



EUROPEAN PROCESS  
SAFETY CENTRE



# Quantification of Asset Integrity Program

Prepared by: Ankit Agarwal  
Process Safety Professional

December 2025  
EPSC Process Safety Conference, Aachen



Building a Sustainable World Together



ENHANCING YOUR LIFE EVERYDAY®

# Ankit Agarwal

## Process Safety Professional



- MSc in Safety Engg. (KU Leuven, BE)
- MSc in Aerospace Engg. (TU Delft, NL)
- B.Tech in Mech. Engg. (Indian Institute of Technology J, IN)

KU LEUVEN

TU Delft



### Current Position:

1 yr PSM focused Engineer, WL Pernis, NL  
5yrs SAP plant mt. Global BPO Epoxy

### Experience:

1 yr CFD engineer at Airbus Defence, Spain  
5 yrs Mech engg. (rotating eqm.), Hexion, NL  
5 yrs MI program Leader Global Epoxy, Hexion, NL

### Hobby:

Gardening, Stock market trading



# Agenda

---

- Asset Integrity Program (AIM) definition
- Components of AIM
- Why Quantify an AIM program?
- How to Quantify AIM?
- Benefits of Quantification

# What is Asset Integrity Management?

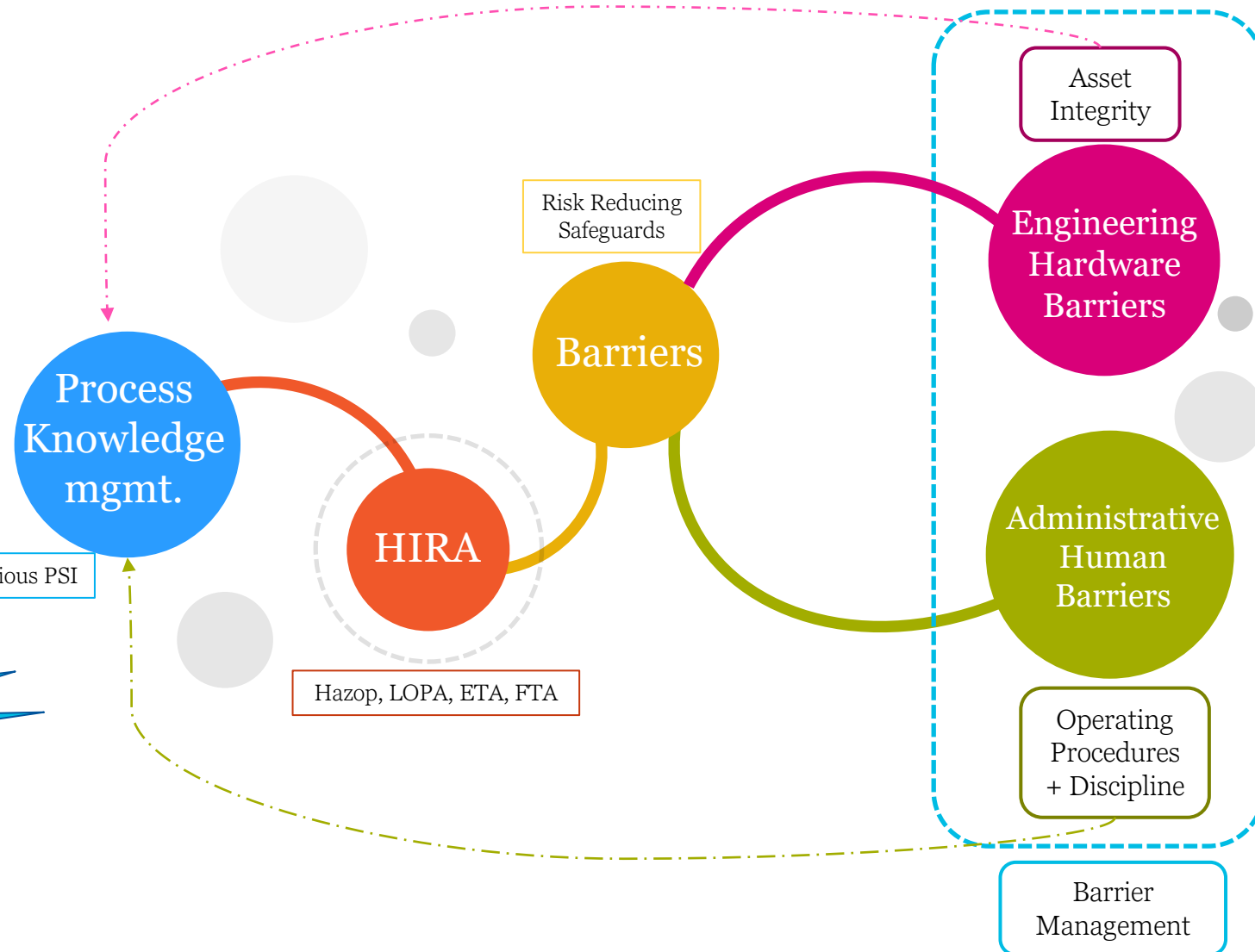


Management of critical process equipment to ensure it is

1. designed,
2. installed,
3. operated &
4. maintained

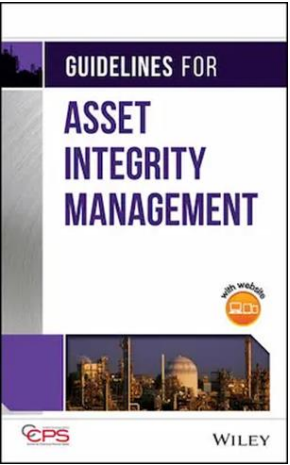
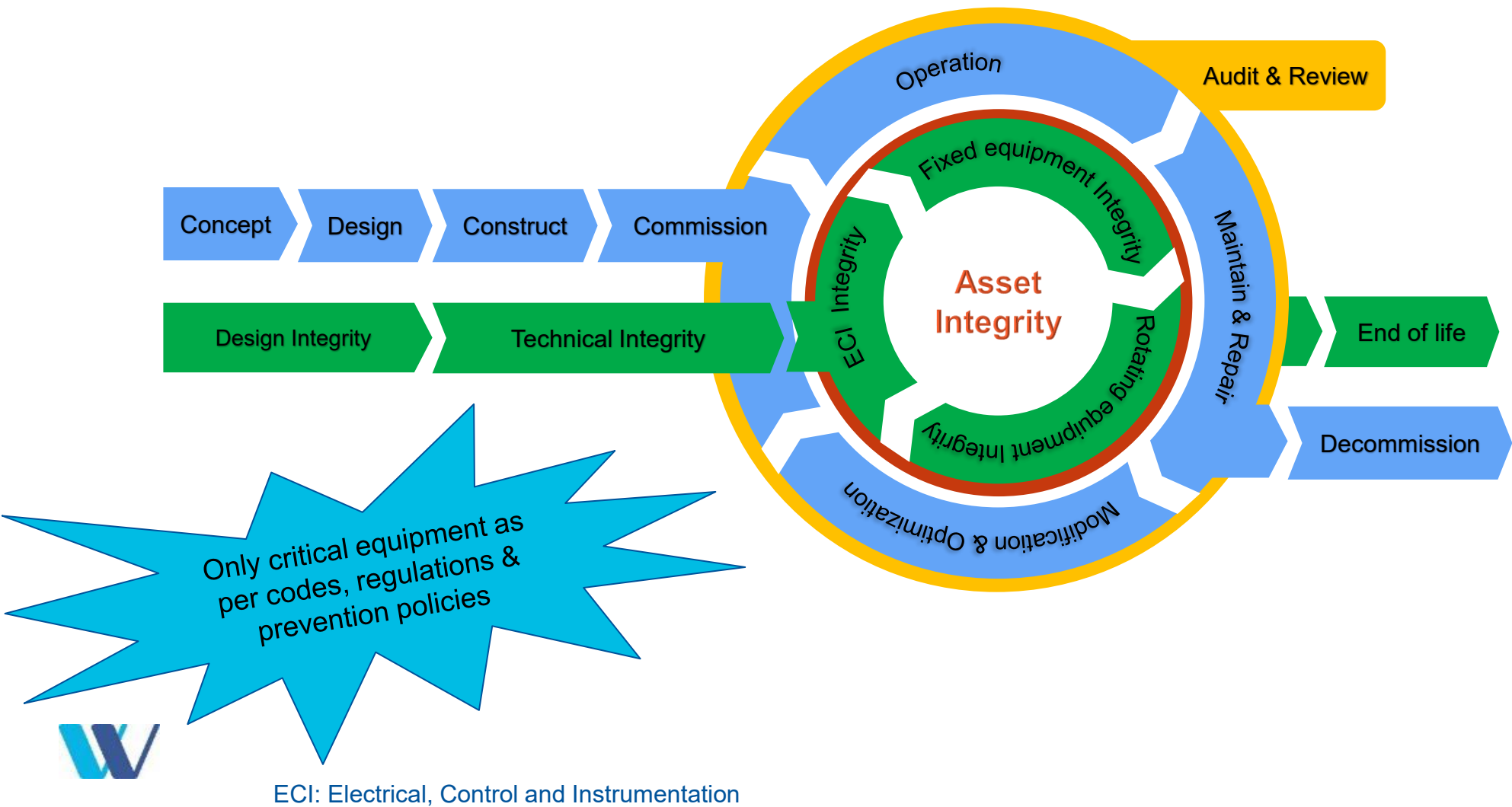
to get desired performance in a safe manner.

