WANO

GLOBAL LEADERSHIP IN **NUCLEAR SAFETY**

WANO PERFORMANCE OBJECTIVES AND CRITERIA

PO&C | 2013-01 Rev 2

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APPLICABILITY

THIS WANO PERFORMANCE OBJECTIVES AND CRITERIA REPORT APPLIES TO ALL REACTOR TYPES

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Revision History

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REASON FOR CHANGES	Numerous changes were made throughout the document. The most significant changes include the following: 1. Reorganised the document by discipline to make it more useable – eliminated the separation between Functional and Cross-Functional areas. 2. Moved Safety Culture to Foundations and made it Nuclear Safety Culture. 3. Clarified the terms for “leaders” and “managers” and made the use more consistent. 4. Restructured the LF and OR areas. 5. Added a new Risk Management objective. 6. Added a new Fire Safety objective to focus on general staff behaviours. 7. Rewrote TR.1 into two objectives - Training Fundamentals and Conduct of Training. Structure is consistent with operations and maintenance. 8. Moved CM.4 and FA.1 into a new Nuclear Fuels area since they both focus on nuclear fuels activities. Little change in content. 9. Combined PI.1, PI.2, and PI.3 into a single objective (PI.1). Little change in content. 10. Combined seven RP objectives into two - RP Fundamentals and Conduct of RP. Structure is consistent with operations and maintenance.

CONTENTS

Foreword

The performance objectives in this document are standards for plant and corporate performance intended to promote excellence in the operation, maintenance, support and governance of commercial nuclear power plants. This document represents the World Association of Nuclear Operators standard for nuclear excellence. This edition will become effective on *(later)* and will supersede WANO PO&C 2013-1 Rev 1, *Performance Objectives and Criteria*, dated January 2019.

The performance objectives support achievement of a set of outcomes that reflect excellence in important aspects of nuclear plant operations. These outcomes include sustained high levels of plant performance; sustained event-free operations; avoidance of unplanned, long-duration shutdowns; well-managed and understood safety, design and operating margins; high levels of plant worker safety; a highly skilled, knowledgeable and collaborative workforce; and readiness to respond effectively in an emergency situation.

The performance objectives typically describe the expected results of effective programmes and activities. Supporting criteria provide breadth and depth to each objective. Member utilities should strive to achieve the performance objectives, rather than focusing on the supporting criteria. Guidelines, principles documents and other documents are available to assist member utilities in achieving these performance objectives. Utilities do not need to meet each specific criterion in an objective to achieve excellence in an area. Members are expected to meet the intent of the guidelines that support the performance objectives and criteria.

The structure of the document has changed from the previous version to make it easier to use – the functional and cross-functional areas have been combined and arranged in an order that groups objectives with a similar focus together. The performance objectives are grouped into seven sections: Foundations, Effective Organisation, Learning Organisation, Plant Operation, Equipment Performance, Safety and Protection, and Corporate Areas.

The Foundations are objectives that should be reflected in the behaviours of all nuclear workers, regardless of their positions in the organisation, and emulated every day. The Foundations objectives emphasise the importance of a strong nuclear safety culture, address the attributes of a nuclear professional, and describe leadership behaviours. Nuclear Safety Culture was moved to the beginning of Foundations to reinforce the concept that nuclear safety should be the overriding priority.

Sections Two through Six combine Functional areas that generally correspond to nuclear station organisational functions as well as Cross-Functional areas that focus on processes and behaviours that cross organisational boundaries. Functional areas usually include Operations, Maintenance, Chemistry, Engineering, Radiological Protection, Fire Protection, and Training. Cross-Functional areas include Organisational Effectiveness, Integrated Risk Management, Performance Improvement, Operating Experience, Human Performance, Operational Focus, Work Management, Equipment Reliability, Nuclear Fuels, Configuration Management, Project Management, Fire Safety, Radiological Safety, Industrial Safety, and Emergency Preparedness. It is important to note that this distinction is somewhat dependent on a station's organisational structure – a functional area at one station may be a shared responsibility at another and thus be considered cross-functional. All applicable performance objectives should be considered when using this document to conduct self-assessments of specific functions and activities.

The Corporate objectives are comprised of basic corporate functions, including leadership, governance, oversight and support – with emphasis on human resources and communications. The objectives are written to encompass single-site corporate organisations as well as large nuclear fleet organisations. Recognising that the nuclear industry has taken diverse approaches to corporate functions, the performance objectives are written to describe excellence with the flexibility to consider a utility's chosen organisational operating structure. As such, several specific criteria in each performance objective describe activities and organisational structures, such as peer groups and functional area managers, that are not directly applicable to single-site corporate organisations, yet the underlying concept is applicable to all.

This revision continues the emphasis placed on the importance of Nuclear Safety Culture, "Engaged, Thinking Organisations", the lessons-learned from the Fukushima Daiichi Accident, and the incorporation of Severe Accident Management. Two additional areas received additional emphasis in this revision – Leadership and Management, and Integrated Risk Management. Analysis of station performance gaps and industry operating experience has identified leader and manager shortfalls as contributing factors to many stations weaknesses. Addressing this has been complicated by confusion over what is meant by Leadership and how it differs from Management. These differences have been clarified in this document. In addition, core leadership traits identified by a working group of industry executives in 2019 were considered in the revision of the Leadership Fundamentals area.

Further emphasis was placed on Integrated Risk Management with the creation of a new performance objective that incorporates principles identified significant operating experience from 2015. That operating experience identified that as part of

a healthy nuclear safety culture, Risk Management must be embedded in all processes, including those required for daily operation.

Nuclear Safety Culture

Nuclear Safety Culture (SC.1)

Performance Objective:

The organisation's core values and behaviours reflect a focused and collective commitment by all nuclear professionals to make nuclear safety the overriding priority.

Criteria:

1. All individuals take personal responsibility for nuclear safety.
2. Individuals avoid complacency and continuously challenge existing conditions, assumptions, anomalies and activities in order to identify nuclear safety discrepancies that might result in error or inappropriate action.
3. Communications maintain a focus on nuclear safety.
4. Leaders demonstrate a commitment to nuclear safety in their decisions and behaviours.
5. Decisions that support or affect nuclear safety are systematic, rigorous and thorough.
6. Trust and respect permeate the organisation, creating a respectful work environment focused on nuclear safety.
7. Opportunities to continuously learn are valued, sought out and implemented to enhance nuclear safety.
8. Issues potentially impacting nuclear safety are promptly identified, fully evaluated and promptly addressed and corrected, commensurate with significance.
9. A nuclear safety-conscious work environment is maintained in which personnel feel free to raise nuclear safety concerns without fear of retaliation, intimidation, harassment or discrimination.

10. The process of planning and controlling work activities is implemented so that nuclear safety is maintained.

Nuclear Professionals

Nuclear Professionals (NP.1)

Performance Objective:

Nuclear professionals apply the essential knowledge, skills, behaviours and practices needed to conduct their work safely and reliably.

Criteria:

1. Nuclear professionals understand the risk associated with assigned jobs and apply the appropriate measures to manage risk. They first and foremost implement their work in a way that protects the operation of the reactor core and the barriers to the release of radioactivity. They also manage the potential operational, technical, radiological, industrial, and environmental risks associated with their work.
2. Nuclear professionals understand and anticipate the effects of their actions and are aware of their surroundings to include potential hazards and sensitive equipment.
3. Nuclear professionals question assumptions, identify anomalies and stop and place their work in a safe condition when they experience or see conditions different than those expected.
4. Nuclear professionals have high ownership for the preparation and safe execution of assigned work activities. They consider the most likely undesired consequence of their activities and validate contingency actions. They actively participate in briefings, are self-aware of challenges to their proficiency and are focused and engaged in the tasks they execute.
5. Nuclear professionals understand and apply error prevention techniques. They understand management expectations and the bases for applying each technique to avoid plant events.
6. Nuclear professionals understand and apply standards for procedure use and adherence. They use procedures or other approved written guidance to manipulate plant equipment under the conditions for which the procedures were developed. If procedures cannot be followed as written, nuclear professionals stop and correct the procedures.
7. Nuclear professionals understand what is expected of them regarding radiological protection. They perform work in accordance with station

radiological work instructions and postings and practice ALARA. Nuclear professionals correctly respond to dosimeter, contamination and radiation alarms.

8. Nuclear professionals understand what is expected of them regarding industrial safety. They perform work in accordance with established safety standards and expectations. They select the appropriate safety equipment for each task and use personal protective and safety equipment correctly. Nuclear professionals view their own and co-workers' safety as a personal responsibility.

9. Nuclear professionals maintain high personal responsibility for their performance. They understand their own capabilities and consider knowledge, skill, familiarity, understanding and recent experience before executing an activity. They are receptive to feedback and strive to continuously learn to perform their jobs better. Nuclear professionals coach and provide feedback to each other.

10. Nuclear professionals attend and actively participate in training. They perform tasks for which they are qualified.

11. Nuclear professionals learn from operating experience and use this knowledge to improve performance.

12. Nuclear professionals have a low threshold for reporting problems and they recommend improvements. Nuclear professionals promptly engage their supervisors and others with questions and concerns. They do not tolerate long-standing issues and they pursue solutions continuously.

13. Nuclear professionals understand their assigned emergency preparedness responsibilities, including assembly and evacuation and are well prepared to perform their emergency response organisation duties.

14. Nuclear professionals practice good housekeeping and control of work areas to minimise the potential for injuries, the likelihood for human error, the spread of contamination, and the generation of radioactive waste.

Leadership Fundamentals

Leadership Fundamentals (LF.1)

Performance Objective:

Leaders, by commitment and example, inspire, motivate and align the organisation to achieve safe and reliable station operations, event-free outages and effective emergency response. They continually strive for improvement by establishing and reinforcing standards of excellence based on industry top performance, and they intervene to correct performance at the early signs of decline.

Criteria:

Vision of Excellence

1. Leaders are personally committed to nuclear safety as the overriding priority and routinely reinforce this concept in their dealing with other personnel.
2. Leaders establish the vision, direction and strategies to achieve excellence in plant performance related to safety and reliability.
3. Leaders at all levels work with their teams to translate the vision and strategies into specific goals and actions.
4. Leaders ensure that expectations and performance standards are defined by industry excellence and are prominently communicated and well understood. High standards are seen as inherent in the site culture and are deeply embedded in the organisation.
5. Leaders regularly communicate, model and reinforce the vision, values, behaviours, standards, expectations and strategies to align the organisation to achieve excellence.
6. Leaders encourage and support teamwork in their organisation by creating and fostering an open and collaborative work environment
7. Leaders demonstrate high levels of integrity, sound judgment, and a capacity to think tactically and strategically.
8. Leaders demonstrate ownership for organisational decisions and align the workforce to ensure successful outcomes of decisions.

Engagement

9. Leaders ensure the entire organisation owns performance and solves problems. Station personnel are self-aware and committed to broad success and challenge the status quo, defects, and misbehaviours.

10. Leaders communicate the bases for decisions frequently so that all personnel understand why the decisions were made, including the linkage to core values, vision and nuclear safety. They communicate changes in priorities effectively and follow through on change and improvement initiatives by resolving conflicts and clarifying expectations.

11. Leaders are agents of change and they influence, inspire, motivate, coach and energise the workforce to achieve excellence in plant performance and organisational goals.

12. Leaders reinforce the importance of individuals executing their assigned team roles and challenge team members who do not meet the intent or who step out of their assigned roles.

13. Leaders foster mutual trust and respect through active engagement of station and supplemental personnel in project planning and implementation as well as issue resolution.

14. Leaders understand and reinforce the importance of technical and organisational considerations in decision-making to preserve the plant design, safety margins and licensing bases.

15. Leaders challenge the thoroughness of the analyses and rationale, used as the bases for decisions and recommendations, to ensure potential consequences of decisions, especially those that affect nuclear safety, are clearly defined, understood and communicated.

16. Leaders are cognisant of organisational risks prior to taking decisions; they analyse and mitigate such risks.

17. Leaders model and reinforce healthy accountability at the individual and organisational levels.

18. Leaders have a visible presence in the field and foster an environment that promotes effective feedback and continual improvement in worker performance. They coach, motivate and engage the workforce to strive for excellence.

19. Leaders frequently reinforce that coaching, providing feedback and correcting performance and behaviour shortfalls are expectations for all personnel, regardless of their positions, duties and responsibilities.

20. Leaders provide prompt, positive reinforcement for station and supplemental employee adherence to defined standards and expectations. They address performance shortfalls in a timely manner.

Sustainable Results

21. Leaders demonstrate a firm and unwavering commitment to nuclear, radiological, fire, industrial and environmental safety, event-free outages and effective emergency response.

22. Leaders maintain focus on safe and reliable plant operations during periods of significant change or other potential distractions.

23. Leaders support one another and the efforts of others by demonstrating shared ownership for station performance, including improving human and technical aspects of the entire organisation, not just their areas of specific functional responsibility.

24. Leaders ensure training standards are maintained, particularly during significant station challenges and distractions.

25. Leaders demonstrate a low threshold for identifying problems and they work collaboratively to resolve those problems.

26. Leaders evaluate and take prompt action to correct organisational and cultural contributors to inappropriate behaviours.

27. Leaders instil, in the workforce, behaviours that drive the mind-set and capabilities to demonstrate core values, helping others, owning issues, solving problems and implementing solutions to achieve desired results in support of the station vision and plan.

28. Leaders develop healthy relationships with their counterparts in industry organisations to keep aware of current issues, new approaches, and new standards of excellence. They provide support to industry initiatives, programmes, processes and activities.

Maximise Competence

29. Leaders foster a learning organisation that recognises small signs of decline and uses appropriate methods for aggressively closing performance gaps.

30. Leaders demonstrate strong ownership of the training, qualification, and proficiency of their personnel and use appropriate strategies to achieve and maintain high levels of individual and team performance.

