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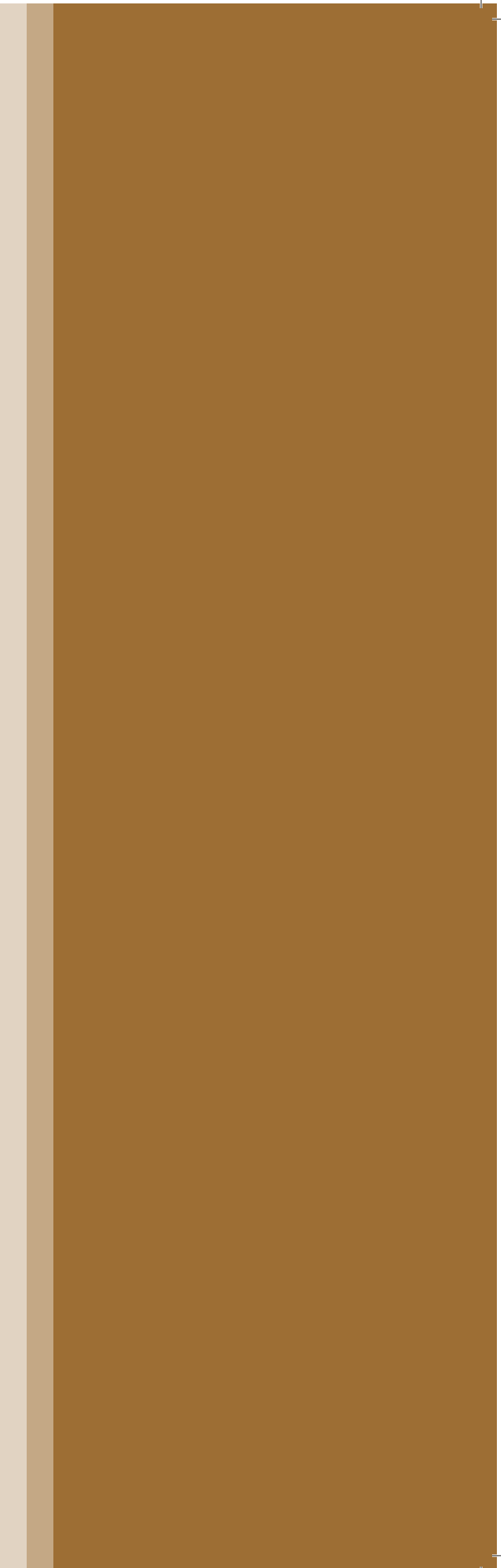
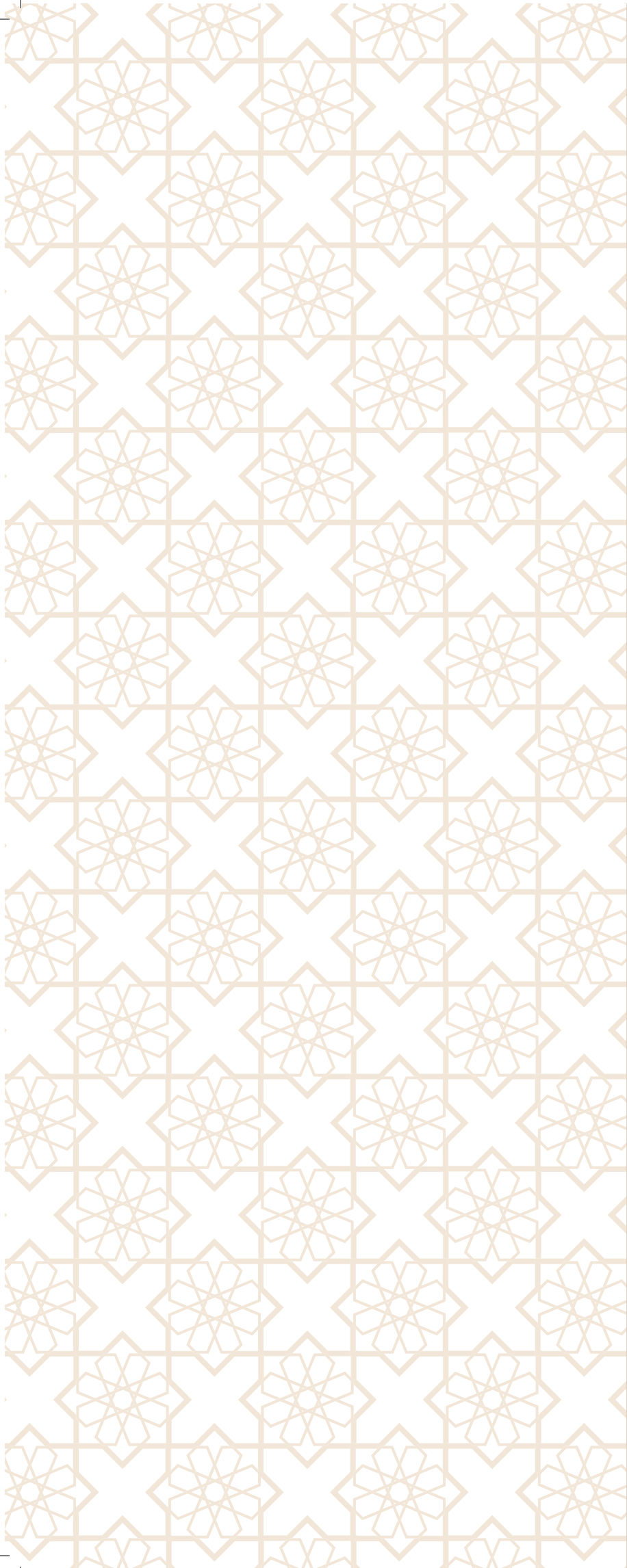
THE SUPREME COUNCIL FOR NATIONAL SECURITY

الهيئة الوطنية لإدارة الطوارئ والأزمات والكوارث

National Emergency Crisis and Disasters Management Authority

UAE OCCUPATIONAL HEALTH AND SAFETY MANAGEMENT SYSTEM (OHSMS) NATIONAL STANDARD

AE/SCNS/NCEMA 6000:2016

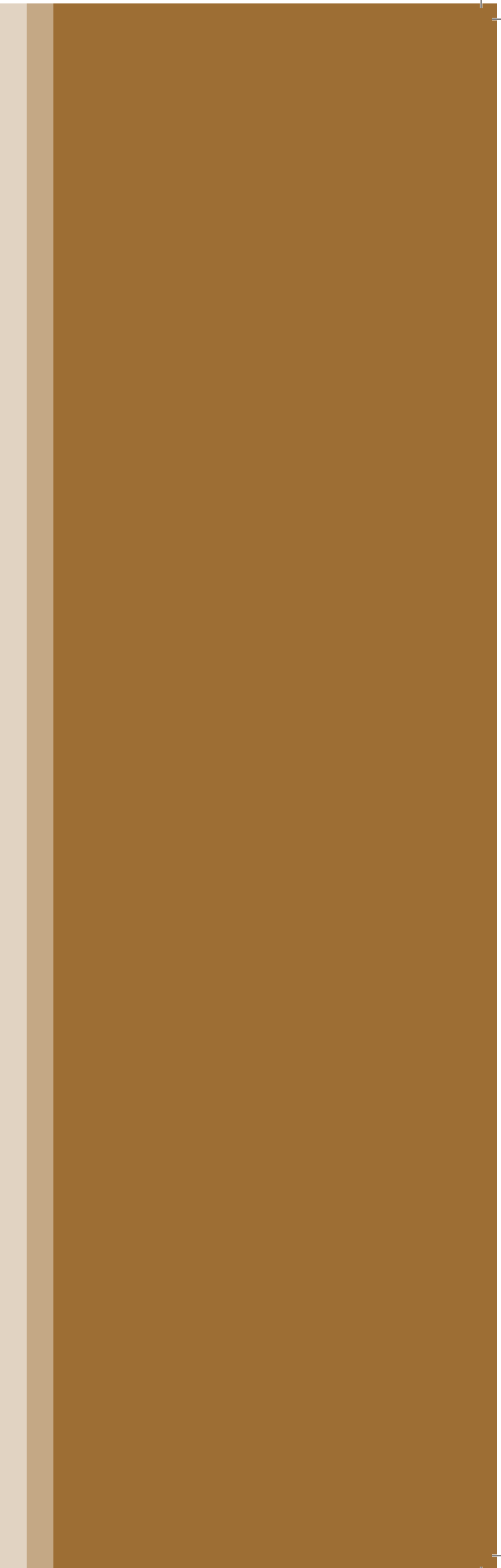
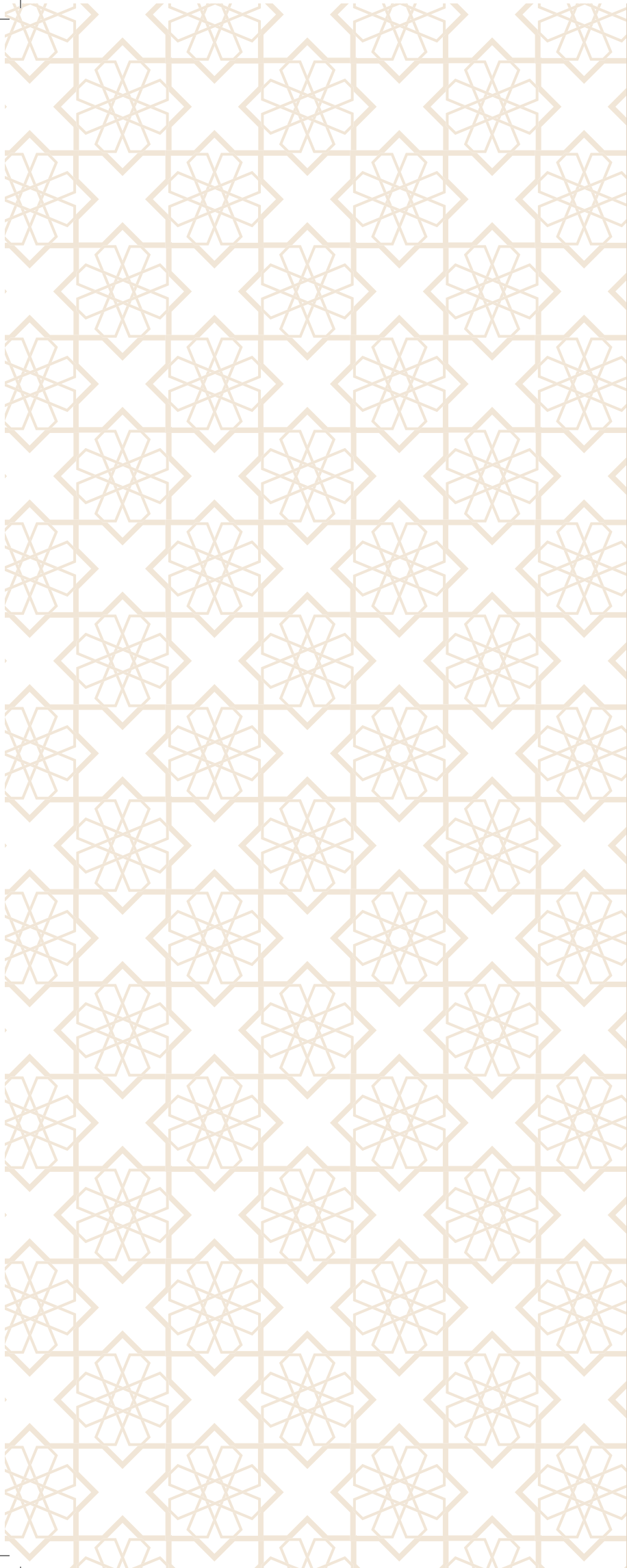




His Highness

Sheikh Khalifa bin Zayed Al Nahyan

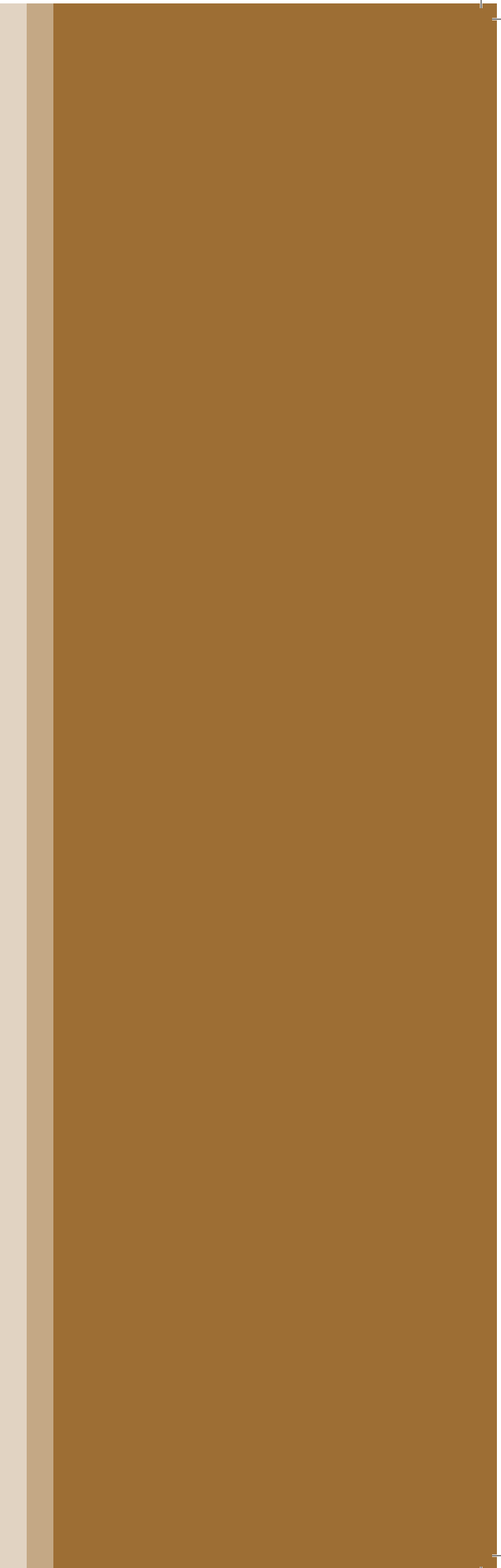
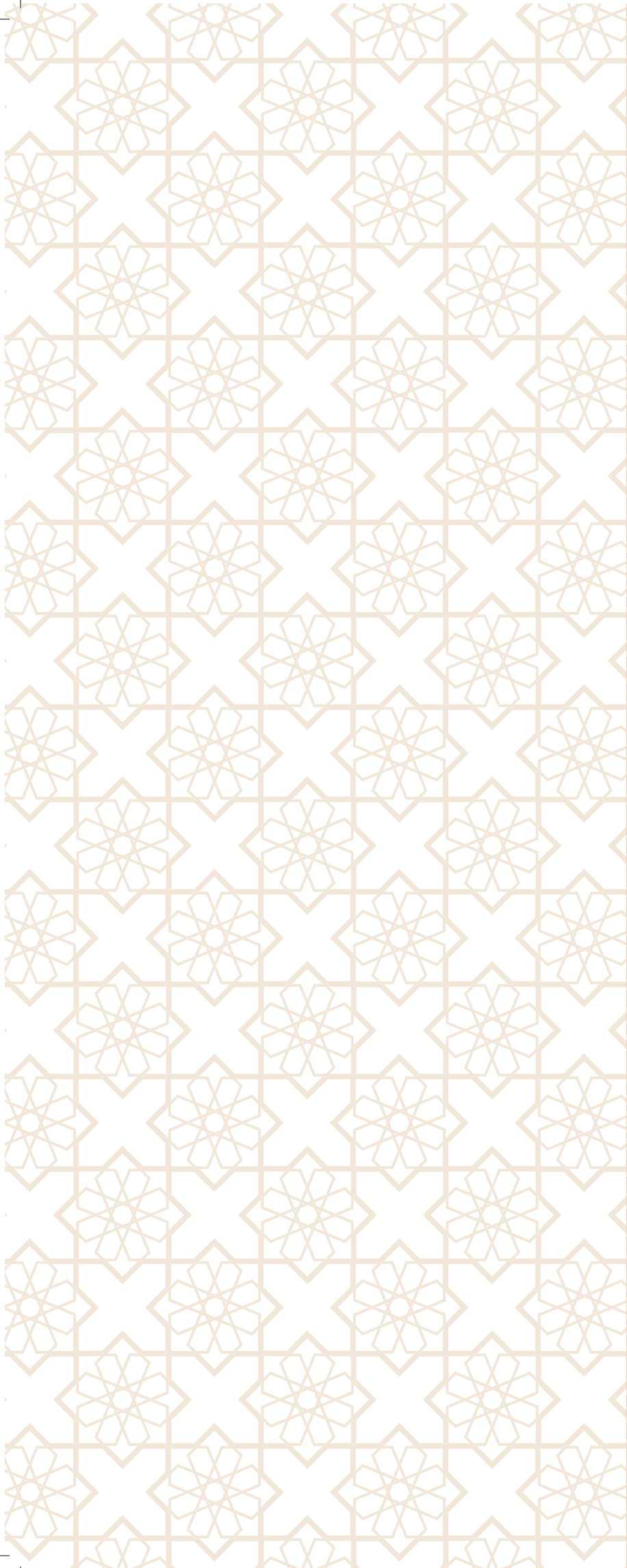
President of the United Arab Emirates
Chairman of the Supreme Council for National Security





