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RISK BASED INSPECTION (RBI) & PIPELINE INTEGRITY MANAGEMENT SYSTEM (PIMS) IMPLEMENTATION

PART OF AIMS IMPLEMENTATION

WHY RBI

SUMBER	DESKRIPSI	PENGHEMATAN
Jurnal "Risk-based Inspection – Yanbu Gas Plant Study Case Study Module #4 Butane Merox & Caustic Regeneration Module #4 Butane Merox & Caustic Regeneration & Caustic Regeneration Units", November 2006	Yanbu Gas Plant Engineering melakukan Case Study pada inspection & maintenance yang dilakukan di Saudi Aramco	• Penghematan biaya maintenance termasuk Turn Around, sebesar $11,277M (Rp. 183.476.790.000,-) per tahun setelah menerapkan RBI.
https://www.aoccorp.com/knowledge/rbi-yields-big-savings	Jumlah Equipment yang dioperasikan oleh Gulf Coast Chemical Plant sebanyak 300 Vessels lebih	• Biaya inspeksi tereduksi sebanyak 65% (termasuk biaya persiapan maintenance seperti Scaffolding, Erection, Internal Cleaning dan lain-lain) • Biaya maintenance sebesar $3,2M (Rp. 52.064.000.000,-) • Optimasi interval Turn Around sehingga menghemat $8M (Rp. 130.160.000.000,-) • Kurun waktu penghematan : 10 tahun
Studi dari Thesis Universiti Teknologi PETRONAS "Risk Based Inspection on Gas Processing Plant" oleh Mohd Zulfadli Bin Mohd Yunus	Membandingkan antara menerapkan RBI dan tidak pada suatu perusahaan	• Penerapan RBI dapat menghemat cost inspeksi sebesar 410.000 RM (Rp. 1.572.907.600,-) • Penghematan cost dengan penerapan RBI untuk 1 kali Turn Around sebesar 24.000 RM (Rp. 92.072.640,-)

Seluruh area Pertagas mengoperasikan 615 vessels, 27 tanks, 652 PSV, serta lebih dari 1000 piping line pada 150 stasiun, maka peran RBI di Pertagas sangatlah diperlukan.