31. Leaders implement a development strategy that creates an organisation comprised of qualified, capable and proficient individuals able to sustain long-term performance.

32. Station leaders take ownership for their personnel development program and are largely focused on creating a reserve of ready-now successors from within. As such, they have a deep knowledge of the capabilities of their personnel and proactively create leadership succession opportunities.

33. Leaders foster a culture of continuous improvement and learning within all levels of the organisation.

34. Leaders establish a culture in which personnel work together to communicate and promptly address any equipment issues and degraded conditions that could detract from nuclear safety and equipment reliability.

35. Leaders practice and develop the skills necessary to improve their own leadership capability.

36. Leaders ensure positions are filled with well-qualified candidates who have the behaviours, necessary expertise, and experience to be successful.

37. Leaders routinely assess individual and team performance and make adjustments as necessary for the organisation to succeed.

38. Leaders ensure new leaders support one another, and are supported by more experienced leaders, to build their leadership proficiency.

39. Development activities are provided to reinforce leadership skills and behaviours, for example; through paired observations, classroom lectures, practical exercises, case studies, dynamic learning activities, simulated scenarios, and in-field exercises.

Section 2 – Effective Organisation

Organisational Effectiveness

Management Systems (OR.1)

Performance Objective:

Management systems are defined clearly, resourced appropriately and implemented effectively to support the vision, values and goals of the organisation. This includes developing and preparing individuals to take leadership roles and assume positions of greater responsibility.

Criteria:

1. The organisational structure, responsibilities, and decision-making authorities of each management position are clearly defined and understood by station and supplemental personnel. Interfaces between supporting organisations such as corporate, oversight/review boards, and vendors are clearly defined and understood.
2. Core values, goals, standards, and expectations are defined, communicated, and exhibited consistently to achieve industry standards of excellence in safety and reliability. These are routinely monitored, especially during organisational changes and periods of organisational stress such as unplanned plant shutdowns, refuelling outages, and ownership changes.
3. The line organisation has primary responsibility for nuclear safety and plant reliability. The line is the decision-maker and source of direction. Committees, review boards, and other functional groups reinforce line responsibility and accountability.
4. Programs and processes for the continuous examination of nuclear safety culture are implemented. Self-assessments of nuclear safety culture are conducted periodically to evaluate overall status and to ensure that nuclear safety is not degrading.
5. Periodic reviews of backlogs, particularly backlogs that require operator compensatory actions, are conducted to verify appropriate priorities are in place. These reviews focus on understanding and managing the aggregate and individual impacts of the backlogs.

6. Change management processes are used, when appropriate, to systematically plan and implement large organisational, procedure, process and schedule changes. The progress of changes are systematically monitored to verify the intent of each change is met, to identify possible unintended consequences and to ensure sustained safe and reliable plant operation. Consideration of the need for a communication plan and a training evaluation are part of the change management process.

7. Management systems, programs, and processes are implemented effectively to identify and assess risks to nuclear, fire, radiological, personal, and environmental safety as well as plant reliability and emergency response. These risks are mitigated using an appropriate course of action commensurate with the level of risk.

8. Managers are aligned on the required support and allocation of resources needed to achieve and sustain high levels of nuclear, radiological, industrial and environmental safety performance

9. An internal and external staffing strategy for filling roles is clearly defined and implemented effectively. Changing demographics are anticipated and plans adjusted accordingly. The strategy incorporates current and future competencies required for key positions, such as senior managers. The competencies are used to identify candidates for advancement and to guide their development.

10. Succession and development plans identify candidates for key positions and highlight the readiness of each candidate to fill the position. The plans and implementing activities are periodically reviewed and adjusted as needed.

11. Personnel are prepared for their future assignments through an integrated and structured approach of development.

Manager Effectiveness (OR.2)

Performance Objective:

Managers apply a management model that reflects a strong commitment to achieve safe, reliable plant operation, event free outages and effective emergency response. They define priorities and provide support and feedback to one another and hold each other accountable to achieve the goals of the organisation.

Criteria:

1. Managers implement policies, procedures, standards, and expectations that reflect a strong commitment to nuclear, fire, radiological, industrial, and environmental safety. Their personal monitoring of activities confirms that those standards and expectations are understood and used by all personnel.

2. Managers understand their expected role when providing oversight for an activity and take appropriate compensatory actions to preserve the oversight function should their direct involvement in the activity become necessary. Managers ensure assigned actions and tasks are completed on time and in a quality manner.

3. Managers use and promote processes and activities designed to support continuous improvement. They periodically compare station performance against best industry practices and implement actions to close gaps to excellence through various methods such as a corrective action program, self-assessments, use of operating experience, training, benchmarking and error-reduction tools.

4. Managers establish and monitor personnel performance and management systems including work management, corrective action, system health, and observed behaviours, to identify subtle performance declines. They take actions to ensure that the importance and effects of these subtle problems and precursor events, such as gradual declines in standards and repetitive or long-standing personnel or equipment deficiencies, are recognised, analysed, prioritised, and addressed appropriately.

5. Managers actively monitor performance, mentor their subordinates, use appropriate performance management tools to provide feedback, and address performance issues. Managers take prompt action to address performance shortfalls identified.

6. Managers establish priorities to achieve a balance among the station wide workload, meetings, and supervision of in-field and training activities. They

participate in activities to ensure plant conditions and related decisions that can affect nuclear safety, plant reliability or safety margins are identified, evaluated and resolved promptly.

7. Managers encourage giving feedback and they actively seek and listen to employee input. They follow up on identified concerns and communicate actions taken to address these concerns. They actively use positive reinforcement to improve proper individual behaviour and performance focusing on safety.

8. Managers provide the staffing and resources for each department or functional area to support delivery of their assigned responsibilities and to facilitate meeting cross- functional responsibilities. They consider and pro-actively mitigate the potential effects of organisational changes and resource reductions.

9. Managers encourage employee initiative, issue ownership, and participation. They use multidiscipline teams, where appropriate, for problem-solving, employee development, and removing barriers that impede employee success.

10. Managers verify that all personnel have the requisite knowledge, skill, and proficiency to achieve safe and reliable plant operation, event-free outage performance, and effective emergency response through training, periodic assessments, and evaluations. They monitor activities such as training, scheduling and in-plant work to ensure expectations are met and the appropriate level of supervision is provided.

11. Managers understand the importance of recognising and mitigating proficiency challenges at all levels of the organisation both during routine and non-routine activities. Challenges to knowledge, skill and familiarity are recognised, acknowledged, and mitigated.

12. Senior managers frequently engage with station operators to reinforce their roles and responsibilities to place the plant in a safe condition whenever the situation warrants. They verify technical and management support is readily available to the operations shift manager.

13. Senior managers personally communicate with operations instructors to reinforce their roles and responsibilities to simulate closely the plant environment, to emphasise conservative decision-making, and to support resolution of current operator performance deficiencies.

14. Managers demonstrate strong ownership of the training, qualification and performance of their personnel and use training as a strategic tool to improve performance.

a. Staff are developed through targeted activities designed to provide the knowledge, skills and behaviours required for future responsibilities.

b. High-potential personnel are given varied and challenging assignments that provide professional development and growth opportunities.

c. Supervisors are provided the knowledge and skills to conduct behavioural observations. They are trained in the methods and techniques to effectively reinforce, challenge, coach, and correct inappropriate behaviours and practices.

d. Managers provide individuals with honest and constructive feedback on their development, technical proficiency, leadership behaviours and management skills.

Independent Oversight (OR.3)

Performance Objective:

Independent oversight personnel conduct evaluations, inspections, investigations, audits and assessments of performance to verify nuclear safety standards and regulatory requirements are met and to promote continuous improvement.

Criteria:

Performance Monitoring

1. Independent oversight personnel monitor and assess activities and results that affect nuclear safety and plant reliability, in addition to specific regulatory responsibilities and requirements.
2. Methods used by independent oversight personnel are effective in assessing and helping to improve operations performance.
3. Appropriate expertise from both inside and outside the company is used to monitor and evaluate behaviours, performance data and key activities.
4. Independent oversight personnel monitor line management use of corporate functional area managers and peer groups, if applicable, to leverage expertise and resources needed for continuous improvement.
5. Independent oversight personnel conduct inspections, audits and assessments of performance focused on identifying gaps to excellence as well as compliance to regulatory requirements.
6. Independent oversight personnel monitor the effectiveness of the actions taken in response to significant operating experience recommendations, external performance assessments, evaluations, inspections and audits.

Structure, Conduct and Communication

7. The responsibility, accountability and reporting structure of the independent oversight organisation are clearly defined, understood and implemented.
8. Independence is maintained between oversight personnel and line management such that the oversight organisation has the authority and organisational freedom to identify issues and verify solution implementation.
9. Based on issue significance, oversight personnel follow up on the effectiveness of actions taken to resolve oversight findings.

10. The results of independent oversight activities are communicated formally to line senior managers, owners of assessed activities, offsite nuclear safety committees and corporate management to provide an independent view of performance.

11. A formal escalation process is used when corrective actions are ineffective or the responsible organisation does not resolve the identified problem in a timely manner.

12. Individuals assigned to the independent oversight organisation have the necessary experience, training, skills and credibility to conduct analyses, reviews, audits and assessments.

13. Independent monitoring and assessment of oversight organisation effectiveness are periodically evaluated and results are reported to senior station and corporate management. Methods include self-assessments by external participants, reviews of missed opportunities and performance indicators of oversight effectiveness.

Integrated Risk Management

Integrated Risk Management (RM.1)

Performance Objective:

All personnel, from the corporate senior managers to the front-line workers, exhibit the behaviours necessary to identify, reduce and manage the inherent risks associated with nuclear plant operation.

Criteria:

Governance

1. Policies establish a governance model for integrated risk management that includes consideration of corporate exposure and margins, strategy, business planning and budget preparation.
2. Roles and responsibilities are clearly established. The levels of authority for decision-making are defined and applied using a graded approach commensurate with the level of potential risk. Risk assessment and management procedures are in place.
3. Projects undergo initial and ongoing structured reviews to validate that initial assumptions and external conditions remain valid.
4. Integrated risk strategies consider other undesirable outcomes in decision-making that may be less consequential than the worst possible outcome.
5. The requirements for management and independent oversight are described as part of the integrated risk process.
6. A comprehensive approach to risk assessment is in place, used and maintained current.

Leader and Manager Responsibility

7. Leaders foster a culture in which people are aware of risk and have a strong bias for risk mitigation such that nuclear safety margins are maximised.
8. Managers ensure integrated risk management practices are part of core business, and appropriate behaviours are reinforced in training and plant environments.
9. Managers encourage independent challenge of decisions, including assumptions. Their behaviour demonstrates an understanding and mitigation of risks.

10. Leaders establish an acceptable threshold for risk. Decisions to manage or accept risk are made at the appropriate organisational level.

11. Managers ensure appropriate rigor is applied to potentially consequential decisions in order to achieve the desirable results.

Individual Responsibility

12. Individuals have appropriate knowledge to identify potential sources of risk. Individuals exhibit self-awareness, recognise error traps, and initiate actions to mitigate or eliminate the risk.

13. Individuals are aware of the significance of their activities and of their impact on station risk. Individuals apply risk reduction tools such as procedure use and adherence in the conduct of their activities to minimise station risk.

14. Individuals take personal responsibility and demonstrate appropriate behaviour for challenging the risk involved in their activities and when necessary communicate potential risk conditions.

15. Individuals consider the extent to which first-of-a kind and first-in-a-while technologies and methods create adverse consequences.

Risk Determination and Decision-Making

16. In addition to considering the consequence of the most probable outcome of decisions, the most undesirable consequence is considered in decisions affecting risk even if the perceived probability is low. Consequences are also assessed from the perspective of external stakeholders.

17. Formal methods and processes are used to recognise and assess the potential risk, including the aggregate of conditions and activities.

18. Acceptance criteria are established for the risks associated with activities, states, conditions, projects, organisational changes and decisions.

19. Degrading plant systems or enterprise conditions that affect risk are promptly identified, communicated and addressed with urgency commensurate with potential or actual consequences.

20. The risks associated with not taking action are carefully assessed, and strategies are implemented to mitigate risk until permanent action is taken.

21. Risk assessments are performed to analyse the full range of possible risks and consequences including inherent design vulnerabilities and external hazards.

22. Independent third-party reviews of critical inputs, assumptions and other decisions impacting risk are conducted, particularly when gaps in expertise are recognised.

23. Vendors and sub-vendors understand, appreciate, and adhere to the established risk management principles and standards.

Risk Minimisation and Mitigation

24. Contingencies and alternate approaches for most probable adverse outcomes are developed. Actions to eliminate or minimise risk and manage residual risk are developed.

25. The time of exposure to risk is minimised, provided this does not unduly stress the task and introduce additional risk.

Communication of Risk

26. Risk-related information is communicated effectively among applicable stakeholders to share information and to prompt action.

27. Enterprise risk implications are discussed, as appropriate, with non-nuclear corporate executives for organisational alignment and for potential impact beyond the nuclear division.

28. Risk-related decisions and their bases are shared with the workforce to assist in alignment and understanding.

29. Risk awareness is promoted through visible means such as videos, posters, metrics and schedules throughout the site.

30. The effectiveness of communications is validated through various methods, such as asking clarifying questions and observing working practices to ensure complete understanding of applicable risk.

Self-Evaluation and Learning

31. Senior managers maintain a clear diagnosis of the organisational proficiency to identify and mitigate risk.

32. Periodic effectiveness reviews and on-going trending are performed to verify understanding and application of risk management.

33. Changes to risk models and assessment methods are incorporated into the integrated risk management process.

Performance Improvement

Performance Improvement (PI.1)

Performance Objective:

Performance monitoring activities and improvement processes are consistently implemented to identify, analyse, and correct gaps between current levels of performance and desired management and industry standards.

