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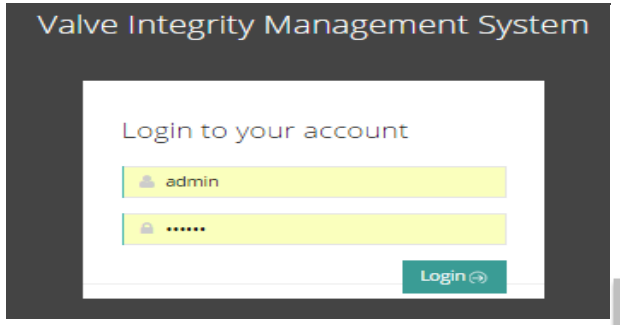
Operations, engineers and management are integrated through a one stop shop for anything valve integrity



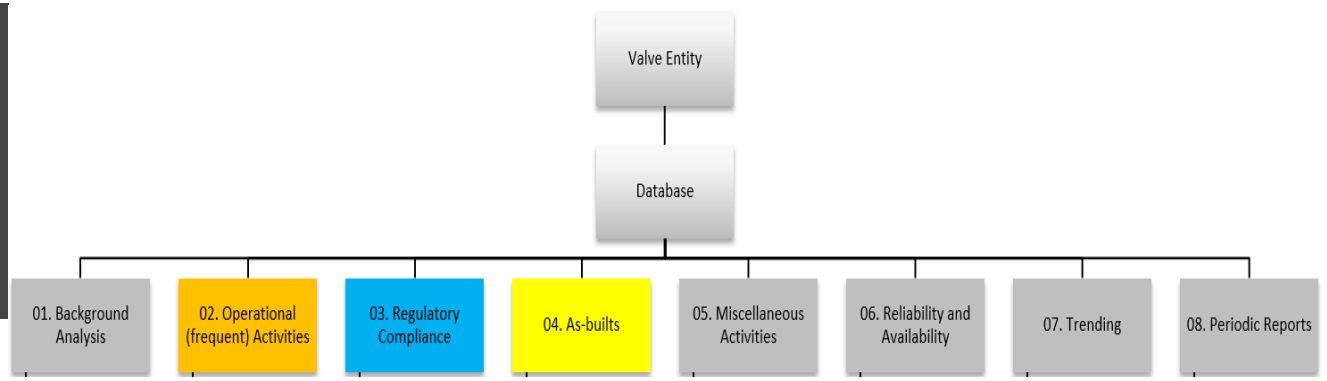


Table of Content

	VIMS	No VIMS
Reliability engineering	7,000.00	-
Sparing	30,000.00	-
Cost per outage (per USD)	160,000.00	160,000.00
Personnel cost per day (USD)	6,000.00	6,000.00
Reactive RCA time	-	3.00
Reactive sparing purchase time	-	4.00
Repair time	1.00	1.00
Additional duration of wait	3.00	7.00
Total downtime	4.00	15.00
Cost of lost production	640,000.00	2,400,000.00
Cost of personnel	24,000.00	90,000.00
Reliability cost	37,000.00	-
Total cost	701,000.00	2,490,000.00
Savings	**71.85%**	

Typical Challenges

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Lack of Knowledge

- Valves – historically, poor management and integrity of valves and lack of data or traceability

Lack of Monitoring

- There is no monitoring process which effectively connects the front end users of equipment (valves and pigs) to the back-end team in an automated and meticulous way.

Lack of Expertise

- Due to the lack of historical information and transfer of knowledge, teams make the same mistakes as they fail to build on historical events, experience or statistics.

Cost of Operation

- Increased costs through unknown failure prediction, unplanned shutdown and events
- Increased and unnecessary man-hour spend on carrying out inspections and repairs

Existing Alternatives

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Engineering firms services

- Providing ad-hoc services, including periodic review of data and reporting to client. This is typically a very expensive and slow (time-consuming) solution

CMMS

Computerised Maintenance Management Systems

- Generic maintenance management software established within companies for managing their systems, however lacks the interactive capability of a bespoke system

Specific Software

Other software solutions

- Valves – solutions are mainly reactive with no real integration to front-end activity

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Valve-IMS ®™ and VIMS ®™

The VIMS Process®™

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Solution

Focus on creating value through continuous improvement and development of technologies and tools which improve the current practices

Create software solutions to integrate front-end operation demand directly with back-end engineering and decision making

Process Integration	Reduce Failures	Save Costs
• Front-end input tool • Creating an automated feedback loop • Notification to back-end team • Immediate response and analysis	• Assisted engineering • Provision of algorithms for decision making • Development of highlights and indicators • Failure prediction and monitoring	• Man hour saving • Reduced maintenance cost • Reduction in unplanned failures / shutdown

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Risk Management
Likelihood, Consequence, Risk ranking, Risk profiling

Operational Excellence
Technician Interface, PM link, Calendar support

Compliance Support
Company policies, Country policies

As-built Warehouse
OEM data, Maintenance manuals, File deposit

...

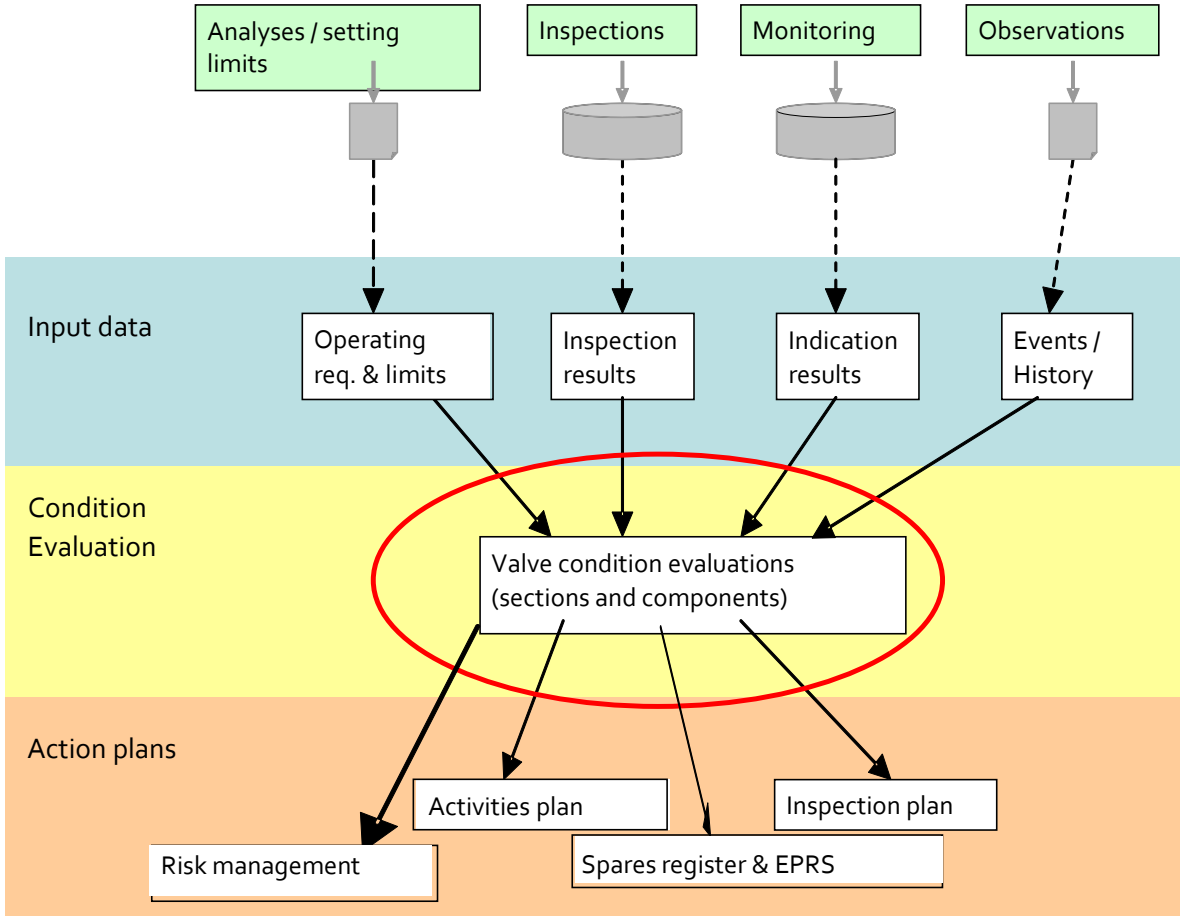
Miscellaneous & New Valve Support
Pigging information, Anomalies, New valve / valve repair selection support

