Subsea Integrity Management System

a brief overview

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PHE ONWJ

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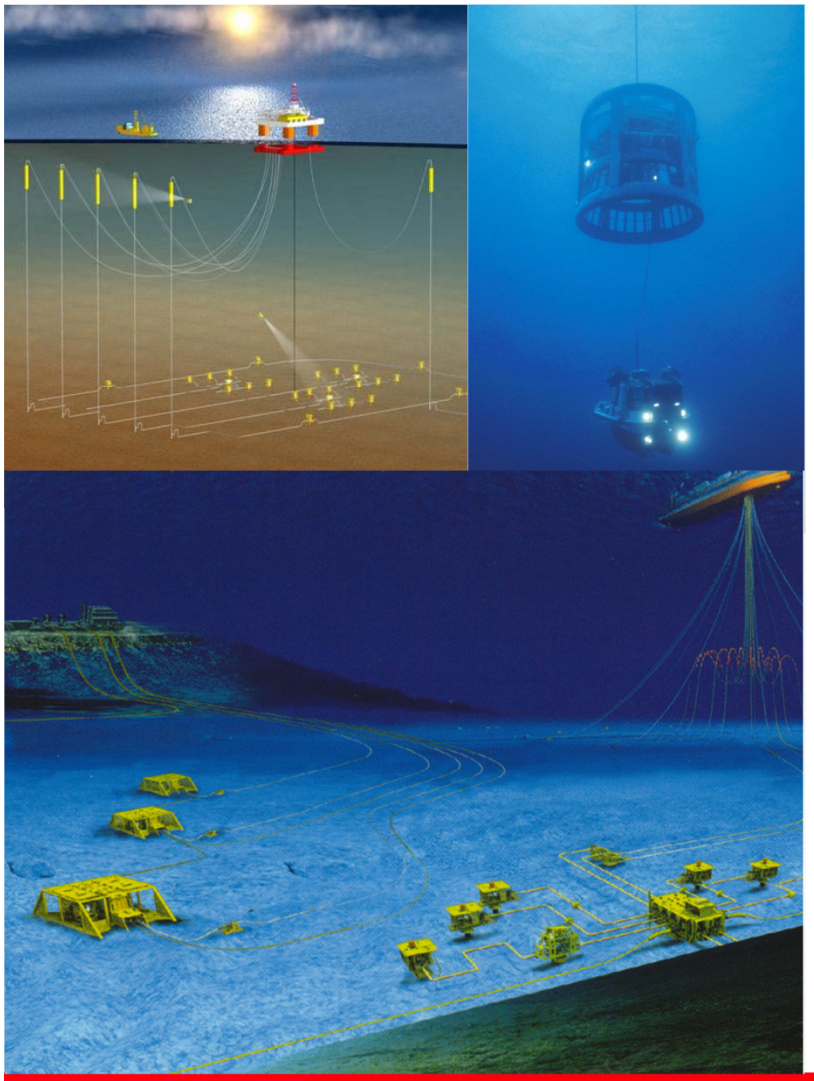
Content



- Background
- Strategy
- Implementation

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Integrity Management

the asset/system fulfill the **design** requirements throughout its whole lifecycle

ensure fitness for purpose of assets with optimal use of effort whilst **complying with** company policies and regulatory requirements

a **continuous process** of 'Knowledge and Experience Management' applied throughout the lifecycle to assure that the asset/system is managed cost effectively and safely and remains reliable and available, with due focus on personnel, assets, operations and environment

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IM Objectives

- Fulfill company requirements
- Comply with regulatory and legislative requirement
- Protect the environment, health and safety, avoid accident/incident
- Prevent or reduce unplanned costs, meet production targets/minimum downtime
- Low maintenance and repair costs
- Protect the value of assets, reputation

IM aims to ensure the integrity of an asset/system within a set of specified operational limitations throughout the lifecycle

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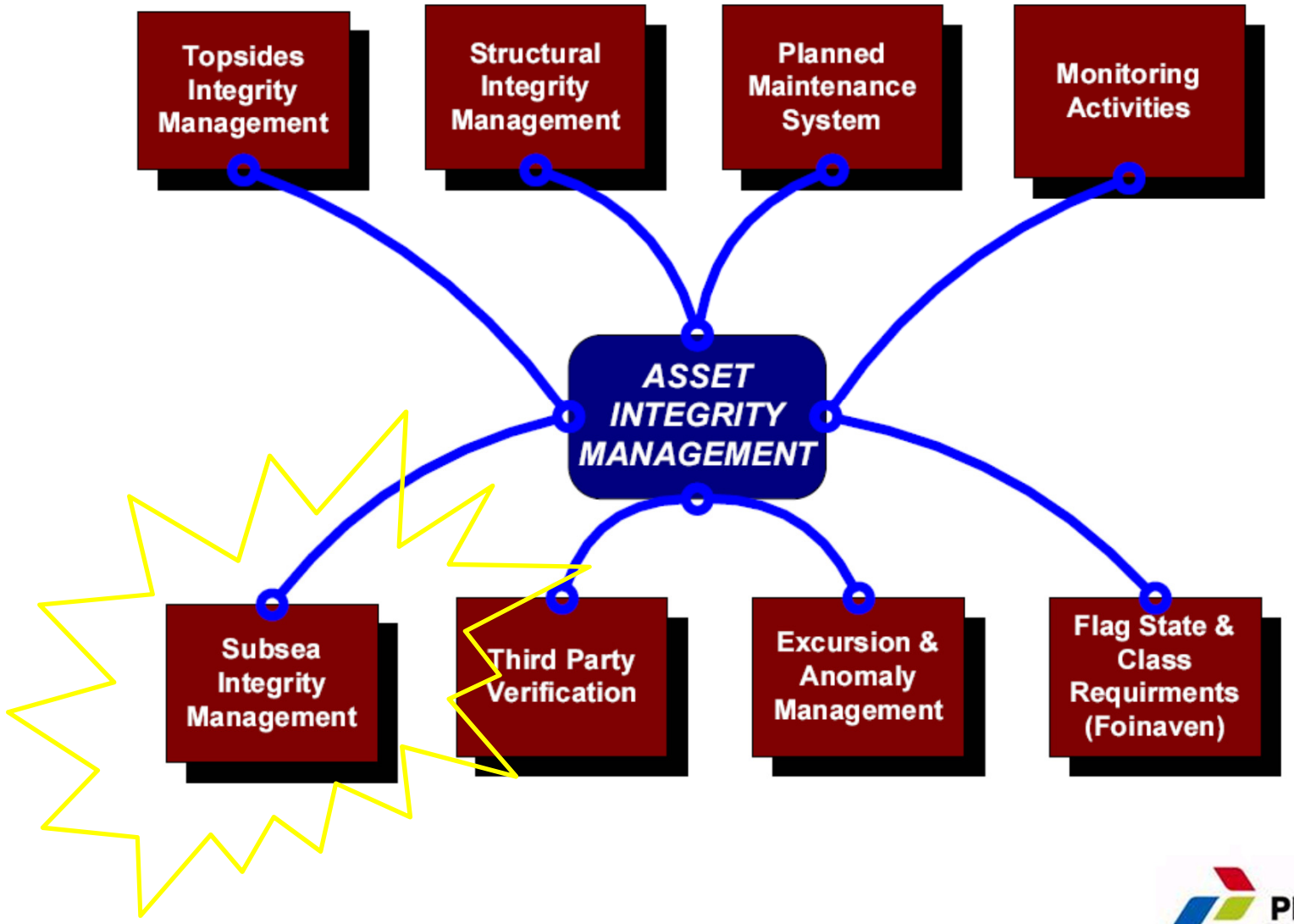
Asset Integrity Management