Where in PSM framework?

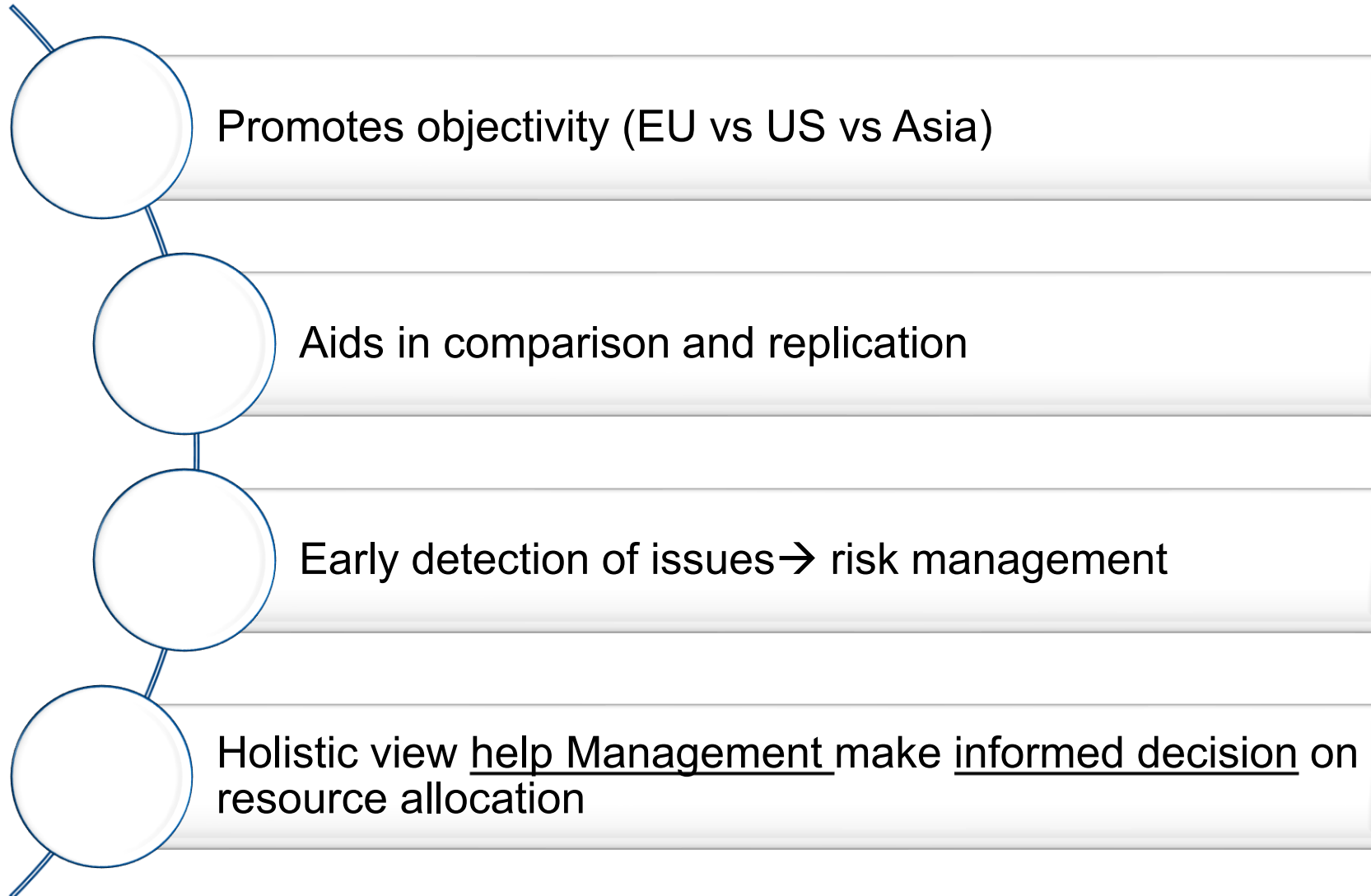


# Components of Asset Integrity Program

## Lifecycle Approach



# Why Quantify an AIM program?



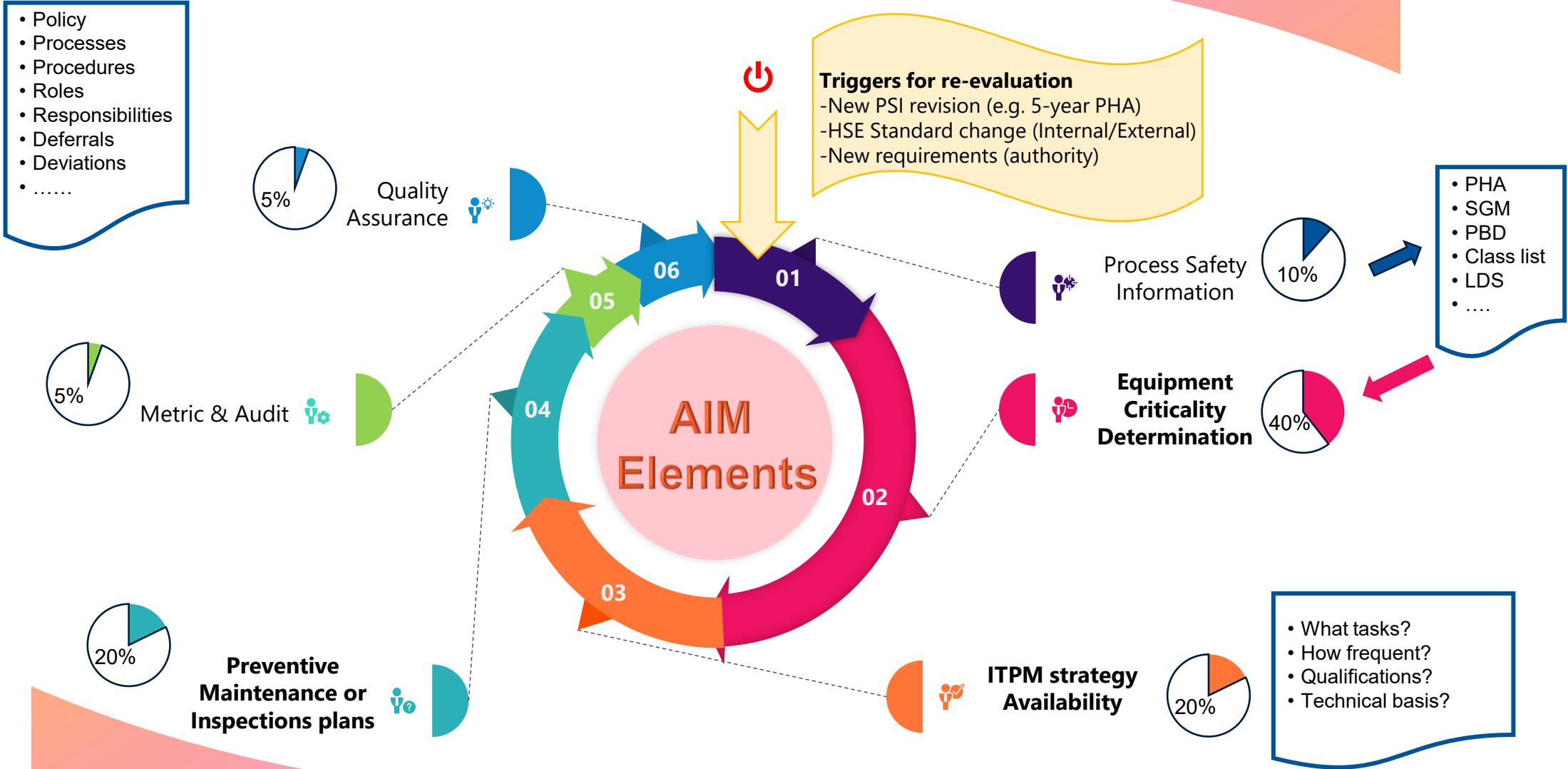


## Elements of AIM program



# Quantification of Asset Integrity Management

## 6 Elements of AIM







---

## Setting up the scorecard template




# Listing various contributing factors per element

## Template

Plant name									
Reference Date XX/XX/XXXX			Version no. XX						
N/A			Applicable			Included in scoring			
Work in progress			Work in progress			Work in progress			
Implemented									
Overall	#DIV/0!	Implementation Score	####	####	####	####	####	####	####
STAGE GATE		REQUIREMENTS	Process Safety Information	Equipment Criticality Determination	ITPM Verified / Available	Maintenance Plan (in SAP/RBI)	Measure & Audit	QA	
		0	1	2	3	4	5	6	
X.01		REGULATORY	A - Basic information	A - REGULATORY	Equipment Disciplines	Equipment types	Metrics	Maint.Management.Syst.	
X.02		PIR (SEVESO)	PFD/ Simplified block diagrams	ATEX [electrical]	Fixed Equipment	Fixed Equipment	Audits (PSM - audit)	Document mgmt system	
X.03		PED [Press Equip.]	P&ID set	ATEX [mechanical]	Instrumentation & Control	Instrumentation & Control	Audits (PS04 - self audit)	Roles & Responsibilities	
X.04		ATEX	Process Boundary Determination systems	LDS	Piping	Piping		Training	
X.05		Omgevings vergunning	Highly hazardous Chemicals list	Class list	Relief devices	Relief devices		MOC process	
X.06		BRZO NL	Operating manual	VR-Insluitsystemen	Rotating	Rotating		Naming conv. Strategy	
X.07		National electric code	Mass and heat balance	Process Boundary Determination				Managem. review process	
X.08		WBDA NL	Insluitsystemen (containment systems)	Safe Guarding Memorandum				ITPM Inspection criteria	
X.09		External Safety report		Emergency shutdown systems				ITPM Deviations	
X.10		Company MANDATORY	B - Technical documents					Material verification	
X.11		GMS-PSM	Safe Guarding Memorandum	C - Risk				Qualified personnel	
X.12		GMS- PSI	Dust safety	Hazop				Continuous improvement	
X.13		GMS-PHA	Expl. Safety Document	LOPA				Incident investigation	
X.14		GMS-Mech.Integrity	Area classification dwg	SIL				PM planning process	
X.15		GMS- Comb.Sol&Dusts	Equip. Class list [for covered equipment]	RBMI criticality				Equipment documnetation	
X.16		GMS- Phen.Handl.St.	Line Designation Sheet [for covered systems]					CUI inspection program	
X.17		PFSS	Equip. documentation [for covered equipment]						
X.18		GMS-Open Ended Lines and	Pipeline Isometrics [for covered equipment]						
X.19		AgSS (Low conv)	Emergency shutdown systems						
X.20		GMS-ATM	Alarm management system						
X.21		others	C - Risk [determination]						
X.22		GMS- electrical safety	Hazop						
X.23		OTHER	LOPA (SIL determination)						