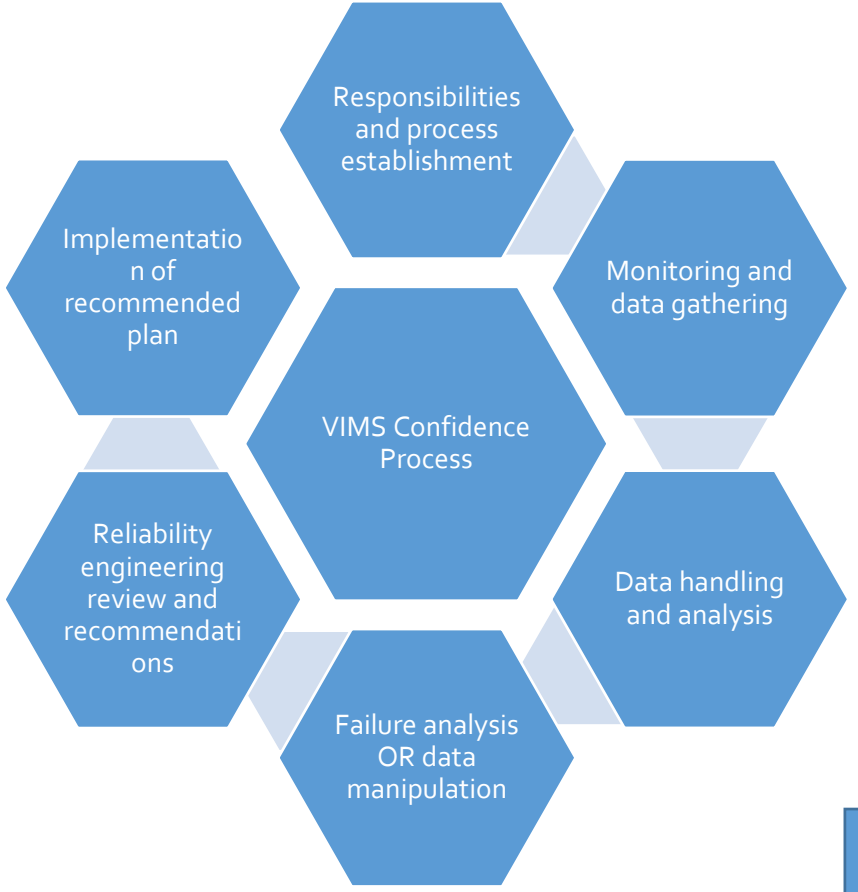
Reliability Engineering
MTTF / MTTR, Common mode failure, availability, regional/global/industry statistics

Trending
Leak rate, Strokes, Closure time, Failures

Periodic Assessment
Yearly integrity review, Periodic failure statistics, Incident investigation

Functional Process





Integrity Management Provisions

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- Defined valve integrity management process
- Visible and easy to interpret leading and lagging indicators
- Activity manager linked with PMs, actions and inspection frequencies
- Elimination of human error
- Established method of complying with performance standards
- Defined method of executing and recording RCA
- Review / development of testing volumes and maximum normal operating pressures
- Emergency repair preparedness development
- Holistic view of valve integrity
- Removal of paper based reporting, inclusion of quality control and assurance
- Common mode failure analysis (from global, to regional, to valve, to component level)
- Yearly maintenance regime review
- Performance indicators
- Risk management and reduction
- Reduce downtime and interventions
- Training and competencies support / management

Benefits

- Quantitative and qualitative risk assessment
- Failure mode analysis and review
- Independent valve integrity assessment including failure cause review
- Savings on man hours
- Significant savings on lost revenue from unplanned SD – up to 75 %
- Live monitoring and failure mode feed
- Quality control and assurance on valves
- Reduction in the occurrence of serious incidents
- Continuous valve integrity monitoring
- New valve / replacement / repair support

- Stringent control of valve integrity, maintenance and operational activities
- Integration with CMMS: Direct feed to and from CMMS such as Maximo, aggressor etc.
- Instant feedback on any form of maintenance or failures carried out
- Risk ranking and prioritization of valves based on regulatory requirements and company engineering technical practices
- Document and as-built storage
- Incorporates standard operating procedures (SOPs) Modifiable dashboard to suit the user's requirement i.e. highlighting important KPIs such as MTBF, ORAs, reliability, etc..

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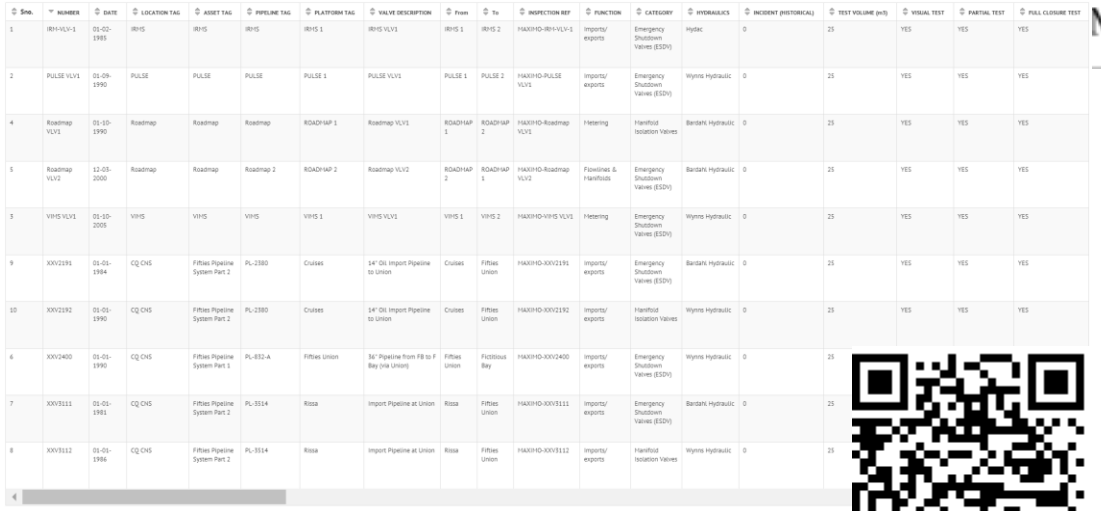
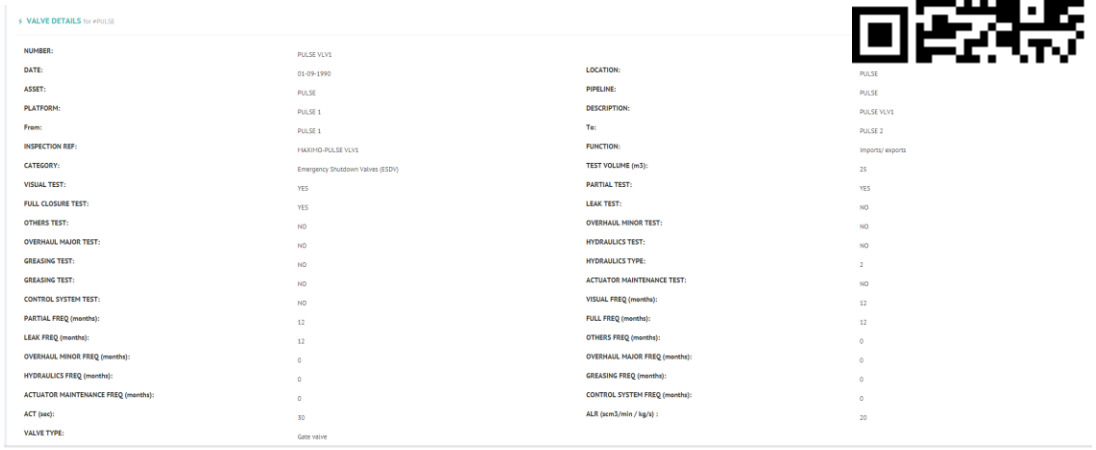
Product Modules

As-built Warehouse

- Valve information and datasheet print
- Details of OEM requirements
- Details of operational activities
- Documentation of as-built
- Highlight of incidents
- Indication of last and future test
- QR tagging system
- Details of changes to valve i.e. repairs, replacement, overhaul etc.



Sno.	NUMBER	DATE	LOCATION TAG	ASSET TAG	PIPELINE TAG	PLATFORM TAG	VALVE DESCRIPTION	From	To	INSPECTION REF	FUNCTION	CATEGORY	HYDRAULICS	INCIDENT (HISTORICAL)	TEST VOLUME (m3)	VISUAL TEST	PARTIAL TEST	FULL CLOSURE TEST
1	IRH-VLV-1	01-02-1985	IRHS	IRHS	IRHS	IRHS 1	IRHS VLV1	IRHS 1	IRHS 2	HAXIHO-IRH-VLV-1	Imports/ exports	Emergency Shutdown Valves (ESDV)	Hydac	0	25	YES	YES	YES
2	PULSE VLV1	01-09-1990	PULSE	PULSE	PULSE	PULSE 1	PULSE VLV1	PULSE 1	PULSE 2	HAXIHO-PULSE VLV1	Imports/ exports	Emergency Shutdown Valves (ESDV)	Wynns Hydraulic	0	25	YES	YES	YES
4	Roadmap VLV1	01-10-1990	Roadmap	Roadmap	Roadmap	ROADMAP 1	Roadmap VLV1	ROADMAP 1	ROADMAP 2	HAXIHO-Roadmap VLV1	Metering	Manifold Isolation Valves	Bardahl Hydraulic	0	25	YES	YES	YES
5	Roadmap VLV2	12-03-2000	Roadmap	Roadmap	Roadmap 2	ROADMAP 2	Roadmap VLV2	ROADMAP 2	ROADMAP 1	HAXIHO-Roadmap VLV2	Flowlines & Manifolds	Emergency Shutdown Valves (ESDV)	Bardahl Hydraulic	0	25	YES	YES	YES
3	VIHS VLV1	01-10-2005	VIHS	VIHS	VIHS	VIHS 1	VIHS VLV1	VIHS 1	VIHS 2	HAXIHO-VIHS VLV1	Metering	Emergency Shutdown Valves (ESDV)	Wynns Hydraulic	0	25	YES	YES	YES
9	XXV2191	01-01-1984	CQ CNS	Fifties Pipeline System Part 2	PL-2380	Cruises	14" Oil Import Pipeline to Union	Cruises	Fifties Union	HAXIHO-XXV2191	Imports/ exports	Emergency Shutdown Valves (ESDV)	Bardahl Hydraulic	0	25	YES	YES	YES
10	XXV2192	01-01-1990	CQ CNS	Fifties Pipeline System Part 2	PL-2380	Cruises	14" Oil Import Pipeline to Union	Cruises	Fifties Union	HAXIHO-XXV2192	Imports/ exports	Manifold Isolation Valves	Wynns Hydraulic	0	25	YES	YES	YES
6	XXV2400	01-01-1990	CQ CNS	Fifties Pipeline System Part 1	PL-892-A	Fifties Union	36" Pipeline from FB to F Bay (via Union)	Fifties Union	Fictitious Bay	HAXIHO-XXV2400	Imports/ exports	Emergency Shutdown Valves (ESDV)	Wynns Hydraulic	0	25			
7	XXV3111	01-01-1981	CQ CNS	Fifties Pipeline System Part 2	PL-3514	Rissa	Import Pipeline at Union	Rissa	Fifties Union	HAXIHO-XXV3111	Imports/ exports	Emergency Shutdown Valves (ESDV)	Bardahl Hydraulic	0	25			
8	XXV3112	01-01-1986	CQ CNS	Fifties Pipeline System Part 2	PL-3514	Rissa	Import Pipeline at Union	Rissa	Fifties Union	HAXIHO-XXV3112	Imports/ exports	Manifold Isolation Valves	Wynns Hydraulic	0	25			



