International Civil Aviation Organization

Fifth Meeting of the Aerodrome Safety, Planning & Implementation Group

(ASPIG/5) ***(Doha, Qatar, 13-15 June 2023)***

Agenda Item 2: Regional Performance Framework for Aerodrome Safety

AERODROME SAFETY MANAGEMENT SYSTEM/ SAFETY INDEX

(Presented by the State of Qatar)

SUMMARY

This paper presents the Aerodrome Safety Management System (AD SMS) of MATAR which is Qatar Company for Airports Management, the Aerodrome Operator of both Hamad and Doha International Airports. The paper focus attention also on the Aerodrome Safety Index which is representing the overall Aerodrome Safety Performance.

Action by the meeting is at paragraph 3.

REFERENCES

- QCAR 006 (as Amended)
- QCAR 19 Safety Management Systems
- QCAR 004 - 2017 Regulation on the Reporting, Analysis and follow-up of occurrences in Civil Aviation.
- QCAA Advisory Circular No. AC01/09, issue 02, dated 07 November 2015, Safety Management System - Guidance to Organizations.
- ICAO Annex 14 Aerodromes - Volume 1 Aerodrome Design & Operations
- ICAO Annex 19 Safety Management
- ICAO Doc 9859 Safety Management Manual
- ICAO Doc 9981 PANS Aerodromes

1. INTRODUCTION

1.1 MATAR is Qatar Company for Airports Management, the Aerodrome Operator of both Hamad and Doha International Airports. The Safety Management System established at MATAR relates to the safety of aviation activities and the safe provisions of aerodrome services in accordance with the provisions of Qatar Civil Aviation Regulations - QCAR 006 (as amended), the provisions of ICAO Annex 14, ICAO Doc 9859 and the Aerodrome Manuals of Hamad and Doha International Airports.

1.2 The meeting may wish to note that SMS has bearing on activities not only directly performed under the jurisdiction of the Airport Operator but also with strong interfaces to it or where elements of the process are contributed by Airport Operator as:

a) Air Traffic Control
b) Aerodrome Data and Reporting
c) Rescue and Fire Fighting
d) Aircraft Fueling
e) Control of Meteorological Hazardous Situations
f) Access to Movement Area
g) Protection against hazardous activities in the vicinity of the aerodrome

1.3 The meeting may wish to highlight that SMS implementation at MATAR has been undertaken on a phased approach. SMS implementation started in 2010 and was documented in 2011 with the publication of the First edition of the SMS Manual and has been finalized in 2013. Brief retrospection of the Implementation phases is as follow:

1.3.1 Phase one of MATAR SMS implementation includes:

a) Identifying key Safety Personnel
b) Defining responsibilities
c) Developing the Safety policy
d) Undertaking a Gap Analysis

1.3.2 Phase two is a reactive phase that includes implementing essential safety management processes, while at the same time correcting potential deficiencies in existing safety management processes. This involves delivering training on the SMS and Risk management systems, creating safety documentation and formal methods of communication.

1.3.3 Phase Three is a proactive and predictive period looking at and refining the analytical safety management processes to ensure suitability and effectiveness of the arrangements.

1.3.4 Phase Four is looking at operational safety assurance through the implementation of periodic monitoring, feedback and continuous corrective actions to maintain the effectiveness of safety risk controls under continuing or changing operational demands.

2. DISCUSSION

Safety Policy and Objectives

2.1 The meeting may wish to highlight that the management commitment to safety is formally expressed in a statement of Safety Policy. This reflects Aerodrome Operator philosophy of Safety Management and becomes the foundation on which the Safety Management System is built. The safety policy outlines the methods and processes that will be used to achieve the desired safety outcomes. In developing the Safety Policy and other relevant processes, following safety principles were used:

a) Reflect organizational commitment regarding safety.
b) Include a clear statement about the provision of the necessary resources for the implementation of the safety policy.
c) Include safety reporting procedures.
d) Clearly indicate which types of behaviours are unacceptable and include the circumstances under which disciplinary action would not apply.

2.2 The meeting may wish to recognize that the Aerodrome Operator has to establish a set of safety objectives, interconnected to the safety performance indicators to facilitate monitoring and

measurement of the Safety Performance. Safety objectives are broad directions describing the organization's commitment to the establishment of specific safety goals or desired targets. Safety objectives are publicized and distributed covering the relevant aspects of the organization's safety vision, senior management commitments, realistic safety milestones and desired outcomes.

