Civil Aviation Authority of Singapore

Advisory Circular

SAFETY MANAGEMENT SYSTEM

GENERAL

Advisory Circulars (ACs) are issued by the Director-General of Civil Aviation Authority of Singapore (DGCA) from time to time to provide practical guidance or certainty in respect of the statutory requirements for aviation safety. ACs contain information about standards, practices and procedures acceptable to CAAS. An AC may be used, in accordance with section 3C of the Air Navigation Act (Cap. 6) (ANA), to demonstrate compliance with a statutory requirement. The revision number of the AC is indicated in parenthesis in the suffix of the AC number.

PURPOSE

This AC provides guidance on the key concepts and components for effective implementation of an SMS, as required under CAAS' regulations. This AC complements other guidance material issued by CAAS on safety management-related subjects.

APPLICABILITY

This AC applies to all holders of Singapore Air Operator Certificate (AOC), holders of Aerial Work Certificate, holders of Complex General Aviation Certificate, SAR-145 Approved Maintenance Organisations (except SAR-145, Subpart D organisations), Aviation Training Organisations (ATOs) approved by CAAS that are exposed to safety risks during the provision of their services, the air navigation service provider in Singapore, the operator of certified aerodromes in Singapore, and the Aeronautical Meteorological Service Provider.

CANCELLATION

This AC supersedes AC 1-3(7) dated 3 June 2019.

EFFECTIVE DATE
This AC is effective on 8 January 2020.

REFERENCES
- ICAO Annex 19
- ICAO Safety Management Manual (Doc 9859)
- Singapore Airworthiness Requirements Part 145 (SAR-145)
- Singapore Air Safety Publication Part 10 (SASP 10)
- Manual of Standards – Air Traffic Services (MOS-ATS)
- Manual of Aerodrome Standards (MOAS)
- MOS – Meteorological Service for International Air Navigation (MOS-MET (IAN))
- Air Navigation (119 – Air Operator Certification) Regulations 2018
- Air Navigation (125 – Complex General Aviation) Regulations 2018
- Air Navigation (137 – Aerial work) Regulations

1. INTRODUCTION

1.1 This AC has been revised to provide guidance on the implementation of an SMS.

1.2 ICAO Annex 19 – *Safety Management* defines SMS as "*a systematic approach to managing safety, including the necessary organisational structures, accountability, responsibilities, policies and procedures"*. ICAO Doc 9859 – *Safety Management Manual* further elaborates that the SMS should assist the service provider to continuously improve safety through identifying hazards, collecting and analysing safety data and safety information and continuous assessment of safety risks. This will enable the service provider to proactively contain or mitigate risks before they result in aviation accidents and incidents[1].

1.3 The SMS of a service provider should be minimally applied to its activities that are related to the safe operation of aircraft. The implementation of an SMS should take into account interfaces with key stakeholders, industry partners and corporate activities such as finance, human resources and legal.

1.4 A glossary of terms used in this AC may be found in **Appendix A**.

2. SMS REQUIREMENTS

2.1 As required under Singapore's legislations and regulations, the following service providers are required to implement an SMS that is acceptable to CAAS:

a. Singapore AOC holder;

b. SAR-145 Approved Maintenance Organisation (except SAR-145, Subpart D organisation);

c. Aviation Training Organisation (ATO) approved by CAAS that is exposed to safety risks during the provision of their services;

d. Air navigation service provider in Singapore;

e. Operator of certified aerodromes in Singapore;

f. Singapore Complex General Aviation Certificate holder

g. Singapore Aerial Work Certificate holder; and

h. Aeronautical Meteorological Service Provider.

2.2 The SMS framework comprises 4 components and the associated elements as reflected in the table below. Details of each element are explained in subsequent paragraphs. To implement an SMS, an organisation needs to translate these components and elements into how it manages safety that commensurate with the size and complexity of its operations.

[1] More information on the SMS fundamentals of safety management can be found in ICAO Doc 9859 – Safety Management Manual.

COMPONENT	ELEMENT
1. Safety policy and objectives	1.1 Management commitment
	1.2 Safety accountability and responsibilities
	1.3 Appointment of key safety personnel
	1.4 Coordination of emergency response planning
	1.5 SMS documentation
2. Safety risk management	2.1 Hazard identification
	2.2 Safety risk assessment and mitigation
3. Safety assurance	3.1 Safety performance monitoring and measurement
	3.2 The management of change
	3.3 Continuous improvement of the SMS
4. Safety promotion	4.1 Training and education
	4.2 Safety communication

3. SMS FRAMEWORK – (1) SAFETY POLICY AND OBJECTIVES

3.1 The Safety Policy and Objectives set out the commitment and high-level directions for safety management and safety performance improvement. They also encompass processes on emergency response planning and SMS documentation.

