

Thaton Combined Cycle Gas Turbine (CCGT) Power Plant

Environmental, Health & Safety Management System

EHS Management System Manual






Photo: Fichtner
Power Plant Construction Site in Indonesia

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List of Acronyms

CCGT	Combined Cycle Gas Turbine
DD	Due Dilligence
EHS	Environment, Health and Safety
EPGE	Electric Power Generation Enterprise
ISO	International Organization for Standardization
MEPP	Myanmar Electric Power Project
MOEE	Ministry of Electricity and Energy
MS	Management System
OHS	Occupational Health & Safety
OHSAS	Occupational Health- and Safety Assessment Series
WHO	World Health Organization

1. Introduction

1.1 Project Background

Myanmar is facing large electricity shortages and high risk of blackouts in the power system. The power system experienced more than 15 blackouts in 2012. Thus, the Government of Myanmar through the Ministry of Electricity and Energy (MOEE) has requested the World Bank's support in scaling-up gas fired power generation in order to rapidly reduce and eventually eliminate electricity shortages and improve reliability and quality of power supply in the country. In this sense, the Myanmar Electric Power Project (MEPP) has been launched. In this sense, the Myanmar Electric Power Project (MEPP) has been launched. One of the components of the MEPP is the development of a new CCGT power plant at Thaton in the Mon State (the "Project").

The main objective of Fichtner's consultancy services is to develop and implement **Environmental, Health & Safety Management Systems (EHS-MS)** for the construction and the operation of the Project.

1.2 Definition of EHS-MS

The International Organization for Standardization (ISO) defines it as a "set of procedures an organization needs to follow in order to meet its objectives."

Management systems comprehensively address the topic of concern - in this case, either employee health and safety and/or the environment. They are the total sum of the processes and procedures which supports to operate safely and/or protect the environment.

1.3 Objective of the EHS-MS

The **Environmental, Health & Safety Management System Manual (EHS-MS Manual)** at hand refers to the operation phase of the new CCGT power plant at Thaton. The Manual is written in such a way that it can be applied in general to other power plants in Myanmar as well.

The content and requirements respectively presented in this Environmental, Health & Safety Management System are based on the general principles of good management as well as on the OHSAS 18001 Occupational Health and Safety Management Certification and the 14001 Environmental Management Certification and its requirements.

The EHS Management System for the Thaton Power Plant is designed to integrate EHS management in the general and common management and working practices and procedures to be followed. The EHS Management System should ensure the provision of an environmentally friendly, safe and healthy working environment. The establishment of an EHS management

system should ensure that EHS risks are controlled in a systematic proactive manner.

1.4 Content of the EHS-MS

The results of the **EHS Due Diligence (DD) Audit** together with the environmental & social management measures included in the ESMP summarized in a detailed **Environmental, Health & Safety Management System (EHS-MS)**.

The EHS-MS is the prevailing document for the management of all identified environmental, social and health and safety requirements needed for the safe and environmental and social friendly operation of the new plant. The EHS-MS provides an outline of the conditions at the power plant site together with an overview of the surrounding concerned area. The EHS-MS includes the following:

- Definition of an EHS policy applicable to the new power plant;
- Identification of EHS roles and responsibilities;
- Identification of EHS routines and procedures and resulting EHS management measures;
- Identification of EHS internal and external reporting requirements and procedures;
- Description of the national legal background, considering applicable laws, guidelines and standards. In case that national legal requirements do not exist, international directives, guidelines and standards will be taken into account;
- Based on a EHS risk assessment (to be undertaken based on the available design documents), risk management procedures and tasks will be included;
- Description of EHS emergency response requirements, including incident and accident management procedures;
- Description of the EHS review procedures, incl. compliance reviews and internal auditing;
- Description of the EHS requirements for the main tasks of the power plant's operation.

1.5 Structure of EHS Management System

The EHS management system follows a specific structure. It is more or less divided into 3 different components.

- Component No. 1 refers to the general background and content, provides the EHS policy and outlines the purpose why to implement such a management tool.
- Component No.2 refers to the measures and procedures required to ensure an adequate implementation of the EHS management system.

This component is highlighting review, reporting and monitoring procedures as well as training and induction requirements.

- Component No. 3 explains the content of required EHS tools, such as different registers and plans.

The following figure provides an overview of the entire EHS management system.

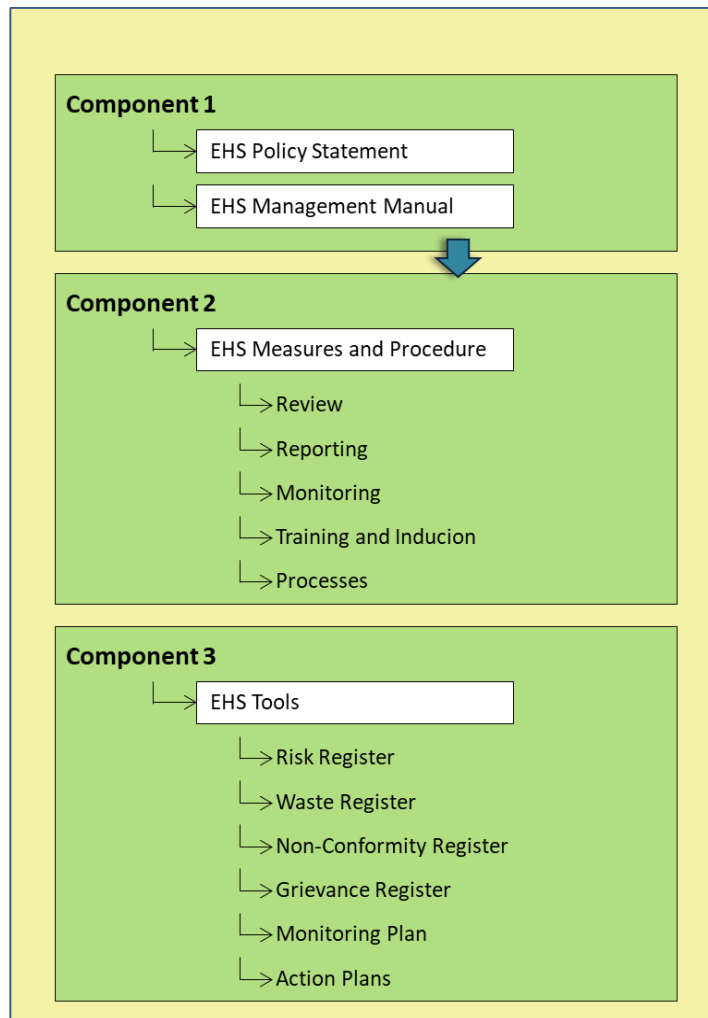


Figure 1-1: Overview of EHS management system

2. Environmental, Health & Safety Policy Statement

The statement of policy on environment, health and safety sets out the commitment of EPGE to manage environmental, health and safety requirements effectively.

Management commitment to EHS performance is one of the most important but as well critical elements for the success of an EHS Management System and for the development of a strong safety culture within EPGE.

Therefore, this EHS document establishes a management commitment with a formal statement of intent that defines examples of performance goals and how they will be supported. Examples of how this commitment is supported include the following:

- *Establish methods to use energy more efficiently, reduce waste, and prevent accidents.*
- *Comply with laws, regulations, and organizational requirements applicable to their operations.*
- *Improve EHS performance continually.*
- *Conduct periodic assessments to verify and validate EHS performance.*

The EHS policy statement defines what shall be achieved by EPGE and the staff team members working at Thaton Power Station and being responsible to operate the plant is a safe manager according to the EHS policy objectives.

The EHS policy should be applicable as well for all external parties working at the plant site or visiting the plant site. This refers for example to external service staff working at site during maintenance periods.

2.1 Suggested draft EHS Policy Statement to be adopted by EPGE

EPGE is committed to provide and maintain a safe and healthy working environment and an environmental friendly and sustainable operation of the power plant for all staff team members and to the public around the plant site, and to provide the information, training and supervision needed to achieve this.

All involved parties are committed to protect the fundamental rights of all appointed workers and the public and feel obliged to create a sound work-management relationship as a key ingredient in a sustainable and successful operation of the plant.

All involved parties from the upper management of the power plant down to every single worker should take responsibility for all required EHS procedures but in the same way, all staff team members need to be aware of their responsibilities to comply with the EHS Policy.

The following requirements are mandatory for EPGE and each worker for the implementation of an unimpaired environment and safe and healthy working environment through:

- *being involved in the workplace EHS system;*
- *sticking to correct procedures and equipment;*
- *wearing protective clothing and equipment as and when required;*
- *reporting any pain or discomfort as soon as possible;*
- *ensuring all accidents and incidents are reported;*
- *helping new workers, trainees and visitors to the workplace to understand the right EHS procedures and why they exist;*
- *telling the responsible Managers immediately of any EHS concerns;*
- *keeping the work place tidy to minimise the risk of any trips and falls.*

The EHS Policy Statement is implemented to achieve the following goals:

- *Zero fatalities of workers, visitors or the public;*
- *Zero accidents and incidents of workers, visitors or the public;*
- *Zero harmful, hazardous or dangerous situations or occurrences;*
- *Zero environmental concerns, risks or impacts;*
- *Continuous improvement of the health & safety performance at site under practical conditions.*

3. Description of the National Legal Background

3.1 National Laws

3.1.1 National Factories Act

The following chapter on OHS is based on the National Factories Act of 1951. The chapters are outlining the requirement on occupational health and a safe working environment to be considered for the planning, design and operation of workplaces and the general plant environment. These chapters are not replacing the need to familiarize with the specific legislative requirements. They should be understood as a summary of the content of the prevailing law, only.

The factories act of 1951 is divided in various sections which will hereby not be summarized entirely. The purpose of this chapter is to identify the main articles concerning OHS in the workspace of a CCGT power plant.

a. Health:

The main goal of this section is to ensure a healthy workspace for the personnel of the power plant.

The facility shall be kept clean and free from effluvia and leakages arising from drains, pits, latrines for hygienic and health purposes. Also, accumulation of dirt and waste shall be re-moved from the floor and from work spaces to ensure a secure workspace. In relation to the hygienic aspect, cleaning of work rooms shall be performed once a week by washing and disinfecting, if necessary.

Every workroom shall have adequate ventilation by circulating fresh air. Furthermore, the room temperature should be suitable for the security, comfort and the health of the personnel. In workrooms in which high temperature is produced, ventilation or further temperature lowering techniques (like insulating) shall be considered. Regarding the CCGT, the work-spaces adjacent to the burning chamber should be considered.

The workspace for each worker should not be less than 11 m³ (400 cubic feet). The space above 4 meters (14 feet) is considered in the calculated workspace.

The power plant personnel should have an easy access to clean drinking water. The location of the water outputs should be easily accessible and labeled “drinking water”. If the amount of worker exceeds the number of 250, the drinking water shall be cooled during hot weather.

Latrines and urinals should be divided for male and female workers. Furthermore, they should be ventilated, lighted and maintained in clean and sanitary conditions all the time to on the one hand prevent health hazard and on the other hand to increase the working com-fort of the personnel.

Dust and exhaust should be managed to prevent any health issue to the personnel. Inhalation and direct contact should be avoided. If a fume leakage is provoked, all the measures necessary to resolve the impurity shall be executed.

b. Artificial humidity

In any factory in which the humidity of the air is artificially increased, the water used for the purpose shall be taken from the source of the supply of drinking water, or shall be such as have been purified.

c. Overcrowding

No room in a factory shall be overcrowded to such an extent as to be injurious to the health of the workers employed therein.

d. Artificial lighting

In every part of a factory where workers are working or passing, there shall be provided and maintained sufficient and suitable lighting natural or artificial.

e. Safety

The main goal of this section is to prevent any accidents or issues which could severely endanger the workers and operation of the power plant.

Following machineries and machinery parts should be fenced to avoid incidents and injuries:

- Every moving part
- The headrace and tailrace of every turbine or wheel
- Every part of an electric generator, motor or rotating compound
- Every part of machinery transmission

If examination of moving machinery is necessary, the examination should be carried out by specially trained, instructed or supervised adult male workers wearing the appropriate safe-ty clothing. Neither woman nor child shall be allowed to clean, lubricate or examine any moving part of machinery. No young person shall work around and with machines which are considered dangerous, which is defined by the president.

Openings, pits and tanks should either be covered or securely fenced to avoid any accidents by fall.

Every hoist or lift should:

- be of good mechanical construction;
- properly maintained
- thoroughly examined by authorized personnel once every six months
- fitted with enclosure and gates to avoid accidents
- labeled with the maximum load capacity

Effective measures should be taken around the power plant machinery and equipment which operates at a pressure above the atmospheric pressure. The safe working pressure shall not be exceeded during operation.

Floors, steps, stairs, passages and gangways should be properly maintained and equipped with fences and handrails. The safe access to every working space should be granted.

No woman or adolescent should carry excessive weights.

Due to the presence of Gas in the power plant, no person shall enter in any chamber or pipe which contains dangerous fumes which could asphyxiate or be highly inflammable. Further-more no electric light of voltage exceeding 24 volts shall be permitted in the above-mentioned spaces. In dangerous segments of the plant, in which asphyxiating fumes could be emitted, suitable breathing apparatus shall be kept ready for use.

The burning chamber should not be accessed before ensuring the cooling of the chamber for safety purposes. The workspace which must be accessed by a member of the personnel must be secured before his entry.

To prevent any high damages in case of fire, the plant should be equipped appropriately. Doors should always be opened from the inside and should open outwards. Every window, door or escape route shall be marked in an understandable language. Warning apparatus should be installed in the power plant to give a warning in case of a fire outburst. The entire personnel should be trained appropriately to prevent any incidents in case of fire.

f. Safety of buildings and machinery

If it appears to the Inspector that any building or part of a building or any part of the passage way, machinery or plant in a factory is in such a condition that it will be dangerous to human life or safety, he may sever on the Manager of the factor an order in writing specifying the measures which in his opinion should be adopted, and requiring them to be carried out before a specified date.

If it appears to the Inspector that the use of any building or part of a building or of any part of the passage ways, machinery or plant in factory involves imminent danger to human life or safety, he may serve on the Manager of the factory an order in writing prohibiting its use until it has been properly repaired or altered.

g. Hoists and lifts

In the event of breakage or collapse of the ropes, chains or attachments efficient devices capable of supporting the cage together with its maximum load shall be provided and maintained.

h. Cranes and such other lifting and hoisting machinery

Every part thereof, including the working gear, whether fixed or moveable, and anchoring and fixing appliances, shall be

- i. of good construction, sound material and strength;
- ii. properly maintained, and shall be thoroughly examined by an authorized examiner at least once in every period of twelve months and a register shall be kept containing the pre-scribed particulars of every such examination;

No such machinery shall be loaded beyond the safe working load which shall be clearly marked thereon.

i. Working Hours of Adults

No adult worker shall be required to work more than forty-four hours in a week. In one day the worker should not work more than eight hours. Every five working hours a half an hour should be invested for resting. Sunday is not a working day unless there might be a special shift or case in which case exceptions can be made.

If a worker works for more hours than specified above, he shall be entitled to be paid at the rate of twice his ordinary rate of wages for his overtime.

Finally, no worker shall work twice in one day in two separate facilities.

j. Night shifts

Where a worker in a factory works on a shift which extends beyond midnight, the following day for him shall be deemed to be the period of twenty-four hours beginning with the end such shift and his work hours after mid-night shall be counted as those of the previous day;

k. Employment of young persons:

No child who has not completed his thirteen years of age shall be required or allowed to work in the power plant.

A child who has completed his thirteen years of age or an adolescent shall not be allowed to work in the power plant unless he gets a certificate of fitness. In this case, and under the supervision of the power plant Manager he might work.

In case of child employment, the working time should not exceed the four hours in any day. The working time should not be between 6 p.m. and 6 a.m. Therefore, no night shift can be done by children. On the same day no child should work at two separate places.

A registry of child workers should be created in the concerned power plant. The registry should always be accessible by inspectors.

3.2 Further National Laws, Rules and Standards

The Government of Myanmar has introduced legislation, rules and procedures for the undertaking of projects in the country. The principle piece of legislation in relation to environmental and social issues for the projects is the *Environmental Conservation Law* of 2012. This law has

procedures related to environmental conservation, pollution and other issues. In section 7 of the Law it is said, that the Ministry has the power for prescribing environmental quality standards including standards on emission, effluents, solid waste, production procedures and enhancement of environmental quality. Therefore, it can specify the categories of hazardous substances that may affect the environment and promotes the establishment of necessary factories and stations for the treatment of solid and liquid waste.

The *Environmental Conservation Rules* include similar rules and legislations as the *Environmental Conservation Law* of 2012. The Ministry of Environmental Conservation and Forestry shall create categories and classes of hazardous wastes generated by the CCGT Power Plant. The Ministry also cooperates with the responsible Governmental Agencies to build facilities for the treatment of such waste waster and it may assign inspection duty to the responsible Department to analyze the waste disposal facilities to determine the correct procedure. Furthermore the Ministry shall determine the categories of activity which shall carry out the environmental impact assessment.

In 2015 the *Ministry of Natural Resources and Environmental Conservation* (MONREC) released the *National Environmental Quality (Emission) Guidelines* which prescribes specific principles to control noise, air emission and effluent discharges. The Guideline applies to all projects requiring a environmental assessment, with the main goal to control pollution and protecting the environment.

3.2.1 Air Emissions

This guideline is based on the WHO Air Quality Guidelines with additional requirement for small combustion facilities (3-50 MW thermal power)

Parameter	Averaging Period	Guideline Value $\mu\text{g}/\text{m}^3$
Nitrogen dioxin	1- year	40
	1- hour	200
Ozone	8-hour daily maximum	100
Particulate matter PM ₁₀	1-year	20
	24-hour	50
Particulate matter PM _{2.5}	1-year	10
	24-hour	25
Sulfur dioxide	24-hour	20
	10-minute	500

Table 3-1: WHO Air Emission Limit Values

The following emission guideline applies to project systems designed to deliver electrical or mechanical power, steam, heat or any combination of these. Therefore, it might apply to the CCGT Power Plant. The exact combustion technology should be known to define the emissions allowed.

Combustion Technology / Fuel	Particulates matter PM10	Sulfur Dioxide	Nitrogen Dioxides
Gas	-	-	200 (spark ignition) mg/Nm ³ 400 (dual fuel) mg/Nm ³ 1600 (compression ignition) mg/Nm ³
Liquid	100	3%	1,600-1,850 (bore size >400mm) mg/Nm ³
Natural gas (3-<15 MW)	-	-	90 (electric generation) mg/Nm ³ 210 (mechanical drive) mg/Nm ³
Natural gas (15-<50 MW)	-	-	50 mg/Nm ³
Fuels other than natural gas (3-<15 MW)	-	0.5%	200 (electric generation) mg/Nm ³ 310 (mechanical drive) mg/Nm ³
Fuels other than natural gas (15-<50 MW)	-	0.5%	150 mg/Nm ³
Gas	-	-	320 mg/Nm ³
Liquid	150 mg/Nm ³	2,000 mg/Nm ³	460 mg/Nm ³
Solid	150 mg/Nm ³	2,000 mg/Nm ³	650 mg/Nm ³

Table 3-2: Emission guideline applicable for electrical or mechanical power, steam, heat or any combination

3.2.2 Wastewater

Wastewater generated from project operations includes process wastewater, wastewater from utilities operations, runoff from process and storage areas and miscellaneous activities including wastewater from laboratories and equipment maintenance. For projects with the potential to generate process wastewater should incorporate the necessary precaution to avoid or minimize the adverse impacts on human health and environment.

Parameter	Unit	Guideline Value
5-day Biochemical oxygen demand	mg/l	50
Ammonia	mg/l	10
Arsenic	mg/l	0.1
Cadmium	mg/l	0.1
Chemical oxygen demand	mg/l	250
Chlorine (total residual)	mg/l	0.2
Chromium (hexavalent)	mg/l	0.1
Chromium (total)	mg/l	0.5
Copper	mg/l	0.5
Cyanide (free)	mg/l	0.1
Cyanide (total)	mg/l	1

Parameter	Unit	Guideline Value
Fluoride	mg/l	20
Heavy metals (total)	mg/l	10
Iron	mg/l	3.5
Lead	mg/l	0.1
Mercury	mg/l	0.01
Nickel	mg/l	0.5
Oil and grease	mg/l	10
pH	Standard Unit	6-9
Phenols	mg/l	0.5
Selenium	mg/l	0.1
Silver	mg/l	0.5
Sulphide	mg/l	1
Temperature increase	°C	<3
Total coliform bacteria	100 ml	400
Total phosphorus	mg/l	2
Total suspended solid	mg/l	50
Zinc	mg/l	2

Table 3-3: Wastewater limit values

Furthermore, the following guideline values apply during the construction phase of projects.

Parameter	Unit	Maximum Concentration
Biochemical oxygen demand	mg/l	30
Chemical oxygen demand	mg/l	125
Oil and grease	mg/l	10
pH	Standard Unit	6-9
Total coliform bacteria	100 ml	400
Total nitrogen	mg/l	10
Total phosphorus	mg/l	2
Total suspended solids	mg/l	50

Table 3-4: Wastewater guideline values during construction

3.2.3 Noise Levels

Noise prevention and mitigation measures should be taken by all projects where predicted or measured noise impacts from a project facility or operation exceeds the applicable noise level guideline. Noise impacts in the surrounding of a plant site should not exceed the levels shown in the following table.

Receptor	One Hour dBA	
	Daytime 07:00-22:00 (10:00-22:00 for Public holidays)	Nighttime 22:00-07:00 (22:00-10:00 for Public holidays)
Residential, institutional, educational	55	45
Industrial, commercial	70	70

Table 3-5: Environmental noise limit values

3.2.4 Thermal Power Specific Guidelines

This guideline applies to combustion processes fueled by gaseous fuels and that are designed to deliver electrical or mechanical power, steam, heat or any combination of these. The heat input capacity is above 50 MW, which must be considered when the power of the CCGT is known.

Parameter	Unit	Guideline Value
Arsenic	mg/l	0.5
Cadmium	mg/l	0.1
Chromium (total)	mg/l	0.5
Copper	mg/l	0.5
Iron	mg/l	1
Lead	mg/l	0.5
Mercury	mg/l	0.005
Oil and grease	mg/l	10
pH	Standard Unit	6-9
Temperature increase	°C	<3
Total residual chlorine	mg/l	0.2
Total suspended solids	mg/l	50
Zinc	mg/l	1

Table 3-6: Thermal power plant effluent guideline values

Combustion Technology / Fuel	Parameter / Guideline Values		
	Particulate matter PM ₁₀	Sulfur dioxide	Nitrogen oxides
<i>Combustion turbine</i>			
Fuels other than natural gas (unit >50 MW)	50 mg/Nm ³	Use of <1% Sulfur fuel	310 mg/Nm ³
Natural gas (all turbine types; unit >50 MW)	-	-	100 mg/Nm ³
<i>Boiler</i>			
Liquid fuels (plant >600 MW)	50 mg/Nm ³	200 mg/Nm ³	400 mg/Nm ³
Liquid fuels (plant 50-600 MW)	50 mg/Nm ³	900 mg/Nm ³	400 mg/Nm ³
Natural gas			240 mg/Nm ³
Other gaseous fuels	50 mg/Nm ³	400 mg/Nm ³	240 mg/Nm ³
Solid fuels (plant >600 MW)	50 mg/Nm ³	200 mg/Nm ³	510 mg/Nm ³
Solid fuels (plant 50-600 MW)	50 mg/Nm ³	900 mg/Nm ³	510 mg/Nm ³
<i>Reciprocating engine</i>			
Biofuels / gaseous fuels other than natural gas	50 mg/Nm ³	-	30% higher than for other fuels
Liquid fuels (plant >300 MW)	50 mg/Nm ³	585 mg/Nm ³	740 mg/Nm ³

Liquid fuels (plant 50-300 MW)	50 mg/Nm ³	1,170 mg/Nm ³	1,460 mg/Nm ³
Natural gas	-	-	200 mg/Nm ³

Table 3-7: Thermal power plant air emission guideline levels

3.3 International Directives, Guidelines and Standards

3.3.1 World Bank EHS Guidelines

The World Bank group Environmental, Health and Safety Guidelines are technical framework guidelines with general and industry-specific examples of Good International Industry Practice. When members of the World Bank Group are involved in a project, the EHS Guidelines are applied as required by their respective policies and standards. The General EHS Guidelines are designed to be used in combination with the relevant Industry Sector EHS Guidelines. The International Finance Corporation and other international financing institutions use the EHS Guidelines as a technical source of information during project appraisal activities.

The EHS Guidelines contain the performance levels and measures that are the most achievable in new facilities by existing technology at a reasonable cost. The applicability of the EHS Guidelines should be adjusted for each project whereby the results of the EIA (Environmental Impact Assessment) are considered. In the case of a discrepancy in the national and World Bank EHS Guidelines, projects are expected to achieve whichever Guideline is more stringent. In some case, less stringent alternatives can be proposed and implemented, under the condition that human health and environmental protection are still sufficiently considered.

The general approach to the management of EHS issues requires the incorporation of such Guidelines in the entire process of the project management. The approach is hierarchical and includes the following steps:

- Identification of EHS project hazards and associated risks as early as possible in the development of the project. During the site selection process, product design process, engineering planning process and more, the EHS Guidelines should be considered.
- Involving EHS professionals, which have the experience and competence to assess and manage EHS impacts and risks.
- Analyze and individuate the likelihood and magnitude of EHS risks. This is based on the nature of the project activities (generation of high emissions, involves hazardous materials) and the potential consequences to workers, communities or the environment
- Prioritize risk management strategies with the objective of achieving a reduction of risk to human health and the environment. The focus lies on the prevention of irreversible and significant impacts
- Giving the priority to strategies that eliminate the cause of hazard by selecting less hazardous materials or processes

- When the impacts are not avoidable, incorporate engineering and management controls to reduce or minimize the possibility and magnitude of those impacts
- Prepare workers and nearby communities to respond to accidents

The World Bank General EHS Guidelines apply generally to all project types and divide into:

- Environmental guidelines
- Occupational Health and Safety guidelines
- Community Health and Safety guidelines
- Construction and Decommissioning guidelines

Also applicable to the Thaton Power Plant are the following industry specific EHS Guidelines:

- EHS Guidelines for Thermal Power Plants
- EHS Guidelines for Electricity Transmission and Distribution

3.4 Management Certifications

3.4.1 Occupational Health and Safety Management Certification

The Occupational Health and Safety Management Certification (OHSAS 18001) is an international standard which provides a framework to identify, control and decrease the risks associated with health and safety within the workplace. Implementing the standard will send a clear signal to your stakeholders that you view employee's health and safety as a priority within your organisation.

An increasing number of organisations are completing OHSAS 18001 certification as employers are under increasing pressure to ensure that a rigorous health and safety policy is in place which protects employees against possible occupational risks and reduces the likelihood of accidents in the workplace. By planning ahead an organisation can also identify health and safety risks and conform to health and safety legislation.
(<https://www.certificationeurope.com>)

According to the originator of the above-mentioned reference, the benefit of OHSAS 18001 is as follows:

- *Improves corporate image and credibility among stakeholders, regulators, customers, prospective clients and the public*
- *Adopts international best practice in relation to risk management*
- *Ensures health and well-being of employees, sub-contractors and the public*

- *Minimizes the liability of employers through adoption of proactive rather than reactive controls*

- *Ensures legislative awareness and compliance*

- *Reduces accident and incident rates by reducing or eliminating workplace hazards*

- *Improves the incident investigation process*

- *Increases employee motivation through the provision of a safer workplace and participation process*

3.4.2 Environmental Management Certification

ISO 14001 is an internationally agreed standard which sets out the requirements and criteria for an environmental management system. This standard provides a framework which can be followed by companies and organizations of all types, size, private, non-profit or governmental to set up an effective environmental management system.

The company is required to consider all environmental issues relevant to its operation, such as air pollution, water and sewage issues, waste management, soil contamination, climate change mitigation and adaptation and finally the resource use and efficiency.

By applying ISO 14001, the company management and employees as well as external stakeholders can be assured that environmental impacts are being measured and improved.

ISO 14001 also creates a financial advantage through the improvement of efficiency. Furthermore, by integrating suppliers, manufacturers etc. into the organization's business system, an improved environmental performance can be expected from them.

There are many sources which provide detailed guidance on how to use the ISO 14001 standard. In the following, some key factors are shown which can be applied to get started with the process:

- Definition of objectives. What shall be achieved with the ISO14001 Standard?
- Receive the support from senior management. It is important, that the leadership of the organization supports the objectives of an environmental management system. The leadership have to be committed to the process.
- Get an overview of existing processes and systems which are relevant for the environmental impacts. The overview helps to identify gaps and therefore improvement possibilities.