2.3 In this regard, the established safety objectives of the Airport Operator will be reviewed and updated annually; this responsibility lies with the Aerodrome Safety Manager, who will perform a comprehensive analysis of the Safety Performance throughout a specific period and as an outcome of this analysis Safety Objectives could be revised and SPI's / KSPI's target established. The result of this process is to be communicated to the Airport Safety Committee attendees together with the results of the yearly Safety Performance.

2.4 In addition, the key safety personnel names, roles, responsibilities, and accountabilities to be clearly stated. Appropriate case to case arrangements can be made for deputation in case of Key Safety Personnel absence.

Safety Risk Management

2.5 The meeting may wish to note that Safety Risk management is a key component of Safety Management System. It is a data-driven approach to safety management resources allocation i.e. priority is accorded to activities based on their risk index. Risk Evaluation will be integral to all strategic and operational planning activities ensuring hazards are quantified and risks evaluated at every stage of the planning process.

2.6 The meeting may wish to highlight that, risk management is a task shared by the company as a whole, from the accountable manager through the Safety Committee to Line Managers. Safety risk must be considered in all decisions. Risk management consists of hazard identification, hazard analysis, risk assessment and risk mitigation of risks associated with the hazards of the aerodrome operations. The meeting may wish to refer to the example of MATAR Risk Management Process Flowchart presented at **Appendix A.**

Hazard Identification

2.6.1 The meeting may wish to emphasise that the hazard identification (and related risks assessment & mitigation) process is continuous as there are frequently either incident (reactive), or repeated occurrences (proactive), or upcoming changes (predictive); therefore, the hazard identification process is based on a combination of three-time perspectives.

2.6.1.1 The meeting may wish to reiterate that a systematic process for identifying hazards relies on an effective reporting system. Aerodrome Operator has to establish a comprehensive airport-wide **occurrence reporting system** to facilitate the Aerodrome operator's Safety Management System. The Airport SMS is not confined to the organizational boundary of the aerodrome organization but also captures the operation of the entire airport system and the operation of other agencies on the airport premises.

2.6.1.2 Once the Airside occurrences are reported, they are then to be recorded on the Incident database and reviewed daily by airport safety investigation management, and on a weekly basis through Incident Review Meeting. All incidents are to be investigated and closed out, with the recommendation shared with relevant parties. In some cases, a Safety communication e.g. Safety Alert, Safety Notice, Safety Flash, etc. is to be issued to raise awareness of specific safety-related issues.

2.6.1.3 Besides the occurrences for which reporting obligations are established, any staff operating at the airport has the ability to file a safety report in order to suggest safety improvements, identify safety hazards, or report violations of rules. The reports are treated confidentially.

2.6.1.4 The meeting may wish to emphasize the aerodrome operator's obligation to report occurrences to civil aviation authority based on the relevant Civil Aviation Regulations for Mandatory Occurrence Reporting.

Occurrence Taxonomy

2.6.2 The meeting may wish to note that a unified occurrence taxonomy is a key element for safety reporting. It provides an aligned base for the categorization of all occurrences that can be used as a base for proper logging in the Incident Database.

2.6.3 Occurrence Class may refer to a division in a system of classification based on defined main (or most important) characteristics. In the taxonomy, it means a group of occurrences regarded as having their outcome in common. The common outcome is the Level of Safety, which is defined as the state in which risks associated with the aviation activities, related to, or in direct support of the operation of aircraft are reduced and controlled to an acceptable level through a continuing process of hazard identification and risk management. Occurrence classes are accidents, serious incident, incident, near miss, and hazard.

2.6.4 Occurrence Category may refer to a group of occurrences categorized based on their object/subject, human, environment, or process involvement. Category classification encompasses all manner of the occurrence providing further identity within the system of established categories.

2.7 The meeting may wish to distinguish that as part of the Aerodrome Safety Management Processes, the Occurrence Categories, may serves as a Safety Performance Indicator (SPI). SPI's are to be subject for yearly review. The outcome of this review might result in the establishment of new SPI(s) or the revision of the existing ones.

