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CS ENERGY PROCEDURE

PROCESS SAFETY MANAGEMENT
CS-RISK-08

Responsible Officer: Process Safety Manager
Responsible Manager: Head of Engineering
Responsible Executive: Executive General Manager Asset Management

DOCUMENT HISTORY

Key Changes	Prepared By	Checked By	Approved By	Date
Original Release	L Kayess	D Bell	G Schumacher	03/09/2018
Figures update	L Kayess	Y Chok	B Lawrence	07/12/2018

CONTENTS

1 PURPOSE

This Procedure for Process Safety Management explains CS Energy's approach for managing the Major Accident Hazards (MAHs) risks inherent in our business to ensure the integrity of Power Generation sites, equipment and facilities and enable the safety and responsible delivery of energy.

2 SCOPE

The procedure is applicable to the management of process safety hazards at all CS Energy sites and throughout all phases of the asset lifecycle.

3 RESPONSIBILITIES AND ACCOUNTABILITIES

3.1 Chief Executive Officer

The Chief Executive Officer has overall responsibility for Process Safety Management within CS Energy, including:

- Demonstrating commitment to the development of a Process Safety culture throughout the organisation; and
- Ensuring there is Process Safety Management at CS Energy; and
- Reporting on Process Safety Management to the Board; and
- Ensuring senior leadership commitment in relation to Process Safety Management.

3.2 Executive Leadership Team

The Executive Leadership Team (ELT) is responsible for oversight of the Process Safety requirements within their division at CS Energy. Including;

- Being ultimately accountable for managing Process Safety risks within the organisational risk appetite parameters and ensuring that CS Energy complies with its legal, regulatory and other obligations; and
- Demonstrating commitment to promoting a Process Safety culture; and
- Ensuring adequate resources are in place to manage Process Safety within their area of responsibility in accordance with the Process Safety Management Procedure; and
- Ensuring process safety failures are promptly identified, investigated, reported, controlled, monitored and reviewed.

3.3 EGM Asset Management

EGM Asset Management has responsibility for the implementation of the Process Safety Procedure including:

- Ensuring the Process Safety Procedure and associated tools are in place; and
- Ensure appropriate resources are allocated to manage Process Safety.

3.4 Asset Management - Head of Business Improvement

The Head of Engineering is responsible for, including:

- The implementation of the Process Safety Procedure; and

- Providing cross functional, cross asset expert advice and support in relation to Process Safety management.

3.5 Process Safety Manager, Process Safety Specialists

The Process Safety Manager and Process Safety Specialists are responsible for:

- Facilitating the implementation of the Process Safety procedure; and
- Coordinating a consistent approach to the identification, escalation and management of Process Safety risks, reporting processes and the integration of Process Safety Management into “business as usual”; and
- Maintaining the Dashboard and BowTie systems; and
- The review and continuous improvement of the Process Safety Procedure.

3.6 EGM Plant Operations

EGM Asset Management has responsibility for the implementation of the Process Safety Procedure, more particularly in the areas of Maintenance and Operations, including:

- Ensure appropriate resources are allocated to manage Process Safety.

3.7 Plant Operations – General Managers

The Plant Operations General Managers are responsible for:

- The implementation of the Process Safety controls, particularly in relation to Maintenance and Operations; and
- Providing support to the Asset Management division for the implementation of Process Safety management.

3.8 Plant Operations – Plant Engineers & Performance Engineers

These Plant Operations Engineers are responsible for:

- Providing support to the Asset Management division for the implementation of Process Safety management.
- Providing support to ensure consistent approach to the identification, and management of Process Safety risks, and reporting.

3.9 Employees / Contractors

All employees, including contractors, are responsible for, including:

- Understanding the Process Safety risk that relate to their roles and activities;
- Participating in the Process Safety risk review and assessments relevant to their roles; and
- Reporting new Process Safety risks, breaches and weaknesses of controls in line with the Process Safety procedure.

4 OVERVIEW

Process Safety Management is the application of management principles and systems identification, understanding and control of process hazards to prevent process related incidents.

The Process Safety Procedure is based on holistic and systematic approaches to ensuring the integrity of operations. The methodology adopted for managing Process Safety seeks to answer three (3) fundamental questions:

1. Do we understand what can go wrong?
2. Do we know what our systems are to prevent something from going wrong?
3. Do we have information to assure our systems are working effectively?

To understand what can go wrong at CS Energy, the Swiss Cheese model is used, adopted from James Reason (1990) - refer to Figure 1. The “Swiss Cheese” model describes how major accidents result when a series of failings within several critical risk control systems materialise concurrently.

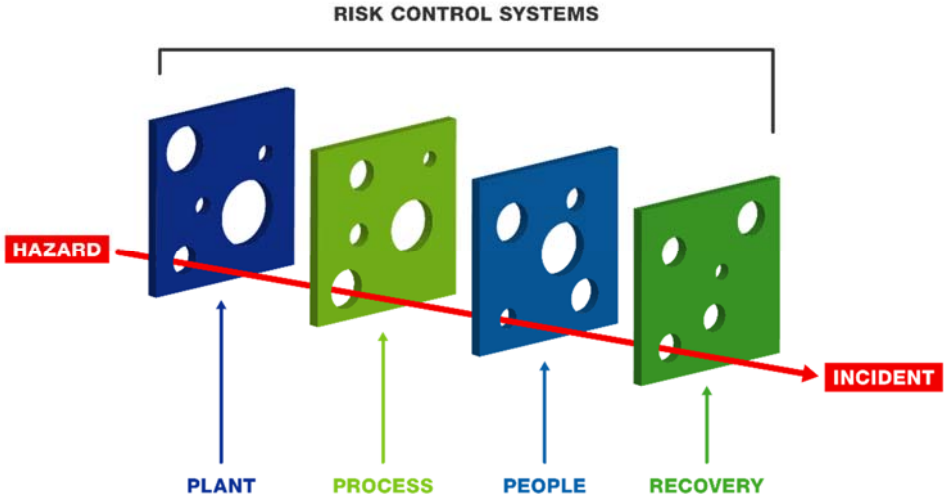

Figure 1 Swiss Cheese Model (Reference *Reason, James (1990-04-12). "The Contribution of Latent Human Failures to the Breakdown of Complex Systems". Philosophical Transactions of the Royal Society of London. Series B, Biological Sciences. **327** (1241): 475–484.*)

In this model the concept of layers of control (e.g. primary containment, engineered systems, etc) is used while holes in each layer correspond to the deficiencies due to latent errors or defects (e.g. organizational errors, environment etc). When the holes in the defensive layers align, then a particular hazard can be released and lead to an incident. The main aspect of this model is that latent conditions interact with the local triggering conditions which could lead to an incident or adverse event.