Generally, the application of ISO 14001 guarantees the international acceptance of the applied environmental management system. The most important benefits are as follows:

- *Compliance regarding actual and future regulatory requirements*

- *Increase leadership involvement and engagement of employees*

- *Improve the reputation of the concerned company and the confidence of stakeholders*

4. Environmental conditions at the Thaton Power Plant site

As part of its assignment, Fichtner undertook an **EHS Due Diligence (DD) Audit** of the Thaton Power Plant in July 2016. In September 2016, a new visit to the power plant was undertaken to clarify open issues from the first visit.

The DD aimed at the identification of the EHS risks of the **existing plant**. The compliance of the plant's structures and operations with related legislation and standards has been assessed as well during the DD Audit.

The hereby description of the Plant's conditions is based on information provided orally to Fichtner by the TPP management, on a sensorial assessment, on laboratory analysis of samples, and on discussions with local communities. No document regarding the TPP's EHS management is available at site nor has been delivered to Fichtner.

The complete **DD Site Audit Report** has been separately prepared as part of Fichtner's assignment (June 2017). The below paragraphs provide an overview of the environmental conditions at site at the time of the audit.

4.1 General

The Thaton PP was built in 1985. It consists of 3 gas turbines with an installed capacity of 54 MW. The TPP runs in a closed cycle but the produced steam is not used for producing additional energy. Instead, it is sold to the neighboring rubber plant.

Water is obtained from the rubber plant which sources the water via an own pipeline and pumping station from the Donthami River nearby. The water is used for domestic needs in the TPP, as well as for cooling and as process water.

The plant site, equipment, and buildings are generally in very poor conditions. Within the last decades no obvious general maintenance took place, except for some technical refurbishment (turbine renovation).

In the three storage buildings, Fichtner encountered broken asbestos-containing ceilings. The floor in one of the control rooms and on the transformer station has holes, some of which large enough to pose a severe injury risk. Some open and unprotected man holes have also been identified.

Although the steam turbine is not used nowadays, its old building is of free access to any worker and animal. The old structures and pipes inside the building are not secured, there are no safety or warning signs, and there is no light.

Dogs walk freely throughout the plant's installations, and seem to have no fear of approaching the structures, buildings and people.

On site 85 employees (55 males and 30 females) are working in 4 shifts. This includes also 1 health officer sited in the workers' residential area nearby the plant. At night 11 people are present. None of the employees is under 18 years old. The female employees that work in the offices are allowed to have their children with them during the day. No additional facilities for children are provided.

The whole area of the PP is fenced. The external fence is in good conditions. Some internal fences (for example the one surrounding the transformer station) are degraded and require repairs. Since two years the site is guarded by police officers who sit in a small police station very close to the PP site.

4.2 Welfare conditions

A little tea shop with an adjacent eating room is available where the workers eat their own food. There is no canteen available on site, but the workers can purchase tea, coffee and food prepared by two female employees at the tea shop. The shop and eating room is generally dirty and covered by asbestos plates.

A small library is available adjacent to the tea shop and the eating room. The books are very old and it seems that they are not borrowed by the workers anymore.

3 toilets inside the control building and 8 toilets outside are installed and are separated by gender. Tap water is available but the quality is not monitored. The exterior toilets are kept in deplorable conditions and there is a plan to dismount them. There are no showers on site.

4.3 Housing area

Nearby the plant (800 m to the south), there is a housing area for the workers of the Thaton Power Plant and for the workers of the rubber plant (Figure 4-1).

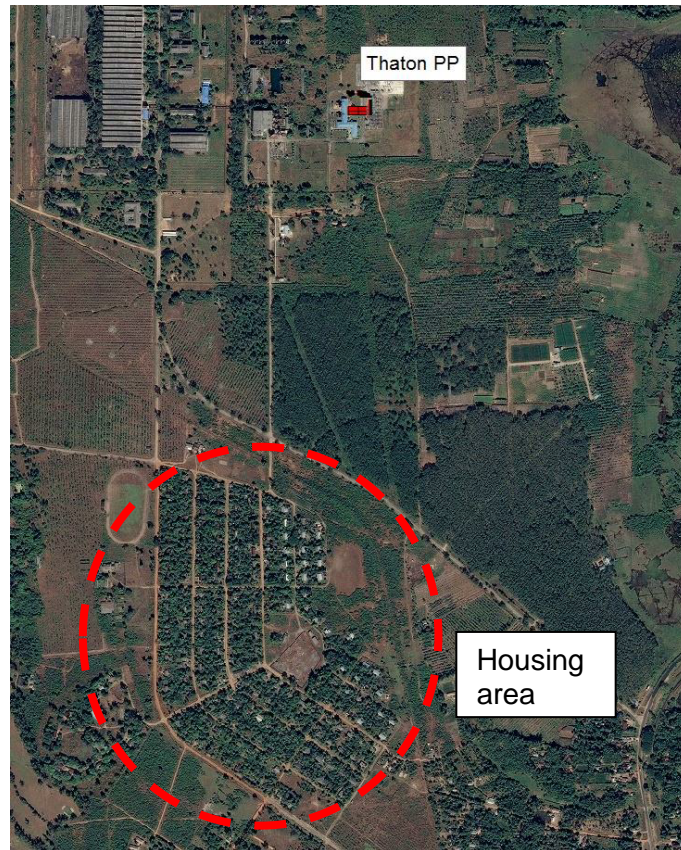


Figure 4-1: Housing area for the workers of the Thaton PP

All workers are allowed to rent a house in this area for them and their families. 75% of all employees use the housing area, and the remaining 25% live in Thaton.

During the dry season water is only supplied to the housing area two times a day for 30 minutes. The power plant's management sees therefore as highest priority to improve the water supply situation of the employees housing area. A new water pipeline to supply the new power plant is planned to be built as part of the Project. It is the strong demand of the power plant's management to include a connection to the housing area to solve the supply problems.

4.4 Workers rights

The plant's management does not have a formal human resources policy, nor are the employees' rights described in the working contract. However, the national legislation on the matter is said to be respected at the Thaton Power Plant, as well as in every power plant at national level. The same salary is guaranteed for all workers undertaking the same job; every worker, independently of her/his position, is allowed to use the accommodation services provided nearby the plant.

No workers unions exist at the Thaton Power Plant. This is a new theme in the country, as only since 2011 labour unions may be formed at the factory level.

Children are not employed at the plant, but are allowed to spend the day with their mothers within the office area. However, no area or infrastructure dedicated to child care exists at the plant.

It is not clear presently for how long the existing Thaton Power Plant will continue operating. It is as well unclear whether the workers of the existing Thaton Power Plant will be transferred to the new plant or be let go in case the old plant closes down.

4.5 Wastewater

The sanitary waste water is collected in pits, which are emptied approximately once every 4 years by the municipality. It is not known what happens with this wastewater. A waste water treatment is not in place at Thaton.

Storm waters are drained and sent down to the river. Fichtner visited the power plant twice during the rainy season and it seems that the drainage channels are working well, despite the lack of maintenance (plants grow and garbage is deposited inside some of the channels). No oil separators are installed.

4.6 Stack emissions

The stacks of the gas turbines are about 30 feet high (9 m) and are not equipped with any air pollution control equipment. Air emissions monitoring is not conducted, as no monitoring devices are available.

4.7 Solid and hazardous waste

Old used oil, old batteries, and small amounts of mercury from energy saving light bulbs, HCl and NaOH are collected, stored in unspecified locations everywhere on site and sold. There is not a specific plan to manage the plant's waste. For example, old oil is stored ca. 5 years on site before being sold. For other waste typologies, no information could be given regarding storage time.

Solid waste such as domestic waste or packages is burnt on site.

4.8 Noise

The noise levels at site are generally very high. For example, close to the gas turbine 3 (GT 3), a conversation cannot be held without considerably raising the voice tone. Silencers or any other noise reduction structures around the turbines do not exist. The walls and windows from the offices and control rooms provide little dampening effect from the exterior noises. The existing ESA report provides a quantitative assessment of the noise

levels at site, showing that these exceed noise limits such as those considered in the National Environmental Quality Guidelines.

Despite the noisy environment, no workers have been seen wearing ear protection.

The closest sensitive receptors to the site are located in the power plant's housing area, ca. 800 meters away. Normally, the noises from the power plant are masked by other noises, especially traffic related, at these locations.

4.9 Monitoring and inspections

There is no supervision of EHS issues on site, either internal or performed by relevant official authorities.

No monitoring of air emissions, air quality, noise, waste water, surface water or groundwater is undertaken at site. The process water received from the rubber/tire plant undergoes a certain monitoring regarding pH and hardness.

4.10 EHS training

The staff undergoes a quarterly general training in Nay Pyi Taw, but no EHS issues are covered. A record of these training sessions was not available.

During Fichtner's visit in September 2016, it was suggested that a training session in H&S issues is provided at the plant by the FGLLID.

4.11 Emergency procedures and first aid

First aid equipment onsite consists of one poorly equipped first aid box. In the small workers' housing area nearby the plant site, a health officer (senior main nurse) provides first aid measures in case of small injuries of the employees and their families. According to the health officer, no severe accidents happened in the last years. In case patients have severe problems, they are sent to the nearest hospital, located in Thaton city.

An Emergency Response Plan in written form is not available. Fichtner was informed that a plan of this kind has been developed in the past. The TPP's management added that this plan is not available on site nor people receive training on its dispositions because "nowadays all workers are aware of what to do in case of an emergency".

Reports to the headquarters (MOEE) are only written in case of unfavorable weather conditions to justify an eventual shutdown or loss of efficiency of the power plant. In case of severe accidents, also a report shall be written. According to the TPP's management, such severe accidents never happened.

Several hand-held fire-extinguishers are located inside one of the control rooms. Some of them are new (dated February 2016) and still covered in plastic wrap, some are old and outdated. There is no fire brigade on site, but there is one in Thaton and one in the adjacent tyre factory.

There are no emergency exit signs or maps in the plant.

4.12 Polychlorinated biphenyls (PCB)

In former times, polychlorinated biphenyls (PCB) were widely-used as coolants and lubricants in transformers, capacitors, and other electrical equipment because PCB possess good insulating properties and are fire retardant. These substances consist of two phenyl-rings that can contain different amounts of chlorine molecules.

In general, the acute toxicity of PCB is small, but regarding its chronic effects, PCB has a high toxic potential. Especially when burned with low temperatures (below 1.000°C), PCB can be turned into highly toxic and carcinogenic dibenzofurans (PCDF) and dibenzodioxins (PCDD). Therefore, special attention has to be put on this issue. Proper special incineration plants for PCB containing fluids operate with temperatures of around 1.200°C.

Three samples of oil (old, used and new transformer oil as well as old, used and new turbine oil) were taken during the first visit of Fichtner to the Thaton PP in July 2016, transported in closed plastic containers to Germany and analyzed for PCB in a certified laboratory. In Table 4-1, the results of the PCB analyses are summarized.

Table 4-1: Results of the analysis for PCB in oil samples from the Thaton Power Plant

Sample	PCB [ppm]
Old, used turbine oil	< 0.2
New Turbine oil	< 0.2
Old, used transformer oil	9.95
New transformer oil	< 0.2

Detection limit for PCB = 0.2 ppm

According to US EPA, a transformer is 'a transformer that contains PCB' if the concentration of PCB is higher than 500 ppm. Oil containing between 50 and 499 ppm PCB is considered to be polluted with PCB and therefore specific methods for removal are necessary (e.g. specific incineration plants). According to the EU Directive 75/439/EEC and its amendments, oil containing less than 50 ppm PCB can be burned in a regular incineration plant.

According to the above, none of the samples is polluted with PCB. Only the sample of old, used transformer oil showed traces of PCB (9.95 ppm) which is, however, far below the threshold of 50 ppm.

From these findings it can be reasonably assumed that none of the oil used at Thaton PP contains PCB. This statement is in accordance with Fichtner's experience gained in at least six other projects in central Asia: in big transformers (others than those installed in connection with distribution systems) and turbines, PCB has never been found. Capacitors, however, contain very often the so called PCB 28 (trichlorobiphenyl). But, as capacitors are not in use at the Thaton PP, this problem will not occur.

In summary, the oil used at Thaton PP site **is most probably free of PCB**. Therefore, no special treatment has to be done and no special disposal procedure has to be followed. This oil can either be recycled, reused, sold, or burned in a regular oil fired power plant without PCB-related environmental constraints.

4.13 Asbestos

At three different sites at Thaton PP, broken panel material used to cover roof and walls have been collected and analyzed for asbestos fibers. These parts were taken from ceiling panels from the warehouse nr. 3 (where oil is stored), and from wall panels from the tea house/library and the old steam turbine building.

The referring material analyses (also done in a certified laboratory in Germany) have revealed that **all three samples contain asbestos fibers**. In all samples amphibole asbestos and chrysotile asbestos were detected (content of fibers between 1 and 15 %). Chrysotile asbestos is known as "white asbestos". Its fibers are generally finer than amphibole asbestos types. The results can be consulted in Annex 4 to this report.

All types of asbestos cause lung cancer, mesotheliom, cancer of the larynx and ovary, and asbestosis (fibrosis of the lungs). Exposure to asbestos occurs through inhalation of fibers in air in the working environment, ambient air in the vicinity of point sources such as factories handling asbestos, or indoor air in housing and buildings containing friable (crumbly) asbestos materials.

Most critical is, if panels containing asbestos are demolished and break during eventual demolition works. During such activities, asbestos fibers are freed and might be inhaled by workers. This means that wearing a surgical mask (better is a real respiration filter) is essential when working with such panels.

However, because there is no appropriate disposal site for asbestos available in Myanmar at the moment, the panels which are not damaged should be left untouched, if there is not a real urgent need to remove them. In order to protect asbestos fibers from being released from the *damaged* panels, painting of the panels would be a proper method to minimize the risks of exposure. Regarding the specific case of the tea shop/library, where

damaged wall panels containing asbestos are present, Fichtner recommends the closure of this building and its replacement by a new building.

4.14 Environmental and Social Action Plan

The existing Thaton Power Plant is non-compliant with international EHS standards. Given the state of degradation of the facilities (which motivated the decision for construction of a new plant instead of its renovation), it is not possible to propose feasible actions to achieve full compliance. It is Fichtner's opinion that for the existing plant only **emergency measures** to achieve some level of compliance can be developed. These measures have been described in an Environmental and Social Action Plan - ESAP available in the separate DD Site Audit Report (July 2017).

The ESAP for the Thaton Power Plant follows a conservative approach. Fichtner considered the country's and the plant's financial, technical, human and legal limitations which are presently a reality and which hinder the realization of deep re-structuring measures. In an ideal case, the plant would have been shut down due to serious safety issues and human health hazards. However, the city of Thaton relies on the power plant for power supply and for provision of mostly needed job positions. The application of the measures foreseen in the ESAP is intended to help to keep the plant operating while at the same time the most serious EHS issues can be handled as good as the available resources allow.

5. EHS Routines and Procedures

5.1 Description of required Routines and Procedures

5.1.1 Operational Procedures

5.1.1.1 Introduction

Standard operating procedures (SOPs) are written instructions intended to document how to perform a routine activity. Many companies rely on standard operating procedures to help ensure consistency and quality in their products and in the execution of tasks and works. Standard operating procedures are useful tools to communicate important corporate policies, government regulations, and best practices.

Many workplace processes require strict adherence to a set of instructions to ensure the intended outcome occurs. Even the best employees don't have perfect memories, so having a set of written instructions they can refer to when performing the steps of the process ensures everything is done correctly. When new employees are trained, standard operating procedures help keep their training fresh and serve as important reference tools. Copies of standard operating procedures should be available at the actual location where the work is being done. This not only ensures the people that need them can access them, but it also demonstrates the company's efforts to communicate policy and regulation to employees.

5.1.1.2 Requirements

EPGE is requested to develop workplace and task specific EHS Procedures. The identification of EHS procedures will be based on risk assessments (see **Chapter 11**). This will influence the content of the procedures as well beside some general aspects.

Environmental, health & safety procedures are generally part of the project framework for an effective EHS management. The EHS Policy (see **Chapter 2**) states the requirement to provide and maintain a safe and healthy working environment and an environmental friendly and sustainable operation of the power plant, and outlines the EHS goals related to the entire operation of the power plant.

Specific EHS workplace and task procedures shall address particular issues or hazards and the measures how to control workplaces and tasks subject to those identified hazards. The procedures should be used together with other hazard control measures to eliminate or reduce the risks of accidents and incidents, of workplace illness and/or injuries and of any possible environmental concerns.

EHS procedures are required to be developed for the following activities expected to be needed for the safe operation of the power plant and during any maintenance periods and activities. A tentative list of required EHS procedures is shown below but must be subject of review and change, if necessary:

- Site access control and site security procedure;
- Health & safety protection for electrical works;
- Use of hazardous chemicals and materials;
- Simultaneous activities;
- Shift work, shift rotation and fatigue;
- Risk assessment;
- Job Safety Analysis;
- Working at height;
- Working in confined spaces;
- Use of personal protective equipment;
- Hot works;
- Welding;
- Emergency response;
- Evacuation procedure;
- First aid;
- Working in or close to water (if applicable);
- Use of electrical equipment;

Checklists for the review if all required content has been addressed and for the approval of the above listed procedures must be developed by the appointed HSE Manager in close cooperation with the lead operational staff team members. The checklist must define the minimum requirements to be met.

The HSE Manager in close cooperation with the responsible operational staff is obliged to ensure that the EHS procedures are always based on the recent applicable legislation.

Timing and updating:

- The EHS procedures must be prepared and approved two weeks after start of operation of the power plant at the latest.
- New EHS procedures for identified required new workplaces and tasks must be prepared and approved two days after the new workplace has been commissioned or two days before the execution of the new task.
- Existing EHS procedures must be checked with respect to the need of an update once per year. The requirement for an update must be assessed after the implementation of a new EHS legislation (law, regulation or guideline) or after the implementation of respective revisions.

5.2 Grievance Management

5.2.1 Workers Grievance Management System

EPGE must implement a grievance management system to enable the workers to raise complaints and to inform about non-compliances with the implemented EHS management system. The grievance management system should provide the possibility as well to issues complaints in case of discrimination and/or the non-consideration of equal opportunities.

The grievance management system shall consider the possibility to contact directly a member of the EHS staff. The contacted staff member(s) must take a note of the reported complaint or non-compliance and must report it to the site Manager and the EHS Manager.

The EHS management is requested to solve the complaint or non-compliance within 3 working days. In case the problem could not be solved, an action procedure specifying the needed activities together with a final deadline until the problem is expected to be solved must be prepared and submitted to the site Manager.

The grievance management system must consider the possibility for the workers to notify a complaint or non-compliance in a confidential way.

All reported grievances or non-compliance notifications must be documented. The number of advices together with the corresponding topics, the timeframe until the issues have been solved must be documented. These information and figures must be part of the HSE content of any annual performance report.

Documentation and Reporting:

- *All grievance and non-compliance notifications must be documented and reported as part of the annual performance report.*

5.2.2 Public Grievance Management System

A grievance management system shall be developed and implemented according to the structure and organisation of the workers grievance management system. The public grievance management system shall be generally open all public complaints.

A respective procedure must be developed by EPGE. It must consider a simple and understandable summarized description in the national language highlighting the purpose of the grievance management system and how to use it.

The grievance management system for the public must consider a reporting procedure to the local authority to demonstrate to the administrative body that the grievances have been identified, noted, managed and solved. The acceptance by the public community member must be documented.

The responsible authorities at community level must be identified and included in the respective procedure. The contact person and contact details must be included as well.

The reporting procedure should be discussed and agreed together with the administrative body and specific attention should be paid to any specific requirements to be announced by the authority.

Documentation and Reporting:

- *All grievance notifications must be documented together with the acceptance by the community member who issued the grievance. All grievances must be reported as part of the annual performance report, this shall include the number of grievances, the corresponding topic together with the timeframe until the issue has been solved.*

6. EHS Roles & Responsibilities

Adequate staff planning and structuring the roles and responsibilities is one of the first tasks and in parallel one of the most critical issues to organize the EHS site staff team.

Three aspects are outlined in the following chapters

1. developing an overall organizational structure for EHS site staff and site operations;
2. establishing a comprehensive work plan that considers each specific activity for the EHS site staff; and
3. developing and implementing a site specific Environmental, Health and Safety Plan

The organizational structure should identify the site staff needed for the overall EHS site management as well as the specific overall responsibilities of each employee.

The work plan should describe all tasks that fall under the responsibility of the site EHS staff and should describe the frequency, specific dates and times when each task must be undertaken, executed and completed.

A fourth important aspect is the coordinating with all relevant external parties, e.g. authorities, agencies etc., and with the site management staff and the work staff.

6.1 EHS Organization

EPGE has implemented a new HSE section at Thaton Power Station in summer 2017. In order to support the successful implementation of all EHS requirements. The following content describes in more detail the implementation and organization of an EHS organization. The roles and responsibilities with respect to the appointed staff team members are described in **Chapter 5.2**.

The new organization shifts away from project teams working in isolation toward using cross-functional teams.

An organizational structure that supports the overall objectives of the project should be developed in the first stage of planning. This structure should:

- identify a leader who has the authority to direct all activities;
- identify other personnel needed for the operation of the CCGT, and assign their general functions and responsibilities.
- show lines of authority, responsibility, and communication.
- Identify the interface with the response community.

As the project progresses, it may be necessary to modify some organizational aspects, such as personnel responsibilities and the content of procedures, so that individual tasks can be performed as efficiently and safely as possible.

Any changes to the overall organizational structure must be recorded in the Environmental, Health & Safety Plan that must be developed for the Thaton plant site. Any changes must be communicated to all parties involved.

The positions considered in the EHS organigram for the Thaton site are outlined in the following figure.

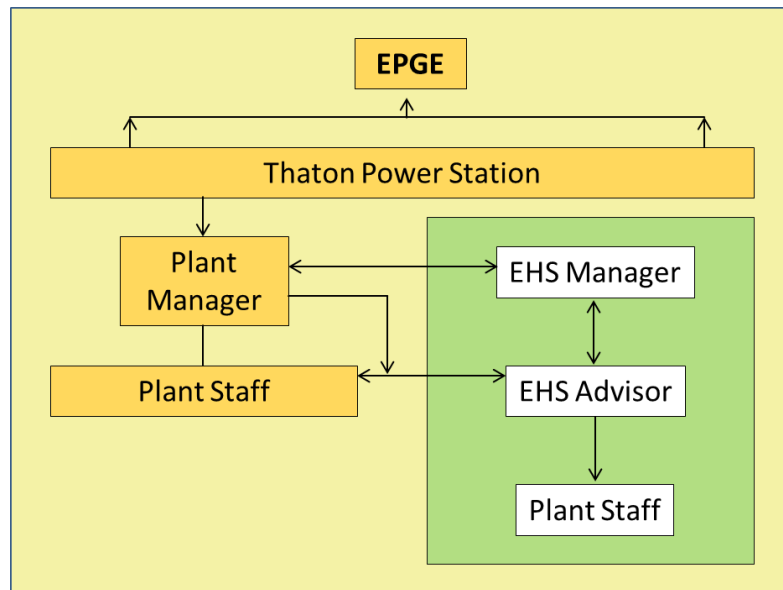


Figure 6-1: EPGE and Thaton Power Station EHS organization chart

The roles and responsibilities are described in **Chapter 5.2**. The onsite staff is divided in different responsibility levels, starting with the EHS Manager through the EHS Advisor(s) to the work staff.

The suggested organization should illustrate the scope of responsibilities and functions that must be covered. The personnel categories described can be used as a starting point for designing an organizational structure.

Once the organizational system has been developed, all individuals responsible for establishing and enforcing environmental, health and safety requirements should be identified and their respective authorities clearly explained to all members of the work staff.

One of the most critical elements in EHS is the attitude of all management levels not appointed for specific EHS roles. A strong and visible commitment must be present from the very first beginning. This initial attitude sets the tone for the entire operation. The EHS staff must have the clear support of the plant Manager and of the entire EPGE management for establishing, implementing, and enforcing EHS programs. The importance of management's attitude toward EHS throughout the EHS management

system cannot be overemphasized; site staff are more likely to cooperate with EHS measures if they sense a genuine concern on the part of management.

Several organizational factors are indicators of successful EHS management. These factors include:

- *Strong management commitment to EHS, as defined by various actions reflecting management's support and involvement in EHS activities.*
- *Close contact and interaction among workers, supervisors, and management enabling open communication on safety as well as other job-related matters.*
- *A high level of housekeeping, orderly workplace conditions, and effective environmental quality control.*
- *Well-developed selection, job placement, and advancement procedures plus other employee support services.*
- *Training practices emphasizing early indoctrination and follow-up instruction in job safety procedures.*
- *Effective disciplinary plan to encourage employees to adhere to EHS practices.*

Open communication among workers, supervisors, and management concerning worksite EHS issues is essential.

6.2 EHS Roles & Responsibilities

6.2.1 Environmental, Health & Safety Manager

EPGE will appoint an EHS Manager for the entire project. The EHS Manager will have the overall responsibility with respect to the supervision of the EHS organisation, the execution of the various EHS tasks and steps, means the implementation e.g. of all defined EHS procedures. He must be contacted in case of major and severe injuries or fatalities.

He will be the person to decide if the entire EHS documentation, incl. all required reporting, preparation of documents and procedures etc. is suitable and acceptable. He will be the person in charge with respect to the approval of the entire EHS documentation.

The EHS Manager is at least responsible for:

- the implementation, monitoring and supervision of EPGE's environmental, health & safety staff;
- all communication and reporting procedures;
- the communication and reporting with all related authorities and administrative bodies;
- the approval of all related EHS deliverables to be developed;
- the planning of all internal EHS audits;

- the participation in all internal and external, if any, EHS audits;
- planning for the execution of unannounced workplace inspections, etc.
- participation in project meetings and/or management meetings, if any;
- approval of updates of the Environmental, Health & Safety Management Manual;
- approval of updates of the Environmental, Health & Safety Policy Statement;
- approval of all EHS status reports;

The EHS Manager is responsible:

- to implement the measures of the EHS Plan
- to undertake risk assessments;
- to approve permits to work;
- to approve safe job analysis;
- to prepare work procedures and instructions;
- to provide training and induction on health & safety issues;
- to undertake EHS audits and workplace inspections;
- to prepare EHS reports;
- to prepare and revise the emergency response plan;
- to investigate incidents and accidents.

The EHS Manager is authorized to instruct the workers to follow the implemented EHS requirements and he is authorized to stop any activities in case of non-compliance with the permit to work.

Reporting:

The EHS Manager reports to the Plant Manager.

6.2.2 Environmental, Health & Safety Advisor

EPGE will appoint a suitable number of EHS Advisor. It will be the responsibility of the EHS Advisor to coordinate in close cooperation with the EHS Manager all environmental, health & safety management activities to be undertaken at site and in the power plant. He will be the focal point for any maintenance contractors for the submission of any type of reports to be prepared and submitted during maintenance periods. The EHS Advisor will report to the EHS Manager.

The duties of the H&S Coordinator are at least as follows:

- Representation of the Health & Safety Manager in case of his absence;
- Development and continuation of the operation schedule of the Project Implementation Consultant;
- Management of overtime announcements;
- Review and documentation of list of workers below 18 years;
- Communication with the appointed Contractor(s);
- Participation in Health & Safety Audits;
- Review of monthly reports;
- Review of weekly reports;

Reporting:

The EHS Advisor reports to the EHS Manager.

6.2.3 Workers

All workers, working permanent or temporarily at site, must follow any approved and implemented EHS instructions and procedures independent if the instructions are provided as a written or verbal instruction.

They must report any non-compliances of actions and situations with the EHS Management System to the Plant Manager, the EHS Manager or the EHS Advisors.

The workers shall keep their workplace and their accommodation tidy and clean with the overall aim to prevent any environmental, health and safety risks.

The workers are requested to inform the EHS staff in case they feel uncomfortable to execute any work instructions because of expected risks or dangerous occurrences.

They must contact the medical staff at site (see **Chapter 8.3**) in case of any injuries or diseases.