Investigation of Safety Occurrences

2.7.1 The meeting may wish to emphasize that the objective of an accident investigation is to uncover the root cause of the accident to enable management to implement measures to prevent a reoccurrence. Although ultimately there might be a human error at the onset of a final chain of events leading to the accident, the investigation process should not be based on a "blame'' methodology; this is not only counterproductive for establishing a good safety culture it will also have the effect of closing doors to the investigator during the investigation process. The meeting may wish to refer to the Flowchart of MATAR Investigation of Occurrences Process presented at **Appendix B.**

Safety Risk Assessment and Mitigation

2.8 The meeting may wish to note that once the hazard has been identified following the above processes, the next step is to perform Hazard Analysis. The importance of hazard analysis is to provide a full understanding of the system and conditions where the hazard exists. Identification of the accident causation elements will provide a firm basis and will precise the next phase, which is the risk assessment process - Probability should be based on the frequency of the triggering event that could lead to the unwanted event, whereas severity should be based on the outcomes of the ultimate consequence considering the worst scenario.

2.9 Following approval received for a Risk Assessment, Change Management, or Safety Case, the appropriate mitigation measures are to be communicated to the identified stakeholders as having a role in the mitigation process. Monitoring the implementation will be accomplished by the Author of the Assessment, assisted by the stakeholder responsible personnel. The subject is falling under the provisions of the Compliance Monitoring System and Auditing Regime, therefore non-scheduled audits may be performed in order to verify the implementation and effectiveness of the identified mitigation measures.

Safety Assurance

2.10 The meeting may wish to highlight that Safety Risk Management requires feedback on safety performance to complete the safety management cycle. Through monitoring and feedback, SMS performance can be evaluated, and any necessary changes to the system implemented. In addition, safety assurance provides airport operator Management, CAA, and airport stakeholders with an indication of the level of the safety performance of the system.

Safety Performance

2.10.1 The meeting my wish to highlight that Safety performance Indicators are to be continuously monitored. Their status is to be reported through the various safety committees, the primary forum is the Aerodrome Safety Committee, where a number of established safety performance indicators (SPIs) and Key Safety Performance Indicators (KSPI) are reviewed and actions are taken where required. If an increased focus is required to improve safety performance, SPIs, and relevant action plans may be escalated to a higher-level safety committee.

2.10.2 Lagging indicators are metrics that measure safety events that have already occurred including those unwanted safety events trying to be prevented. Lagging indicators are measures of safety occurrences, in particular, the negative outcomes that the organization is aiming to prevent.

2.10.3 Leading SPI's are metrics that provide information on the current situation that may affect future performance. Leading Safety Performance Indicators are dynamically established by Safety Management and serve to measure the performance of a particular activity, which is put under thorough review. An example of Leading indicators and indicators that might be used is Safety Management Training.

Aerodrome Safety Performance Index

2.10.4 The meeting may wish to recognize that the Aerodrome Safety Performance Index may presents a single index, combining all details from the SPI's and the KSPI and representing the overall Aerodrome Safety Performance calculated per 1000 movements and shown as an index, consisting of a two-digit number.

2.10.5 The first step in developing the Aerodrome SPI is to establish quantifiers for the severity of the ultimate consequence of each of the SPI:

50	25	10	4	1
Catastrophic	Major	Moderate	Minor	Insignificant

Figure 01. Severity Quantification Index - SPI(cev)

2.10.6 The second step is to establish the Comparative Index (SPI ci), which serves as a tool to measure the Weightage amongst all SPIs. For that purpose, the SPIs are divided into 4 groups, based on the level of severity of the consequence.

Group 1	50	Group 2	30	Group 3	15	Group 4	5
RWY Excursion	16	Dangerous goods	5	Wildlife Hazard	3	Injury	1
Runway Incursion	12	Emergency	4.8	Docking	2.8	Fire/Smoke	0.8
TWY Excursion	9	Interference with aircraft movement	4.6	Wrong Aircraft Parking	2.4	TWY Depression	0.7
Aircraft Damage	7	Bird Strike	4.3	Wrong Aircraft Pushback	2	Fuel Spillage	0.65
TWY Incursion	6	Jet Blast	4	Aircraft Diversion	1.7	Oil Spillage	0.6
		FOD	3.8	Aircraft Air Return	1.6	Vehicular Occurrence	0.5
		Uncontrolled Equipment Movement	3.5	Aircraft Ground Return	1.5	Property Damage	0.3
				Medical	1.2	Vehicular Traffic Violation	0.25
						Others	0.2

Figure 02. SPI Comparative Index - SPI (ci)

2.10.7 The next step is to perform the calculation, based on the below formula:

$$A\ SPI_{(1K)} = \frac{Occurrence_{\ 1}\ (SPI_{\ (ci)} * SPI_{(cev.)}) + Occurrence_{\ 2}\ (SPI_{\ (ci)} * SPI_{(cev.)}) + \ldots\ldots + Occurrence_{\ n}\ (SPI_{\ (ci)} * SPI_{(cev.)})}{Movements\ /\ 1000}$$

2.10.8 After an occurrence is logged into the Incident database, its severity and probability are assessed and inserted. The Methodology then multiplies the SPI Severity Index - SPI(cev) by the SPI comparative index (ci). For the normalization of the value, the sum of all monthly occurrences is divided on the value of the aircraft movement, expressed in 1000. The meeting may wish to refer to the matrix, presented at **Appendix C,** and used by MATAR for the Calculation of the Aerodrome SPI.