A set of hazard barriers is referred to as a Risk Control System (RCS). Each Risk Control System (RCS) represents an important safety layer within the Process Safety Management system.

Significant failings in just one risk control system may be sufficient in itself to give rise to a major accident event (MAE) and due to the complex nature of hazards, multiple risk control systems are required to manage them successfully.

Effective management of Major Accident Hazard (MAH) Risks, and avoiding major accident events (MAE), requires a proactive approach to risk management so RCSs are operating as intended.

4.1 Process Safety Methodology

CS Energy has adopted a three-step process for Process Safety Management:

1. Identify and Assess
2. Control using Risk Control Systems
3. Monitoring and Review

4.2 Process Safety Management - an Integrated approach

Process Safety success requires good Asset Management at all stages of the life cycle. The Process Safety Procedure aligns with, and is reliant on, the CS Energy Asset Management Systems, which are based on the international standard for Asset Management ISO55000, for successful Process Safety outcomes.

The Process Safety Procedure is supported by risk control systems across the business including but not limited to; Health and Safety, Environmental, Learning, Risk Governance and Assurance.

5 IDENTIFICATION AND ASSESSMENT

The primary purpose of Process Safety Management is to identify Major Accident Hazards (MAHs) present in CS Energy's business and manage risks associated with the identified Major Accident Hazards (MAHs) to Reasonably Practicable levels

The first step is to identify Major Accident Hazards (MAHs) present in CS Energy's business. This is done using the principles of CS Energy's Risk Management Standard and the AS/NZS ISO 31000:2009 Risk management process is shown in Figure 2 below, and is intended to be a continuous loop.

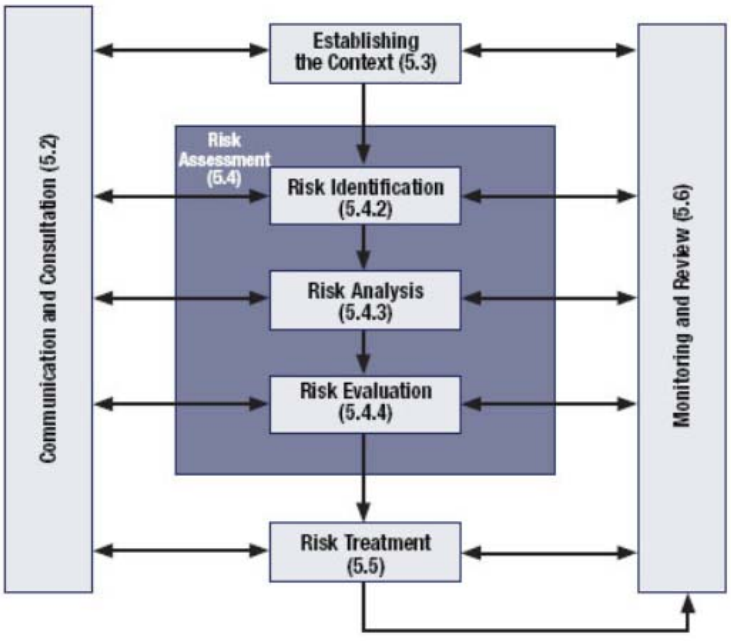

Figure 2 - Risk Management Process (AS/NZS ISO 31000:2009)

For Process Safety the Bowtie analysis technique will be used for Risk Assessment. The Bowtie analysis technique is a facilitated, structured and systematic team-based examination of a planned or existing process or operation design intent, in order to identify hazards and evaluate associated risks by taking existing hazard barriers into consideration. Refer to Use of Bowtie Risk Assessment Technique (CS-RISK-10)

Bowtie review teams at each individual site have identified actions to improve the hazard barrier strength. The identified Major Accident Hazards (MAHs) risks are managed to Reasonably Practicable levels with the identified actions then prioritised and tracked to completion.

Figure 3 shows the MAHs for the power generation including: high energy pressure fluids (steam), explosive substances (pulverised coal), rotating plant and high voltage electricity.