7. Incident and Accident Management

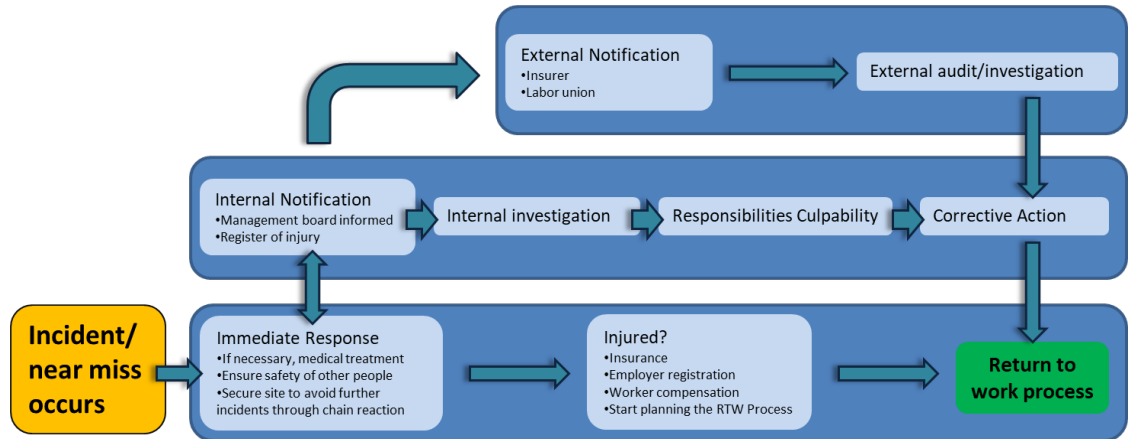


Figure 7-1: Accident and incident management process

7.1 Investigation and Reporting

The site management together with EPGE management and EHS staff shall be notified within 24 hours or as soon as reasonably possible after the occurrence of any incident or accident which has resulted in damage or loss of property, disability or loss of human life, or which has or which could reasonably be foreseen to have a material impact on the environment.

The notification can be done by phone or email and must be followed by a written report not later than 7 days after the occurrence of such an event.

The notification must include the following information (see as well Annex No 1 for further details):

- Location, date and time of event;
- Type of event;?
- Type of harm (or potential of harm);
- Contact details of reporter;
- Brief description of event;
- Details of witness(es);
- Investigation details;
- Causes of the event;
- Control measures to be implemented to prevent recurrence;
- Risk assessment/procedures to be reviewed;
- Members of investigation team;
- Signatures
- Findings needed to be reported.

The following instructions should be acknowledged as a general advice for the EHS staff.

When incidents or accidents are investigated, the emphasis should be concentrated on finding the root cause rather than the investigation

procedure itself. This will prevent that the occurrence will happen again. The purpose is to find facts that can lead to avoidance actions and not to find fault. It is needed to look for the deeper causes.

Reasons to investigate, e.g. a workplace accident include:

- *Finding out the cause of accidents and to prevent similar accidents in the future;*
- *Fulfilment of any legal requirements;*
- *Determination of the cost of the accident;*
- *Determination compliance with applicable safety regulations;*
- *Processing workers' compensation claims*

Incidents that involve no injury or property damage must be investigated as well to determine the hazards that should be corrected. The same principles apply to a quick inquiry of a minor incident and to the more formal investigation of a serious event.

Ideally, an investigation would be conducted by someone experienced in accident causation, experienced in investigative techniques, fully knowledgeable of the work processes, procedures, persons, and industrial relations environment of a situation.

Some jurisdictions provide guidance such as requiring that it must be conducted jointly, with both management and labor represented, or that the investigators must be knowledgeable about the work processes involved.

It is recommended that the following team members are part of the investigation team:

- Lead investigator;
- Site Manager;
- EHS Manager;
- Workers with knowledge of the task and workplace;

In case of severe accidents resulting in major injuries or fatalities, the Site Manager is requested to inform the local police for further investigations.

Training Requirements:

- *A member of the EHS site staff must be trained how to undertake incident and accident investigation.*
- *Regular refresher courses must be offered to ensure the consideration of best practices.*

7.2 Incident and Accident Investigation Process

The accident investigation process should involve the following steps:

- Report the accident occurrence to the EHS Manager or to the EHS Advisor;
- Provide first aid and medical care to injured person(s) and prevent further injuries or damage;
- Investigate the accident;
- Identify the causes;
- Report the findings;

- Develop a plan for corrective action (see **Chapter 6.3**);
- Implement the plan or corrective action;
- Evaluate the effectiveness of the corrective action (for compliance review, see **Chapter 6.4**).

As little time as possible should get lost between the moment of an incident or accident and the beginning of the investigation. In this way, one is most likely able to observe the conditions as they were at the time, prevent disturbance of evidence, and identify witnesses.

The tools that members of the investigating team may need (pencil, paper, camera, film, camera flash, tape measure, etc.) should be available at site to avoid any time delays.

7.3 Corrective Actions

During incident and accident investigation, it is assumed that corrective actions will be identified to prevent and avoid the occurrence of further complains.

The accident report must include the need for corrective actions. The list corrective actions must include the following information:

- Identified risks and non-compliances;
- Needed corrective actions;
- Needed personal and material resources;
- Responsible person;
- Date for latest finalisation.

The effectiveness of the corrective actions will be subject of internal EHS audits.

7.4 Compliance Review

One week after the implementation of the corrective actions, the EHS Manager is requested to undertake a compliance review. After observation of the full compliance of the corrective actions, the EHS Manager has to report the finalization to the Plant Manager.

7.5 Lessons Learned

Identified needed changes in the EHS Management System resulting from the incident & accident investigation must be communicated to the workers. It is recommended to implement the lessons learned task during the toolbox talks.

8. Environmental, Health and Safety Program

8.1 EHS Auditing

Environmental, health & safety audits must be undertaken monthly. The audits should be performed by the EHS Manager and/or the EHS Advisor.

The audits should comprise the power plant itself, material and equipment storage areas, workshop areas and accommodation areas (Worker's camp area).

These audits shall be recorded and the results should be slipped into the monthly EHS reports. A copy of the audit report must be attached to the monthly report.

8.2 EHS Inspections

EHS Inspections must be carried out on specific work areas and work places associated with the project on a weekly basis but independent thereof if they are assessed as medium or high-risk areas or workplaces according to the risk register. The results of the inspections must be considered in the weekly EHS reports to be submitted to EPGE head quarter. A copy of the EHS inspection report must be attached to the weekly report. The EHS inspections shall be executed by the EHS Manager together with the EHS Advisor.

8.3 EHS Surveys

Specific EHS Surveys shall be conducted daily. The date and time of the surveys must be documented but the results must not be recorded in a written report but significant findings must be communicated to the Plant Manager.

8.4 Reporting Requirements

The results of EHS audits and inspections must be recorded and the reports must be submitted to EPGE within 3 working days after finalisation of the audit or inspection respectively. Forms to be used for the audits and audit reports respectively, inspections and surveys must be developed in advance.

The reports must include all relevant subjects according to the purpose of the H&S Reviews, but at least the results and the needed corrective actions.

A detailed reporting schedule for each particular construction site must be developed by the Contractor and should be submitted to MCA for review and approval.

8.4.1 Non-Conformities

The definition of nonconformity is “non-fulfillment of a requirement” (ISO 9001:2005) – this basically means that a nonconformity is when you do not fulfill what is required by the standard, by your own documentation, or by a third party.

Nonconformities are used both in internal and in external audits – they are a “tool” by which EHS staff will be able to judge up to which level the management system is compliant with the defined requirements.

In other words, the more nonconformities, the less compliant of the system must be stated – and vice versa. Nonconformities must be reported through an audit report.

When reporting the nonconformity, the EHS Manager or EHS Advisor must include the following elements:

- Describe the nonconformity – general description of what is wrong in a sentence or two
- Provide the audit evidence – e.g., refer to a concrete document or record that is missing or is used improperly, to the activity that is not performed or is performed in a wrong fashion, etc.
- Refer to the exact requirement – e.g., concrete number of the clause in the standard, procedure, or the contract
- Summarize the requirement – usually, rephrase what the standard, the internal document, or the contract requires to be done

8.4.2 Corrective Actions

Resulting from the EHS program, it is assumed that corrective actions will be identified to prevent the occurrence of risks, non-conformities etc. Required corrective actions must be mentioned in any EHS reporting, such as weekly and monthly reports. The list of required corrective actions must include the following information:

- Identified risks and non-compliances;
- Needed corrective actions;
- Needed personal and material resources;
- Responsible person;
- Date for latest finalisation.

The effectiveness of the corrective actions will be subject of following subsequent audits, inspections and surveys.

8.5 Performance Measurement

The primary purpose of measuring EHS performance is to judge the implementation and effectiveness of the processes established for controlling possible risks.

Performance measurement provides information on the progress and status of the arrangements (strategies, processes, and activities) used by an organization to control risks. Measurement information includes data to judge the management system by

- gathering information on how the system operates in practice,
- identifying areas where corrective action is necessary, and
- providing a basis for continual improvement.

All the components of the EHS management system should be adequately inspected, evaluated, maintained, and monitored to ensure continued effective operation. Risk assessment and risk control should be reviewed in the light of modifications or technological developments. Results of evaluation activities are used as part of the planning process and management review, to improve performance and correct deficiencies over time.

Periodic but regular audits should enable a deeper and more critical appraisal of all the elements of the EHS management system. To maximize benefits, competent persons independent of the area or activity should conduct the audits. The use of external, impartial auditors can be considered to assist in evaluation of the EHS management system. When performing these reviews, it is important that the organization have a plan for following up on the results of the audit to ensure that problems are addressed and that recognition is given where it is deserved.

8.6 Description of required Reporting Process

8.6.1 Weekly EHS Performance Reporting

Weekly EHS reports must be prepared. The weekly reports shall be submitted by close of business on the first working day after a completed working week, e.g. the reporting timeframe is from Monday to Friday and the respective following working day is the upcoming Monday, if not a public holiday.

The weekly reports shall comprise of the following information with respect to the reporting timeframe:

- Originator
- Name of the project
- Activities performed
- Health occurrences

- Safety occurrences
- Resulting accidents, incidents or dangerous situations
- Undertaken measures

8.6.2 Monthly EHS Performance Reporting

Monthly EHS reports must be prepared. The monthly reports shall be submitted by close of business of the last working day of the first working week after the reporting timeframe, e.g. the reporting timeframe is from 1st of January until 31 of January and the due day of the submission of the report is the Friday of the first working week in February, if not a public holiday.

The weekly reports shall comprise of the following information with respect to the reporting timeframe:

- Originator
- Name of the project
- Activities performed
- Health occurrences
- Safety occurrences
- Resulting accidents, incidents or dangerous situations
- Investigation results
- Undertaken measures
- Lessons learned
- Informed authorities and resulting obligations/conditions
- Results of workplace inspections

8.6.3 Annual EHS Performance Reporting

Annual EHS performance reporting is a need to compare performance data year by year. Annual reports should be prepared for the use of EPGE management and the site management to evaluate and assess the trends and tendencies of the EHS occurrences, such as accidents, incidents, non-compliances and required corrective actions.

All in all, the annual reports should provide a statistical overview of the plant HS performance on a yearly basis.

9. Emergency Preparedness & Response

9.1 Description of Emergency Preparedness Requirements

9.1.1 Emergency Response Procedure

An emergency is a serious, unexpected, often dangerous situation that requires immediate action. The emergency procedure is the strategy of actions to be outlined in the emergency response plan to respond to an emergency event.

This could include, but not limited to rescue:

- from working at height;
- in confined spaces, shafts and tunnels;
- from fire & smoke, etc.

9.1.2 Emergency Preparedness & Response Plan

An emergency response plan must be developed.

The EPRP has to consider at least the following information and instruction for an adequate management of emergency situations:

- Result of a risk assessment to determine the most probably emergency situation;
- Identification of suitable emergency response procedures, such as:
 - . Determination of safe evacuation areas;
 - . Determination of safe evacuation routes;
 - . Determination of accurate and suitable fire fighting equipment;
 - . Determination of fire brigade;
 - . Training and induction of emergency response procedure.

IMPORTANT: Specific attention should be paid to the investigation of the nearest hospital or first aid station. The contact numbers of the hospital or first aid station together with at least one contact of a medically examined staff team member of the hospital or first aid station must be included in the EPRP in case of injuries at night-time hours or during weekends or during bank holidays.

10. EHS Induction and Training Requirements

Training means supporting workers and management staff to learn how undertake a task, explaining colleagues and third-party employees what they should do or not do, or simply providing them information they need to know.

Training should not be understood as formal 'classroom' course.

The provision of environmental, health and safety information by competent trainer should support each single worker and management staff team member to:

- Ensure that staff members know how to work safely and without risks to health and environment;
- Develop a positive EHS culture, where safe, healthy and environmental friendly working becomes a second nature to every involved person;
- Meet the legal duty to protect the health and safety of the employees and to protect the environment from any impacts and harm.

An effective EHS training:

- will contribute making the staff team members competent in environmental, health and safety requirements;
- can support the operation of the power plant facility by avoiding the distress that incidents, accidents and environmental concerns may cause;
- can support to avoid financial costs of incidents, accidents and environmental concerns

10.1 Training Needs Analysis

The EHS Manager must develop and implement a mechanism for the assessment of competence of the workforce.

The needed qualification of key individuals shall be identified together with a mechanism of confirmation of the availability of suitable qualified and experienced Managers, engineers and workers, incl. support staff for the health & safety sector, medical staff etc.

10.2 Training Schedule

The analysis of training needs shall result in a training schedule for the staff team members and workforce. The training schedule shall especially highlight:

- Training requirements for identified workers in conjunction with the activities and tasks that are needed prior to the commencement

The induction course shall be tailored to include: all relevant information relating to the known hazards and potential risks arising from the site activities; the actions to be taken in the event of incidents/emergencies; clearly description of the mechanism for hazard observation/near miss reporting system; a short introduction from a member of the EHS staff team member.

All inductions shall be supported by a formal evaluation of individuals understanding of the induction information. Records shall be kept available for inspection by EPGE or the responsible authority.

10.3.2 Visitor Induction

In case of site visits by visitors, the EHS staff must ensure that all visitors undergo an EHS induction which informs about the risks at site and any implemented EHS Measures.

Visitors must get familiar with the use of any needed personal protective equipment to be worn during the entire stay at site. No visitor can enter the site without the EHS induction and without proper sized and adequate PPE (Personal Protective Equipment, see **Chapter 10**).

Visitors are requested to confirm the receipt of the induction and of PPE by signature in the construction site visitor register (guestbook).

10.3.3 Toolbox Talks

The Plant Manager and the EHS Manager should implement toolbox talks as an informal group discussion that focuses on a particular safety issue. These toolbox talks should be used daily to promote an EHS culture. Toolbox talks should consider as well lessons learned from incident and accident investigation, audits, workplace inspections etc.

11. Personal Protective Equipment

11.1 The Requirement for Personal Protective Equipment

To ensure the greatest possible protection for employees in the workplace, the cooperative efforts of both employers and employees will help in establishing and maintaining a safe and healthful work environment.

In general, EPGE is responsible for:

- Performing a “hazard assessment” of the workplace to identify and control physical and health hazards.
- Identifying and providing appropriate PPE for the site staff.
- Training employees in the use and care of the PPE.
- Maintaining PPE, including replacing worn or damaged PPE.
- Periodically reviewing, updating and evaluating the effectiveness of the PPE program.

In general, workers should:

- Properly wear PPE,
- Attend training sessions on PPE,
- Care for, clean and maintain PPE, and
- Inform a supervisor of the need to repair or replace PPE.

11.2 Need for Hazard Assessment



Figure 11-1: Hazard and Risk

11.3 Selection of Personal Protective Equipment

All PPE clothing and equipment should be of safe design and construction, and should be maintained in a clean and reliable fashion. Employers should take the fit and comfort of PPE into consideration when selecting appropriate items for their workplace. PPE that fits well and is comfortable to wear will encourage employee use of PPE. Most protective devices are available in multiple sizes and care should be taken to select the proper size for each employee. If several different types of PPE are worn together,

make sure they are compatible. If PPE does not fit properly, it can make the difference between being safely covered or dangerously exposed. It may not provide the level of protection desired and may discourage employee use.

OSHA requires that many categories of PPE meet or be equivalent to standards developed by the American National Standards Institute (ANSI).

ANSI has been preparing safety standards since the 1920s, when the first safety standard was approved to protect the heads and eyes of industrial workers. Employers who need to provide PPE... .. must make certain that any new equipment procured meets the cited ANSI standard.

Existing PPE stocks must meet the ANSI standard in effect at the time of its manufacture or provide protection equivalent to PPE manufactured to the ANSI criteria.

Employers should inform employees who provide their own PPE of the employer's selection decisions and ensure that any employee-owned PPE used in the workplace conforms to the employer's criteria, based on the hazard assessment, OSHA requirements and ANSI standards. OSHA requires PPE to meet the following ANSI standards:

For hand protection, there is no ANSI standard for gloves but OSHA recommends that selection be based upon the tasks to be performed and the performance and construction characteristics of the glove material. For protection against chemicals, glove selection must be based on the chemicals encountered, the chemical resistance and the physical properties of the glove material.

11.4 Training in the Proper Use of PPE

EPGE and the CCGT management are required to train each worker who must use the general item of PPE (safety shoes, helmet and safety glasses) as well as specific item of PPE in case of high risk works or workplaces.

Employees must be trained to know at least the following:

- When PPE is necessary?
- What type of PPE is necessary?
- How to properly put on, take off, adjust and wear the PPE!
- The limitations of the PPE.
- Proper care, maintenance, useful life and disposal of PPE.

The EHS staff must make sure that each employee demonstrates an understanding of the PPE training as well as the ability to properly wear and use PPE before they can perform work requiring the use of the PPE. If the EHS staff believes that a previously trained employee is not demonstrating the proper understanding and skill level in the use of PPE, that employee is not allowed to undertake the task or work and must receive retraining. Other

situations that require additional or retraining of employees include the following circumstances:

- changes in the workplace
- changes in the type of required PPE

Both circumstances are making prior training obsolete. The EHS staff must document the training of each worker requested to wear or use PPE by preparing a certification containing the name of each staff trained, the date of training and a clear identification of the subject of the certification.

12. Risk Management

The following described risk management procedure with specifically needed steps requires a careful document administration and control.

Risk management is the significant and most important step in avoiding and preventing serious accidents, incidents and environmental occurrences etc. Therefore, the execution and consideration of each step is mandatory.

EPGE, the plant management and the EHS staff should be aware that the documents resulting from the risk management process, in detail risk assessments, permits to work and job safety analysis, will not be specifically subject of approval by a third party. The overall responsibility for the appropriate execution of the risk management procedure is with the aforementioned parties.

12.1 Risk Management Process

Risk management is the identification, assessment and prioritization of risks to avoid impacts on workers, the public and the environment.

A suitable and appropriate risk management process is needed at Thaton power station to enable the site staff to prevent any non-compliances resulting in critical, harmful or dangerous situations followed by incidents, accidents or fatalities.

In the following the mandatory risk management process is described that must be considered. In case of a deviation from the proposed risk management process, there will be the need to outline and discuss in detail the advantages of the alternative suggestion and the disadvantages of the proposed process.

The description of the alternatives shall be provided in the EHS Plan. The alternative risk management process will be subject of review and approval by the appointed EHS Manager.

12.2 Hierarchy of Control

The first part of evaluating the risk stage, consideration must be spent how likely each hazard could cause harm. When the potential for harm has been decided, the existing control measures should be identified. In this course, each step of the activity must determine what type of control measures might already be in place. When evaluating a risk, it is imperative to check the applicable legislation and to ensure that everything required by law is in place.

When considering current controls and further required control measures, the general principles of control should be applied:

Eliminate

- It must be checked if the risk associated with the hazard could be eliminated.

Reduce

- It must be assessed if the possible extent of the hazard or the exposure to the hazard could be reduced.

Isolate

- It must be evaluated if the hazard could be isolated. Isolating is the principle of preventing the contact with the hazard.

Control

- It must be assessed if a safe system of work, permit to work and/or procedures are in place to control the hazard to prevent that somebody becomes injured.

Personal Protective Equipment

- Because of running through the hierarchy of control, the supply of personal protective equipment is the result of controlling the hazard. The provision of PPE must not be the first and final stage of risk mitigation.

12.2.1 Risk Assessment

The EHS staff is requested to undertake a risk assessment for all activities assessed to be of a medium, high or very high risk.

The risk assessment must be done with the participation of the staff experienced with the tasks and activities and the equipment. The team appointed for the risk assessment process should consist of:

- the responsible EHS Manager;
- the EHS Advisor;
- the foreman for the execution of the activity
- the worker(s) asked to undertake the activity

The risk assessment must be done prior to the execution of the activity and it must be done in written. The written risk assessment must be documented and stored.

The risk assessment should be undertaken in a simple and comprehensive way, understandable by each participant.

The following table could be used as an example for a risk assessment form sheet.

Hazard	People at Risk	Existing Controls	Further controls
	<input checked="" type="checkbox"/> Worker <input type="checkbox"/> Visitor <input type="checkbox"/> Public <input type="checkbox"/> Others		

Table 12-1: Form sheet for a Risk Assessment

The risk assessment must be approved by the Plant Manager and the EHS Manager. The detailed risk assessment process, including the preparation and approval, is shown in the flow chart below.

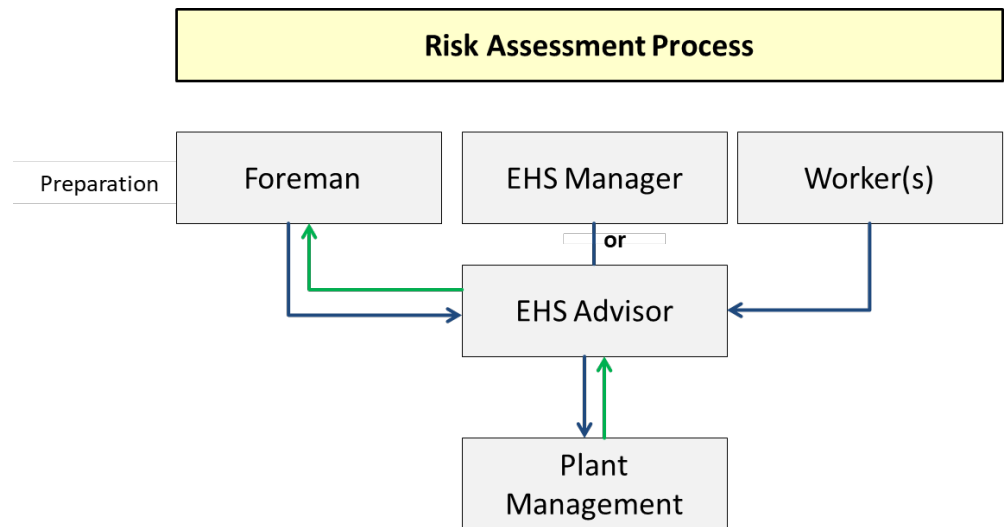


Figure 12-1: Flow Chart Risk Assessment Process

12.2.2 Permit to Work

A permit to work system must be implemented by EHS staff but supported by the Plant Manager. The permit to work system must be organized considering the following approach.

The following figure shows the detailed permit to work process.

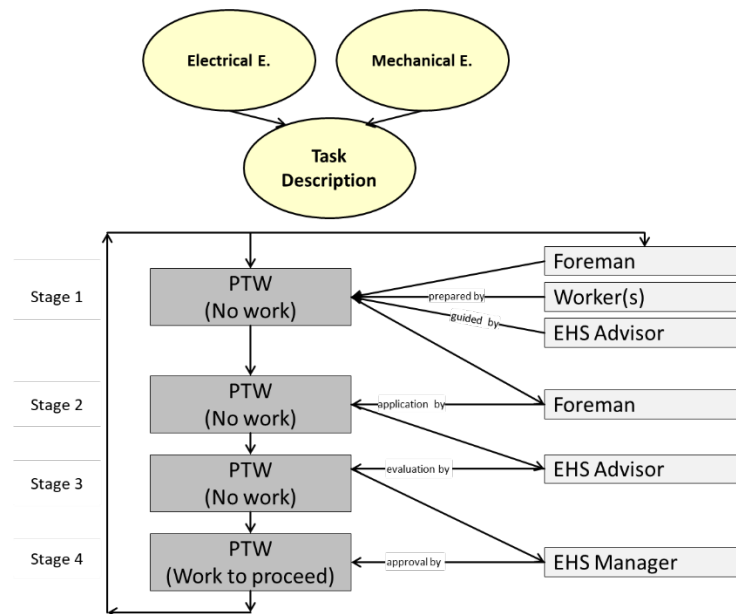


Figure 12-2: Permit to Work Flow Chart

Stage 1

Highlight Potential Hazards: Worker(s) and the foreman guided by the EHS Advisor highlight potential hazards of a task and identify all necessary safety measures. The hazard identification must consider all required electrical and mechanical equipment. Stage 1 has to be done in written.

Work is not permitted to commence until Stage 4.

Stage 2

Application of Permit: The Foreman applies for permission to start work on a prescribed form (see sample Annex No. 6) and submit the application to the EHS Advisor only when all requirements and conditions described in the permit to work have been fulfilled. The Foreman must indicate in the written permit to work that risk assessment was conducted. The risk assessment must be attached to the permit to work.

Stage 3

Evaluation of Permit: The EHS Advisor will evaluate and verify that all conditions specified in the permit to work have been fulfilled and are adequate described. He may also recommend additional measures in the permit to work when necessary. He will need to inspect the location of work where the permit to work has been applied for, with the Foreman during this process.

Only when all safety requirements and conditions stated in the permit to work are fulfilled, the EHS Advisor will then endorse the permit to work form and forward to the EHS Manager.

Stage 4

Approval of Permit: The EHS Manager may approve and issue the permit to work only when he is satisfied that:

- Proper evaluation of risk and hazards for the work concerned has been conducted;
- No incompatible work will be carried out in the same time and location of the permit to work, which may pose a risk to the persons at work;
- All reasonably practicable safety measures have been taken and all persons involved in the work have been informed of the work hazards under the PTW;
- All electrical and mechanical equipment is demonstrable checked and in safe conditions.

A work permit is valid for one working day and for the specified working time. An extension could be provided for an additional working day. In case the tasks could not be finalised within the validity of the permit to work, the permit to work must be renewed before commencement of work on the day the work may continue.

The Contractor is requested to submit the permit to work form to be used. The form must be.

The permit to work form must include at least the following information:

- Originator
- Date
- Description of task activity
- Duration of the task
- Needed equipment
- Security certificates of equipment
- Risk Assessment
- Already implemented mitigation measures
- Further mitigation measures
- Needed training or induction
- Approved by
- Date and time of approval

An example of a permit to work form is included in Annex No. 6.

12.2.3 Job Safety Analysis (JSA)

Job safety (JSA) analysis must be undertaken (JSA). A JSA is a procedure which shall help to integrate safety and health principles and practices into a particular job operation. In a JSA, each basic step of the job-related hazards

has to be identified and recommendations have to be provided to choose the safest way to do the job.

For conducting a JSA four steps must be considered:

- selecting the job to be analysed;
- breaking the job down into a sequence of steps;
- identifying potential hazards;
- determining preventive measures to overcome these hazards.

The EHS staff is requested to provide a specific procedure for conducting a job safety analysis.

12.3 Environmental, Health & Safety Risk Register

The EHS staff is requested to develop and prepare a risk register. A risk register is a document that summarizes and defines the possible risks resulting from activities, in the present case from operation related activities.

The concept of a risk register recognises that risk elements arising from proposed or actual activities fall into one of following three categories:

1. Risks which are deemed to have a low risk and do not need to be managed;
2. Risks that have a medium or high risk and will need to be managed;
3. Risks which have an extreme risk and therefore the activity should probably not proceed.

The risk register records detail all risks identified for the operation phase, incl. maintenance activities, and associates them in terms of likelihood of occurring and seriousness of impact.

The risk registers to be prepared should identify:

- a description of each risk and its potential consequences;
- factors that may impact upon the likelihood and severity of the risk;
- an assessed risk ranking, such as
 - low,
 - medium
 - high or
 - very high;
- whether the risk ranking is acceptable or not;
- actions and controls that currently exist to mitigate risks.

The definition of the risks from low to very high is explained in the following risk ranking table:

Likelihood	4	4	8	12	16
	3	3	6	9	12
	2	2	4	6	8
	1	1	2	3	4
		1	2	3	4
	Severity				

Table 12-2: Risk ranking table

It is recommended to develop the risk register at the beginning stage before start of operation or shortly after start of operation when all potential activities are known by following the following steps:

1. Identification of potential risks;
2. Identification of the consequences;
3. Identification of the likelihood and severity that the risk would result in adverse consequences;
4. Where risks have been ranked as medium, high or very high, mitigation measures must be addressed:

Medium (Risk ranking 3 to 4): Mitigation actions to reduce the likelihood and severity should be identified and appropriate actions must be endorsed.