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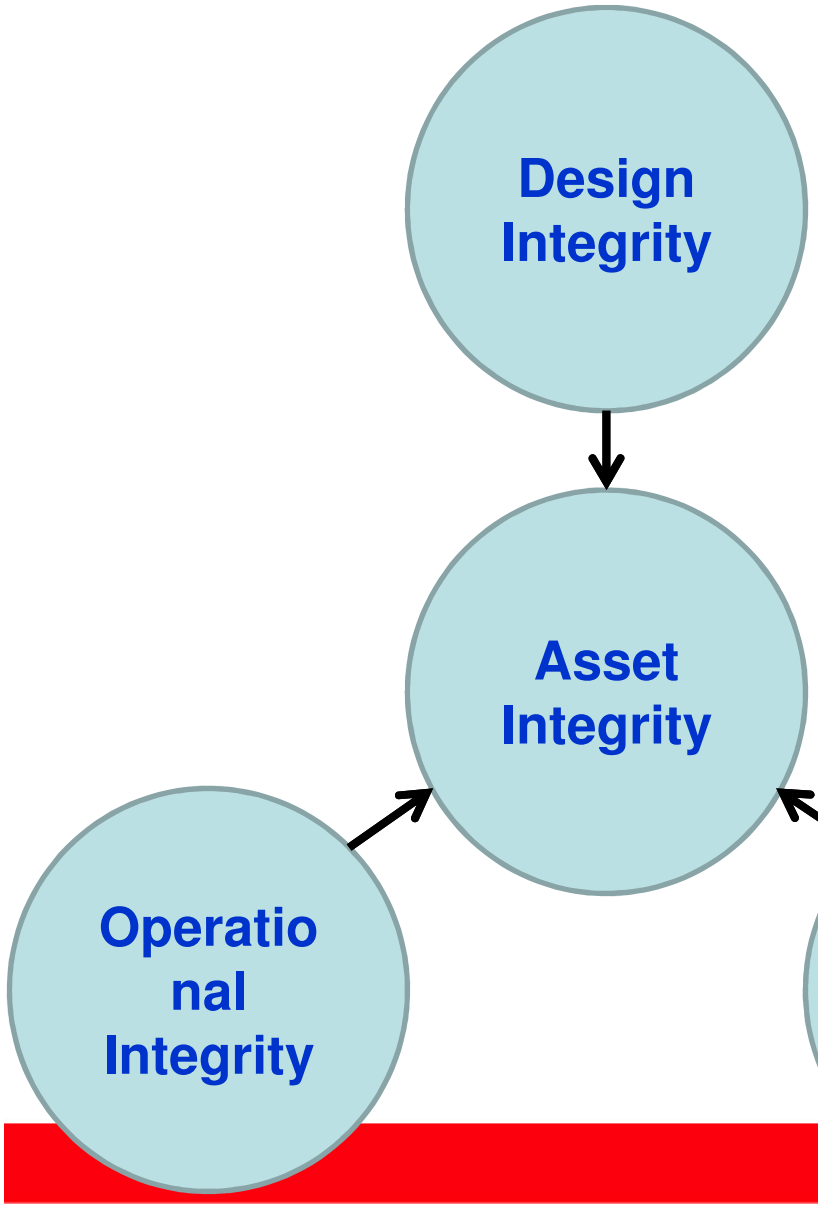
Integrity Management Structure



- Policy
- Framework
- Strategy:
  Plant, Process, People
- Procedures and working practices (RCM, RBI, etc)