His Highness
Sheikh Mohammed bin Rashid Al Maktoum

Vice President and Prime Minister and Ruler of Dubai
Deputy Chairman of the Supreme Council for National Security

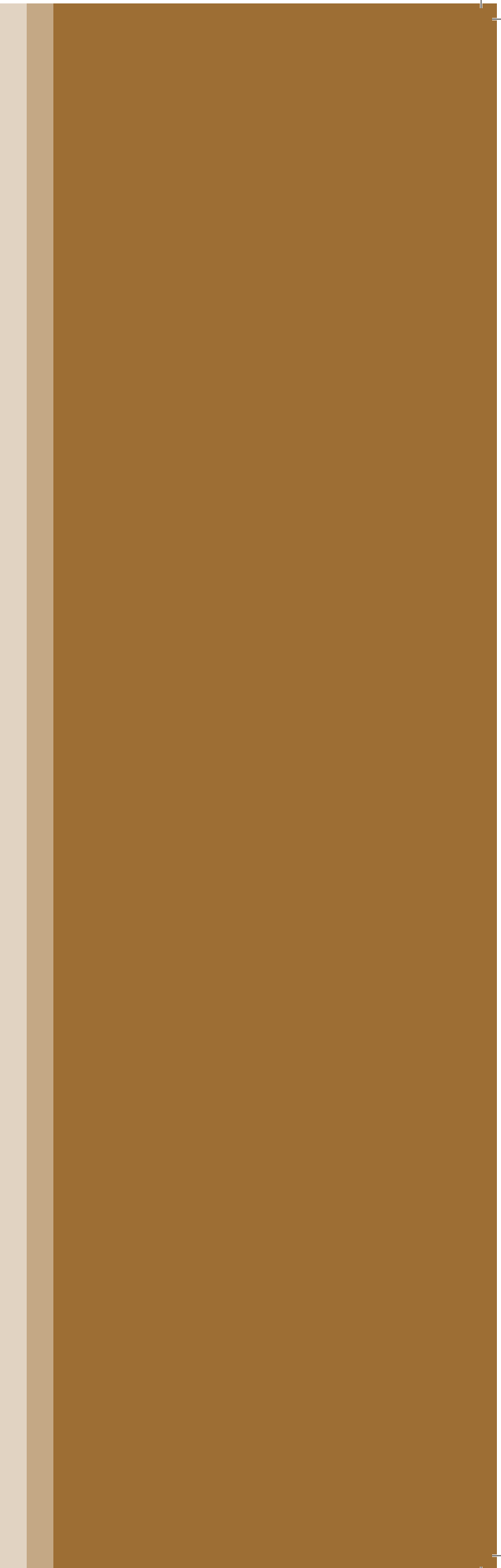
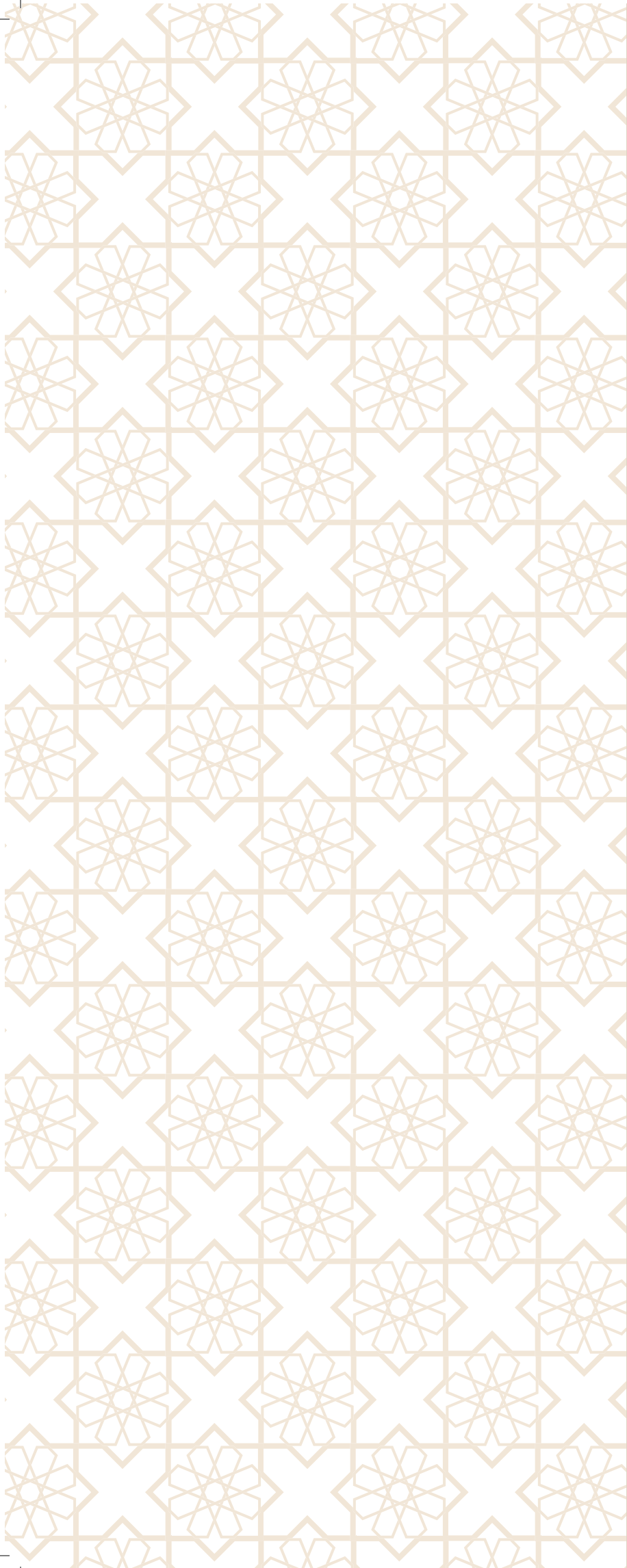




His Highness

Sheikh Mohammed bin Zayed Al Nahyan

Crown Prince of Abu Dhabi and Deputy Supreme Commander of the Armed Forces
Member of the Supreme Council for National Security





His Highness
Sheikh Tahnoon bin Zayed Al Nahyan

National Security Adviser

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1. Foreword_____

The United Arab Emirates (UAE) economy continues to expand year after year. This economic growth has driven the need for a robust labor force capable of filling critical jobs across multiple industries. To protect the health and safety of this expanding workforce, the UAE seeks to establish a standardized approach for managing occupational health and safety (OHS) risks.

The UAE has affirmed the importance of OHS through recent efforts at the individual, organization, and Emirate levels. We must continue to gather these efforts in a coordinated and systematic manner to reduce occupational health and safety risks, prevent workplace incidents and facilitate the integration of occupational health and safety management systems in the UAE. These efforts are combined under the Occupational Health and Safety Management System (OHSMS) National Standard (the Standard), AE/NSCS/NCEMA 71000 2016. The National Crisis Emergency and Disasters Management Authority (NCEMA) developed the UAE OHSMS Standard as part of its mandate to align and direct national OHS efforts. The Standard was developed based on research of international standards in occupational health and safety, study of incidents in the UAE, and with support of a nation-wide stakeholder community. The Standard provides OHS guidelines for all organizations in the UAE.

The adoption of the Standard by UAE organizations will sustain the benefits of a safe work place environment for businesses and individuals across the nation. As OHS risks are a shared responsibility of every organization, collaboration and partnerships among Government and private sector organizations are key to success. I am confident that our combined efforts will make implementation of this Standard a success towards achieving the UAE's OHS objectives and allow our nation's interests to thrive.

NCEMA Signature



2. Main Partners_____

UNITED ARAB EMIRATES
MINISTRY OF ECONOMY



الإمارات العربية المتحدة
وزارة الاقتصاد

UNITED ARAB EMIRATES
MINISTRY OF CLIMATE CHANGE
& ENVIRONMENT



الإمارات العربية المتحدة
وزارة التغير المناخي
والبيئة

UNITED ARAB EMIRATES
MINISTRY OF ENERGY



الإمارات العربية المتحدة
وزارة الطاقة

UNITED ARAB EMIRATES
MINISTRY OF HUMAN RESOURCES
AND EMIRATISATION



الإمارات العربية المتحدة
وزارة الموارد البشرية
والتوطين

مصلحة الإمارات للمواصفات والمقاييس
Emirates Authority For Standardization & Metrology



الهيئة الاتحادية للجمارك
Federal Customs Authority



دولة الإمارات العربية المتحدة
وزارة الداخلية
القيادة العامة للدفاع المدني



شركة أبوظبي للموانئ
ABU DHABI PORTS COMPANY



مركز أبوظبي للسلامة والصحة المهنية
ABU DHABI OCCUPATIONAL SAFETY AND HEALTH CENTER

أوشاد
oshad



هيئة حماية البيئة والتنمية
Environment Protection & Development Authority



موانئ دبي العالمية
DP WORLD



TIP
مجمع توارن الصناعي
Tawazun Industrial Park



هيئة تنظيم الاتصالات
TRA
TELECOMMUNICATIONS REGULATORY AUTHORITY



دائرة النقل
DEPARTMENT OF TRANSPORT



أدنوك
ADNOC



الهيئة الاتحادية للمواصلات البرية والبحرية
Federal Transport Authority - Land & Maritime



مكتب التنظيم و الرقابة
Regulation & Supervision Bureau



Julphar
الصناعات الدوائية
Gulf Pharmaceutical Industries

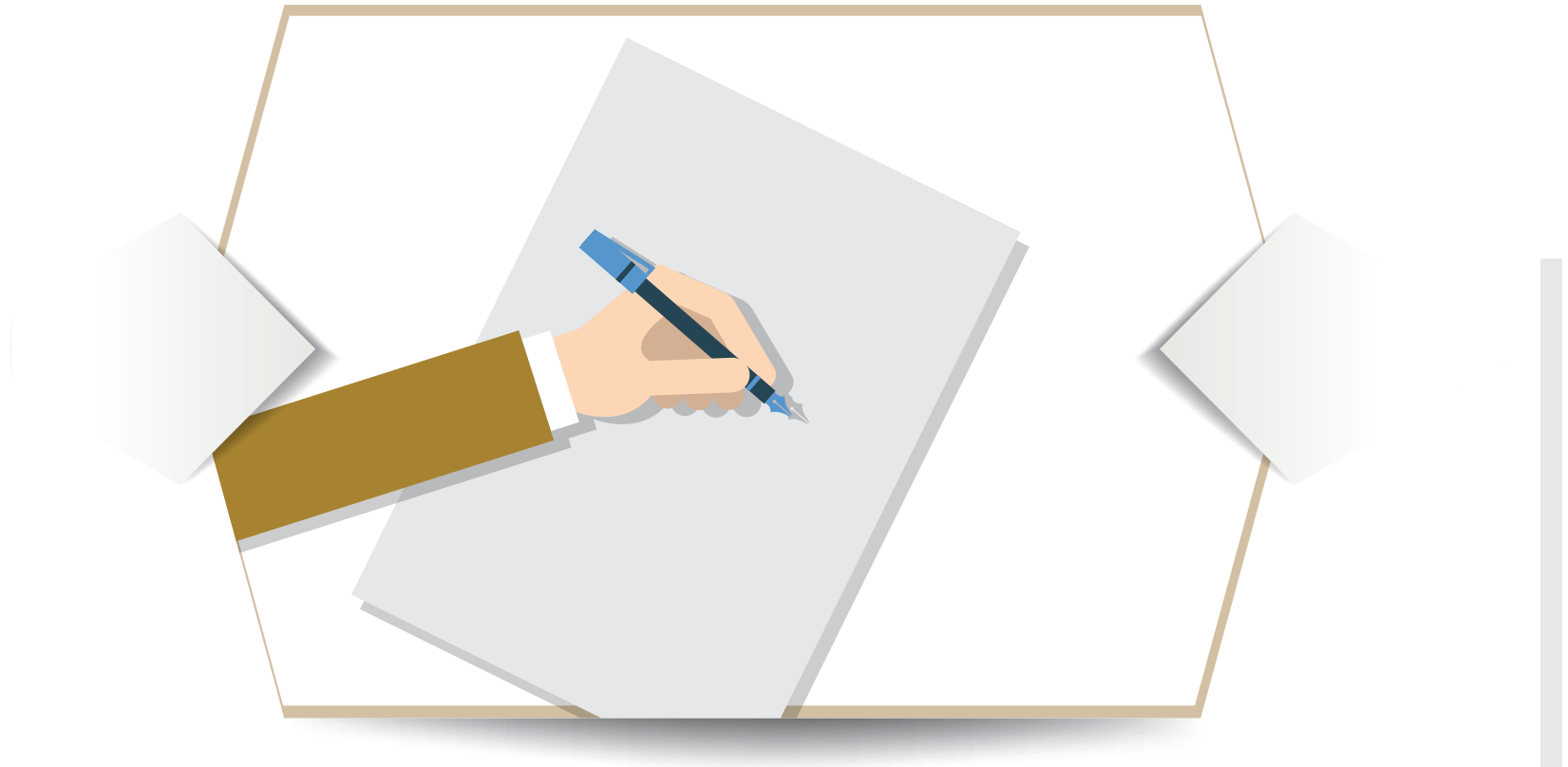
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Federal Authority for Nuclear Regulation



الهيئة الوطنية للبحث العلمي
National Research Foundation



حكومة الشارقة
دائرة التنمية الاقتصادية



3. Introduction_____

3.1 Background

Along with the expanding workforce of the UAE comes an increase in Occupational Health and Safety (OHS) risks in the workplace environment. Sound OHS management controls are required to prevent the causes and reduce the costs of these risks and corresponding OHS incidents.