X.24		Risk Rubric score process an	SIL (3 SIL docs)						
X.25		Process Boundary Files	RBI criticality						
X.26		PSM Road map							
X.27		Lifecycle management SIL							

Responsibilities								
		Maintenance Manager	EHS Safety Engineer	MI Coordinator	Maintenance Engineer	Maintenance Supervisor	Technician and Operator	Project / Design Engineer
1	Training and awareness	responsible	none	supports	none	none	none	none
2	Equipment Criticality Determination	none	responsible	informed	supports	none	none	supports
3	Define and Maintain ITPM's in SAP	none	none	supports	responsible	none	none	none
4	Provide Technical Content for ITPM's	none	supports	none	supports	supports	responsible	supports
5	Maintain Equipment Records	none	none	none	responsible	supports	none	supports
6	Maintain MI controlled documents	none	none	responsible	supports	none	none	none
7	Plan & schedule MI tasks	none	none	none	responsible	supports	informed	none
8	Overseeing Contractors (in MI Roles)	none	none	none	none	responsible	supports	none
9	Registering ITPM results / test reports	none	none	none	informed	supports	responsible	none
10	Equipment Deficiency Management	informed	none	none	responsible	supports	none	none
11	Report / Review Metrics	informed	informed	responsible	supports	supports	informed	none
12	Establish Audit Schedule and Content	responsible	none	supports	none	none	none	none
13	Follow up on modifications	none	supports	supports	responsible	none	none	responsible
14	MI Process Development, roles and systems	responsible	supports	supports	none	none	none	none





# List all contributing factors of each element







Process Safety Information	
1	
A - Basic information	
<input type="checkbox"/>	PFD/ Simplified block diagrams
<input type="checkbox"/>	P&ID set
<input type="checkbox"/>	Process Boundary Determination systems
<input type="checkbox"/>	Highly hazardous Chemicals list
<input type="checkbox"/>	Operating manual
<input type="checkbox"/>	Mass and heat balance
<input type="checkbox"/>	Insluitsystemen (containment systems)
<input type="checkbox"/>	
B - Technical documents	
<input type="checkbox"/>	Safe Guarding Memorandum
<input type="checkbox"/>	Dust safety
<input type="checkbox"/>	Expl. Safety Document
<input type="checkbox"/>	Area classification dwg
<input type="checkbox"/>	Equip. Class list [for covered equipment]
<input type="checkbox"/>	Line Designation Sheet [for covered systems]
<input type="checkbox"/>	Equip. documentation [for covered equipment]
<input type="checkbox"/>	Pipeline Isometrics [for covered equipment]
<input type="checkbox"/>	Emergency shutdown systems
<input type="checkbox"/>	Alarm management system
C - Risk [determination]	
<input type="checkbox"/>	Hazop
<input type="checkbox"/>	LOPA (SIL determination)
<input type="checkbox"/>	SIL (3 SIL docs)
<input type="checkbox"/>	RBI criticality
<input type="checkbox"/>	