Criteria:

Identifying and Monitoring

1. Deficiencies, near misses, low level or precursor events, and abnormal plant conditions are promptly identified to recognise gradual decline in performance.
2. A method is available to all employees to identify and document human performance, equipment, organisational, and process concerns and issues that could impede safe and reliable operation, emergency response capability, or personnel safety.
3. Identified deficiencies are reviewed promptly for safety, reliability, impact to plant operations, and event reporting concerns. Immediate and interim actions are put in place commensurate with the significance of the deficiencies.
4. Initial evaluation and prioritisation of identified issues use systematic and cognitive trending approaches to identify repetitive issues of low consequence. Trending methods categorise issues for action before they become bigger problems. Aggregate analysis is performed on a prioritised basis for groups of similar issues.
5. Performance metrics and monitoring methods promote a clear picture of results and behaviours that support excellence in station, department, and crew performance. Monitoring methods compare current performance to industry standards and are periodically benchmarked against industry best practices.
6. Performance indicators are used for early detection and promote prompt intervention of issues and subtle declines before they become consequential.

When performance indicators reveal a trend, the issue is prioritised and addressed through station processes.

7. Performance improvement activities, including self-assessments, benchmarking, and observations, are critical and identify performance gaps by comparing actual performance to established targets and management expectations, performance of other high-performing organisations, industry standards of excellence, and regulatory requirements.

Analysing

8. A consistent and deliberate approach is used to investigate problems, analyse causes, and improve performance.

9. Skilled and knowledgeable personnel perform causal analyses and event investigations. Investigations are timely and thorough to preserve information and physical evidence.

10. Performance gaps are understood and prioritised using appropriate investigation and performance analysis tools.

11. Based on risk and consequence, internal and external events and performance trends are analysed at the department as well as station level.

12. Significant conditions are investigated promptly to identify corrective actions to prevent recurrence as well as to identify interim actions, extent of condition, extent of cause, and technical, behavioural, organisational, programmatic, causes and contributors. If significant problems recur, the scope of investigation is increased to understand the reason(s) for the recurrence.

13. Industry operating experience is considered during investigations and analyses of station events, to both learn from industry experience and to identify gaps in operating experience use.

Correcting

14. Performance improvement actions are commensurate with the significance and causes of the problems. The focus is on the actions to efficiently address the causes and resolve the problems.

15. Performance improvement actions are specific, measurable, actionable, realistic and timely.

16. Corrective actions are completed as intended and solve the identified problems.

17. Corrective action backlogs are kept low to avoid impeding managers' abilities to recognise and respond to significant safety and reliability issues.

18. Performance improvement plans and solutions are communicated and visible to personnel so that individuals know how their work contributes to eliminating these gaps.

19. Corrective actions to preclude repetition either eliminate the potential for repeat events or reduces the potential of recurrence to an acceptable level. Repetitive and long-standing issues are recognised and appropriately prioritised for correction.

20. Effectiveness reviews are conducted on corrective actions intended to preclude repetition of important problems. The reviews confirm that barriers have been institutionalised, knowledge has been retained, and behaviours and work practices have been sustained. Implementation status is monitored and tracked.

Operating Experience

Operating Experience (OE.1)

Performance Objective:

Internal and industry operating experience is shared and used to prevent events and improve equipment, worker, and station performance.

Criteria:

Use of Operating Experience

1. Station personnel demonstrate strong ownership of and involvement in the operating experience programme. They reinforce the connection between operating experience use, event prevention, and improved performance.
2. Supervisors understand and use insights from relevant significant operating experience and job-related operating experience to prevent events as applicable to each functional area.
3. Personnel develop an understanding of lessons learned from operating experience and use this knowledge to improve equipment and worker performance. This information is readily accessible to managers and individuals.
4. Recommendations resulting from significant operating experience are applied to station processes and procedures to prevent events.
5. Industry operating experience is promptly reviewed by skilled and knowledgeable personnel for applicability, with a focus on the potential for a similar event or problem to occur. Lessons learned are communicated to station personnel in a timely manner and integrated into station processes when applicable.

Sharing of Operating Experience

6. Lessons learned from internal operating experience are shared with the nuclear industry in a timely manner.
7. Important equipment performance data is shared with the industry in a timely manner. Performance data from external sources is used to improve station equipment reliability.
8. Documentation accurately reflects the event and captures the most relevant lessons learned for communication to the industry.

Training

Training Fundamentals (TR.1)

Performance Objective:

All personnel involved in training apply the essential knowledge, skills, behaviours and practices needed to develop and maintain qualified, skilled, and competent personnel to operate and maintain nuclear facilities in a safe and reliable manner.

Criteria:

1. Training is established and maintained such that all personnel, plant and supplemental workers, satisfy established training and qualification requirements before performing work independently. Nuclear safety is foremost in training.
2. Line managers are responsible for the development, approval, and implementation of initial and continuing training programmes that provides plant and supplemental workers with the necessary knowledge and skills to independently operate and maintain the plant, provide technical support, and fulfil emergency roles.
3. Performance standards established by line managers should be presented, discussed, and reinforced during initial and refresher training. Understanding of these standards should be verified during training evaluation and the qualification process.
4. A systematic approach is used to develop training that results in a high level of personnel knowledge, skill and performance.
5. Training needs are identified and systematically analysed. This results in the timely delivery of objective-based training. Inputs include, but are not limited to, the following:
    a. Changes in worker responsibilities, tasks, plant design and system configuration, station procedures, operation processes and regulatory requirements
    b. Integrated risk identification, assessment and contingency implementation
    c. Results from performance improvement processes
    d. Internal and external operating experience, including industry lessons learned

6. Training effectiveness reviews are used to enhance worker performance through improved training content and delivery.
7. Training managers establish high standards of learning performance and align the training organisation to implement and control training activities effectively, to ensure personnel are qualified to support safe and reliable plant operation.
8. Personnel who conduct training and evaluation are trained, qualified, and demonstrate on an ongoing basis the required knowledge, skill, standards and expectations to perform their assigned duties. They understand the importance of the training activity to safe and reliable plant operation.
9. Performance based training accurately represents plant conditions and minimises the potential for inadvertent equipment manipulations.

Conduct of Training (TR.2)

Performance Objective:

Training activities support safe and reliable plant operations by improving individual, team, and crew performance.

Criteria

1. Classroom, laboratory, simulator, and on-the-job training and task performance evaluation activities should be observed periodically by line managers to verify that station and personnel needs are met, management performance standards are reinforced, and participants are challenged.
2. Line managers give feedback after training sessions about their observations and assess effectiveness of training of their staff after a certain period of time conducting jobs.
3. Training personnel effectively support line managers through the provision of high quality training required to support the qualification of station and supplemental personnel.
4. Training managers monitor and assess training activities to maintain and reinforce high standards of performance.
5. Training managers establish staffing plans to ensure sufficient resources are available, along with the required knowledge, skill and proficiency needed to accomplish tasks to train personnel in safe, reliable plant operation.
6. Training managers ensure facilities are adequately resourced and maintained to support realistic and effective training.
7. Initial and continuing training should include the applicable significant operating experience in a manner such that the responsible trainees understand it.
8. When evaluation of trainee performance is conducted it verifies that the trainee has attained the essential performance skills associated with his or her tasks. Remedial training and re-evaluation are provided when performance standards are not met.
9. In-plant, simulator and laboratory training and evaluation, such as on-the-job training and task performance evaluations, accurately represent plant conditions. Trainee controls in place during in-plant training ensure that inadvertent equipment manipulations are avoided.

10. Records of each individual's training participation and qualification status are maintained.

11. Suitable simulators are used effectively for hands-on training to demonstrate plant operational characteristics and for recognition and control of normal, abnormal and emergency plant conditions. Differences between the simulator and the plant are considered during training sessions.

12. Procedures used during simulator training reflect those used in the plant. Methods are established to ensure that procedure conflicts and errors identified during simulator training are fed back to the station for resolution in a timely manner.

13. Simulator training is enhanced by the use of pre-exercise briefings and post-exercise critiques. Post-exercise critiques identify and correct important weaknesses.

14. Training materials are up to date and accurate, include emphasis on fundamentals and operating experience and are approved for use to train personnel.

15. Line manager expectations for personnel performance in areas such as human error reduction and demonstrating nuclear, radiological, industrial and environmental safety techniques are embedded in approved training material. These expectations are also reinforced during training delivery and evaluation.

Human Performance

Human Performance (HU.1)

Performance Objective:

Human performance standards and expected behaviours are defined, established and incorporated in an organisation's programmes, processes and training. These standards and behaviours are reinforced to reduce the likelihood for human error and to achieve sustainable, event-free operations.

Criteria:

1. Managers are advocates of human performance standards and promote the use of error reduction practices and defence-in-depth measures. Error reduction practices and defence-in-depth measures are communicated and reinforced frequently to promote high levels of human performance.
2. Supervisor responsibilities in human performance processes are defined to include maintaining situational awareness of job-site conditions, assessing worker capability to execute tasks event free, incorporating defence-in-depth measures as needed and regularly monitoring work activities to reinforce proper human performance behaviours.
3. Workers focus on the task at hand, stop to seek assistance when faced with uncertain or unexpected conditions and prepare themselves for potential consequences prior to taking actions. Workers understand and value human performance error reduction standards and use them as a means to reduce errors and prevent plant events.
4. Human error reduction practices and their use are clearly defined and are embedded in procedures, processes and training.
5. Human error reduction practices and defence-in-depth measures are factored into worker preparation activities and work plan development. These practices identify error-likely conditions and establish appropriate compensatory measures to mitigate the likelihood and effects of human error.
6. Procedures and work documents are written and structured to minimise the likelihood of human error.
7. Guidance is provided on the use of physical barriers to prevent or mitigate human-performance- related events during plant activities. This includes controls such as limiting access to risk-sensitive equipment, installing temporary

barriers during work near sensitive equipment and posting signs to highlight error-likely situations and hazards to personnel.

8. Guidance is provided and incorporated in the design change process for the use of engineered controls to reduce the likelihood of human error during the operation and maintenance of modified systems or components. Where appropriate, engineered controls are used to reduce the likelihood and the effects of human error.

9. Job-site conditions that increase the likelihood for human error, such as inoperable lighting, degraded labels and signage and cluttered work areas, are addressed in a timely manner.

10. Initial training programmes incorporate human performance standards and practices, provide the necessary skills and knowledge to understand conditions that lead to human error and train and qualify personnel on the selection and use of applicable error reduction practices and defence-in- depth measures commensurate with the task. Continuing training programmes embed human performance practices in day-to-day training activities.

Operations

Operations Fundamentals (OP.1)

Performance Objective:

Operations personnel apply the essential knowledge, skills, behaviours and practices needed to operate the plant safely and reliably.

Criteria:

Monitor Closely

1. Operators monitor plant parameters at a frequency based on importance and plant conditions, and they communicate to other crew members when needed by describing the parameter—its value, trend, and action needed or taken.
2. Operators increase the frequency of monitoring key parameters during transients.
3. Operators identify adverse parameter and equipment trends.
4. Operators validate the accuracy and proper function of indications through multiple independent means, if available, avoiding undue focus on any single indicator.
5. Operators validate expected system response to equipment operation and status changes.
6. Operators investigate to understand unexpected trends and alarms, take action to restore systems and parameters to normal, and request assistance when needed.
7. Operators establish increased monitoring, as appropriate, for any disabled alarm function.
8. Field operators perform detailed rounds and take prompt actions to address abnormal conditions. Important information from monitoring field equipment and parameters is reported promptly to control room operators.

Control Precisely

9. Operators control parameters within the specified bands and at specified rates. Supervisors clearly communicate action points to all crew members.

10. Operators anticipate automatic trips and equipment protective features, pre-emptively taking manual actions or ensuring expected automatic actions occur, where appropriate.

11. Operators verify and report automatic system actuations or responses, including operator actions if the plant has not responded as expected.

12. Operators verify that indications and initial plant conditions are appropriate for the procedure before implementing a procedure section or step.

13. Operators know the objective of the procedure and the basis for procedure steps prior to manipulation. They operate the plant in accordance with approved, up-to-date operating procedures and information.

14. Operators identify steps that could result in undesirable consequences if not performed correctly. They ensure appropriate contingencies are established.

15. Operators use appropriate equipment labels and line-ups for equipment manipulations and verifications.

Conservative Bias

16. Operators ensure the equipment needed to support effective plant operation is available and is operating properly, including that backup indications are available, controllers are tuned and in automatic, and redundant equipment is operational.

17. Operators have a low threshold for identifying operational problems. Interim corrective actions are taken, and problems are communicated to supervision and entered into the appropriate process for resolution.

18. Operators manage scheduled activities and emergent work to avoid simultaneous evolutions that have the potential to overload control room personnel and hamper plant monitoring.

19. Operators understand plant conditions and know the appropriate action to take when plant or component control cannot be maintained, including stopping the evolution and involving supervision.

20. Operators question conditions and situations that are out of the ordinary, that are unexpected, or that could erode margins to operating the plant conservatively. They resolve these issues before continuing.

21. Operators set conservative bands for critical parameters to ensure that operating margins to undesirable states are maintained.

22. Operators control operating bands and rates to create and maintain sufficient operating margins.

23. Operators establish contingency plans, commensurate with the associated risk, to mitigate potential adverse consequences during plant evolutions.

Effective Teamwork

24. Operating crew members ask questions to obtain necessary information.

25. Operating crew members question each other and share experience when an action is being taken that appears inappropriate or when the expected action for a given condition is not being taken.

26. Operating crew members resolve conflicts to achieve the best solutions and to improve team effectiveness. They use open and accurate communication.

27. Operating crew members are critical of team performance so that they can identify performance improvements. They are keen to improve and encourage others to do so.