WITH RBI

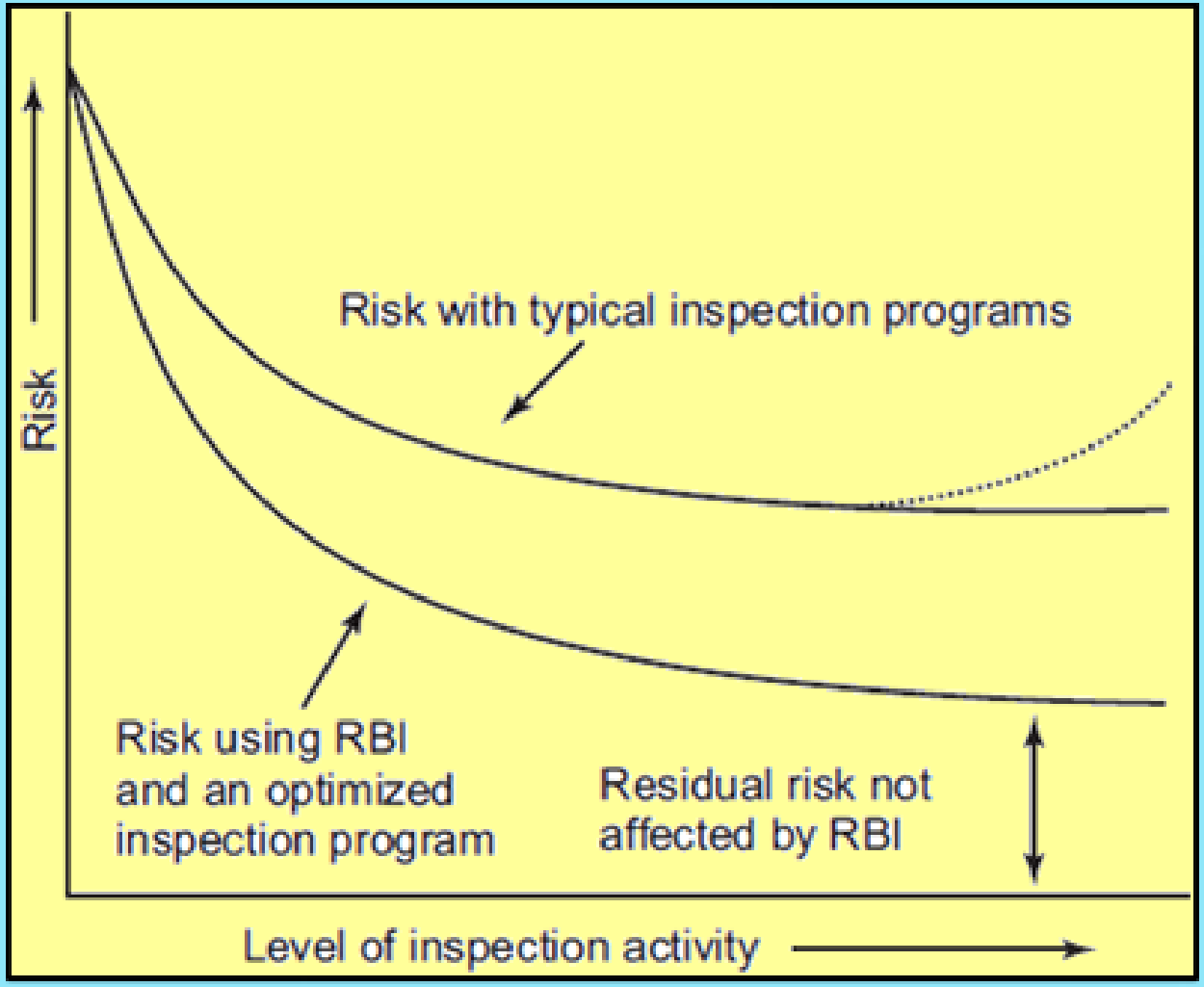

Figure from API 580

Inspeksi API pada dasarnya berbasis pada failure prevention dan tidak mengkonsider konsekuen dari kegagalan (COF) atapun potensi kerusakan yang akan terjadi (POF).

RBI Assessment akan menghasilkan Equipment Risk Ranking berdasarkan COF dan POF tersebut dengan output dapat dilakukannya pembuatan strategi operasi dan pemeliharaan berkelanjutan yang optimal.

Peningkatan *reliability*, *availability*, dan efisiensi biaya operasi dan pemeliharaan.

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Why PIMS

30 INCH PIPE RUPTURE (ENBRIDGE ENERGY)

DILUTED BITUMEN OIL SPILL ALONG 58 KM KALAMAZOO RIVER

Lesson Learned ?

Sumber: U.S. National Transportation Safety Board

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Lesson Learned ?

Reliable database

Standard operating procedure

Desain dan konstruksi yang sejalan dengan *company policy*

With PIMS ...

Guidance, SOP, TKO/TKI

Inspection & maintenance
(e.g. ILI, cathodic protection, corrosion monitoring)

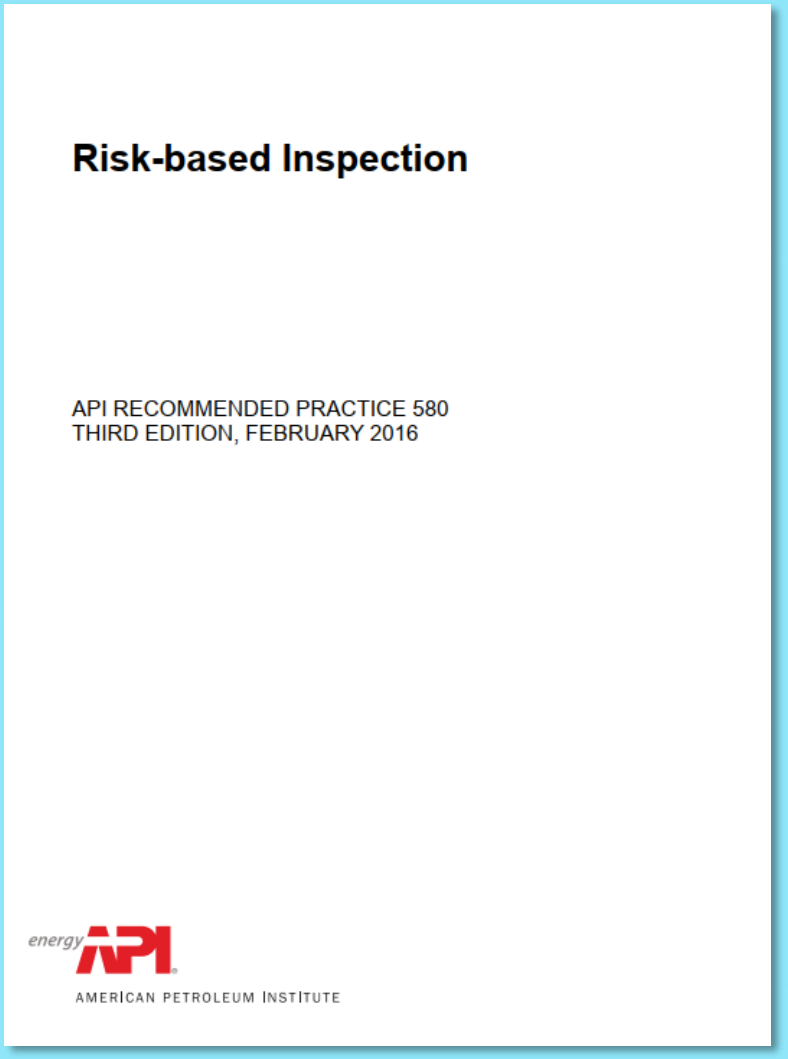
Risk assessment Integrity assessment
(e.g. Fitness-for-service)