High (Risk ranking 6 to 9): If uncontrolled, a risk event at this level may have a significant impact for the actions and tasks as a whole. Mitigating actions need to be very reliable and should be approved and monitored. Even with mitigating actions in place, the site staff potentially exposed to that risk should be advised of identified or potential risks which have been graded at this level.

Very High (Risk ranking 12 to 16): Activities and projects with unmitigated risks at this level should be avoided or terminated. Mitigation actions of these types of risks may outweigh the benefits of the execution method. This is because risk events graded at this level have the potential to have significant adverse effects with the potential to cause serious accidents and incidents resulting in fatalities.

4. Identify if there are any controls currently in place to mitigate those risk;
5. If not, develop and document risk mitigation actions. These could include:

6. Planned actions:

Reduction the likelihood a negative risk will occur and/or reduce the seriousness should it occur (What should you do now?)

7. Contingency actions:

Planned actions to reduce the immediate seriousness of a negative risk when it does occur. (What should you do when?)

Recovery actions:

Planned actions taken once a negative risk has occurred to allow you to move on. (What should you do after?)

Risk Transfer:

e.g. through assignment of contractual responsibilities or insurance.

Actions:

Necessary to ensure the realisation of opportunities (positive risks)

8. A risk register must be developed considering the tasks and activities as well to be undertaken and executed by sub-contractors to be appointed for specific repair or maintenance activities.

The risk register has to be prepared by a competent and experienced group of engineers and workers approx. 4 weeks before mobilization to the site and start of any works at site even if they deemed to be of general nature and without having a risk potential. The risk register has to consider every transportation activity as well to the site.

12.4 Risk Matrix

Step 1: The organization identifies the consequence for each potential risk by using the table below. Note: If a combination of harm, loss or damage could occur the worst case consequence is selected.

Consequence Rating

Rank	People & Public	Environmental	Descriptor
1	Injuries or illness not requiring medical attention, or Minor first aid injury	No lasting effect on the environment or social amenity, and/or Recovery– less than 1 week, and/ or Cosmetic remediation	Insignificant
2	Injury requiring medical treatment(no alternative duties), or Localised illnesses requiring medical attention	Short term or low-level long-term impact on the environment or social amenity, and/or Recovery – 1 week to several months, and/or Easy remediation	Minor
3	Middle to long term injury (able to return to work), or Long term condition, or Localised illnesses requiring hospitalisation	Long term impact on the environment or social amenity, and/or Recovery – several months to several years, and/or Challenging remediation	Moderate
4	Permanent disabling injuries, or Widespread illness requiring hospitalisation, or Single death	Extensive, long term impact on the environment or social amenity, and/or Recovery – several years to several decades, and/or Uncertain reversibility of remediation	Major
5	Multiple Deaths	Impacts are irreversible and/or permanent.	Catastrophic

Step 2: Using the following table, the organisation determines how likely it is that the risk will occur and result in the consequence identified above.

Likelihood Rating

Rank	Descriptor	Frequency	Description
A	Almost Certain	Will occur more than once a year Multiple times in a year	The event is expected or known to occur often
B	Likely	Once per year Once in a year or so	Known to re-occur approximately annually
C	Possible	Will occur once every 5 years Once in 5 years or multiple times over 10 years	The event should occur at some time Is sporadic, but not uncommon
D	Unlikely	Will occur once in 10 years Could occur once in 10 years or multiple times over 20 years	The event could occur at some time, usually requires combination of circumstances to occur
E	Rare	Will occur once every 30 years Once in 30 years or less frequent	The event may occur in exceptional circumstances Not likely to occur, but it's not impossible

Step 3: Using the risk matrix below, the organisation identifies the risk class/ranking.

Risk Matrix

Consequences	Level of Risk				
5 Catastrophic	H	H	E	E	E
4 Major	M	H	H	E	E
3 Moderate	L	M	H	H	H
2 Minor	L	L	M	H	H
1 Insignificant	L	L	L	M	M
	E Rare	D Unlikely	C Possible	B Likely	A Almost Certain
	Likelihood				

Risk Acceptance Decision

Rank	Acceptance evaluation <i>This decision should be considerate of compliance requirements As Low As Reasonably Practicable (ALARP)</i>	Descriptor
Extreme	Unacceptable STOP WORK	Work shall not proceed without further controls to reduce risk. Contact your Line Manager / Supervisor.
High	Undesirable ALARP	Work shall only proceed with Line Manager / Supervisor approval and risk mitigation recorded e.g. Permit issued.
Moderate	Monitor ALARP	Work may proceed with ongoing monitoring of control measures, e.g. regular inspection of barricading etc.
Low	Acceptable Proceed	Work may proceed, working in accordance with planned controls.

13. Annexes

13.1 Annex 1: Accident Incident Investigation Form

Sample Accident/Incident Report/Investigation Form

Project	Location	Date/Time of Event
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Type of Event	Accident	Incident	Near miss
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Harm (or Potential of Harm)	Fatal or Major	Serious	Minor	Property Damage
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Contact Details of Reporter	Name:	Position:
	Address:	Contact No:

Brief Description of Event: (Details of what happened, when, where and any emergency action taken)	
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Details of witness(es), if any: (Name, position)	
---	--

Investigation Required:	Yes	No	Reportable:	Yes	No
Investigation Level:	High	Med	Entered in Accident Book:	Yes	No
Leader of Investigation:	Minimal		Date/Time of Entry:		

Reported By	Position	Date	Signature
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Causes of the Event		
Immediate Causes	Underlying Causes	Root Causes

Control Measures to be Implemented to Prevent Recurrence:			
Recommendation	Planned Completion Date	Actual Completion Date	Manager Responsible

Risk Assessment/Procedures to be Reviewed:			
Risk Assessment/Procedure	Planned Review Date	Actual Review Date	Manager Responsible

Further Details:

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Members of the Investigation Team:

Members of the Investigation Team:	Name	Position	Name	Position

Signed on behalf of the investigation team:

Name	Position	Date	Signature

Report accepted by:

Name	Position	Date	Signature

The findings of the investigation need to be communicated to the following people:

Name	Position	Date	Signature

13.2 Annex 2: Contractor Site Audit Questionnaire Form

Contractor Site Audit Questionnaire Form

Company name: _____

Site location: _____

Name of H&S staff of Contractor:

Name of H&S staff of MCA:

Date & time: _____

Audit no.: _____

Yes	No	General	Correction needed	Latest date
		1. Posters and safety signs/warning installed?		
		2. Safety meetings held periodically		
		3. First aid kit available and adequately stocked?		
		4. Job related safety training completed?		
		5. Accident reporting procedure established?		
		6. Injury record being kept?		
		7. Emergency phone numbers and contacts posted?		
		8. Traffic routes identified?		
Yes	No	Housekeeping and Sanitation	Correction needed	Latest date
		1. General neatness of work area(s)?		
		2. Regular disposal of waste and trash?		
		3. Procedure to handle hazardous waste?		
		4. Passageways and walkways clear?		
		5. Adequate lighting?		
		6. Waste containers provided and used?		
		7. Sanitary facilities adequate and clean?		
		8. Adequate potable water supply?		
		9. Adequate number of sanitary facilities?		

Yes	No	Construction Area	Correction needed	Latest date
		1. Warning signs in place?		
		2. Open ditches protected?		
		3. Drop-offs protected?		
		4. Ladders lowered?		
		5. Equipment secured?		
		6. Utility ditches flagged or barricaded?		
		7. Personnel informed about dangerous situation?		
Yes	No	Hazard Communication	Correction needed	Latest date
		1. Written programme?		
		2. Employees trained?		
		3. MSDS on file and available?		
		4. Control and documentation measures established?		
		5. Material properly stored and labeled?		
		6. Log of all chemicals on site available?		
Yes	No	Fire Prevention	Correction needed	Latest date
		1. Adequate number and type of fire extinguishers available?		
		2. Fire prevention/extinguisher training completed?		
		3. Fire extinguisher inspection accomplished?		
		4. Phone number of fire department posted?		
		5. Are flammable substances correctly stored and labeled?		
		6. Fire alarm and evacuation plan available?		
		7. Fuel supply protected from accident impact?		
		8. Fire wards nominated?		
		9. "No smoking" signs posted?		
		10. Are technical measures against fire propagation in place?		
Yes	No	Flammable Liquids/Materials	Correction needed	Latest date
		1. Empty containers removed?		
		2. Containers stored in approved and appropriate areas?		

		3. Outside storage bermed for containment?		
		4. Cylinders stored and secured in upright position?		
Yes	No	Electrical	Correction needed	Latest date
		1. Electrical devices have current inspection and coding?		
		2. Electrical equipment properly maintained?		
		3. Equipment properly grounded?		
		4. Fuses provided?		
		5. Electrical dangers posted?		
		6. Proper fire extinguishers provided?		
Yes	No	Personal Protective Equipment	Correction needed	Latest date
		1. Hazard evaluation accomplished and certified?		
		2. PPE adequate for exposure?		
		3. Employees informed where to use PPE?		
		4. Is PPE being used?		
		5. Employees trained in the use of PPE?		
		6. Are inspections accomplished before and after use of PPE?		
		7. Adequate fall protection provided?		
		8. Eye protection provided?		
		9. Face protection provided?		
		10. Hearing protection provided?		
		11. Head protection provided?		
		12. Hand and foot protection provided?		
Yes	No	Power Tools	Correction needed	Latest date
		1. Good housekeeping where tools are used?		
		2. Inspections accomplished?		
		3. Tools grounded properly or double insulated?		
		4. Guards in place and used correctly?		
		5. Damaged or malfunctioning tools tagged out until repaired or replaced?		
		6. Local laws and ordinance compliance?		
		7. All operators qualified?		

		8. Tools protected against unauthorized use?		
		9. Competent instruction and supervision?		
		10. Cords included in electrical inspection?		
Yes	No	Ladders	Correction needed	Latest date
		1. Ladders inspected and in good condition?		
		2. Ladders secured to prevent slipping, sliding or falling?		
		3. Are ladders spliced?		
		4. Proper maintenance and storage?		
Yes	No	Scaffolds	Correction needed	Latest date
		1. Erection properly supervised?		
		2. All structural parts free from defects and meet safety standards?		
		3. Are all connection secured?		
		4. Are scaffolds erected on solid ground?		
		5. Is scaffold tied to structure?		
		6. Are workers protected from falling objects?		
		7. Is scaffold plumb and square, with cross-bracing?		
		8. Are guard rails, intermediate rails, and toe boards in place?		
		9. Are robes and cable in good conditions?		
		10. Fall protection available and in use?		
Yes	No	Welding and Cutting	Correction needed	Latest date
		1. Are operators qualified?		
		2. Screens and shield in place?		
		3. Are bottles not in use secured with caps in place?		
		4. Proper eye protection and PPE used?		
		5. Electrical equipment grounded?		
		6. Area inspected for fire hazard?		
Yes	No	Work Permits	Correction needed	Latest date
		1. Permit to work procedures followed?		
		2. Work instructions prepared?		

		3. Risk assessment undertaken?		
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List of items to be subject of inspection must be cross-checked before execution of site audit with respect to extend of task, works and used equipment.

13.3 Annex 3: Workplace Inspection Checklist

Workspace Inspection Checklist

Use the following questions to carry out a workspace inspection. Record any faults and required action on the action list below.		Y	N
2.	Are portable electric appliances in good conditions?		
4.	Is the ground/are surfaces in good condition - free from slip and tripping hazards?		
6.	Are office or workshop furniture in good conditions?		
7.	Are ladders in good conditions		
8.	Are handrails securely fixed?		
9.	Do toilet have the following:		
	a) Running water?		
	b) Consumables e.g. paper, soap, means of drying hands?		
	c) A lock on the door of the WC?		
	d) Adequate ventilation - either natural or mechanical?		
	e) A waste disposal bin?		
10.	Are toilets cleaned at least daily and waste bins emptied?		
11.	Is there a routine cleaning program for all areas, are bins emptied daily?		
12.	Are there adequate facilities for the storage of materials and substances?		
13.	Are hazardous substances stored in a secure location?		
14.	Are the signing in/out, access control procedures rigorously applied?		
15.	Are areas adequately ventilated and are ventilation systems in working order?		
16.	Are windows clean and is there a cleaning program?		
17.	Are escape routes clearly mentioned/shown on a map or signposted/labeled?		

Question No.	Hazard or Actions Required	Person Responsible	Date Completed	Signature

Name (Person completing inspection):	
Signature	Date:

13.4 Annex 4: Sample Inspection Checklist (Ladders)

Sample Inspection Checklist (Ladders)

Location	Inspectors Name	Date of Inspection
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Is there evidence of:	Yes / No	Comments
Cracked, split, worn or broken stiles?	Yes / No	
Twisted or distorted stiles?	Yes / No	
Cracked, split, worn or broken rungs?	Yes / No	
Loose rungs (considered loose if they can be moved by hand)?	Yes / No	
Twisted, distorted or missing rungs?	Yes / No	
Rusted, corroded, damaged, worn or missing fittings/screws/nails etc?	Yes / No	
Damaged, worn, badly deteriorated or missing ropes	Yes / No	
Missing or damaged feet	Yes / No	
Paint or other substances that could hide damage	Yes / No	
Isolated cable management?	Yes / No	

Comments

Is the ladder safe for use?	Signature
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13.5 Annex 5: Basic Risk Assessment Form

Sample Basic Risk Assessment Form

Areas/task covered by this assessment:	Assessor's Name:	Date:	Review Date:
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Hazards	People at Risk	Existing Controls	Further Controls
	Employer Contractor (Worker) Visitor Public		
	Employer Contractor (Worker) Visitor Public		
	Employer Contractor (Worker) Visitor Public		
	Employer Contractor (Worker) Visitor Public		
	Employer Contractor (Worker) Visitor Public		

13.6 Annex 6: Permit to Work Form

Sample Permit to Work

Permit to Work for:..... (COMPLETE PRECISELY AND LEGELY IN BLOCK CAPITALS)	PERMIT BOOK No: WORK ORDERNO:.....	PERMIT SERIAL No:																																										
PART 1 WORK DETAILS (TO BE COMPLETED BY THE AUTHORISED PERSON BEFORE ISSUE)																																												
PERMIT TO WORK ISSUED (DATE):..... REF NO. OF WORK PLACE: TYPE/DESCRIPTION OF AREA: LOCATION OF AREA: REASON FOR WORK: EXPECTED DURATION OF TASK:.....HOURS-STARTING AT.....ON(DATE)..... KNOWN HAZARDS:..... NAMES OF STAFF TEAM:.....	LOCATION OF EMERGENCY TELEPHONE: EMERGENCY TELEPHOEN NO: CONTACT NAME:																																											
SAFETY CHECKLIST: (TICK APPLICABLE BOXES)																																												
<table style="width:100%; border-collapse: collapse;"> <tr> <td style="width:35%;">Competency of staff team checked</td> <td style="width:10%;">YES</td> <td style="width:10%;">NO</td> <td style="width:35%;">Lighting installed</td> <td style="width:10%;">YES</td> <td style="width:10%;">NO</td> </tr> <tr> <td>Inflows stopped / diverted</td> <td>YES</td> <td>NO</td> <td>Safety/protective equipment examined</td> <td>YES</td> <td>NO</td> </tr> <tr> <td>All plant/equipment/utilities isolated/locked out</td> <td>YES</td> <td>NO</td> <td>Emergency/rescue procedures in place</td> <td>YES</td> <td>NO</td> </tr> <tr> <td>Special precautions or equipment required</td> <td>YES</td> <td>NO</td> <td>Rescue services informed</td> <td>YES</td> <td>NO</td> </tr> <tr> <td>Warning signs / barriers in place</td> <td>YES</td> <td>NO</td> <td>Work instruction attached</td> <td>YES</td> <td>NO</td> </tr> <tr> <td>Cleaning work completed</td> <td>YES</td> <td>NO</td> <td>Other permit to work required</td> <td>YES</td> <td>NO</td> </tr> <tr> <td>Forced air ventilation in place & working</td> <td>YES</td> <td>NO</td> <td>Risk assessment attached</td> <td>YES</td> <td>NO</td> </tr> </table>	Competency of staff team checked	YES	NO	Lighting installed	YES	NO	Inflows stopped / diverted	YES	NO	Safety/protective equipment examined	YES	NO	All plant/equipment/utilities isolated/locked out	YES	NO	Emergency/rescue procedures in place	YES	NO	Special precautions or equipment required	YES	NO	Rescue services informed	YES	NO	Warning signs / barriers in place	YES	NO	Work instruction attached	YES	NO	Cleaning work completed	YES	NO	Other permit to work required	YES	NO	Forced air ventilation in place & working	YES	NO	Risk assessment attached	YES	NO		
Competency of staff team checked	YES	NO	Lighting installed	YES	NO																																							
Inflows stopped / diverted	YES	NO	Safety/protective equipment examined	YES	NO																																							
All plant/equipment/utilities isolated/locked out	YES	NO	Emergency/rescue procedures in place	YES	NO																																							
Special precautions or equipment required	YES	NO	Rescue services informed	YES	NO																																							
Warning signs / barriers in place	YES	NO	Work instruction attached	YES	NO																																							
Cleaning work completed	YES	NO	Other permit to work required	YES	NO																																							
Forced air ventilation in place & working	YES	NO	Risk assessment attached	YES	NO																																							
SPECIAL INSTRUCTIONS AND/OR SAFETY MEASURES.....																																												
<p>I declare that it is safe to work in the above defined area/workplace which has been examined and assessed in accordance with the attached risk assessment and work instruction. I have explained the risk assessment and the resulting safety, precaution and mitigation measures and demonstrated the extent of the work and the safety arrangements at the points of location and other places affecting the work of the person in charge. I am confident that all persons listed and in charge of the defined task are properly trained and equipped and that all safety equipment is present and working.</p> <p>Signed:.....(Authorized Person) Name: (Block Capitals)..... Date & Time:.....</p> <p>Contact Telephone No.:.....</p>																																												
PART 2 RECEIPT: TO BE COMPLETED BY THE PERSON IN CHARGE																																												
<p>I declare that all persons listed and in charge of the defined task are familiar with the safety and emergency arrangements and are properly equipped. I am confident that the all measures are implemented and it is safe to work at the defined location under the described circumstances and considering the task to be undertaken. I accept responsibility for carrying out the work listed in Part 1 of the permit to work in accordance with the risk assessment and the applicable rules and procedures.</p> <p>Signed:.....(Person in charge) Name: (Block Capitals)..... Date & Time:.....</p> <p>Contact Telephone No.:.....</p>																																												
PART 3 COMPLETION OR STOPPAGE: TO BE COMPLETED BY THE PERSON IN CHARGE																																												
<p>I declare that the work described in Part 1 of the Permit has been completed/stopped and that all persons, equipment, tools and instruments under my control have been withdrawn and the location has been made safe. I have recorded any changes that have occurred at the location and during the work, reason for stopping the work (if applicable) and the action taken.</p> <p>Signed:.....(Person in charge) Name: (Block Capitals)..... Date & Time:.....</p>																																												
PART 4 CANCELLATIO: TO BE COMPLETED BY THE AUTHORISED PERSON																																												
<p>I hereby declare that the work described in Part 1 of this Permit has been satisfactory completed / stopped, and that the Permit is canceled. I have noted the changes reported and will take the necessary follow-up action.</p> <p>Signed:.....(Person in charge) Name: (Block Capitals)..... Date & Time:.....</p>																																												

13.7 Annex 7: Fire Risk Assessment Form

Fire Risk Assessment Form

Areas covered by this assessment:	Assessor's Name(s):
Date of assessment	Date of re-assessment






Identify Fire Hazards		
Ignition Sources	Fuel Sources	Oxygen Sources
People at Risk		
Employer Contractor (Worker) Visitor Public	Others	
Existing Control Measures in Place		
Fire Alarm		
Fire Extinguishers		
Escape Routes		
Signage		
Emergency & Evacuation Plan		

Assembly Point		
Training		
Fire Drills		
Flammables / Combustibles		
Control of Ignition Sources		
Visitor Procedures		
Technical fire control/prevention		
Level of risk at assessment date		
High	Medium	Low
Corrective actions needed		
No		
Yes		
Description of required actions:		

Level of risk at re-assessment date		
High	Medium	Low

13.8 Annex 8: Hazardous Substance Risk Assessment Form

Hazardous Substances Risk Assessment Form

Substances Assessed		Supplier/Manufacturer		
Hazardous Ingredients		Process/Activity		
Duration of Activity		Frequency of Activity		
Hazard Warning				
Harmful	Irritant	Corrosive	Toxic	Very Toxic
				
Risk Phrases		Safety Phrases		
Persons Exposed		No. of Persons Exposed		
Possible Route of Entry				
Inhalation	Ingestion	Absorption	Injection	
Existing Control Measures				

Further Control Measures	
Can use of the substances be discontinued?	
Can the substance be substituted for a safer alternative?	
Can engineering controls be introduced? Ventilation Enclosure	
Can Personal Protective Equipment be provided? (LAST RESORT)	
Have all staff been informed, instructed and trained in risk and control measures?	
Storage Requirements	Waste Disposal Requirements
Action to be Taken in Event of Spillage	
Emergency Procedures	
Eye contact	
Skin contact	
Ingestion	
Inhalation	
Assessment Team	
Date	Review Date

13.9 Annex 9: Implementation Plan

EHS-MS Implementation Plan for Thaton Power Station

Item No.	Task	Reference	Description of Task	Responsibility	Duration
1	EHS Policy Statement	Section 2.1	Finalization of EHS Policy Statement	EPGE	4 weeks
Timeline					Weeks
2	Legal Requirements	Section 3.1	Review of national EHS Legislation to get a clear understanding and overview of the applicable legal EHS requirements, incl. International guidelines	Plant EHS Manager	4 weeks
Timeline					Weeks
3	Training	Section 4.10 Section 10.1 Section 10.2	Execution of training need analysis ¹⁾ and development of a training schedule ²⁾ considering the need of the result of the analysis	EHS Staff 1	3 weeks ¹⁾ 1 week ²⁾
Timeline					Weeks
4	Hazard Identification	Section 11.2	Execution of a hazard identification to identify that can cause harm to workers and supports in the identification of needed PPE.	EHS Staff 3	2 weeks
Timeline					Weeks
5	PPE	Section 11	Selection ¹⁾ of appropriate and suitable personal protective equipment and training ²⁾ in using the PPE	EHS Staff 2	1 week ¹⁾ 6 weeks ²⁾
Timeline					Weeks
6	Risk Management	Section 12.1	Development of a risk management procedure including the specific process how risk management and risk assessment should be done.	Plant EHS Manager	2 weeks
Timeline					Weeks
7	Permit to Work	Section 12.2.2	Development of permit to work system and of a procedure to undertake a safe job analysis	EHS Staff 3	3 weeks
Timeline					Weeks
8	EHS Risk Register	Section 12.3	Development of a EHS risk register to summarize and define the possible risks resulting from all site activities	EHS Team	1 week
Timeline					Weeks
9	Auditing and Inspections	Section 8.1 Section 8.2 Section 8.3	Development of a final format to be used for the auditing, inspection and survey checklist; development of a reporting format to address all findings identified during audits, inspections and surveys	Plant EHS Manager	2 weeks
Timeline					Weeks
10	Reporting	Section 8.6	Development of a reporting schedule and of specific weekly, monthly and annual EHS performance reports	EHS Staff 1	1 week
Timeline					Weeks
11	EPRP	Section 9.3	Development of an Emergency Preparedness and Response Plan	Plant EHS Manager EHS Staff 2	4 weeks
Timeline					Weeks
12	EPRP Procedure	Section 9.2	Development of an emergency response procedure	EHS Staff 3	1 week
Timeline					Weeks
13	Incidents & Accidents	Section 7	Development of an incident and accident investigation procedure(s) and of reporting forms	EHS Staff 1	3 weeks
Timeline					Weeks
14	Procedures	Section 5.1.1	Identification and development of required operational procedures, if not already considered in other tasks of the implementation plan	EHS Staff	6 weeks
Timeline					Weeks
15	Grievance	Section 5.2	Development of workers and public grievance management systems	Plant EHS Manager	1 week
Timeline					Weeks
16	Waste Management	Annex 10	Update of the existing waste inventory on a regular basis, at least twice per year.	Plant EHS Manager	1 week
Timeline					Weeks

13.10 Annex 10: Draft Waste Inventory

Annex 10: Draft Waste Inventory for Operation Phase

Item	Type of waste	Resulting from	Any specifics	Storage requirements	Disposal recommendations
1	Hazardous waste	Maintenance/Operation Phase		<p>Storage in closed containers away from direct sunlight, wind and rain.</p> <ul style="list-style-type: none"> Secondary containment systems should be constructed with materials appropriate for the wastes being contained and adequate to prevent loss to the environment. Secondary containment is included wherever liquid wastes are stored in volumes greater than 220 liters. <p>The available volume of secondary containment should be at least 110 percent of the largest storage container, or 25 percent of the total storage capacity (whichever is greater), in that specific location</p> <ul style="list-style-type: none"> Provide adequate ventilation where volatile wastes are stored. (IFC (EHS) Guidelines) 	Contact the Municipal solid waste collection system in Thaton to arrange safe disposal of hazardous (commercial) waste at Municipal facilities.
2	Industrial waste water (sewage, cooling water discharged to river)	Compressor wash systems.	Contamination arises from demineralizers; lubricating and auxiliary fuel oils; trace contaminants in the fuel (introduced through the PM-handling wastewater); and chlorine, biocides, and other chemicals used to manage the quality of water in cooling and compressor wash systems.	Operation activities include the generation of sanitary wastewater discharges in varying quantities depending on the number of workers involved. Adequate portable or permanent sanitation facilities serving all workers should be provided at operation sites.	Dispose as per requirements of the Liquid Waste (Waste Water and Sanitation) Management of Myanmar and surface and groundwater quality within national and World Bank guidelines. Pretreatment of cooling system water, installation of automated bleed/feed controllers, and use of inert construction materials to reduce chemical treatment requirements for cooling towers;
3	Industrial fuel/ oil waste	In case, diesel used as a back up fuel oil.	<p>Solid, liquid, and gaseous waste-based fuels</p> <p>Maintenance and operation chemicals (e.g., lubricants, and cleaners).</p> <p>Spill prevention and response guidance needs to be addressed.</p>	Assessing the contents of hazardous materials and petroleum-based products in building systems (e.g. PCB containing electrical equipment, asbestos-containing building materials) and process equipment and removing them prior to initiation of decommissioning activities, and managing their treatment and disposal.	<p>Garbage shall not be burned or buried in the compound; For garbage collection and disposal contact Municipal solid waste collection system in Thaton.</p> <p>Use of fuels with a lower content of sulfur where economically feasible;</p>
4	1) Food and beverages 2) Packing processing waste	Kitchen / non-industrial	<p>1) Grain, Yeast, oils and grease; food preparation waste; uneaten food,</p> <p>2) leftover portions of meals, Leftover Fruits.</p> <p>3) Cardboard, paperboard, steel cans, aluminum cans, plastic bottles and jars,</p>	N/A	<p>Filter the waste as per</p> <p>1) Composture, and 2) Recycling requirements of the Municipal solid waste collection system in Thaton.</p> <p>Arrange the pick up and disposal with Municipal Waste Management Department.</p>
5	Maintenance works during operation of the Power plant;	Maintenance during gas/diesel turbines operation	Air / Oil filters, aluminium products, wire, unwanted electrical device, lithium, lead containing battery, light bulbs, mercury containing device, cathode ray tube	If the waste is hazardous, store it in accordance with IFC requirements on EHS guidelines (section 1.6)	<p>Filter the waste as per</p> <p>1) Recyclable, and 2) Hazardous requirements of the Municipal solid waste collection system in Thaton</p>