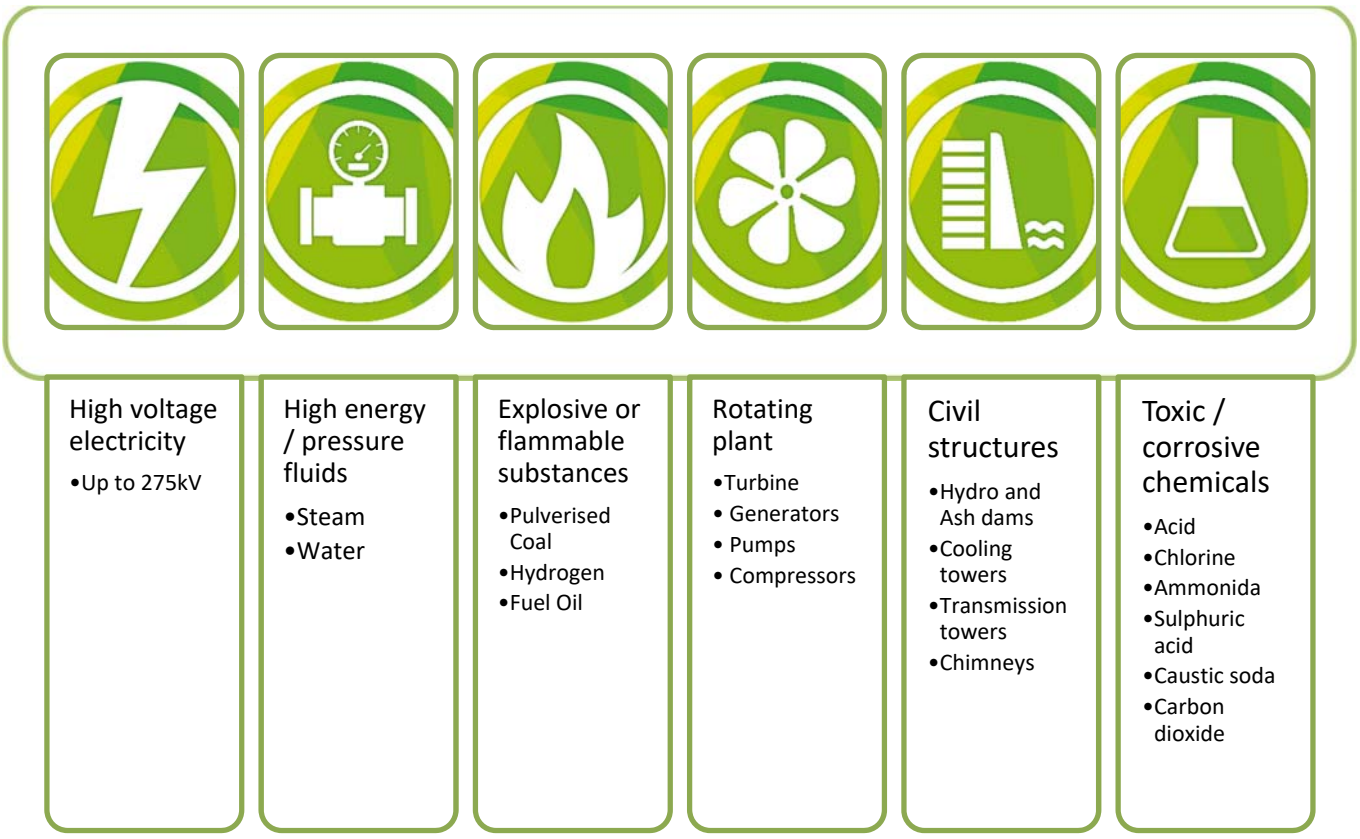

Figure 3: Major Accident Hazards at CS Energy

5.1 Risk Review Cycle

Given these are some of the organisations most critical risks, each MAH Bowtie will be reviewed on a cyclical basis with the intent of every bowtie being reviewed at least once every 5 years with each sites. These reviews will require a multi-disciplined team of approximately 5 people reviewing each risk, taking approximately one hour each (dependent on the level of complexity or change).

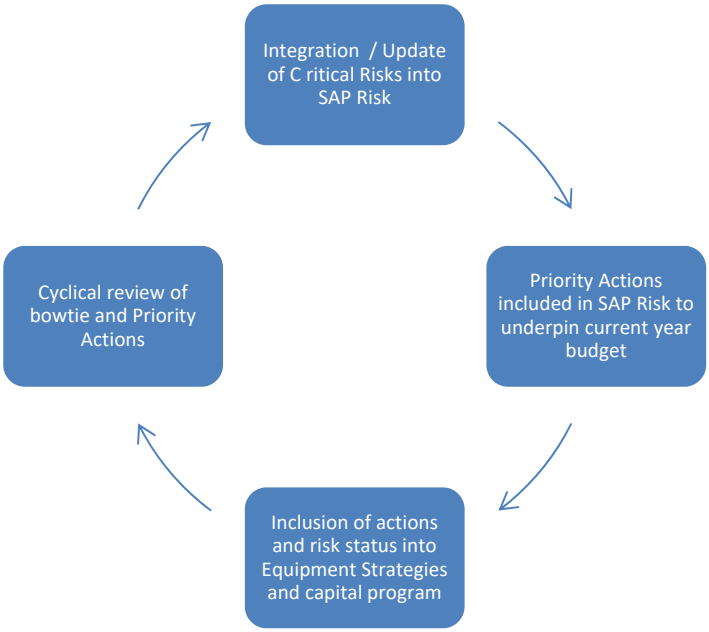

Figure 4: Major Accident Hazards Bowtie Review Cycle at CS Energy

This review would be done in preparation for the annual plant asset review system (Asset Strategy Review), refer to Figure 4.

These reviews are not intended to be duplicates of risk reviews required under CS-RISK-01 but a substitute. These reviews will continue to keep the risks front of mind and continue the education of our people. These are the businesses most important risks and this ongoing time investment is crucial to maintaining visibility and appropriate management of these risks.

6 RISK CONTROL SYSTEMS

For each Hazard (or MAH), the Risk Control Systems which prevent the hazard from harming people, the environment or assets are identified. These controls are shown in the Process Safety Framework and their performance requirements are determined and documented. Refer to Section 6.2).

In general, the Risk Control Systems can be considered in four (4) categories:

- Plant – the design of the plant (or subsequent modifications) will carry the primary objective of successfully managing the risks associated to the identified hazards.
- Process – clear and practical processes to design, build, commission, modify, operate and maintain the plant and assets.
- People – people capabilities in terms of hazard awareness, competency, culture and supervision.
- Recovery – processes to mitigate the consequences should an incident or adverse event occur.

6.1 Process Safety Risk Management Framework

The Process Safety Risk Management Framework has eight (8) risk control areas to manage Major Accident Hazards (MAH) risks. These control areas are as follows:

- Technical Risk Management,
- Safety Critical Systems,
- Alarm and Instrument Management,
- Maintenance Management,
- Operations Management,
- Staff Competence,
- Emergency Preparedness, and
- Governance and Assurance.

Within each risk control area, there are a number of risk control systems which can be reviewed to continuously improve processes and safety performance. The Framework including the Risk control areas and systems are illustrated on the following page Figure 5.

