THE 21ST INTERNATIONAL OPERATIONS & MAINTENANCE CONFERENCE IN THE ARAB COUNTRIES

A STRUCTURED ASSESSMENT PROGRAM TO REINFORCE INTEGRITY OF HIGH VOLTAGE ELECTRICAL ASSETS AND VISIBILITY OF MAINTENANCE PROGRAM

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An Initiative by

OMAINTEC
المجلس العربي للتشغيل والصيانة
Arab Operations & Maintenance Council

Organized by

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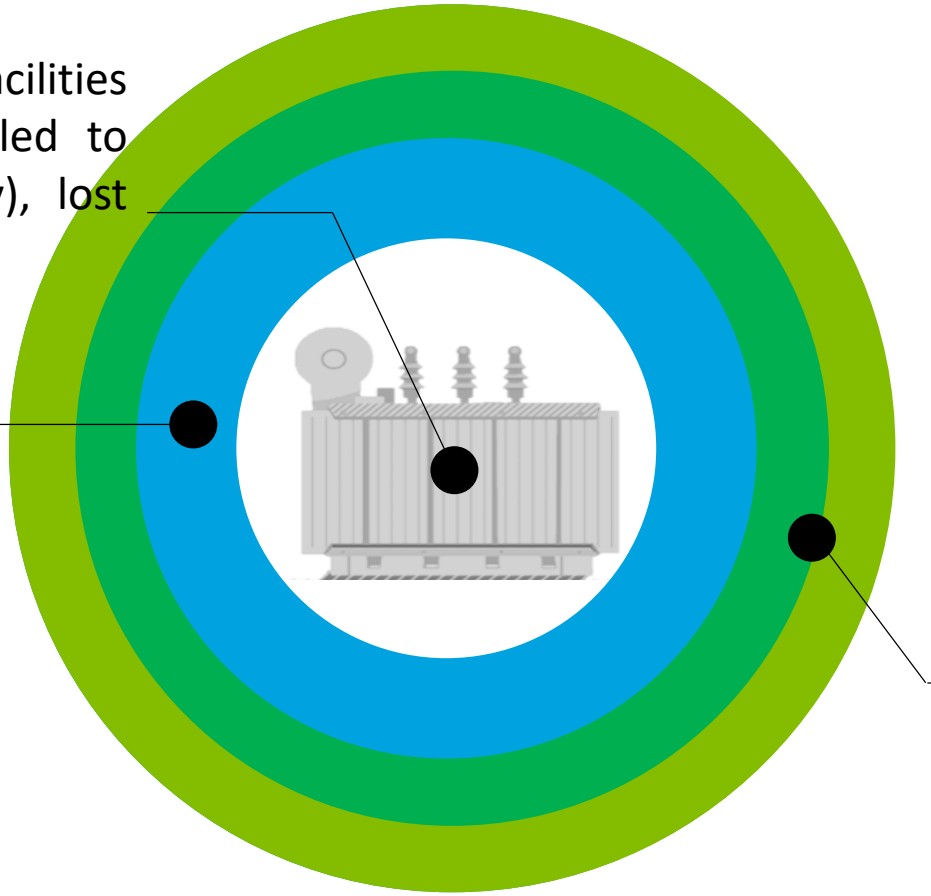
Why QA and QC for Maintenance

Electrical assets are integral part of any facilities and their failure or malfunction may led to accidents (hazards to life and property), lost production, and loss of profit.

Effective maintenance program can reduce accidents, save lives, and minimize costly unplanned shutdowns of production equipment



Layers of **Quality Management (QA and QC)** will ensure the effective implementation of Maintenance programs, sustain equipment integrity, and improve system reliability.

Quality Management System

Quality Management System (QMS) is a set of business responsibilities, procedures, and processes intended to achieve quality policies and objectives

Establishing a **Quality Management System (QMS)** has many benefits to any organization including:

- Meet customer requirements
- Align with organization goals and KPIs
- Define, implement, and control processes
- Ensure proper and effective communication
- Identify issues and capture lessons learned

QMS Principles, ISO 9001:2015

Quality Assessment Methodology

Planning

- Assessment focus areas evaluation methodology.