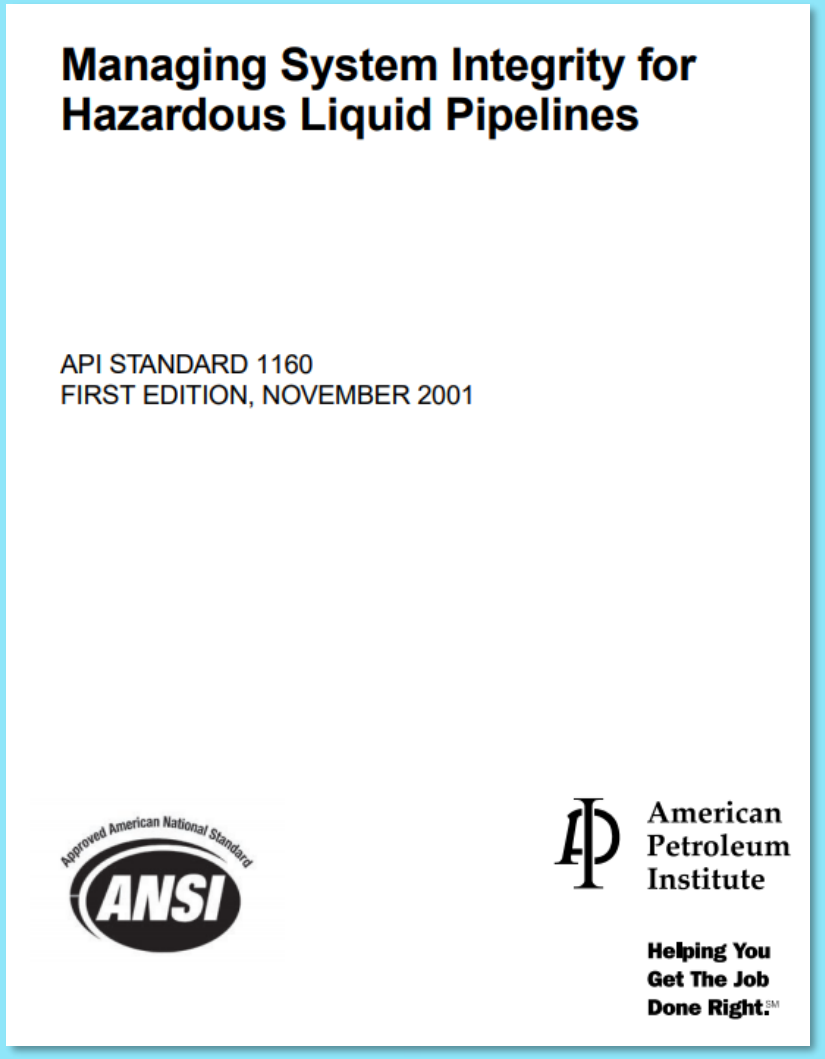
Corrective action

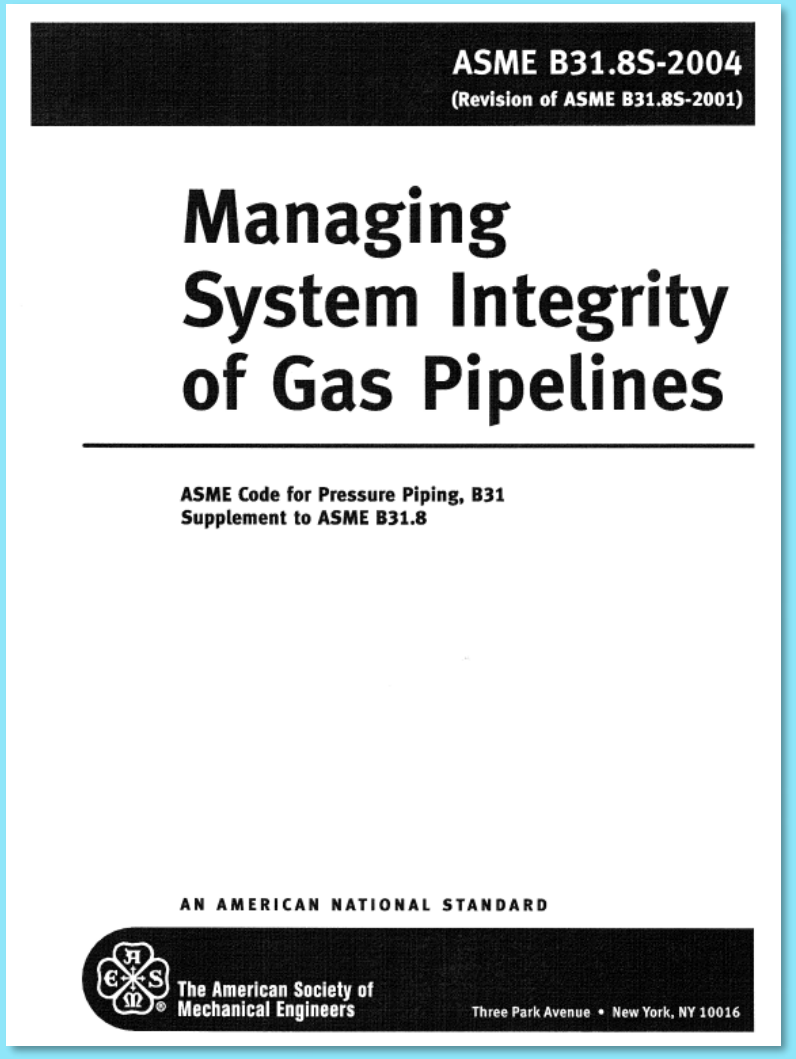
ZERO INCIDENT ZERO ACCIDENT

Sumber: How Pipeline Integrity & Risk Management Can Equal Zero Incidents. (audubooncompanies.com)

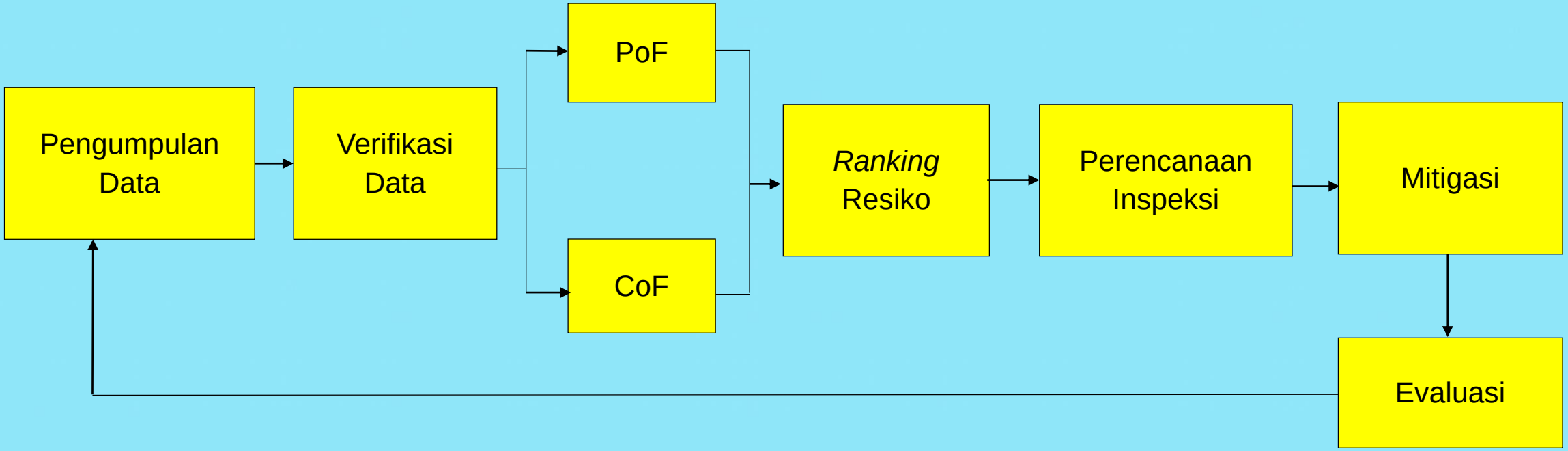
What reference do we use?







RBI METHODOLOGY



Risk Based Inspection (RBI) adalah metode untuk menentukan rencana inspeksi berdasarkan level resiko kegagalan suatu peralatan.

Definisi Kegagalan (Failure): Containment Loss

Risk = Probability of Failure (PoF) × Consequence of Failure (CoF)

	PoF	Risk Matrix				
LIKELIHOOD OF EVENT HAPPENING	5	5	10	15	20	25
	4	4	8	12	16	20
	3	3	6	9	12	15
	2	2	4	6	8	10
	1	1	2	3	4	5