28. Operators provide thorough and accurate turnovers when relieved during or at the completion of a duty shift.

29. Operators fulfil their assigned roles and do not assume another team role without a proper turnover. During transients, those roles include the following:

    - Lead operating crews to diagnose plant conditions and implement abnormal and emergency procedures effectively.
    - Maintain oversight of the plant and crew to ensure crew actions are performed correctly and in accordance with procedures.
    - Provide an independent assessment of operator actions and plant responses to ensure safety functions are maintained and mitigation strategies are implemented effectively.
    - Promptly communicate important information about plant conditions and actions taken, as well as clearly presenting positions to the team.

Understand Sciences, Engineering Principles, and Plant Design

30. Before operating a component, operators confirm an understanding of its function and interactions with other components.

31. Operators understand the rationale for procedures that requires power reductions or tripping the reactor.

32. Operators understand the risk associated with plant configuration, including the collective risk of having multiple, diverse components out of service or in off-normal conditions.

33. Operators establish a learning environment among crew members that encourages questioning, challenging, and knowledge reviews.

34. Operators ask for simulator scenarios that challenge fundamental knowledge of sciences, engineering principles, and plant design.

35. Licensed operators have a strong understanding of the basic core fundamental principles of reactor theory, electrical theory, and thermodynamics. Operators apply this knowledge to anticipate expected responses as they operate the plant.

36. Operators regularly evaluate crew member knowledge of sciences, engineering principles, and plant design.

37. Operators discuss expected system and parameter changes and their bases during pre-job briefings.

Conduct of Operations (OP.2)

Performance Objective:

Operations programs, processes, and activities are implemented in a manner that promotes sustained high levels of safe and reliable operation.

Criteria:

Operations Management and Leadership

1. Operations managers verify, through active monitoring, that on-duty shift managers provide requisite oversight of operational activities and control room crew performance. Managers also ensure shift managers are appropriately integrated into the management team.
2. Operations managers ensure that operator fundamentals are clearly defined, taught, and reinforced in training and are actively monitored during operations. This includes reviews after important plant evolutions, significant plant transients, and scrams to identify potential weaknesses in behaviours, knowledge, and practices.
3. Operations managers verify, through active monitoring, that the senior licensed supervisors in the control room remain in a supervisory role by directing plant operations and the control room crew.
4. Operations managers establish and maintain training and programs that support control room teamwork. Training and programme aspects should include the importance of staying in role, challenging other team members who do not meet the intent of their roles or step out of their roles, and working together to control and monitor the plant effectively.
5. Operations managers establish clear roles, responsibilities, and procedure guidance for the interface between reactor engineers and the operations organisation with respect to reactivity management.
6. Supervisors understand relevant operations-related significant operating experience and the importance of using this and other job-related operating experience to prevent events.
7. Operations managers evaluate leadership and team effectiveness of control room operations personnel to ensure crews function effectively as a team. Operations managers implement mitigating plans to address individual and crew shortfalls.

8. Operations managers ensure newly constituted crews are evaluated for crew leadership and team effectiveness in the simulator before, or soon after, the crew assumes control room duties. Mitigating actions are taken to address any crew shortfalls or delays in conducting this evaluation.

9. Shift managers periodically review and assess simulator instructor performance and give feedback to improve proficiency in creating and delivering simulator training scenarios. This includes, but is not limited to, aspects such as:

    - Monitoring and controlling reactor and systems using appropriate knowledge, skills and experience
    - Operator decision-making and diagnostic skills
    - Conservative decision making
    - Procedural adherence and use of error prevention tools
    - Crew teamwork and communication

Control Room Activities

10. Control room activities are conducted in a business-like and formal manner, reflecting the highest standards of professionalism. Control room access is limited to authorised personnel, and additional restrictions are imposed on personnel entering the ‑controls area.

11. Plant activities, including emergent work, are scheduled and coordinated to avoid simultaneous evolutions that have the potential to overload control room personnel and hamper plant monitoring.

12. Activities that change reactivity are performed in a deliberate and controlled manner. Detailed procedures are followed, human error prevention techniques are used, and increased supervisor oversight is provided to minimise the probability and consequences of a reactivity management event.

Administrative Controls

13. Administrative processes are established to ensure the proper authorisation and controls are in place for those times when safety systems need to be bypassed or removed from service.

14. Equipment tagging and clearances are controlled and tracked using approved processes.

15. Senior reactor operators provide prompt, accurate initial assessments of

equipment operability and reporting requirements for identified deficiencies. Senior reactor operators are authorised to draw on other technical resources to help address plant issues.

16. Administrative controls are in place to document entry into and compliance with the requirements of technical specification action statements. Shift management is cognisant of and responsible for entry into action statements and verifies that appropriate actions are taken.

17. System operating, alarm response, abnormal operating, and emergency operating procedures are written with clear and accurate guidance for plant equipment operation. Emergency operating procedures are current with owner's group guidance.

18. Clear and specific policies are in place to allow operations personnel to identify and make procedure changes necessary to support the safe operation of the plant. The method used should provide adequate controls to ensure changes are within the scope allowed for on-the- spot changes and require peer review to ensure these changes are accurate.

Operations Staffing

19. The composition of operating crews takes into account operator experience, backgrounds, and personalities to enhance crew teamwork.

20. A long-term operations workforce plan is established to maintain sufficient operations staffing and includes the following attributes:

    - The number of qualified operators is sufficient to permit rotation of operators to other departments and groups after on-shift crews have been fully staffed.

    - Senior managers provide oversight for and endorse the workforce plan to ensure it is supported with the resources needed to implement it and to ensure organisational alignment on workforce plan expectations and maintenance.

    - A thorough and comprehensive strategy is in place for attracting, hiring, and developing the highly skilled workforce necessary to operate the plant as well as to support operations. Recruiting and hiring strategies help obtain the operators needed to achieve the organisation's mission and goals.

    - A rigorous process is used to identify, screen, select, and qualify operators.

- A tailored orientation programme is implemented for license programme candidates who lack significant plant specific experience. This programme ensures the candidates have sufficient base knowledge of plant systems, plant layout, overall plant operations, and plant organisational structure and management to be successful in licensing classes.

Operational Focus

Operational Priorities (OF.1)

Performance Objective:

Station personnel and programs are aligned to identify and prioritise the resolution of operational problems. Organisational roles, responsibilities, processes, procedures, and infrastructure are established such that unexpected operational conditions are managed promptly and safely.

Criteria:

Operational Priorities

1. Personnel have a low threshold for identifying and communicating problems with equipment that is important to safe and reliable plant operation.
2. Operational problems are evaluated individually and in the aggregate to determine the priority for resolution. Priorities are based on the impact to the operator's ability to monitor and control the plant, on the impact to operating margin, or on the impact to high-risk-worth systems and components based on station probabilistic safety analysis.
3. Operational problems are monitored and re-evaluated as conditions change. The aggregate effects of problems that could affect plant operation are managed such that operators can monitor plant conditions and respond to transients effectively at all times.
4. Solutions to plant operational problems are focused on both the immediate concerns and the long-term resolution of the issues. Temporary solutions are limited to mitigating the actual or potential effects of operational problems until permanent resolutions can be implemented.
5. Aggressive outage goals are established and pursued to resolve problems such as degraded equipment important to plant operation, low margin conditions, out-of-specification parameters, control room deficiencies, operator workarounds and burdens, and installed temporary modifications.

Response to Emergent Operational Issues

6. Plans and procedures are established for managing unexpected and complex operational conditions and are re-evaluated when additional equipment degrades or environmental conditions change. Sites that are susceptible to

specific conditions should use training and drills to ensure personnel are proficient in the use of those procedures.

7. Priorities are established for addressing challenges based on operational significance. Multi-departmental support is provided and aligned to help on-shift operators address emergent plant operational challenges.
8. Station personnel who fill positions in support organisations for response to emergent issues are proficient in their roles. Training and drills occur frequently enough to ensure personnel can work effectively as a team to respond to urgent plant needs.
9. Personnel, such as operations, chemistry, and maintenance personnel, are authorised and have been provided clear guidance prior to manipulating plant components and systems. These individuals are proficient in implementing procedures that require urgent action, and they train on or simulate actions taken for such events.
10. Station personnel utilise off-site resources and expertise in response to emergent operational challenges that exceed their on-site capabilities.

Operational Risk (OF.2)

Performance Objective:

The plant operational risk associated with equipment removed from service or degraded and from planned plant activities is maintained low. Inadvertent operational events are prevented through planning, preparation, controls, contingencies, and communication.

Criteria:

Risk from Equipment Removed From Service or Degraded

1. The actual and potential effects of removing equipment from service are thoroughly reviewed and understood. This includes the use of both probabilistic safety assessment considering the potential effects on core damage frequency, if applicable; and the qualitative assessment of the operational risk of performing the activity.
2. Important equipment is verified to be operating properly before redundant equipment is removed from service. The extent of this verification should be commensurate with the potential operational impact of the equipment failing.
3. Planned evolutions that remove equipment from service are scheduled in a manner that maintains operational risk and operational burden at acceptable levels. The work schedule is designed and followed to ensure work activities are controlled as planned. Contingency plans are established as necessary where work is particularly complicated or risk significant.
4. Operational decisions concerning degraded plant conditions that could affect plant operation are based on an in-depth understanding of short- and long-term operational risks as well as the potential effects of alternative options. Decisions are made such that the plant is operated with margin to design limits and can be monitored and controlled effectively until the condition is resolved.
5. When decisions are made to operate the plant with degraded conditions that could affect safe and reliable plant operation, clear trigger points are established for operators to take action if conditions degrade further.
6. Work that may be outside the normal scope of the work management process is scheduled and integrated with plant work such that integrated risk from these activities is assessed and managed. This work includes activities such as grid operations, security upgrades, excavation, and switchyard maintenance.

7. Thorough post-maintenance testing is performed promptly after work on equipment is completed, to verify proper functionality or operability of the component or system, as appropriate.

8. Equipment that could affect plant operation, is important to plant safety or is required to maintain decay heat removal or inventory control, is temporarily protected to prevent inadvertent operation, maintenance, or bumping when:

    - redundant equipment is out of service or degraded, or
    - the time to approach bulk boiling in the spent fuel pool is less than 72 hours

Risk Associated With Plant Activities

9. Extra preparatory actions are considered for higher-consequence or complex activities on safety systems and equipment that can cause plant transients. These actions may include practicing on mock-ups or the simulator, performing dry runs, or controlling the activity as an infrequently performed or special test or evolution.

10. Time spent at reduced reactor coolant inventory is minimised.

11. Operational risk is reassessed whenever work is added late in the work planning process. Appropriate approvals are obtained and contingencies established when these changes result in increased operational risk.

12. Personnel who perform plant activities understand the potential operational impact of their activities and take appropriate actions to prevent inadvertent operational events.

13. Plant equipment that is especially vulnerable to causing plant transients or that is important to plant operation is permanently protected from unplanned work, bumping, radio interference, and other activities that could challenge operation. This is accomplished by installed barriers, signage, restricted travel pathways, or other means.

14. Pathways to access local instrumentation and equipment needed to conduct rounds, perform tests, and implement transient response procedures are maintained clear.

15. Plant configuration is maintained by plant procedures and processes. All work groups apply appropriate written guidance any time plant equipment is manipulated, to ensure equipment is restored to the proper position or tracked

as appropriate. Following maintenance, controls are established for component position and sequencing as systems or components are returned to service.

16. Operations, Maintenance, Work Management, and other groups work together to clearly define and control the boundaries between equipment removed from service and the operating plant systems. Clearance and tagging activities are performed in a manner that protects workers and plant equipment.

17. When plant activities, including surveillance testing, maintenance work, and troubleshooting, are transferred from supporting organisations such as Maintenance or Engineering to Operations, system status is accurately and clearly communicated between these departments.

18. Action plans for eliminating, minimising or mitigating risks are specific, measurable, achievable, realistic, and timely. Changes to actions or plans are communicated and approved by appropriate leadership levels and/or decision-making forums.

On-Line and Outage Work Management (WM.1)

Performance Objective:

Work activities are managed during both on-line and outage periods to support safe and reliable operation.

Criteria:

Leadership and Management Roles and Responsibilities

1. Managers ensure that key activities, such as long-range planning, equipment health, training, major and minor modifications, corporate prioritisation and budgeting, are integrated into the work management process.
2. Station leaders establish and communicate clear expectations regarding work management standards. They communicate and reinforce the importance of schedule adherence to support nuclear safety and to reduce operational risk.
3. Station leaders demonstrate the accountability and teamwork needed for work management by supporting station prioritisation, work selection, scope stability and adherence to the published schedule.
4. Managers ensure that emergent issues and work are controlled in accordance with established processes.
5. Managers actively oversee the readiness of the planning and preparation milestones.
6. Station leaders develop clear roles and responsibilities for the various aspects of work management. Roles and responsibilities are enforced, are periodically reviewed and are adjusted when needed.
7. Managers understand and monitor the resources necessary to implement the work management process. Those resources are committed in advance and are managed to ensure successful implementation of the selected work.
8. Managers understand and take action to close identified performance gaps in work management. They also ensure that lessons learnt from station and industry experience are incorporated into subsequent work planning activities and schedules.

9. Managers ensure site personnel are prepared to execute forced outages by having a planned strategy with a defined scope, a risk mitigation strategy and ownership of deliverables.

10. Line managers actively participate in the coordination of key work, elevated risk activities and work scope that presents execution challenges, to ensure the right work is being performed.

11. Work management managers exhibit strong ownership of corrective action, self-assessment, operating experience and benchmarking programs as key tools for work management performance.