2.10.9 The outcome of the methodology is a single index, consisting of two digits that shows the monthly Safety Performance.

Column1	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC
Movement	17,687	15,968	17,823	17,237	17,745	17,840	18,910	19,041	18,554	19,170	18,541	19,301
ASPI	898.1	934.1	984.25	565.95	1113.8	630.2	951.3	1094.8	827.75	1086.7	494.3	594
ASPI/1k	50.78	58.50	55.22	32.83	62.77	35.33	50.31	57.50	44.61	56.69	26.66	30.78

Figure 03. Aerodrome SPI - Tabular Format

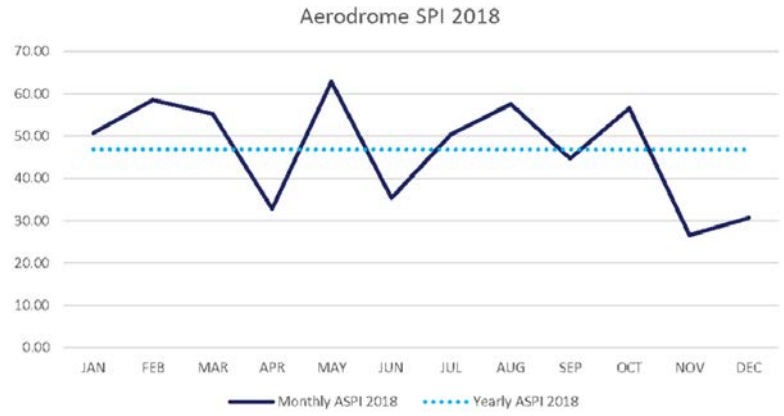


Figure 04. Aerodrome SPI - Graphical Format

2.10.10 From the monitored Safety Performance Indicators, a set of Key Safety Performance Indicators is established. KSPI are Occurrences with High severity negative outcomes, such as accidents or serious incidents; or occurrences at relatively low severity, but a frequent probability. KSPI are put on a detailed analysis and a report on their performance is a key part of the analysis provided by the Airport Safety Committee and other safety forums. The decision on which SPI will form the next year's KSPI list is based on the actual performance review throughout the year and is taken during the SPI Annual Review Meeting, initiated by Aerodrome Safety Manager.

2.10.11 The meeting may wish to explain that the Safety Performance Target presents the Aerodrome Operator planned or intended target for a Key Safety Performance Indicator over the next year. The Safety Performance Target is to be aligned with the safety objectives and to be defined based on a comprehensive analysis of the Safety Performance throughout the year.

2.10.12 Analysis of the SPI, KSPI, and Aerodrome SPI is to be performed on a monthly basis. SPI and KSPI analysis can consider the data provided from a specific year to be used as the baseline for the benchmarking.

2.11 The meeting may wish to explain that, in addition to the established Safety Performance Targets, in Standard Deviation Methodology, 3 alert levels can be defined. The alert level for the current year is based on the preceding year's performance and the standard deviation of the monthly values. The three alert lines are average + 1 SD, average + 2 SD, and average + 3 SD. An alert is indicated if any single point is above the 3 SD line, 2 consecutive points are above the 2 SD line, or 3 consecutive points are above the 1 SD line. When an alert is triggered, appropriate follow-up action will be initiated, such as further analysis to determine the source and root cause of the abnormal incident rate and any necessary action to address the unacceptable trend.

2.12 The meeting may wish to explain that the Aerodrome Operator Management is to carry out a systematic assessment of any changes that may affect aviation safety. Changes that may introduce any new hazards or has an effect on safety are to be assessed for their magnitude of change and the safety outcomes due to the change. The Aerodrome Operator may consider using various models of risk assessments as appropriate and which may be more advanced than the minimum requirement as specified in the SMS model. The assessments of the changes are to be implied to the CAA for notification or acceptance as appropriate.