1.1 Management commitment

3.2 Management's commitment to safety should be formally expressed in a safety policy statement, which captures the service provider's philosophy on safety management, and its key safety objectives. The safety policy, endorsed by the Accountable Executive and senior management, should minimally reflect management's commitment to:

a. continually improve safety performance;

b. provide necessary resources, such as financial, manpower and training, for safety management;

c. comply with applicable regulations and guidance;

d. prioritise safety as a primary responsibility of all personnel; and

e. promote and maintain a positive safety culture within the organisation.

3.3 Safety objectives should be established taking into account the service provider's safety policy, safety priorities and identified significant safety risks. The safety objectives would form the basis for the setting of subsequent setting of safety performance indicators (SPIs) and safety performance targets (SPTs) which are further elaborated in subsequent paragraphs.

3.4 The service provider should clearly communicate the safety policy and objectives to all personnel, and regularly review them to ensure that they remain relevant and appropriate.

1.2 Safety accountability and responsibilities

3.5 The service provider is to appoint an Accountable Executive to hold overall accountability for the implementation and maintenance of the SMS. Depending on the structure, size and complexity of the service provider, the Accountable Executive may be the chairperson of the board of directors, the chief executive, a member of the senior management, or the proprietor. The Accountable Executive should be responsible for the:

a. provision and allocation of adequate resources such as financial and manpower for the effective implementation of SMS;

b. promotion of a positive safety culture;

c. establishment and communication of the organisation's safety policy and safety objectives;

d. establishment, monitoring, review and improvement of safety performance; and

e. implementation and improvement of the SMS.

3.6 Further, the service provider should clearly define, document and communicate the accountability and responsibilities of the management and personnel (including relevant departmental and/or unit managers, and line managers) with respect to safety-related functions or duties. This could include being responsible for safety performance, ensuring appropriate mitigating measures and corrective actions are taken to address reported hazards and errors, as well as responding to accidents and incidents.

3.7 Where appropriate, the service provider should interface its SMS with external organisation's SMS or relevant safety systems. For example, where products or services are provided or supported by an external organisation, such as a contractor or subcontractor, the service provider should ensure that the external organisation meets its safety requirements. Policies and procedures should be established to clearly define the safety accountability and authority flow between the service provider and the external organisation.

1.3 Appointment of key safety personnel

3.8 The service provider is to appoint a Safety Manager who is responsible for:

a. advising the Accountable Executive and line managers on safety management matters;

b. managing the implementation of SMS;

i. performing or facilitating hazard identification, and safety risk analysis;

ii. monitoring safety risk control and corrective actions and evaluating their results;

iii. providing periodic reports on the service provider's safety performance;

iv. maintaining aviation safety-related records and documentation;

v. planning and facilitating personnel training related to aviation safety;

vi. monitoring safety concerns in the aviation industry and their perceived impact on the service provider's operations; and

c. coordinating and communicating with CAAS and other aviation authorities as necessary on issues relating to safety.

3.9 The Safety Manager may hold other concurrent appointments, provided there is no conflict of interest, and the Safety Manager should maintain a direct reporting line to the Accountable Executive to ensure independence of advice relating to the implementation and maintenance of a SMS.

3.10 A service provider should establish a senior management platform, chaired by the Accountable Executive and composed of senior managers responsible for functional and administrative areas. This platform is to provide strategic directions for safety policies and oversees the organisational safety performance, and it should:

a. monitor the effectiveness of the SMS and associated safety management processes;

b. assess safety performance against the service provider's safety policy and objectives;

c. ensure that any necessary safety risk control action is taken in a timely manner;

d. review the effectiveness of safety risk mitigation strategies; and

e. ensure that appropriate resources are allocated to achieve the desired safety performance.

3.11 To drive SMS activities and implement safety strategies at the operational level, the service provider may establish safety action groups specific to functional units within the organisation. Each safety action group should be chaired by the functional manager and composed of other managers and/or front-line personnel, and the group should be reporting to the senior management platform. A safety action group should, in its functional area:

a. oversee operational safety performance;

b. ensure that safety risk management activities, such as hazard identification, risk assessment and mitigation are carried out;

c. assess the impact of operational changes or new technologies to aviation safety;

d. coordinate and implement safety risk controls and corrective actions in a timely manner;

e. review the effectiveness of safety risk controls and corrective actions; and

f. coordinate safety promotion activities to raise awareness in safety matters.