“How to” process PSI to determine critical equipment

Equipment Criticality Determination	
2	
A - REGULATORY	
<input type="checkbox"/>	ATEX [electrical]
<input type="checkbox"/>	ATEX [mechanical]
<input type="checkbox"/>	LDS
<input type="checkbox"/>	Class list
<input type="checkbox"/>	VR-Insluitsystemen
<input type="checkbox"/>	Process Boundary Determination
<input type="checkbox"/>	Safe Guarding Memorandum
<input type="checkbox"/>	Emergency shutdown systems
<input type="checkbox"/>	
C - Risk	
<input type="checkbox"/>	Hazop
<input type="checkbox"/>	LOPA
<input type="checkbox"/>	SIL
<input type="checkbox"/>	RBMI criticality
<input type="checkbox"/>	



# List all contributing factors of each element

ITPM Verified / Available	
3	
Equipment types	
	Fixed Equipment
	Instrumentation & Control
	Piping
	Relief devices
	Rotating
	

Based on engineering disciplines

Equipment Class/ Item	Equipment type	Equipment	Required Tasks	Task Interval	Technical Basis	Inspection Personnel Qualification Requirements	Procedure(s)	Comments
Section 1 – Pressure Vessels and Storage Tanks								
Pressure vessels (ASME-coded and noncoded)	Reactor	Reactor	Routine visual surveillance	Recommended daily; not to exceed 1 month	Industry practice	No specific certifications required; however, personnel knowledgeable in equipment operation are recommended		Normal operation is not documented; deficiencies are documented via an equipment deficiency report and/or work order
			External visual inspection and thickness measurement	Lesser of 5 years or calculated internal (or on-stream) inspection task interval	API 510 ANSI/NB-23	API 510 certification (inspector)  NDE: ANST SNT-TC-1A Level I (or equivalent) to collect data  ASNT SNT-TC-1A Level II (or equivalent) to collect and interpret data		N/A
			Internal visual inspection and thickness measurement	Lesser of 10 years or ½ of the remaining corrosion life	API 510 ANSI/NB-23	API 510 certification (inspector)  NDE: ANST SNT-TC-1A Level I (or equivalent) to collect data  ASNT SNT-TC-1A Level II (or equivalent) to collect and interpret data		Additional nondestructive testing to be performed as necessary

1. ITEMS:

Boilers	Pressure Vessels	Piping	Valves	Aboveground Storage Tanks	Safety/Safety Relief Valves	Pumps	Instrumentation and Controls	Pipelines (49 CFR-186-199)
---------	------------------	--------	--------	---------------------------	-----------------------------	-------	------------------------------	----------------------------

2. DESIGN OR CONSTRUCTION CODES:

ASME I ASME IV	ASME VIII DIV. 1 & 2	ASME B31.1 ASME B31.3	ASME B16.34 API 600 API 609	API 12B API 650 API 620	ASME I ASME IV ASME VIII API 2000	API 610 API 574-676	VARIOUS ISA STANDARDS AND RP 551	B31.4 B31.8 API 1104
-------------------	-------------------------	--------------------------	-----------------------------------	-------------------------------	--	------------------------	--	----------------------------

3. INSPECTION, REPAIR, ALTERATION, RERATING, OR FITNESS FOR SERVICE CODES:

NBIC	NBIC API 510 API 579	API 570 API 579	API 598 API RP591	API 653 API 579	NBIC API RP 576	API RP683 MFG STDS	ISA/MFG STANDARDS	ASME B31G
------	----------------------------	--------------------	----------------------	--------------------	--------------------	-----------------------	----------------------	-----------

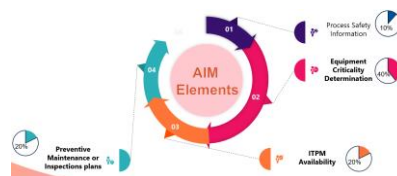
4. "SUPPORT" OR "REFERENCED" CODES OR PUBLICATIONS:

ASME II, ABCD ASME V ASME VI & VI ASME IX API RP 573 SNT-TC-1A	ASME II, ABCD ASME V ASME IX API RP 572 API IRE II SNT-TC-1A	ASME II, ABCD ASME V ASME IX API RP 574 ASME B16.5 SNT-TC-1A	API RP 574 ASME V ASME IX	API 651 API 652 API 2016 API 2207 API RP 575 ASME V ASME IX SNT-TC-1A	ASME PTC-25 API 627 ASME V ASME IX	MFG. STANDARDS AWS D14.5	INSTRUMENT ENGINEER'S HANDBOOK MFG. STANDARDS	ASME V ASME IX
---	---	---	---------------------------------	--	---	--------------------------------	---	-------------------

Common RAGAGEPs

Equipment Class/ Item	Equipment type	Equipment	Required Tasks	Task Interval	Technical Basis
Section 1 – Pressure Vessels and Storage Tanks					
Section 2 – Piping					
Section 3 – Relief and Vent Systems					
Section 4 – Safety and Emergency Systems					
Section 5 – Instrumentation, Controls, and Electrical					
Section 6 – Pumps and other Rotating Equipment					
Section 7 – Infrastructure					

# List all contributing factors of each element



## SAP PM plan

Create Maintenance Plan: Single cycle plan 000000000404 [www.tutorialkart.com](http://www.tutorialkart.com)

Maintenance plan 404 Oil filter change for every 50 days

Maint. plan head...

Maintenance plan cycle Maintenance plan scheduling parameters Maintenance plan additional data

**Date determination**

Shift Factor Late Compl. 100 %

Tolerance (+) 100 %

Shift Factor Early Compl. 100 %

Tolerance (-) 100 %

Cycle modification factor 1,00

Factory calendar

**Call control parameter**

Call horizon 365 DAY

Scheduling period 365 DAY

Completion Requirement

**Scheduling indicator**

Time

Time - key date

Time - factory caldr

**Start scheduling**

Start of cycle

Item Object list item Item location

Maintenance Item 1127 Oil filter change for every 50 days

Reference object

Functional loc. TKBL-PRD-PM-02 TKS Functional Location Area

Equipment ELCTRICPUMP Electric Pump

Assembly

UII

Planning Data

Planning plant TKBL TKBL - Bangalore Plant Maint. Planner Group 100 Planner Group 100

Order Type IM01 Regular Maintenance Service MaintActivityType

Maintenance Plan (in SAP/RBI)	
4	
Equipment Disciplines	
<input type="radio"/>	Fixed Equipment
<input type="radio"/>	Instrumentation & Control
<input type="radio"/>	Piping
<input type="radio"/>	Relief devices
<input type="radio"/>	Rotating