Identification and Prioritisation

12. Operations and other key organisations screen new work collaboratively to determine the appropriate priority and classification of an identified deficiency based on its safety significance, operational impact and effect on emergency preparedness. The collaborative decision should also consider the effect on core damage frequency or risk for the mode of operation in which the work is to be performed.

13. Priorities are well defined, communicated and adhered to. Previously prioritised work is periodically re-evaluated based on the aggregate impact of deficient equipment or operational conditions.

Work Selection and Scoping

14. Work is bundled effectively to maximise equipment availability, minimise risk and minimise operations burdens. Equipment deficiencies and work activities are selected such that the maximum amount of work can be accomplished in a safe, reliable and efficient manner.

15. Work is added to or removed from planned work with input from a multi-discipline team, taking into consideration safety impact, equipment reliability, operational focus, long-range planning, preventive maintenance strategies and estimated resources needed to perform the work.

Work Planning

16. The level of detail in work planning and instructions is based on the safety significance and complexity of the activity. This also considers the training, experience and skills of the workers and supervisory oversight.

17. Resources needed for the work activity such as tools, equipment, materials and parts are identified sufficiently early in the planning process to support the schedule.

18. Work planning is performed by knowledgeable personnel who use approved criteria and guidelines that include elements required by the work management processes.

19. Plans are developed that include the identification of key activities and steps, post-maintenance testing, interfacing activities and support groups. Planners verify or walk down tasks to ensure that work package quality for the planning milestone meets station standards and is ready for maintenance personnel to use during work activities.

20. Work plans are assessed to verify the appropriate level of risk will exist during work execution. When necessary, contingencies are developed and included in work plans to maintain the appropriate level of risk.

21. Work execution risk is factored into the assessment of integrated risk as work documents are developed and as additional reviews are performed.

Scheduling and Coordination

22. Work activities are analysed and scheduled to maximise equipment availability and minimise operational risk.

23. Challenges and conflicts to successful completion of work are identified in the early phases of schedule development so additional attention can be applied as needed to facilitate resolution.

24. Schedules are developed in sufficient detail to identify periods of higher core damage frequency risk during on-line and outage periods.

25. Cross-discipline horizontal and vertical reviews are used throughout the work management process to identify and correct scheduling conflicts. Progressive reviews focus on additional level of detail, with an emphasis on key safety system work.

26. Contingency plans used to mitigate risk are reviewed in advance and communicated to appropriate stakeholders.

27. Emergent work activities are evaluated for inclusion in the work schedule considering inoperable and out-of-service equipment, the impact on maintaining defence-in-depth and operational risk and the disruption of scheduled activities and resources.

28. The integrated schedule is periodically assessed and adjusted to resolve conflicts and reduce risk. Schedule changes are evaluated against predefined criteria, with management approval at the appropriate level commensurate with the risk and impact to performance goals.

29. Resources are confirmed and committed to complete the scheduled work. Committed resources are monitored and gaps are identified and closed to support the scheduled work.

30. Personnel prepare for work implementation commensurate with the level of risk, the importance of the component to work execution and their knowledge and experience with the scheduled work. Work group interfaces and coordination points are identified as part of the preparation.

Self-Assessment

31. Lessons learnt as a result of gaps in scheduling and coordination are reviewed and are incorporated as applicable for future occurrences.

32. Work management process performance is routinely measured, trended and critiqued. Corrective actions to close performance gaps are identified and tracked to completion.

33. Workers and support personnel, as appropriate, participate in post-job critiques of completed work.

Maintenance

Maintenance Fundamentals (MA.1)

Performance Objective:

All personnel performing maintenance activities apply the essential knowledge, fundamentals, technical skills, behaviours, and practices to improve equipment performance, contributing to safe and reliable operation.

Criteria:

Knowledge and Skills

1. Maintenance personnel possess the knowledge, technical skills and experience in order to perform quality maintenance. They know the basic design and key functions of equipment and components.
2. Maintenance personnel recognised the importance equipment and components being maintained and their impact to operations and plant safety.
3. Maintenance personnel understand the application and limitation of tools, equipment and methods used to maintain equipment.
4. Maintenance personnel know how to use reference materials, such as plant drawings and vendor manuals.

Preparation to Perform Maintenance

5. Maintenance personnel prepare in advance for work by performing required walkdowns, reviewing instructions, verifying qualifications and participating in pre-job briefings. Attention given to walkdowns and pre-job briefings is commensurate with the work assigned.
6. Maintenance personnel determine needed the tools and test equipment and ensure these are used properly. They use available technology and innovation to improve performance and efficiency.
7. Maintenance personnel identify opportunities to use just-in-time training and relevant operating experience to improve performance and to increase their familiarity with the task.
8. Maintenance personnel are aware of the importance of effective preparation to the safe and reliable plant operation of the equipment to be repaired. They

review and understand workplace hazards, plan in order to avoid mistakes, and identify required mitigating actions.

Performance of Maintenance

9. Maintenance workers perform quality maintenance. They document pertinent technical information, such as as-found and as-left conditions during repairs, troubleshooting and preventive maintenance, and ensure abnormal conditions are identified and communicated.

10. Maintenance personnel ensure equipment is reassembled to exacting specifications by applying knowledge and proper maintenance fundamentals and technical skills and using correct tools, instruments and repair parts.

11. Maintenance personnel maintain situational awareness to prevent injury to self and others, inadvertent equipment actuation, and equipment damage.

12. Maintenance workers keep work areas and open equipment clean and free of foreign material during work. They maintain high standards for housekeeping; leave the job site in as good as or better condition than it was found.

13. Maintenance personnel plan and perform rigging, lifting and material-handling activities to high standards that ensure equipment and personnel safety.

14. All personnel performing maintenance work only when authorised and only on equipment that is properly aligned for the maintenance. Work activities are performed in accordance with controlled procedures.

15. Maintenance personnel provide feedback to improve maintenance, work instructions, procedures and processes.

16. Maintenance personnel clearly communicate work status during turnovers and handoffs.

Deliberate and Conservative Actions

17. Maintenance personnel question plant conditions, identify technical concerns with plant equipment, and take conservative actions. They recognise the importance of configuration control to ensure plant design is maintained and plant operations are not impacted.

18. Maintenance personnel minimise out-of-service time through a meticulous but graded approach of preparation and execution of maintenance.

19. Maintenance workers stop and obtain help or clear direction from supervisors when faced with uncertainty, unexpected results or changing conditions.

20. Maintenance personnel anticipate and validate equipment responses during maintenance and post-maintenance testing.

Ownership of Plant Performance

21. Maintenance personnel demonstrate, through performance of fundamentals and technical skills, ownership when implementing maintenance tasks. They participate in projects and initiatives to improve plant equipment and work processes (for example, benchmarking, self-assessments and industry working groups).

22. Maintenance personnel are intolerant of unplanned failures of equipment that are not run-to-failure, and participate in solving emergent equipment problems and discovering the reason for the failures. They ensure rework is identified, documented, trended and apply measures for prevention of rework recurrence

23. Maintenance personnel understand and support policies and procedures that govern the conduct of maintenance and they provide feedback if improvement is necessary.

24. Maintenance personnel are self-critical and frequently provide feedback to improve plant performance, processes, plans, procedures and training. They strive for continuous improvement.

25. Maintenance personnel maintain high standards and provide and accept effective coaching (for example, peer-to-peer and upward) to sustain or improve performance. They recognise their role in the development of less-experienced workers.

26. Maintenance personnel identify potential shortfalls and ensure appropriate actions are taken to improve performance. They collaborate across departments to resolve problems and improve performance.

Conduct of Maintenance (MA.2)

Performance Objective:

Maintenance activities are conducted, and programs and processes implemented, in a manner that promotes sustained high levels of safe and reliable operation.

Criteria:

Maintenance Managers

1. Maintenance managers establish, communicate and reinforce high standards. They establish measures of performance that focus on results and behaviours.
2. Maintenance managers own and value training as a means to improve performance. They ensure maintenance fundamentals are clearly defined, taught, reinforced in training and are actively monitored during maintenance activities.
3. Maintenance managers establish clear roles, responsibilities, and procedure guidance for maintenance supervisors and workers.
4. Maintenance managers provide supplemental workers with an appropriate level of oversight and engagement by personnel to ensure that performance is commensurate with that of the station standards and expectations.
5. Maintenance managers ensure high standards of equipment performance are achieved and sustained by providing the tools, facilities, controls, appropriate oversight, and qualified workers necessary to support quality maintenance.

Maintenance Supervisors

6. Maintenance supervisors are knowledgeable of industry performance, especially in assigned areas, and remain current on industry excellence, and encourage craft ownership of equipment. They understand the importance of using significant operating experience and other job-related operating experience to prevent events.
7. Maintenance supervisors reinforce favourable worker behaviours and coach incorrect behaviours in a professional manner. They ensure workers perform quality maintenance and document technical information accurately.
8. Maintenance supervisors and workers take conservative and deliberate actions. They understand plant conditions, equipment significance and job preparation.

9. Maintenance supervisors ensure workers are trained qualified and exhibit the correct behaviours to perform high quality maintenance, through application of maintenance fundamentals and technical skills.

10. Maintenance supervisors influence managers and senior leaders during decision-making and then communicate management decisions to employees, with personnel ownership. They develop and maintain an environment that encourages a healthy ownership of work and of the plant.

11. Maintenance supervisors display a deep-seated passion for the business, openly discuss teamwork and promote excellence, and are effective at both celebrating group success and capitalising on learning opportunities.

12. Maintenance supervisors ensure workers review work packages, provide feedback and are ready to work with all necessary written instructions, resources, parts, tools and equipment.

Supplemental Maintenance Personnel

13. Maintenance and station line managers clearly identify and reinforce responsibilities for supplemental personnel performance.

14. Maintenance or other site managers communicate standards and expectations to supplemental personnel thoroughly and confirm that those standards and expectations are understood.

15. Maintenance or other site managers create an effective means of feedback that promotes continual improvement in supplemental personnel performance.

16. Maintenance or other site managers regularly provide oversight of supplemental personnel, especially during critical work activities and when supplemental personnel perform work independently.

17. Maintenance and station line managers ensure that supplemental personnel have the correct level of knowledge of maintenance fundamentals and technical skills to perform assigned tasks.

Programs and Processes

18. Maintenance work is authorised, controlled, and documented properly. Work activities and component manipulations are performed in accordance with controlled procedures, instructions, manuals, and drawings.

19. Programmatic controls exist for the use of temporary equipment, including scaffolding, combustible materials, special equipment, and other support material needed to perform maintenance.

20. Maintenance procedures and documents are clear and technically accurate, provide appropriate direction, and are used to support safe and reliable plant operation. Applicable operating experience is incorporated during document preparation and revision.

21. Measuring and test equipment is calibrated and controlled to provide for accuracy and traceability. Out-of-tolerance test equipment is removed from service. Plant equipment found to be maintained with out-of-tolerance test equipment is evaluated in a timely manner for operability, and deficiencies are corrected.

22. Maintenance rework is identified, documented, and trended. Actions are taken to determine causes, including periodic reviews for common or generic implications; and subsequent corrective actions are taken to prevent recurrence.

23. Maintenance activities are planned and performed to prevent the introduction of foreign material into components and systems. Programs are implemented to clearly establish a foreign material prevention philosophy and provide guidance for the recovery of foreign material.

24. Rigging, lifting, and material-handling activities are planned and performed to high standards that ensure equipment and personnel safety.

25. Maintenance facility size, arrangement, and equipment promote safe work and training. Appropriate facilities are provided for work on radioactive components and hazardous materials.

26. A maintenance training and qualification programme serves to develop, maintain, and improve the fundamental knowledge and technical skills that maintenance personnel need to perform their assignments effectively.

27. Maintenance personnel performance is trended and analysed to identify areas of knowledge and skill that need improvement.

28. Maintenance managers ensure periodic self-assessments and benchmarks are conducted to ensure standards are maintained at high levels, considering industry best practices.

29. Maintenance personnel engage in training as subject-matter experts and provide useful, critical feedback into the training process.

Chemistry

Chemistry Fundamentals (CY.1)

Performance Objective:

Chemistry personnel apply the essential knowledge, skills, behaviours, and practices needed to implement chemistry activities that support safe and reliable plant operation.

Criteria:

Sample and Analyse

1. Chemistry technicians obtain representative samples, at the correct frequency, from plant systems and the environment.
2. Chemistry technicians analyse samples accurately using the laboratory quality control programme with the appropriate analytical chemistry method.
3. Chemistry technicians review, evaluate, and document chemistry data in a manner such that adverse trends are identified and corrected promptly before exceeding station goals and limits.

Monitor, Assess, and Respond

4. Chemistry personnel monitor system chemistry conditions accurately and coordinate chemical addition or dilutions to minimise material corrosion rates.
5. Chemistry personnel identify degrading conditions and act to improve chemical treatment programs and materials.
6. Chemistry personnel routinely evaluate chemistry strategies, operating practices, and evaluation techniques (such as hideout return and impurity mass balance studies) for effectiveness and to ensure they are integrated into station performance monitoring and corrosion control initiatives.
7. Chemistry personnel closely monitor radiochemistry parameters to detect and confirm the presence of failed fuel.

Chemistry Knowledge

8. Chemistry personnel are knowledgeable of chemical degradation mechanisms and integrate strategies for normal and abnormal conditions, including startup and shutdown.

9. Chemistry personnel understand the bases, capabilities, and limitations of chemistry sampling and analytical methods.

10. Chemistry personnel use diverse information sources to understand technical issues and provide recommendations for decisions that affect plant chemistry.

11. Chemistry personnel are knowledgeable of industry technical concerns, advances in technology, and industry operating experience. They use this knowledge to optimise chemistry controls that protect plant assets.

12. Supervisors understand chemistry significant operating experience and the importance of using relevant and job-related operating experience to prevent events.