1.4 Coordination of emergency response planning

3.12 An Emergency Response Plan (ERP) identifies aviation-related emergency scenarios and corresponding actions to be taken so as to ensure safe continuation of the service provider's operations and the return to normal operations as soon as possible. Such scenarios may include occurrences of accidents, serious incidents, or any events that could affect the safety of aviation operations. A service provider's ERP should also be coordinated with external stakeholders and interface with their respective ERPs.

3.13 Where appropriate, an ERP should:

a. identify foreseeable emergencies;

b. establish the emergency authority, and respective roles and responsibilities of units and personnel involved;

c. identify actions to be taken by responsible personnel during an emergency, including those of external organisations; and

d. detail the coordination procedures including with external stakeholders to manage the emergency.

3.14 The ERP should be regularly tested through exercises and reviewed to maintain its relevance.

1.5 SMS documentation

3.15 A service provider should establish and maintain an SMS Manual, acceptable by CAAS, that describes the components and elements in its SMS, and their associated policies and procedures. Depending on the complexity of the service provider's operations, the SMS Manual may be a stand-alone document or a section within existing manuals, with references to relevant documents as necessary.

3.16 Clear documentation and communication of safety policies, safety management processes and methodologies will help organisational personnel, partner organisations and CAAS in understanding how the organisation's SMS functions, and how the safety policy and objectives will be met.

3.17 SMS documentation should also include any records substantiating the SMS processes, such as:

a. SMS implementation plan (during implementation process);

b. occurrence (accident and incident) reports and investigations;

c. hazards register and reports;

d. safety performance indicators and related charts;

e. records of completed safety risk assessments;

f. records of internal SMS reviews or audits;

g. training records

h. records of safety promotion activities; and

i. minutes of SMS-related meetings

4. SMS FRAMEWORK – (2) SAFETY RISK MANAGEMENT

4.1 A service provider is to establish a safety risk management process which includes systematically identifying safety hazards, conducting of safety risk assessment and, if necessary, subsequent undertaking of remedial actions or mitigation measures. **Appendix B** provides an example of a safety risk management flowchart.

2.1 Hazard identification

4.2 Hazards may be related, but not limited, to:

a. design factors, such as equipment and task design;

b. procedures and operating practices, such as documentation and checklists;

c. communications, such as language proficiency and terminology;

d. organisational factors, such as company policies for recruitment, training, remuneration and allocation of resources;

e. operational environment factors, such as ambient noise and vibration, temperature, lighting, protective equipment and clothing;

f. human factors, such as medical conditions, human performance limitations, and human-machine interface;

g. regulatory compliance factors, such as the applicability of regulations and the certification of equipment, personnel and procedures; and

h. organisational or safety systems interfaces.

Note: Hazards should not be confused with outcomes. For example, a runway incursion is an outcome, not a hazard. On the other hand, "unclear aerodrome signage" is a hazard that could lead to an outcome of runway incursion, which could result in adverse consequences.

4.3 A service provider should develop and maintain processes to identify hazards that could affect aviation safety. This may be done through analysis of existing processes or various safety data and information sources such as mandatory reports, voluntary and confidential safety reports, audits and investigations.

4.4 Where appropriate and relevant, a service provider should implement policies, processes or initiatives that encourage the contribution, reporting or sharing of safety data and information from its personnel and relevant stakeholders, for hazards identification.

2.2 Safety risk assessment and mitigation

4.5 A service provider should develop a safety risk assessment model to determine the safety risks associated with identified hazards.

4.6 A typical safety risk assessment model combines the likelihood and severity assessments of an identified hazard to produce a safety risk index score. Tables 1 to 4 show an example of the risk assessment matrices that may be used to determine the overall safety risk. A service provider may customise the sample model or develop its own safety risk assessment model that suits its context.