VALVE DETAILS for #PULSE

NUMBER:	PULSE VLV1		
DATE:	01-09-1990	LOCATION:	PULSE
ASSET:	PULSE	PIPELINE:	PULSE
PLATFORM:	PULSE 1	DESCRIPTION:	PULSE VLV1
From:	PULSE 1	To:	PULSE 2
INSPECTION REF:	HAXIHO-PULSE VLV1	FUNCTION:	Imports/ exports
CATEGORY:	Emergency Shutdown Valves (ESDV)	TEST VOLUME (m3):	25
VISUAL TEST:	YES	PARTIAL TEST:	YES
FULL CLOSURE TEST:	YES	LEAK TEST:	NO
OTHERS TEST:	NO	OVERHAUL MINOR TEST:	NO
OVERHAUL MAJOR TEST:	NO	HYDRAULICS TEST:	NO
GREASING TEST:	NO	HYDRAULICS TYPE:	2
GREASING TEST:	NO	ACTUATOR MAINTENANCE TEST:	NO
CONTROL SYSTEM TEST:	NO	VISUAL FREQ (months):	12
PARTIAL FREQ (months):	12	FULL FREQ (months):	12
LEAK FREQ (months):	12	OTHERS FREQ (months):	0
OVERHAUL MINOR FREQ (months):	0	OVERHAUL MAJOR FREQ (months):	0
HYDRAULICS FREQ (months):	0	GREASING FREQ (months):	0
ACTUATOR MAINTENANCE FREQ (months):	0	CONTROL SYSTEM FREQ (months):	0
ACT (sec):	30	ALR (scm3/min / kg/s) :	20
VALVE TYPE:	Gate valve		

Operational Excellence

Report Created

- 7 reports available (Inspection, RCA, incidents, repairs, IVB, pigging and actions)

Report Reviewed

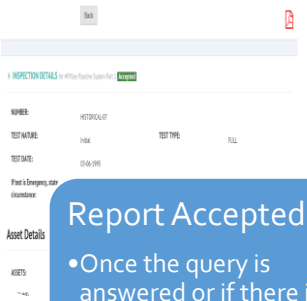
- Supervisory level reviews report (e.g. OIM, OTL, etc)
- Once reviewed, report cannot be modified

Report Review (2)

- Once reviewed, the report is further reviewed by the responsible engineer. It can then either be accepted or queried

Report Queried

- A queried report gets pushed back to the supervisor
- Once queried, information in the report can be changed



Report Accepted

- Once the query is answered or if there is no query, a report can be accepted. Only accepted report influences analysis and trending.

Operational and Maintenance Support

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- Review / development of standard operational testing procedures
- Emergency breakdown response
- Routine maintenance during scheduled shutdown
- Valve tagging and identification
- Maintenance system support (e.g. Maximo, credo etc.)
- Valve preventative maintenance
  - actuator preventative maintenance
  - visual
  - partial/stroke test
  - leak off testing
  - greasing / oil level checks
  - valve annulus testing … etc.
- Enquiry logging and support request interface
- Development of and adhering to valve maintenance strategy
- Root cause investigation, diagnostics, repairs and reporting
- Reconditioning and servicing
- Valve stock / spares management including spares assessment and obsolescence review.
- Component replacement cycle review
- Development of performance standards for valves which falls under SCE
- Historical performance analysis and benchmarking

Compliance Support

- Risk assessment is designed to suit specific client's processes and policies
- Algorithms considers the location (country, region, etc.) and respective compliance scores associated with the region
- Reporting requires compliance to certain standards and processes depending on the type of valve / equipment
- Software supports activity planning and record management
- Software supports independent verification and company audit processes through the IVB reporting templates
- Increasingly smart system that can integrate with maintenance plans and KPIs

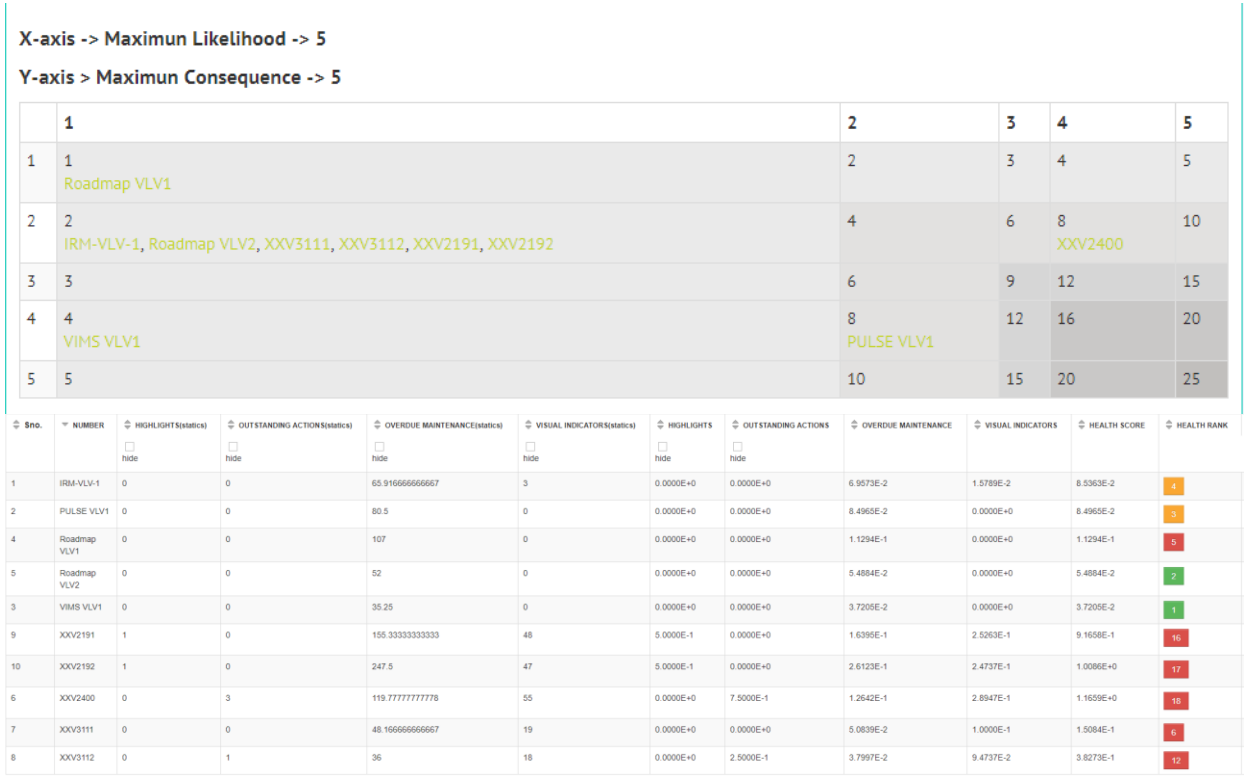
DESCRIPTION	FUNCTION	CONSEQUENCE FACTOR	MAX SCALE CONSEQUENCE	MAX SCALE LIKELIHOOD
CQ Finding Group	CASE STUDY 8 by 8 matrix	4.00	8	8
IRMS	Global 4 by 4 matrix	1.00	4	4
PULSE	Africa 5 by 5 matrix	3.00	5	5
VIMS	Global 6 by 6 matrix	1.50	6	6