EX ONLINE

OPEN BLANK CHECKSHEET SAVE & EXIT

EDIT SHOW SELECTION Selected: 1

Tag No	Description	Area	Location	
<input type="checkbox"/> A09_0004	Solenoid valve	009 - Secondary Processing	Secondary Processing House - 1	0 +
<input type="checkbox"/> A09_0002	Limit Switch	009 - Secondary Processing	Secondary Processing House 2/	0 +
<input type="checkbox"/> A09_0028	Light	009 - Secondary Processing	Secondary Processing House - 1	0 +
<input type="checkbox"/> A09_0030	Junction box - Lighting	009 - Secondary Processing	Secondary Processing House - 1	0 +
<input checked="" type="checkbox"/> A09_0026	Light	009 - Secondary Processing	Secondary Processing House - 1	0 +
<input type="checkbox"/> A09_0040	Level Transmitter	009 - Secondary Processing	Secondary Processing House - 1	0 +
<input type="checkbox"/> A09_0058	Level Switch	009 - Secondary Processing	Secondary Processing House - 1	0 +
<input type="checkbox"/> A09_0039	Level Switch	009 - Secondary Processing	Secondary Processing House - 1	0 +
<input type="checkbox"/> A09_0059	General Purpose Outlet	009 - Secondary Processing	Secondary Processing House - 1	0 +
<input type="checkbox"/> A09_0067	Junction box - Lighting	009 - Secondary Processing	Secondary Processing House - 1	0 +
<input type="checkbox"/> A09_0068	Lighting	009 - Secondary Processing	Secondary Processing House - 1	0 +

Total Checksheet: 150

Filter Tag no Description Area Location

Not Started In Progress Completed Deleted Transferred

APPLY CLEAR

## ATEX inspection plan

## RBI inspection plan



### RBI Inspection Plan

ReportDate: 10/07/2014

500 > TT1000

Asset No.: F7712

Equipment Type: Tower  
Description: CRUDE TOWER

Next S/D: 11/01/2016  
Subs S/D: 01/01/2019

P & ID Drawing No.:  
U-1 on File: Yes

#### Circuit Damage Mechanisms

Circuit ID	Damage Mechanism	Act. POF	Screening Basis	Target Date
<b>Environment Assisted Cracking</b>				
COLUMN MIDDLE	Wet H2S (HIC/SOHIC/Blistering)	0.0146880	CS/Chrome Moly Alloy w/ H2S and Water/Sour Water, Temp <= 300F	10/02/2014
COLUMN TOP	Wet H2S (HIC/SOHIC/Blistering)	0.0038250	CS/Chrome Moly Alloy w/ H2S and Water/Sour Water, Temp <= 300F	10/06/2014
	Wet H2S (Sulfide Stress Cracking)	0.0000597	CS/Chrome Moly w/ H2S and H2O/Sour H2O, No PWH-T, Temp <= 180F	01/01/2051

#### External Loss of Thickness

COLUMN MIDDLE	CUI Carbon and Low Alloy Steels	0.0581400	CS/Chrome Moly Alloy/CS .5 Mo, Insulated, Temp <= 350F	10/02/2014
COLUMN TOP	CUI Carbon and Low Alloy Steels	0.0459000	CS/Chrome Moly Alloy/CS .5 Mo, Insulated, Temp <= 350F	10/06/2014

#### Internal Loss of Thickness

COLUMN BOTTOM	High Temperature Sulfur Corrosion	0.0000612	Service contains Sulfur, Temp >= 400F	11/09/2023
	Naphthenic Acid Corrosion	0.0000612	Service contains Naphthenic Acid, Temp >= 400F	11/09/2023
COLUMN MIDDLE	Low Temperature H2S Corrosion	0.0027540	Carbon Steel with Water and H2S, Temp <= 250F	10/02/2014
COLUMN TOP	Low Temperature H2S Corrosion	0.0000306	Carbon Steel with Water and H2S, Temp <= 250F	07/27/2031

Inspection Plan	Damage Type	Inspection Effectiveness / Procedure	W/O Insp.	W/ Insp.
-----------------	-------------	--------------------------------------	-----------	----------

<b>Event Type:</b> Internal Inspection	<b>Event Basis:</b> Max RBI Interval	<b>Due Date:</b> 10/09/2025	<b>Schedule Date:</b> 10/01/2016
COLUMN TOP	Check Internal Cracking	B Wet fluorescent/Magnetic particle testing of 20-49% of welds/cold bends	01/01/2050 01/01/2050

<b>Event Type:</b> External Inspection	<b>Event Basis:</b> RBI Target Date	<b>Due Date:</b> 10/02/2014	<b>Schedule Date:</b> 11/30/2014
COLUMN BOTTOM	Check General Thinning	B Nominally 20% ultrasonic scanning coverage (automated or manual), or profile radiography, or spot external thickness (statistically validated)	11/09/2023 11/09/2023

COLUMN MIDDLE	Check HIC SOHIC H2S	A 50-100% scanning coverage (automated or manual) with followup inspection at locations with indications (HIC). 50-100% Shearwave UT for cracking near weldments (SOHIC)	10/02/2014 06/02/2019
---------------	---------------------	--	-----------------------

COLUMN TOP	Check CUI	B For the total surface area 95-100% external visual inspection and follow-up with profile or real-time radiography or 60-100 total surface area of insulation including suspect areas	10/06/2014 05/06/2022
------------	-----------	--	-----------------------

	Check HIC SOHIC H2S	B Automated shear wave ultrasonic testing of 20-100% of weldments or Acoustic Emission testing with follow-up shear wave UT	10/06/2014 06/06/2017
--	---------------------	---	-----------------------

# List all contributing factors of each element

Measure & Audit		
5		
<input type="radio"/>		Metrics
<input type="radio"/>		Audits (PSM - audit)
<input type="radio"/>		Audits (PS04 - self audit)
<input type="radio"/>		

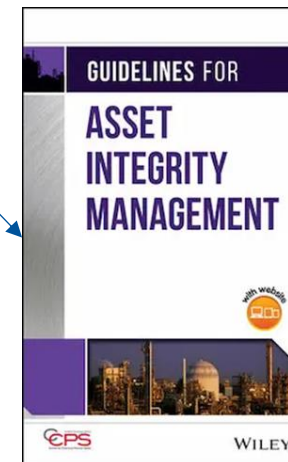
E.g. PSM work overdue,  
Deficiency corrective actions,  
Deviation / Deferrals

Detailed Internal PSM audit every 3yrs



QA	
6	
<input type="radio"/>	Maint. Management Syst.
<input type="radio"/>	Document mgmt system
<input type="radio"/>	Roles & Responsibilities
<input type="radio"/>	Training
<input type="radio"/>	MOC process
<input type="radio"/>	Naming conv. Strategy
<input type="radio"/>	Managem. review process
<input type="radio"/>	ITPM Inspection criteria
<input type="radio"/>	ITPM Deviations
<input type="radio"/>	Material verification
<input type="radio"/>	Qualified personnel
<input type="radio"/>	Continuous improvement
<input type="radio"/>	Incident investigation
<input type="radio"/>	PM planning process
<input type="radio"/>	Equipment documnetation
<input type="radio"/>	CUI inspection program
<input type="radio"/>	