Likelihood	Meaning	Value
Frequent	Likely to occur many times (has occurred frequently)	5
Occasional	Likely to occur sometimes (has occurred infrequently)	4
Remote	Unlikely, but possible to occur (has occurred rarely)	3
Improbable	Very unlikely to occur (not known to have occurred)	2
Extremely improbable	Almost inconceivable that the event will occur	1

Table 1: Safety Risk Likelihood Classification

Note: Likelihood may also be defined quantitatively e.g. number of events within a time period

Severity	Meaning	Value
Catastrophic	• Results in loss of life or destruction of equipment	A
Major	• Results in serious injury to persons or major equipment damage	B
Moderate	• Results in injury to persons or failure of significant operational processes or systems	C
Minor	• Affects normal operating procedures or performance	D
Negligible	• No significant impact to operational safety	E

Table 2: Safety Risk Severity Classification

Risk Likelihood	**Risk severity**				
	Catastrophic A	Major B	Moderate C	Minor D	Negligible E
Frequent (5)	Unacceptable	Unacceptable	Unacceptable	Review	Review
Occasional (4)	Unacceptable	Unacceptable	Review	Review	Review
Remote (3)	Unacceptable	Review	Review	Review	Acceptable
Improbable (2)	Review	Review	Review	Acceptable	Acceptable
Extremely improbable (1)	Review	Review	Acceptable	Acceptable	Acceptable

Table 3: Risk Tolerability Matrix

Tolerability	Explanation
Unacceptable	The risk is unacceptable and operations should not take place until sufficient major risk mitigating measures have been implemented to reduce risk to an acceptable level.
Review	The risk is of concern and risk mitigating measures should be put in place to reduce the level of risk to as low as reasonably practicable. Where further risk reduction / mitigation is not practicable or viable, the risk may be accepted, provided endorsement is given by management.
Acceptable	The risk is considered acceptable.

Table 4: Risk Tolerability Notes

4.7 Based on the risk assessment, the service provider should take appropriate mitigation measures to eliminate or reduce the level of risks associated with hazards to an acceptable level. Typical risk mitigation measures include:

a. cancelling the operation or activity because the risks exceed the benefits of continuing;

b. reducing the frequency of the operation or activity; and

c. taking action to reduce likelihood/ severity of the risk(s) by enhancing existing defences or introducing new defences.

4.8 A consistent and systematic approach, such as developing a hazard register to record identified hazards and how they are addressed, should be implemented to document the process of safety risk assessment and mitigation.

5. SMS FRAMEWORK – (3) SAFETY ASSURANCE

5.1 Safety assurance refers to processes and activities that a service provider takes to determine whether its SMS is operating according to its expectations or specifications.

3.1 Safety performance monitoring and measurement

5.2 A service provider should perform internal audits to ensure regulatory compliance and proper implementation of its SMS and safety-related operations and processes to meet its desired level of safety performance.

5.3 In addition, a service provider should establish lagging and leading SPIs relevant to its operations to measure and monitor its safety performance, and validate the effectiveness of its safety risk control measures. Where appropriate, safety performance targets (SPTs) and safety triggers should also be set for these SPIs. A service provider should be able to demonstrate how the SPIs together with SPTs and safety triggers support the service provider in achieving its safety objectives and management's decision-making. This could include developing new safety risk control measures to address deteriorating safety performance, or initiatives to achieve better safety performance.

5.4 *Lagging SPIs* refer to indicators that measure events that have occurred and are "outcome-based", e.g. number of wildlife strikes, or rate of runway incursion.

5.5 *Leading SPIs* refer to indicators that measure processes and inputs implemented to improve or maintain safety and are "activity- or process-based", e.g. number of inspections conducted, or number of recurrent training conducted.

5.6 *Safety performance targets (SPTs)* are desired achievements that the service provider sets with respect to its SPIs. An SPT may be set based on a reasonable level of safety improvement, e.g. 5% improvement from past 12-months average, or to achieve a certain level of safety performance, e.g. not more than 3 hours of unplanned downtime, or more than 50% of staff trained in safety risk assessment. For certain SPIs, it may also not be appropriate to set SPTs due to the possibility of undesirable outcomes, e.g. setting a target number of safety reports.

5.7 *Safety triggers* are established levels or criteria values that initiate or trigger a service provider to evaluate or take safety actions to address its safety performance. Such triggers are usually set based on out-of-limits or threshold figures which if exceeded, would be deemed as unacceptable safety performance.

3.2 The management of change

5.8 Changes such as organisational restructuring or the introduction of new procedures or new equipment may affect existing safety risk controls, or introduce new hazards into the operating environment. To manage these changes and minimise any adverse impact they may have on aviation safety, a service provider is to establish a change management process. This process

should include or incorporate processes for:

a. identification of the types of event or triggers that necessitates a formal change process;

b. assessment of who and what will be affected by the change;

c. hazards identification and risk assessment (HIRA) arising from the changes; and

d. development and proper implementation of an action plan to address the changes.