Sno.	DESCRIPTION	LOCATION TAG	COMAH / SC CONSEQUENCE	Fabric Matenance	Falling Objects	Others (against)	Debris Protection	Operational Valve Process	Others (for)
9	Fifties Bravo	CQ CNS	Accommodates 5+	Sometimes (supp)	Never (against)	Never (against)	Sometimes (supp)	Sometimes (supp)	Frequent (against)
10	Hillside	CQ CNS	Accommodates 10+	Sometimes (supp)	Never (against)	Never (against)	Sometimes (supp)	Sometimes (supp)	Frequent (against)
1	IRMS 1	IRMS	Accommodates 5+	Sometimes (against)	Frequent (supp)	Seldom (against)	Seldom (against)	Frequent (supp)	Seldom (against)
2	IRMS 2	IRMS	Accommodates 10+	Frequent (against)	Sometimes (against)	Never (against)	Sometimes (against)	Never (against)	Never (supp)
3	PULSE 1	PULSE	3rd Party Asset	Sometimes (against)	Frequent (against)	Frequent (against)	Sometimes (against)	Sometimes (against)	Frequent (against)
4	PULSE 2	PULSE	Accommodates 10+	Frequent (against)	Frequent (supp)	Never (supp)	Never (against)	Sometimes (against)	Frequent (against)
7	ROADMAP 1	Roadmap	3rd Party Asset	Seldom (supp)	Sometimes (supp)	Frequent (supp)	Frequent (supp)	Seldom (against)	Never (supp)
8	ROADMAP 2	Roadmap	Remote (little access)	Seldom (supp)	Never (against)	Never (against)	Seldom (supp)	Frequent (supp)	Never (supp)
5	VIMS 1	VIMS	Remote (little access)	Frequent (against)	Frequent (against)	Frequent (against)	Frequent (against)	Frequent (against)	Frequent (against)
6	VIMS 2	VIMS	Remote Locations	Frequent (supp)	Frequent (against)	Never (supp)	Seldom (against)	Never (against)	Never (supp)

Risk Management

- Provides a risk matrix based on client's matrix and criteria
  - Can be fed directly to company's risk matrix or register
  - Allows for holistic understanding of long term risks
  - Risk matrix designed to be compliant with company's local and global policies

- Provides a health check to enable prioritisation of inspection activities
  - Allows prioritisation of activities
  - Highlights areas of immediate concern
  - Allows for holistic understanding of short-term risks
  - Health check considers operational activities required to maintain the valve in a good condition and highlights / observations from inspection activities



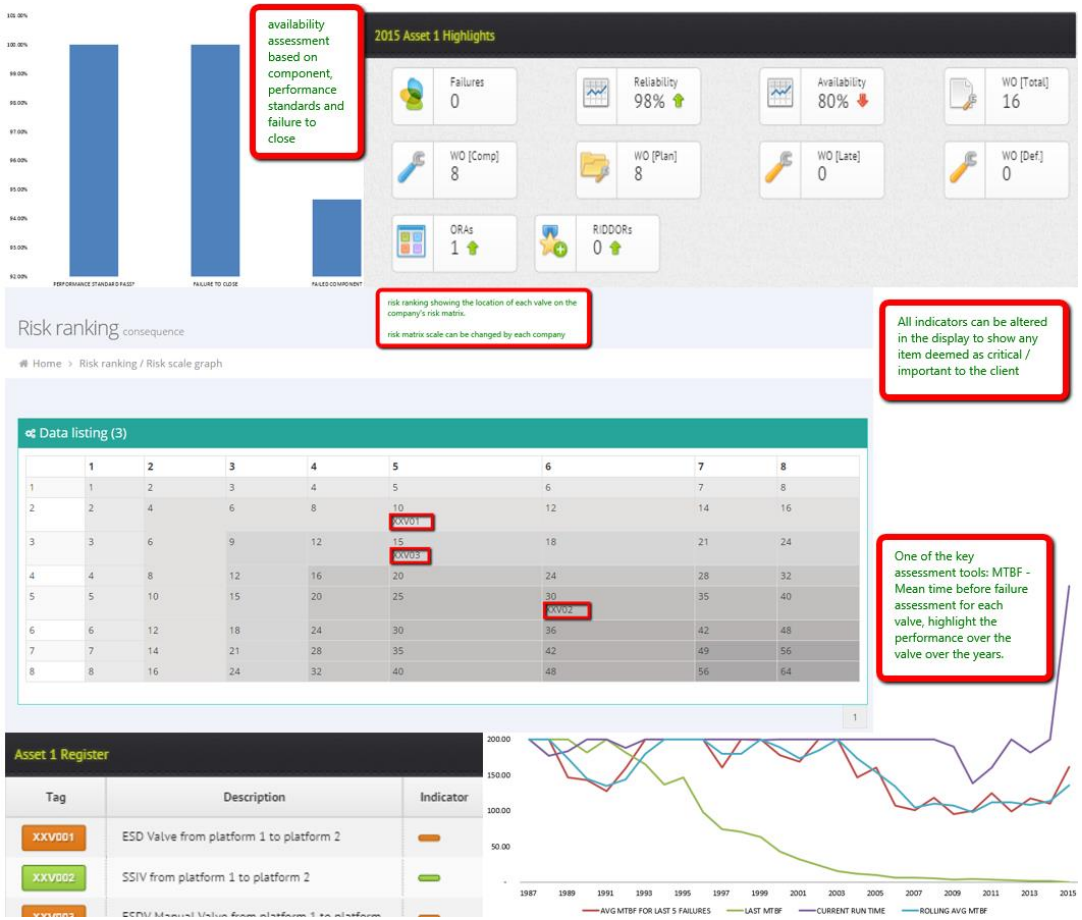
X-axis -> Maximun Likelihood -> 5

Y-axis > Maximun Consequence -> 5

	1	2	3	4	5
1	1 Roadmap VLV1	2	3	4	5
2	2 IRM-VLV-1, Roadmap VLV2, XXV3111, XXV3112, XXV2191, XXV2192	4	6	8 XXV2400	10
3	3	6	9	12	15
4	4 VIMS VLV1	8 PULSE VLV1	12	16	20
5	5	10	15	20	25

Sno.	NUMBER	HIGHLIGHTS(statics) hide	OUTSTANDING ACTIONS(statics) hide	OVERDUE MAINTENANCE(statics) hide	VISUAL INDICATORS(statics) hide	HIGHLIGHTS hide	OUTSTANDING ACTIONS hide	OVERDUE MAINTENANCE	VISUAL INDICATORS	HEALTH SCORE	HEALTH RANK
1	IRM-VLV-1	0	0	65.916666666667	3	0.0000E+0	0.0000E+0	6.9573E-2	1.5789E-2	8.5363E-2	4
2	PULSE VLV1	0	0	80.5	0	0.0000E+0	0.0000E+0	8.4965E-2	0.0000E+0	8.4965E-2	3
4	Roadmap VLV1	0	0	107	0	0.0000E+0	0.0000E+0	1.1294E-1	0.0000E+0	1.1294E-1	5
5	Roadmap VLV2	0	0	52	0	0.0000E+0	0.0000E+0	5.4884E-2	0.0000E+0	5.4884E-2	2
3	VIMS VLV1	0	0	35.25	0	0.0000E+0	0.0000E+0	3.7205E-2	0.0000E+0	3.7205E-2	1
9	XXV2191	1	0	155.33333333333	48	5.0000E-1	0.0000E+0	1.6395E-1	2.5263E-1	9.1658E-1	16
10	XXV2192	1	0	247.5	47	5.0000E-1	0.0000E+0	2.6123E-1	2.4737E-1	1.0086E+0	17
6	XXV2400	0	3	119.77777777778	55	0.0000E+0	7.5000E-1	1.2642E-1	2.8947E-1	1.1659E+0	18
7	XXV3111	0	0	48.166666666667	19	0.0000E+0	0.0000E+0	5.0839E-2	1.0000E-1	1.5084E-1	6
8	XXV3112	0	1	36	18	0.0000E+0	2.5000E-1	3.7997E-2	9.4737E-2	3.8273E-1	12

Reliability Engineering



- Indicators tailored to support day to day operation
  - MTBF
  - Different availability assessment methods
  - Highlights (activities planned vs actuals)
  - Failure mode analysis
  - Trending
  - Asset highlights from IVB
- Improved integrity management through one stop shop holistic picture
- Highlights
  - Inspection
  - Performance standards
  - Process
  - Standards
  - Etc.

Failure Mode Support Engineering

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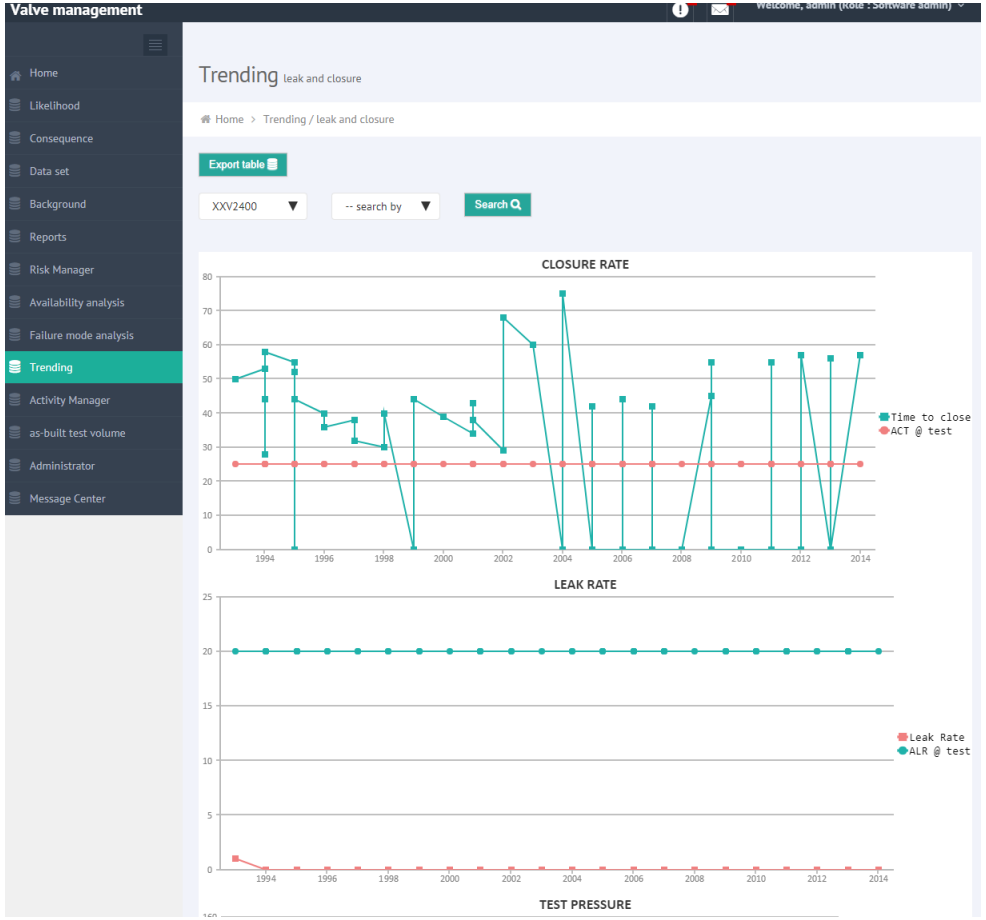
- Failure mode classification
  - Over 91 failure modes
  - Inadequate maintenance
  - Design inadequacy
  - Inexperienced staff
  - Corrosion
  - QA issue
  - etc.
- Incident category
  - Dangerous occurrence
  - Covered by risk assessment
  - Other safety related
  - Non-safety related
  - Company-HIGH, MID, LOW
  - etc.
- Re-emphasis
- Actions
- Failed component
  - stem
  - body
  - etc.