Safety Promotion

2.13 The meeting way wish to emphasize that the aerodrome operator program of safety promotion will ensure that all employees involved in airside duties benefit from safety lessons learned from occurring incidents/accidents and continue to understand the organization's SMS.

2.14 Safety promotion is linked closely with safety training and the dissemination of safety information. It focuses on those activities which the organization carries out in order to ensure that the staff understands why safety management procedures are being introduced, what safety management means, why particular safety actions are being taken, etc. Safety personnel provides a means of, encouraging the development of a positive safety culture and ensuring that, once established, the safety culture is maintained. Publication of safety policies, procedures, newsletters, and bulletins alone will not necessarily bring about the development of a positive safety culture.

2.15 While it is important that staff is well informed, it is also important that they see evidence of the commitment of management to safety. The attitudes and actions of management will, therefore, be a significant factor in the promotion of safe work practices and the development of a positive safety culture.

2.16 The meeting may wish to stress on the aerodrome Operator's system to impart job specific training and to test the competency of such staff involved in performing aerodrome operations, maintenance and management functions, thereby ensuring that staff with required competency are deployed to perform their respective tasks.

2.16.1 To ensure that the staff remain competent, the Training & Proficiency Program should include Recurrent and Refresher training as well. For safety critical activity, only Trained and Authorised staff are deployed to perform such tasks (i.e staff performing RWY inspection, aircraft marshalling activity etc.). Renewal frequency of such authorisation is established. Based on the core safety role of the staff, the necessary competency to perform that role is derived. The meeting may wish to refer to the flowchart, presented at **Appendix D,** and indicating MATAR Training Management Cycle.

2.17 All such competency requirements are to be mapped in the Training & Proficiency Program Manual. The Training Programme may also include identification of training needs as per staff role, formulating the training matrix, design and development of training programs, provision of training, documentation and record-keeping. Moreover, procedures related to the training programme, including the following identification of training needs as per staff role, formulating the training matrix, design and development of training programs, provision of training, documentation and record-keeping.

2.18 The meeting may wish to recognize that it is essential to communicate the organization's SMS processes and activities to the organization's population. The means for such communication/promotion may include notices or statements on safety policy/objectives, Safety meeting minutes, newsletters, bulletins, safety seminars/workshops, orientation program etc. The purpose of such communication includes:

a) Ensuring that all staff members are aware of the SMS;

b) Conveying safety lessons/information;

c) Explaining why SMS related activities are introduced or changed;

d) Conveying SMS activities updates;

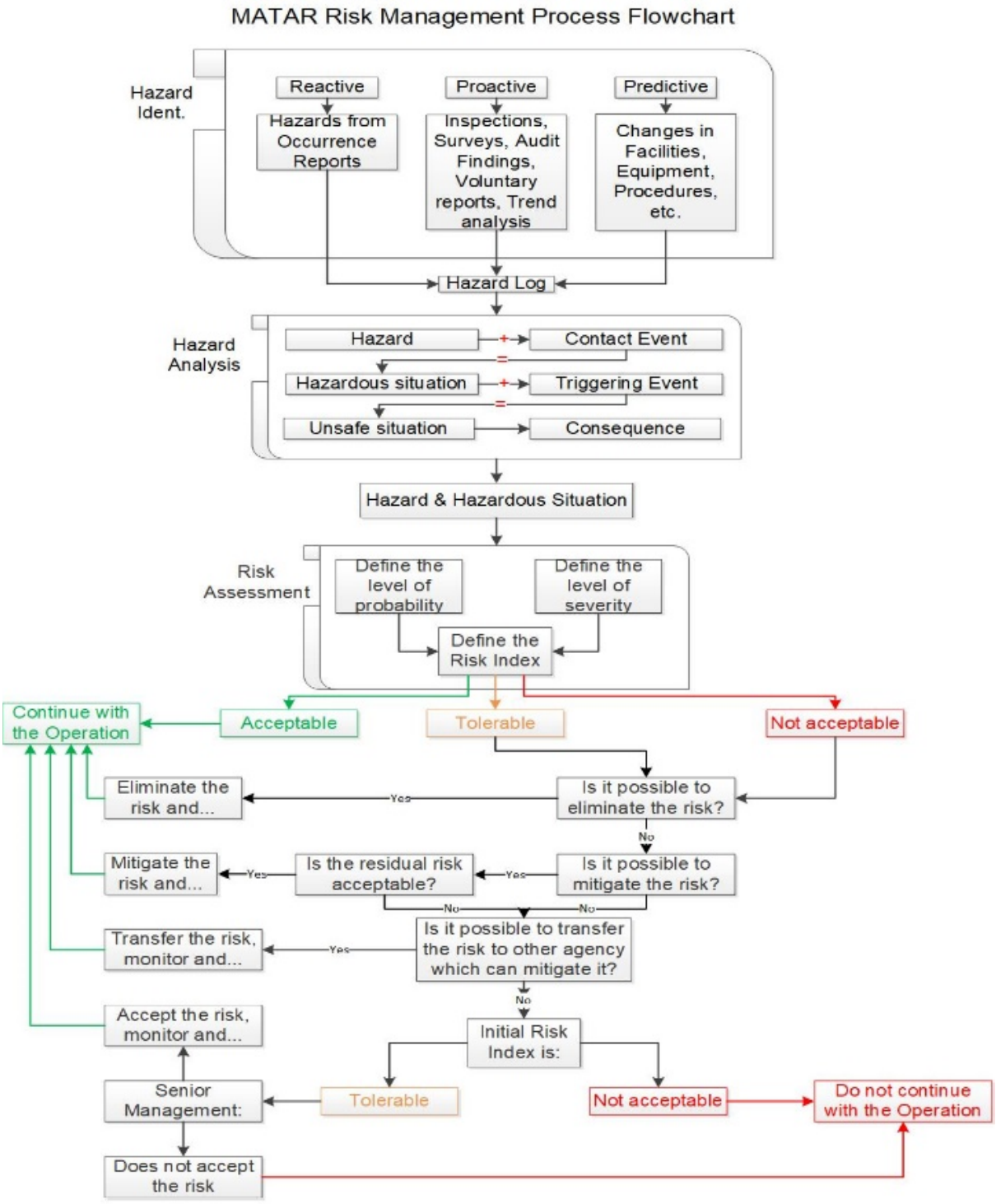
e) Dissemination of completed safety assessments to concerned personnel;