A “how to” on each as part of site  
Quality Management System





# Template with various contributing factors per element

Plant name										
Reference Date XX/XX/XXXX			Version no. XX							
Overall	N/A	Not included in scoring	Applicable	Included in scoring						
	Work in progress	> 30% to < 60 %		> 60% to < 90%						
	Implemented	>90%								
	#DIV/0!	Implementation Score	####	####	####	####	#####	####		
STAGE GATE	REQUIREMENTS	Process Safety Information	Equipment Criticality Determination	ITPM Verified / Available	Maintenance Plan (in SAP/RBI)	Measure & Audit	QA			
	0	1	2	3	4	5	6			
	REGULATORY	A - Basic information	A - REGULATORY	Equipment Disciplines	Equipment types	Metrics	Maint.Management.Syst.			
X.01	PIR (SEVESO)	PFD/ Simplified block diagrams	ATEX [electrical]	Fixed Equipment	Fixed Equipment	Audits (PSM - audit)	Document mgmt system			
X.02	PED [Press Equip.]	P&ID set	ATEX [mechanical]	Instrumentation & Control	Instrumentation & Control	Audits (PS04 - self audit)	Roles & Responsibilities			
X.03	ATEX	Process Boundary Determination systems	LDS	Piping	Piping		Training			
X.04	Omgevings vergunning	Highly hazardous Chemicals list	Class list	Relief devices	Relief devices		MOC process			
X.05	BRZO NL	Operating manual	VR-Insluitsystemen	Rotating	Rotating		Naming conv. Strategy			
X.06	National electric code	Mass and heat balance	Process Boundary Determination				Managem. review process			
X.07	WBDA NL	Insluitsystemen (containment systems)	Safe Guarding Memorandum				ITPM Inspection criteria			
X.08	External Safety report		Emergency shutdown systems				ITPM Deviations			
X.09	Company MANDATORY	B - Technical documents					Material verification			
X.10	GMS-PSM	Safe Guarding Memorandum	C - Risk				Qualified personnel			
X.11	GMS- PSI	Dust safety	Hazop				Continuous improvement			
X.12	GMS-PHA	Expl. Safety Document	LOPA				Incident investigation			
X.13	GMS-Mech.Integrity	Area classification dwg	SIL				PM planning process			
X.14	GMS- Comb.Sol&Dusts	Equip. Class list [for covered equipment]	RBMI criticality				Equipment documnetation			
X.15	GMS- Phen.Handl.St.	Line Designation Sheet [for covered systems]					CUI inspection program			
X.16	PFSS	Equip. documentation [for covered equipment]								
X.17	GMS-Open Ended Lines and	Pipeline Isometrics [for covered equipment]								
X.18	AgSS (Low conv)	Emergency shutdown systems								
X.19	GMS-ATM	Alarm management system								
X.20	others	C - Risk [determination]								
X.21	GMS- electrical safety	Hazop								
X.22	OTHER	LOPA (SIL determination)								
X.23	Risk Rubric score process an	SIL (3 SIL docs)								
X.24	Process Boundary Files	RBI criticality								
X.25	PSM Road map									
X.26	Lifecycle management SIL									










How to do the scoring?

## Scorecard Legend





















---

Symbol	Text	Description	Contribution
	N/A	Not included in scoring	-
	Applicable	Included in scoring	0
	Work in progress	> 30% to < 60 %	0.5
	Work in progress	> 60% to < 90%	0.75
	Implemented	>90%	1



# Scoring Each Element

## E.g. Element 1: PSI

87%

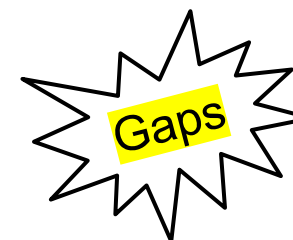
Process Safety Information	
1	
A - Basic information	
	PFD/ Simplified block diagrams
	P&ID set
	Process Boundary Determination systems
	Highly hazardous Chemicals list
	Operating manual
	Mass and heat balance
	Insluitsystemen (containment systems)
B - Technical documents	
	Safe Guarding Memorandum
	Dust safety
	Expl. Safety Document
	Area classification dwg
	Equip. Class list [for covered equipment]
	Line Designation Sheet [for covered systems]
	Equip. documentation [for covered equipment]
	Pipeline Isometrics [for covered equipment]
	ESD / Interl. Definition
C - Risk [determination]	
	Hazop
	LOPA (SIL determination)
	SIL (3 SIL docs)
	RBMI criticality

- Equal wt. to each contributing row
- E.g. Dust Safety is not applicable
- Clear visibility on gaps (highlighted yellow)
- Notes to capture comments

See cell comment for additional guidelines!					Actionlog reference and / or final state reference	
1	PSI	A - Basic information				
2		1.02 PFD/ Simplified block diagrams	PFD available but not up-to-date	-	GMS-PS02 5.5.1.1 A Block Flow Diagram or Simplified Process Flow Diagram.  [for non complicated processes where a PFD will not add value (like process flow easy to understand from limited number of P&ID's) PFD not required under the MI program]	 Available Block diagram helps in scaling up/down; but not a showstopper if not available Data available is sufficient for MI
3		1.03 P&ID set	PID set available for majority of the processes but not up-to-date	PID set available for all processes. PID set not older than 3 years and likely up-to-date with respect to critical modifications. No process in place to secure PID's are kept up-to-date.	GMS-PS02 5.6.1 At a minimum, Equipment Process Safety Information must include: 5.6.1.2 Piping and Instrumentation Diagrams (P&IDs)  GMS-PS04 5.4.2 Equipment Criticality: 5.4.2.3 The Following is a list of items recommended for use in establishing equipment criticality. • P&ID's	 Available Data available is sufficient for MI

# An example of AIM quantification

Plant name											
Reference Date XX/XX/XXXX			Version no. XX								
<div> <div></div> N/A Not included in scoring                 </div> <div> <div></div> Work in progress &gt; 30% to &lt; 60 %                 </div> <div> <div></div> Implemented &gt;90%                 </div>			<div> <div></div> Applicable                 </div> <div> <div></div> Work in progress                 </div>			<div> <div></div> Included in scoring &gt; 60% to &lt; 90%                 </div>					
Overall	74%	Implementation Score	87%	75%	70%	65%	100%	72%			
STAGE GATE		REQUIREMENTS	Process Safety Information	Equipment Criticality Determination	Maintenance Plan (in SAP/RBMIT)	ITPM verified / Available	Measure & Audit	QA			
	0		1	2	3	4	5	6			
	X.01	REGULATORY	A - Basic information	A - REGULATORY	Equipment types	Equipment types	Metrics	Maint.Management.Syst.			
	X.02	✓ PIR (SEVESO)	✓ PFD/ Simplified block diagrams	✓ ATEX [electrical]	✓ Fixed Equipment	✓ Fixed Equipment	✓ Audits (PSM - audit)	✓ DMS			
	X.03	✓ PED [Press Equip.]	✓ P&ID set	✓ ATEX [mechanical]	✓ Instrumentation & Control	✓ Instrumentation & Control	✓ Audits (PS04 - self audit)	✓ Responsibilities			
	X.04	✓ ATEX	✓ Process Boundary Determination systems	✓ LDS	✓ Piping	✓ Piping		✓ Training			
	X.05	✓ Omgevings vergunning	✓ Highly hazardous Chemicals list	✓ Class list	✓ Relief devices	✓ Relief devices		✓ MOC process			
	X.06	✓ BRZO NL	✓ Operating manual	✓ VR-Insluitsystemen	✓ Rotating	✓ Rotating		✓ Naming conv. Strategy			
	X.07	✓ National electric code	✓ Mass and heat balance	✓ Process Boundary Determination				✓ Managem. review process			
	X.08	✓ WBDA NL	✓ Insluitsystemen (containment systems)	✓ Safe Guarding Memorandum				✓ ITPM Inspection criteria			
	X.09	✓ External Safety report						✓ ITPM Deviations			
	X.10	Company MANDATORY	B - Technical documents					✓ Material verification			
	X.11	✓ GMS-PS01 PSM	✓ Safe Guarding Memorandum					✓ Qualified personnel			
	X.12	✓ GMS-PS02 PSI	✓ Dust safety					✓ Continuous improvement			
	X.13	✓ GMS-PS03 PHA	✓ Expl. Safety Document					✓ Incident investigation			
	X.14	✓ GMS-PS04 Mech.Integrity	✓ Area classification dwg					✓ PM planning process			
	X.15	✓ GMS-PS07 Comb.Sol&Dusts	✓ Equip. Class list [for covered equipment]					✓ Equipment documnetation			
	X.16	✓ GMS-PS-T08 Phen.Handl.St	✓ Line Designation Sheet [for covered systems]					✓ CUI inspection program			
	X.17	✓ PFSS	✓ Equip. documentation [for covered equipment]								
	X.18	✓ GMS-PS06 Open Ended Line	✓ Pipeline Isometrics [for covered equipment]								
	X.19	✓ AgSS (Low conv)	✓ ESD / Interl. Definition								
	X.20	✓ GMS-S15 ATM									
	X.21	others	C - Risk [determination]	C - Risk							
	X.22	✓ GMS-S02 electrical safety	✓ Hazop	✓ Hazop							
	X.23	OTHER	✓ LOPA (SIL determination)	✓ LOPA							
	X.24	✓ Risk Rubric score process ar	✓ SIL (3 SIL docs)	✓ SIL							
	X.25	✓ Process Boundary Files	✓ RBMI criticality	✓ RBMI criticality							
	X.26	✓ PSM Road map									
	X.27	✓ Lifecycle management SIL									