**13.11 Annex 11:
EHS Management System Manual
EHS Workshop, 31 January – 1 February 2018**

Thaton Combined Cycle Gas Turbine (CCGT) Power Plant

Environmental, Health & Safety Management System
EHS Management System Manual

EHS Workshop by Mr. Axel Fricke
31 January – 1 February 2018



CONSULTING & IT



ENERGY



ENVIRONMENT

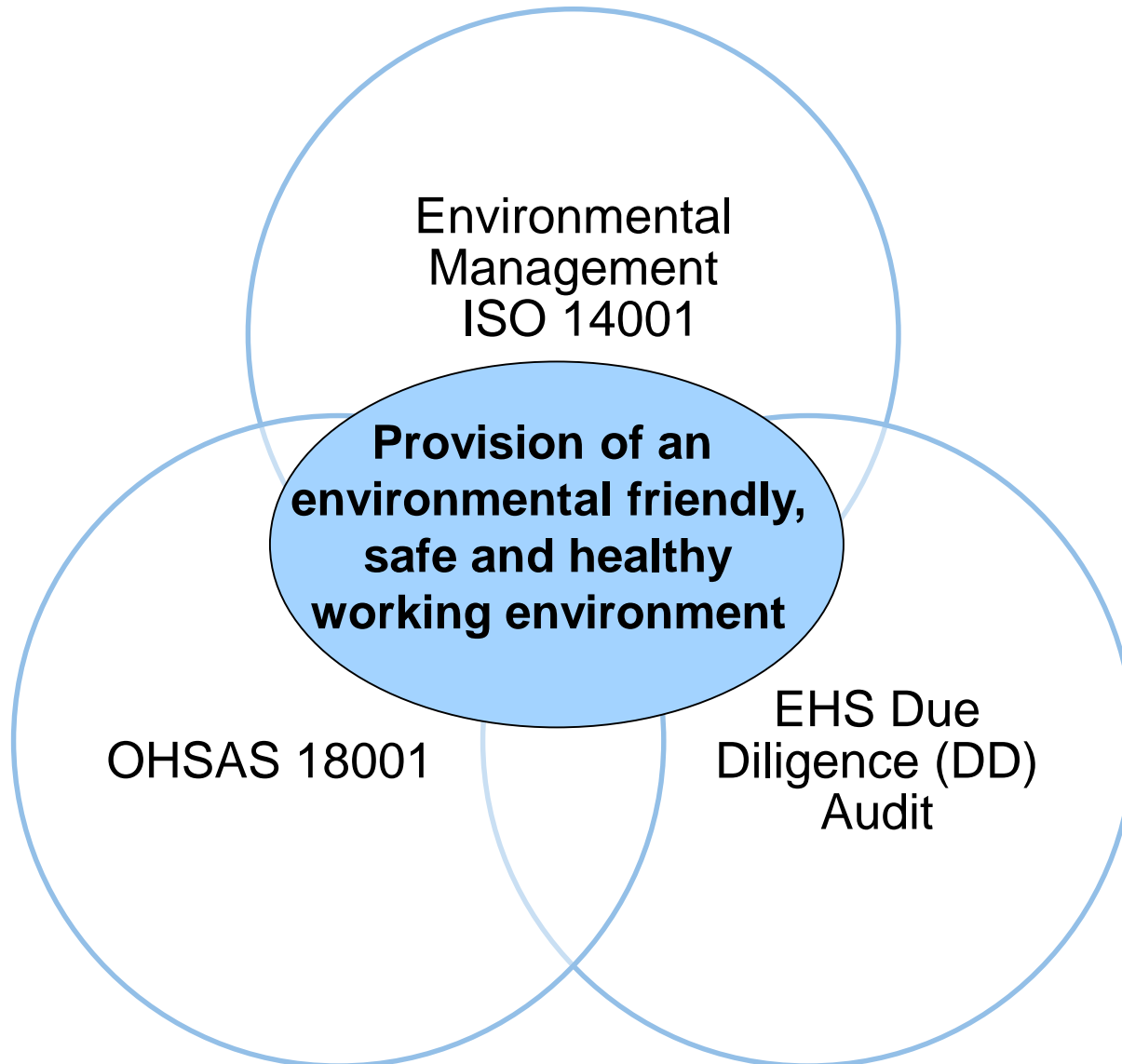


WATER & INFRASTRUCTURE

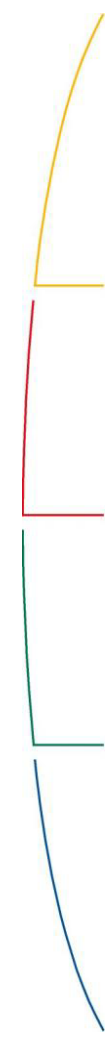
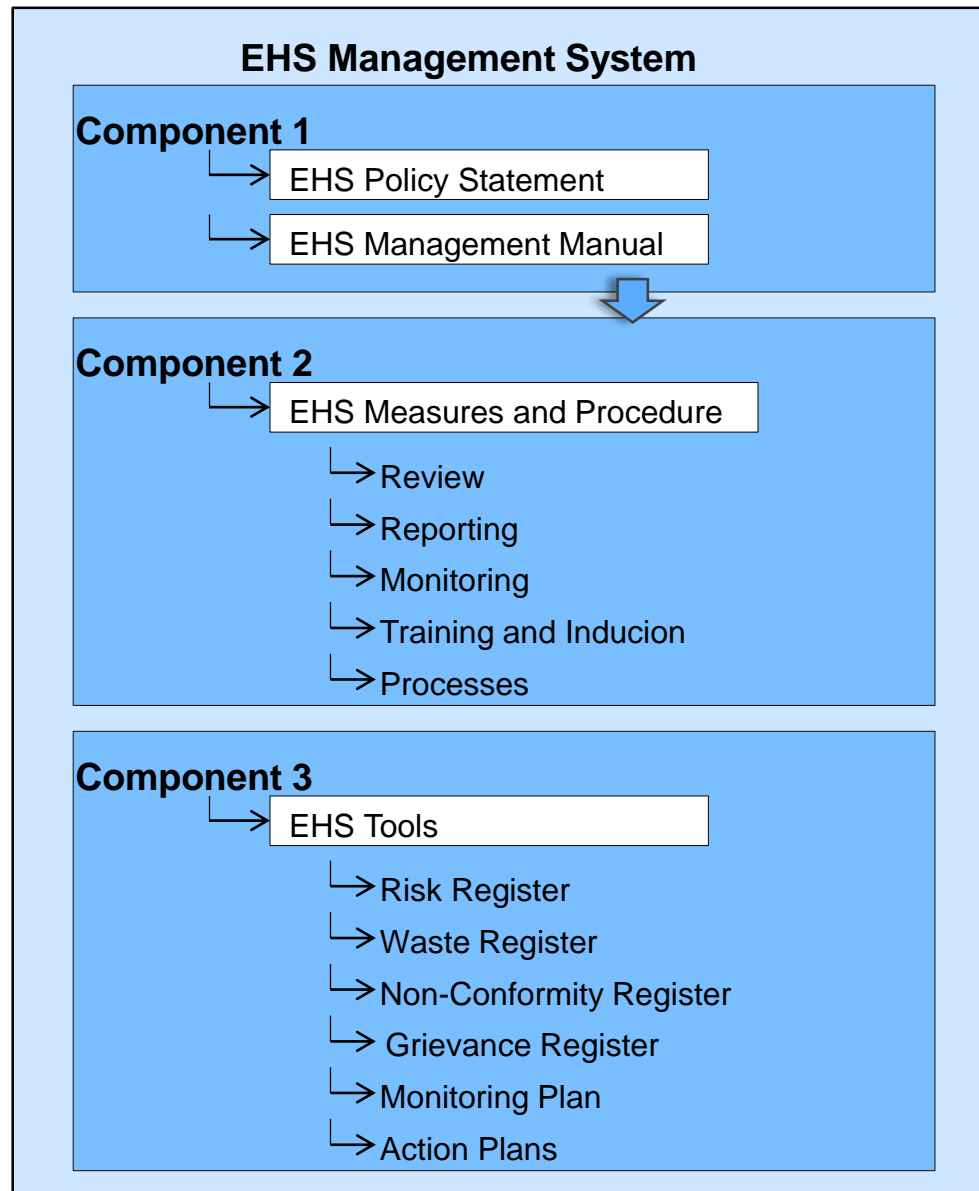
Agenda

Thaton Combined Cycle Gas Turbine Power Plant Environmental, Health & Safety Management System Workshop			
Day 1		Day 2	
Time	Topic	Time	Topic
09.00-09.15	Welcome and Introduction of Participants	09.00-09.15	Wrap-Up of Day 1 and Topics of Day 2
09.15-09.45	Introduction and Basics	09.15-10.15	Emergency Preparedness and Response EHS Training and Response Discussion
09.45-10.45 10.45-11.00	Laws, Guidelines, Standards and Safeguards Discussion		
11.00-11.15	Coffee and Tea Break	10.45-11.00	Coffee and Tea Break
11.15-12.15 12.15-12.45	EHS Routines and Procedures Discussion	11.00-11.45 11.45-12.00	Personal Protective Equipment Discussion
12.45-13.30	Lunch	12.00-13.30	Lunch
13.30-14.00 14.00-14.15	EHS Roles and Responsibilities Discussion	13.30-14.15 14.15-14.30	Risk Management Discussion
14.15-14.30	Coffee and Tea Break	14.15-14.30	Coffee and Tea Break
14.30-15.30 15.30-16.00	EHS Review and Reporting Discussion	14.30-16.00	Waste Register, EHS Monitoring Plan EHS Action Plan, incl. Discussion
16.15-16.30	Summary and Closure of Day 1	16.15-16.30	Summary and Closure of Workshop

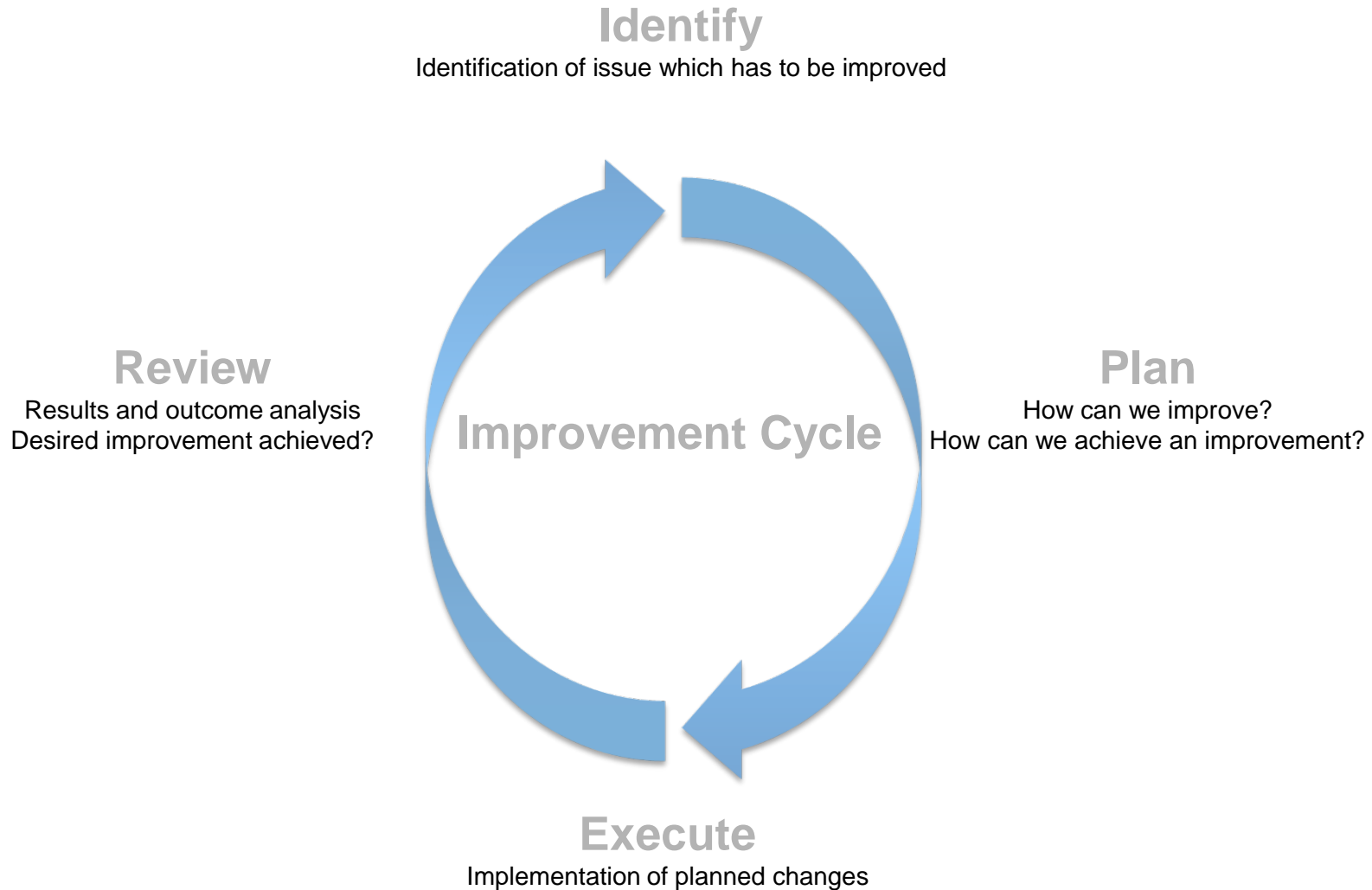
1. Introduction – Purpose and Content of the EHS-MS



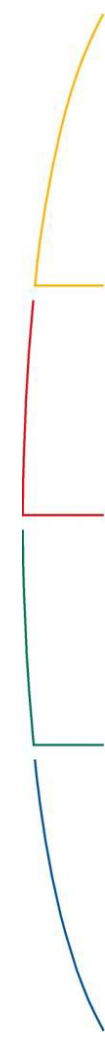
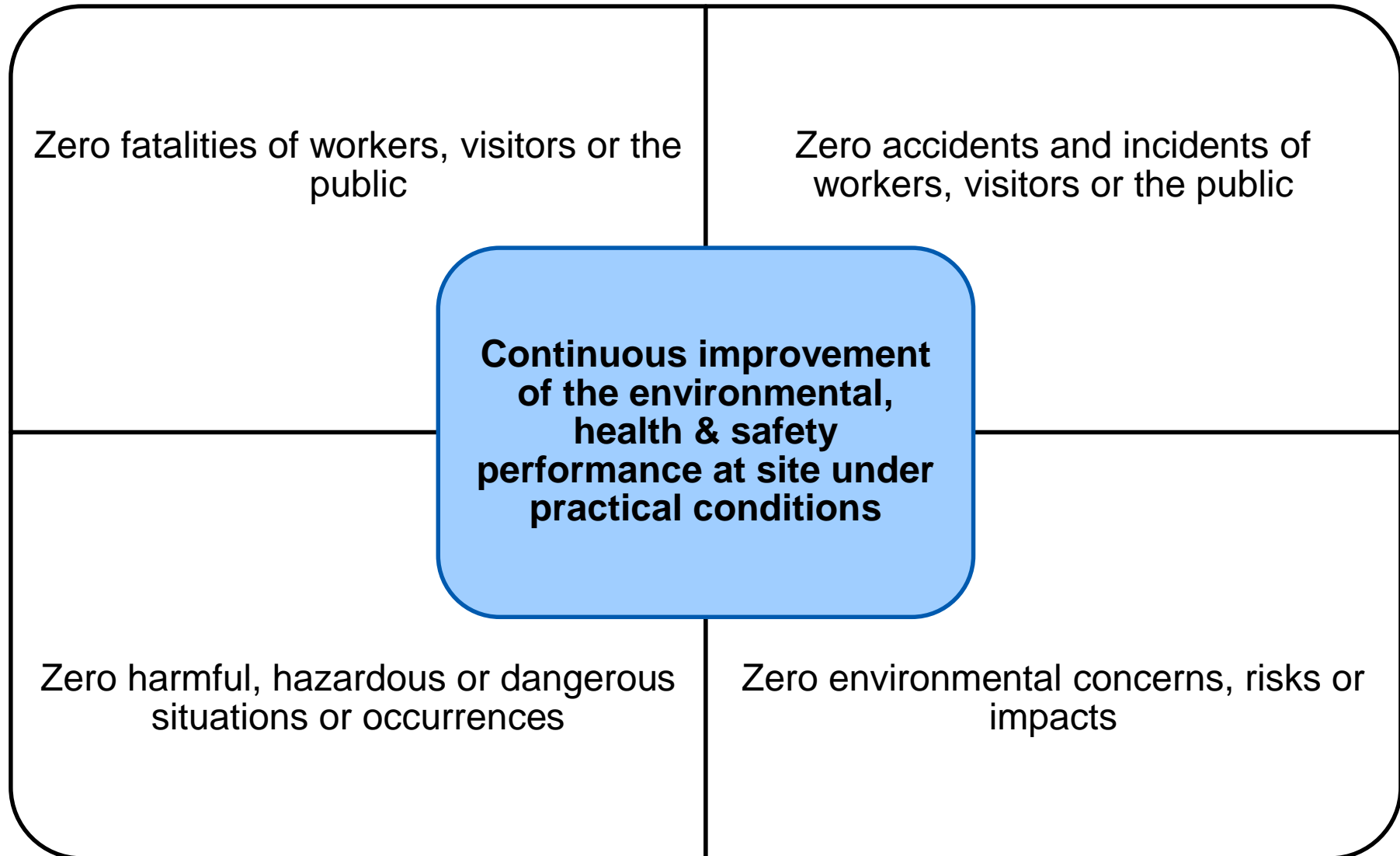
1. Introduction - Structure of EHS Management System



2. Environmental, Health and Safety Policy Statement



2. Environmental, Health and Safety Policy Statement



3. International Guidelines and Safeguards

World Bank EHS Safeguards

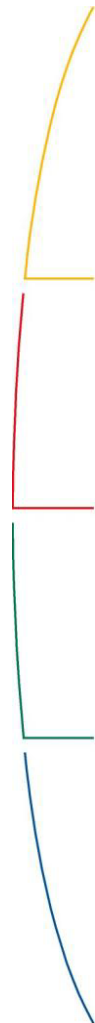
- Target of the World Bank: Protection of people and Environment
- Environmental and Social Framework → World Bank's vision for sustainable development
- Increased responsibility of financial borrowers
- Borrowers should comply with the ten Environmental and Social Standards (ESS)
 - ESS1: Assessment and Management of Environmental and Social Risks and Impacts
 - ESS2: Labor and Working Conditions
 - ESS3: Resource Efficiency and Pollution Prevention and Management
 - ESS4: Community Health and Safety
 - ESS5: Land Acquisition, Restrictions on Land Use and Involuntary Resettlement
 - ESS6: Biodiversity Conservation and Suitable Management of Living Natural Resources
 - ESS7: Indigenous People; Historically Underserved Traditional Local Communities
 - ESS8: Cultural Heritage
 - ESS9: Financial Intermediaries
 - ESS10: Stakeholder Engagement and Information Disclosure

3. Description of the International Legal Background

Ambient Air Quality Standard

(based on the WHO Air Quality Guidelines)

Parameter	Averaging Period	Guideline Value µg/m ³
Nitrogen dioxide	1- year	40
	1- hour	200
Ozone	8-hour daily maximum	100
Particulate matter PM ₁₀	1-year	20
	24-hour	50
Particulate matter PM _{2.5}	1-year	10
	24-hour	25
Sulfur dioxide	24-hour	20
	10-minute	500



3. Description of the International Legal Background

Wastewater

Wastewater defined as: Wastewater and runoff from utilities operations, process and storage areas and miscellaneous activities

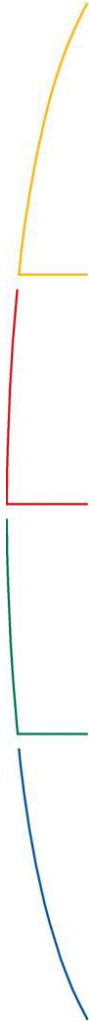
Parameter	Unit	Guideline Value
5-day Biochemical oxygen demand	mg/l	50
Ammonia	mg/l	10
Arsenic	mg/l	0.1
Cadmium	mg/l	0.1
Chemical oxygen demand	mg/l	250
Chlorine (total residual)	mg/l	0.2
Chromium (hexavalent)	mg/l	0.1
Chromium (total)	mg/l	0.5
Copper	mg/l	0.5
Cyanide (free)	mg/l	0.1
Cyanide (total)	mg/l	1
Fluoride	mg/l	20
Heavy metals (total)	mg/l	10
Iron	mg/l	3.5
Lead	mg/l	0.1
Mercury	mg/l	0.01
Nickel	mg/l	0.5
Oil and grease	mg/l	10
pH	Standard Unit	6-9
Phenols	mg/l	0.5
Selenium	mg/l	0.1
Silver	mg/l	0.5
Sulphide	mg/l	1
Temperature increase	°C	<3
Total coliform bacteria	100 ml	400
Total phosphorus	mg/l	2
Total suspended solid	mg/l	50
Zinc	mg/l	2

3. Description of the International Legal Background

Noise Level

- Noise prevention and mitigation measures should be taken when noise level is predicted to be higher than limit values
- Noise impacts should not exceed the values in the table

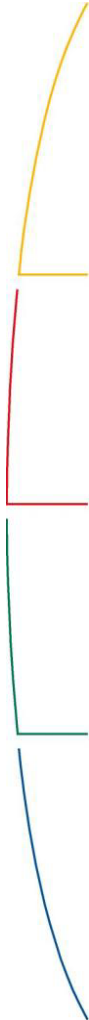
Receptor	One Hour dBA	
	Daytime 07:00-22:00 (10:00-22:00 for Public holidays)	Nighttime 22:00-07:00 (22:00-10:00 for Public holidays)
Residential, institutional, educational	55	45
Industrial, commercial	70	70



3. International Guidelines and Safeguards

World Bank Environmental, Health and Safety Guidelines overview

- Technical framework with examples of Good International Industry Practice
- Involvement of WB in a project requires the application of the EHS Guidelines
- General EHS Guidelines applied with respective Industry Sector EHS Guidelines
- EHS Guidelines used as a technical source of information
- The EHS Guidelines contain the performance levels and measures that are the most achievable in new facilities by existing technology at a reasonable cost
- In case of discrepancy between the national and the WB Guidelines, projects have to be achieved by following the more stringent Guidelines
- Less stringent Guidelines can be applied in condition that human health and the environment are still considered

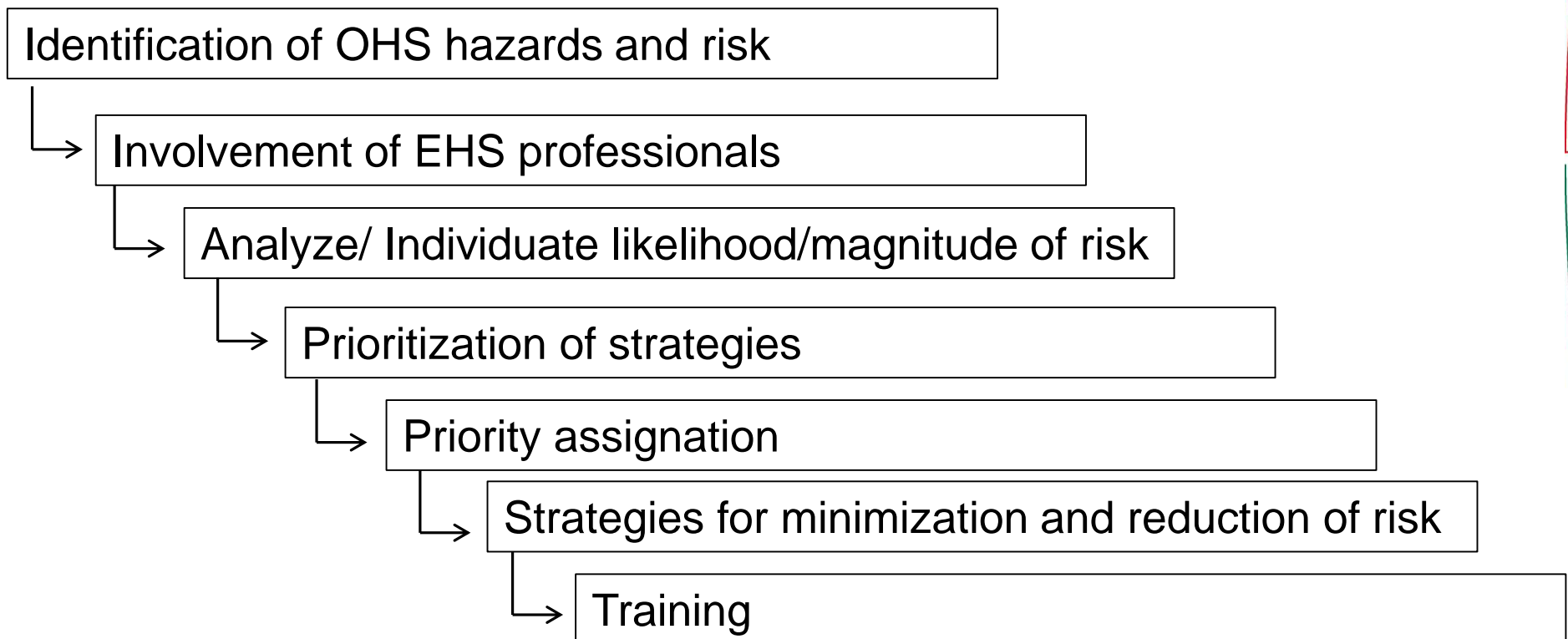


3. International Guidelines and Safeguards

World Bank Environmental, Health and Safety Guidelines overview

Management of EHS Issues requires the incorporation of Guidelines in the entire process of the project management.