3.3 Continuous improvement of SMS

5.9 A service provider should also implement processes to continuously monitor and review the effectiveness of its SMS and where appropriate, identify areas for improvements. This may be done through activities such as internal audits, assessments, management reviews and evaluation of SPIs and SPTs.

6. SMS FRAMEWORK – (4) SAFETY PROMOTION

6.1 Safety promotion encourages a positive safety culture through training, education, effective communication and information sharing.

4.1 Training and education

6.2 A service provider should develop and implement a safety training programme for personnel at different levels and relevant functions in the organisation, including operational personnel, managers/supervisors, senior management and the Accountable Executive. The scope of safety training should include elements of the organisation's SMS and be appropriate to an individual's involvement in the organisation's operations and SMS to ensure that he/she is trained and competent to perform the relevant SMS functions or duties. The safety training programme may be part of a larger training programme for the service provider's personnel.

4.2 Safety communication

6.3 A service provider should develop and maintain means of safety communication to disseminate safety-related information within and, where necessary, outside its organisation. Such information could include its safety objectives, SMS processes, safety-critical issues and safety lessons. The effectiveness of such means of communication should also be reviewed periodically to ensure that the intended audience received and understood the information.

7. SMS INTEGRATION AND INTERFACES

7.1 An SMS may be integrated with other management systems such as quality management system, and human factor (HF) and error management systems

for better coordination and optimising of resources. Where appropriate, common platforms may be established to integrate the processes across different management systems, and minimise duplication or complication of work and resources. Examples of such include having a single hazard or risk register, and establishing a common safety/quality committee.

7.2 A service provider's SMS could be affected by both internal (e.g. internal corporate departments such as marketing, finance etc.) and external interfaces (e.g. with other organisations). A service provider should identify and manage these interfaces as part of its safety risk management processes, and develop collaborative risk control strategy to address any identified issues.

7.3 A service provider's SMS should also interface, where relevant, with the Singapore State Safety Programme (SSP) which is safety management at the State-level. Such interfaces could include providing or sharing safety data and information for the monitoring of safety performance and identification of aviation hazards and risks; and conducting joint projects or initiatives to mitigate these hazards and risks.

8. CONTACT INFORMATION

8.1 Should you have any queries relating to this AC, please contact CAAS at CAAS_Safety_Policy@caas.gov.sg.

APPENDIX A: EXPLANATION OF TERMS USED

Accountable Executive. *A single, identifiable person having responsibility for the effective and efficient performance of the service provider's SMS.*

Contractor. *An organisation holding a CAAS approval and engaged by another organisation to perform work that is within the scope approved by CAAS.*

Defences. *Specific mitigating actions, preventive controls or recovery measures put in place to prevent the realisation of a hazard or its escalation into an undesirable consequence.*

Error. *An action or inaction by an operational person that leads to deviations from organisational or the operational person's intentions or expectations.*

Hazard. *A condition or an object with the potential to cause or contribute to an aircraft incident or accident.*

Risk mitigation. *The process of incorporating defences or preventive controls to lower the severity and/or likelihood of a hazard's projected consequence.*

Safety. *The state in which risks associated with aviation activities, related to, or in direct support of the operation of aircraft, are reduced and controlled to an acceptable level.*

Safety data. *A defined set of facts or set of safety values collected from various aviation-related sources, which is used to maintain or improve safety.*

Safety information. *Safety data processed, organised or analysed in a given context so as to make it useful for safety management purposes.*

Safety Management System. *A systematic approach to managing safety, including the necessary organisational structures, accountability, responsibilities, policies and procedures.*

Safety performance. *A State or service provider´s safety achievement as defined by its safety performance targets and safety performance indicators.*

Safety performance indicator. *A data-based safety parameter used for monitoring and assessing safety performance.*

Safety performance target. *The service provider's planned or intended target for a safety performance indicator over a given period that aligns with the safety objectives.*

Safety risk. *The predicted probability and severity of the consequences or outcomes of a hazard.*

