Legally compliant Piping & Pipeline Maintenance

A reflection on the RBI approach followed by Secunda Synfuels Operations (SSO) and the associated resource impact

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Piping should be recognized as “key” equipment

Conceptually an easy task to perform pipeline maintenance

- Identify relevant failure mechanisms
- Implement proactive maintenance strategy
- Strategy to be a mix of preventative and predictive tasks
- A smart metallurgist and alert inspector always helps a lot ☺

Practical execution can be a big challenge

- Access not always easy – PM could be as “simple” as a coat of paint
- Can be resource intensive – people and cost
- PM could be a victim of cost reduction

Pipeline maintenance requires a holistic approach

Predictive maintenance has various challenges – some prominent ones

- Control of process stream qualities not always implemented with pipeline integrity in mind (e.g. protecting the chemistry)
- Control of utility stream qualities not always implemented with pipeline integrity in mind (e.g. prevent scaling)
- Online monitoring of internal corrosion often installed as an afterthought
- Inspection techniques limited while pipeline is in operation, hence possibly big shutdown scope
- External corrosion hidden by insulation or pipe supports

Pipeline maintenance strategy depends on sound maintenance of peripherals

- Steam traps
- Supports / hangers
- Dosing systems / Cathodic protection

Towards a more sophisticated maintenance approach

Historic approach at SSO towards pipeline maintenance

- “Critical lines” identified – internal definition applied
- “Statutory” maintenance plan implemented – IPE involvement

Resulted in reasonable reliability

Supplemented with the utilization of leak seal devices

Satisfactory process safety and business results

BUT what about the ageing plant?

Statutory compliance in support of business objectives

Pressure Equipment Regulations – effective 1 October 2009

- 11(1)(e) – piping to be inspected in accordance with relevant health and safety standard
- Allow for sound engineering practice through RBI

API 570 health & safety standard principles

- All piping to be inspected based on fluid classification - not practical for Secunda complex
- Also allow for RBI utilization to extend intervals and/or adjust inspection scope
- Class 3 - max inspection interval of 10 years (Class 4 is optional)

At the latest October ’19 to inspect representative sample if RBI approach

Will you find the failure or will it find you…?

RBI for piping – SSO approach in a nutshell

Identify corrosion loops combining lines with similar expected degradation

- Rules-based assigning of lines to corrosion loops allowing for worst case approach

Utilize knowledge from inspections of "critical lines" and other info (e.g. PRA's)

Conservative estimation of fluid inventory

SHE and business risk considered

Same analysis approach than pressure equipment

Outcome of RBI review to be converted to EMS per corrosion loop catering for relevant failure mechanisms (preventative and predictive)

The number of lines to be inspected are determined by the risk ranking of the corrosion loop

Inspection interval can be up to 12 years – in general accordance with API 581

Resource requirements for RBI piping implementation

RBI review and EMS development

- Engineering & operations personnel

Execution

- Planning
- Scaffolding, sandblasting, painting & insulation
- Inspectors
- Corrective maintenance

Cost – direct and opportunity

- Increased preventative cost
- Less reactive repair costs, leak seal boxes & production losses

Will you find the failure or will it find you…?

Significant personnel resources required for front end loading of proactive maintenance approach

Resource for Front End Loading of inspection	RBI [days]	API 570 [days]
RBI approach (~2,500 lines in a operating unit)	**80**	**73**
Technical Clerk	10	10
Process Engineer (characterize process streams)	30	30
Mechanical Technician (strategy maintainer role)	33	18
Process Technician (operating conditions)	9	6
Metallurgist (corrosion loops & possible degradation)	13	10
Reliability Engineer (facilitate reviews & quality assurance)	10	4
Inspector of Pressurized Equipment (IPE to identify appropriate inspections)	38	35
Plant owner (GMR 2(1) or representative is accountable)	12	9
Maintenance planner (plan for execution)	5	5

API 570 without RBI, requires all lines to be inspected (except class 4)

An RBI approach to pipeline maintenance is efficient

Typical direct cost: scaffolding, sandblasting, insulation, painting, inspection

Item	Critical lines	RBI	API 570
% of lines to be inspected (based on SSO risk profile, including business risk)	~10%	~35%	~100%
Direct predictive maintenance cost p.a. (indexed to cost of historical maintenance approach)	1	5 to 6	~16

Leak seal clamp prevention opportunity

- Indexed direct cost per annum - 1 to 2
- Currently only a small reduction in amount of leak seal clamps – expect improvement

Annual indexed production losses (past 3 years) due to line failures – 15 to 20

Cost to repair – for now fix whether you find the failure or the failure finds you

A more sophisticated pipeline maintenance strategy triggered by RBI approach should in time also reduce repair costs

RBI pipelines

Possibly the most efficient pipeline maintenance approach

Will you find the failure, or will the failure find you…?