The approach is hierarchical and includes the following steps:



3. Description of the National Legal Background

OHS Regulations Myanmar – Based on the Factories Act of 1951

Health

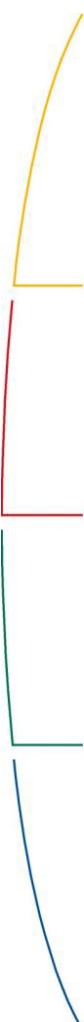
- Facilities shall be kept clean, free from effluvia and leakages [Chapter III, 13. (1)]
- Dirt and waste → removed from the floor and work spaces [Chapter III, 13. (1a)]
- Cleaning once a week by washing and disinfecting [Chapter III, 13. (1b)]
- Every workroom shall be ventilated with fresh air [Chapter III, 15. (1)]
- Room temperature suitable for security, comfort and health [Chapter III, 15. (1)]
- Workspace for each worker → not less than 11 cubic meters [Chapter III, 18.(2)]
- Drinking water sources should be conveniently situated [Chapter III, 20.(1)]
- Worker > 250 → cooling of drinking water [Chapter III, 20.(3)]
- Latrines and urinals should be divided for men and women [Chapter III, 21.(b)]
- Latrines and urinal rooms → ventilated, lighted, maintained clean [Chapter III, 21.(d)]
- In every factory a first aid box shall be equipped [Chapter V, 47(1)]
- Worker > 250 → first aid room or dispensary shall be installed [Chapter V, 47(3)]

3. Description of the National Legal Background

OHS Regulations Myanmar – Based on the Factories Act of 1951

Safety (1)

- Following machineries and parts should be fenced [Chapter IV, 23.(1a,b,c)]:
 - Every moving part
 - The headrace and tailrace of every turbine or wheel
 - Every part of an electric generator, motor or rotating compound
 - Every part of machinery transmission
- Examination should be carried out by specially trained, instructed or supervised adult male worker wearing the appropriate safety clothing [Chapter IV, 24.(1)]
- Openings, pits and tanks either covered or securely fenced [Chapter IV, 35(1)]

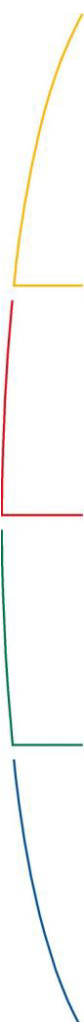


3. Description of the National Legal Background

OHS Regulations Myanmar – Based on the Factories Act of 1951

Safety (2)

- Every hoist or lift should [Chapter IV, 30(1,2,3,4)]:
 - Be of good mechanical construction
 - Properly maintained
 - Thoroughly examined
 - Fitted with enclosure and gates
 - Labeled with the maximum load capacity
- Women/Children shall not be allowed to clean, lubricate or examine moving parts [Chapter IV, 25(2)]
- Effective measures around machinery and equipment which operates at a pressure above the atmospheric pressure. Safe working pressure → not be exceeded during operation [Chapter IV, 33(1)]



3. Description of the National Legal Background

OHS Regulations Myanmar – Based on the Factories Act of 1951

Safety (3)

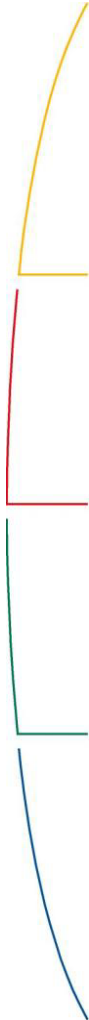
- Floors, steps, stairs, passages and gangways → properly maintained and equipped with fences/handrails [Chapter IV, 34(a)]
- The safe access to every working space should be grated [Chapter IV, 34(b)]
- No woman or adolescent should carry excessive weights [Chapter IV, 36(1)]
- No person shall enter in locations containing dangerous fumes [Chapter IV, 38(1)]
- The workspace which has to be accessed must be secured [Chapter IV, 38(5)]
- For fire prevention the structure must equip as follows: [Chapter IV, 40(2,3,4)]:
 - Doors should always be opened from the inside → open outwards
 - Every window, door or escape route shall be marked
 - Warning apparatus should be installed in the power plant to give a warning
 - Personnel should be trained appropriately to prevent any incidents

3. Description of the National Legal Background

OHS Regulations Myanmar – Based on the Factories Act of 1951

Working Hours of Adults

- Adult worker shall not work more than 44 hrs per week [Chapter VII, 59]
- In one day the worker should not work more than 8 hours [Chapter VII, 62]
- Every 5 working hours → 0,5 hr invested for resting [Chapter VII, 63]
- Sunday: not a working day → special shifts or exception possible [Chapter VII, 60(1,a)]
- Overtime shall be paid double the amount of the ordinary [Chapter VII. 73(1)]
- No worker shall work twice in one day in two separate facilities [Chapter VII, 74]

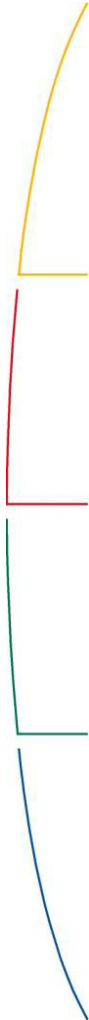


3. Description of the National Legal Background

OHS Regulations Myanmar – Based on the Factories Act of 1951

Employment of young persons

- No child under 13 shall be required or allowed to work [Chapter VIII, 75]
- A child above 13 may be allowed to work → certificate of fitness [Chapter VIII, 76(a)]
- The working time should not exceed four hours in any day [Chapter VIII, 79(1)]
- No night shift should be allowed for children [Chapter VIII, 79(2)]
- No child is allowed to work at two separate places in one day [Chapter VIII, 79(3)]
- A register, accessible for any inspection, of child workers should be created in the concerned facility [Chapter VIII, 81(1,a-f)]



4. EHS Routines and Procedures

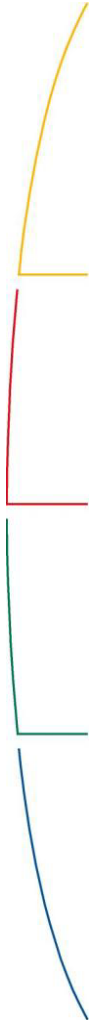
Safety Operating Procedure

A document which describes the operations of a certain work or job in order to ensure its quality

A set of compulsory instructions, systems, procedures or steps which is written so that other individuals can follow to complete the job safely

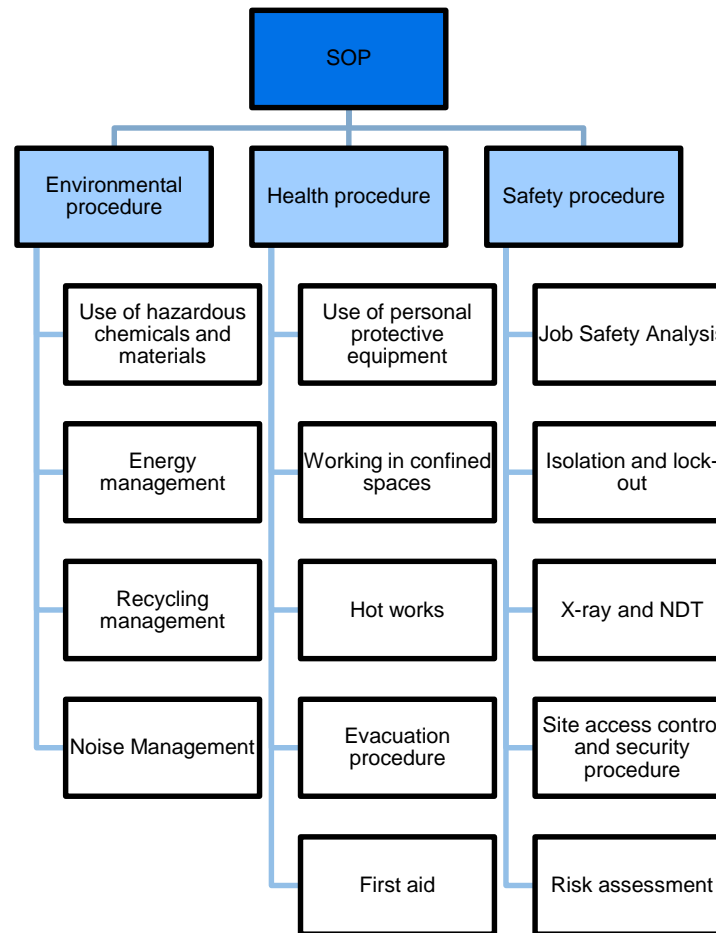
It also maximises operational and production requirements

The purpose of a SOP is to carry out the operations correctly and always in the same manner



4. EHS Routines and Procedures

Requirements



4. EHS Routines and Procedures - Examples

Sample Inspection Checklist (Ladders)

Location	Inspectors Name	Date of Inspection
----------	-----------------	--------------------

Is there evidence of:	Yes / No	Comments
Cracked, split, worn or broken stiles?	Yes / No	
Twisted or distorted stiles?	Yes / No	
Cracked, split, worn or broken rungs?	Yes / No	
Loose rungs (considered loose if they can be moved by hand)?	Yes / No	
Twisted, distorted or missing rungs?	Yes / No	
Rusted, corroded, damaged, worn or missing fittings/screws/nails etc?	Yes / No	
Damaged, worn, badly deteriorated or missing ropes	Yes / No	
Missing or damaged feet	Yes / No	
Paint or other substances that could hide damage	Yes / No	
Isolated cable management?	Yes / No	

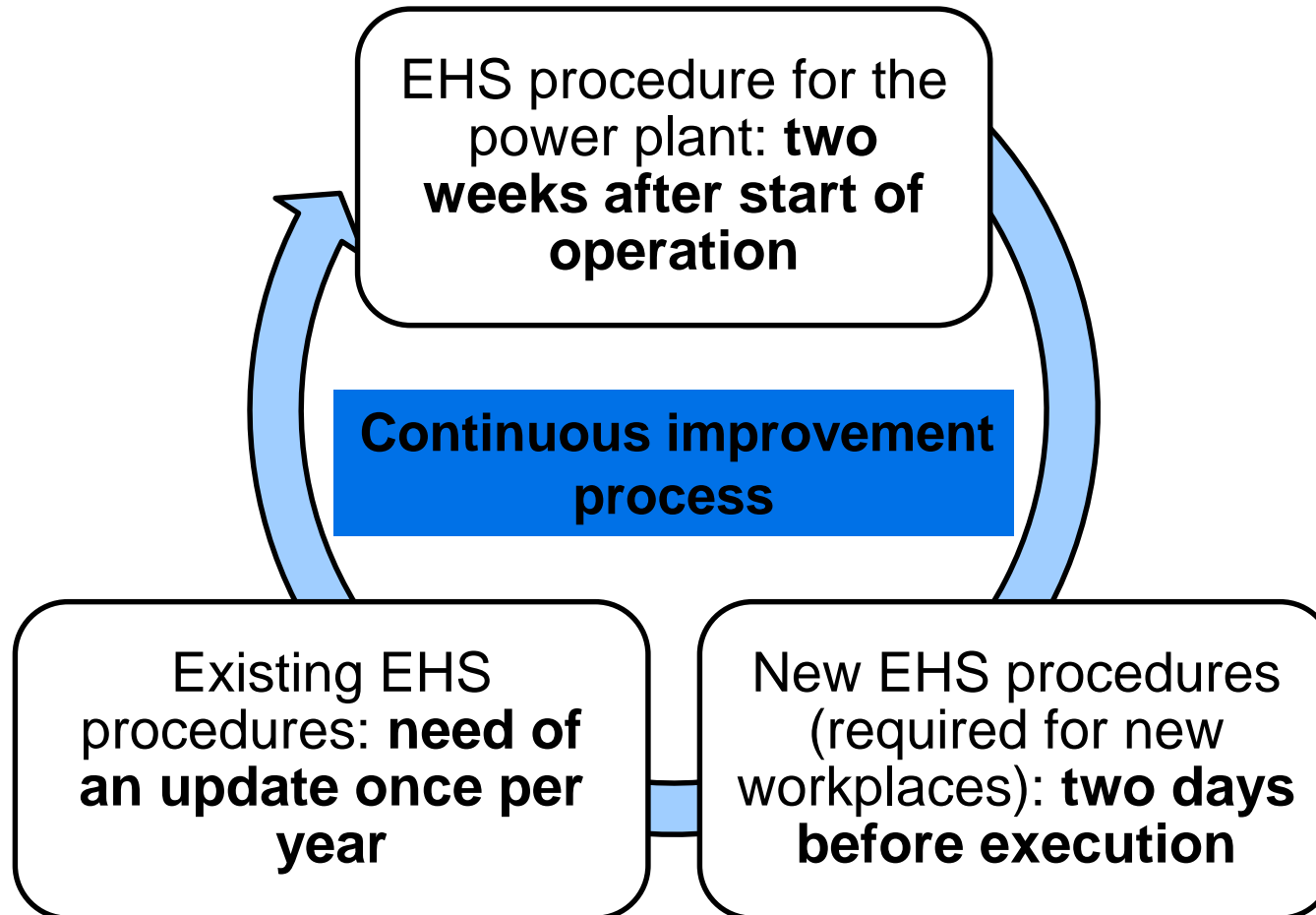


4. EHS Routines and Procedures - Examples

Workspace Inspection Checklist

Use the following questions to carry out a workspace inspection. Record any faults and required action on the action list below.		Y	N
2.	Are portable electric appliances in good conditions?	<input type="checkbox"/>	<input type="checkbox"/>
4.	Is the <u>ground/are surfaces</u> in good condition - free from slip and tripping hazards?	<input type="checkbox"/>	<input type="checkbox"/>
6.	Are <u>office or workshop furniture</u> in good conditions?	<input type="checkbox"/>	<input type="checkbox"/>
7.	Are ladders in good conditions	<input type="checkbox"/>	<input type="checkbox"/>
8.	Are handrails securely fixed?	<input type="checkbox"/>	<input type="checkbox"/>
9.	Do toilet have the following:		
	a) Running water?	<input type="checkbox"/>	<input type="checkbox"/>
	b) Consumables e.g. paper, soap, means of drying hands?	<input type="checkbox"/>	<input type="checkbox"/>
	c) A lock on the door of the WC?	<input type="checkbox"/>	<input type="checkbox"/>
	d) Adequate ventilation - either natural or mechanical?	<input type="checkbox"/>	<input type="checkbox"/>
	e) A waste disposal bin?	<input type="checkbox"/>	<input type="checkbox"/>
10.	Are toilets cleaned at least daily and waste bins emptied?	<input type="checkbox"/>	<input type="checkbox"/>
11.	Is there a routine cleaning program for all areas, are bins emptied daily?	<input type="checkbox"/>	<input type="checkbox"/>
12.	Are there adequate facilities for the storage of materials and substances?	<input type="checkbox"/>	<input type="checkbox"/>
13.	Are hazardous substances stored in a secure location?	<input type="checkbox"/>	<input type="checkbox"/>
14.	Are the <u>signing in/out</u> , access control procedures rigorously applied?	<input type="checkbox"/>	<input type="checkbox"/>
15.	Are areas adequately ventilated and are ventilation systems in working order?	<input type="checkbox"/>	<input type="checkbox"/>
16.	Are windows clean and is there a cleaning program?	<input type="checkbox"/>	<input type="checkbox"/>
17.	Are escape routes clearly mentioned/shown on a map or signposted/labeled?		

4. EHS Routines and Procedures – Timing and Updating



4. EHS Routines and Procedures

Grievance Management

To enable the workers to raise complaints in a confidential way

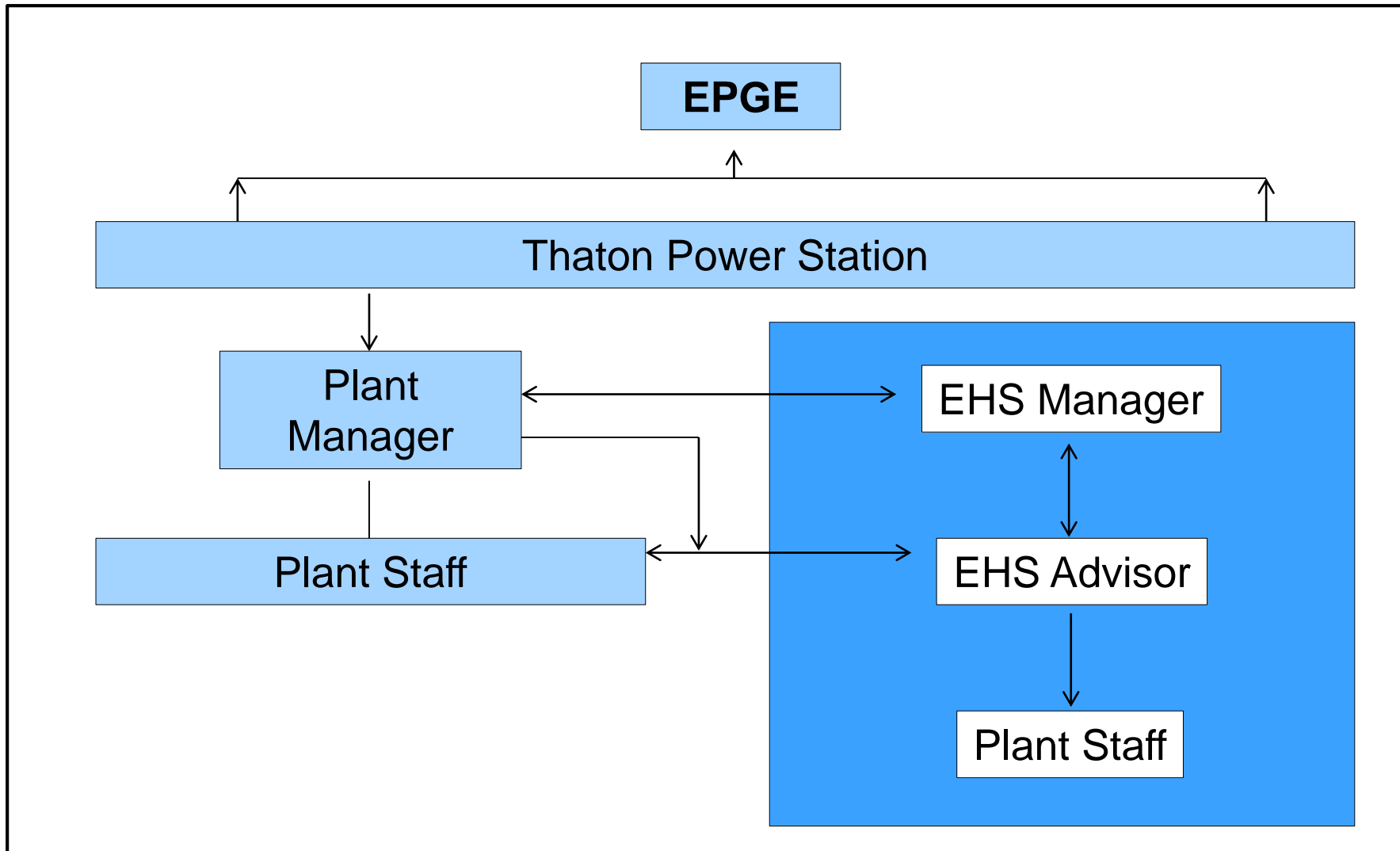
Complaints are reported to the EHS manager

The EHS management is requested to solve the complaint within 3 working days

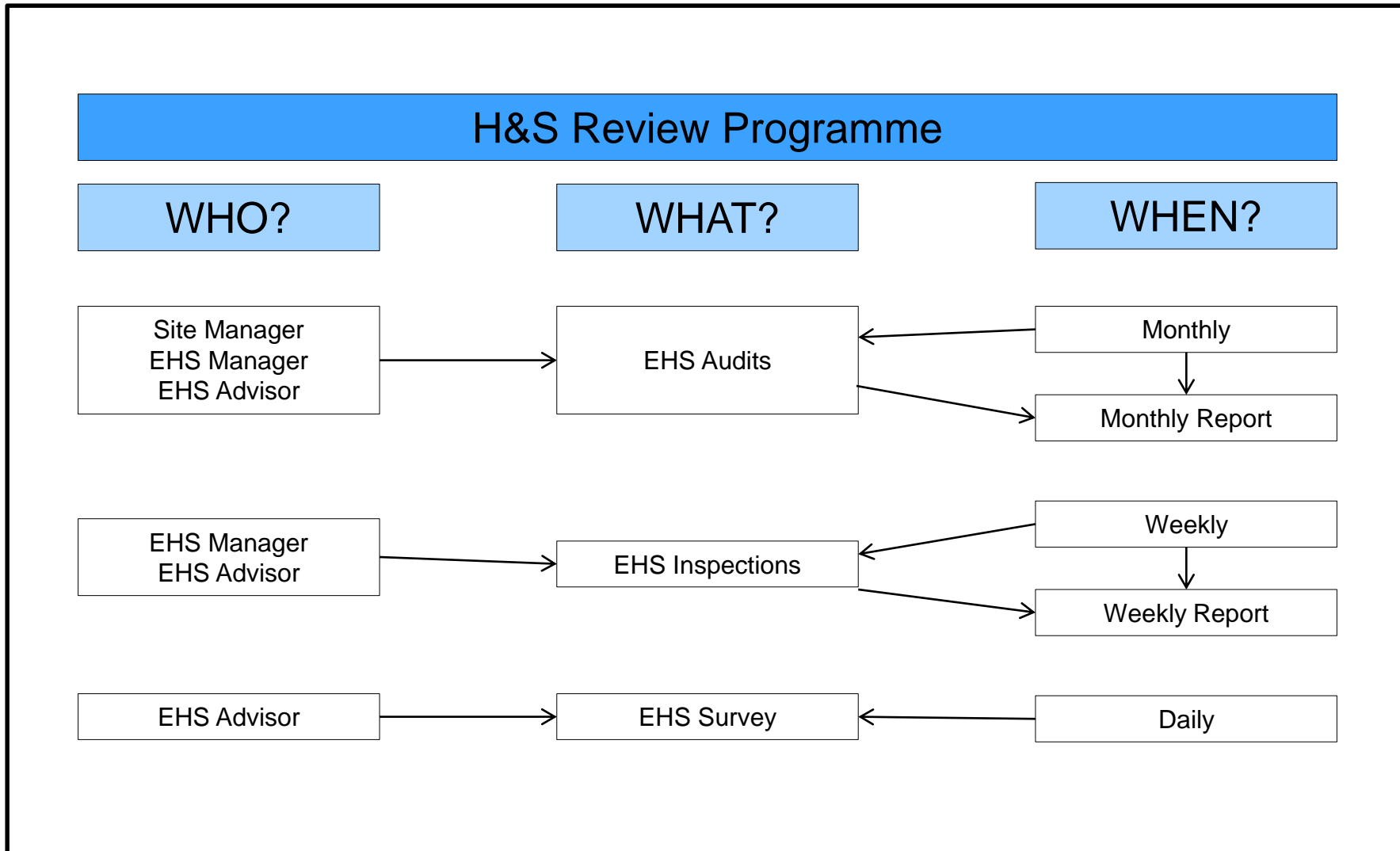
In case the problem could not be solved, an action procedure specifying the needed activities to be solved must be prepared and submitted to the site manager.

All reported grievances notifications must be documented

5. EHS Roles and Responsibilities - Organisation

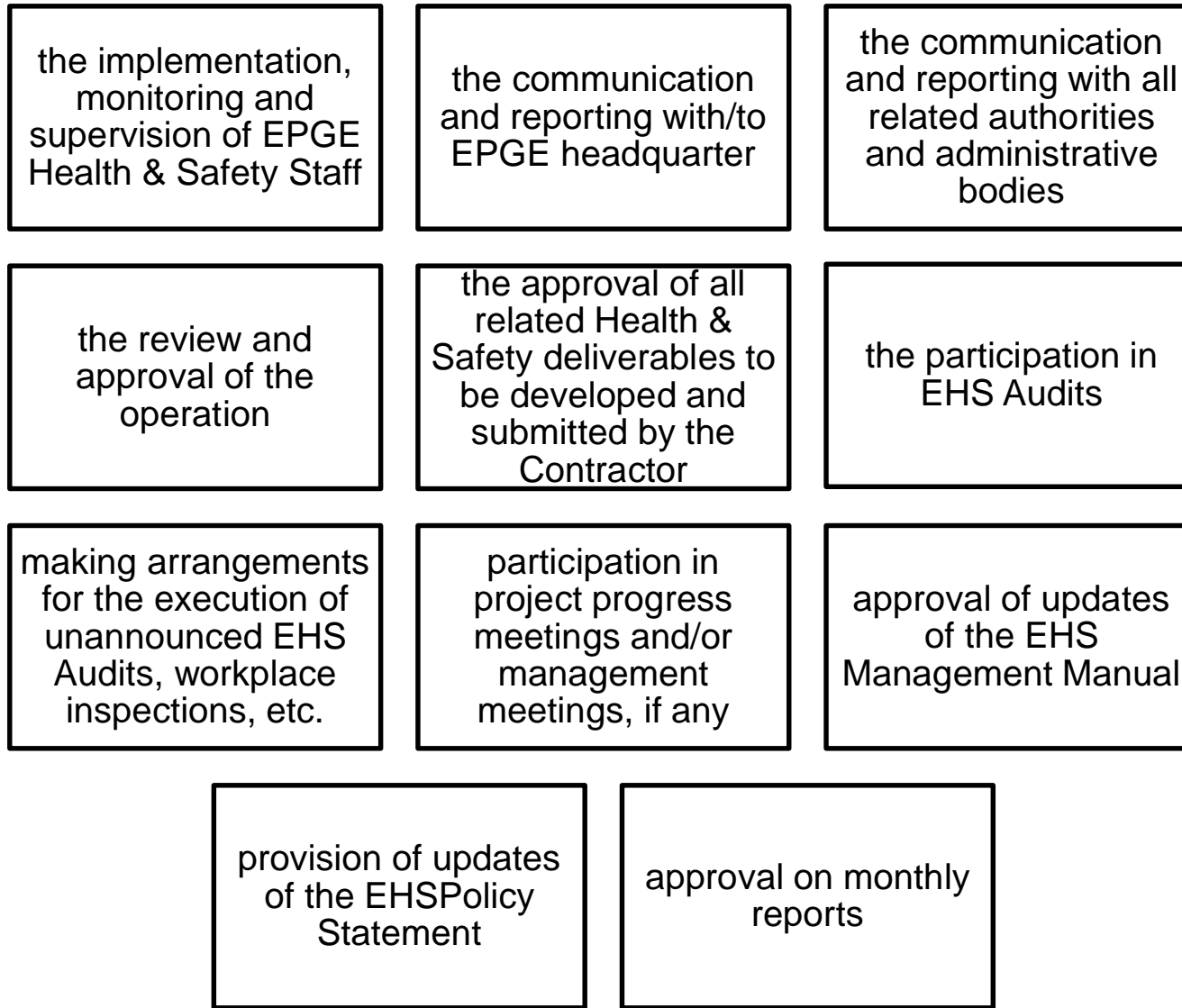


5. EHS Roles and Responsibilities - Organisation



5. EHS Roles and Responsibilities – EHS Manager

The Health & Safety Manager is responsible for:



5. EHS Roles and Responsibilities – EHS Manager

The Health & Safety Manager is responsible:

to implement the measures of the EHS Plan

to undertake risk assessments

to approve permits to work

to approve safe job analysis

to prepare work procedures and instructions

to provide training and induction on health & safety issues

to undertake EHS Audits and workplace inspections

to prepare EHS Reports

to prepare and revise the emergency response plan

to investigate incidents and accidents

5. EHS Roles and Responsibilities – EHS Advisor

Examples of the duties of the H&S Coordinator are at least as follows:

Representation of the EHS Manager in case of his absence

Development and continuation of the operation

Management of overtime announcements

Review and documentation of list of workers below 18 years

Communication with the appointed Contractor(s)

Participation in EHS Audits

Review of monthly reports

Review of weekly reports

5. EHS Roles and Responsibilities – Plant Staff

Examples of the duties of the Plant Staff are at least as follows:

Following of any implemented EHS Instructions implemented at site

Reporting of any in-compliances with the EHS Management System to the site manager, the EHS Manager or his representative(s)

Keeping the workplace and the accommodation tidy and clean

Informing the EHS Manager or his representative(s) in case of feeling uncomfortable to execute any work instructions



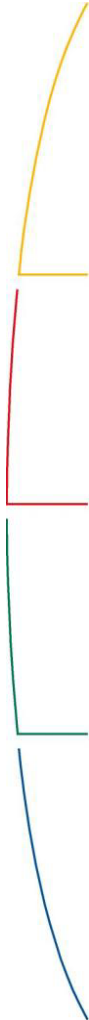
7. EHS Program – Audits, Inspections, Surveys

Audit : on monthly basis by the Site Manager, the H&S Manager and the H&S Advisor.

Content of audit: the construction site itself, material and equipment storage areas, workshop areas and accommodation areas

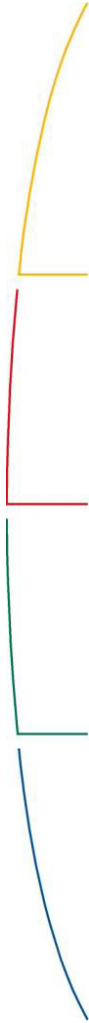
Inspection: on weekly basis by the H&S Manager and the H&S Advisor.

Health & Safety Inspections must be carried out on specific work areas and work places associated with the project on a weekly basis but independent thereof if they are assessed as medium or high risk areas or workplaces according to the risk register. The results of the inspections must be considered in the weekly H&S reports to be submitted to MCA. A copy of the H&S Inspection report must be attached to the weekly report. The H&S Inspections shall be executed by the H&S Manager together with the H&S Advisor.



7. EHS Program – Audits, Inspections, Surveys

	Participants	Content	Frequency	Documentation
Audit	Site Manager, H&S Manager, H&S Advisor.	construction site itself, material and equipment storage areas, workshop areas and accommodation areas	monthly	A copy must be attached to the monthly report
Inspection	H&S Manager, H&S Advisor.	specific work areas and work places associated with the project	weekly	A copy must be attached to the weekly report
Survey	H&S Advisor.		daily	Significant findings must be communicated to the H&S Manager.



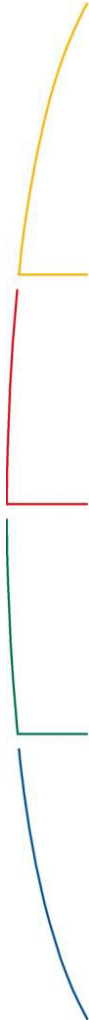
7. EHS Program – Non-Conformities

Non-Conformities...

...are a “non-fulfillment of a requirement” (ISO 9001:2005) –you do not fulfill what is required by the standard.