f) Educating personnel on hazards reporting; and

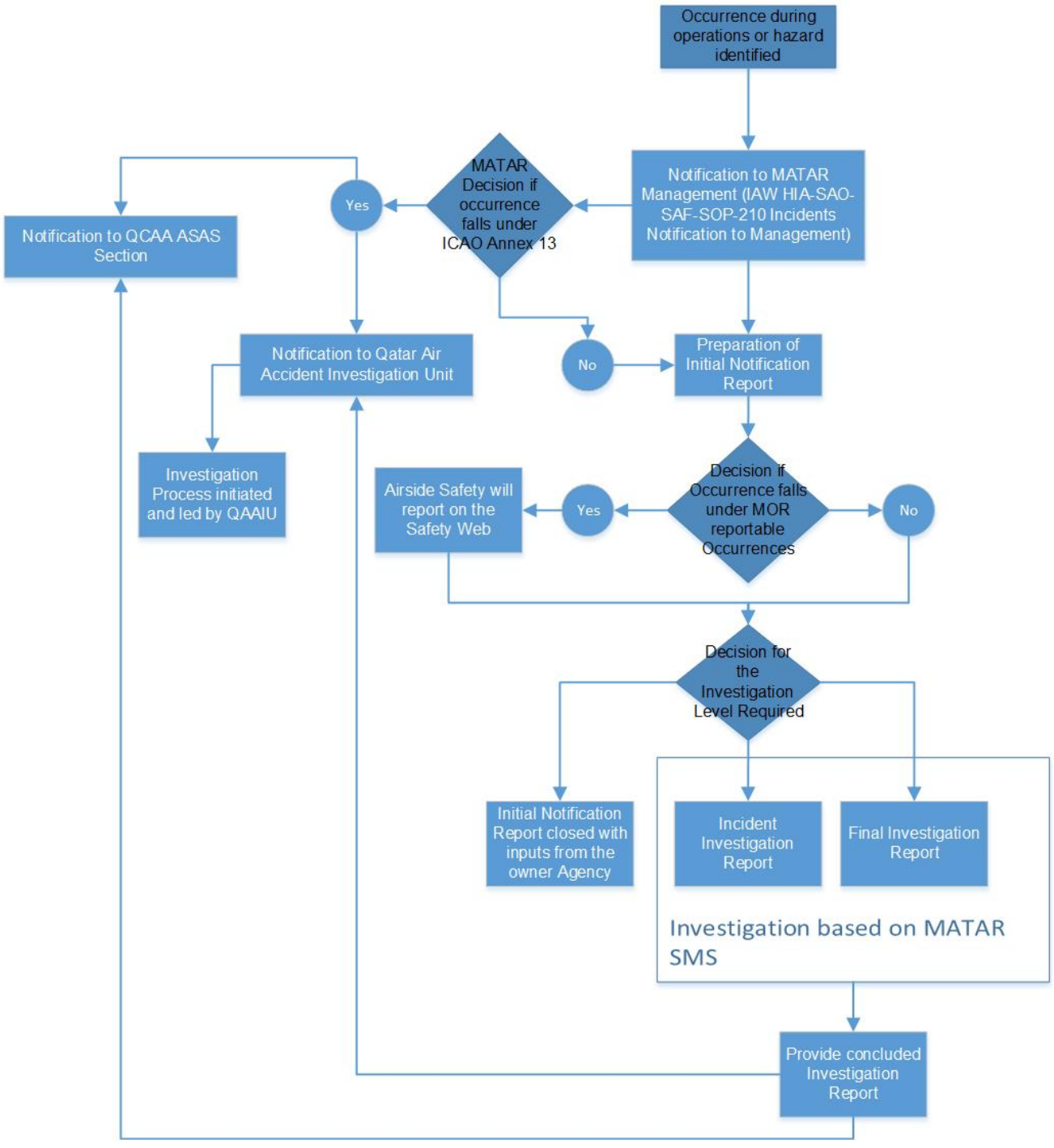
g) Promotion of the company's safety objectives, goals and culture.