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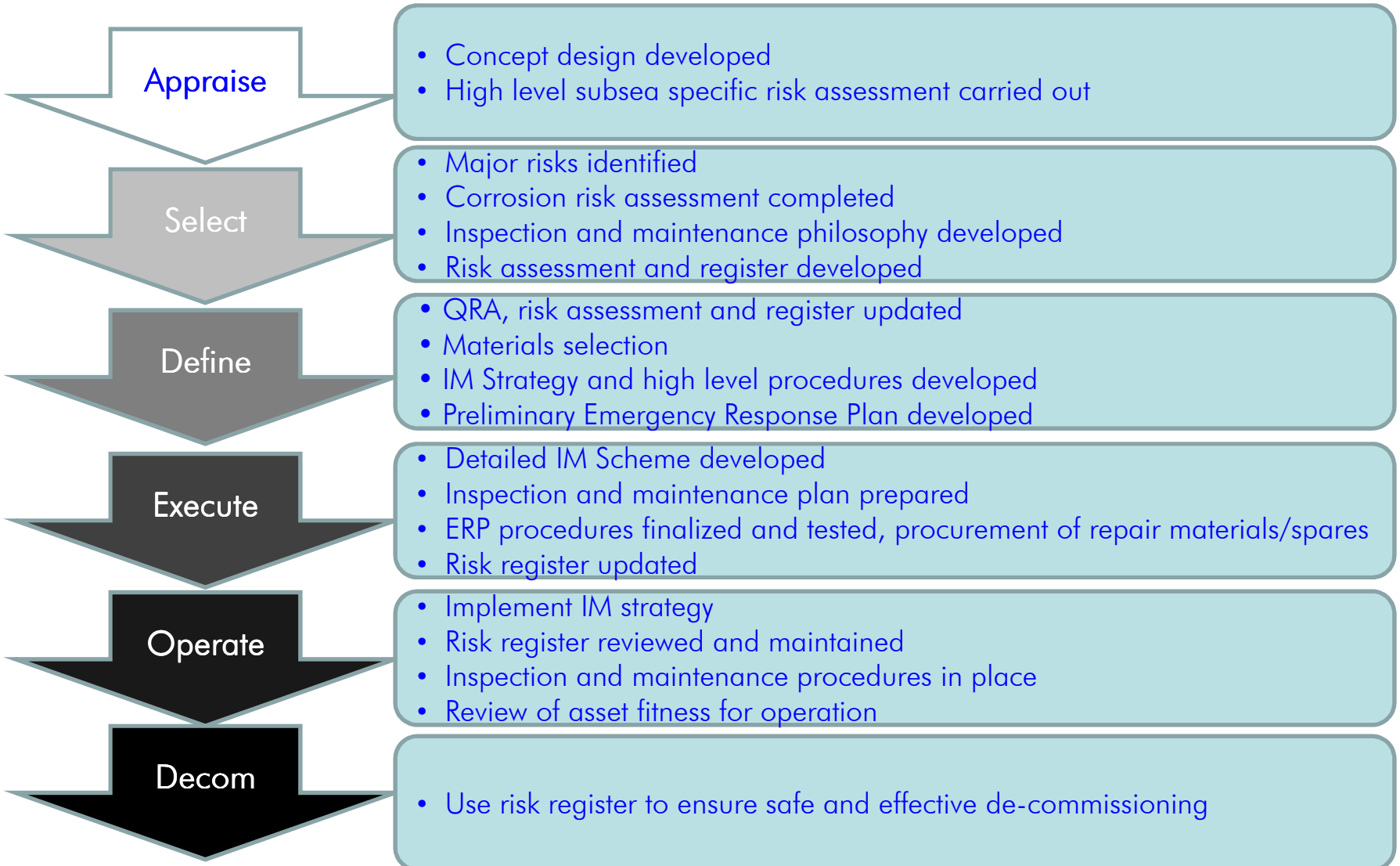
Integrity Management of Asset Life Cycle



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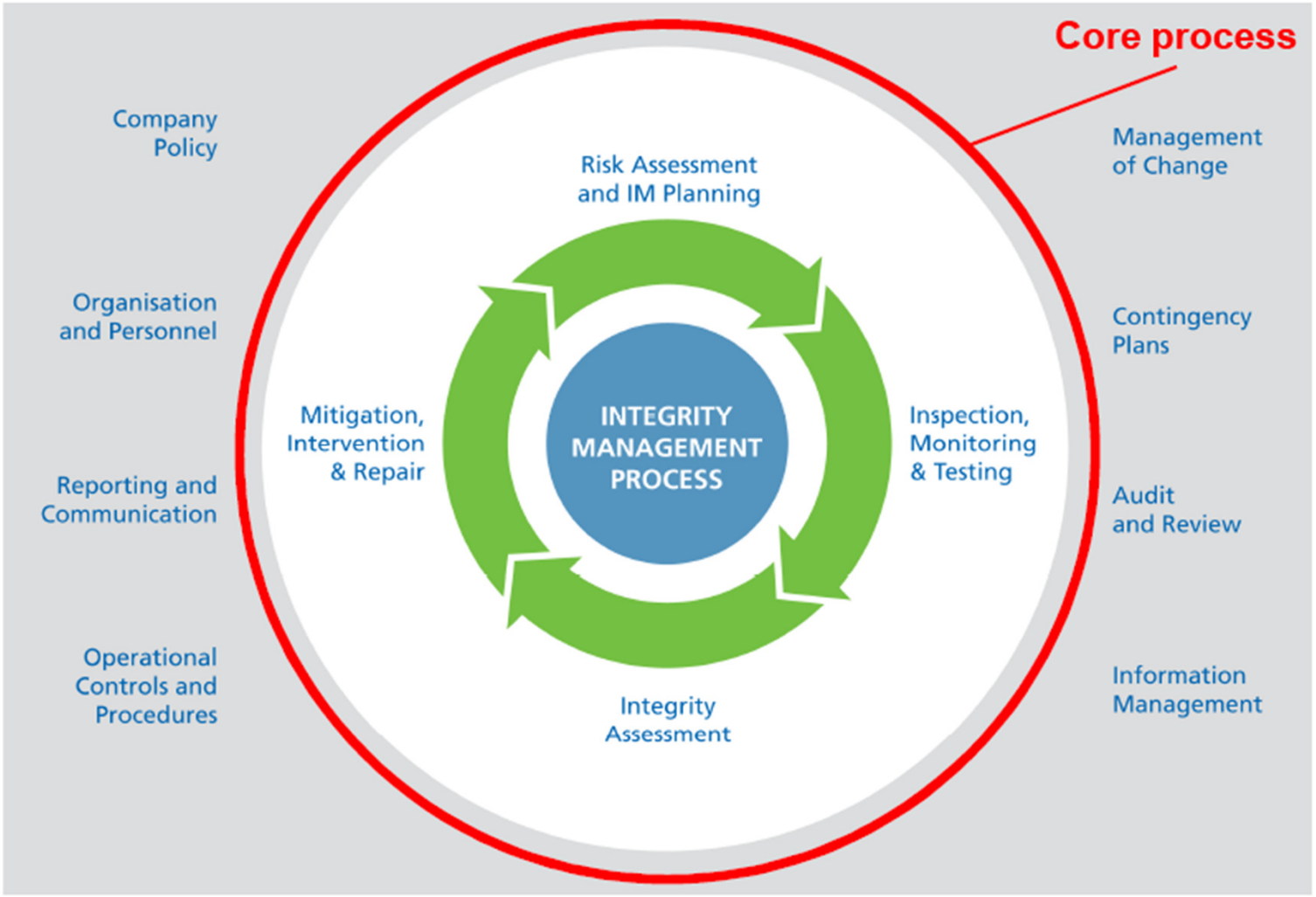
Integrity Management System