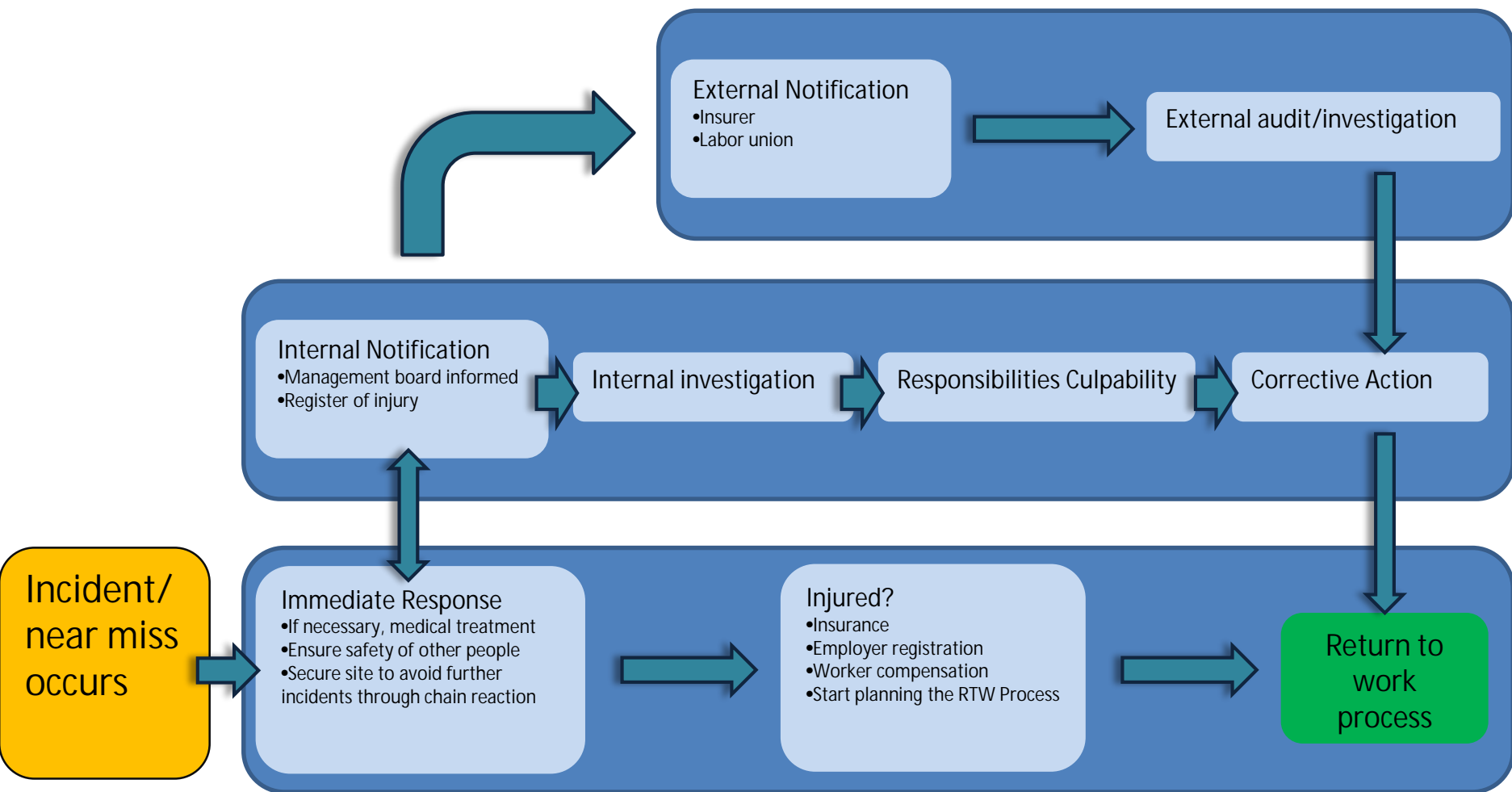
...are used both in internal and in external (certification) audits – they are a “tool” by which the auditor will be able to judge up to which level your management system is compliant with a standard.

Nonconformities must be reported through an audit report!



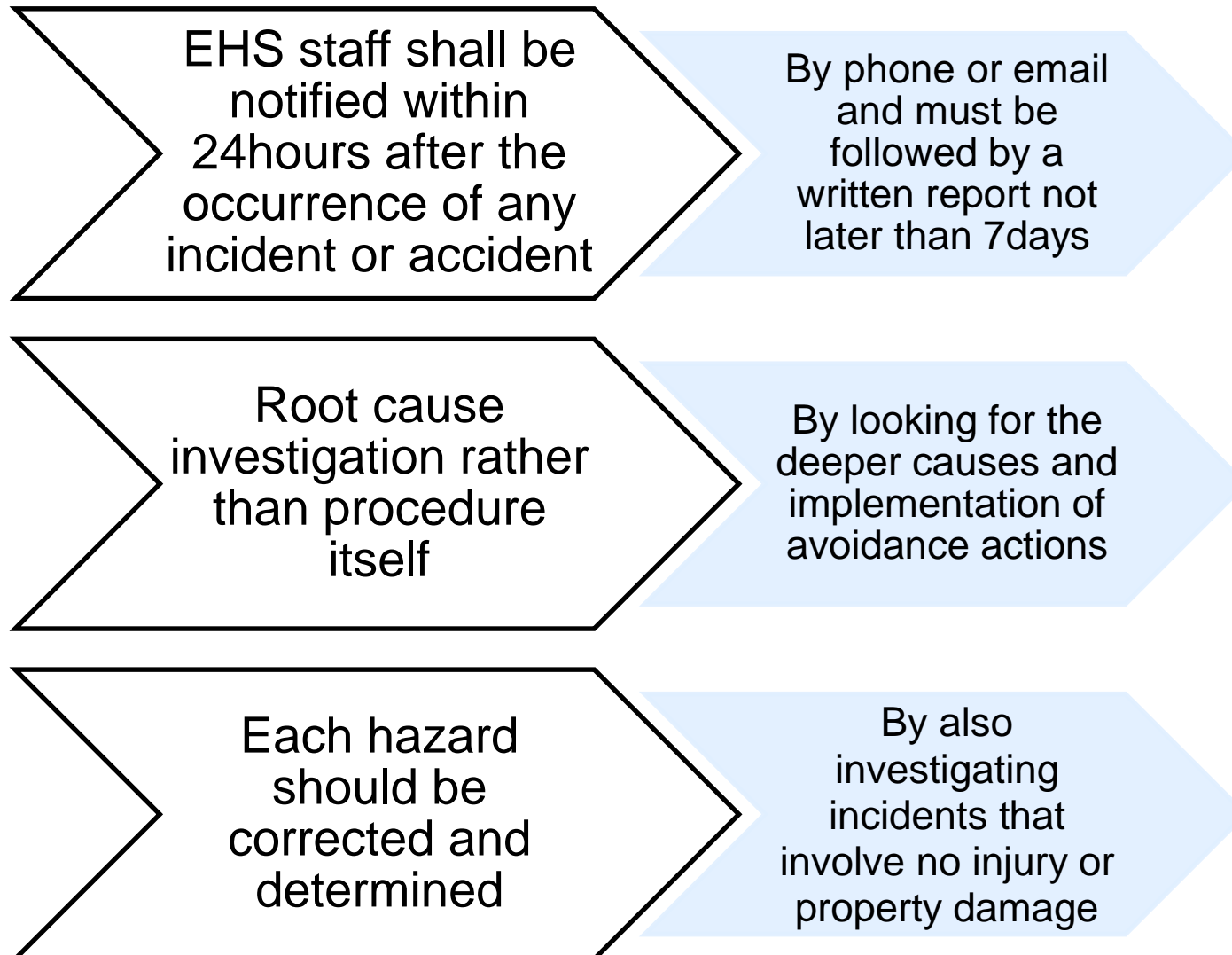
6. Incident and Accident Management

Investigation Process



6. Incident and Accident Management

Investigation and Reporting



6. Incident and Accident Management

Example Operating Procedure (1)

Sample Accident/Incident Report/Investigation Form

Project		Location		Date/Time of Event	
Type of Event	<input type="checkbox"/> Accident	<input type="checkbox"/> Incident	<input type="checkbox"/> Near miss		
Harm (or Potential of Harm)	<input type="checkbox"/> Fatal or Major	<input type="checkbox"/> Serious	<input type="checkbox"/> Minor	<input type="checkbox"/> Property Damage	
Harm (or Potential of Harm)	Name:		Position:		
	Address:		Contact No:		
Brief Description of Event: (Details of what happened, when, where and any emergency action taken)					
Details of witness(es), if any: (Name, position)					
Investigation Required:	<input type="checkbox"/> Yes <input type="checkbox"/> No		Reportable:	<input type="checkbox"/> Yes <input type="checkbox"/> No	
Investigation Level:	<input type="checkbox"/> High <input type="checkbox"/> Med <input type="checkbox"/> Low		Entered in Accident Book:	<input type="checkbox"/> Yes <input type="checkbox"/> No	
Leader of Investigation:	<input type="checkbox"/> Minimal		Date/Time of Entry:		
Reported By	Position	Date	Signature		

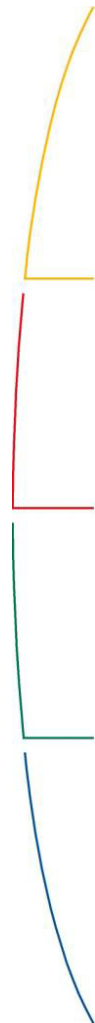
6. Incident and Accident Management

Example Operating Procedure (2)

Causes of the Event		
Immediate Cases	Underlying Causes	Root Causes

Control Measures to be Implemented to Prevent Recurrence:			
Recommendation	Planned Completion Date	Actual Completion Date	Manager Responsible

Risk Assessment/Procedures to be Reviewed:			
Risk Assessment/Procedure	Planned Review Date	Actual Review Date	Manager Responsible



6. Incident and Accident Management

Example Operating Procedure (3)

Further Details:	
------------------	--

Members of the Investigation Team:	Name	Position	Name	Position

Signed on behalf of the investigation team:

Name	Position	Date	Signature
------	----------	------	-----------

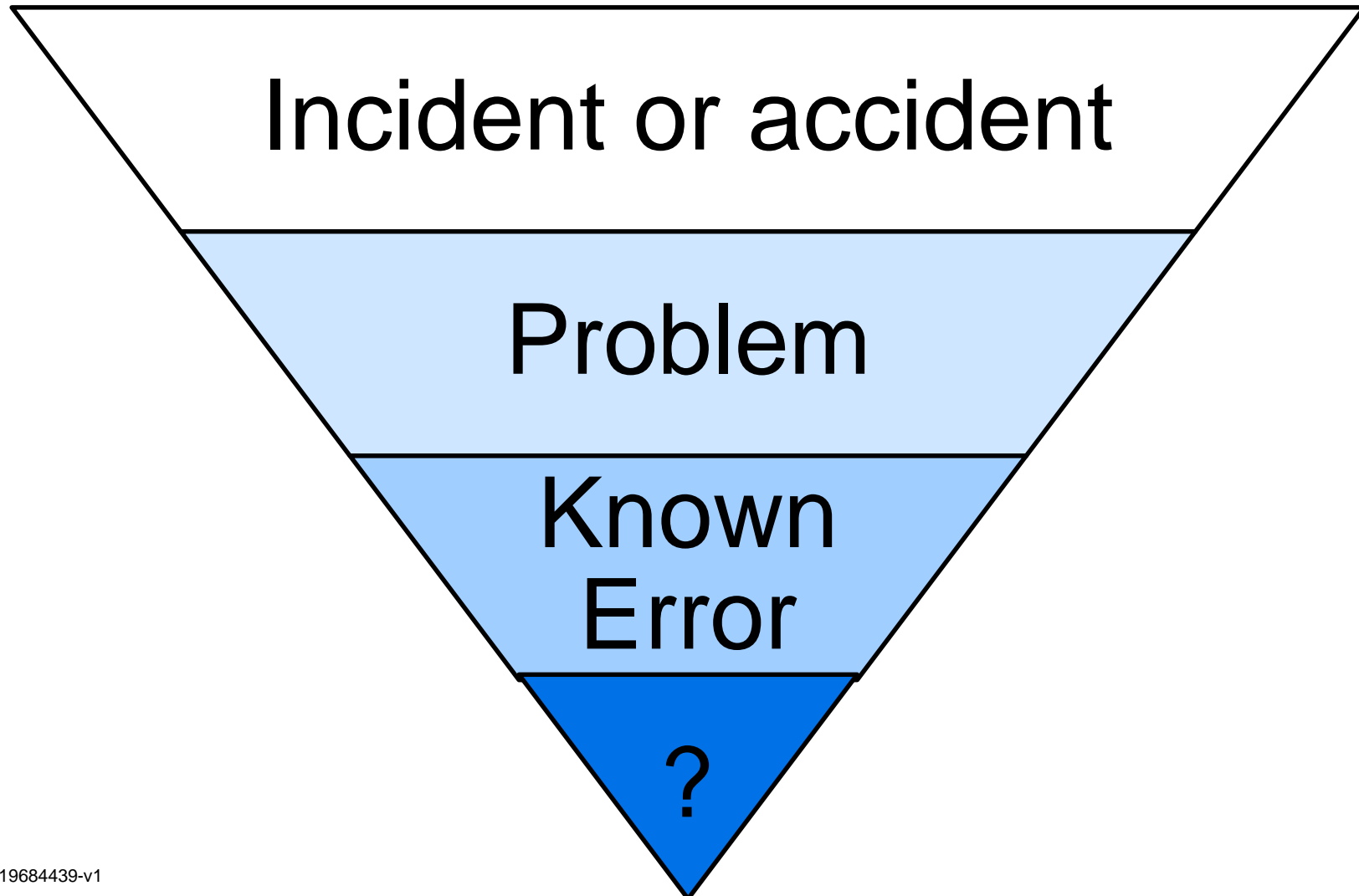
Report accepted by:

Name	Position	Date	Signature
------	----------	------	-----------

The findings of the investigation need to be communicated to the following people:			
Name	Position	Date	Signature

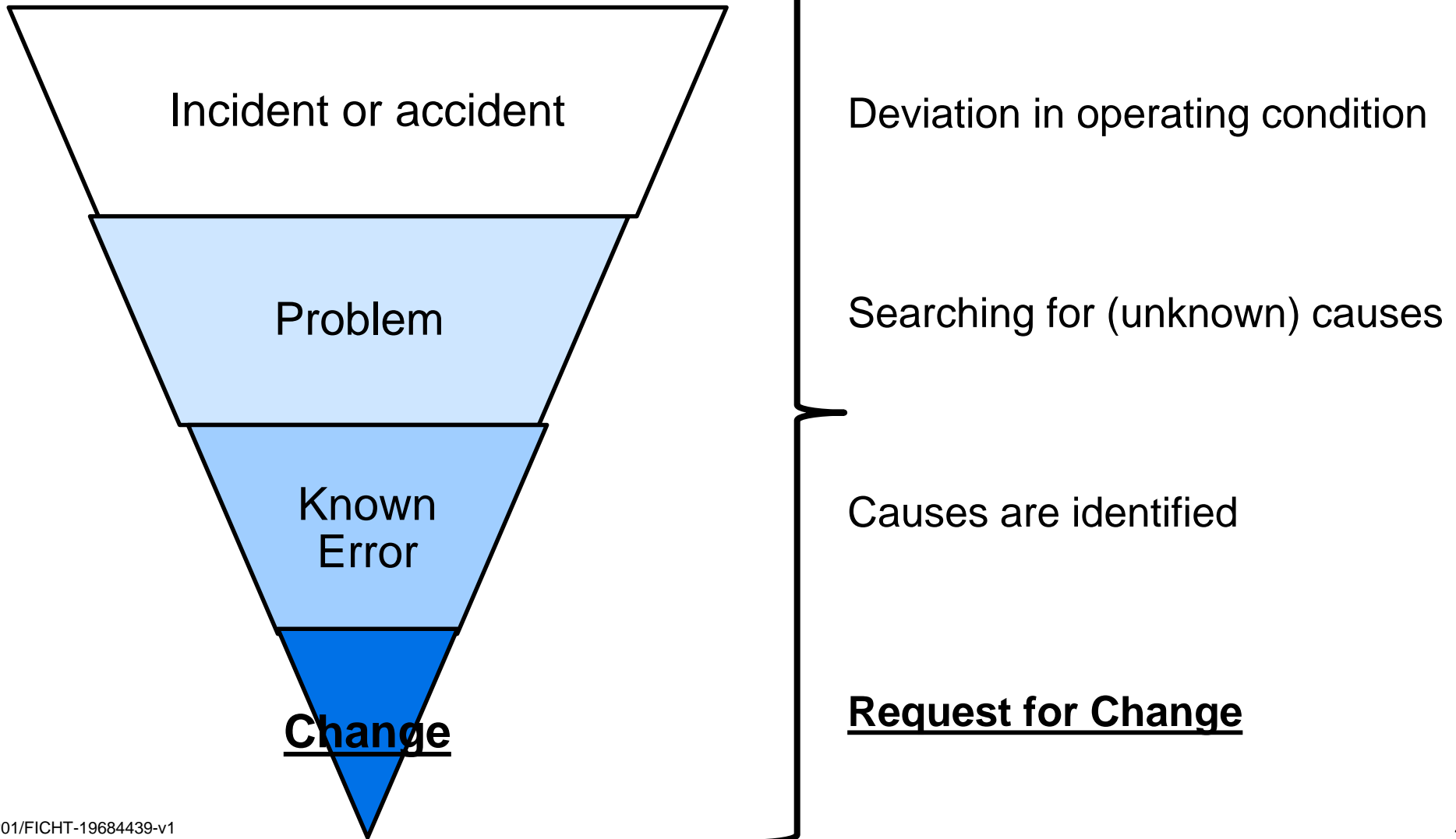
6. Incident and Accident Management

Corrective Actions



6. Incident and Accident Management

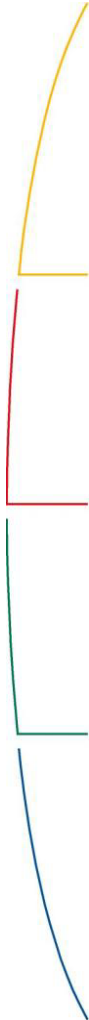
Corrective Actions



8. Emergency Preparedness and Response

The emergency response plan contains:

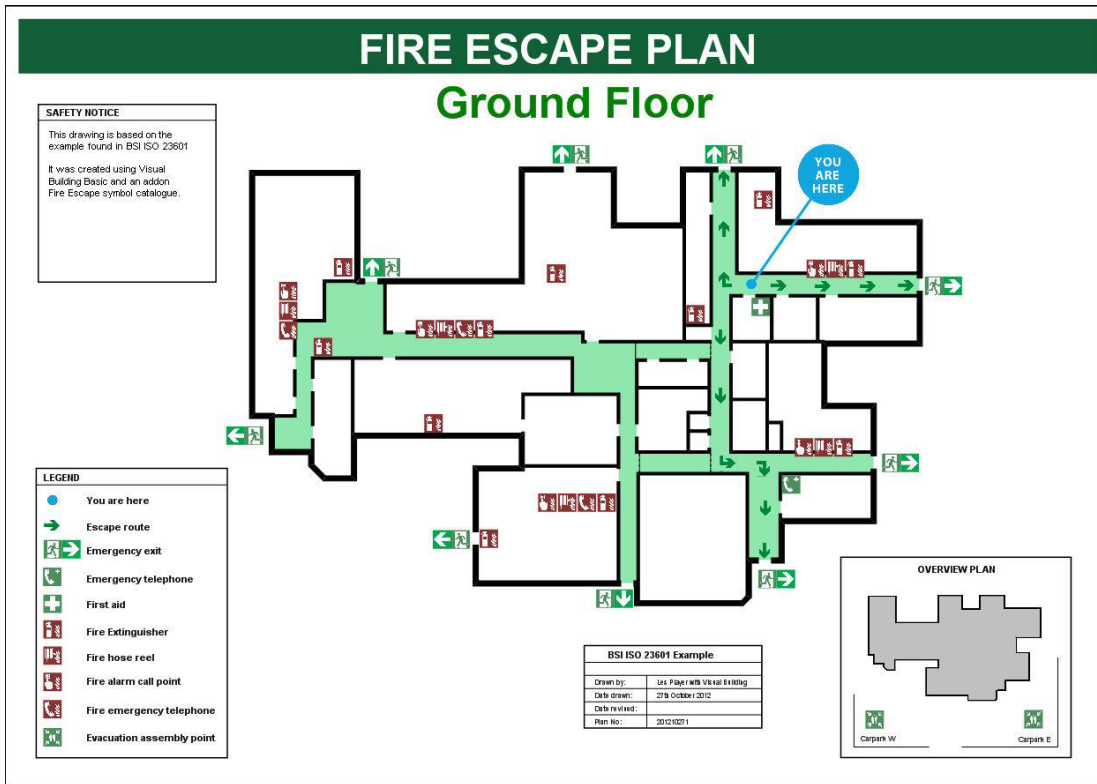
- an evacuation assembly point / a safe evacuation area



8. Emergency Preparedness and Response

The emergency response plan contains:

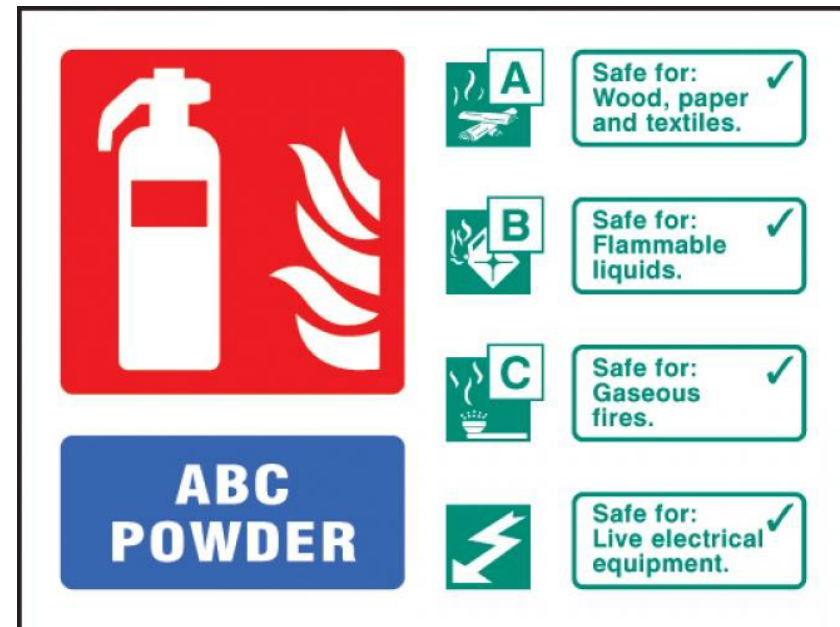
- an evacuation map / safe evacuation routes



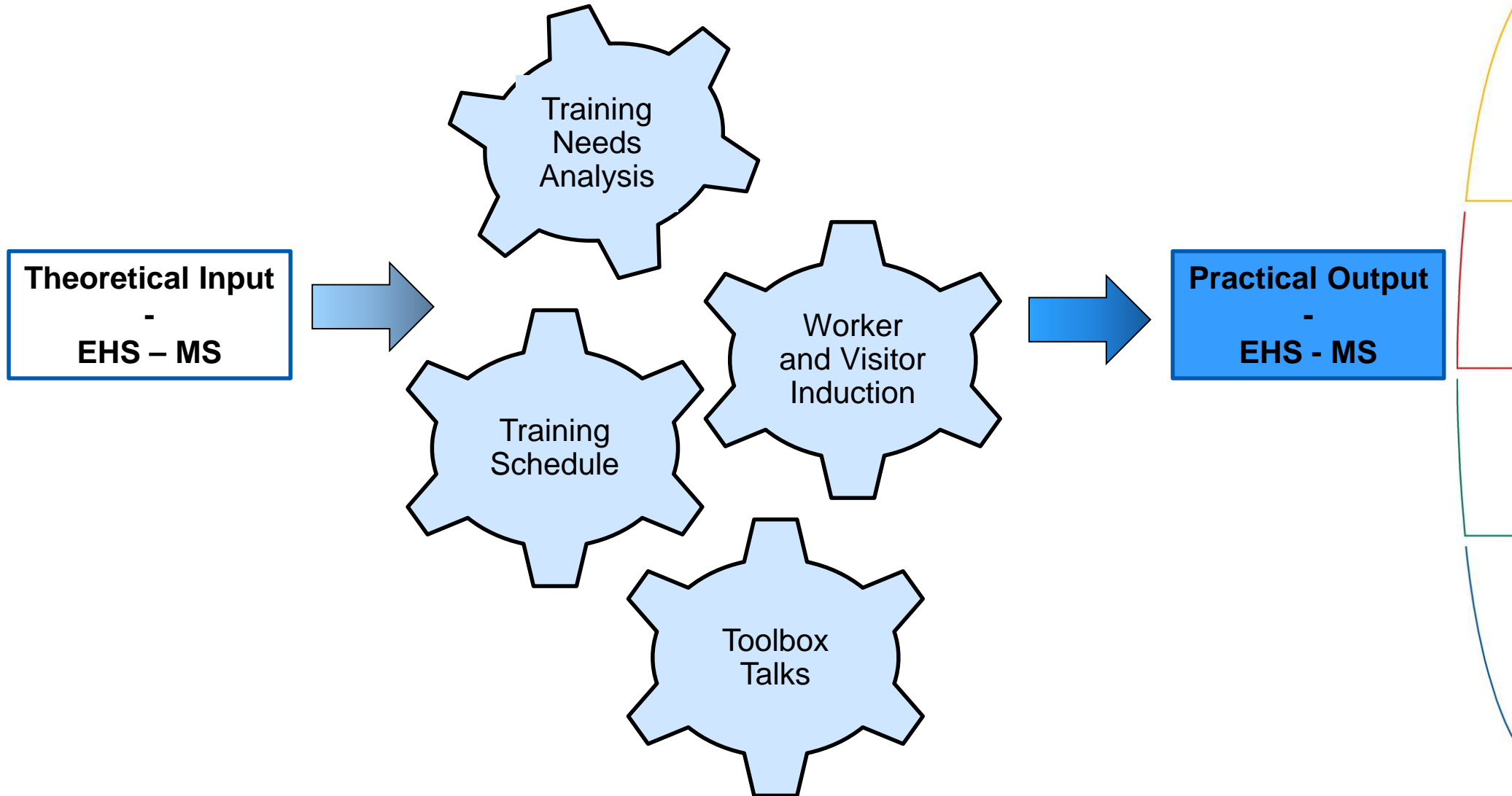
8. Emergency Preparedness and Response

The emergency response plan contains:

- the determination of accurate and suitable fire fighting equipment and emergency items



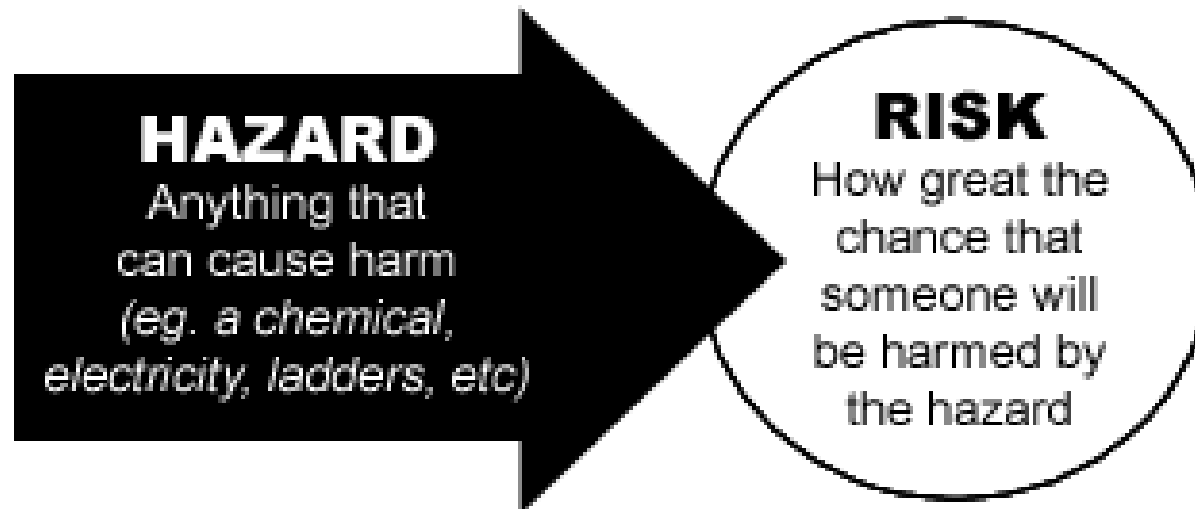
9. EHS Induction and Training Requirements



10. Personal Protective Equipment

Hazard Assessment

In general, employers are responsible for:








Performing a “hazardmain assessment”
of the workplace to identify and control
physical and health hazards

10. Personal Protective Equipment

Hazard Assessment Example (1)

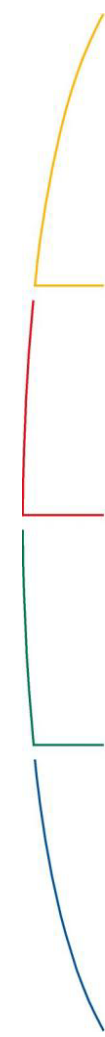
Hazardous Substances Risk Assessment Form

Substances Assessed			Supplier/Manufacturer	
Hazardous Ingredients			Process/Activity	
Duration of Activity			Frequency of Activity	
Hazard Warning				
Harmful	Irritant	Corrosive	Toxic	Very Toxic
				
Risk Phrases			Safety Phrases	
Persons Exposed			No. of Persons Exposed	
Possible Route of Entry				
Inhalation	Ingestion	Absorption		Injection
Existing Control Measures				

10. Personal Protective Equipment

Hazard Assessment Example (2)

Further Control Measures	
Can use of the substances be discontinued?	
Can the substance be substituted for a safer alternative?	
Can engineering controls be introduced? Ventilation Enclosure	
Can Personal Protective Equipment be provided? (LAST RESORT)	
Have all staff been informed, instructed and trained in risk and control measures?	
Storage Requirements	Waste Disposal Requirements
Action to be Taken in Event of Spillage	
Emergency Procedures	
Eye contact	
Skin contact	
Ingestion	
Inhalation	
Assessment Team	
Date	Review Date



10. Personal Protective Equipment

In general, employees should:



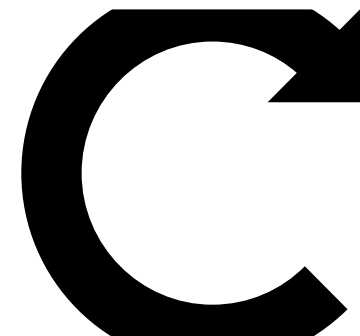
Properly wear PPE



Care for, clean and maintain PPE



Inform a supervisor of the need to repair or replace PPE



Attend training sessions on PPE

10. Personal Protective Equipment

Employees must be trained to know at least the following:

When PPE is necessary.