Execution

- Sample Selection Methodologies
- Feild visit selection method

Analysis

- Assessemnt analysis utilizating FMEA and Pareto

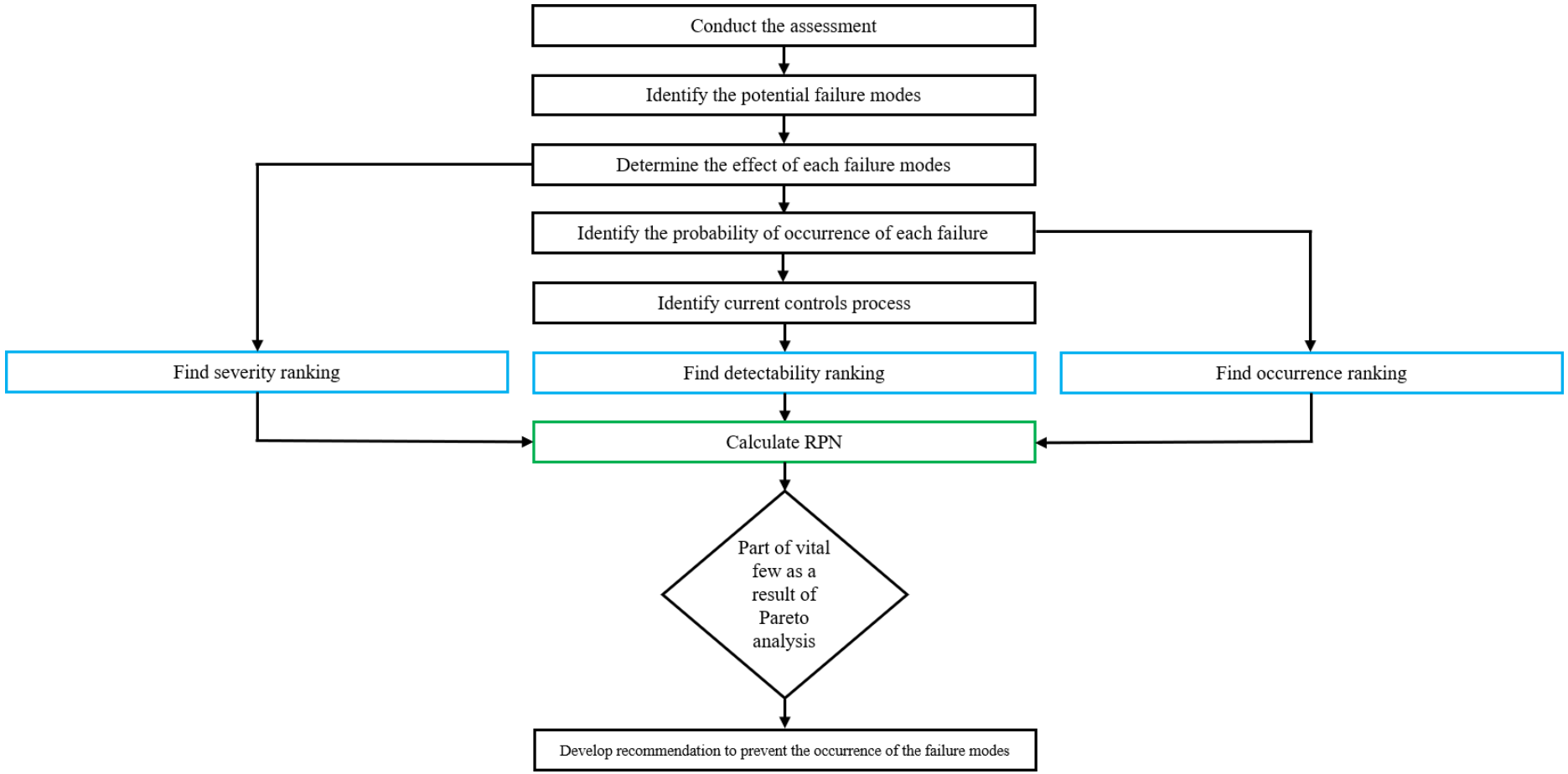
Adjust

- Continuous Improvement for future assessment

Determine Assessment Focus Areas

Main Objective	#	Assessment Focus Areas	Evaluation Methodology
Maintenance Program	1	Maintenance Administration and Planning	All maintained assets are governed with effective administration and planning. Suitable maintenance strategy, proper asset control, and competent maintenance workforce are key tools of a functional maintenance program.
	2	Maintenance Systems and Tracking	All controls are in place to effectively track maintenance systems performance, and monitor compliance of preventive maintenance activities from initiation to close-out.
	3	Specific Maintenance Activities	All controls, tools, resources, and records are availed to perform and maintain records for specific maintenance activities that can predict unreliability occurrences. Emphasis was given to Thermographic Inspection and Insulation Power Factor testing.
Asset Integrity	4	Field Assessment	Sufficient preventive maintenance measures are in place to ensure assets are reliable and operational. Any major or minor defects, trips, and failures shall be identified and reported by maintenance workforce continuously.
	5	Failure and Interruption Reporting	All unreliability events are well investigated using the corporate tool: Failure and Reliability Correction Action System (FRACAS). To ensure asset integrity, investigations and recommendations shall contain adequate corrective and preventives measures.