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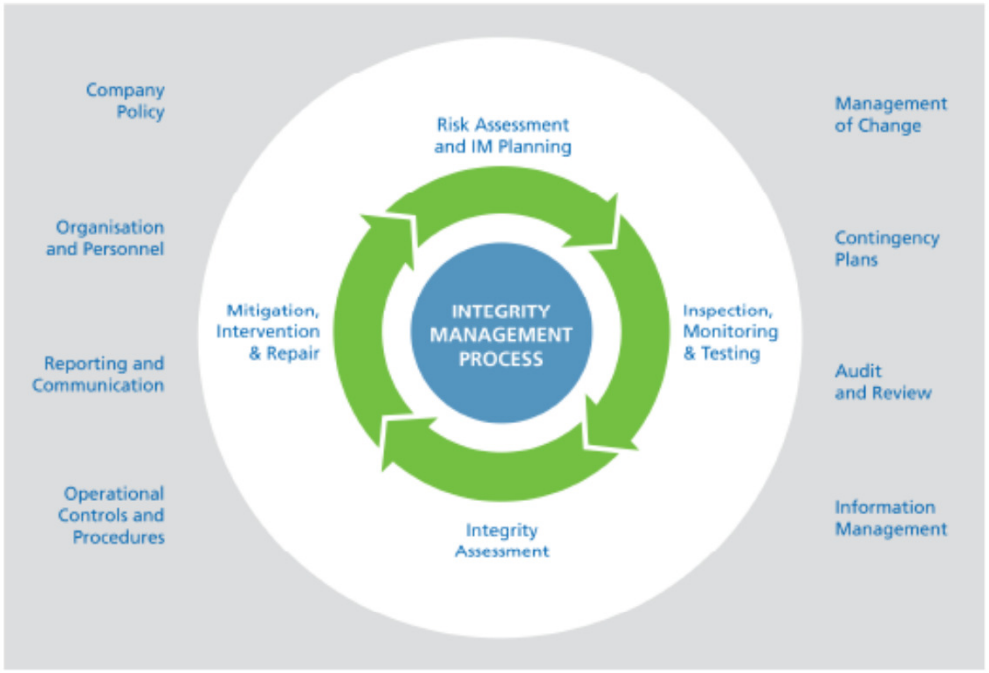

Establish integrity stage Concept, design and construction	**Maintain integrity stage** Operation and maintenance			Abandonment
INTEGRITY MANAGEMENT PROCESS				
System risk review and strategy development	Inspection, monitoring and testing	Integrity Assessment	Mitigation, intervention and repair	

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Subsea Integrity Management

"the management of a subsea system or asset to ensure that it delivers the design requirements, and does not harm life, health or the environment, through the required life"

– Energy Institute Guidelines for the Management of Integrity of Subsea Facilities

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SIMS Key Challenges

- New technologies
- Working in deeper and harsher environments
- High cost of subsea inspection and intervention
- Limited inspection intervals available
- Lead times for replacement or repair
- Complex matters: HP/HT, flow assurance, remote, etc.
- Not (yet) standardized equipments
- Limited resources

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IM Building Blocks

1. Risk assessment and IM planning
2. Inspection, monitoring and testing.
3. Integrity assessment
4. Review and update. If required, intervention for maintenance and/or repair as required

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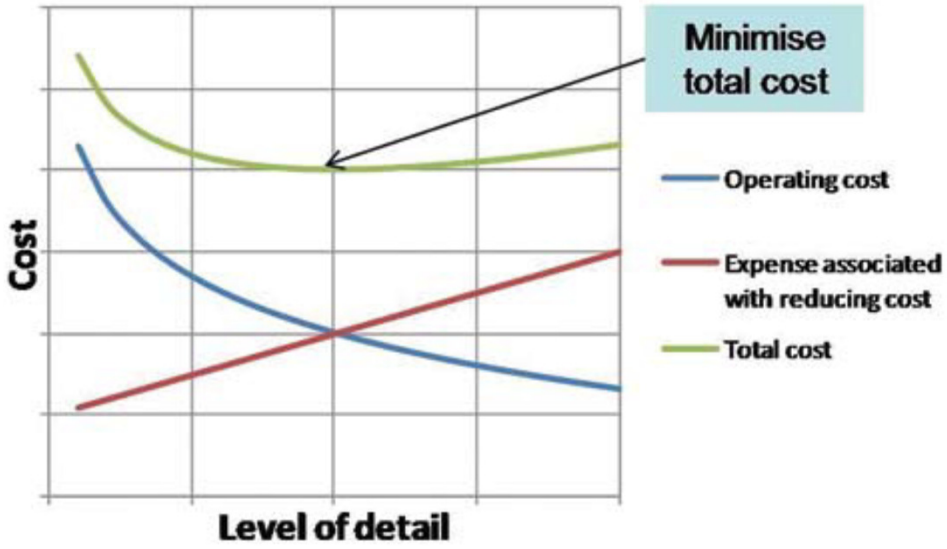
Risk Based Planning

- System breakdown to inspection component level (type & service)
- Assessment of individual risks
- The level of inspection, monitoring or maintenance should be related to the level of risk identified
- Periodic review