Research of incidents in the UAE shows that OHS related incidents in the UAE typically have three primary causes: lack of proper safety governance, inadequate safety planning, and poor safety culture.

Sample Scenario

A construction worker was killed and four others were injured when a concrete block fell from a height and led to a collapse of a wall at a construction site. The worker had been working with the company for three weeks. The investigation found that the incident was caused by a lack of safety protocols used at the construction site, a lack of supervision and a lack of knowledge of safe working at heights.

- I. OHS related incidents that are caused by lack of proper safety governance commonly occur due to (i) a lack of supervision at the operational level, in particular management of contractors and subcontractors; or (ii) the absence of mature safety systems to ensure appropriate governance of the OHS management system across all facets of operations.
- II. Incidents from inadequate safety planning have root causes in conducting insufficient OHS risk assessments. These risks could be associated with performing tasks, managing contractors, or managing the operating environment and its changes.
- III. Incidents that result from poor safety culture are commonly due to (i) poor safety attitudes and behavior of staff at an operational level; and (ii) lack of supervision and safety awareness.

Most regulatory authorities for high hazard industries have developed safety management system requirements specific to their own industries. For example, oil and gas companies typically have a mature OHS system. The UAE has progressed significantly to prevent OHS risks in the Emirates. The Abu Dhabi OHS Center and Dubai Municipality are two examples of strong OHS oversight programs. However, the level of OHS system development varies tremendously across organizations, industries and within the UAE. Therefore, there is a need for a standardized approach to OHS that can be used by all organizations and industries in the UAE.

3.2 Purpose

The United Arab Emirates (UAE) Occupational Health and Safety Management System (OHSMS) National Standard (the Standard) specifies the requirements for an organization to establish, implement and maintain an OHSMS to manage OHS risks to as low as reasonably practicable.

The intent is to help organizations develop a health and safety management system in accordance to the scope and the context of their operations. It also may serve as a leadership and management tool to enhance and improve compliance with relevant laws and regulations, and ensure that the OHS objectives in an organization are achieved. This standard intends to drive OHS performance to continually improve and ensure that OHS risks are addressed in a systematic manner. It is important to institutionalize OHS management and integrate it into the organization's overall business processes.

The objectives of the OHSMS Standard are summarized as follows:

- Define the required OHS strategy and OHS policy for an organization operating in the UAE;
- Provide guidelines for an organization to set up an OHS management system with roles and responsibilities in accordance with established procedures; and
- Provide an OHS risk management methodology to identify, assess, control and monitor OHS risks, including the prevention and response to workplace incidents.

3.3 Scope and Applicability

This OHSMS Standard defines the requirements for an OHS management program at the organizational level. The scope and applicability of the standard are as follows:

- The Standard applies to government and private organizations, as well as international organizations operating in the UAE;
- The Standard applies across the entire UAE, excluding organizations in the free zones;
- The requirements specified in the OHSMS Standard are intended to be applicable to all organizations of all types of industries, sizes, geographical locations, cultures and communities within the UAE;
- This Standard may apply as advisory, serving as a guideline in setting up the OHSMS in an organization. The Standard may also serve as a mandatory requirement. For example, a contract can include this Standard as a clause with sub-contractors. In this Standard, "shall" is used for a mandatory actions and "should" is used for advisory actions;
- It enhances compliance with existing Federal, Local, Ministerial and other laws/regulations, in accordance with Decree-Federal Law No.2 of 2011, Articles 21 and 22;
- Employees and workers of the organization, as well as, the contractors and sub-contractors to the organization are responsible to follow the OHSMS set by the organization;
- The requirements for the OHS system varies with the degree of the OHS risk exposure of the organization, ranging from low to high hazards. Organizations should also adhere to the specific requirements and relevant Authority in their Sector, to protect their staff, workers, and the public from any adverse impacts that may result from their activities;
- For high hazard industries, specific codes of practices should be referenced for guidance on managing the risks of specific hazards, for example, ionizing radiation.

3.4 Document Organization

The Standard is organized into the following sections and appendices;

Figure 1: Document Organization

Section Name	Description
Introduction	Provides the background, purpose, scope and applicability of the Standard and discusses how the Standard is organized.
OHSMS Framework	Provides a description of the OHSMS Framework. The Framework defines each of the five components of the Standard: Governance, OHS Culture, Personnel Management, OHS Management System and OHSMS Performance Management. Components of the framework work together to establish an effective OHSMS aligned with the purpose of the Standard.
Governance	This section outlines the activities required to set up a governance structure around health and safety. Roles and responsibilities are also described. It is divided into four sections as Policy, Objectives, Resourcing and Regulatory Compliance. • OHS Policy: Describes the organization's commitment to establish, implement and maintain an OHSMS. Management should define OHSMS policy and ensure the implementation. • Objectives: Provides the objectives to establish, implement and maintain a documented OHSMS. Objectives may differ at management levels and functions. • Resourcing: Outlines resource required to ensure that resources are available to establish, implement and maintain the OHSMS. Roles and responsibilities and accountabilities are also described. • Regulatory Compliance: Explains procedures to identify and have access to all legal and other requirements relating to OHSMS.
OHS Culture	Outlines the requirements on how to achieve an OHS risk aware culture and structures and processes for effective consultation with stakeholders. It includes areas such as involvement of stakeholders, accountability, transparency, continuous improvement, and responsiveness.
Personnel Management	Outlines Health and Fitness, Fatigue Management, Training and Awareness: • Health and Fitness: - o Describes the requirements for processes and programs to ensure employees (and contractors and sub-contractors) are in sufficient good health and fitness. - o Discusses the effective processes and programs to ensure employees (and contractors and sub-contractors) are not working under the influence of drugs or alcohol. - o Describes the effective processes and programs to ensure employees (and contractors and sub-contractors) are not subject to levels of fatigue that may compromise their ability to perform their work safely and competently. • Training and Awareness: Describes requirements for training and awareness throughout an organization.

OHS Management System: OHS Risk Management Methodology

Describes the Standard as using an integrated systems approach to OHS. This section defines the risk management methodology, including defining the system, setting the risk criteria, identifying the OHS hazards, analyzing, controlling and reporting the OHS risks:

- Define the System: Defines system boundaries, and how the system, subsystems, interfaces and other systems interconnect.
- Define the Risk Criteria: Describes the criteria to be used to evaluate and determine the significance of OHS risks.
- Identify the OHS Hazards: Defines hazard identification process as finding, recognizing and recording the OHS hazards. It discusses the importance of an organization to review and to consider all human, organizational, system, and operations environment elements that could negatively impact the OHSMS.
- Analyze the OHS Risks: Discusses various OHS risk analysis techniques.
- Control the OHS Risks: Defines OHS risk treatment elements and control methodologies.
- Verify and Report the OHS Risks: Defines the risk register and how to verify and report OHS risks.

OHS Management System: OHSMS Management

This section defines the detailed requirements in order to manage and implement an OHSMS, including Management of Change, Procurement and Contract Management, Incident Investigation and Reporting, Corrective Action and Prevention, Engineering and Operational Safety Systems and Emergency Management.

- Management of Change: Outlines the requirements to establish suitable and sufficient processes to ensure the safe management of change.
- Procurement and Contract Management: Describes the requirements to establish processes for regular review and recording of the performance of contractors and subcontractors. This includes conducting audits and review of contractor OHS performance.
- Incident Investigation and Reporting: Outlines the requirements to establish procedures for reporting and investigating incidents and accidents.
- Corrective Action and Prevention: Outlines the requirements to establish, implement and maintain procedure(s) for dealing with actual and potential nonconformity (ies) and for taking corrective and preventive action.
- Engineering and Operational Safety Systems: Outlines the requirements to establish processes to ensure the integrity of structure, equipment and systems in accordance with safety requirements for engineering and operational systems.
- Emergency Management: Outlines the requirements to ensure a secure and a resilient organization, to prevent, protect, mitigate, respond and recover from OHS related risks.

OHSMS Performance Management

This section outlines requirements for managing performance of the OHS management system. The elements of the OHS performance system are described as follows:

- OHSMS Performance Indicators: Outlines the requirements to establish OHSMS key performance indicators (KPI), set targets and regularly review performance against these KPI's.
- Internal audit and review: Describes the requirements to establish processes for conducting internal audits of the OHSMS at planned intervals.
- Management review: Outlines the requirements to establish processes for conducting management reviews of the OHSMS at planned intervals.

Document Control

The document control section describes how the OHSMS related documents in an organization should be maintained.

References

Outlines the references used in the development of the Standard.

Glossary and Acronyms

Provides the terms and their definitions used in the Standard.



4. OHSMS Framework_____

In collaboration with key stakeholders across the UAE, NCEMA developed the OHSMS Framework. This framework informed the structure of the requirements in this Standard, and can also serve as a reference guide for organizations to establish and implement a comprehensive OHSMS.

The OHSMS Framework describes the five core elements of OHSMS, which include the following:

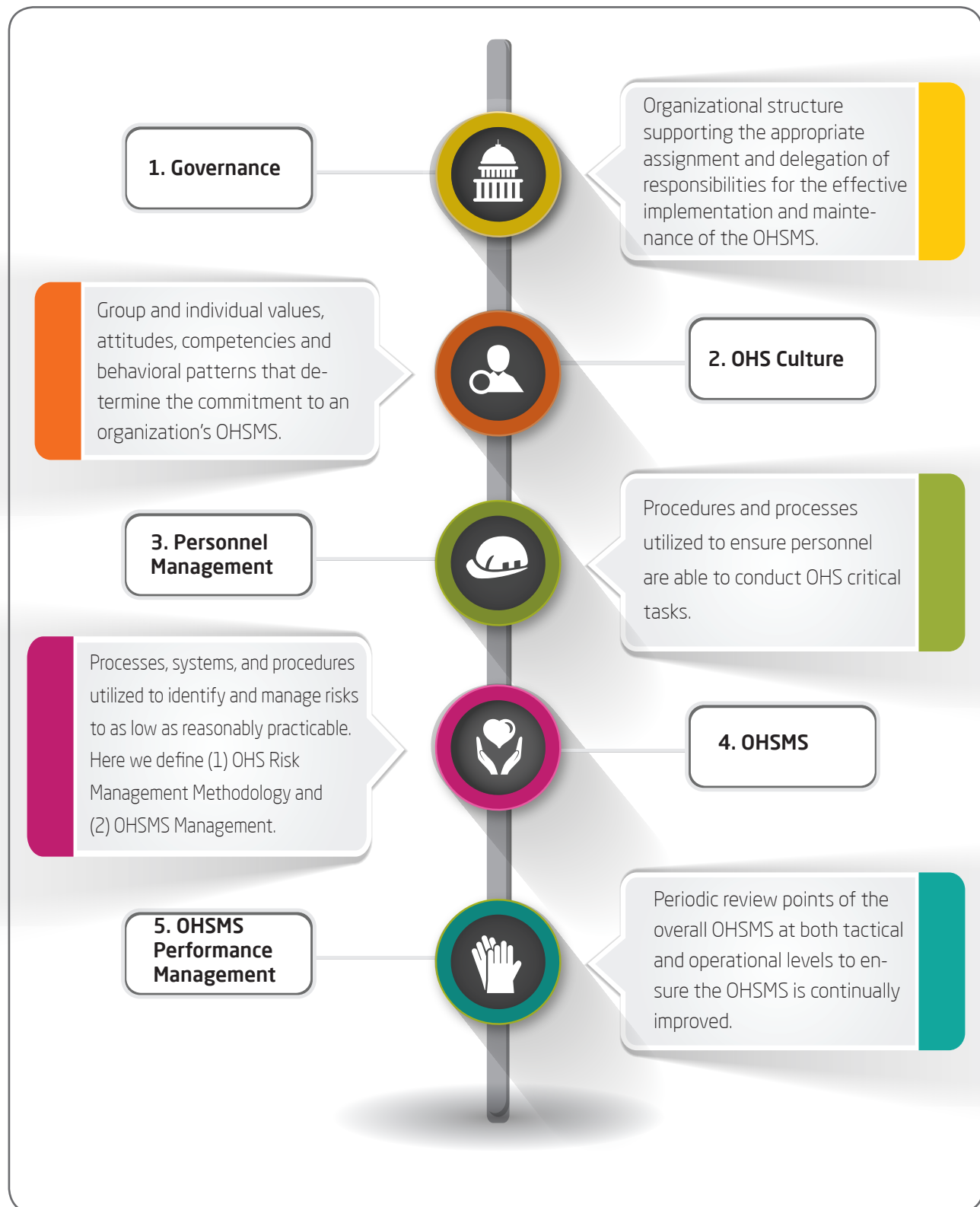


Figure 2: OHSMS Framework

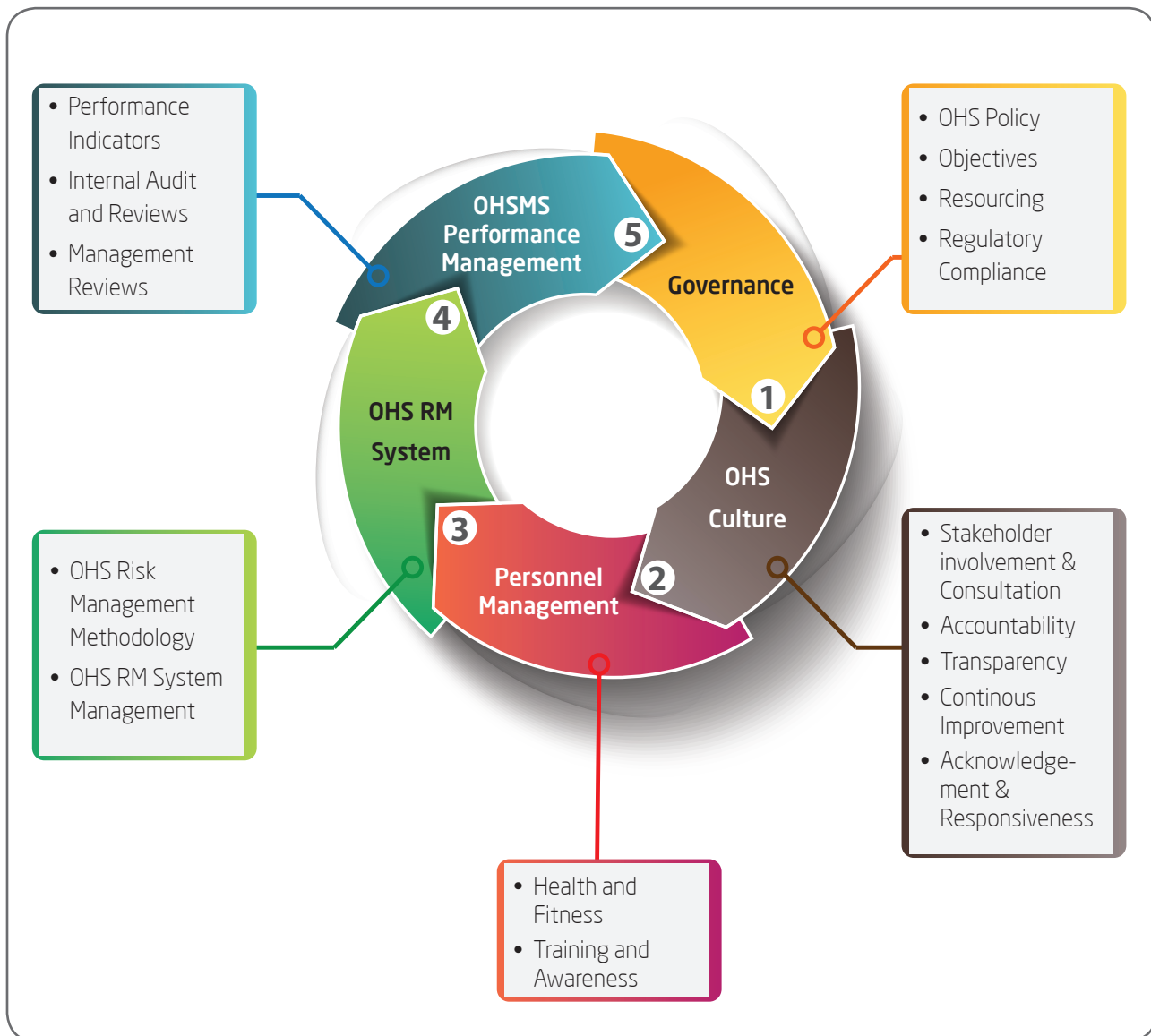


Figure 2 illustrates how the five components of the framework work together. The framework is a risk-based, structured, management framework, yet highly adaptable and scalable.