Communicate and Advocate

13. Chemistry personnel identify and report adverse chemistry trends in a timely manner and communicate to operations and engineering personnel those trends that can impact the operation of plant systems. Pre-emptive actions are taken to maintain system chemistry contaminants as low as reasonably achievable, anticipating potential results of adverse trends.

14. Chemistry personnel advocate prompt resolution for critical chemistry equipment issues.

15. Chemistry personnel minimise the generation of radioactive and chemical waste.

Control of Chemicals

16. Chemistry personnel work with other station groups to properly control the use of chemicals throughout the station.

17. Chemistry personnel ensure laboratory chemicals are labelled, dated, segregated, and disposed of properly.

18. Chemistry personnel prevent the use of impure or ineffective process chemicals by verifying quality specifications and key parameters upon receipt through on-site laboratory analysis or by reviewing the certificate of analysis from the vendor.

Chemistry Controls (CY.2)

Performance Objective:

Chemistry personnel maintain proper chemistry conditions during all phases of plant operations.

Criteria:

1. Chemistry personnel proactively monitor, evaluate, and trend chemistry results to control chemistry parameters within a technically defined range and take actions to prevent or minimise the ingress of contaminants.
2. Chemistry personnel promptly communicate recommendations to resolve adverse chemistry trends, anomalous conditions, and out-of-specification parameters.
3. Chemistry personnel control makeup water closely to ensure it is consistently of high quality.
4. Chemistry personnel maintain and use off-normal procedures to address abnormal conditions and have contingency plans for minimising chemistry excursions and restoring plant systems to normal operating conditions.
5. Chemistry personnel monitor diesel fuel oil conditions to ensure a high quality of fuel oil is maintained during normal and accident conditions.
6. Chemistry personnel monitor specific parameters to validate that intended cooling water treatment is effective.
7. Chemistry personnel tightly control primary water chemistry to prevent fuel cladding corrosion and crud buildup that can lead to fuel failures.

Effluent Controls (CY.3)

Performance Objective:

Station effluents are monitored and controlled to protect the environment.

Criteria:

1. Managers control and direct activities, including shutdown and startup, to minimise dose and the generation of liquid and gaseous radioactive waste. Liquid and gaseous waste processing is managed to reduce dose to workers and the public.
2. Plant personnel delay releasing radioactive gaseous and liquid waste as long as practicable to allow for radioactive decay.
3. Plant personnel maintain radiological effluent monitors operational and calibrated to accurately measure and provide alarms for key effluent parameters.
4. Plant personnel identify, monitor, and mitigate groundwater radioactive contamination. The identification of contamination sources and the corrective actions to resolve the issues are timely.
5. Plant personnel determine, record, and track total curie content and volume of plant effluents. The results are compared to current industry performance, and improvement opportunities are identified.
6. Chemistry personnel closely monitor cooling waters that are chemically treated and returned to the environment. They promptly investigate and correct adverse trends.

Engineering

Engineering Fundamentals (EN.1)

Performance Objective:

Engineering personnel apply the essential knowledge, skills, behaviours and practices needed to ensure equipment performs as required, the plant is maintained within design requirements, performance trends are analysed, margins are controlled and the plant is operated safely and reliably.

Criteria:

Monitor and Evaluate

1. Engineers monitor and trend key parameters of system and component performance to prevent loss of function or equipment failure. When losses or equipment failures do occur, engineers determine the causes and actions to prevent future events and consider the potential for common-mode failure.
2. Engineers investigate abnormal operating conditions thoroughly and evaluate potential impact both individually and in the aggregate.
3. Engineers analyse system and component performance deviations and anomalies, including equipment availability and reliability impacts.
4. Engineers examine physical conditions or use the results of testing to validate evaluation inputs and assumptions for design changes, plant conditions and equipment performance, where possible.
5. Engineers engage operations and maintenance personnel to fully understand equipment condition and performance issues, the operational impact of those issues and preventive maintenance effectiveness.
6. Engineers use diverse information sources, such as design information, probabilistic safety assessment, operating experience, vendor information, analytical techniques and engineering principles, to understand technical issues and provide the best possible input for making operational decisions.

7. Engineers are focused on preventing failures by ensuring timely, thorough reviews of internal and industry operating experience and vendor recommendations for applicability to prevent equipment failures.

Operate, Maintain and Modify in a Controlled Manner

8. Engineers ensure plant operational, maintenance and testing activities are conducted in a manner consistent with design and licensing bases and safety analysis assumptions.

9. Engineers quantify and protect design and operating margins to ensure safe and reliable plant operation.

10. Engineers control temporary and permanent changes to plant equipment, operating requirements and design requirements.

11. Engineers proactively identify, evaluate and address design vulnerabilities through modifications, maintenance or other compensating measures, to restore or improve design and operating margins.

12. Engineers develop permanent solutions that address the causes of equipment failure.

13. Engineers identify and address potential failure modes and the effects of proposed changes to plant design for structures, systems and components important to safety and reliability.

14. Engineers verify that design changes improve equipment operation and maintenance, consider industrial and radiological safety aspects and use actual plant performance information when developing design inputs.

15. Engineers develop comprehensive post-modification testing to ensure changes to the plant have been designed and implemented correctly.

Communicate, Advise and Advocate

16. Engineers communicate plant design requirements and bases, including design and operating margins, design codes, models and safety analyses, as well as respective limitations, to decision-makers.

17. Engineers communicate methods, inputs, assumptions, analysis limitations and the bases for conclusions in engineering deliverables, to support thorough reviews and informed decision-making.

18. Engineers communicate emerging technical issues and the related potential risks to management and operations personnel as information becomes available, to ensure necessary compensatory and contingency actions are implemented.

19. Engineers advise station managers and advocate engineering positions on operational and technical matters to ensure balanced and informed decision-making. They solicit feedback to verify key technical considerations are understood.

20. Engineers communicate the actual or potential impact to integrated plant operations from degraded equipment, environmental challenges and planned design changes.

21. Engineers advocate resolution of abnormal conditions, adverse trends and long-term equipment deficiencies to prevent unplanned equipment failures, margin reduction or a loss of function.

22. Engineers identify equipment management strategies, including preventive and predictive maintenance, to improve equipment performance and ensure long-term reliability.

Acquire and Maintain Expert Knowledge

23. Engineers understand codes and standards, design requirements, design and operating margins, licensing bases and safety analyses for assigned systems and have knowledge of integrated plant operations.

24. Engineers continually improve skills in areas of expertise and are cognisant of generic industry issues, advances in technology, industry operating experience and technical concerns in those areas. They use this knowledge to improve plant equipment, procedures and practices.

25. Engineers maintain technical programmes current with industry best practices and operating experience.

26. Engineers develop and maintain industry peer relationships and technical expertise networks.

27. Engineers develop and maintain the ability to read and interpret plant drawings, manuals and specifications accurately.

Critical Thinking, Decision-Making and Challenging

28. Engineers include reactor safety considerations in technical evaluations, design changes and decision- making.

29. Engineers identify key system and component parameters and base conclusions on well-supported information with full consideration of risk to avoid unintended results.

30. Engineers encourage differing opinions and the challenging of positions, considering all opinions equally, when making decisions. They verify facts and differentiate opinions or beliefs stated as facts.

31. Engineers resolve issues by systematically identifying, evaluating and addressing physical evidence, possible and probable causes and applicable operating experience to ensure that all relevant information is considered.

32. Engineers document the bases for technical evaluations and recommendations thoroughly, including conservatisms used for unknown conditions, to enable critical and comprehensive independent reviews and to facilitate informed decision-making.

33. Engineers validate design and analysis inputs and the assumptions used in performing technical evaluations. When engineering judgment is used, the factual bases and the individual's experience are carefully considered. Departures from accepted methods or practices are identified and justified.

34. Engineers perform thorough, critical reviews of work performed by external organisations to verify that all requirements are met, risks are identified and necessary compensatory or contingency actions are implemented.

Technical Authority (EN.2)

Performance Objective:

Engineering managers and personnel recognise and accept their responsibility to address plant technical issues and act to ensure plant operations are conducted in a manner consistent with plant design. They uphold the plant design and licensing bases and ensure a margin of safety is maintained.

Criteria:

1. Engineering personnel are the guardians of plant design and licensing bases. As such, they preserve operating and design margins. Abnormal plant conditions or indications that cannot be readily explained are documented and evaluated to verify the conditions and indications do not challenge design limits that protect plant safety and reliability.
2. Engineering leaders set high standards and reinforce expectations for thorough technical reviews of conditions that potentially deviate from design requirements, or that could reduce operating, design or safety margins.
3. Engineering leaders technically challenge analyses and recommendations to ensure the potential consequences of decisions are clearly defined, understood and communicated. Managers also challenge the thoroughness of engineering judgment used as a basis for decisions and recommendations.
4. Engineering managers advise station leadership and advocate engineering positions on operational and technical matters to ensure balanced and informed decision-making.
5. Engineering managers ensure personnel who perform technical evaluations fully understand their responsibility and personal obligation to perform high-quality technical work.
6. Engineering managers actively participate in issue management forums, such as key plant meetings, to ensure plant conditions and related decisions that can affect design requirements and operating, design or safety margins are identified and evaluated.
7. Engineering managers ensure the organisation understands that technical analyses and decisions are to be consistent with the plant design requirements.
8. Engineering personnel understand relevant significant operating experience and the importance of using this and other job-related operating experience to prevent events.

Equipment Reliability

Equipment Performance (ER.1)

Performance Objective:

High levels of reliability are achieved for equipment that supports nuclear safety, plant reliability and emergency response capability.

Criteria:

1. Engineering and other organisations are aligned to find solutions to equipment problems such that those solutions support plant operational objectives in a thorough and timely manner.
2. High standards for equipment performance and promote intolerance for failures of critical equipment are established. Long-standing equipment issues are identified, prioritised, and addressed in a timely manner.
3. Off-normal conditions are corrected expeditiously to increase system and component margins and reduce the probability of transients.
4. A system and component health approach is used to improve equipment performance and promote high levels of collaboration among Operations, Engineering, Maintenance, and Work Management. This ensures station managers are informed and included in the decision process.
5. Problems with safety-system equipment and components, that operators need to monitor and control the plant, are addressed with the highest priority. Fire protection equipment, emergency response components, fuel-handling equipment, and equipment important to plant reliability are addressed with the appropriate priority.
6. Complex troubleshooting of degraded or failed equipment is executed with engineering involvement to determine and correct the cause of the problem.
7. The causes of equipment failures that impede nuclear safety, reliability, and emergency response are determined; corrective actions are implemented; and subsequent reviews are performed to ensure the actions are effective. This includes the equipment degradation mechanism and programmatic or organisational weaknesses that allowed the degradation.
8. Repetitive equipment deficiencies and trends of degraded performance are identified, analysed and resolved.

9. Temporary repairs on equipment important to safe and reliable plant operation are evaluated, controlled, and tracked until removal. The use of temporary repairs is minimised, and permanent repairs are made at the earliest reasonable opportunity.

Equipment Failure Prevention (ER.2)

Performance Objective:

Preventive and predictive maintenance and performance monitoring are used to prevent failures of equipment important to safety, reliability and emergency response.

Criteria:

Preventive and Predictive Maintenance

1. Engineering and maintenance strategies focus on components and systems that are critical to safe, reliable plant operation. Components are classified as critical based on the relative high importance for maintaining safety system function.
2. Preventive maintenance implementation is a station priority. The station management team monitors implementation, and enforces accountability.
3. The technical bases for preventive maintenance tasks and frequencies are defined, technically supported, documented, and retrievable.
4. First-time preventive maintenance tasks that are past the original performance date and that represent a potential threat to critical component performance are given the appropriate priority during the scheduling process.
5. Preventive maintenance is improved based on operations and maintenance feedback, failure analysis, and internal and industry operating experience.
6. A thorough process is used to review and document the technical bases of deferrals, changes, additions, and deletions of preventive maintenance tasks.
7. Predictive maintenance is used to monitor the condition of equipment important for safety and reliability, detect and trend equipment degradation, and diagnose specific problems in order to prevent equipment failures. Diagnostic equipment and methods are used to confirm the current operating condition of installed equipment.
8. Predictive maintenance technologies such as vibration, thermography, oil analysis, electric motor monitoring, and ultrasonic techniques are used to understand equipment status, data trends and supplement preventive maintenance strategies. These are used to determine an integrated assessment of equipment condition.
9. Refuelling, maintenance, system and forced outages are used as opportunities for the timely improvement of equipment condition. The scope of work to

improve equipment reliability is thoroughly reviewed, defined, scheduled and executed.

System, Component, and Programme Health Monitoring

10. Corrective actions, off-normal conditions, and the associated risks are identified, tracked, documented, and periodically reviewed to ensure managers understand challenges to system, program, and component health. These conditions include latent, degraded, and low margin conditions.

11. Compensatory measures and bridging strategies, such as additional trending and monitoring, are in place for equipment with off-normal or low margin conditions awaiting correction.

12. Internal and industry operating experience and vendor recommendations are reviewed in a timely manner for applicability to prevent equipment failures.

13. Consequential events that could result from equipment failure because of active single-point vulnerabilities that could adversely affect safety or reliability are identified, evaluated, and risk ranked. There is a bias toward eliminating rather than managing the vulnerability.

14. Equipment design and degraded condition vulnerabilities are identified, evaluated, and addressed through modification, maintenance, or other compensatory measures.

15. Off-normal alignments that result in conditional single point vulnerabilities are identified, mitigated, and eliminated.

16. Engineers, operators, and maintenance personnel perform aggregate reviews to identify low-level conditions that singularly or in combination could result in equipment failures, operational transients, and consequential events.

17. Programs for equipment performance monitoring and testing detect degradation and allow corrective actions to be implemented before unanticipated failures occur. Programs are kept current with industry improvements and operating experience to support safe, reliable equipment operation.