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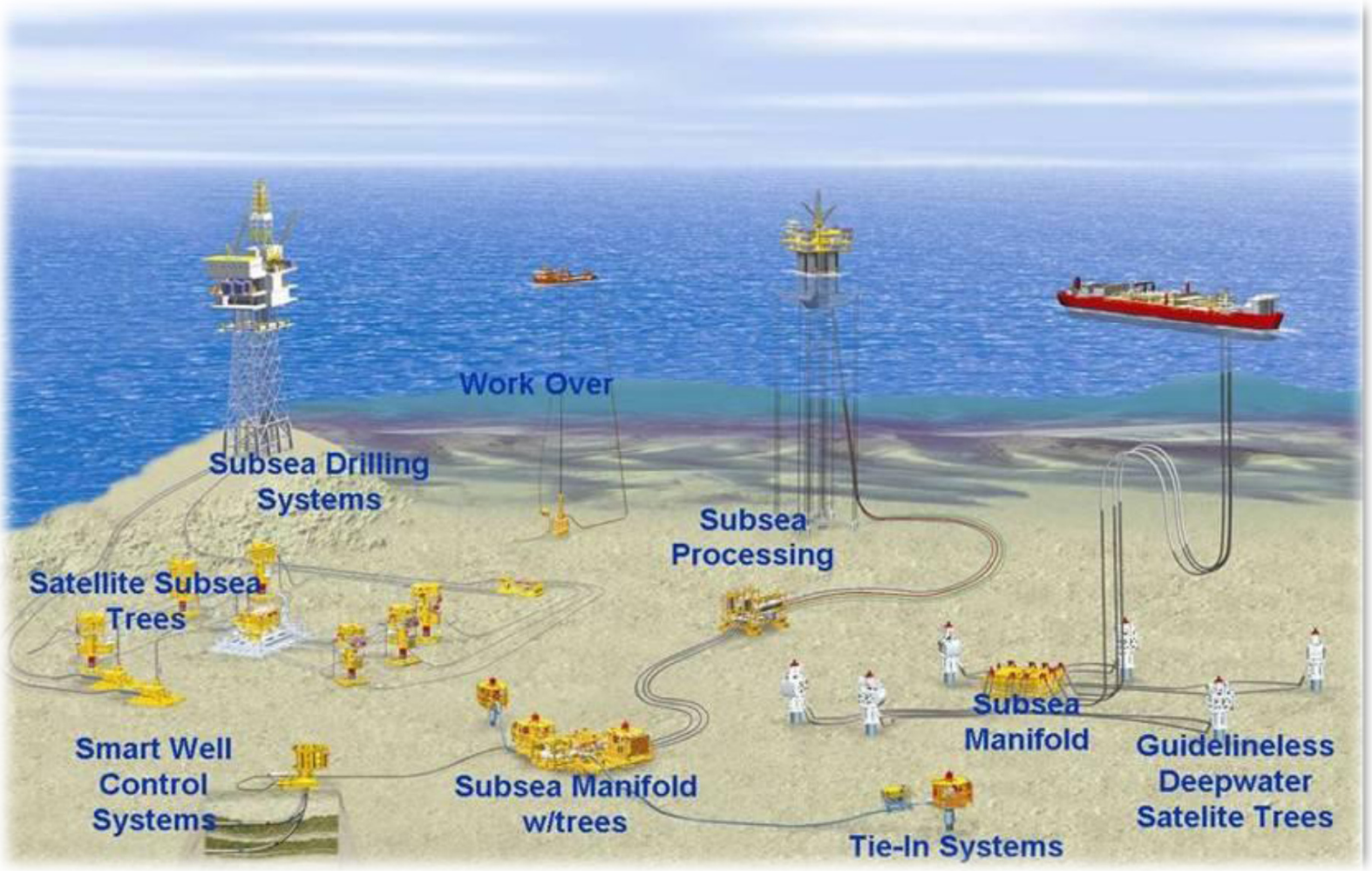
Subsea Assets



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Subsea Facility Limits

- the production system and test systems
- the gas injection and gas export systems
- the water injection system
- the subsea control and chemical injection systems

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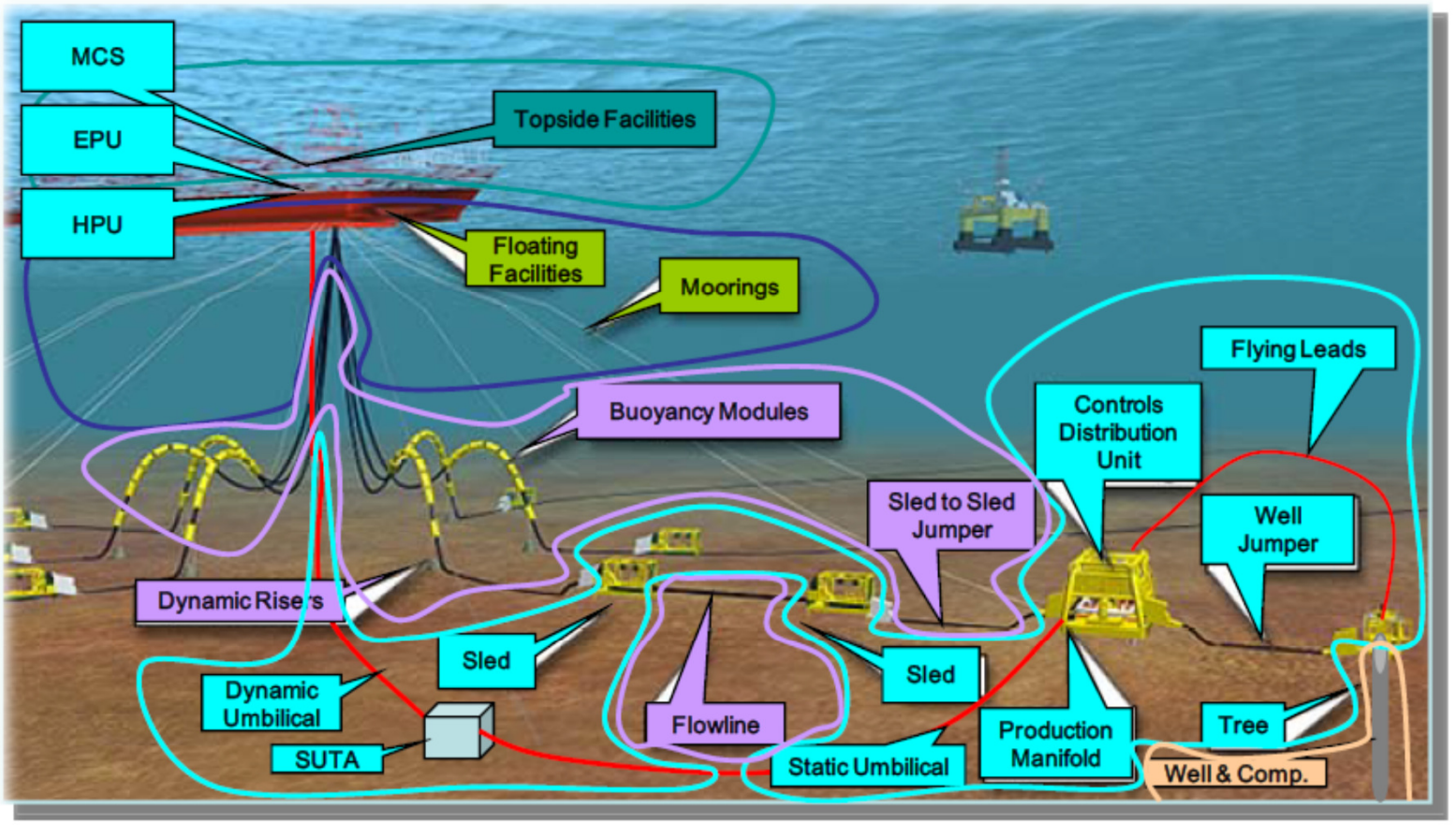
System Breakdown