	CoF	1 - Insignificant	2 - Minor	3 - Moderate	4 - Significant	5 - Catastrophic

VERY LOW LOW MEDIUM MEDIUM HIGH HIGH

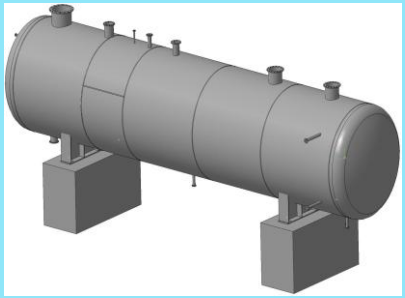
RBI REQUIRED DOCUMENT

NO	DESCRIPTION	REQUIREMENT	REMARKS
1	Design Basis	Mandatory	Per station
2	Process Flow Diagram (PFD)	Mandatory	Per station
3	Piping and Instrumentation Diagram (PID)	Mandatory	Per station
4	Datasheet Equipment	Mandatory	Per equipment
5	Thickness Measurement Report	Mandatory	Per equipment
6	Gas Analysis Report	Mandatory	Per operated fluid
7	Strength Calculation Report	Complementary	Per equipment
8	GA Drawing Equipment	Complementary	Per equipment
9	Plot Plan	Complementary	Per station
10	Isometric Drawing	Mandatory	For piping
11	Pipe Stress Analysis Report	Complementary	For piping