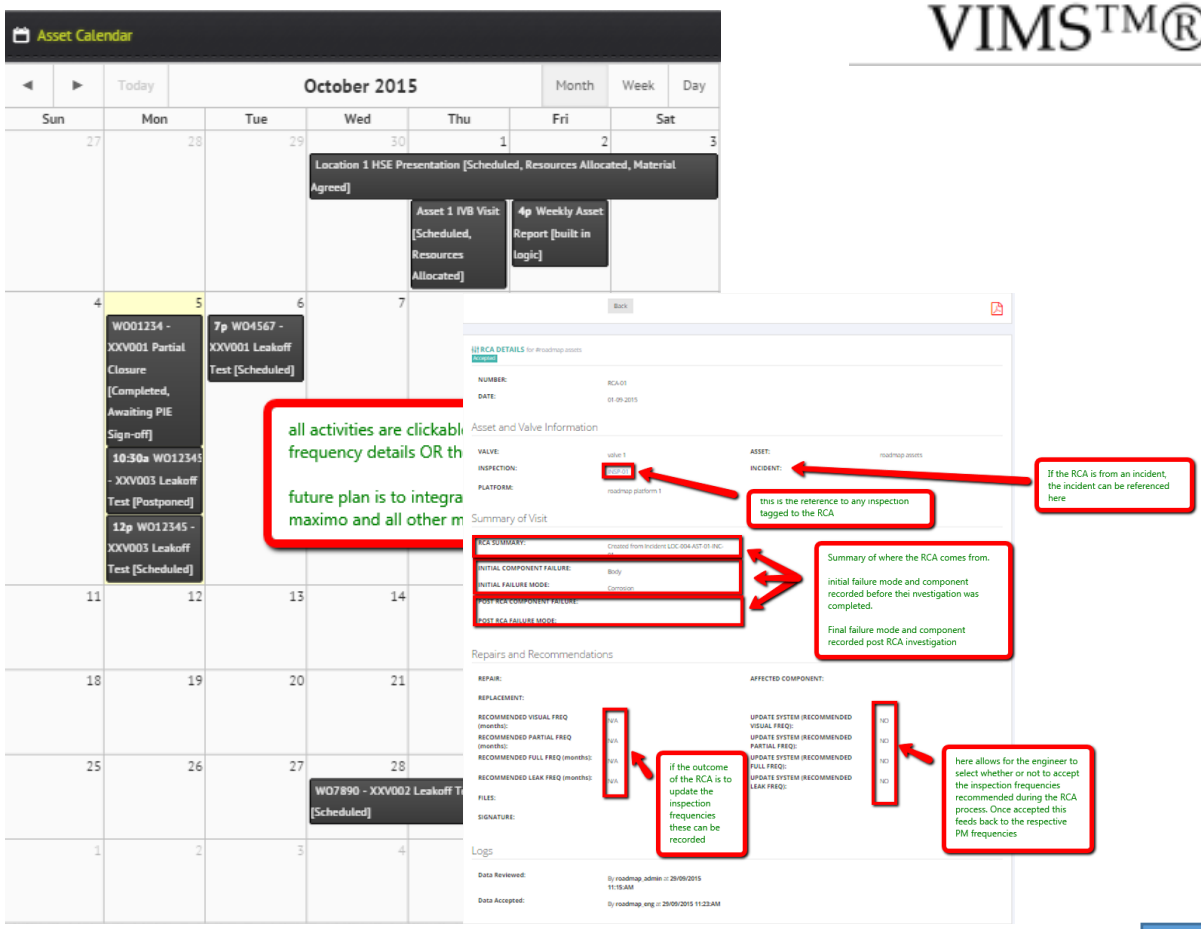
Trending and Periodic Assessment



- Failure trending and analysis
- Time to close trending
- Leak rate trending
- Test pressure trending
- Reliability and availability trending
- PDF reports generation
- Support the asset integrity yearly review activities

Miscellaneous

- Activity manager
- Pipeline valve bore management
- Availability analysis
- Root cause analysis
- Independent verification visit management
- Action management
- Software integration with CMMS
- Repair management
- Spares and obsolescence



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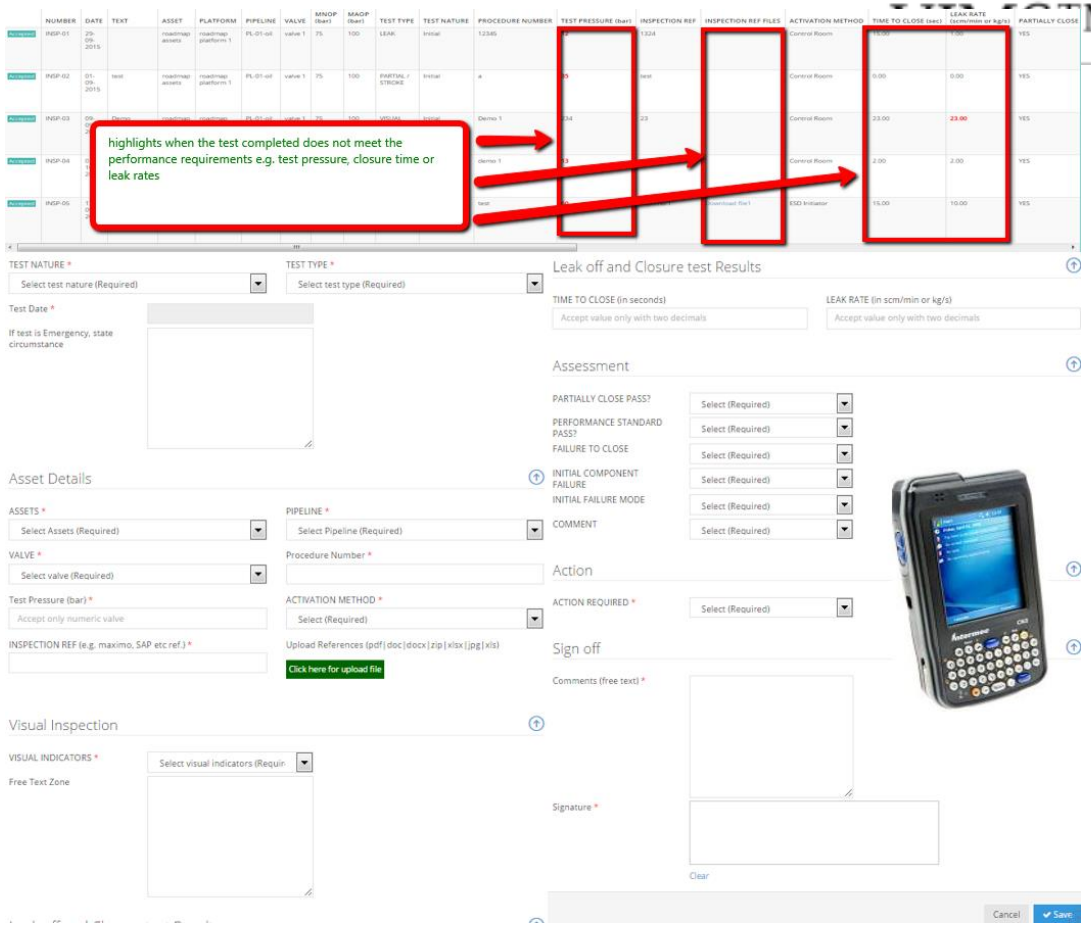
Product Demo

The prototype

Demo Deployment

- Product demo consists of;
  - Web interface and access to all valves
  - Ability to input information and review information on valves
  - Ability to review valve reliability and availability
  - Ability to review valve trends
- Demo installation takes 2 weeks for an asset of 20 valves and 100 – 250 historical verifiable reports
- Maximum number of users 4
- Demo duration is 3 months