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Subsea Integrity Management Strategy

Structures	Subsea Structures Integrity Management System Structure Integrity Management System (SIMS)
Connections	Subsea Connections Management System
Controls	Subsea Control Management System
Flexibles	Flexibles Integrity Management System
Risers	Riser Integrity Management System (RIMS)
Rigid Pipelines	Pipeline Integrity Management System (PIMS)
Trees	X-Mas Trees IMS

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Risk Based Process

- Breakdown system
  - ✓ type & service
- HAZID
  - ✓ failure from various threats
  - ✓ performance limits
- Consequence Assessment
- Probability Assessment
- Failure Driver Approach
- Risk Matrix, IM Strategy
  - ✓ scope of work
  - ✓ schedule

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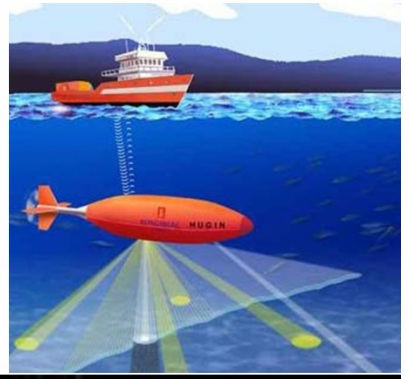
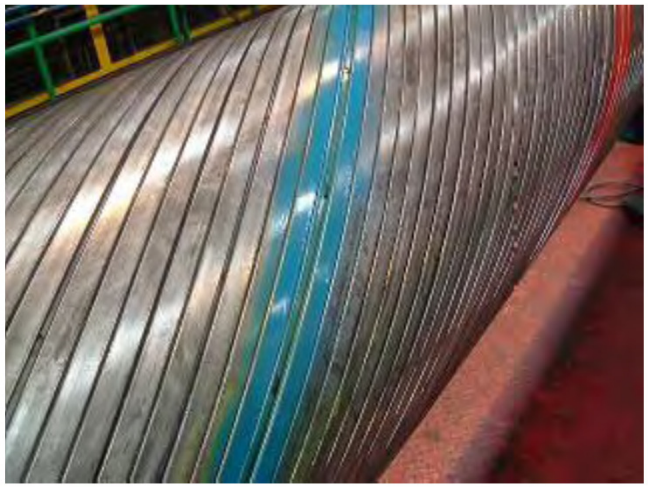
Inspection

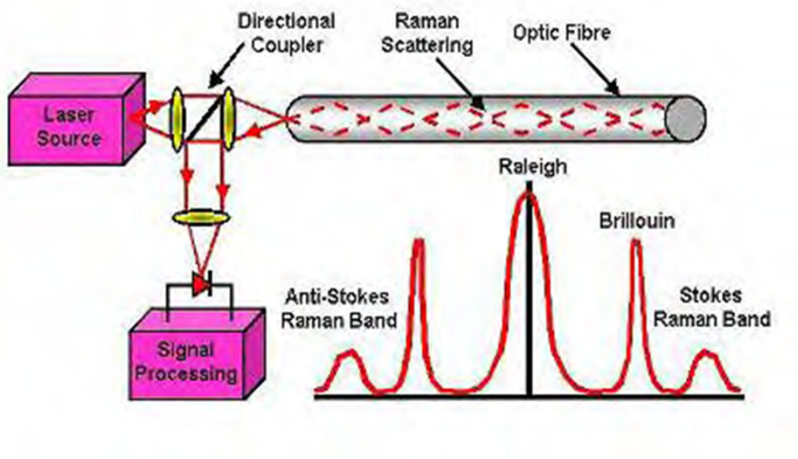
- Could be prescribed, opportunistic, or triggered
- Obtaining subsea inspection data may include:
  - Remotely operated vehicle
  - Remote operated towed vehicle
  - Autonomous underwater vehicle, and
  - Diving
- Inspection methods may include:
  - Gross/General visual inspection (GVI)
  - Close visual inspection (CVI)
- CP checks



Condition Monitoring

- Flow rates and composition
- Sand probes
- H_2S/CO_2 concentration
- Corrosion probes
- Internal pressure
- Fluid temperature
- Base water and salts
- Residual corrosion inhibitor levels
- Environment – current and wave
- Vessel motions – drift and dynamic motions





Distributed Temp Sensing with Raman Reflectometry from Schlumberger

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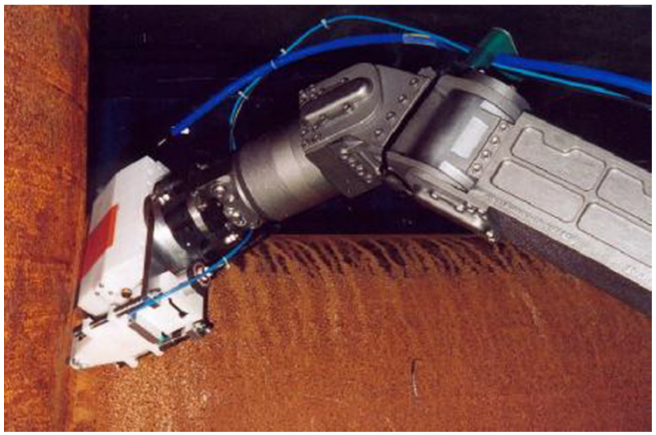