RBI ASSESMENT LEVEL

RBI Assessment Level:
1. Qualitative > applicable to Plant / Station / Unit / Equipment
2. Semi Quantitative > applicable to Equipment
3. Quantitative > applicable to Component

Plant



Equipment

Component

LEVEL 1
- Fluid Operated (Chemical Compound)
- Total of Equipment
- Potential hazard to equipment, personnel, and environment
- Likelihood Factor

LEVEL 2

The calculation for Level 2 RBI is simpler compared to Quantitative RBI. The Semi-Quantitative approach is applied when a quick risk assessment is required without the use of dedicated software.

POF:
1. Internal Thinning
2. Stress Corrosion Cracking (SCC)
3. External Damage
4. High Temperature Hydrogen Attack (HTHA)
5. Embrittlement
6. Mechanical Fatigue

LEVEL 3

COF:
1. Flammable Consequence
2. Personnel Injury Consequence
3. Toxic Consequence
4. Financial Consequence
5. Non Flammable Non Toxic Consequence

In summary, POF calculation main thing is influenced by:
1. Chemical Composition
2. Inspection Result
3. Inspection Method
4. Design Pressure
5. Design Temperature
6. Component Geometry
7. Interconnected Equipment
8. Management System
9. Historical Record
10. External Intrusion

In summary, COF calculation main thing is influenced by:
1. Chemical Composition
2. Fluid Volume
3. Operating Pressure
4. Operating Temperature
5. Component Geometry
6. Interconnected Equipment
7. Environmental Data

RBI CONSEQUENCE OF FAILURES

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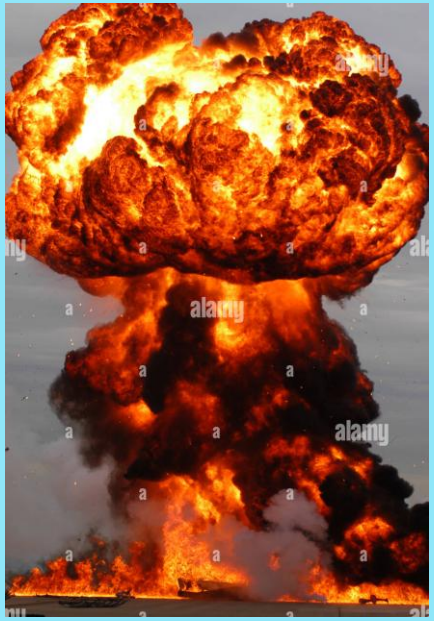
VAPOR CLOUD EXPLOSION (VCE)