3. ACTION BY THE MEETING:

3.1 The meeting is invited to note the content of this working paper and encourage States who need support on the implementation of a robust Aerodromes SMS, supporting the Aerodrome Certification Process, to communicate their Capacity Building Needs to the ICAO MID Office to proactively plan potential assistance in this regard.


MATAR Risk Management Process Flowchart
Hazard Ident.
Reactive
Hazards from Occurrence Reports
Proactive
Inspections, Surveys, Audit Findings, Voluntary reports, Trend analysis
Predictive
Changes in Facilities, Equipment, Procedures, etc.
Hazard Log
Hazard Analysis
Hazard
Contact Event
Hazardous situation
Triggering Event
Unsafe situation
Consequence
Hazard & Hazardous Situation
Risk Assessment
Define the level of probability
Define the level of severity
Define the Risk Index
Continue with the Operation
Acceptable
Tolerable
Not acceptable
Eliminate the risk and...
Yes
Is it possible to eliminate the risk?
No
Mitigate the risk and...
Yes
Is the residual risk acceptable?
Yes
Is it possible to mitigate the risk?
No
No
Transfer the risk, monitor and...
Yes
Is it possible to transfer the risk to other agency which can mitigate it?
No
Accept the risk, monitor and...
Initial Risk Index is:
Senior Management:
Tolerable
Not acceptable
Do not continue with the Operation
Does not accept the risk