Some of the benefits of implementing the OHSMS framework components are:

- Reduce corporate risks and liabilities;
- Improve business efficiency;
- Improve management of OHS and social impacts; and
- Improve worker communication and community health and safety.



5. Governance_____

The organization shall establish a clear statement of responsibilities for setting required standards for OHS risks for the organization, implementing the OHS risk standards, and monitoring risk performance. Roles and responsibilities assign accountability to establish, implement, and maintain the OHSMS.

The occupational health and safety organization shall include: (1) Formal committee establishment within the organization which manages the OHSMS. It should have a clear link to decision makers and enable ownership of the health and safety processes. (2) Specific staff can be assigned to ensure a robust, integrated health and safety system is in place through facilitation of efficient safety interface coordination and consultation. Health and safety is the responsibility of each individual in the organization and not only of those specific staff assigned facilitation. (3) Temporary or permanent safety committees can be established, depending on their need and purpose to review and support safety procedures and ensure that they are integrated at all levels and in the daily activity cycle of an organization.

5.1 OHS Policy

It is required for the organization to have an OHS policy to demonstrate its commitment to OHS performance. The policy shall clearly state the OHS objectives. It needs to provide elements of the OHSMS framework for establishing OHSMS in the organization.

5.1.1 Management shall define OHS policy and ensure that the policy:

- ▶ Considers the nature and scale of organization's OHS risks in the workplace environment;
- ▶ Includes a management commitment to manage OHS risks and for performance management of the OHSMS;
- ▶ Demonstrates the commitment to comply with applicable legal requirements; and
- ▶ Sets the OHSMS objectives for the organization.

5.1.2 The policy shall be:

- ▶ Documented, implemented and maintained;
- ▶ Communicated to all persons working under the control of the organization;
- ▶ Available to interested parties; and,
- ▶ Reviewed periodically and remains relevant to the organization.

5.2 Objectives

The objectives of the OHSMS shall consider the organization's operational environment, including management of health and safety related risks during operations throughout the entire product life-cycle. It shall set the boundaries on what is applicable and what is in scope and out of scope. The OHSMS objectives shall be consistent with the OHS policy and be measurable.

5.3 Resourcing

Management shall demonstrate its commitment by ensuring availability of resources to establish, implement and maintain the OHSMS. Resources include human resources, organizational infrastructure, technological, and financial resources.

Responsibilities and reporting structure shall include clear statements describing of the OHSMS, implementing the OHSMS, and monitoring the performance of the OHSMS.

The organization shall appoint a member of management with specific responsibility of OHS, irrespective of other responsibilities and with defined roles and authority to ensure that the OHSMS is established, implemented and maintained in accordance with this Standard.

The organization shall ensure that persons in the workplace take responsibility for aspects of OHS over which they have control, including adherence to the organization's applicable OHS requirements.

5.4 Regulatory Compliance

Regulatory compliance should cover elements as follows:

All persons conducting a business have a responsibility to provide a safe and healthy workplace for their staff and workers and those that visit their workplaces;

An organization shall establish, implement and maintain procedures to identify, have access to, and assess the applicable legal and regulatory requirements related to the OHSMS;

An organization shall consider legal and regulatory requirements related to OHSMS in establishing, implementing and maintaining the OHSMS;

An organization shall document OHS related information and keep it up to date. New variations to legal and regulatory requirements should be considered and communicated; and In this Standard, "shall" is used for a mandatory actions and "should" is used for advisory actions.



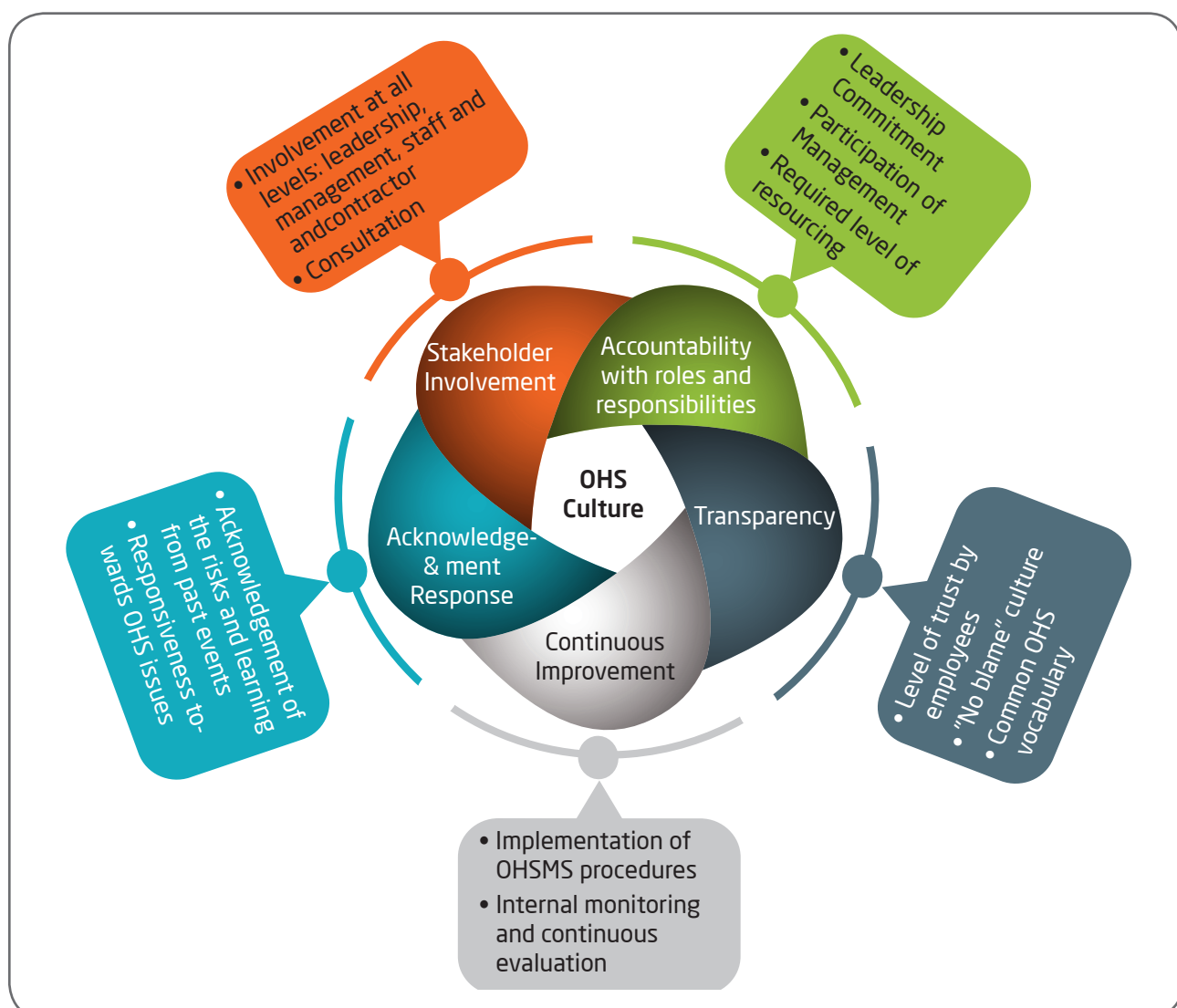
6. OHS Culture_____

An occupational health and safety culture in an organization needs to be created where effective OHS risk management is integral to operations and a way of work in the organization. Behavior of individuals and the collective ability to identify, understand, discuss and take actions against OHS risks are demonstrations of OHS culture. The integration of OHS into other systems of management and operations within the organization demonstrates the maturity of the OHS culture within an organization. An organization's communication channels shall be used to embed OHS culture, within an organization.

Success of an occupational health and safety risk management system requires (1) an informed culture in which those who manage and operate the system have current knowledge about the human, technical, organizational and environmental factors that determine the safety of the system as a whole; (2) a reporting culture in which people are willing to report errors and near misses; and (3) a just culture with 'no blame' where an atmosphere of trust is present and people in the organization are encouraged to provide essential safety-related information.

There are five elements required for an organization establishing an OHSMS to establish a successful health and safety risk-aware culture. Figure 2 illustrate the elements.

Figure 3: OHS Culture



6.1 Stakeholder Involvement

Communication identifies processes for circulating safety information and procedures within the organization and other stakeholders. The stakeholder interface presents the requirements to establish processes with the other stakeholders.

A risk aware culture is achieved by involvement of all stakeholders, in all stages of the OHS system. Involvement is required at leadership, management, staff and contractor levels. Specifically, in high risk organizations, a high level of dedication from management is required to actively promote OHS risk-aware culture.

Based on the recognition that worker input and participation improves decision-making in health and safety matters and assists in reducing work-related injuries and disease, it is necessary to consult with staff, workers and contractors. Consultation is necessary with staff in an organization, plus anyone else who carries out work for your business.

A safe workplace is more easily achieved when everyone involved in the work communicates with each other to identify hazards and risks, talks about any health and safety concerns and works together to find solutions. This includes cooperation, consultation and communication. The objective of consultation is to understand risks and communicate information related to risk. Clear communication paths should be established both internally and externally. Internal communication involves staff and workers, whereas external communication can be between the organization, contractors and relevant stakeholders.

In organizations where it may not be reasonably practical to consult each worker individually, health and safety representatives or committees may be more appropriate. A health and safety committee brings together workers and management to assist in the development and review of health and safety policies and procedures for the workplace.

6.2 Accountability

An appropriate degree of accountability must be given to relevant parties, with establishment of health and safety roles and responsibilities, in an organization. Involvement and participation of management is required. Adequate level of resourcing should be committed to OHS.

6.3 Transparency

It is key to have transparency in communication in OHS risk management issues and the lessons learnt. Employees' perception on the level of trust in an organization and "no blame" culture must be established. Vocabulary of OHS terms must be known and published in an organization. Shared OHS vocabulary is a key element of the transparent communication.

6.4 Continuous Improvement

Emphasis must be given on continuous improvement. This should include the implementation of OHS risk management procedures and learnings from past events. Internal monitoring and continuous evaluation of safety processes are required. Established processes need to allow for continuous improvement of OHSMS, through collection of relevant data from safety performance information. Based on the amount of change and growth in the organization overtime, the degree of continuous learning and improvement changes.

6.5 Acknowledgement and Responsiveness

Acknowledgement and responsiveness towards OHS issues secures the implementation of the OHSMS. It is important to acknowledge the risks and learnings from past events. Effective response to OHS issues is necessary at all levels of an organization.



7. Personnel Management _____

7.1 Health and Fitness

Training to improve employee awareness of health and fitness should be organized. Employee wellness programs for all employees is one example.

Medical surveillance to identify conditions that may affect a worker's competency is required periodically. Maintenance of the health and fitness of workers must be ensured through a periodic physical/medical exam.

The nature of workplace hazards that should be considered depends on the nature of the activities of the organization. Specific health issues may arise from working with: dangerous machinery, pressure systems, electrical systems, hazardous substances, lifting and manual handling, and handling radioactive isotopes.

Management of stress at work is an example where OHS personnel management control measures may be appropriate to identify early warning signs that stress is affecting staff.

An organization should develop a drug and alcohol management program that includes:

- A drug and alcohol policy that sets out the objectives of the organization, with respect to drug and alcohol management in the workplace; and
- Procedure(s) for the provision of information and education for workers in relation to the drug and alcohol management program.

An organization should develop a stress and fatigue risk management program. When preparing a stress and fatigue risk management program, an organization should consider, and assess, any stress and fatigue-related risks to safety arising from factors, including the following:

- Scheduling of work and non-work periods, including time-on-task and rest opportunities in shifts and the total period of time in which work is being carried out;
- On-call arrangements and extended hours of work, including overtime;
- The impact of work scheduling and relief practices generally on social and psychological factors that may impact performance and safety;
- Physiological factors arising out of work practices affecting workers, such as the effect on worker alertness and recovery of the time when work is undertaken, the length and frequency of breaks, commuting time, circadian effects, extended wakefulness and chronic sleep loss effects;
- Variations in shifts and rest periods that may be required by different work requirements and suitability of rest environments; and
- The physical workplace environment in which work is to be carried out, including climatic conditions, noise, vibration and fumes.

An organization's fatigue risk management program must establish and maintain documented procedures to manage, as low as reasonably practicable, fatigue related risks, including:

- 1 Specified work scheduling practices and procedures that provide for:
 - a. Safe hours of work;
 - b. Sufficient periods of time between shifts; and
 - c. Sufficient workers to be available to meet demands for relief arrangements; and
- 2 Provisions for monitoring of hours of work, in particular:
 - a. Procedures for monitoring how actual hours of work of safety workers compare with planned hours and
 - b. Provision of appropriate education and information in relation to the identification and management of fatigue risks.

7.2 Training and Awareness

An organization shall develop an OHS training program to ensure that the OHSMS roles and responsibilities are clearly defined and workers understand how to implement their duties under the OHSMS. Training shall improve the knowledge and skills required for the workforce to implement their OHS duties and awareness should inform the workforce of the critical aspects of OHSMS.