What PPE is necessary.

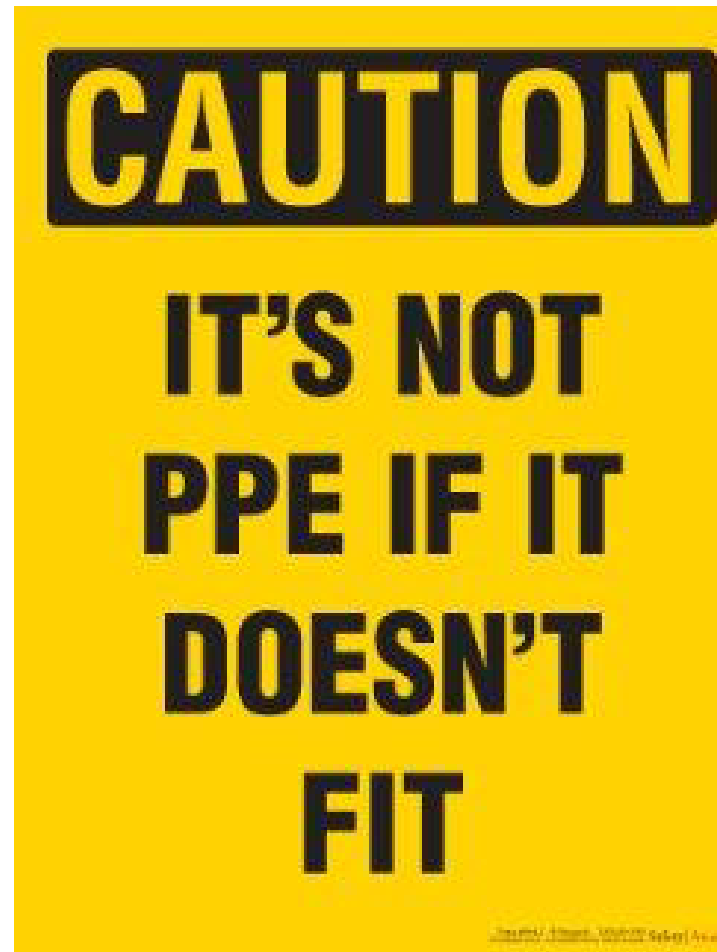
How to properly put on, take off, adjust and wear the PPE.

The limitations of the PPE.

Proper care, maintenance, useful life and disposal of PPE.

10. Personal Protective Equipment

Employers should take the fit and comfort of PPE:



10. Personal Protective Equipment

Types of PPE



Ear protection



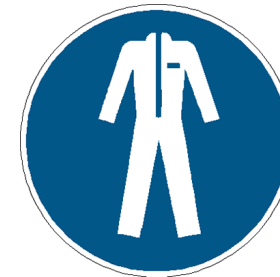
Eye protection



Foot protection



Hand protection



Protective clothing



Wash hands



Use handrail



Face protection



Head protection



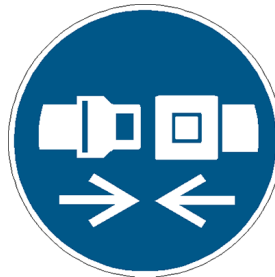
Use high visibility vest



Respiratory protection



Use safety harness



Use of safety belt

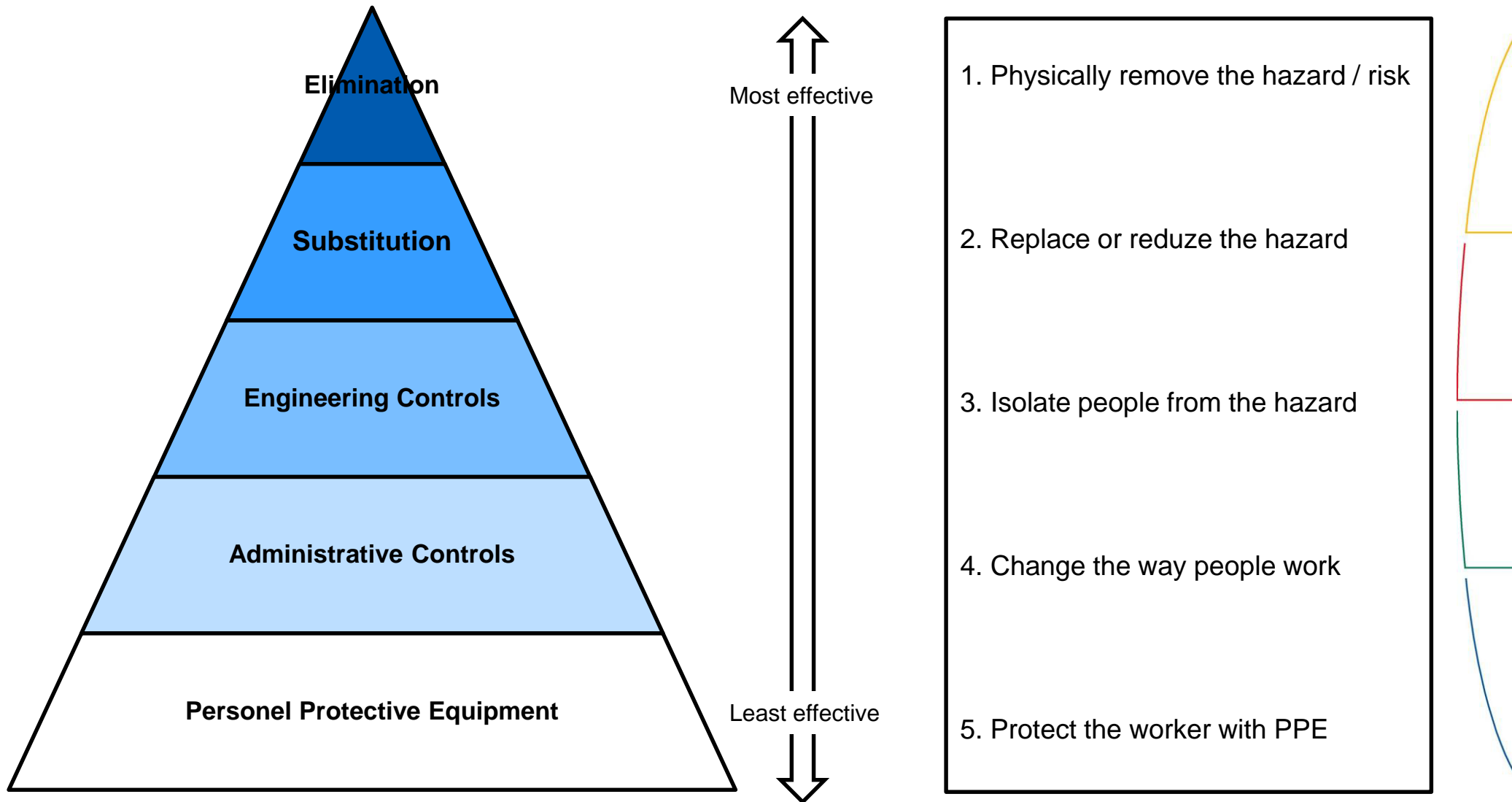


Use footbridge



Hand protecting agent

11. Risk Management – Hierachy of Control



Elimination

Substitution

Engineering Controls

Administrative Controls

Personel Protective Equipment

Most effective

Least effective

1. Physically remove the hazard / risk

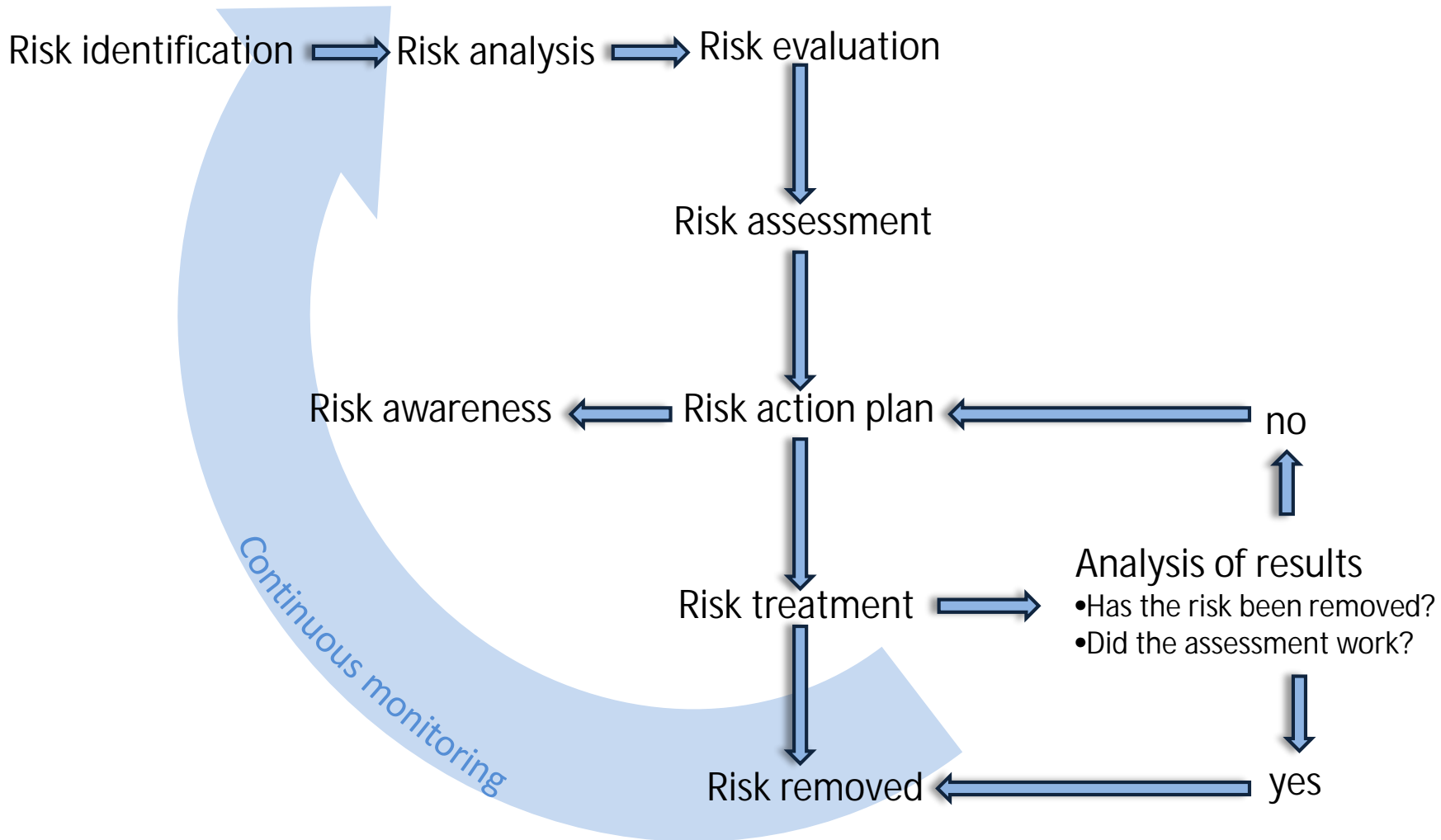
2. Replace or reduze the hazard

3. Isolate people from the hazard

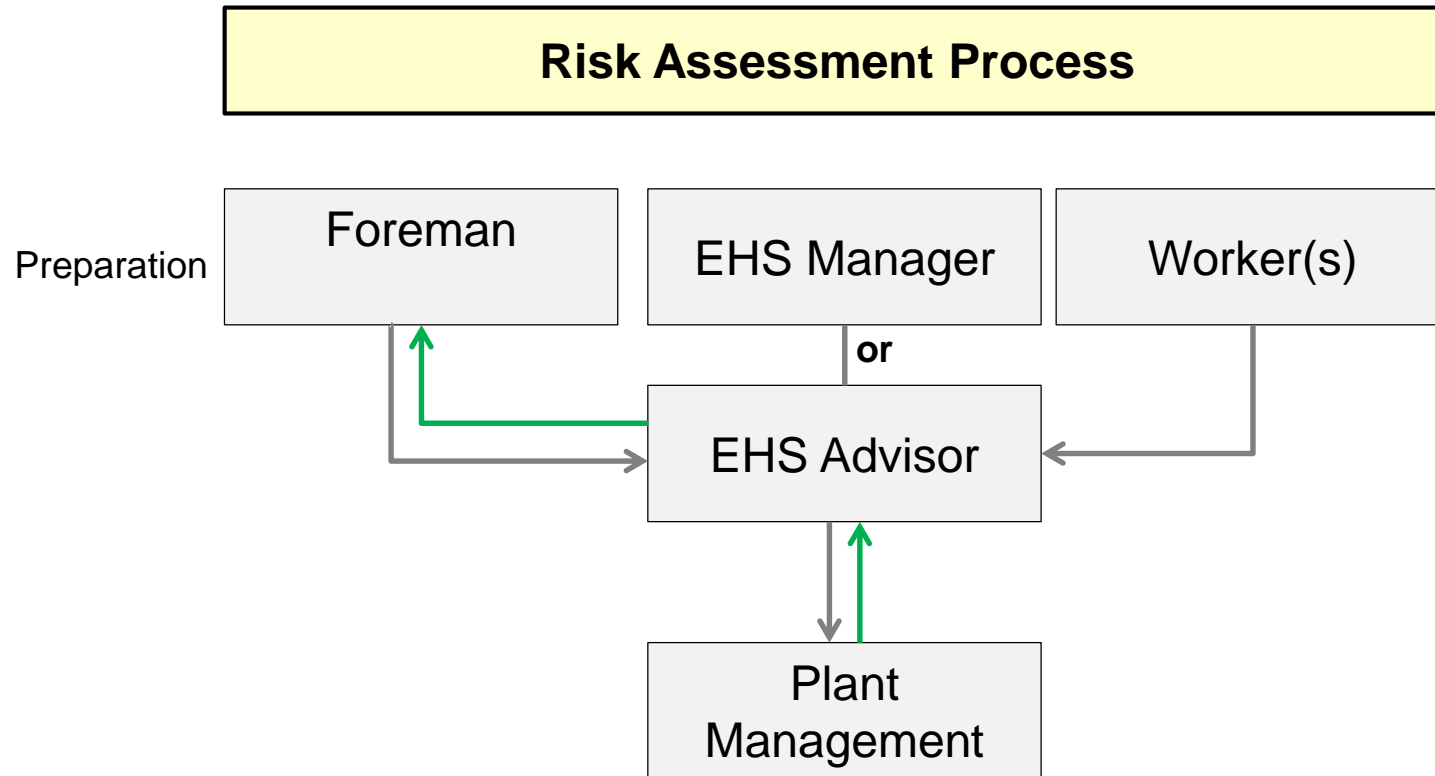
4. Change the way people work

5. Protect the worker with PPE

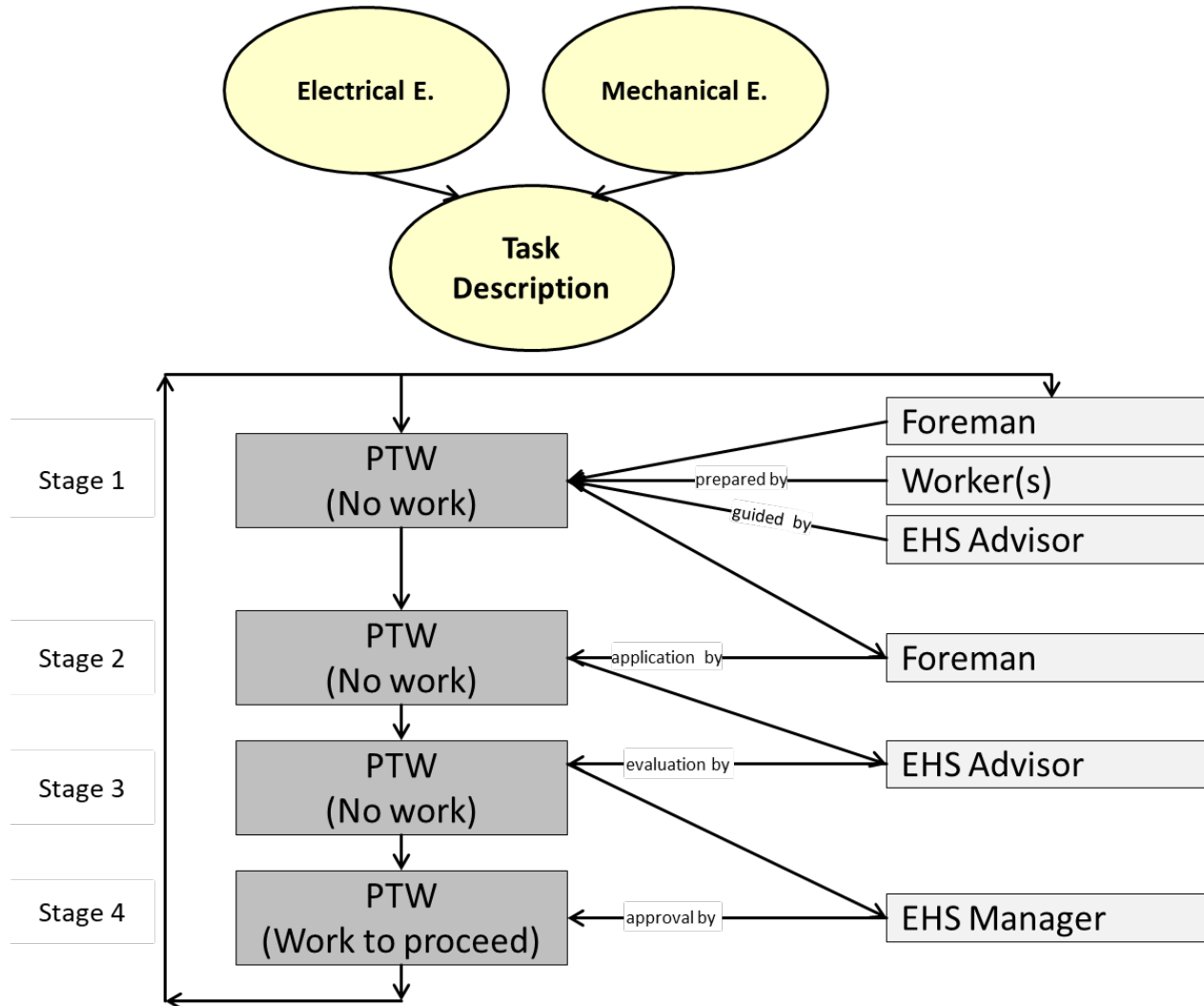
11. Risk Management - Process



11. Risk Management - Process



11. Risk Management – Permit to Work Process



11. Risk Management – Permit to Work Example

Sample Permit to Work

Permit to Work for:..... (COMPLETE PRECISELY AND LEGELY IN BLOCK CAPITALS)	PERMIT BOOK No: WORK ORDERNO:.....	PERMIT SERIAL No:	
PART 1 WORK DETAILS (TO BE COMPLETED BY THE AUTHORISED PERSON BEFORE ISSUE)			
PERMIT TO WORK ISSUED (DATE):..... REF NO. OF WORK PLACE: TYPE/DESCRIPTION OF AREA: LOCATION OF AREA: REASON FOR WORK: EXPECTED DURATION OF TASK:.....HOURS-STARTING AT.....ON (DATE)..... KNOWN HAZARDS:..... NAMES OF STAFF TEAM:.....	LOCATION OF EMERGENCY TELEPHONE: EMERGENCY TELEPHOEN NO: CONTACT NAME:		
SAFETY CHECKLIST: (<input type="checkbox"/> TICK APPLICABLE BOXES)			
Competency of staff team checked	YES <input type="checkbox"/> NO <input type="checkbox"/>	Lighting installed	YES <input type="checkbox"/> NO <input type="checkbox"/>
Inflows stopped / diverted	YES <input type="checkbox"/> NO <input type="checkbox"/>	Safety/protective equipment examined	YES <input type="checkbox"/> NO <input type="checkbox"/>
All plant/equipment/utilities isolated/locked out	YES <input type="checkbox"/> NO <input type="checkbox"/>	Emergency/rescue procedures in place	YES <input type="checkbox"/> NO <input type="checkbox"/>
Special precautions or equipment required	YES <input type="checkbox"/> NO <input type="checkbox"/>	Rescue services informed	YES <input type="checkbox"/> NO <input type="checkbox"/>
Warning signs / barriers in place	YES <input type="checkbox"/> NO <input type="checkbox"/>	Work instruction attached	YES <input type="checkbox"/> NO <input type="checkbox"/>
Cleaning work completed	YES <input type="checkbox"/> NO <input type="checkbox"/>	Other permit to work required	YES <input type="checkbox"/> NO <input type="checkbox"/>
Forced air ventilation in place & working	YES <input type="checkbox"/> NO <input type="checkbox"/>	Risk assessment attached	YES <input type="checkbox"/> NO <input type="checkbox"/>
SPECIAL INSTRUCTIONS AND/OR SAFETY MEASURES:.....			
<p>I declare that it is safe to work in the above defined area/workplace which has been examined and assessed in accordance with the attached risk assessment and work instruction. I have explained the risk assessment and the resulting safety, precaution and mitigation measures and demonstrated the extent of the work and the safety arrangements at the points of location and other places affecting the work of the person in charge. I am confident that all persons listed and in charge of the defined task are properly trained and equipped and that all safety equipment is present and working.</p> <p>Signed:.....(Authorized Person) Name: (Block Capitals)..... Date & Time:.....</p> <p>Contact Telephone No.:</p>			
PART 2 RECEIPT: TO BE COMPLETED BY THE PERSON IN CHARGE			
<p>I declare that all persons listed and in charge of the defined task are familiar with the safety and emergency arrangements and are properly equipped. I am confident that the all measures are implemented and it is safe to work at the defined location under the described circumstances and considering the task to be undertaken. I accept responsibility for carrying out the work listed in Part 1 of the permit to work in accordance with the risk assessment and the applicable rules and procedures.</p> <p>Signed:.....(Person in charge) Name: (Block Capitals)..... Date & Time:.....</p> <p>Contact Telephone No.:</p>			
PART 3 COMPLETION OR STOPPAGE: TO BE COMPLETED BY THE PERSON IN CHARGE			
<p>I declare that the work described in Part 1 of the Permit has been completed/stopped and that all persons, equipment, tools and instruments under my control have been withdrawn and the location has been made safe. I have recorded any changes that have occurred at the location and during the work, reason for stopping the work (if applicable) and the action taken.</p> <p>Signed:.....(Person in charge) Name: (Block Capitals)..... Date & Time:.....</p>			
PART 4 CANCELLATIO: TO BE COMPLETED BY THE AUTHORISED PERSON			
<p>I hereby declare that the work described in Part 1 of this Permit has been satisfactory completed / stopped, and that the Permit is canceled. I have noted the changes reported and will take the necessary follow-up action.</p> <p>Signed:.....(Person in charge) Name: (Block Capitals)..... Date & Time:.....</p>			

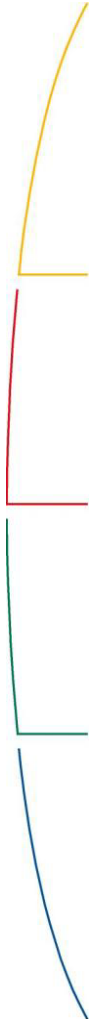
11. EHS Risk Register - Preparation

Likelihood	4	4	8	12	16
	3	3	6	9	12
	2	2	4	6	8
	1	1	2	3	4
		1	2	3	4
	Severity				

11. EHS Risk Register - Preparation

Consequence Rating

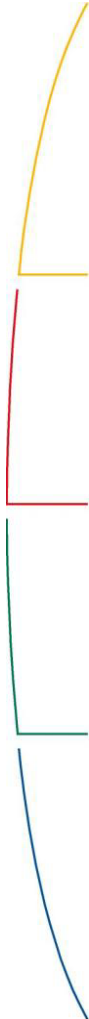
Rank	People & Public	Environmental	Descriptor
1	Injuries or illness not requiring medical attention, or Minor first aid Injury	No lasting effect on the environment or social amenity, and/or Recovery- less than 1 week, and/or Cosmetic remediation	Insignificant
2	Injury requiring medical treatment(no alternative duties), or Localised illnesses requiring medical attention	Short term or low-level long-term impact on the environment or social amenity, and/or Recovery – 1 week to several months, and/or Easy remediation	Minor
3	Middle to long term injury (able to return to work), or Long term condition, or Localised illnesses requiring hospitalisation	Long term impact on the environment or social amenity, and/or Recovery – several months to several years, and/or Challenging remediation	Moderate
4	Permanent disabling injuries, or Widespread illness requiring hospitalisation, or Single death	Extensive, long term impact on the environment or social amenity, and/or Recovery – several years to several decades, and/or Uncertain reversibility of remediation	Major
5	Multiple Deaths	Impacts are irreversible and/or permanent.	Catastrophic



11. EHS Risk Register - Preparation

Likelihood Rating

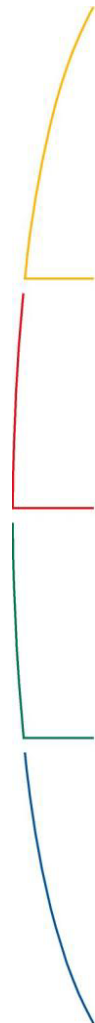
Rank	Descriptor	Frequency	Description
A	Almost Certain	Will occur more than once a year Multiple times in a year	The event is expected or known to occur often
B	Likely	Once per year Once in a year or so	Known to re-occur approximately annually
C	Possible	Will occur once every 5 years Once in 5 years or multiple times over 10 years	The event should occur at some time Is sporadic, but not uncommon
D	Unlikely	Will occur once in 10 years Could occur once in 10 years or multiple times over 20 years	The event could occur at some time, usually requires combination of circumstances to occur
E	Rare	Will occur once every 30 years Once in 30 years or less frequent	The event may occur in exceptional circumstances Not likely to occur, but it's not impossible



11. EHS Risk Register - Preparation

Risk Matrix

Consequences	Level of Risk				
5 Catastrophic	H	H	E	E	E
4 Major	M	H	H	E	E
3 Moderate	L	M	H	H	H
2 Minor	L	L	M	H	H
1 Insignificant	L	L	L	M	M
	E Rare	D Unlikely	C Possible	B Likely	A Almost Certain
	Likelihood				



11. EHS Risk Register - Preparation

Risk Acceptance Decision

Rank	Acceptance evaluation <i>This decision should be considerate of compliance requirements</i> <i>As Low As Reasonably Practicable (ALARP)</i>	Descriptor
Extreme	Unacceptable STOP WORK	Work shall not proceed without further controls to reduce risk. Contact your Line Manager / Supervisor.
High	Undesirable ALARP	Work shall only proceed with Line Manager / Supervisor approval and risk mitigation recorded e.g. Permit issued.
Moderate	Monitor ALARP	Work may proceed with ongoing monitoring of control measures, e.g. regular inspection of barricading etc.
Low	Acceptable Proceed	Work may proceed, working in accordance with planned controls.

Last Words

Thank you for the kind attention during the last two days.
It was a pleasure presenting this EHS Management System Manual

Please provide your comments on the content of the presentation and on the draft EHS Management Manual within the next 60 calendar days.

End of Presentation

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0	01.02.2018	EHS Management System Presentation	Axel Fricke	Sofia Sousa/Axel Fricke

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