FIREBALL



FLASH FIRE

JETFIRE

POOL FIRE

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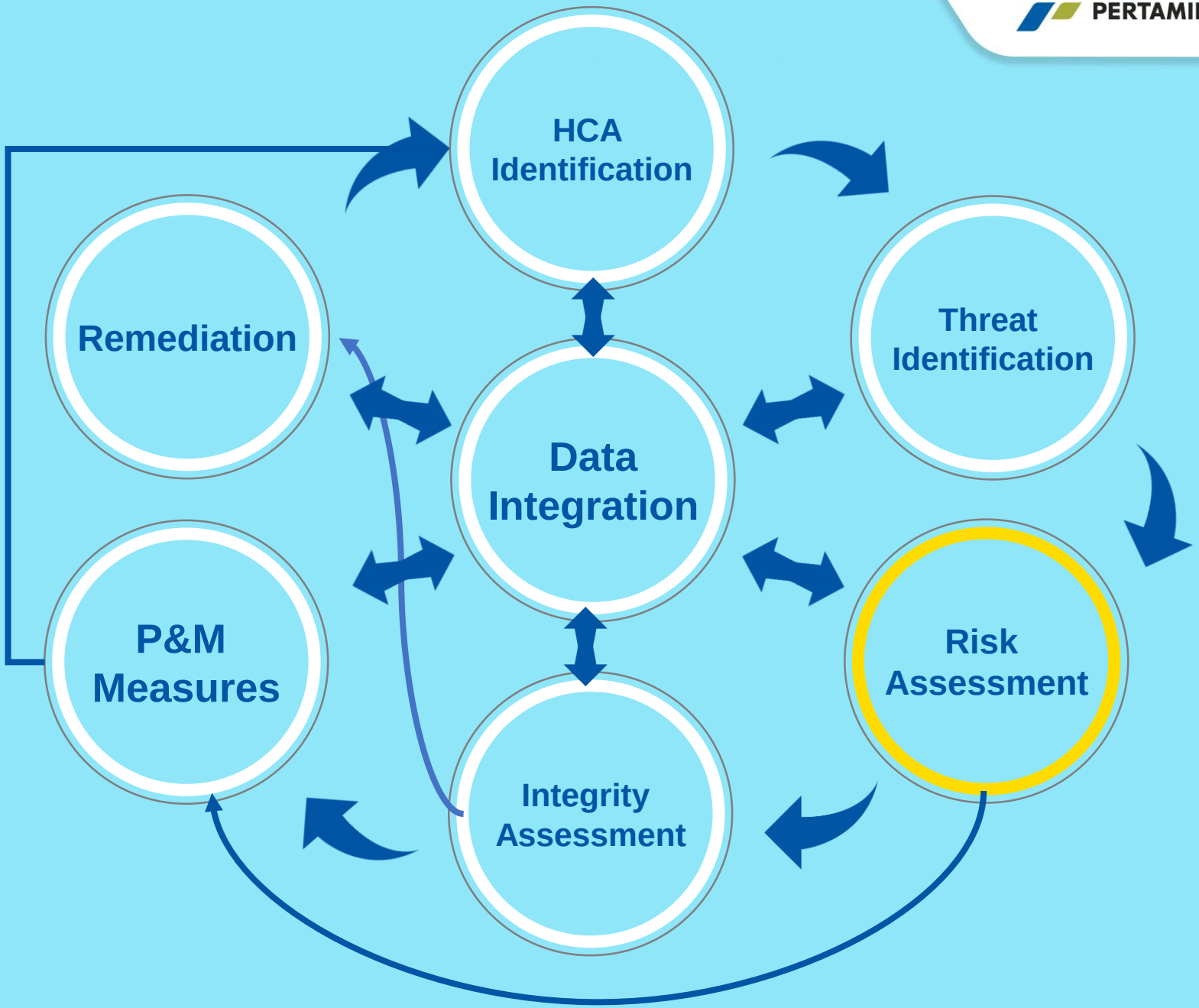
PIMS Cycle



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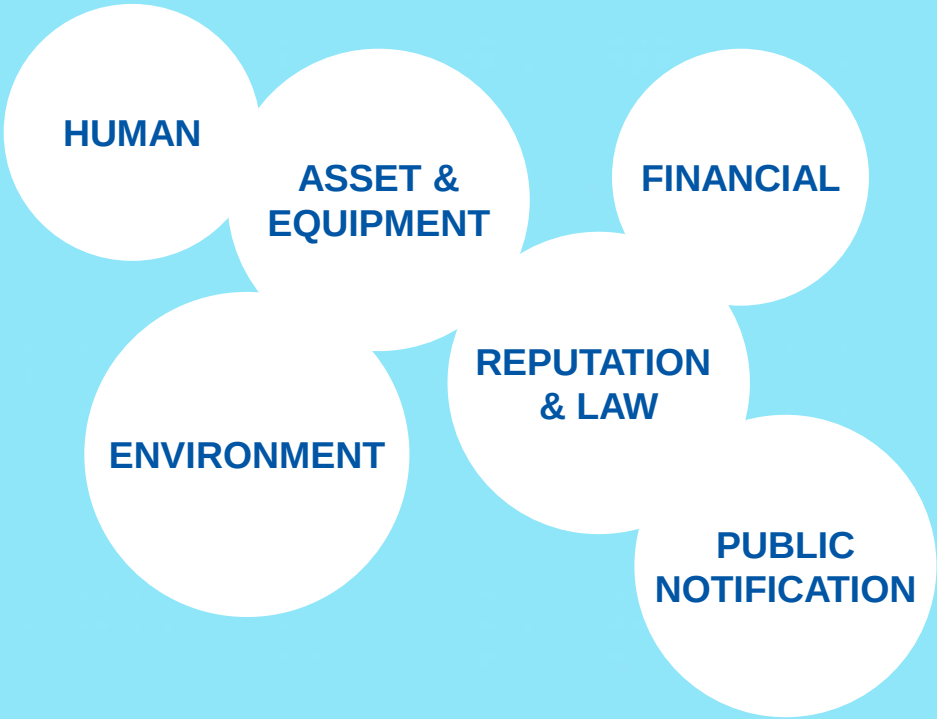
Probability

Consequence



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PERTAGAS AIMS PREVIEW

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Asset Management

Risk Based Inspection

Monitored Data

PIMS

RCM

SIL

Anomaly Management

Preventive Maintenance

Work Scope

Management Dashboard

Data Loading

Technical Library

SAP Integration

RBI MODULE

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Menu

PERTAMINA GAS RBI Engineer

Component Details | Mechanical Design | Process Design | Financial and Prod... | 2 Documents | Screening | 1 RBI Analysis