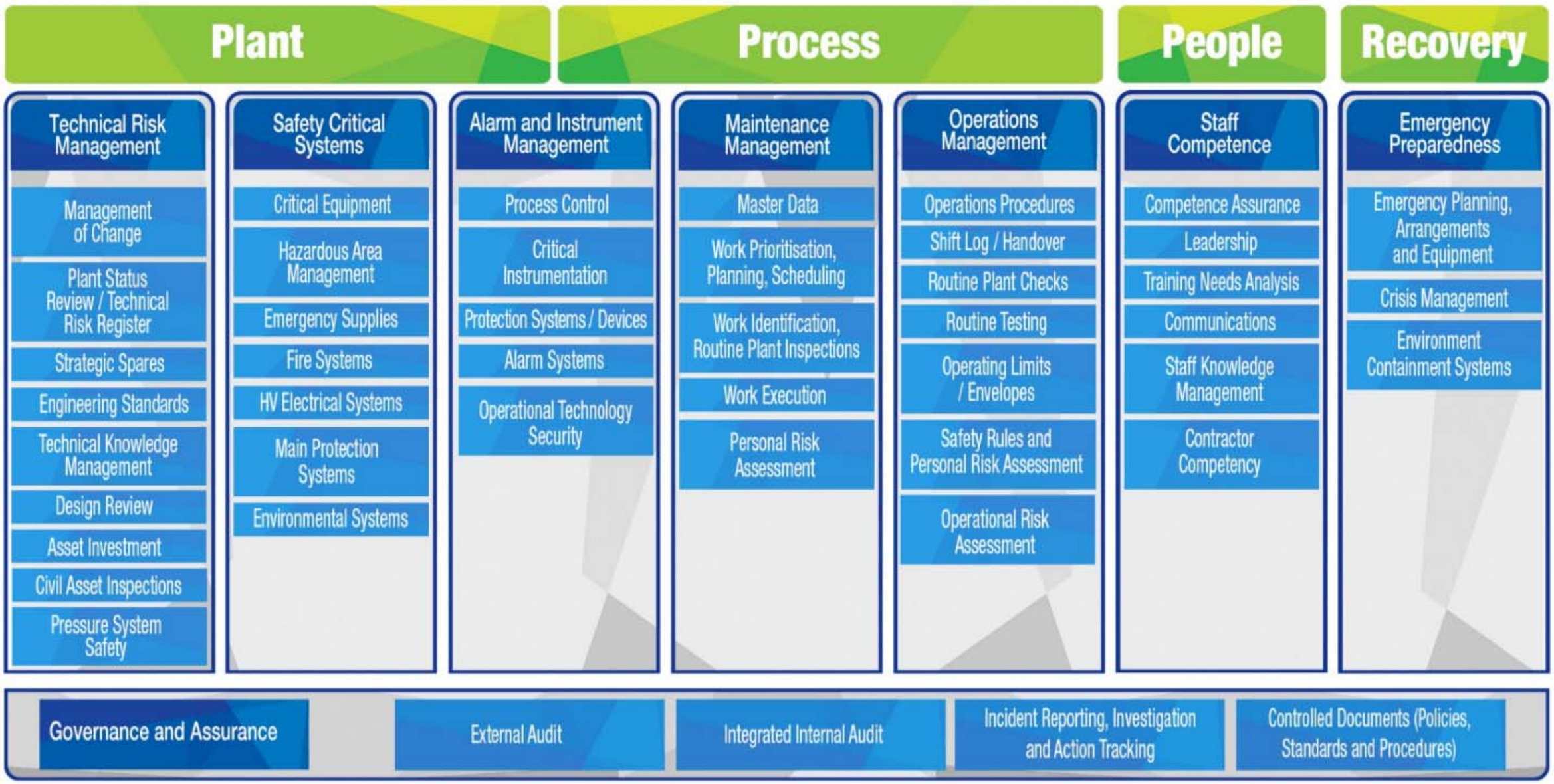

Figure 5: Process Safety Framework

6.2 Process Safety Risk Management Expectations

In this section the eight risk control areas (and associated risk control elements and/or systems) are defined in more detail to ensure that critical risk controls and their performance requirements are identified, understood, documented and managed.

Expectations are established for key aspects which need to be functional to prevent major accident events (MAEs) and assure the integrity of operations. By establishing these expectations, the risk control element and/or systems can be reviewed and analysed with a view to continuously improve.

6.2.1 Technical Risk Management

The aims of this element are to:

- Ensure technical risk is managed through the application of robust change processes, a common risk based framework and good industry practice engineering standards.
- Ensure that a comprehensive hazard identification and risk assessment process is implemented to systematically identify, assess, understand and appropriately reduce the Major Accident Event (MAE) risks, arising from CS Energy operations, so far as is reasonably practicable.
- Ensure that critical risk controls and their performance requirements are identified, understood, documented and managed. Ensure facilities, and modifications to facilities, are designed to achieve safe operation with risk reduced so far as is reasonably practicable.

For more detailed information regarding Technical Risk Management performance expectation refer to Appendix 1.

6.2.2 Safety Critical Systems

The aims of this element are to:

- Ensure safety critical systems and equipment (including critical spares) are engineered, built/ manufactured/fabricated/commissioned, actively inspected, tested and maintained to ensure safe operation and availability to the required standard.

For more detailed information regarding Safety Critical Systems performance expectation refer to Appendix 1.

6.2.3 Alarm and Instrument Management

The aims of this element are to:

- Ensure alarms are prioritised consistently and actively managed to resolution
- Ensure there are no long term standing/shelved alarms
- Ensure control loops are optimised and in control

For more detailed information regarding Alarm and Instrument Management performance expectation refer to Appendix 1.

6.2.4 Maintenance Management

The aims of this element are to:

- Ensure that there is a maintenance strategy across all asset types by classification[Note 1].

- Ensure that work is captured, prioritised, planned, scheduled and executed using a proactive approach common to all assets.

Note 1: Full process safety criticality classification is still to be developed for CS Energy.

For more detailed information regarding Maintenance Management performance expectation refer to Appendix 1

6.2.5 Operations Management

The aims of this element are to:

- Ensure that there are operational standards established and implemented across all assets.
- Ensure plant is operated within its design parameters and according to agreed procedures.
- Ensure plant is put back into operation safely following an outage or commissioning.

For more detailed information regarding Operations Management performance expectation refer to Appendix 1.

6.2.6 Staff Competence

The aims of this element are to:

- Ensure that staff and contractors have the required knowledge and skills to operate and maintain the plant effectively and safely.
- Ensure a process safety culture is embedded at all levels within the organisation.

For more detailed information regarding Staff Competence performance expectation refer to Appendix 1]

6.2.7 Emergency Preparedness

The aims of this element are to:

- Ensure robust emergency response and crisis management plans are established and regularly tested.

For more detailed information regarding Emergency Preparedness expectation refer to Appendix 1.

6.2.8 Governance and Assurance

The aims of this element are to:

- Ensure that there is an integrated audit programme in place that independently checks processes and procedures against good industry practice standards.
- Ensure audit observations are proactively addressed through rolling continual improvements.

For more detailed information regarding Governance and Assurance expectation refer to Appendix 1.

7 MONITORING AND REVIEW

Maintaining a clear view of how effective the Risk Control Systems are performing is essential. This is achieved by the monitoring and review of compliance with the expectations of the Process Safety Framework. Proactively monitoring the effectiveness of controls is measured using leading indicators. Lagging indicators are monitored through the CS Energy incident management system, analysing failure of controls.

Process safety reporting will cover:

- The performance requirements given in this document, identifying if they are met and maintained.
- The key performance indicator as described below
- Targets and measured progress against budgeted initiatives to continually improve Process Safety control effectiveness.
- Reporting will be used
- on a daily and weekly basis to Front Line work groups to assist in work prioritisation and track progress against targets.
- on a regular basis to the ELT and Site Management teams.
- via the standing agenda to the Audit and Risk Committee.

Technology is adopted to enable most reporting (including KPIs and Lead indicators) to be automatically calculated daily and made visible to all staff through the Process Safety Dashboard.

