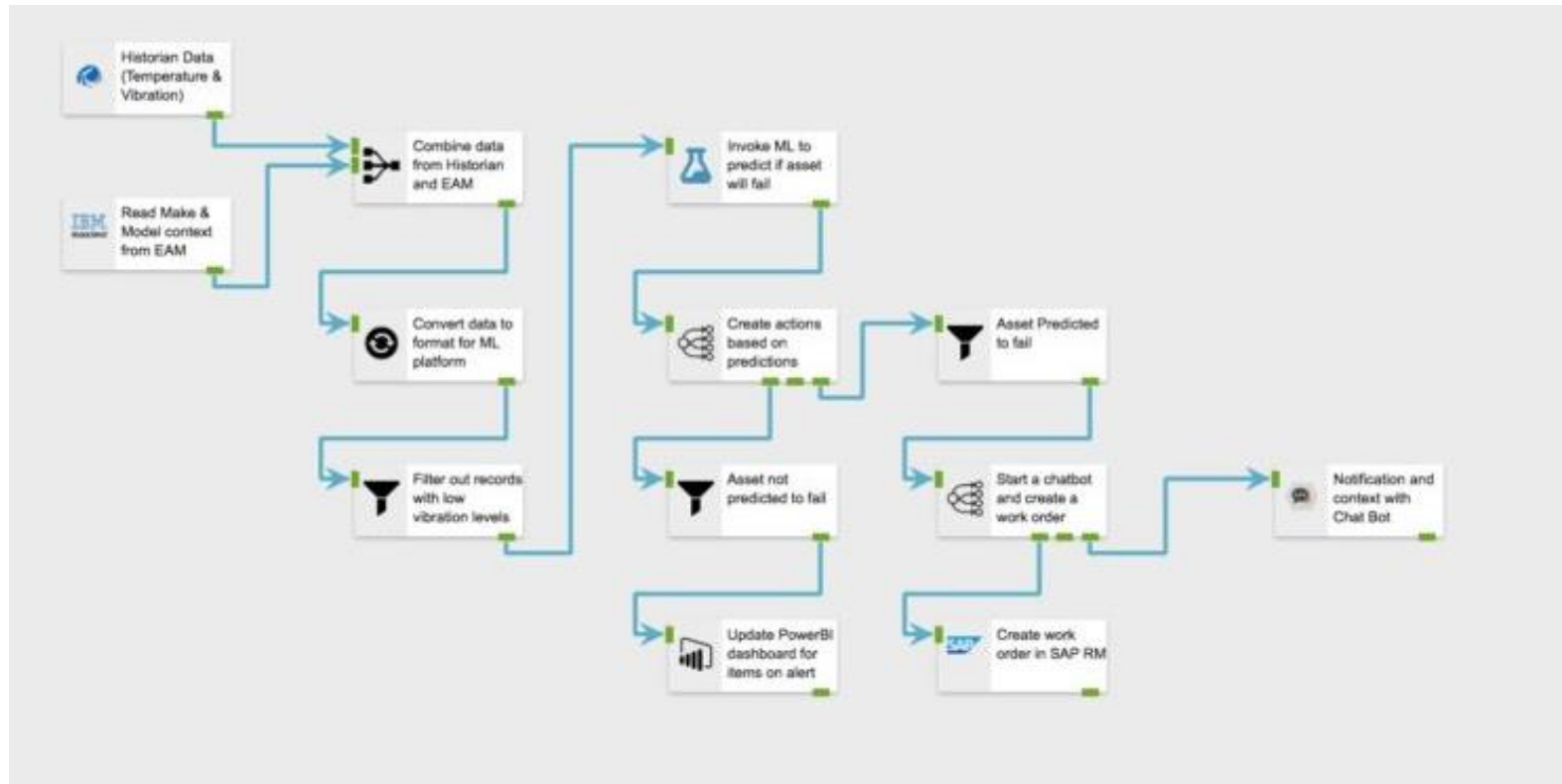
Safety/HSE Incidents Auto Reporting by RPA bots

- Automated notifications – the bots can alert managers and employees to a variety of issues
- Notify employees of upcoming training courses
- Send reminders for refresher courses. This may be required after an incident, or compliance changes, to ensure employees are fully aware of safety procedures
- Alert managers to any accidents or incidents to allow an investigation or disciplinary action
- Identify new high-level risks on the risk register



- An Incident is a class of Ticket, the application would be used for events with a HSE impact. Some Incident records will later be marked as being a Defect.
- An Incident can be an injury/illness, a safety, environmental or security incident, a near miss, a spillage, a safety observation or a failure in a safety process.
- A Ticket Template can be applied to the Incident. It can have a classification, owner or owner group, a Service Group and a set of activities which are copied to the Incident. The applied classification creates a Specification, a set of attributes specific to the class of incident.
- Self-service applications are provided for any user to Create Incident or Review Incidents that they previously created.
- The incident can be related to one or more Locations, Assets or Configuration Items (CI). A regulatory clause may be associated with the incident.
- One or more people who were witnesses to the incident or impacted by it can be recorded. Follow-up actions can be associated with each person and an applicable Operating Procedure referenced.
- The Hazard or Risk Assessment associated with the incident and its impact can be recorded. The impact record is created in the Benefits and Losses application.
- A Solution can be used to indicate how the incident was resolved. In addition a failure report can be recorded if it is known prior to the investigation.

Plant's Non-Compliance Auto Reporting by RPA bots



- RPA bots will measure, predict and benchmark datasets from real time data feeds from the LNG plant/each associated train
- From past A&E datasets and benchmarks laid out by OEM vendors, RPA bots can generate alerts for any abnormality based on predicted datasets
- RPA bots will create variance reporting on actuals, predicted and planned against the operational datasets at an asset level



Thank You

Greenojō provides Automation, Analytics and AI solutions to
enterprise customers

Sales Offices

Houston, TX, USA | Burlington, ON, Canada | Dubai, UAE | Lagos, Nigeria

For RFPs, Solutions and Sales/Partner
enquiries, connect us at - sales@greenojō.com

Delivery Offices - India

Bhubaneswar, Odisha | Hyderabad, Telangana | Trivandrum, Kerala