# Calculating overall score for AIM program per site/unit

AIM overall score = (10% PSI) + (40% ECD) + (20% ITPM availability) + (20% PM planning) + (5% Measure & Audit) + (5% QA)

Let's assume score per element:

1. PSI = 90
2. ECD = 50
3. ITPM availability = 90
4. PM planning = 60
5. Measure & Audit = 100
6. QA = 90

Equal wt. AIM overall score  
=  $(90+50+90+60+100+90)/6$   
= 80

AIM overall score based on proposed wt.  
=  $(0.1*90 + 0.4*50 + 0.2*90 + 0.2*60 + 0.05*100 + 0.05*90)$   
= 68.5





What to do after scoring?



# Make Long term AIM program

MASTER PLAN AIM program						
STRATEGY AND OBJECTIVE	Year 1	Year 2	Year 3	Year 4	Year 5	Year 6
<b>Improve PSM</b>	PSM Audit Hazop U1000 PSI Update	PSM Audit recommendations Hazop U1000 Bulk RM Hazop PSI Update (SGM) Combustible dust hazard analysis	Hazop U2000 complete Start Hazop Utilities PSI Update (SGM)	PSM Audit Contractor MGT Hazop Utilities complete PSI Update (SGM)	Hazop U3000 complete	Hazop U1000 (revalidation)
<b>Mechanical Integrity as standard</b>	Define plan start to implement	Equipment criticality - U1000 PED-PSV (all units)	Equipment criticality - U2000 Validate U1000 APQ (all units) Validate ATEX	Equipment criticality - Utilities Validate U2000 Rotating equipment Piping	Equipment criticality - U3000 Validate PN Validate Utilities Safeguards (interlocks)	Full MI Implementation (meeting the standard)
<b>Preventive Maintenance as standard</b>	Set-up org Define roles & work processes	Implement plan autonomous mttto	Building plans & schedules for preventive maint. - U1000	Buildings plans and schedules for preventive maint. - U2000	Buildings plans and schedules for preventive maint. - Utilities	Others



CONFIDENTIAL

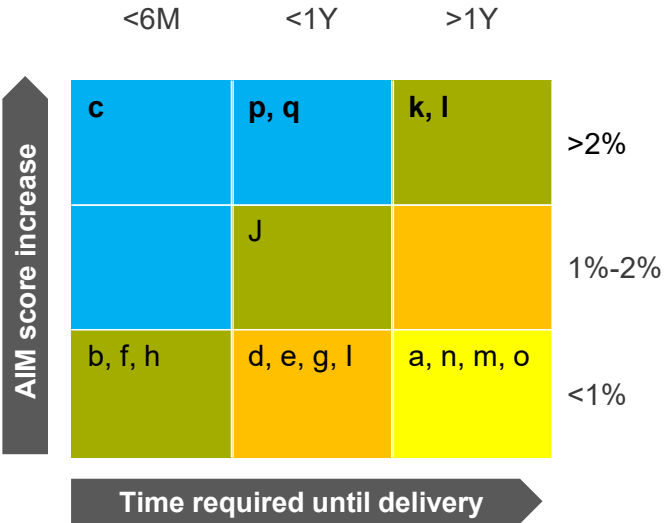


Whether it's engineering schedules or Sunday dinner: some processes can't be rushed.



# Prioritization Matrix

Revisit once per year



Time Reference: January 20XX  
e.g. Current AIM score is 58%



## Moving activities (+12%; AIM score 58% → 70%)

- a. NOBO approval of pressure eqm re-classification study
- b. Migrate to HSE software
- c. MI criticality study
- d. Conclude PM optimization for SIL proof testing
- e. Program of SafeGuarding Memorandum ongoing as planned
- f. Finalize SIL study
- g. Development of ATEX compliance plan



## Activities in pipeline (+8%; AIM score → 78%)

- h. Create missing RBMI piping Inspection plans
- i. SAP master data & RBI inspection plans for relief devices
- j. Hazop revalidation
- k. Remaining MI criticality study



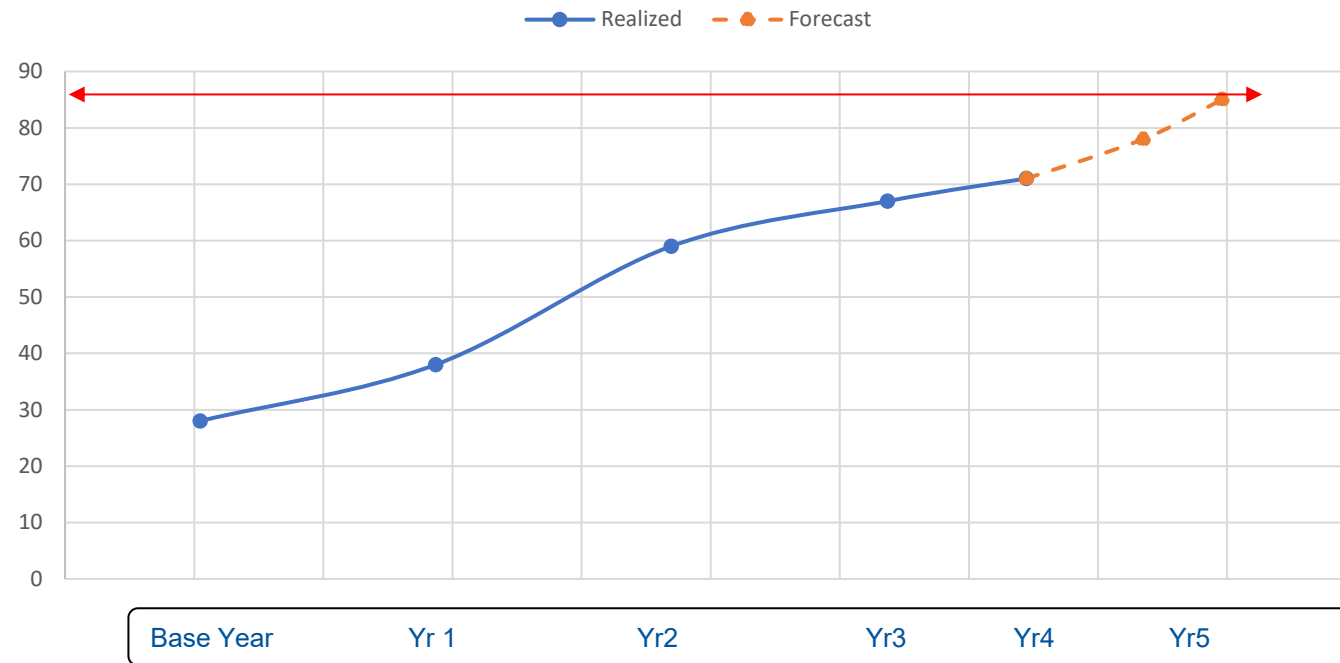
## To be planned (+10%; AIM score → 88%))