— Design Data

Design Code: ASME VIII DIV 1	Code Year: 1977	Set Pressure (kPa): 878.90
Design Pressure (kPa): 1034.00	Manufactured Year: 1999 or prior	Length (m): 0.612

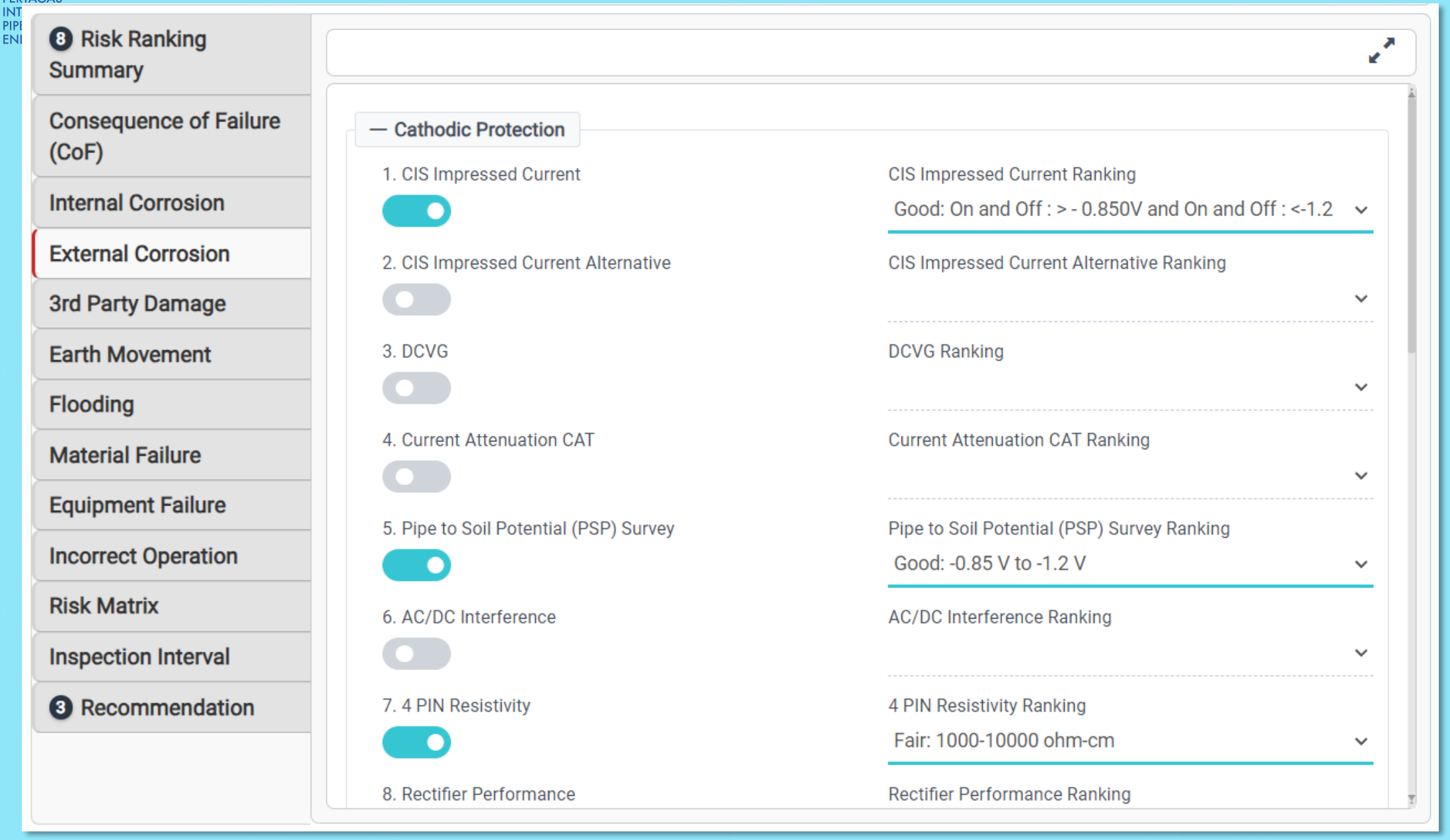
— Material Properties

Material Specification: SA-516 - 70	Material Grade: 70	Material Type: Carbon Steel
Design Temperature (°C): 38	Allowable Stress (kPa): 120750.0000	External Coating Quality: High - Multi Coat Epoxy or Filled Epoxy
Stress Relieve / PWHT ?	Atmospheric Condition: Marine area / Near Cooling Tower	Insulation Available?
Internal Clad / Coating	SMY (psi): 37709.88	