18. Engineering, Operations, Maintenance, and other work groups collectively:

    - Monitor equipment performance to prevent unplanned failures and potential cybersecurity impacts. Routine walkdowns of equipment and sharing of equipment performance observations among work groups are methods used to identify equipment problems.

- Monitor plant system and component performance and analyse degrading trends and deviations from expected performance. Aggressive action is taken to understand and resolve unexpected conditions that could adversely affect safety and reliability. Aggregate risk is identified, evaluated, and communicated to station managers.
- Use technical information, such as design information, operating experience, safety analyses, and fundamental engineering principles, to resolve equipment performance problems and technical issues and to provide input to operational decisions.

Long-Term Equipment Reliability (ER.3)

Performance Objective:

Equipment is proactively managed to maintain long-term equipment reliability.

Criteria:

Equipment Life Cycle Management

1. An overall station and corporate strategy integrate business planning and resources into long-range plans for major maintenance activities, component replacements, and design changes to improve equipment reliability.
2. Long-range plans are developed and implemented for major equipment replacement or refurbishment, major maintenance activities, and design changes, to deal with current equipment reliability problems as well as likely future equipment issues.
3. Long-term strategies for equipment vulnerabilities and obsolescence are implemented to minimise significant plant equipment problems, system function loss, and equipment unavailability.
4. Age-related degradation mechanisms are well understood and documented for major components and families of subcomponents such as circuit cards and relays. Equipment monitoring, preventive maintenance, and replacement plans address these challenges appropriately.
5. Engineering personnel are cognisant of generic industry issues and of advances in technology. These issues and advances are reviewed for applicability, and appropriate actions are initiated.
6. Important equipment needed to support plant safety, reliability, or emergency response but not maintained directly by plant personnel (for example, switchyard equipment) is included in life cycle strategies.
7. Industry operating experience and information from industry working groups are considered in long-range planning to maintain and improve equipment reliability.
8. Feedback on equipment performance from operations, maintenance, and other personnel is an integral part of the strategy to maintain long-term equipment reliability.

9. Thorough evaluations are performed before equipment life cycle management changes are made at the end of plant life to ensure that the equipment continues to be maintained to high standards.

Parts Quality and Availability

10. Supply chain personnel work with station organisations to maintain sufficient inventories of equipment and components that support plant reliability and nuclear safety. A spare parts process that defines the criteria for identifying a component as a critical spare should be used to develop a strategy for obsolescence and lengthy lead times that could result in extended out-of-service time.

11. Controls are in place such that inventory is available, is accurate, and is maintained in a serviceable condition. Such controls include but are not limited to environmental and shelf- life controls, in-storage preventive maintenance, and traceability strategies.

12. Supply chain processes are designed, and implementation is coordinated with station priorities, to meet station needs (outage, on-line, and emergent tasks). This includes feedback of material and service status to station management to enable alignment with station requirements and commitments. Measures are in place to monitor and improve the quality of delivered items.

13. Supply chain processes are established for procured parts, materials, and services. Vendors and suppliers are selected and approved based on qualifications and performance.

14. Controls are established to monitor supplier performance, including the proper oversight and intrusiveness at the manufacturing facility, commensurate with the risk significance of the equipment. Performance data and metrics that could have an impact on plant reliability or nuclear safety are trended and promptly communicated back to the supplier to ensure supplier action and continuous improvement.

Materials Reliability (ER.4)

Performance Objective:

Activities are implemented to preserve materials and components in a manner that supports long-term, reliable plant operation.

Criteria:

Material Selection, Inspection, and Assessment

1. Critical materials issues that could hinder reactor vessel and internals or primary system integrity, including steam generators, are understood by station management and are appropriately evaluated, prioritised, and resolved.
2. Components constructed with materials susceptible to long-term degradation are monitored and inspected, and actions are taken to prevent operational failures.
3. Emerging industry issues related to materials degradation and ageing are proactively addressed to ensure safe, reliable operation and to avoid extended shutdowns.
4. Passive components and normally inaccessible equipment, such as heat exchangers, tanks, vessels, safety-related structures, and underground piping, are periodically tested or inspected to assess life expectancy. Ageing mechanisms are defined, and performance evaluated. Degraded conditions are evaluated, risk assessed, trended, and repairs are planned consistent with importance.
5. Industry operating experience and information from technical experts and industry working groups are considered in long-range planning to maintain and improve material and passive component reliability.
6. Material selection and equipment modifications consider plant chemistry and design requirements to minimise corrosion and promote long-term reliable plant operation.

Material Preservation

7. High standards and expectations for plant chemistry are established and achieved such that plant materials are preserved to promote long-term reliable plant operation.
8. Support is provided for monitoring, adjusting, and optimising chemistry controls.

Prompt actions are taken, when required, to resolve adverse chemistry conditions. Chemistry equipment issues are addressed commensurate with importance to preserving plant materials.

9. Large components that are replaced or that undergo extensive maintenance activities are inspected for chemical cleanliness and are cleaned, flushed, and provided proper lay-up, as necessary, to maintain chemistry within limits when equipment is placed in service, to prevent adverse impact to plant material.

10. Engineering, operations, and other station personnel understand the chemistry impacts on plant systems and work with Chemistry to protect and prolong the life of plant materials.

11. Operations, Maintenance, and Chemistry coordinate, schedule, and execute the operation of clean-up systems, filter replacements, and chemical adjustments and proactively communicate anticipated changes in plant conditions such that chemistry controls remain within specification.

12. Proposed changes to reactor coolant chemistry are evaluated for potential impacts on system corrosion rates, fuel corrosion, and safety-related component/system performance and are approved with technical rigor.

13. The source of raw water in-leakage is identified and isolated to minimise chemical impurity ingress into plant systems, including radwaste.

14. Personnel comply with the established standards for controlling consumable chemicals to prevent them from entering plant systems.

15. Deviations from industry and station chemistry standards are approved only after a technical evaluation of the potential system chemistry and materials impact is completed and verified acceptable.

16. Makeup water quality is closely controlled, and equipment is maintained to ensure consistently high quality.

Nuclear Fuel Management (NF.1)

Performance Objective:

Nuclear reactor fuel is operated, handled and stored in a manner to ensure fuel integrity. Fuel design, fabrication, testing and core design activities support high levels of fuel reliability.

Criteria:

Reactor Core Operations and Monitoring

1. Reactor engineering and operations personnel establish thoughtful, deliberate approaches to core reactivity and power changes that maintain margin of operating and nuclear fuel performance limits.
    - Reactor engineering and operations personnel clearly understand reactor core operational characteristics and operating margins.
    - Roles, responsibilities and expectations for the interface between reactor engineering and operations are clearly established and documented. Shift supervisor oversight is provided during testing activities led by reactor engineering.
    - Core prediction tool limitations are well documented in station procedures and are understood by reactor engineering and operations personnel.
2. Reactor engineers are trained and qualified to provide technical support during evolutions that affect the reactor core. High-quality procedures and processes contribute to consistent, sustained high levels of performance.
    - Reactor engineering training ensures reactor engineers meet operations standards during key activities such as interfacing with the control room, performing core monitoring and surveillance, developing fuel or fuel component movement plans and assisting in fuel handling.
    - Reactor engineers understand the expected reactor response and parameter changes for evolutions that affect the reactor core and can clearly communicate their expectations to operations personnel during pre-job and control room briefings. Unexpected conditions are communicated to operations personnel promptly.

- Reactor engineering procedures are detailed and easily followed and human error prevention techniques are incorporated and used.

3. Reactor engineering personnel monitor core performance and analyse deviations from expected performance.

    - Aggressive action is taken to understand and resolve unexpected conditions that could adversely affect fuel performance or core response.

    - Operations and plant senior managers take conservative actions regarding continued reactor operation or return to power, if core parameter limits are exceeded.

4. Radiochemistry parameters are closely monitored to detect and confirm the presence of fuel failures. Action levels are established for restricting power operation and initiating fuel inspections for failed fuel. Failed fuel is not knowingly or intentionally reloaded into the core.

Fuel Performance

5. Station leaders focus the organisation on achieving and sustaining failure-free fuel performance. Individuals understand how their actions can affect fuel performance and consistently act in a manner to maximise fuel reliability.

6. Station personnel execute a strategy for achieving and maintaining failure-free fuel performance. The strategy incorporates a defence-in-depth approach and includes actions to prevent all applicable fuel failure mechanisms.

7. Controls prevent foreign material (debris) from causing fuel-cladding failures. Maintenance practices reduce the opportunity for debris to be introduced into plant systems. Existing debris, that could challenge fuel reliability, is removed from plant systems.

8. Fuel operating guidance is based on vendor recommendations or appropriate analyses and ensures sufficient margin to preclude pellet-clad interaction failures during power manoeuvres.

9. Changes to plant design and operation, fuel management practices and chemistry programmes are evaluated, monitored and controlled to prevent fuel failures. Primary water chemistry controls prevent excessive crud build-up on fuel-cladding surfaces that can lead to accelerated cladding corrosion, changes in core power distribution and fuel failures.

10. Oversight of fuel fabrication activities focuses on critical fuel reliability attributes to ensure that new fuel is free of manufacturing defects that could lead to a fuel

failure. Utility fuel engineers and fuel vendors collaborate to ensure that the fuel design and fabrication processes repeatedly produce fuel assemblies that will not fail, impede control element insertion, or significantly hinder fuel-handling operations. The corrective action process is used to identify, track and resolve problems with fuel design or fabrication.

11. Fuel monitoring and inspection activities assess current fuel performance margins and evaluate the effects of plant changes on fuel performance. Station managers ensure evaluations are performed to understand the cause of failed fuel.

Reload Core Design

12. Reactor cores operate as predicted, without operational challenges such as abnormal core response to reactivity changes or higher-than-expected flux peaks. Core and fuel design changes that could adversely affect reactor response or nuclear instrumentation are identified and communicated before the changes are implemented.

13. Senior management is included early in the core design phase and approval is obtained for significant core and fuel design changes.

14. Risk assessments associated with changes to reactor core design, core component or system chemistry, consider the potential impact on fuel performance and core behaviour. Monitoring and contingency plans are established to address the potential adverse effects of these changes.

15. Reactor core design, fuel assembly design and fuel assembly reconstitution changes are prepared, reviewed and approved using controls consistent with those used to modify safety systems and components.

16. Core design and fuelling assumptions and analyses are documented and changes to these assumptions and analyses are appropriately reviewed to identify potential effects on other analysis or plant operations.

17. An interface with fuel vendors is established and oversight is provided for vendor core design and fuel fabrication activities. Periodic reviews of changes to vendor design and manufacturing processes, the adequacy of vendor sharing of internal operating experience and the effectiveness of vendor self- assessment and corrective action processes are conducted.

18. The neutronic, thermal-hydraulic and mechanical stability of new fuel designs is validated and confirmed through fuel vendor testing, lead fuel assembly

performance, detailed evaluation, or the implementation of comprehensive performance monitoring plans.

19. Roles and responsibilities of groups involved in core design and fuel reload analyses are established and communicated. These groups may include core design personnel, fuel engineers, reactor engineers; and chemistry, operations and training personnel.

Fuel Storage and Usage

20. High standards are established for storage of irradiated and new fuel. While in wet or dry storage, reactivity controls and heat removal rate requirements are maintained within the design of the storage location. Neutronic and thermal-hydraulic analyses demonstrate that proper fuel design limits are maintained during all other special configurations, such as fuel cleaning, vacuum sipping and cask loading evolutions.

21. Approved fuel movement plans are used to control, monitor and verify core loading, cask loading and other fuel movement operations.

22. Risks associated with not having full core offload capability are identified, understood by managers and considered in decision-making. Inspection and maintenance activities to ensure safe, reliable plant operation are not delayed because of inadequate fuel storage capability for full core offload.

23. Irradiated fuel integrity is protected from losses of fuel pool cooling and inventory that may result from external events or siphoning. Diverse methods are available for timely restoration of inventory and cooling to irradiated fuel.

24. Risk assessments are performed when special core uses, such as isotope production, are considered. The operational effects of performing these activities – such as handling, storage and shipping activities – are considered and managed to minimise additional personnel exposure.

25. Special nuclear material control and accountability programmes are implemented to maintain complete, accurate and current material history and inventory. This material includes detectors stored before or after use for reactor monitoring.

Fuelling Activities (NF.2)

Performance Objective:

Fuelling activities, including fuel, cask and reactor component handling and maintenance, are planned and controlled to ensure the integrity and proper assembly of all components.

Criteria:

1. Fuelling activities are not fully delegated to supplemental work groups and station personnel provide oversight of supplemental workers involved in fuelling activities.
2. Procedures and work instructions used in fuelling operations provide accurate and complete technical information that can be followed in accordance with station procedure adherence standards.
3. Critical steps, defined as those actions that could produce irrecoverable actions, are identified in procedures and work instructions as they pertain to maintaining reactor components, core alterations and other fuelling activities. Appropriate error reduction techniques are used during task performance to ensure critical steps are performed correctly.
4. Infrequently performed tests or evolution controls are used when appropriate.
5. The level of detail provided in technical procedures and work instructions is assessed to ensure it is commensurate with the workers' knowledge level. When necessary, specific training is provided on implementing procedures before execution, particularly when fuelling work crew composition changes significantly.
6. Management identifies undue distractions to work performance and oversight and takes mitigating actions. Personnel experience, concurrent activities and environmental and equipment conditions are factors that management should assess.
7. New processes and techniques are pursued to improve fuel, core, cask and reactor component handling, disassembly, assembly, inspection and repair.
8. Equipment used to support fuelling activities, fuel inspection and reactor vessel and internal manipulations or inspections, is maintained and tested to ensure it performs reliably and does not present a source of foreign material intrusion.