The training program shall cover identification of qualifications, induction, ongoing training on work practices, procedures, policies, standards, work instructions and specified hazards and control measures, to ensure workers carry out their work safely.

Consistent response to OHS risks can be improved through training and communication. When identifying the OHS training needs of the organization, capabilities, training, knowledge and experience of the workers should be taken into consideration, ensuring that the demands of the work do not exceed their ability to carry out their work without OHS risks impacting themselves and others.

Training Needs Assessments	Identify the OHSMS training needs of an employee in accordance to their job description and OHS requirements;
Training and Awareness	Develop training and awareness programs suited to training needs analysis; and
Competency of Trainer	Ensure trainers are competent to deliver OHS training.



8. OHSMS

The OHSMS is comprised of two elements, including (1) OHS Risk Management Methodology and the (2) OHSMS Management.

8.1 OHS Risk Management Methodology

An integrated systems approach to OHS is necessary to ensure workplace safety in any organization. The workplace system is defined as: people in the workplace (as well as the public that could be impacted), operational processes and activities in the workplace, technology and hardware or equipment used by workers, and the infrastructure in place that supports the organization's operation. OHS workplace risks need to be identified, evaluated, and controlled in the entire workplace. This also includes the system lifecycle during product development and manufacturing or operations.

A successful OHSMS includes a set of management and engineering processes that ensure OHS risks are managed throughout the lifecycle of a project, a program or an activity. This includes ensuring OHS risks are identified, assessed and managed to as low as reasonably practicable from the conceptual phase of a system, through the detailed design, construction and operation phases, as applicable.

The safety lifecycle must be integrated in to the various stages of a project or a program. Primary safety activities in an organization include, but are not limited to the following: developing a system safety program, reviewing contractor and sub-contractor safety programs, developing safety design criteria, implementing a hazard tracking and risk resolution system, conducting safety design reviews, conducting safety analysis, identifying personal protection equipment, performing safety tests on the system, conducting safety training and awareness, auditing the safety program, and participating in incident investigations. From concept definition to operations, the safety life cycle must be integrated into the business operation, as appropriate.

Many organizations use the Plan-Do-Check-Act process to help manage OHS programs. Figure 4 illustrates the process.

Figure 4: Plan-Do-Check-Act Cycle



1. "Planning" is the stage where the necessary processes are defined for delivery of results stated in the OHS policy. A number of important elements are specified to set the occupational health and safety policy and creation of plans and organizational capacity to realize that policy.
2. "Do" is the stage where the processes are implemented and where the analysis of hazards and effects are done, leading to planning and implementation of the plans in order to manage the health and safety related risks.
3. "Check" is the stage where processes are measured against objectives stated in the OHS policy, the controls on the effective performance of those steps are established, reviewed and reported.
4. "Act" is the stage for correction and continuous improvement of the performance. A number of feedback loops are needed to be specified to see how the health and safety information gained should be coordinated.

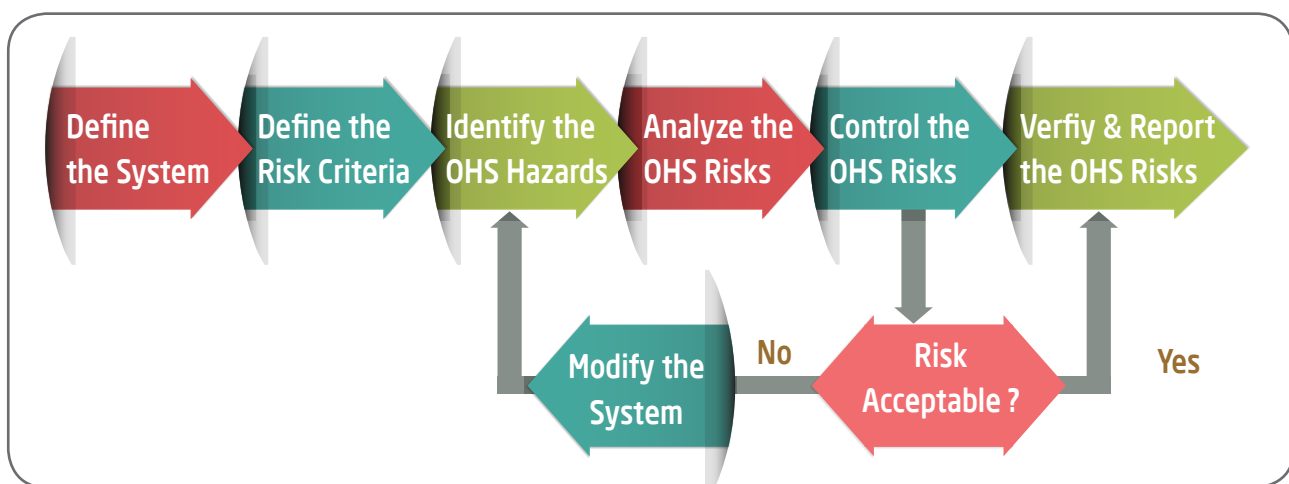
Risk Management plays a critical role in the OHSMS Standard. Figure 5 illustrates the methodology. Managing workplace health and safety risks is an ongoing process, during all work activities. The OHS Risk Management Methodology can be used in several circumstances. Some examples are: starting a new business or purchasing a business; changing work practices, procedures or the work environment; purchasing new equipment or using new processing materials; planning to improve productivity or reduce costs; new information about workplace risks becomes available; responding to workplace incidents or incidents and responding to concerns raised by workers, health and safety representatives or others in the workplace.

It is also important to use the risk management approach when designing and planning new products, processes or places used for work. It is often easier and more effective to eliminate hazards before they are introduced into a workplace by incorporating safety features during the design stage.

Consultation with workers and their health and safety representatives is required at each step of the risk management process. By drawing on the experience, knowledge and ideas of staff and workers, an organization is more likely to identify all hazards and choose effective control measures.

The OHS Risk Management methodology is a closed-loop process that identifies workplace hazards, analyzes the hazards and determines the risk. Risk controls are evaluated to determine that risks are sufficiently controlled or if those controls need to be modified. This process combines management oversight and engineering analysis, which uses a comprehensive, systematic approach to manage the OHS system risks.

Figure 5: OHS Risk Management Methodology



As a first step, the objectives of the risk management system and the boundary conditions need to be defined for the system. Clearly defining the scope and level of protection desired is critical at the beginning of the risk management process. The system should be defined comprehensively, including: how the system operates, assets involved within the system, hardware and equipment used, software used in system operations; and how people and the environment interact with the system. The system should be described in sufficient detail that system hazards can be easily identified.

Risk criteria is defined as how risk is defined and accepted by the organization and how much risk the organization is willing to accept (risk appetite). The OHS risk criteria will be different according to the industry, size and nature of the operations for each organization and is unique for that organization.

Then hazards are identified. The hazard identification process can use a brainstorming technique, where as many hazards as are possible and credible are identified. Results are summarized in a preliminary hazard list (PHL). During the PHL process, the site can be visited and site personnel interviewed. Another method to create the PHL is to convene a technical expert panel. The Panel is comprised of staff that have deep understanding of how the system operates and together brainstorm the PHL. Similar systems can also be compared and analyzed to help identify hazards. Reviewing previous incidents or incidents can also help inform the PHL.

Once the hazards are identified, they are analyzed. A hazard analysis is a technique for identifying the causes and consequences that the hazard has on the system. The purpose is to evaluate the preliminary hazard list in more detail, determine the hazard causes and then assess how each hazard impacts the safety of a system. At this stage the likelihood or probability of the hazard resulting in an incident is determined and factored into the analysis.

After the hazard analysis is completed, the risks must be controlled. Definition of the likelihood of occurrence and how much damage the hazard will cause to the system are the two elements that help organizations to understand the relationship between the hazard cause and the effect. The likelihood of occurrence and consequence or impact help the organization to prioritize and rank the most important risks for control. For example, a low probability and low impact hazard may not need any controls at all.

The next step is to control the risks. It is important to review and verify that these controls actually control the hazards or mitigate the risks to an acceptable level, based on the determined risk criteria that is specific to the organization. The most frequent means of verification is inspection where the adequacy of controls are validated and if they are operating effectively or if further controls are required.

Only after all the described steps are taken, management may choose to accept the risk with a formal decision of which risks are accepted based on a cost-benefit analysis and the risk criteria. Periodic system reviews are required to measure the adequacy of the controls and if they are still effective or need to be modified based on new operating conditions.

If the risks are not acceptable at this stage, then system modification is required. Once the system is modified, the process of hazard identification starts again.

8.2 OHSMS Management

8.2.1 Management of Change

The organization shall identify OHS hazards and risks associated with changes in the organization, the OHS system or its activities, prior to the introduction of such changes. The management of change process must be completed for work arising from temporary and permanent changes to the organization that impacts personnel, systems, process, procedures, equipment, products and materials.

Prior to implementation of the change, a risk assessment shall be conducted and a work plan must be developed. The work plan defines the timeline for the change and any control measures that need to be implemented.

As a start, it is required to establish the context of the change. It involves identifying the change and developing the necessary plans for change management in consultation with stakeholders, including interfacing organizations. A clear description of the current situation, including the problem or matter that the change seeks to address, and the change itself, is required. This should be sufficiently detailed to fully define the overall nature and scope of the change. Changes can be defined and analyzed at several levels, for example at the project level, component level and/or process level. More than one may be applicable.

It is then required to develop an implementation plan. It requires evaluation of the consolidated information gathered, further consultation (if practicable) with appropriate stakeholders and making decisions on the options available. The change and associated activities are identified and an implementation plan developed.

It is necessary to document changes to obtain approvals. It involves consolidating documentation on the change including any supporting records. The change should be clearly documented and gain internal sign off from the appropriately authorized person or persons. Once a change has received the necessary internal and external approvals, the change may be implemented using the approved implementation plan.

Monitoring and review arrangements need to take place immediately following the implementation of the change to ensure all risk controls, including training are in place and effective.

8.2.2 Procurement and Contract Management

It is critical that OHS is incorporated early into the procurement process as part of tender requirements along the entire value chain of the organization.

1. The organization shall implement controls related to goods purchased, services and equipment.
2. Purchase specifications for goods should include requirements to comply with OHSMS.
3. The need for training for supply of personal protective equipment should be considered before purchase.
4. Controls related to contractors must be established on managing the risks associated with contractors.

Some elements are:

- ▶ Scoping and identifying risks associated with work;
- ▶ Managing the risks associated with the work i.e. safety method statements;
- ▶ Ensuring contractors are properly inducted with risks associated to the site/work;
- ▶ Monitoring contractors; and
- ▶ Handover ensuring risks are communicated.

Stages of procurement where aspects of health and safety should be considered, including the roles and responsibilities of the contractor and worker are⁽¹⁾ :

Planning

Planning stage will ensure the best possible outcomes and should be consistent with the nature of the procurement (e.g. size, value, complexity and level of risk). Planning should include defining the work and identifying the risks in health and safety, while it is essential to conduct it in consultation with all key stakeholders.

Develop Tendering Documentation

Besides the specific requirements generally determined by the cost, complexity, and risk profile of the procurement, the documentation should also detail requirements relative to health and safety.

Tender Release

When issuing tender documents to prospective tenderers, relevant health and safety checklists must be met.

Evaluate the tenders

Consideration should be given to the level of risk involved in the proposed solution and tenderers capacity and capability to comply with all health and safety requirements.

Contract Negotiation and Award

It is important to examine the history of the tenderer and to conduct a full assessment of their past health and safety performance.

Contract Management

Management of the contract involves monitoring and supervising the works to ensure that they are being undertaken in accordance with the health and safety requirements. On starting and every time a new worker is introduced to the site, induction briefings need to be conducted. A list of designated inspections need to be implemented following a different stage of work relative to the nature of work. Safe work plans and risk assessments need to be reviewed during works and updated as required.

Contract Completion

On completion of the contract, any outstanding work health and safety issues need to be identified.

Post Contract Evaluation

On completion of the work, one should conduct a whole of project evaluation critically examining the contractor's ability to comply with the contract requirements. One should review the competency of the work and the contractors' health and safety performance, including the adequacy of their health and safety performance, identifying any strengths and weaknesses.

1) "The Electrical Contractor Safety Program Guide", Australian Trade Commission, December 2013

8.2.3 Incident Investigation and Reporting

Before an incident occurs, the management shall prepare and publish incident reporting and investigation procedures. Procedures must be in place to record and analyze safety incidents. Relevant team members should be trained in incident investigation.

When an incident occurs, the first step is reporting the incident. This can happen with the aid of a pre-established process that allows employees to report incidents. Employees must be given the opportunity to freely report all incidents. The reporting structure established should be free from all punishment, otherwise employees will hide information and true causes will likely not be found, leading to re-occurrence of the incident. Organizations may be required to report incidents according to their scale, to appropriate government entities.

If there is an immediate threat to human life, employees should immediately call the emergency line and an incident report should be filled out immediately, no later than the first 24 hours. Automated incident reporting systems may be used as a means of reporting incidents. A sample incident report should include; the contact information of the reporting employee, date of the report, date and time of the incident, location of the incident, description of the incident, assets used during the time of the incident, and witness information.

For the investigation to start, the incident scene must be made safe and an investigation board must be set. As a recommended practice, the incident should be investigated by a group of individuals who are as free from bias and independent from the incident participants as reasonable and free from external influences as possible. Creation of an investigation committee can help to achieve the purposes of serving as an independent body to determine the root causes of the incident, developing recommendations of how to prevent reoccurrence, improve safety of the system investigated and focus on causes of the incident. It is crucial to keep the investigation free of blaming the individuals involved, because blame culture may lead employees to hide causes of occurrence.

During the investigation, incident evidence shall be gathered, preserved properly and the witnesses must be interviewed. (Note: Based on the severity level of an incident, an organization would need to follow police procedures, and procedures of Ministry of Labor and Ministry of Interior, in collecting evidence from the scene.) At this point, the investigation committee may appoint a technical committee to support gathering the information and documentation that may be useful for the investigation. The sequence of events leading to the incident must be determined and reported to management and where required, to public authorities, with the relevant data analyzed. The fault tree analysis (FTA), failure mode and effect analysis (FMEA), bow-tie method described in the "OHS Risk Analysis" section may be useful in this.

Results of data analysis and root causes of the incident shall be discussed and reported to senior management. The report of the investigation may include summary of the background information on the incident, investigation procedures, and sequence of events leading to the incident, analysis results, findings and recommendations. The investigation report is the primary method of documenting the incident. Care should be given in sharing the report if there is a significant amount of proprietary information. Recommendations should be developed and corrective actions must be taken. It is crucial that any corrective action is implemented as soon as possible.

High profile incident investigations should include a crisis communication committee and a formal crisis communication plan to address the needs of internal and external stakeholders.

8.2.4 Corrective Action and Prevention

Preventive actions are to prevent an incident occurrence while the corrective actions are to prevent re-occurrence of incident. Corrective and preventive actions shall be identified and implemented as required. They shall be measurable and their results must be documented and communicated. They need to be tied to the risk register where the status of corrective action and closure are tracked.

All corrective and preventive actions taken to eliminate the root cause of the hazard must be proportionate to the magnitude of the incidents it may cause.