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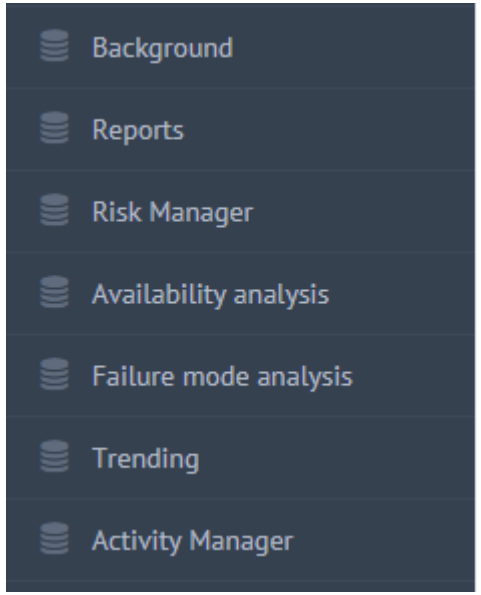
Product Deployment and Packages

The full package

Package Options

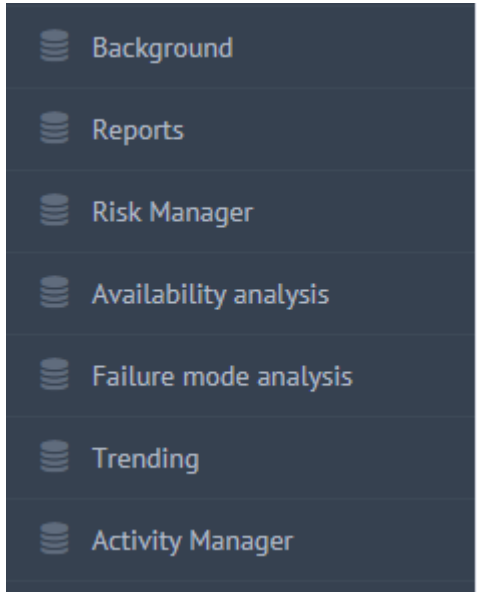
- Basic Package;
- Reliability Package
- Offshore Package
- Integrated / Bespoke Package



- Basic Package
  - Web interface and dashboard
  - Background (location, platforms, lines, assets, valves)
  - Reports (inspection, incidents, IVB, RCA, repairs, miscellaneous, actions)
  - Trending (leak rate, closure, test pressure)
- Reliability Package
  - Basic package
  - Risk manager (risk graph, health check, risk table)
  - Failure mode packages
  - Activity manager

Package Options

- Offshore Package
  - Basic package
  - Reliability package
  - Operation handheld device
  - QR coding of all valves



- Integrated / Bespoke Package
  - Installation of acoustic measuring devices for automated records
  - Integration of Valve-IMS with CMMS
  - Integration of Valve-IMS with telemetry / SCADA systems
  - Additional request of client can be considered

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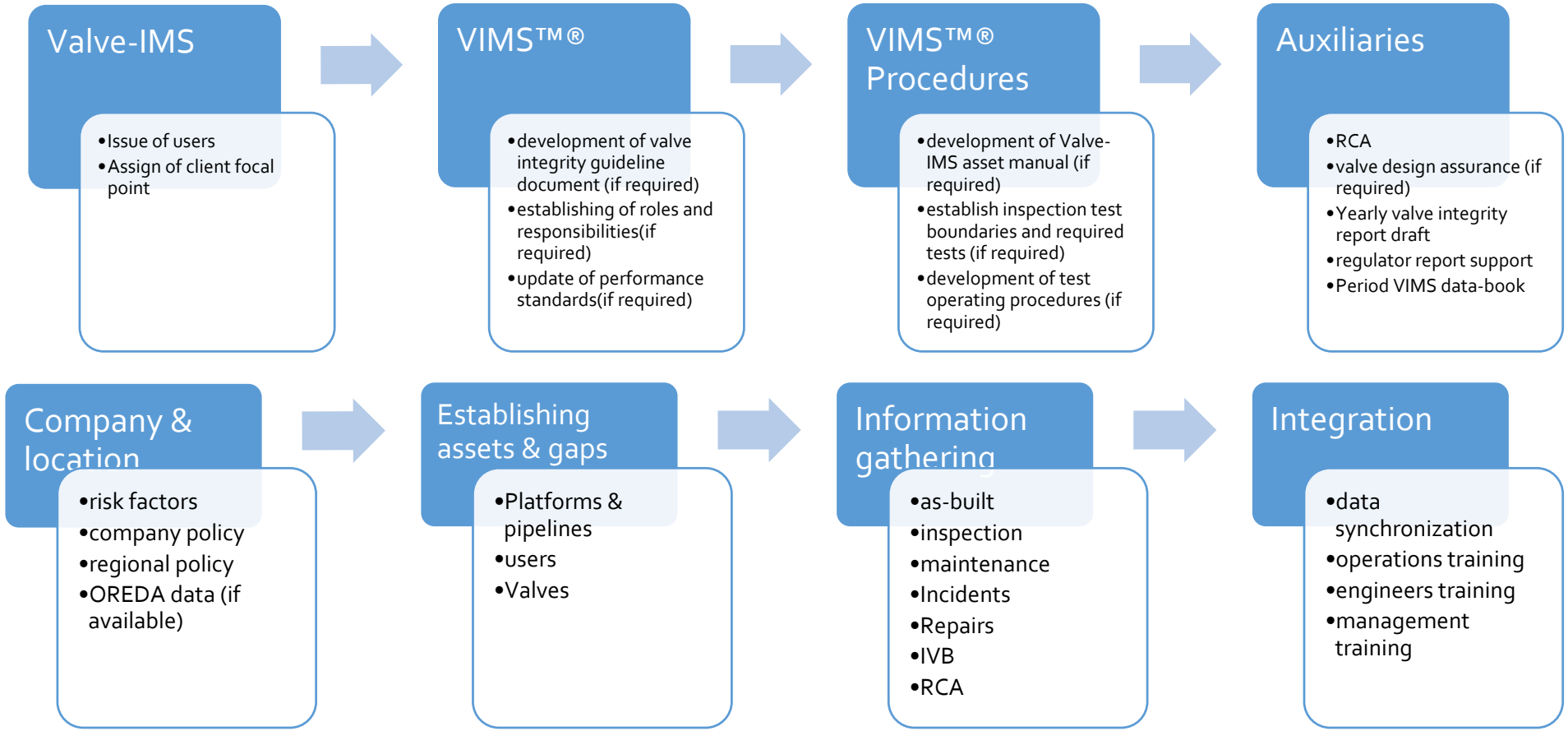
Typical Implementation Process

Software Embedment Process

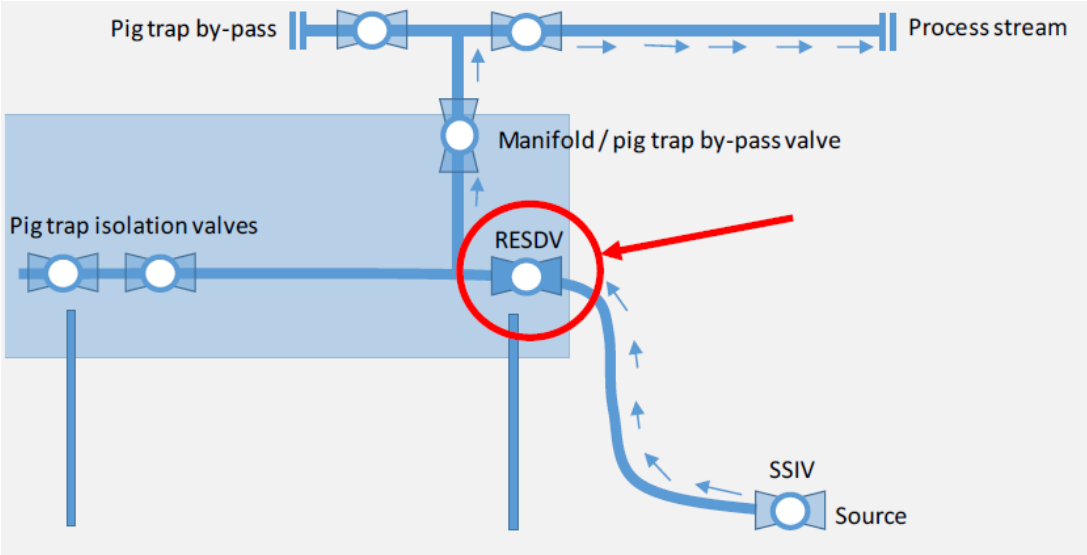


Theoretical System Description

- System type: Pipeline
- 15 platforms
- 3 terminals
- 3 landline, 20 pipeline systems
- Between 5 – 30 years of operation
- Oil and condensate pipeline systems
- Pipeline integrity system exists

- No valve integrity management system
- Lack of traceability on inspection and repairs
- Several ESDV failures
- Lack of as-built and knowledge on valves
- Reactive maintenance resulting in high maintenance costs
- Lack of indicators

Approach



- Phase I - data gathering and survey
- Phase II - establishing valve condition, development of procedures, development of PMs, development of test volumes, MNOP etc. execution of maintenance plan
- Phase III - Incorporation of Valve-IMS on the valve systems
- Phase IV - Training of client personnel as required

Phase I

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Activities

- Carried out an initial survey to understand what the current status of the valves are
- Create a central repository for all information related to valves, valve associated devices and equipment
- A status summary of all RESDVs on the COMPANY's platforms including information such as visual defects and status of all associated components on the valve