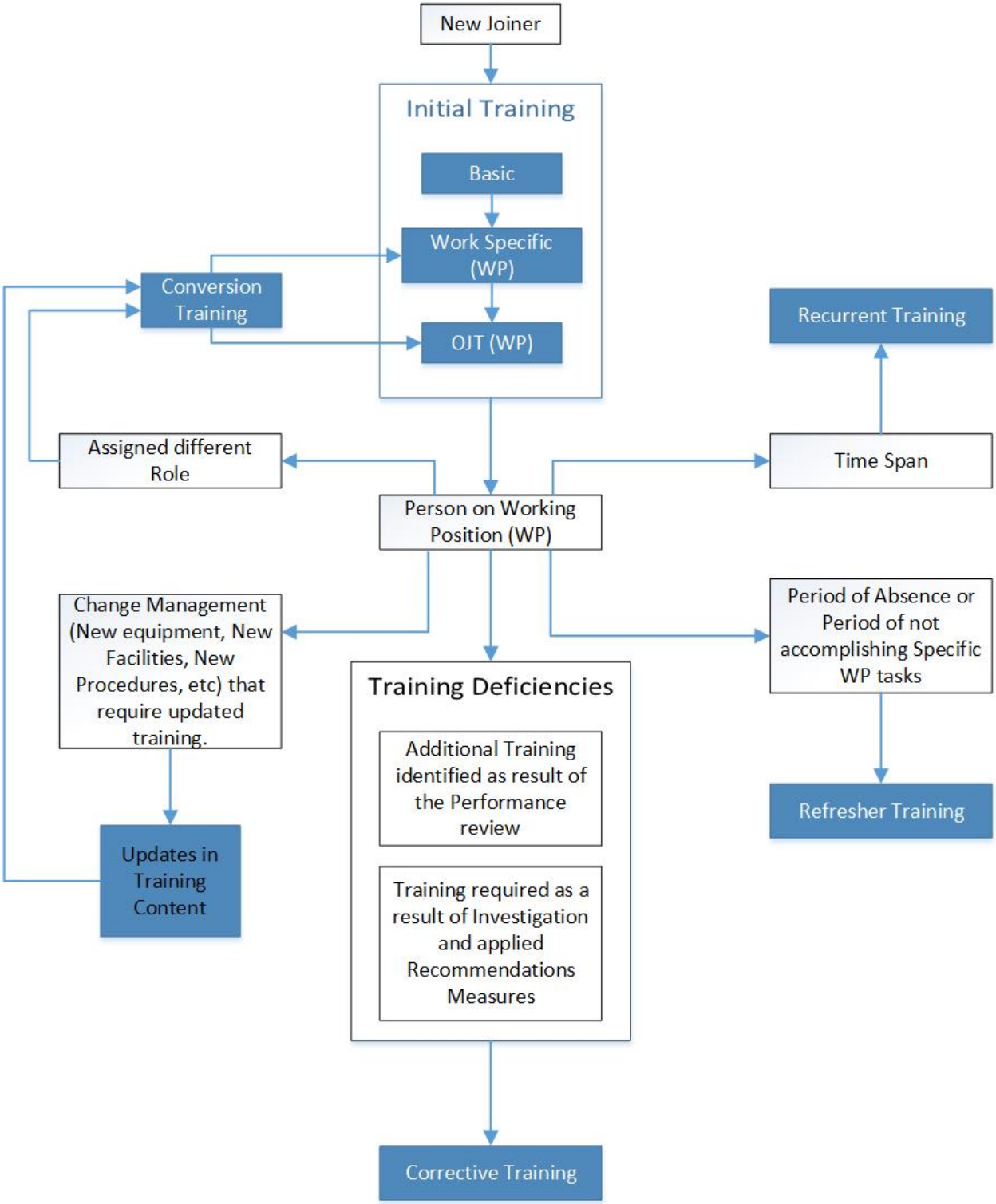
MATAR Occurrence Investigation Process



Calculation of the Aerodrome SPI

10175.25	SPI (ci)	1 Insignificant	4 Minor	10 Moderate	25 Major	50 Catastrophic	SPI(cev.)	ASPI
RWY Excursion	16						0	0
Runway Incursion	12	0	0	1	0	0	10	120
TWY Excursion	9	0	0	0	1	0	25	225
Aircraft Damage	7	0	1	2	2	0	74	518
TWY Incursion	6	0	0	0	3	0	75	450
Dangerous goods	5						0	0
Emergency	4.8	0	1	10	5	0	229	1099.2
nterference with aircraft movemen	4.6	0	0	11	0	0	110	506
Bird Strike	4.3	4	17	6	0	0	132	567.6
Jet Blast	4	0	0	3	0	0	30	120
FOD	3.8	0	0	0	0	0	0	0
Uncontrolled Equipment Movemen	3.5	16	12	11	0	0	174	609
Wildlife Hazard	3	8	13	5	0	0	110	330
Docking	2.7	26	27	15	4	0	384	1036.8
Wrong Aircraft Parking	2.3	0	18	6	1	0	157	361.1
Wrong Aircraft Pushback	1.9	0	0	19	2	0	240	456
Aircraft Diversion	1.5	2	43	1	0	0		
Aircraft Air Return	1.3	2	7	11	1	0		
Aircraft Ground Return	1.2	15	121	65	8	0		Ai
Medical	1.1	0	0	37	0	0	370	407
Injury	1	6	20	76	1	0	871	871
Fire/Smoke	0.8	0	7	28	4	0	408	326.4
TWY Depression	0.7	2	128	36	0	0	874	611.8
Fuel Spillage	0.65	0	2	9	3	0	173	112.45
Oil Spillage	0.6	1	11	16	1	0	230	138
Vehicular Occurrence	0.5	35	257	60	11	0	1938	969
Property Damage	0.3	76	83	16	0	0	568	170.4
Vehicular Traffic Violation	0.25	6	9	4	0	0	82	20.5
Others	0.2	7	32	34	11	0	750	150

MATAR Training Management Concept



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