Failure Mode and Effects Analysis



Identified Failure Modes

#	Assessment Focus Areas	Key Observations (Failure Modes)	Failure Modes Symbol
1	Maintenance Administration and Planning	Maintenance Strategy	F_1
		Criticality Assessment	F_2
		Asset Control	F_3
2	Maintenance Systems and Tracking	Preventive Maintenance Records	F_4
		Corrective Maintenance Activities	F_5
		PM Defects	F_6
		Lack of coordination	F_7

Identified Failure Modes

#	Assessment Focus Areas	Key Observations (Failure Modes)	Failure Modes Symbol
3	Specific Maintenance Activities	Thermography Records	F_8
		Power Factor Test Records	F_9
4	Field Assessment	Equipment Deficiencies	F_{10}
		Preservation of Spare Equipment	F_{11}
		Calibration Records	F_{12}
5	Failure and Interruption Reporting	Failure and Interruption Reporting	F_{13}

Determine the Effect of Each Failure Modes

Failure Modes	Maintenance Intelligence Reporting KPI								Impact	Severity (S) ranking
	MCI	MDI	SC	PE	BL	WO T	QR	FR		
Maintenance Strategy (F_1)	●	●					●	●	VERY HIGH	10
Criticality Assessment (F_2)			●				●	●	HIGH	7
Asset Control (F_3)		●							LOW	1
Preventive Maintenance Records (F_4)							●	●	MED	4
Corrective Maintenance Activities (F_5)	●				●		●	●	VERY HIGH	10
PM Defects (F_6)						●	●	●	HIGH	7
Lack of coordination (F_7)			●	●					MED	4
Thermography Records (F_8)							●	●	MED	4
Power Factor Test Records (F_9)				●			●	●	HIGH	7
Equipment Deficiencies (F_{10})	●						●	●	HIGH	7
Preservation of Spare Equipment (F_{11})		●		●					MED	4
Calibration Records (F_{12})			●	●	●				HIGH	7
Failure and Interruption Reporting (F_{13})	●						●	●	HIGH	7

Identify the Probability of Occurrence

Failure Modes	Probability	Occurrence (O) ranking
Maintenance Strategy (F_1)	FREQUENT	10
Criticality Assessment (F_2)	UNLIKELY	4
Asset Control (F_3)	FREQUENT	10
Preventive Maintenance Records (F_4)	FREQUENT	10
Corrective Maintenance Activities (F_5)	EXTREMELY UNLIKELY	1
PM Defects (F_6)	UNLIKELY	4
Lack of coordination (F_7)	UNLIKELY	4
Thermography Records (F_8)	OCCASIONAL	7
Power Factor Test Records (F_9)	FREQUENT	10
Equipment Deficiencies (F_{10})	FREQUENT	10
Preservation of Spare Equipment (F_{11})	FREQUENT	10
Calibration Records (F_{12})	FREQUENT	10
Failure and Interruption Reporting (F_{13})	OCCASIONAL	7

Identify Current Controls Process

Failure Modes	Availability of Control Processes			Possibility	Detectability (D) ranking
	Corporate Procedures	Internal Procedures	Monitoring Systems		
Maintenance Strategy (F_1)	●			LOW	7
Criticality Assessment (F_2)	●	●		HIGH	4
Asset Control (F_3)	●	●	●	ALMOST CERTAIN	1
Preventive Maintenance Records (F_4)	●			LOW	7
Corrective Maintenance Activities (F_5)	●			LOW	7
PM Defects (F_6)	●	●		HIGH	4
Lack of coordination (F_7)	●	●		HIGH	4
Thermography Records (F_8)	●	●		HIGH	4
Power Factor Test Records (F_9)	●	●		HIGH	4
Equipment Deficiencies (F_{10})				ALMOST IMPOSSIBLE	10
Preservation of Spare Equipment (F_{11})				ALMOST IMPOSSIBLE	10
Calibration Records (F_{12})	●	●		HIGH	4
Failure and Interruption Reporting (F_{13})	●	●	●	ALMOST CERTAIN	1

Risk Priority Number (RPN) Calculation

Failure Modes	S	O	D	RPN
Maintenance Strategy (F_1)	10	10	7	700
Criticality Assessment (F_2)	7	4	4	112
Asset Control (F_3)	1	10	1	10
Preventive Maintenance Records (F_4)	4	10	7	280
Corrective Maintenance Activities (F_5)	10	1	7	70
PM Defects (F_6)	7	4	4	112
Lack of coordination (F_7)	4	4	4	64
Thermography Records (F_8)	4	7	4	112
Power Factor Test Records (F_9)	4	7	4	280
Equipment Deficiencies (F_{10})	7	10	10	700
Preservation of Spare Equipment (F_{11})	4	10	10	400
Calibration Records (F_{12})	7	7	4	280
Failure and Interruption Reporting (F_{13})	7	7	1	49

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THANK YOU!

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