7.1 Key Performance Indicators

An integrated set of leading and lagging key performance indicators (KPIs) will be used to assess the effectiveness of Process Safety Risk Controls.

KPIs will be defined for Board, Executive Team Leadership levels. Additional KPIs of a more detailed nature (cascading) will be developed for each Site.

7.1.1 Leading Indicators

Leading indicators measuring each of the risk control systems to provide assurance they are performing at the desired level. The key benefit of leading indicators is it allows identification of any weaknesses and enables proactive action prior to a potential incident. Proactive action to improve when the performance of risk control systems degrade is the key to preventing major hazard related incidents.

For each Risk Control System, we establish metrics, leading indicators, which enable us to proactively monitor the Risk Control System to provide assurance that was performing as required. Each indicator should have a clear definition and a target for the required level of performance.

7.1.2 Lagging Indicators

Lagging indicators are metrics that capture an occurrence where a barrier or control has failed in some way. These indicators are important but not as effective as leading indicators for Process Safety management as they rely on failure data to monitor performance meaning improvements or changes are only determined after something has gone wrong leading to reactive, post event actions.

Process Safety Event reporting is the most important lagging indicator as it allows us to learn from our events and act to continuously improve. CS Energy's Incident Management System is used to capture and classify incidents that are due to a failure of one or more risk control systems. Refer to Learning from Incidents Procedures CS-IM-01 (September 2018 revision)

7.2 Process Safety Leadership

Process Safety Management requires the visible demonstrated commitment of accountable managers. Further Process Safety Leadership requires communication of expectations, acceptable performance levels and allocations of resources (reference Energy Institute's High Level Guidance for Process Safety Management).

Process safety leadership will also ensure risks that are effectively controlled ensures business efficiency and operational safety performance. Measuring leading and lagging indicators enables visibility and opportunity for continuous improvement.

Figure 7: 4 Pillars of Process Safety Management (reference) Energy Institute High Level framework for process safety management

8 TRAINING & COMPETENCY

Process Safety Training and Competency will be developed in line with IChemE Safety Centre Guidance *Process Safety Competency – A Model*
Note 2: This section is in draft to be updated post the Process Safety Competency Matrix development (scheduled for October 2018).

9 DEFINITIONS

Term	Definition
Control Barriers	A functional grouping of safeguards, such as primary containment, process equipment, engineered systems, operational procedures, management systems, or worker capabilities designed to prevent LOPC and other types of asset integrity or process safety events, and mitigate any potential consequences of such events. A set of barriers is also often referred to as a risk control system
Hazard	A hazard is anything (condition or situation) that has the potential to do harm and/or cause damage. Hazards may be present in processing equipment (e.g. flammable or toxic chemicals in a pipe or a vessel, stored electrical or mechanical energy) or in the occupational environment (e.g. fuel in a road vehicle, the potential and kinetic energy involved in helicopter travel or bullying in the workplace)
Key Performance Indicator (KPI)	In the context of the Process Safety Management Standard, information or data that provides evidence of the company managing its asset integrity and process safety performance. A functional grouping of safeguards, such as primary containment, process equipment, engineered systems, operational procedures, management systems, or worker capabilities designed to prevent LOPC and other types of asset integrity or process safety events, and mitigate any potential consequences of such events. A set of barriers is also often referred to as a risk control system
Loss of Primary Containment (LOPC)	An unplanned or uncontrolled release of any material from primary containment, including non-toxic and non-flammable materials (e.g. steam, hot condensate, nitrogen, compressed CO2 or compressed air).
Major Accident Event (MAE)	An incident that has resulted in multiple fatalities and / or serious damage, possibly beyond the asset itself. Typically, a major incident is initiated by an LOPC event, but may also result from major structural failure or loss of stability that has caused serious damage to an asset.
Major Accident Hazard (MAH)	A Hazard which has the potential to cause Major Accident Event. Potential source of danger in power generation operations including: high energy pressure fluids (steam), explosive substances (pulverised coal), rotating plant and high voltage electricity. .
Process Hazard Analysis	Process hazard analysis (PHA) can take many forms, including Hazard and Operability (HAZOP) studies, bow ties, layers of protection analysis (LOPA), quantitative risk assessment (QRA, including fault and event tree analysis). The imperative is that all potential threats to the control of hazards are identified, that the consequences and impacts of a loss of control are understood and that the barriers that prevent the consequences from occurring are identified.
Reasonably Practicable	in relation to a duty to ensure health and safety, means that which is, or was at a particular time, reasonably able to be done to ensure health and safety, taking into account and weighing up all relevant matters including: the likelihood of the hazard or the risk concerned occurring; and the degree of harm that might result from the hazard or the risk; and what the person concerned knows, or ought reasonably to know, about the hazard or risk, and about the ways of eliminating or minimising the risk; and the availability and suitability of ways to eliminate or minimise the risk; and after assessing the extent of the risk and the available ways of eliminating or minimising the risk, the cost associated with available ways of eliminating or minimising the risk, including whether the cost is grossly disproportionate to the risk.'
Risk Control System (RCS)	A set of hazard barriers is referred to as a Risk Control System (RCS). Multiple RCS are required to manage Process Safety Risk.

Term	Definition
Safety Critical Activity (SCA)	An activity undertaken to support (or maintain) the ongoing integrity (effectiveness/function, availability, reliability and survivability) of SCEs by ensuring escalation factors do not inhibit SCE function and that performance standards are being met throughout the asset lifecycle. SCAs assure that the barrier/control remains: independent of the threats to loss of hazard control and other barriers/controls implemented to manage the same threat; fit for purpose and continues to function per its design intent; reliable and available; and survivable such that it can perform its design function in the event of the major accident event for which it is designed.
Safety Critical Documents	Safety Critical Documents are those that are associated with Safety Critical Elements and/or Safety Critical Activities. Contracts used for out-sourced safety critical activities and operating/ maintenance procedures containing safety critical work instructions are safety- critical documents. Typically, safety critical documents are marked as such and regular revision of the documents for accuracy and adequacy becomes in itself a safety critical task that should be assigned to the document owner/author.
Safety Critical Elements (SCE)	Safety critical elements are parts of an installation and much of its plant (including computer programmes), or any part thereof, the failure of which could cause or contribute substantially to, or a purpose of which is to prevent, or limit the effect of, a major accident. Safety Critical Elements include safety critical equipment (hardware and associated software), safety critical documents (e.g. safety critical procedures or contracts for out-sourced safety critical activities) and safety critical systems (e.g. management of change).
Safety Critical Equipment	Safety Critical Equipment is associated with the hardware barriers (including software and programmable logic controllers used in instrumented safeguarding systems) that play a role in preventing Major Accident Events (MAEs) or mitigating the consequences/effects of MAEs.
Safe Operating Envelopes/Limits	Safe Operating Envelopes are the outer bound of plant conditions, or the set of limits and conditions, within which the operation of asset, plant, process and/or equipment must be maintained in order to comply with, e.g., regulatory requirements, safety design criteria, performance standards and CS Energy safety management expectations.