Any changes arising due to corrective and preventive actions must be implemented in accordance to the management of change process.

8.2.5 Engineering and Operational Safety Systems

An organization shall identify the operations that are required to have controls to manage OHS risks identified through the risk management process. Operational controls should be integrated into the OHS management system. Operational procedures should support the OHS policy requirements. Situations where operational procedures are inadequate to support the OHS policy and objectives should be documented and corrected.

The components of Engineering and Operational Safety Systems are:

- **Design and Development:** Is integrity of the design of structures, equipment and systems in accordance with safety requirements for engineering and operational systems ? Safe design is the process of integration of hazard identification and risk assessment methods early in the design process to eliminate or minimize the risks of injury throughout the life of the product being designed. A safe design approach begins in the conceptual and planning phases with an emphasis on making choices about design, materials used and methods of manufacture or construction to enhance the safety of the finished product. The designer needs to consider how safety can best be achieved in each of the lifecycle phases.
- **Asset Integrity:** Is mechanical integrity of critical process equipment to ensure the asset is designed, installed, operated and maintained properly ?
- **Process control:** Is planning of work activities, standards and procedures to ensure they deal with risk reduction measures as outlined in the risk management process ?
- **Inspection and Testing:** Is inspection and periodic testing of safety-related engineering and operational systems ?

8.2.6 Emergency Management

The organization must be ready to respond to emergencies. All relevant stakeholders must be considered in the scope of emergency management and the emergency response plans must be periodically exercised involving these stakeholders. Maintenance of emergency response plans must ensure that they are up to date and continuous monitoring is required. The risk register should serve as input to the emergency management system—these are the risks that could create the emergency.



9. OHSMS Performance Management_____

9.1 OHSMS Performance Indicators

Key Performance Indicators (KPI) set targets and are used to regularly review OHS performance management. There should be KPIs related to the success of specific procedures and initiatives. They should be measurable and drive the organization for achievement in OHS performance. Based on monitoring of the KPIs, continuous improvement should be a key element in OHSMS Performance Management.

The KPIs can be classified as lagging and leading indicators:

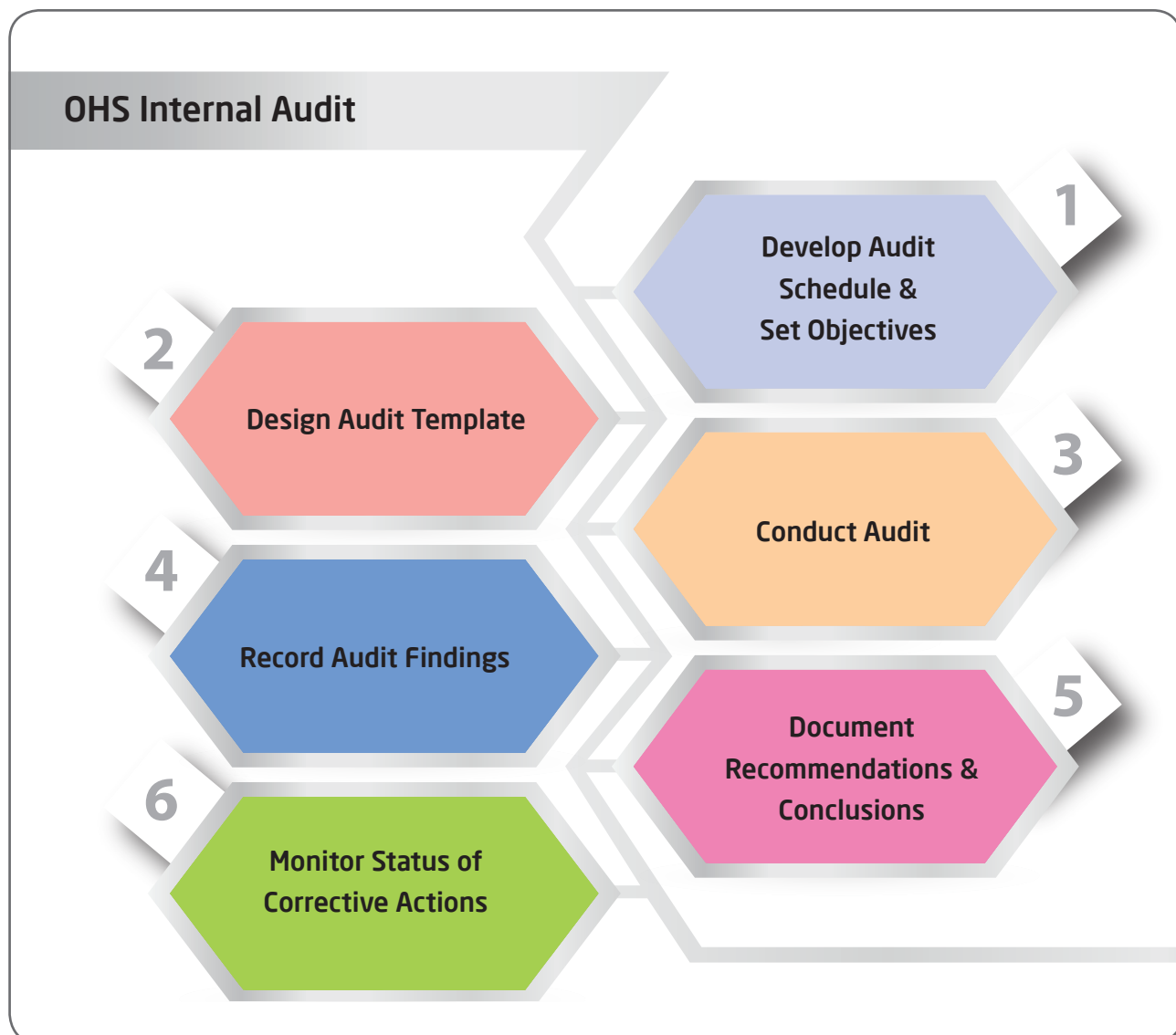
1 Organizations should use lagging safety performance indicators that are based on historical data where incidents, incidents, safety problems and corrective actions are tracked. These indicators assess whether safety-related actions (policies, procedures and practices) achieve their desired results based on historical data.

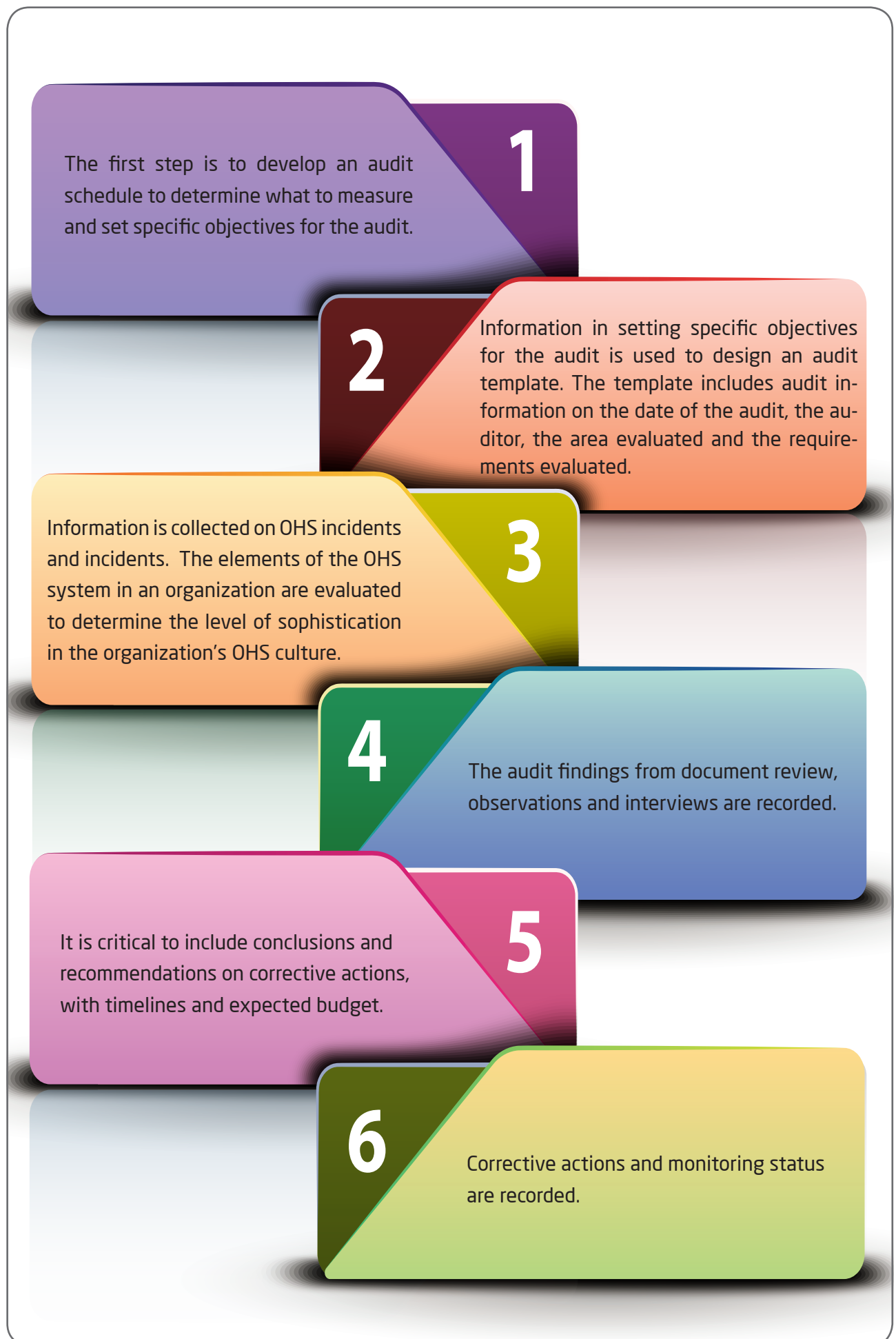
2 Organizations should use leading indicators as measures that help them identify future safety problems and proactively measure their future safety performance. These indicators assess whether an organization is taking actions proactively to lower safety risks.

9.2 OHS Internal Audit and Review

Conducting an OHS review or an internal audit determines if the appropriate processes in the OHS management system are in place, if the OHS activities are carried out correctly and if the OHS risks are appropriately managed. Figure 6 illustrates the steps followed in conducting an OHS review and conducting an internal OHS audit.

Figure 6: Steps in Internal Audit and Review





9.3 Management Review

Management shall review the organization's OHS system, in periodic intervals, to ensure adequacy of processes and procedures in place. Reviews can be made, by independent parties as part of the audit, with recommendation options for management, to use for decision making and action. Opportunities for improvement from the reviews must be evaluated. The reviews must be documented.

Management reviews are part of due-diligence. The outcome of the reviews must summarize the performance of the OHS system. Non-conformances should be recorded, with corrective and preventive actions. After the management review, updates to the OHS system are expected.

Elements for management review are described as part of the OHSMS framework in this Standard. The following is a suggested list that organizations should use for OHS Management reviews:

	OHS Policy and Objectives of OHS System
	Health and Safety Governance
	Health and Safety Culture –Awareness
	Incident / Incident and Near – Miss Reporting System
	Management of Change
	Health and Safety Organization - Safety Committees
	Hazard Identification and Risk Management Methodology
	Document Control
	Management of Contracted Goods and Services
	OHSMS Internal Audit
	Incident / Accident Investigation
	Analysis and Monitoring
	Emergency Management
	Medical Issues
	Human Factors
	Measuring Equipment and Calibration
	Equipment Maintenance
	Training, Education, and Competence
	Operational System Safety Plans and Procedures

A complete list of review elements is included in the appendix B.



10. Document Control _____

An organization shall establish, implement and maintain an OHS document control system. This system controls how OHS documents are updated so that there is a record of how the OHS system evolves over time. A good OHSMS clearly documents how OHS decision making is done and how the core elements of the OHSMS interact with each other.

A. Appendices

A1. OHS Risk Management Methodology

A.1.1 Define the System

An OHS hazard condition can cause injury or death, damage to or loss of equipment or property or environmental harm. Some hazards result from a failure of a system or component, at a certain point in the process life cycle. However, it is important to note that many hazards do not result from a failure. For example, if the operator is expected to perform a set number of activities in an unrealistic time frame, then the operator may make errors and induce a hazard. For this reason the system needs to be defined sufficiently to properly identify and manage occupational health and safety risks. How the system, subsystems, interfaces and other systems interconnect needs to be considered. Before identifying the hazards and conducting a hazard and risk analysis, the entire system and how it operates with other systems must be reviewed.

An automobile in traffic is a useful example of system definition. For example, if we want to analyze the system where there is a car in the traffic, we need to consider elements like, the other cars, traffic lights, pedestrians crossing the street, weather, and maintenance schedule of the car. Some subsystems are: car electrical system, climate control subsystems, audio system, car warning and instrumentation subsystems, steering subsystem, engine cooling subsystem, drive train, emission control subsystem, driver, and safety systems (e.g. anti-lock brakes). Subsystems can be broken down into components, like a tire subsystem include tires, spare tire, accessories, brakes, tire treads, and tire maintenance schedule. Other systems include traffic lights, flow pattern, incidents on other side of the highway, etc.

A.1.2 Define the Risk Criteria

Risk combines the concept of severity of the impact of the incident and the likelihood of its occurring. Risk tolerance is defined in ISO Guide 73 as the organization's or stakeholder's readiness to bear the risk after risk treatment (hazard control) is applied. Residual risk is the risk upon implementation of controls that the organization accepts. In other words, there is no zero risk.

In defining impact and the likelihood scale of health and safety related risks in an organization, the various questions may be asked. However, there is no one size fits all impact and likelihood scales for all organizations. Because there are high risk and low risk industries, their degree of risk level differs according to the nature of operations of an organization. Some of these questions are:

1. How often and for how long are people in the organization exposed to health and safety related risks?
2. How effective are the current health and safety controls?
3. Are there planned changes or certain operational cycles in the organization that can change the level of risk people are exposed to?
4. Do the hazards result because of the working environment or do people's behaviors increase the likelihood of a hazard causing harm?

Hazards may be differentiated between five categories, according to their level of severities. These definitions are customized for each organization, according to the risk criteria defined for the level of risk appropriate to an organization and needs. A high severity event may cause severe injury or loss of mission or operation – critical asset or high cost equipment. A medium to low risk event may cause minor injury or minor system damage, but does not significantly impact the mission. A very low risk event does not result in injury or system damage and does not affect the mission.

Figure 7 illustrates how NCEMA ranks the risk categorization according to severity and likelihood. This is an example that can be used by organizations. Another example is AD OSHMS Technical Guide on Process of Risk Assessment. Figures 8 and 9 are examples of how likelihood and severity can be defined by an organization. It can be defined qualitatively, or quantitatively if the data exists. During the step where we define risk criteria, it is important that each organization carefully discusses and defines each of these levels. These levels will be used throughout the risk assessment process.

Figure 10 is an example of how the two matrices in the figures (Figure 8 and Figure 9) are combined to show how risks can be prioritized and then acted upon. Again, the organization needs to set their own levels of risk acceptance or risk appetite, as illustrated in the risk decision criteria below. Once these levels are set the organization must stand by them and use them to determine how hazardous and risky an operation is and if it is acceptable or not.