Serious injury. *An injury which is sustained by a person in an accident and which:*

a) requires hospitalisation for more than 48 hours, commencing within seven days from the date the injury was received; or

b) results in a fracture of any bone (except simple fractures of fingers, toes or nose); or

c) involves lacerations which cause severe haemorrhage, nerve, muscle or tendon damage; or

d) involves injury to any internal organ; or

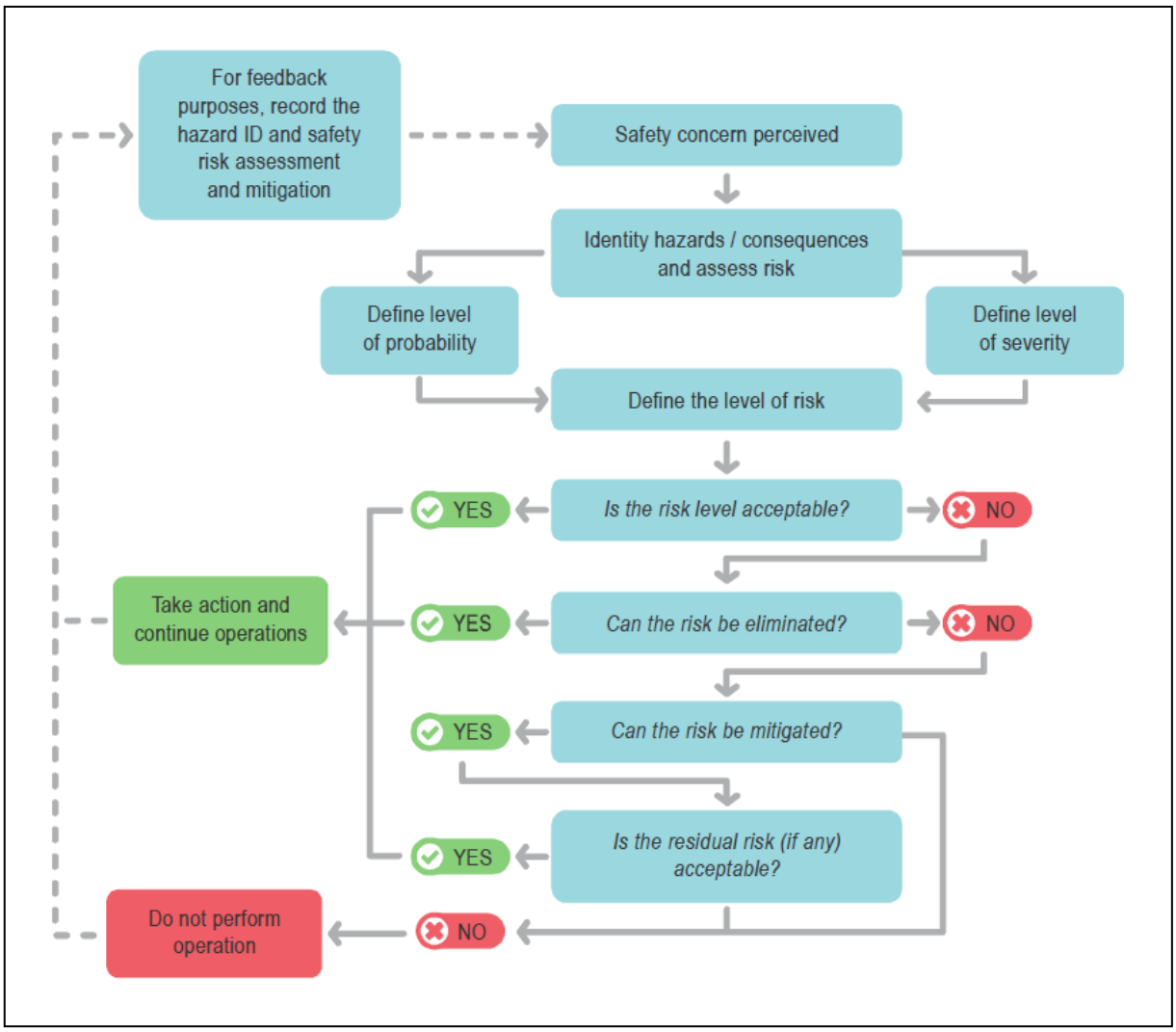
e) involves second or third degree burns, or any burns affecting more than 5 per cent of the body surface; or

f) involves verified exposure to infectious substances or injurious radiation.

State safety programme. *An integrated set of regulations and activities aimed at improving safety.*

Subcontractor. A third party organisation that is engaged by a CAAS-approved organisation to carry out the work under the responsibility of the CAAS-approved organisation.

APPENDIX B: SAMPLE RISK MANAGEMENT PROCESS FLOWCHART



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