10 REFERENCES

Reference No	Reference Title	Author
	HSG254 Developing Process Safety Indicators	HSE UK
	High level framework for process safety management	Energy Institute
	Guidelines for risk based process safety	CCPS
	(ISO55000) International Standard for Asset Management	ISO Technical
	IChemE Safety Centre Guidance *Process Safety Competency – A Model*	IChemE
B/D/12/63934	Standard - CS-RISK-01 - Risk and Compliance Management Framework	CS Energy
	Use of Bowtie Risk Assessment Technique	CS Energy
	H&S and Environmental Management Systems	CS Energy
	Asset Management Systems	CS Energy

11 RECORDS MANAGEMENT

In order to maintain continual improvement, suitability, safety and effectiveness of the organisation, CS Energy's registered documents will be reviewed on a two-yearly basis or at intervals specified by legislative or regulatory requirements. Review of controlled documents should occur where it has been identified that there are changes in technology, legislation, standards, regulation or where experience identifies the need for alteration to the content. Registered documents should also be reviewed following an incident, change management process, modification or where directed as part of a risk assessment process. A 'review' can simply mean that it has been identified, confirmed and appropriately recorded that no changes are required and that the existing process remains the same.

CS Energy must ensure that records are retained according to accountability, legal, administrative, financial, commercial and operational requirements and expectations. In compliance with records retention and disposal, all documentation created in relation to CS Energy business must be retained in line with minimum retention periods as detailed in legal retention and disposal schedules.

12 APPENDIX 1: PROCESS SAFETY RISK MANAGEMENT PERFORMANCE EXPECTATIONS

Control Area 1 - Technical Risk Management		
Element	Definition / Performance Expectations	Key Performance Indicators
Management of Change	## MOD Process definitions • Management must ensure that all risks arising from any form of change are systematically identified, assessed and managed. • All changes are implemented in line with the Management of Change Procedure(s). • The Management of Changes process defines what constitutes a change (including organisational change and temporary modifications) including changes to: o Assets, equipment or plant, including changes to equipment design limits (e.g. de-rating of equipment design integrity following inspection) o Operations (including Safe Operating Envelopes) or operating procedures o Products, materials or substances o Organisation or personnel (safety-critical roles) o Software or control systems o Designs or specifications o Standards or practices, and o Inspection, maintenance or testing programs • Defines authority levels for approving the proposed changes Tracks the communication and close out of the change Identifies any training requirements • Ensures that the original scope and duration of all changes (including temporary modifications) are not exceeded without review or formal approval	## TRIM LINK TO CRIB SHEETS
Plant Status Review / Technical Risk Register	• Ensure that a comprehensive hazard identification and risk assessment process is implemented to systematically identify, assess, understand and appropriately reduce the Major Accident Event (MAE) risk, arising from CS Energy's operations, Reasonably Practicable levels. • Plant Status Reviews and MAE bowtie risk assessments are undertaken on a planned basis with critical process safety risks identified, addressed and documented to ensure that risk has been reduced to Reasonably Practicable.	
Strategic Spares	• Strategic spares reviews are undertaken on a regular basis to identify the necessary spares, test equipment and protection devices and to ensure that these are available when needed	
Engineering Standards	• Approved engineering standards and procedures that meet or exceed applicable regulatory requirements, are fully utilised in the design, procurement and construction of all new or modified assets • A quality assurance process is implemented that ensures assets and materials specified, received and used, meet design specifications and engineering standards.	
Technical Knowledge Management	A Technical Knowledge Management System is established to securely retained and updated knowledge and history of : • Maintenance records Drawings • Asset Information/Specification/BOD Plant manuals • Modifications Failures/Investigations • Operating/maintenance procedures/life plans	
Design Review	• The appropriately qualified Technical Authority reviews and approval of all design and engineering activities are completed in accordance with appropriate design codes, standards and industry good practice. • As appropriate; Process Hazard Analysis workshops (e.g. HAZOP) SIL assessments (out in line with IEC 61508 and IEC 61511 Process Industry standards), Human factors assessments, Hazard analyses and safety assessments are completed for new or modified assets. And ensuring that these activities are documented, verified and where appropriate resolved.	

Control Area 1 - Technical Risk Management		
	• Implement a quality assurance process to control activities undertaken as part of design, procurement, fabrication, installation, construction and commissioning/ completions to ensure that the design basis/criteria are met at each project phase • Develop, during the design stage, the documentation required for operations and, prior to start-up, hand over the documentation to Operations, e.g. 'As- built' design records, safe operating envelopes, operating parameters, alarm parameters and lifecycle asset integrity strategies and supporting implementation plans	
Asset investment	• (ISO55000) is used as a framework for asset management across all assets	
Civil Asset Inspection	Civil Structures, referable dams, high hazard dams • Civil structures are identified, and inspection programmes based on risk are in place and monitored. • Inspection of Ash storage dams shall be in accordance with the relevant conditions in the Environmental Authorities for the sites • Inspection of Splityard Creek dam (a referrable dam) is subject to the Dam Safety Conditions issued by the Dam Safety Unit of Department of Natural Resources, Mines and Energy (DNRME).	
Pressure System Safety	Pressure relief valves, • Compliance with pressure equipment safety Regulations and approved codes of practice and standards is highly visible within the organisation • Where appropriate, inspection programmes based on risk are in place and monitored	