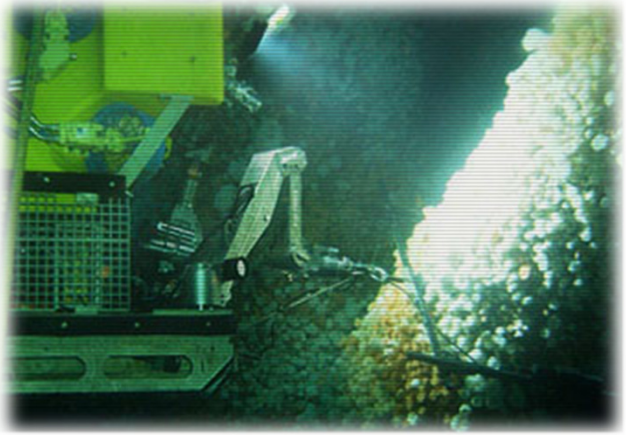

Testing

- Magnetic particle inspection
- Ultrasonic inspection
- Radiography
- Exploratory and remedial grinding
- Eddy currents
- Alternating current potential drop
- Flooded member detection

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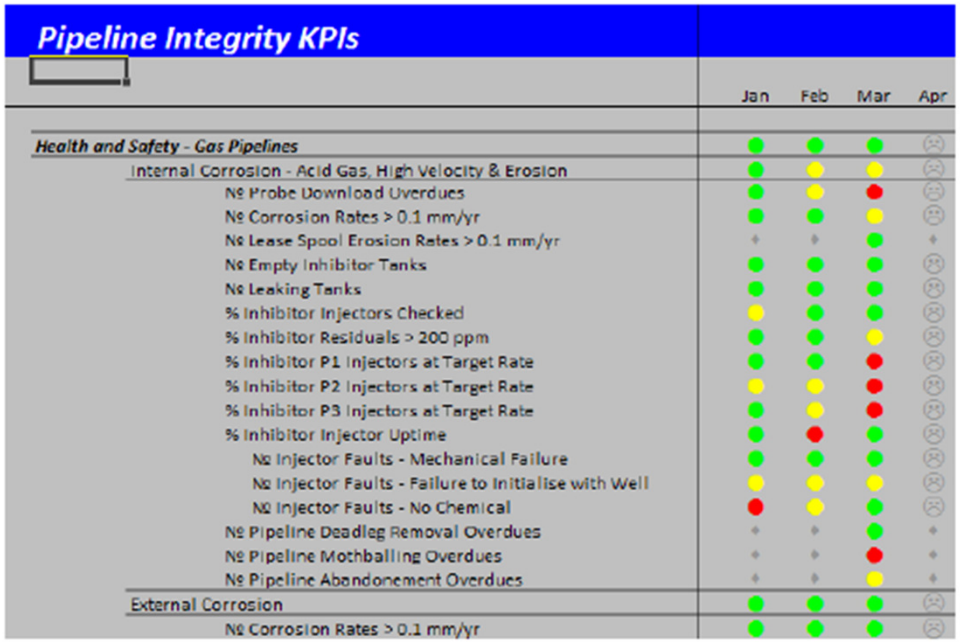
Integrity Assessment

- Results from inspections
- Design data and operational data
- Acceptance criteria
- Integrity evaluation
  - Failure modes
  - Loads and capacity
- Conclusions
- Recommendations
  - Inspections and analyses
  - Mitigation actions
  - Interventions and repairs



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Non-Conformance, Excursion and Anomaly

- Non-Conformance

  any departure from the design specification, the project specification or the installation procedure during the manufacture, hook up and commissioning of subsea equipment

- Excursion

  any event, situation or conditions which may compromise subsea integrity or operability or which may be indicative of the onset of a more serious fault

- Anomaly

  any deviation from a set of pre-defined criteria

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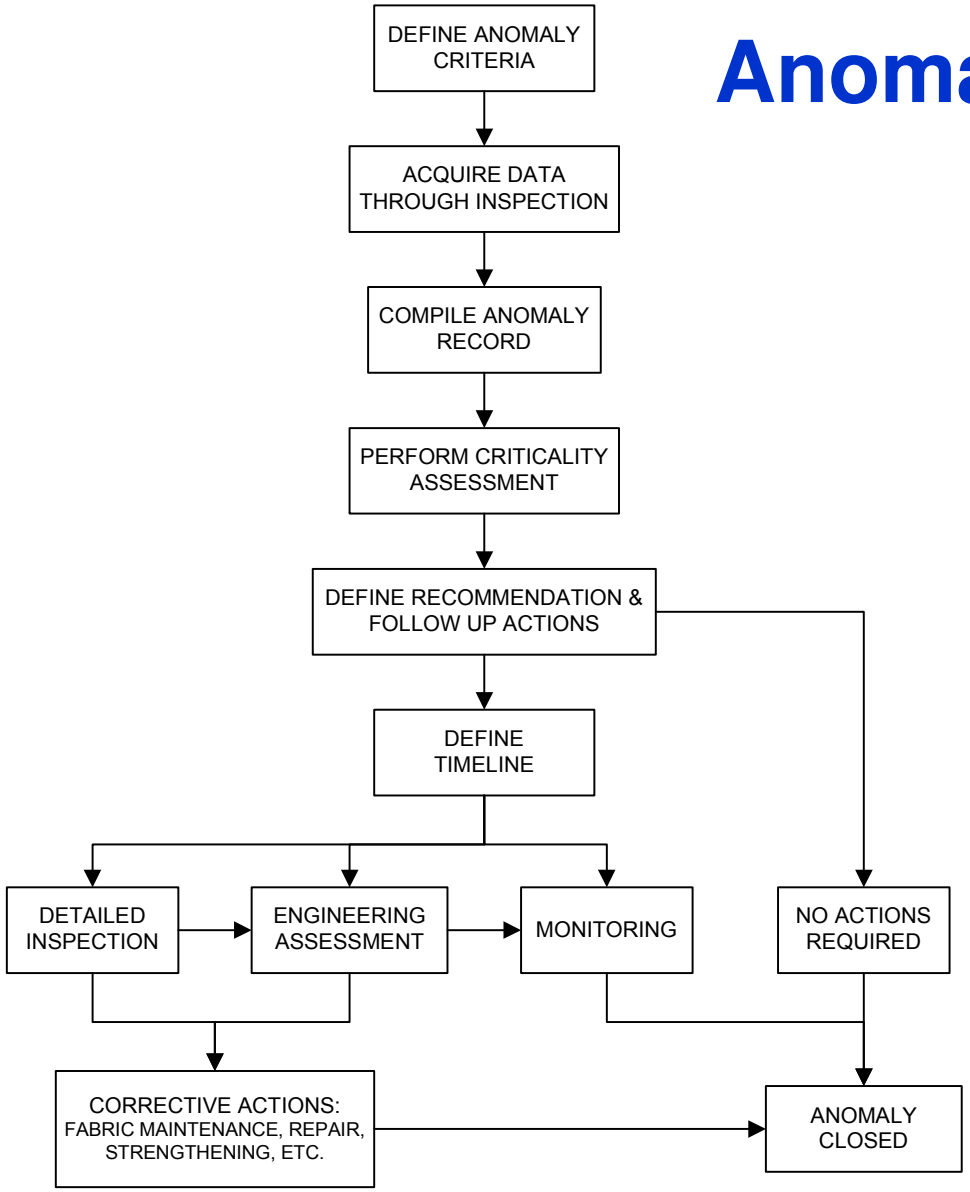
Anomaly Management