Outcome

- Comprehensive list of all ESDVs on the platform including OEM's details
- Comprehensive status summary of all RESDVs on the platform from visual inspection indicators
- KPIs development
- Execution plan for Phase II and Phase III

Phase II

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Activities

- Valve Integrity Management System (VIMS) and Standard Operating Procedure (SOP) documentations that detailed the isolation points, highlights on P&IDs, MNOP, operating restrictions and communication protocols.
- Typical critical valves have a set of minimum inspections carried out on an approved frequency.
- These inspections are usually done to comply and in conformance to the requirements of either the operator or the regulator

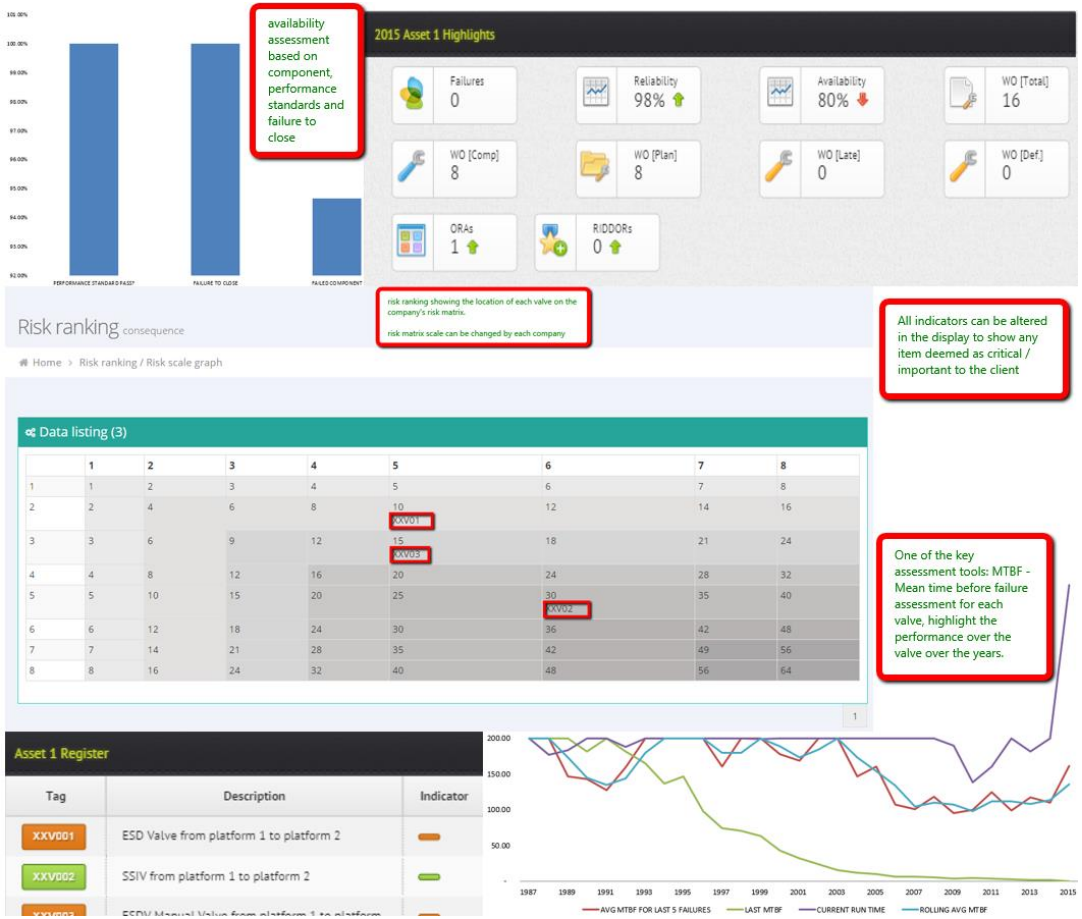
Outcome

- Detailed listing of all ESDVs on the platforms, down to component design details
- Integrated VIMS process for the operator
- Intercompany Valve integrity management system and process
- SOP documentation for all the operator's ESDV
- Maintenance plans and PMS for all ESDV inspections

Phase II – Typical Inspections

Inspection Type	Typical Frequency (regulation)	Brief Content	TAR Required?
Visual Inspection	1 - 3 monthly	Main goal is to confirm mainly valve corrosion deteriorating mechanisms, PM for associated components and supporting systems are under control • Actuator • Valve general condition • Associated controls and panels • Integrity protection checks	No S/D required
Partial Closure	3 - 6 monthly	The main function is to confirm telemetry and valve response • Visual inspection • ESD pre-checks • Telemetry checks • ESDV motion checks	No S/D required
Full Closure	6 - 24 monthly	The main function is to confirm telemetry and valve response in compliance with the performance standards and the platform safety case • Partial closure • Observation of noise • Recording of time to close and open • Time to actuate vs time to close	Partial S/D
Leak Tests	6 - 36 monthly	The main function is to confirm telemetry and valve response in compliance with the performance standards and the platform safety case • Full closure • Leak rate through valve • Consideration and care to prevent over pressure • Staged build up and monitoring	S/D required

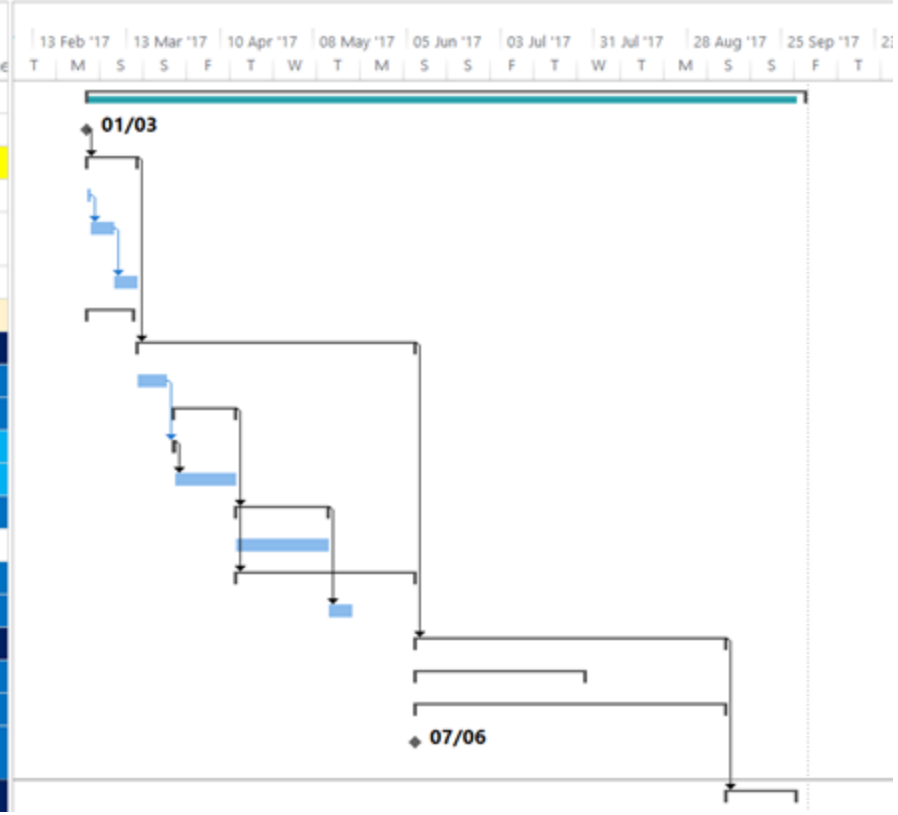
Phase III (15 – 30 days)



- Integration of Valve-IMS with the operator's Computerised Maintenance Management System (CMMS)
- Holistic view on the status of all ESDVs and a forward plan
- Proactive valve management
- Reduced failures through leading and lagging indicators

Typical Schedule

Task Name	Duration	Start	Finish	Predecessors	Resource Name
Operations and Maintenance Valve Schedule	**153.56 days**	**Wed 01/03/17**	**Mon 02/10/17**		
Award	0 days	Wed 01/03/17	Wed 01/03/17		
Kick off	**11 days**	**Wed 01/03/17**	**Wed 15/03/17**	**2**	
Kick off meeting with COMPANY	1 day	Wed 01/03/17	Wed 01/03/17		
Provision of technical plan to COMPANY for approval	5 days	Thu 02/03/17	Wed 08/03/17	4	
Offshore and site approvals	5 days	Thu 09/03/17	Wed 15/03/17	5	
Data gathering	**10 days**	**Wed 01/03/17**	**Tue 14/03/17**		
Phase I	**59.56 days**	**Thu 16/03/17**	**Wed 07/06/17**	**3**	
Mobilization of personnel	**7 days**	**Thu 16/03/17**	**Fri 24/03/17**		
Offshore inspection	**14.56 days**	**Mon 27/03/17**	**Fri 14/04/17**		
Inspection steps	**0.56 days**	**Mon 27/03/17**	**Mon 27/03/17**	**11**	
Completion of other platform inspections	14 days	Mon 27/03/17	Fri 14/04/17	13	
Technical assessment	**20 days**	**Fri 14/04/17**	**Fri 12/05/17**	**12**	
Technical assessment and condition report	20 days	Fri 14/04/17	Fri 12/05/17		
Maintenance and operational procedures	**38 days**	**Fri 14/04/17**	**Wed 07/06/17**	**12**	
Planning for phase 2	**5 days**	**Fri 12/05/17**	**Fri 19/05/17**	**28**	
Phase II	**67 days**	**Wed 07/06/17**	**Fri 08/09/17**	**10**	
COMPANY VIMS process establishment	**37 days**	**Wed 07/06/17**	**Fri 28/07/17**		
Maintenance planning	**67 days**	**Wed 07/06/17**	**Fri 08/09/17**		
ESDVs rectification program (not included in plan)	**0 days**	**Wed 07/06/17**	**Wed 07/06/17**		
Phase III	**15 days**	**Fri 08/09/17**	**Fri 29/09/17**	**39**	