- l. Verify existing PM plans of MI eqm
- m. Start MI self auditing
- n. Migrate from Exsientia 3 to 4
- o. Revise Process Boundary Definition along with system limiter project
- p. Update Area classification
- q. Development of PM inspection strategy for ATEX eqm



# AIM Program Realization

MI scorecard development



Base Year: AIM score → 28%

Year 1: AIM score → 38%

Year 2: AIM score → 59%

Year 3: AIM score → 67%

Year 4: AIM score → 71%

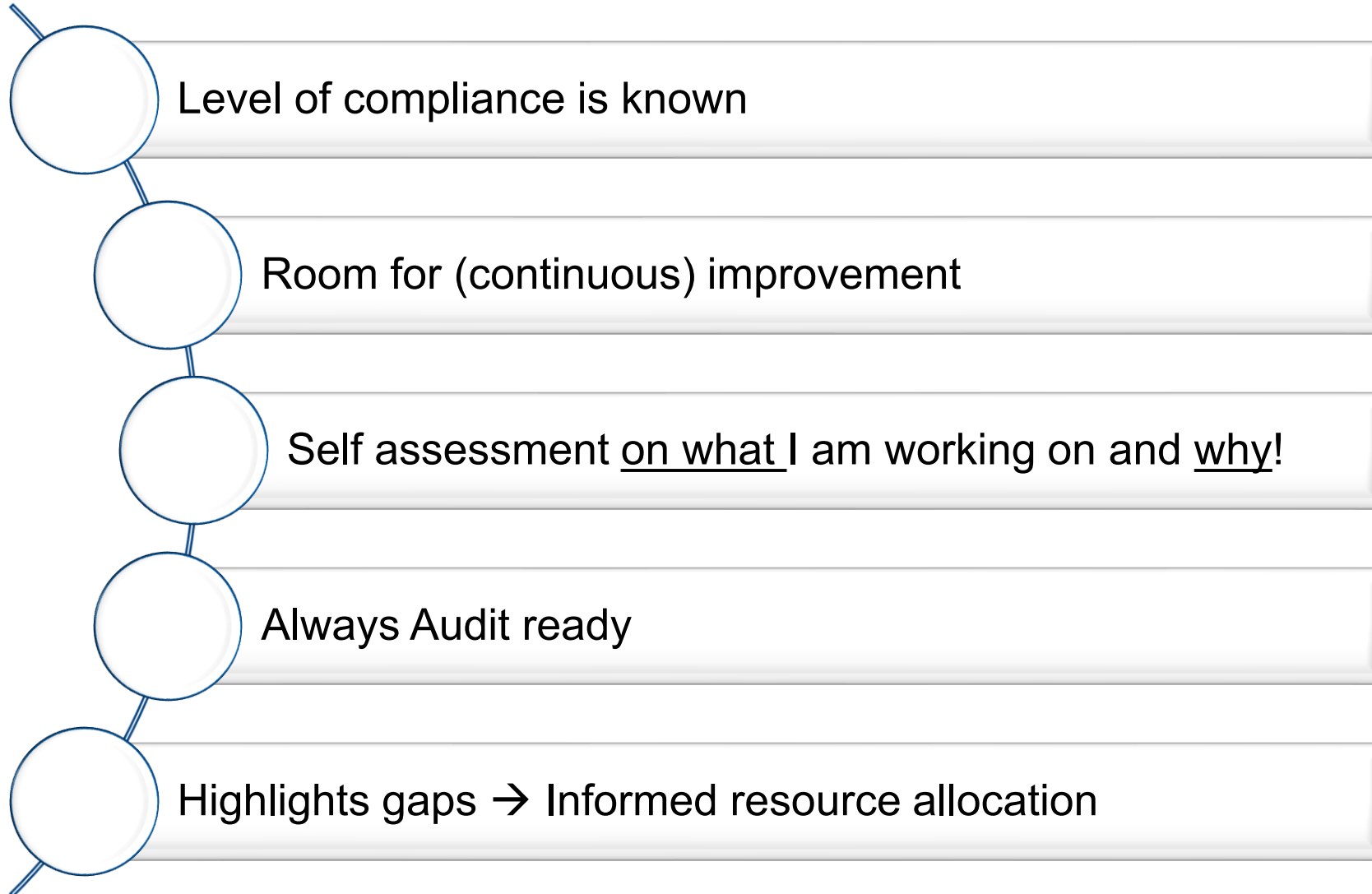


---

**Conclusion:** Benefits of scoring

# Key Benefits of scoring

---





## Acknowledgement

---

Mirko Gast  
MI Leader, WL

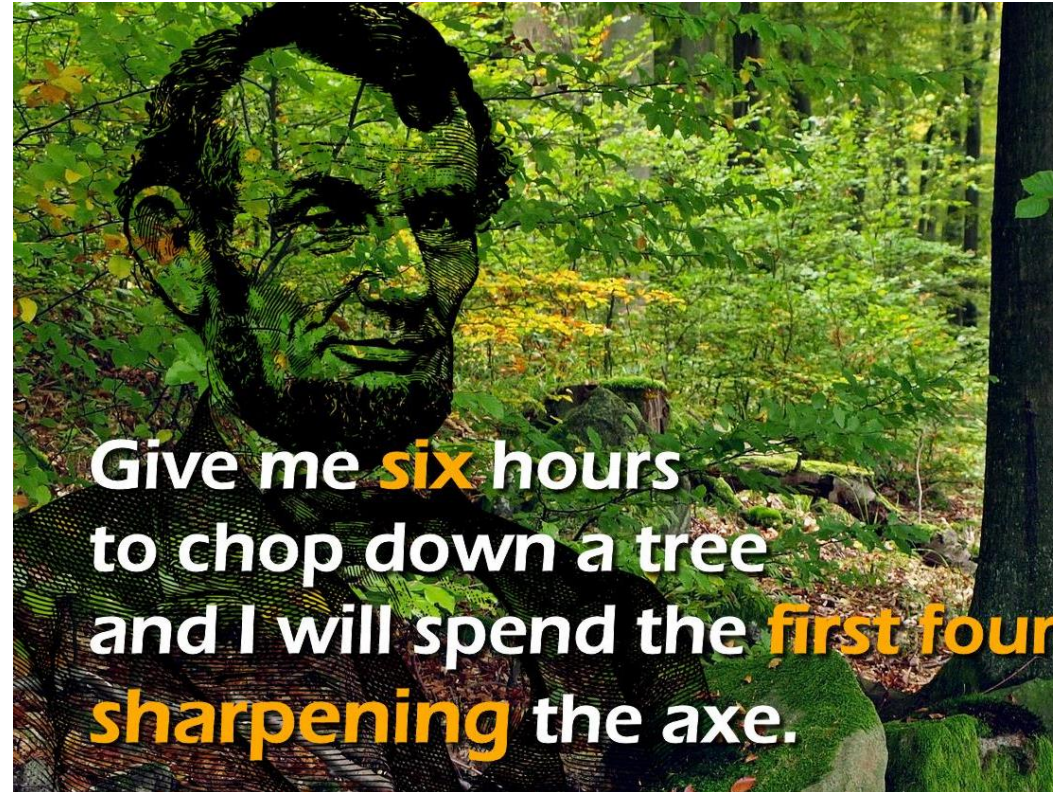
Ed Hertogh  
MI Leader, Bakelite





# Now you know a tool to measure the Unseen !!

---



LinkedIn:

<https://www.linkedin.com/in/ankitdelft/>

Ankit Agarwal  
Email: [ankit.delft@gmail.com](mailto:ankit.delft@gmail.com)