Control Area 2 - Safety Critical Systems		
Element	Definition / Performance Expectations	Key Performance Indicators
Critical Equipment	Shut down valves, • Safety Critical Equipment and their operational criticality and performance standards are identified and documented (likely within the Asset Management system and Maintenance Management System) • Appropriate inspection, testing and maintenance procedures are carried out at set intervals in accordance with statutory or performance standards • Risk of operation with impaired Safety Critical Equipment is managed, and the temporary disarming or deactivation of safety critical systems and subsequent reactivation are managed by a formal procedure	## TRIM LINK TO CRIB SHEETS
Hazardous Area Management	Certified Hazardous Area (HA) rated equipment, including temporary and portable equipment • Certified Hazardous Area (HA) rated equipment and their operational criticality and performance standards are identified and documented in Hazardous Area Classification drawings (likely within the Asset Management system and Maintenance Management System) • Certified Hazardous Area (HA) rated equipment is designed, inspected, testing and maintained to appropriate standards • Risk of operation with impaired or defected (e.g. obvious damage to cables, loose earthing, etc) Certified Hazardous Area (HA) rated equipment is managed	
Emergency Supplies	Personal escape pack • Emergency Supplies and their operational criticality and performance standards are identified and documented (likely within the Asset Management system and Maintenance Management System) • Appropriate inspection, testing and maintenance procedures are carried out at set intervals in accordance with statutory or performance standards • Risk of operation with impaired Emergency Supplies is managed, and the temporary disarming or deactivation of safety critical systems and subsequent reactivation are managed by a formal procedure	
Fire Systems	Fire detection / auto deluge Fire Pumps; fire panels • Compliance with Fire System Regulations and approved codes of practice and standards is highly visible within the organisation • Fire System are identified and documented (likely within the Asset Management system and Maintenance Management System) • Appropriate inspection, testing and maintenance procedures are carried out at set intervals in accordance with statutory or performance standards • Risk of operation with impaired Fire Systems is managed, and the temporary disarming or deactivation of safety critical systems and subsequent reactivation are managed by a formal procedure	
HV Electrical Systems	High Voltage relays, High voltage switches, • HV electrical equipment and their operational criticality and performance standards are identified and documented (likely within the Asset Management system and Maintenance Management System) • HV electrical equipment is designed, inspected, testing and maintained at set intervals in accordance with statutory or performance standards • Risk of operation with impaired or defected (e.g. obvious damage to cables, etc) HV electrical equipment is managed	
Main Protection Systems	Earthing equipment; Circuit Breakers • Mains Protection equipment and their operational criticality and performance standards are identified and documented (likely within the Asset Management system and Maintenance Management System) • Mains Protection equipment is designed, inspected, testing and maintained at set intervals in accordance with statutory or performance standards • Risk of operation with impaired or defected (e.g. obvious damage to earthing, etc) Mains Protection equipment is managed	

Control Area 2 - Safety Critical Systems		
Environmental Systems	Emissions monitoring, • Equipment critical to Environmental management with their operational criticality and performance standards are identified and documented (likely within the Asset Management system and Maintenance Management System) • Appropriately designed, inspected, testing and maintained at set intervals in accordance with statutory or performance standards • Risk of operation with impaired or defected equipment is managed	

Control Area 3 – Alarm and Instrument Management		
Element	Definition / Performance Expectations	Key Performance Indicators
Process Control	• Human factors are considered in the design and implementation of HMI • Ensure control loops are optimised and in control	## TRIM LINK TO CRIB SHEETS
Critical Instrumentation	Instrumentation initiating shutdown functionality, • Safety Critical Instruments and their operational criticality and performance standards are identified and documented (likely within the Asset Management system and Maintenance Management System) • Appropriate inspection, testing and maintenance procedures are carried out at set intervals in accordance with statutory or performance standards • Risk of operation with impaired Safety Critical Instruments is managed, and the temporary disarming or deactivation of safety critical systems and subsequent reactivation are managed by a formal procedure • Safety Instrumented Systems (SIS) are designed, installed, commissioned, operated, maintained in line with the Industry Standards	## TRIM LINK TO CRIB SHEETS
Protection Systems / Devices	OEM protection systems, turbine protection ie overspeed; Boiler Management system • Protection systems/devices are actively inspected, maintained and tested to ensure full operation • The temporary disarming or deactivation of protection systems/devices and subsequent reactivation is managed by formal procedure	
Alarm Systems	EEMUA guidelines 144 alarms/day, 10 in 10mins • Critical process alarm set points are defined, current and commensurate with the defined safe operating envelope. Any changes are formally managed. • Alarms are prioritised consistently and effectively and actively managed to resolution and to a recognised international standard. • Operators are able to identify abnormal events and take clearly defined action on receipt of alarms • Ensure there are no long term standing/shelved alarms.	
Operational Technology Security	Servers • Operational Technology Security requirements are in place and followed.	

Control Area 4 - Maintenance Management		
Element	Definition / Performance Expectations	Key Performance Indicators
Master Data	• Assets, equipment and subcomponents are uniquely identified and configured within a Master Database (the SAP Maintenance Management System). • Master Data clearly references the process design and performance standards, specified limits and operating envelopes, maintenance and inspection procedures for process and equipment operation.	## TRIM LINK TO CRIB SHEETS
Work Prioritisation, Planning and Scheduling	• Work is captured, prioritised, planned and scheduled to assure the inspection, monitoring, testing and maintenance of equipment • A Conditioned Based Maintenance Strategy is in place and implemented. • A procedure is in place to prioritise work and enable appropriate management of the risks to personnel, assets, the public and the environment.	
Work Identification, Routine Plant Inspections	• Maintenance and inspection procedures are developed and include, where appropriate: o Specialised procedures for higher risk activities Operating envelope considerations o Regulatory and environmental considerations o Human factors considerations • Failure and incident trends and information on persistent integrity and reliability issues are periodically reviewed and assessed; subsequent recommendations are proactively addressed to improve reliability and safety. • Maintenance and inspection procedures are independently verified for technical accuracy and are reviewed at periodic intervals and when changes are made. Operating procedures clearly define or reference the process design and performance standards, specified limits and operating envelopes for process and equipment operation	
Work Execution	• Work permits incorporate all necessary risk assessments, method statements, checks and authorisations to execute work safely • Work history is maintained	
Personal Risk Assessment	JSEA • Risk assessments are conducted, using Job safety tools, for appropriate activities in order to identify and address potential hazards to personnel, assets, the public and the environment • A procedure is in place to periodically review the quality of personal risk assessments	