Figure 7: OHS Risk Assessment Matrix

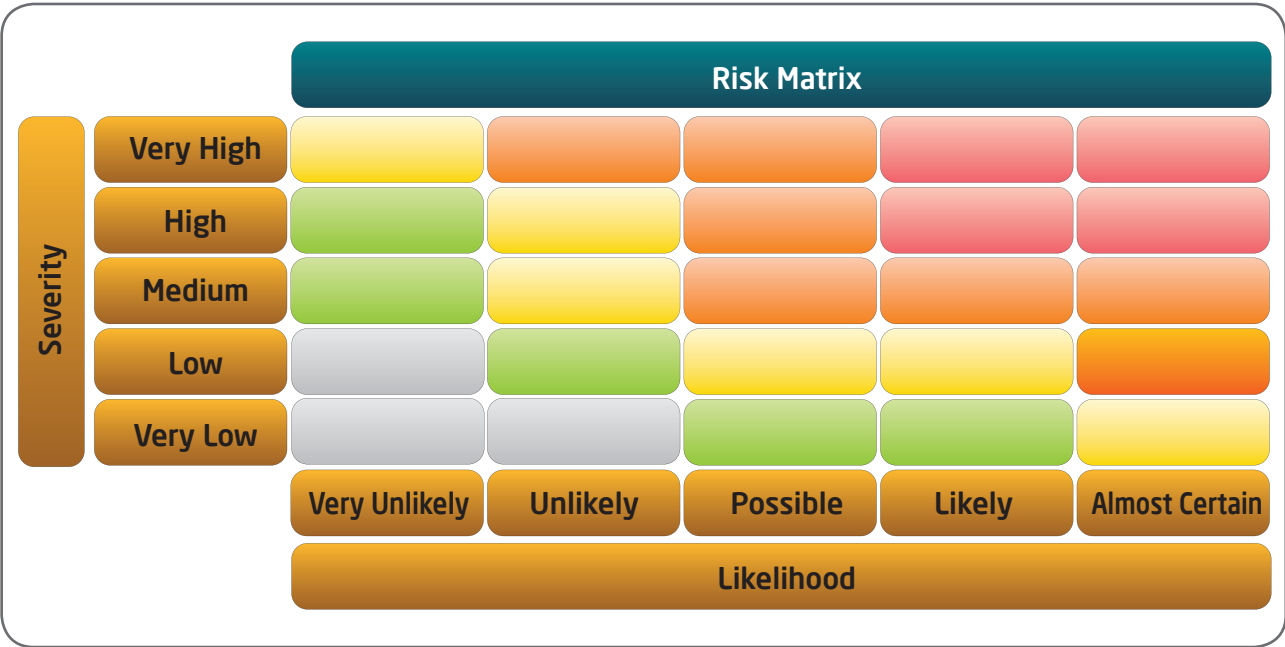


Figure 8: Example Hazard Severity Categories

Description	Category	Definition
Very High	I	Death, Permanent total disability, system loss, irreversible significant environmental impact, or monetary loss equal to or exceeding AED 10M
High	II	Permanent partial disability, injuries, or occupational illness that may result in hospitalization of at least three personnel, reversible significant environmental impact, or monetary loss equal to or exceed AED 5 M but less than AED 10 M
Medium	III	Injury or occupational illness resulting in 5 or more lost workdays, reversible moderate environmental impact, or monetary loss equal to or exceed AED 1 M but less than AED 5 M
Low	IV	Injury or occupational illness resulting in 1 or more lost workdays, reversible moderate environmental impact, or monetary loss equal to or exceed AED 100K but less than AED 1M
Very Low	V	Injury or occupational illness not resulting in a lost workday, minimal environmental impact, or monetary loss less than AED 100K

Figure 9: Qualitative Hazard Likelihood Levels

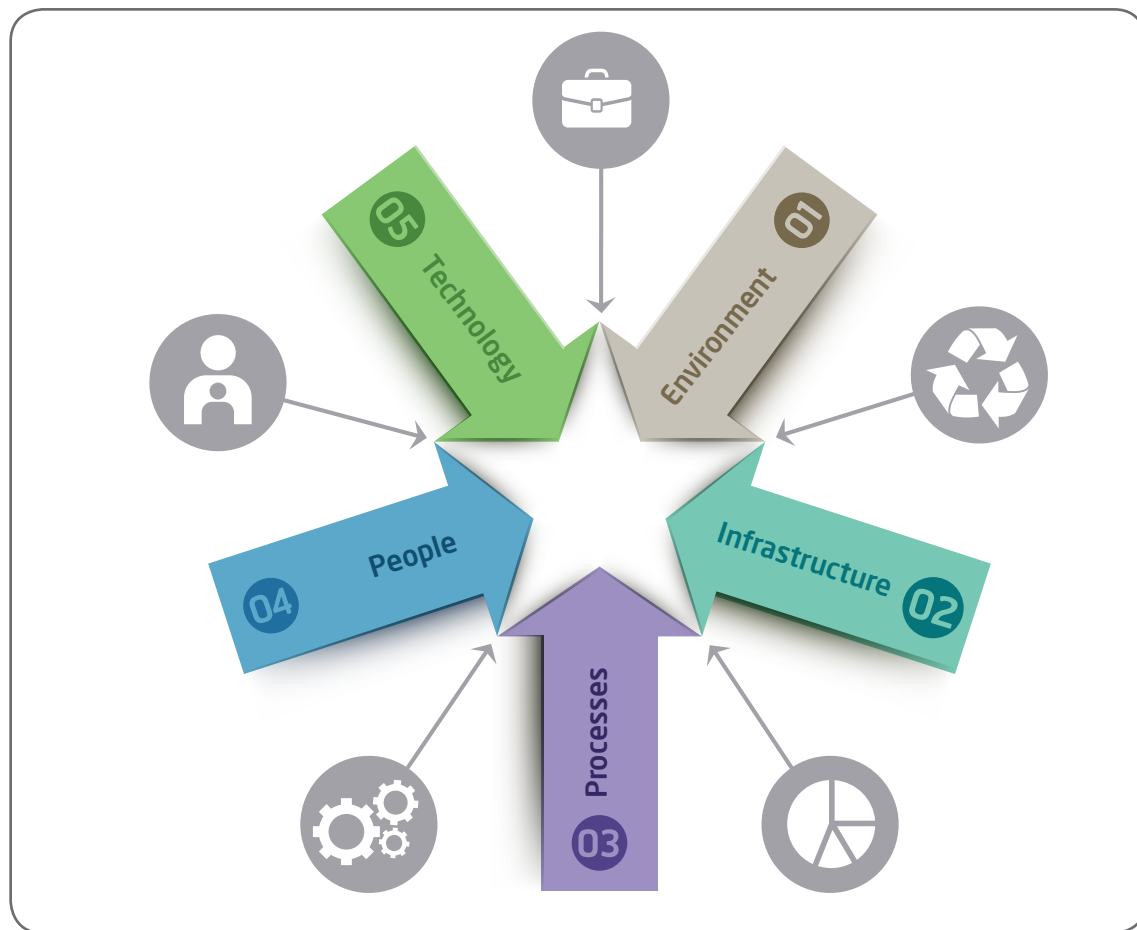
Description (a)	Level	Specific Individual Item	Fleet or Inventory (b)
Almost certain	A	Likely to occur in the life of an item	Continuously experienced
Likely	B	Will occur several times in the life of an item	Will occur frequently
Possible	C	Unlikely, but possible to occur in the life of an item	Will occur several times
Unlikely	D	So unlikely that it can be assumed occurrence may not be experienced in the life of the item	Unlikely to be occur but slightly possible
Very Unlikely	E	Incapable of occurrence. This level is used when potential hazards are identified and later eliminated	Incapable of occurrence. This level is used when potential hazards are identified and later eliminated

Figure 10: Example Risk Assessment Matrix

Hazard Category Frequency	(1) Catastrophic	(2) Critical	(3) Marginal	(4) Negligible
(A) Almost Certain ($x > 10^{-1}$)	1A	2A	3A	4A
(B) Likely ($10^{-1} > x > 10^{-2}$)	1B	2B	3B	4B
(C) Possible ($10^{-1} > x > 10^{-3}$)	1C	2C	3C	4C
(D) Unlikely ($10^{-1} > x > 10^{-4}$)	1D	2D	3D	4D
(E) Very Unlikely ($10^{-1} > x$)	1E	2E	3E	4E
Hazard Risk Index	Risk Decision Criteria			
1A, 1B, 1C, 2A, 2B, 3A	Unacceptable: stop operations and rectify immediately			
1D, 2C, 2D, 3B, 3C	Undesirable: upper-management decision to accept or reject risk			
1E, 2E, 3D, 3E, 4A, 4B	Acceptable with management review			
4C, 4D, 4E	Acceptable without review			

A.1.3 Identify the OHS Hazards

Hazard identification is the process of finding, recognizing and recording hazards. OHS hazards exist in all facets of an organization, therefore all elements of an organization should be considered in the hazard identification such as:



Hazards generally arise during work operations. Understanding the interaction with the physical work environment, equipment, materials and substances used, how work tasks are performed, help to understand the potential hazards in the workplace.

The purpose of hazard identification is to identify what might happen or what situations might exist that might create a hazardous condition that could lead to an incident. The hazard identification process focuses identifying the causes and source of the hazard (in the context of physical harm), events, situations or circumstances that could result in an incident. It is critical that an organization consider all human, organizational, system, and environment elements that could create a hazard to people, the environment, or damage equipment.

Hazard identification methods can include check-lists, reviews of historical data and brainstorming. Systematic team approaches involve a team of experts that follow a systematic process to identify hazards by means of a structured set of prompts or questions. In the system safety process, one needs to understand the safety objectives, as system description first, before identification of hazards and risks. Conditions due to abnormal operations, incidents, planned activities should also be considered.

For example, to create a preliminary hazard list (PHL), an engineer can use the following resources: the site can be surveyed, site personnel interviewed, a technical expert panel can convene to brainstorm hazards, similar systems can be compared and analyzed, and previous incidents and incidents reviewed. Additionally, system specifications should be evaluated, detailed design data and studying preventive, scheduled and unscheduled maintenance methods also help uncover potential hazards. The PHL is a brainstorming tool to develop a list possible hazards. It should be used as early as possible in the design process and can be conducted at various stages following the design.

A typical hazard list may include the following examples:

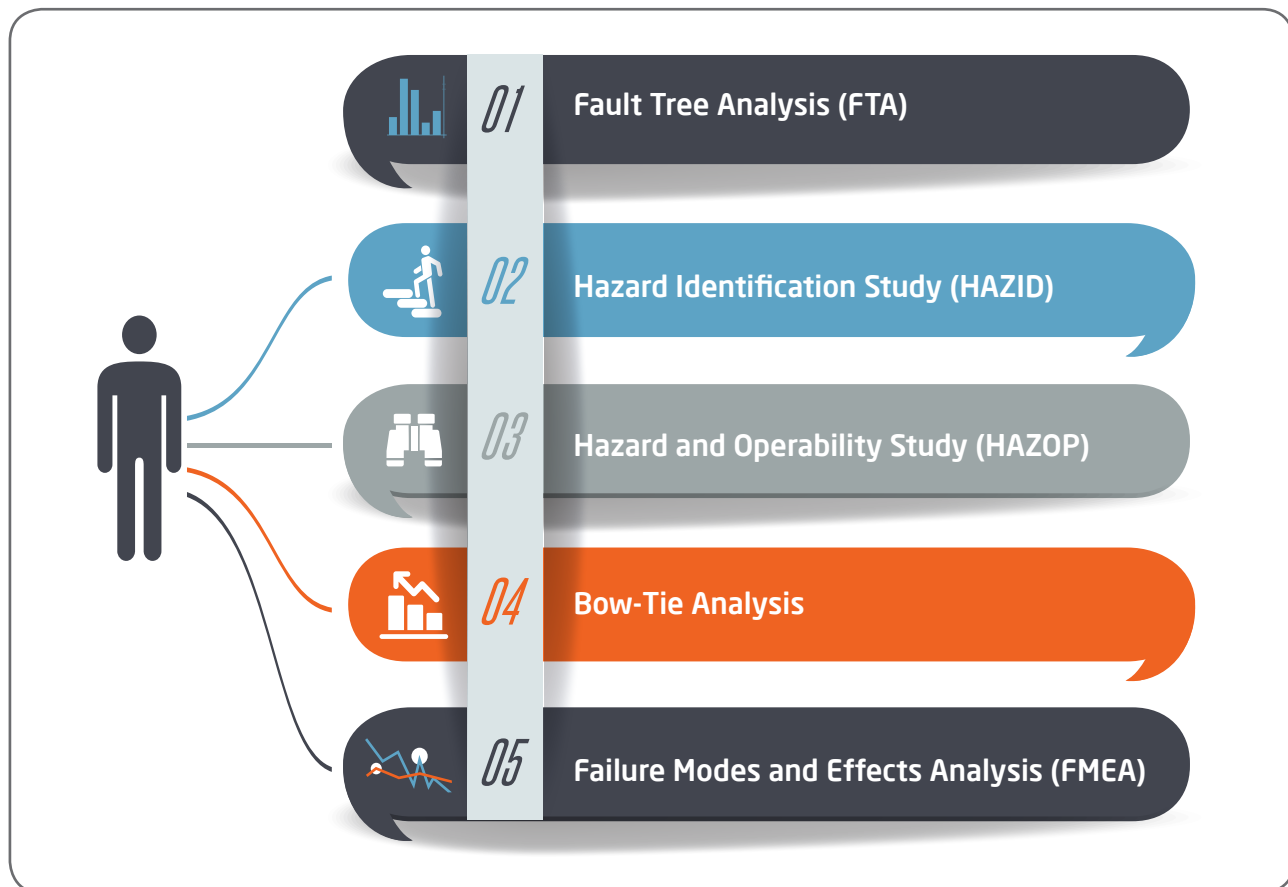
1. Manual tasks: Overexertion or repetitive movement can cause muscular strain
2. Gravity: Falling objects, falls, slips and trips of people can cause fractures, bruises, lacerations, dislocations, concussion, permanent injuries or death
3. Electricity: Potential ignition source. Exposure to live electrical wires can cause shock, burns or death from electrocution
4. Machinery and equipment: Being hit by moving vehicles, or being caught by moving parts of machinery can cause fractures, bruises, lacerations, dislocations, permanent injuries or death
5. Hazardous chemicals: Chemicals (such as acids, hydrocarbons, heavy metals) and dusts (such as asbestos and silica) can cause respiratory illnesses, cancers or dermatitis
6. Extreme temperatures: Heat can cause burns, heat stroke or fatigue. Cold can cause hypothermia or frost bite
7. Noise: Exposure to loud noise can cause permanent hearing damage
8. Radiation: Ultra violet, welding arc flashes, micro waves and lasers can cause burns, cancer or blindness
9. Biological: Micro-organisms can cause hepatitis, Q fever, and allergies
10. Psychosocial hazards: Effects of work-related stress can cause work place violence and work-related fatigue

A.1.4 Analyze the OHS Risks

In analysis of health and safety related risks, it is necessary to inspect the workplace, consult staff and workers and review available health and safety related information. Conducting an OHS Risk Analysis is required to determine how a hazard may result in injury or illness.