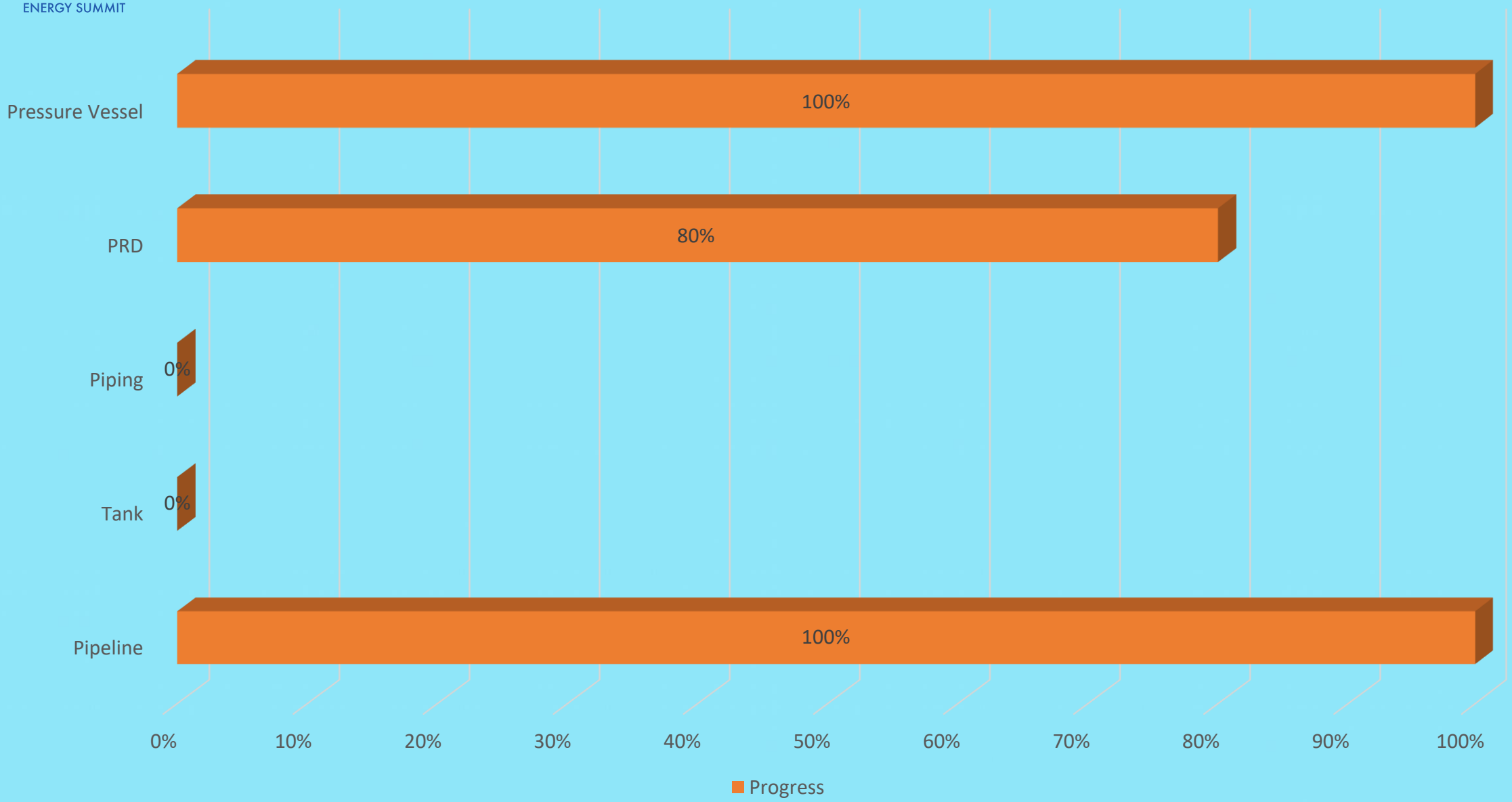
— T-Min Calculation

Base Metal Nominal Thickness (mm): 12.700	Component Shape: PV - Ellipsoidal Head	Internal Diameter (mm): 2447.320
Joint Efficiency	Corrosion Allowance (mm)	Structural Req. Thickness (mm)

PIMS MODULE


8 Risk Ranking Summary
Consequence of Failure (CoF)
Internal Corrosion
External Corrosion
3rd Party Damage
Earth Movement
Flooding
Material Failure
Equipment Failure
Incorrect Operation
Risk Matrix
Inspection Interval
3 Recommendation
— Cathodic Protection
1. CIS Impressed Current
CIS Impressed Current Ranking
Good: On and Off : > - 0.850V and On and Off : <-1.2
2. CIS Impressed Current Alternative
CIS Impressed Current Alternative Ranking
3. DCVG
DCVG Ranking
4. Current Attenuation CAT
Current Attenuation CAT Ranking
5. Pipe to Soil Potential (PSP) Survey
Pipe to Soil Potential (PSP) Survey Ranking
Good: -0.85 V to -1.2 V
6. AC/DC Interference
AC/DC Interference Ranking
7. 4 PIN Resistivity
4 PIN Resistivity Ranking
Fair: 1000-10000 ohm-cm
8. Rectifier Performance
Rectifier Performance Ranking

PERTAGAS RBI & PIMS IMPLEMENTATION PROGRESS



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TERIMA KASIH