Control Area 5 - Operations Management		
Element	Definition / Performance Expectations	Key Performance Indicators
Operations Procedures	• A pre-start up review is performed and documented to ensure that: o Materials and equipment are in accordance with specifications. o Emergency, operations and maintenance procedures are in place and adequate. o All risk management recommendations have been addressed and required actions taken. o Personnel have received suitable training. o Regulatory and permit requirements have been met • There are formal plant start-up and shutdown procedures in place at each site to ensure safe shutdown and return to service of the plant • Implement a systematic process for checking operational readiness and the integrity of systems before they are brought into service • Confirm fitness for return to service has been reviewed before restarting an asset that has been subjected to conditions beyond the original design parameters, after an overhaul or after an event that has potentially threatened the integrity of the asset.	## TRIM LINK TO CRIB SHEETS
Shift Log / handover	• Monitor, formally capture and handover, from shift to shift, information relating to plant, maintenance, process, safeguarding function and operational status, including safety risks.	
Routine Plant Checks	• There is a routine programme of surveillance and monitoring of plant, providing recognition of defects and fault conditions in plant and systems. • Ensure defects and fault conditions are actively managed to resolution	
Routine Testing	• There is a routine programme of operational testing of the plant, providing recognition of defects and fault conditions in plant and systems • Ensure defects and fault conditions are actively managed to resolution	
Operating Limits / Envelopes	• Plant is operated to defined parameters of engineering design and within envelopes of performance capability and environmental compliance	
Safety Rules and Personal Risk Assessment	• All personnel comply with CS Energy Life Savers, six non-negotiable safety rules. • Ensure that the PTW system describes roles, responsibilities, accountabilities and competencies • Implement a Permit to Work (PTW) system to control hazardous work. • Risk assessments are conducted, using Job safety tools, for appropriate activities in order to identify and address potential hazards to personnel, assets, the public and the environment	
Operational Risk Assessment	• Operational risk assessments are performed by qualified and competent personnel and where appropriate, suitable external expertise is sought • Operational risk assessments are performed for abnormal operating conditions • A procedure is in place to periodically review the quality of operational risk assessments • Operational Incidents/Near Misses are always reported and learning points are built into improved operations	

Control Area 6 - Staff Competence		
Element	Definition / Performance Expectations	Key Performance Indicators
Competence Assurance	• A competence management system and assurance programme is in place to ensure Process Safety Competency.	## TRIM LINK TO CRIB SHEETS
Leadership	• Leaders ensure decisions are made at the appropriate level based on an understanding of the effects on Process Safety, and establish, communicate and reinforce expectations of performance that clearly recognise Process Safety as an overriding priority. • All leaders have clear process safety objectives and performance is evaluated against these objectives • All leaders monitor Process Safety performance and seek opportunities for improvement.	
Training needs Analysis	• A process is in place for assessing the qualifications and skills needed by employees to meet specified job requirements • Training programmes are in place to address any skills and knowledge gaps	
Communications	• A communication strategy is implemented for distribution of process safety information, including: o Corporate requirements Site based hazards Procedures and practices o Lessons learned from incident investigations o Process safety performance and improvement goals • Ensure site induction processes include key process safety elements.	
Staff Knowledge Management	• A process is in place to ensure that necessary levels of individual and collective experience and knowledge are maintained and are carefully considered when personnel changes are made	
Contractor Competency	• Contractors are to be evaluated and selected using criteria that include an assessment of capabilities to perform work in a safe and environmentally sound manner and meet CS Energy's process safety performance expectations. • A process must be in place to verify that contractors are providing personnel appropriately screened, trained, qualified and able to perform specified duties competently and in accordance with CS Energy's process safety performance expectations. • Contractor's performance is monitored and assessed, feedback is provided, and deficiencies are corrected.	

Control Area 7 - Emergency Preparedness		
Element	Definition / Performance Expectations	Key Performance Indicators
Emergency Planning, Arrangements and Equipment	• Emergency response plans are in place at each site and are tested on a regular basis to simulate and prepare personnel for major incidents. • Equipment, facilities and trained personnel needed for emergency response are defined and readily available. • Emergency response plans are clearly communicated to all employees, contractors, partners and appropriate external agencies. • Site inductions include information on what personnel should do in the event of an emergency. • Emergency response plans will comply with industry recommended practices, corporate and regulatory requirements. • Learning from emergency response simulations and tests are captured and addressed. • Community expectations and concerns about our operations are sought, recognised and addressed in a timely manner.	## TRIM LINK TO CRIB SHEETS
Crisis Management	• Crisis management plans are in place and are tested on a regular basis to ensure appropriate response action is taken. Crisis management plans will ensure: o Site based emergency response plans are appropriately integrated. o Organisational responsibilities and authorities are clearly defined. o Internal and external communications procedures are clearly defined. o Procedures for accessing personnel and equipment are clearly defined. o Procedures for accessing essential process safety information are clearly defined. o Procedures for interfacing with other companies and external emergency response services are clearly defined. • Crisis management plans are clearly communicated to all employees, contractors, partners and appropriate government agencies. • Crisis management plans will comply with industry recommended practices, corporate and regulatory requirements. • Learning from crisis management simulations and tests are captured and addressed	
Environment Containment Systems	• Risks and potential impacts to the environment are periodically assessed and reviewed within our operations	

Control Area 8 - Governance and Assurance		
Element	Definition / Performance Expectations	Key Performance Indicators
External Audit	• A process is implemented to: o Ensure on-going compliance with all regulatory and corporate requirements o Report and manage any non-compliance to, planned deviations from, or potential violations of regulatory and corporate requirements o Identify, track and comment on proposed legislation, regulations and emerging policy issues	## TRIM LINK TO CRIB SHEETS
Integrated Internal Audit	• Applicable laws, regulations, permits and other government requirements are anticipated and met; the resulting requirements are documented and communicated to those affected • Process safety audits are carried out on planned basis	
Incident Reporting, Investigation and Action Tracking	• All incidents, are reported, documented and maintained in the incident management system • The incident management process ensures that: o Incident investigations carried out reflect the actual and potential severity of the incident o Incidents are periodically reviewed to identify trends and potential system weaknesses. Recommendations are made to address any issues identified or potential improvements to standards, processes, procedures and practices o Follow-up, preventative and corrective actions are prioritised and tracked to conclusion in a timely manner o Industry wide safety alerts are captured and communicated to all relevant personnel o Lessons learned from incident investigations are communicated to the organisation Audit recommendations and observations are prioritised and tracked to conclusion in a timely manner	
Controlled Documents (Policies, Standards and Procedures)	• Policies, procedures and standards are in line with; good industry practice, guidelines, regulations and standards • All controlled documents are stored in the document management system • The document management process ensures that: o Drawings, pertinent records and documentation necessary to effectively manage the design, operation, inspection of sites are identified, accessible, accurate and appropriately safeguarded o Information on the potential hazards of equipment and materials involved in operations is kept current and accessible o Information on applicable laws and regulations, licenses, permits, codes, standards and practices is documented and kept current o Controlled documents are clearly identified, managed and are periodically reviewed/updated	