Organizations (relevant to their operational area) may choose from one or more OHS risk analysis methodologies as a process for hazard analysis. Assessment techniques can be split into two categories: qualitative and quantitative. Both approaches share the goal of finding causal dependencies between a hazard on a system level and failures of individual components. A combination of these methods can also be used.

Examples of some analysis methods include:



The methods listed above can be either quantitative or qualitative in nature. Quantitative data is used to numerically estimate probabilities, rates and/or severity of consequences. A qualitative approach may be impractical due to lack of data or the amount of time and expense required. In this case, a qualitative approach can be used.

FTA is a graphical method commonly used in both reliability engineering and system safety engineering. It is a deductive approach where an undesired top event is based on listing all the faults in the system that must occur for the top event to occur. It is a model of particular system fault modes and their constituent faults that lead to the top event.

HAZOP is a systematic group approach to identify process hazards and inefficiencies in a system. A team conducts a structured brainstorming session to methodically analyze a system, ask how the process can deviate from its intended operation and the resulting impacts. HAZOP is used in highly complex process flows. The structured approach for HAZOP entails defining the objectives and scope, conducting the HAZOP analysis, documenting the results and tracking the hazard control implementation.

Bow tie analysis displays the cause and consequence of a particular hazardous condition. It is a qualitative tool that combines the fault tree to determine the causes and how the fault could occur, with the event tree, which documents the consequences of the hazardous condition. The process industry uses it to assess hazards and risks and also use it as an effective communication tool to illustrate cause-consequence-control and how it can impact a hazardous condition. It is a good visualization tool.

FMEA is a system reliability tool used in safety, which includes reviewing as many components, assemblies, and subsystems as possible to identify failure modes, and their causes and effects. For each component, the failure modes and their resulting effects on the rest of the system are recorded in a specific FMEA worksheet. However, it should be noted that the FMEA identifies only failures in a system—not hazards. Many hazards can occur without a failure. FMEAs are typically used to go deeper into understanding the particular causes of a hazard.

Additionally, there are other analysis methods that can be used; such as what-if analysis and check lists.

A.1.5 Control the OHS Risks

The hazard reduction precedence is a method applicable to all industries. The steps within the hazard reduction precedence are:

Design out the Hazard

The first step in the hazard reduction precedence is to “design out” the hazard, by taking it out of the system completely. Engineering perspective should be used where applicable in trying to decide which part of the system must be taken out to design out the hazard. For example, if the hazard is asphyxiation from nitrogen gas bottles leaking in an enclosed area of a building, the nitrogen bottles can be stored or located outside the building to prevent the hazard from occurring.

Safety Devices

If the hazard cannot be designed out, the next step is to use safety devices. For example, a pressure relief valve is a safety device, to protect equipment against over pressure.

Warning Devices

If the hazard cannot be designed out or cannot be adequately controlled with safety devices, then the next best step is a warning device. For example, when a certain level of smoke is detected, a smoke alarm is sounded, and we are alerted by sound to evacuate the area. Gas monitoring and warning detectors are also common examples of warning devices.

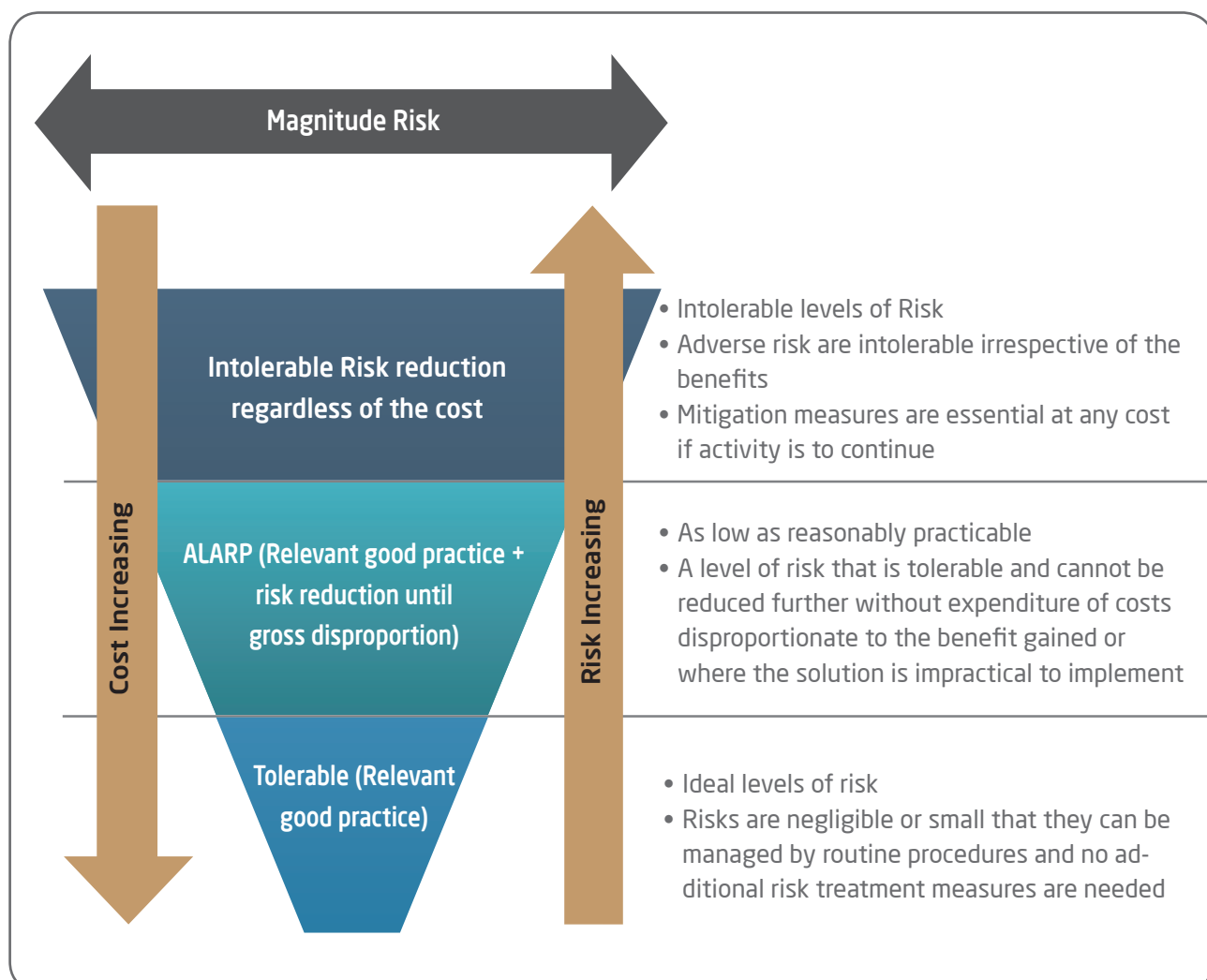
Special Procedures and Training

If warning devices are not sufficient, then to control the hazard or mitigate the consequence of the risk, special procedures and training may be required. Special procedures may also entail the use of personal protective equipment. Special procedures and training can be used to control the hazard or mitigate the consequences. This is the least desirable method because the hazard is controlled, by the ability of people to appropriately respond during the emergency.

If the risk is not acceptable, then the system must be modified to reduce the risk. The process of hazard identification starts again to make sure that the modifications did not change any safety controls and that they reduce the risk to an acceptable level. The risks accepted must be rationally documented.

The ALARP (as low as reasonable practicable) is a way to visualize how risks can be accepted and is based on what is considered reasonably practical. This means that hazard controls are implemented to reduce residual risk to a reasonable level of practicality. For a risk to be considered ALARP, it must be demonstrated that the cost in reducing the residual risk further would be grossly disproportionate to the benefit gained.

Figure 11: ALARP Principle



A.1.6 Verify and Report the OHS Risks

Risk tracking is performed through a risk register. Risk registers should be used, as an action plan for the organization. A risk register is defined in the ISO Guide 73 as the document used for recording risk management processes for identified risks. The purpose of the risk register is to facilitate ownership and management of each risk. The risk register should include all OHS risks for the organization and serve as an historical record. The results of the risk assessment are recorded on the risk register and verifications are tracked there through completion.

The risk register is a critical part of the risk assessment process and helps to make decisions on OHS controls. It forms an agreed record of the significant OHS risks that are identified. It serves as a record of the control activities that are currently undertaken, providing a record of the additional actions that are proposed to improve the control of the particular OHS risk.

Organizations can use risk register formats appropriate to them. A typical risk register includes, the description of the risk, current risk level with its likelihood and severity, overall rating of the risk, current controls and further actions or controls planned. Risk controls should be explained adequately for the controls to be audit-able, specifically with high risk operations.

A typical risk register sheet includes the following:

Figure 12: Example Risk Register Worksheet

Control Number	Hazard Description	Potential Causal Factors	Potential Effects	HRI/ HRA (Hazard Index)	Risk Control Recommendation	Effect of Recommendation on HRI	Risk Control References	Verification of Control	Status of Control
1.1.01A	implosion or failure of pressure hull	improper material selection for pressure	Internal flooding	1C ²	Follow ASME for pressure boundary material specifications and testing	1E ³	ASME PVHO-1A	Conduct formal material selection review and workmanship testing program per hazard control references	Open, Ongoing

Reporting procedures must ensure OHS information is reported timely, monitored and performance is improved. Status of the controls documented must be reviewed. Procedures must include reports for performance monitoring, hazard identification, risk assessment, incident reporting, corrective and preventive actions.

B. Management Review

OHS Policy and Objectives of OHSMS:

- Purpose
- Scope
- Policy
- Objectives

Health and Safety Governance:

- OHS Governance Structure
- Management Responsibilities, Accountabilities, and Authorities
- OHS Organization Description and Organization Chart
- OHS Organization Functions, Responsibilities, and Authorities
- OHS Decision Rights
- Review and Updating the OHS System
- Safety Management System Review and Compliance
- Safety Waiver Review and Approval

Safety Culture - Safety Culture and Awareness:

- Management and Executive Leadership OHS Commitment Letter (Signed)
- Management Commitment in Time, Money, and Resources to OHS
- OHS Culture
- OHS Awareness in the Workplace
- Elements of successful OHS culture

Incident / Incident and Near - Miss Reporting System:

- Notifiable Incident / Incident Reporting Process
- Incident Reporting
- Near - Miss Occurrence Reporting and Tracking
- Incident / Incident and Near - Miss Record Keeping
- Corrective Action Verification Process, Tracking and Record Keeping

Management of Change:

- Change and System Safety
- Managing External Changes to the Organization's Operations
- Managing Internal Changes to the Organization's Operations
- Change Order Review and Signature Authority

Health and Safety Organization:

- Safety, Health, and Environment Committees
- Safety Committee Functions, Responsibilities, and Authorities
- Permanent Safety Committees
- Ad Hoc and Temporary Safety Committees

Hazard Identification and Risk Management Methodology:

- Risk Assessment Criteria
- Hazard Identification
 - Design Verification
 - Inputs to Specifications
 - Acquisition Tests
 - Operational Tests
 - Safety Tests
- Inspections
- Risk Analysis
- Risk Control
- Hazard Reduction Precedence
- Hazard Inspection and Abatement
- Hazard Resolution Process
- Risk Reporting

Document Control:

- Organization's Documentation Control System
- Information Management, Communications
- Documenting Safety Corrective Actions and Safety Verification Tracking
- OHS Compliance Documentation Control

Management of Contracted Goods and Services:

- Contractor and Subcontractor OHS Programs Review and Evaluation
- Oversight and Methods
- Supply Chain Traceability of Goods and Services

OHS Internal Audit:

- OHS Internal Audit Process
- OHS Internal Audit Schedule
- External OHS Audits
- OHS Audit Results Tracking and Incorporation into Systems Safety

Incident / Incident Investigation:

- Reporting the Incident (Internal)
- Forming the Investigation Committee
- Documenting the Incident
- Corrective Action
- Verification of Corrective Action
- Updating the Safety Management System after an Incident
- Informing the Public

Analysis and Monitoring:

- OHS Performance Indicators
- Safety and Production Process Controls
- Evaluating and Trending Safety and Risk Data

Emergency Management:

- Emergency Preparedness, Response, and Business Continuity Analysis
- Emergency Response and Community Services
- Emergency Management and Business Continuity Training
- System Safety and Business Continuity
- Emergency Management and Business Continuity Plans

Medical Issues:

- Occupational Health
- Hazardous Materials and Chemicals Control
- Fatigue Management
- Drugs and Alcohol Policy
- General Employee Health and Fitness Program

Human Factors:

- People, process and technology interfaces
- Human factors and SMS
- Human Factors Considerations for Designing, Operating, and Maintaining Equipment

Measuring Equipment and Calibration:

- Safety Implications to Equipment and System Maintenance
- Scheduled, Unscheduled, and Emergency Maintenance

Equipment Maintenance:

- Safety Implications to Equipment and System Maintenance
- Scheduled, Unscheduled, and Emergency Maintenance

Training, Education, and Competence:

- OHS Competencies in Each Job Function
- Employee's Right to Know
- Employee Safety Awareness and Training
- Personnel Certification for Hazardous Operations
- Internal and External Safety Training and Education

Operational System Safety Plans and Procedures

- Hazardous Operations Procedures
- Construction Safety Procedures
- Safety Design Requirements
- Human Factors Design Requirements

C. Glossary

1. Audit: systematic, independent and documented process for obtaining “audit evidence” and evaluating it objectively to determine the extent to which “audit criteria” are fulfilled (ISO 9000:2005, 3.9.1)
2. Corrective action: action to eliminate the cause of a detected nonconformity or other undesirable situation
 - a. Note 1: There can be more than one cause for a nonconformity
 - b. Note 2: Corrective action is taken to prevent recurrence whereas preventive action is taken to prevent occurrence. (ISO 9000: 2005, 3.6.5)
3. Document: information and its supporting medium (ISO 14001:2004, 3.4)
4. Environment Health and Safety (OHS) System: Part of an organization’s management system used to develop and implement its OHS policy and manage its OHS risks
5. OHS policy: overall direction of an organization related to its OHS performance, formally stated by management
6. OHS performance management: OHS results of an organization that are measurable with relation to OHS risks
7. Hazard: A condition that can cause injury, ill-health, death, damage to or loss of equipment or property, or environmental harm
8. Incident: Work-related event in which an injury or fatality occurred
9. Nonconformity: A requirement is not satisfied
10. Organization: company, corporation, firm, enterprise, authority or institution, or part or combination thereof, whether incorporated or not, public or private that has its own functions and administration
11. Preventive action: Action to prevent the cause of a potential nonconformity
12. Risk: Combination of the probability (or frequency of occurrence) of an event and consequence (or severity) of a hazard
13. System: A combination or interrelation of hardware, software, people and the operating environment
14. System Life Cycle: steps that involve the design, construction, development, test, production, operation, maintenance, expansion and disposal of a system
15. Workplace: Physical location where work related activities are executed