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Case Study

Valve Failure Review

Using Leading and Lagging Indicators

- Tag: valve1
- Installed: 2005
- Operational years: 7 yrs.
- Value of production: 8,000.00 bbl. / day
- Value of production (per barrel, per day): 8,000.00 bbl./day , 20 USD/bbl.
- Number of significant failure(s): 1
- 1 failure resulting in a cost of over 700,000 USD
- Several leading and lagging indicators not picked up

Using Leading and Lagging Indicators

- **Events not picked up or thoroughly assessed without VIMS**
  - Number of silent indicators: 10 +
  - Number of active indicators: 2 (failed PS tests)
  - Number of failed tests: 3
- **Significant failure resulting in outage**
  - Number of significant failure(s): 1
  - Days lost from significant failure(s): 10
- **VIMS process visualizations**
  - Corrosion indicators: 3
  - Ingress / grating indicators: 5
  - Speed restriction / slow activation indicators: 2
  - HSE highlighted 2 historical performance standards issue before final failure
    - Highlights: 2

Health Checks and Risk Review

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Health Check

	valve 1	valve 2	valve 3	valve 4	valve 5	valve 6	valve 7	valve 8	valve 9
Highlights	2	0	0	0	1	0	0	0	0
Outstanding actions	3	2	2	2	3	1	1	1	0
Overdue maintenance	0	2	0	1	0	2	2	1	2
Visual indicators	10	2	0	2	2	0	3	1	1

Factors									
Highlights	6.67E-01	0.00E+00	0.00E+00	0.00E+00	3.33E-01	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Outstanding actions	2.00E-01	1.33E-01	1.33E-01	1.33E-01	2.00E-01	6.67E-02	6.67E-02	6.67E-02	0.00E+00
Overdue maintenance	0.00E+00	2.00E-01	0.00E+00	1.00E-01	0.00E+00	2.00E-01	2.00E-01	1.00E-01	2.00E-01
Visual indicators	4.76E-01	9.52E-02	0.00E+00	9.52E-02	9.52E-02	0.00E+00	1.43E-01	4.76E-02	4.76E-02

Health score	1.34E+00	4.29E-01	1.33E-01	3.29E-01	6.29E-01	2.67E-01	4.10E-01	2.14E-01	2.48E-01
Health rank	9	7	1	5	8	4	6	2	3
Deficiency rank	1	3	9	5	2	6	4	8	7

Risk and Quantitative Assessment

	valve 1	valve 2	valve 3	valve 4	valve 5	valve 6	valve 7	valve 8	valve 9
Category	34.00	66.00	36.00	34.00	66.00	36.00	34.00	66.00	36.00
Component	45.00	18.00	15.00	45.00	18.00	15.00	45.00	18.00	15.00
Region	16.00	7.00	41.00	16.00	7.00	41.00	16.00	7.00	41.00
Function	-	79.00	96.00	-	79.00	96.00	-	79.00	96.00
OEM	86.00	-	89.00	86.00	-	1.00	86.00	-	-
Sector	26.00	15.00	30.00	26.00	15.00	30.00	26.00	15.00	30.00
Type and fluid	97.00	67.00	65.00	97.00	67.00	50.00	97.00	67.00	65.00
Valve	2.00	-	-	-	-	1.00	-	-	-

Factors									
Category	4.66E-03	9.04E-03	4.93E-03	4.66E-03	9.04E-03	4.93E-03	4.66E-03	9.04E-03	4.93E-03
Component	6.16E-03	2.47E-03	2.05E-03	6.16E-03	2.47E-03	2.05E-03	6.16E-03	2.47E-03	2.05E-03
Region	2.19E-03	9.59E-04	5.62E-03	2.19E-03	9.59E-04	5.62E-03	2.19E-03	9.59E-04	5.62E-03
Function	0.00E+00	1.08E-02	1.32E-02	0.00E+00	1.08E-02	1.32E-02	0.00E+00	1.08E-02	1.32E-02
OEM	1.18E-02	0.00E+00	1.22E-02	1.18E-02	0.00E+00	1.37E-04	1.18E-02	0.00E+00	0.00E+00
Sector	3.56E-03	2.05E-03	4.11E-03	3.56E-03	2.05E-03	4.11E-03	3.56E-03	2.05E-03	4.11E-03
Type and fluid	1.33E-02	9.18E-03	8.90E-03	1.33E-02	9.18E-03	6.85E-03	1.33E-02	9.18E-03	8.90E-03
Valve	1.10E-03	0.00E+00	0.00E+00	0.00E+00	0.00E+00	5.48E-04	0.00E+00	0.00E+00	0.00E+00

Failure rate	4.27E-02	3.45E-02	5.10E-02	4.16E-02	3.45E-02	3.74E-02	4.16E-02	3.45E-02	3.88E-02
System availability	95.73%	96.55%	94.90%	95.84%	96.55%	96.26%	95.84%	96.55%	96.12%
Graph alignment	> 4 in 100	> 3 in 100	> 5 in 100	> 4 in 100	> 3 in 100	> 3 in 100	> 4 in 100	> 3 in 100	> 3 in 100

Average days lost	5.00	5.00	5.00	5.00	5.00	5.00	5.00	5.00	5.00
Average cost per day	165,000.00	240,636.00	132,064.00	169,949.00	146,921.00	241,655.00	192,793.00	209,854.00	34,962.00
Cost of loss	825,000.00	1,203,180.00	660,320.00	849,745.00	734,605.00	1,208,275.00	963,965.00	1,049,270.00	174,810.00

QRA value (USD)	35,260.27	41,534.43	33,649.18	35,386.64	25,358.97	45,186.17	40,143.20	36,221.38	6,776.88
Value	6	2	7	5	8	1	3	4	9

Using Leading and Lagging Indicators

	VIMS	No VIMS
Reliability engineering	7,000.00	-
Sparing	30,000.00	-
Cost per outage (per USD)	160,000.00	160,000.00
Personnel cost per day (USD)	6,000.00	6,000.00
Reactive RCA time	-	3.00
Reactive sparing purchase time	-	4.00
Repair time	1.00	1.00
Additional duration of wait	3.00	7.00
Total downtime	4.00	15.00
Cost of lost production	640,000.00	2,400,000.00
Cost of personnel	24,000.00	90,000.00
Reliability cost	37,000.00	-
Total cost	701,000.00	2,490,000.00
Savings	**71.85%**	

- With VIMS, operators would have been pushed to giving valve 1 more attention through the health check assessment following VIMS Reliability Engineering Process. There would have been possible triggers that would have been hit to alert the operator of potential issues

- For valve 1, an RCA (circa 7,000.00 USD) which would have recommended changes to valve housing and purchase of spare actuator (circa 30,000 USD).

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Frequently Asked Questions

(FAQs)

Frequently Asked Questions

- Difference between Valve-IMS and CMMS?
  - A computerised maintenance management system like Agresso, SAP, Maximo etc. focuses on generating PMs and inspection activities and planning. Valve-IMS focus on integrating the operational activities with reliability and engineering decision making of an organisation.
- How does Valve-IMS integrate with CMMS?
  - Integration with CMMS is done through API of Valve-IMS speaking with APIs of the CMMS, e.g. Maximo through Maximo Integration Framework (MIF), SAP through creation of a Valve-IMS user which feeds and seeks information with SAP system, Engica / Valuekeep / Agresso / etc. through direct API communications.
- Can company have their risk assessment table in Valve-IMS?
  - Yes, the risk matrix can be 4x4 or 100 x 100 based on the organisation's risk process
- Can company modify the risk logic to reflect the specific company's process in Valve-IMS?
  - Yes, specific algorithms can be created to support the specific requirements of a client.
- Does a deferral under Activity Manager on Valve-IMS reflect on respective CMMS?
  - If the system is integrated with the CMMS, deferrals on Valve-IMS will be reflected on CMMS
- Does completing an inspection on Valve-IMS reflect on respective CMMS?
  - If the system is integrated with the CMMS, inspections, IVBs, etc. on Valve-IMS will be reflected on CMMS
- Is there any user restriction on Valve-IMS?
  - Yes, user restrictions can be created based on client requirement
- Is there a limit to the number of users possible on Valve-IMS?
  - There is no limit to the number of users
- Can the handheld device be used in all zone areas?
  - Yes, the provided tablets are ATEX rated to the appropriate zone.
- Can reports be emailed and printed from Valve-IMS?
  - Yes
- Is the data reporting process traceable on Valve-IMS and does Valve-IMS keep record of changes to a valve or asset characteristics?
  - Yes, changes of any type on Valve-IMS is tracked, and the date, time and user recorded. This allows for accountability and traceability
- Can Valve-IMS be shared with 3rd party?
  - Yes, 3rd parties can be given access to specific modules and specific rights. E.g. read only, ability to view trends only, ability to view dashboard only, etc.
- Can 3rd party be given limited access to input information for a specific valve or asset without seeing the other assets of the company?
  - Yes, 3rd party access can be granted, where an operator outside the company or within a company is given input, review or technical authority level access only