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CRITICAL ANOMALY FLASH

Anomaly Flash No.: 001	**Date: 08/11/2010**
Installation/Pipeline: AVSA Flare Platform	**Status: Open**
Substructure/KP: Leg B3	**Action: None**
Component: ROW B / 11-203	**Closed:**
Anomaly: Exposed pile on Leg B3	
COABIS Anomaly No.: AVSA/10WIN/1	

Details:

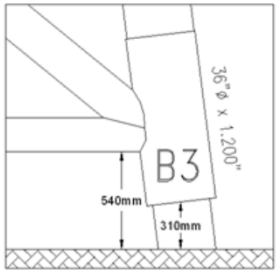
SC.

Critical

Approximately **310mm** of the internal pile was found exposed on the Leg B3 and 100mm of horizontal relative movement (Leg/pile) from east to west observed at the base of Leg B3. Low CP value of (-) 620mV was recorded on the exposed pile below the leg sleeve. UT measurements were carried out on Leg B3 and Pile 3, results as table below;

Component	Location (clock)	WALL THICKNESS(mm)
Leg B3	12	31.2
Leg B3	9	31.1
Leg B3	6	30.7
Leg B3	3	31.2
Pile 3	12	17.6
Pile 3	9	19
Pile 3	6	RA
Pile 3	3	19.1

Scour sketch :



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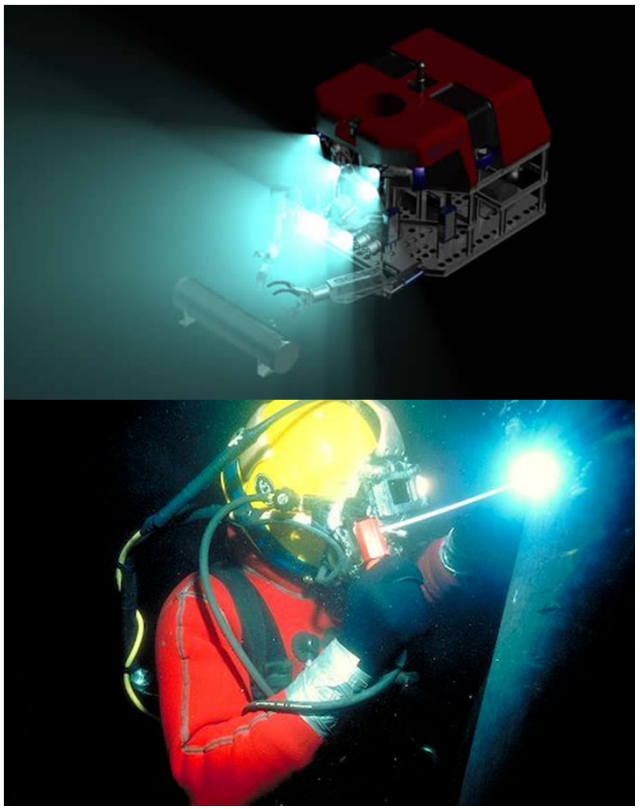
Maintenance and Repair Intervention

- Intrusive maintenance
- Non-intrusive maintenance
  - Function testing
  - Marine growth
  - Calcium carbonate scale
  - Free span/ scour
  - CP retrofit
- Repair and Sparing



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Review, Lesson Learned and Improvement

- Tactical (operations based) and strategic review
- Improve the IM program and make it more effective in meeting expectations and preventing failure events
- Independent audit
  - Review of IM policy, organization and strategy
  - Identifies management level improvements
- Take advantage of external opportunities:
  - New technology that may make elements of the IM program more effective
  - Lessons learned from the successes and failures of external bodies
  - New regulations and standards that may require changes in the way things are done.
- Improvement action should be identified and implemented using the Corrective Action process

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Integrity Data Management

- Integrity database is used to store data generated by the IM process
- Some database can receive data direct from measurement devices such as subsea survey and NDT equipment
- Data can be reported against location or equipment item and in some cases trends can be plotted

- Most have digital video interface for storage and manipulation of survey images
- Most are now web based

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IM Database System Example

Database	Supplier	Pipelines	Structures	Production Facilities
COABIS	Aker Kvaerner	√	√	√
PRISM	BP-Acergy	√		√
Inspection Manager	Wood Group	√	√	√
XPANS-2 and PIMS	PiSYS	√		
PIMSlider	ATP	√		
SCOPE			√	
IRIS	Seascape		√	
FMS			√	

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Q & A

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