9. Controls are in place for all fuel-handling activities such as shipping fuel, fuel components and fuel inserts; and for performing fuel inspections, fuel cleaning, vacuum sipping and cask loading evolutions. Included are controls to ensure the appropriate plant conditions exist prior to performance of fuelling activities.
10. Fuelling activities are planned and performed consistent with a foreign material prevention philosophy, to maintain integrity of fission product barriers.
11. Station managers establish methods to promote teamwork among the refuelling crews. The roles and responsibilities of the fuelling senior reactor operator, or fuelling activity coordinator, are clearly defined and understood by all involved in the evolution.
12. Station and cognisant supplemental personnel assist in the development of work instructions and procedures. They also provide feedback to planners and supervisors in post-job critiques and use the corrective action process to identify improvements to fuelling activities.

Configuration Management

Design and Operating Margin Management (CM.1)

Performance Objective:

Design and operating margins are understood, considered in decision-making and maintained consistent with design and regulatory requirements and operational constraints.

Criteria:

1. Existing plant conditions, or operating practices that potentially create low design or operating margin, are evaluated and dispositioned in a manner commensurate with the related risk.
2. New operating experience indicating a potential challenge to the basis for design or operating margins, such as a significant environmental event or common mode equipment failure, is evaluated for applicability. Modifications, changes in operating practices, revised analyses, or short-term compensatory actions, are implemented to address newly identified risks to safe and reliable plant operation.
3. Degraded conditions that reduce design or operating margins for systems and components important to nuclear safety and reliability are identified, evaluated in aggregate, understood, mitigated when necessary and resolved.
4. The effects of planned design and operational changes on margins are identified, evaluated and documented before the changes are approved for implementation. The potential impact on plant operation, safety and reliability is evaluated when margins are reduced.
5. The operational impact of reduced margins is communicated to decision-makers, including plant operators and managers.
6. Station managers, including operations personnel, are involved with decisions that potentially reduce margins and affect safety and reliability. Engineers advise on those decisions.
7. Engineering calculations and analyses address design and operating margins and the bases for the margins.

8. Engineering programmes, testing and predictive and preventive maintenance activities confirm that system and component design and operating margins are not degraded.

9. Design and operating margins are evaluated as a part of plant life extension preparations. Passive components are considered to ensure that plant reliability and safety margins are maintained during the life extension period.

10. Credible beyond-design-basis events are identified and evaluated. Contingencies such as operational coping strategies have been developed to mitigate consequences of each event. When necessary, modifications are implemented to improve station coping capability. Required emergency response equipment is verified available and ready for use and personnel are trained and qualified to perform required mitigating actions.

Operational Configuration Control (CM.2)

Performance Objective

Plant operation, maintenance and testing activities are conducted in a manner consistent with the licensing and design bases and maintain configuration control.

Criteria:

1. Conditions that could result in structures, systems or components being outside of operating and design requirements are evaluated and resolved on a schedule commensurate with the importance to safety and reliability. Special consideration is given to conditions that may challenge design bases or safety analyses.
2. Engineering evaluations for degraded components or systems validate inputs and assumptions and consider relevant issues such as multiple functions and impacts on other equipment or emergency response.
3. Procedure controls are in place to maintain the plant configuration consistent with design requirements and assumptions. These controls are kept current and are used during normal operation, tests and infrequent evolutions. Controls are also in place to maintain and protect the configuration of digital assets that may have special requirements, such as those relating to cyber security.
4. Process controls are in place for temporary equipment installations, such as scaffolding and material staged in the plant, to ensure equipment design functions are not impaired.
5. The bases for emergency and abnormal operating procedures are documented and controlled. Time- critical operator actions include consideration of adverse work environments, are assessed for aggregate impact and are periodically validated. Operator proficiency is maintained through training.
6. Activities that affect the status of systems and equipment, including out-of-service time, are controlled such that the plant configuration is consistent with design requirements and conditions assumed in safety analyses and probabilistic safety assessments.
7. Processes are in place to formally communicate technical information and recommendations regarding configuration control changes to the plant operating personnel.
8. Documents and software used to operate, design and maintain plant equipment are controlled and updated as changes are made through operating licence

amendments, plant modifications, calculation revisions, vendor manual updates and other change processes. The plant simulator design is maintained consistent with the plant as it is modified.

9. The physical configuration of the plant is consistent with procedures, drawings and other controlled documents. Critical drawings that operations personnel use are maintained current. Other design documents are revised in a time frame that supports proper plant operation after configuration changes are made.
10. Changes to vendor manuals are reviewed by engineering personnel and are incorporated into station implementing procedures.
11. Equipment configuration and performance capability, as well as passive design features, are confirmed through plant activities including walkdowns, testing and field observations. These activities are also used to detect degraded system and component conditions, such as excessive gas accumulation in piping systems.
12. First-of-a-kind or infrequent projects, complex modifications, infrequently performed tests and evolutions and emergent conditions with significant reduction in operating and design margins, are appropriately assessed with the degree of risk.
13. Action plans for eliminating, minimising or mitigating risks are specific, measurable, achievable, realistic and timely. Changes to actions or plans are communicated and approved by appropriate management levels and/or decision making forums.

Design Change Processes (CM.3)

Performance Objective:

Changes to plant configuration, design and licensing bases are evaluated, controlled, tested and implemented while consistency is maintained among the physical plant configuration, design and licensing requirements and the documented plant configuration.

Criteria:

1. The design authority is clearly identified and authorises all plant design changes through a system of controls. Roles, responsibilities and processes for developing, reviewing and approving design and license bases changes are clearly defined and followed.
2. Processes used to maintain consistency among the physical plant configuration, design and licensing requirements and the documented plant configuration are clearly defined.
3. Engineers identify and address all design requirements, codes, standards and inputs during the development of a design change, including consideration of emergency response capability and the effects on plant operation. Design change options are considered to identify the best option that meets all requirements.
4. The potential impact on nuclear safety must be assessed, including the impact on operational risk and the probabilistic safety assessment during design changes. Completed design changes are incorporated into the plant probabilistic safety assessment.
5. Design calculations, drawings, analyses, procurement specifications and other design documents are readily retrievable and clearly describe the bases for the form, fit and function of plant systems, components and passive design features.
6. Clear linkage exists between design requirements, related operating requirements, license requirements and design calculations.
7. Interdisciplinary reviews of proposed design and temporary configuration changes are performed to verify the technical suitability and functionality of resulting modifications. The reviews also verify the constructability and maintainability of the modified equipment.
8. Design change impact reviews are performed to identify required changes to procedures and training.

9. Modifications are tested to verify design requirements and assumptions are met and the design change intent is achieved. Testing addresses component and system interactions during all potential operational modes. Risks associated with potential design or installation errors are taken into account when testing scope is determined.

10. Procedures, drawings, training lesson plans and related documents are updated promptly by the responsible departments following configuration change implementation.

11. Temporary configuration changes, including temporary modifications to equipment, satisfy existing operating and design functional requirements. These design changes are prepared, reviewed, approved, installed and tested in a manner similar to permanent modifications.

12. Temporary configuration changes are reviewed periodically to verify that the changes are still needed; and timely actions are taken to remove such changes, typically within one operating cycle.

13. Equivalency evaluations ensure that part replacements do not adversely affect the design functions of systems, components and structures. Critical design and operational characteristics, including system response effects, are identified and evaluated. Changes in characteristics are thoroughly analysed, documented and validated through testing, when necessary and are approved before the part is placed in service.

14. Engineering design changes are developed with appropriate consideration of possible failure modes and effects. Risk management, considering both the possible consequence and the probability of occurrence, is used to determine if proposed changes need additional review.

15. Roles and responsibilities for design activities performed by supplemental personnel are clearly defined, including station support duties. Interface and oversight requirements for supplemental personnel are established to provide appropriate input and support for engineering product development. Engineering products provided by supplemental personnel receive challenge reviews or acceptance testing to demonstrate acceptable performance before implementation.

16. System and component digital design changes, inclusive of those developed to meet cybersecurity requirements, have controls that address the unique characteristics of digital equipment. This includes controls for specifications,

software, human factors engineering, vendor interfaces, testing, validation and failure modes and effects analysis.

Project Management

Project Management (PM.1)

Performance Objective:

Projects are selected, planned and implemented with predictable quality and resources that improve materiel condition to maintain safe and reliable plant operation.

Criteria:

Project Selection and Initiation

1. Plant problems and opportunities are clearly identified for potential projects and prioritised based on the importance to operational priorities, effective emergency response and improved materiel condition to maximise safe and reliable operations.
2. Plant or system designs that, during implementation, create increased operational risk or that result in reduced plant stability during normal operational or maintenance activities are identified and prioritised for project consideration.
3. Station managers evaluate proposed alternatives for projects and select alternatives based on technical merit, resource requirements, durations, project risk and lessons learnt from similar projects.

Project Resources

4. Project managers and supervisors are knowledgeable and well integrated with station programmes, processes and procedures for developing, scheduling, coordinating and executing work to high standards.
5. Project managers and supervisors provide intrusive oversight of project personnel to ensure quality craftsmanship and to maintain nuclear safety during work execution.
6. Station and supplemental personnel are identified and mobilised in sufficient time to be trained and qualified to support project work activities.
7. Material resources are identified, ordered and received with sufficient time to identify and adjust for problems or deficiencies with the materials provided.

8. Project sponsors are engaged as senior advocates throughout, addressing issues that may be beyond the project manager's or team's influence.

Project Planning and Implementation

9. A structured project management process is established, communicated and implemented to produce expected results in safety, quality, scope, schedule and resource performance. Project scope is at the level of detail necessary to support the identification of all project work. Project team members are assigned based on project needs.

10. Project risks are assessed throughout the project and are prioritised relative to probability and consequence. Actions plans are developed, budgeted and implemented to mitigate risks.

11. Expedited projects contain additional controls to reduce the likelihood of error, mitigate risks and address inefficiencies.

12. Project performance relative to safety, quality, scope, schedule and resources, is monitored and communicated frequently to ensure the project meets high expectations.

13. Project personnel monitor the progress of changes to training, procedures and other documentation that are developed through the implementation of the modification process, to ensure project milestones are supported.

14. Project activities are integrated with station on-line and outage schedules. Preparation milestones provide necessary information for on-line and outage scheduling to ensure that necessary work is identified and assigned and that resources are accounted for. This includes installation, testing and return-to-service activities.

15. Revisions to project plans are managed, communicated and reviewed for risk. Revisions are assessed for effects on schedules and interface activities.

16. Project stakeholders are engaged in and demonstrate ownership of the development and execution of project implementation schedules.

17. Testing is developed and performed to demonstrate the expected equipment and system performance.

18. Controls are established to ensure that all configuration requirements, contract obligations and project closure actions are completed.

19. Project critiques are performed with the project stakeholders upon project completion. Improvement actions and good practices are identified, documented, tracked to completion and communicated, both internally and externally.

Fire Safety

Fire Safety (FS.1)

Performance Objective:

Station leaders and personnel are aligned to ensure high standards of fire safety are implemented and maintained.

Criteria:

1. Senior managers uphold high standards and expectations and reinforce behaviours that promote excellence in fire safety.
2. Personnel maintain high personal responsibility for:
    - Preserving fire barriers, fire doors, and respecting area limits for fire loading and transient combustibles
    - Prompt reporting of fire safety incidents and deficiencies
    - Coaching co-workers or correcting conditions where substandard Fire Safety behaviours and standards are identified
    - Ensuring building fire escape and evacuation routes are clear from obstruction
3. Fire safety is embedded in the scope of relevant safety committees. They promote and reinforce the importance of Fire Safety to safe nuclear operations.
4. Managers promote Fire Safety by monitoring and coaching workers to improve Fire Safety performance. They actively communicate with the workforce, enforce established standards and are held accountable for the industrial safety performance in their work groups.
5. Managers provide the resources, training and equipment needed to implement the organisations fire safety expectations.
6. Personnel, including supplemental workers, understand what is expected of them regarding Fire Safety and perform work in accordance with established

Fire Safety standards and expectations. They are accountable for their behaviours and actions related to industrial safety.

7. Personnel receive fire safety training appropriate for their responsibilities.
8. Prior to work, personnel ensure that the appropriate warnings and barriers for Fire Safety are in place for their safety, the safety of others, and to protect the plant. This includes ensuring that equipment is in a safe condition and that appropriate permits and permit requirements are in place.
9. Personnel use the appropriate tools and protective gear for the work being performed in areas with risk of explosion or fire.
10. Materials and equipment in work areas are stored and controlled in accordance with fire safety standards. Transient fire loads are effectively managed and minimised, and the storage of chemicals prevent flammable or explosive interaction.

Fire Protection

Fire Protection (FP.1)

Performance Objective:

The fire protection programme is implemented to provide a high degree of protection to the plant and personnel by preventing, detecting, controlling and extinguishing fires. Design features and programme controls protect structures, systems and components to prevent significant plant damage and operational challenges and maintain safe shutdown capability.

Criteria:

Organisation, Programme Requirements and Responsibilities

1. Goals, standards and expectations for Fire Protection are clearly defined and thoroughly understood. Performance measures are established and are used to facilitate continuous improvement.
2. Fire protection programme management, organisational responsibilities and authority are clearly defined. A high level of ownership and accountability for programme management is maintained.
3. Resources are allocated appropriately to achieve programme objectives.
4. Programme managers are engaged with fire protection personnel and programme attributes and they provide proper oversight of activities.
5. Fire protection is integrated into station planning processes, including the work control and engineering design change processes. Plant modifications are designed and installed as needed to improve fire safety.

Fire Prevention

6. Administrative controls are established to minimise fire hazards throughout the station.
7. Combustible materials and ignition sources are managed properly to minimise the potential for fire ignition and spread. Non-combustible alternatives are used when appropriate.
8. Flammable materials are controlled and contained to minimise fire potential.
9. Ignition sources such as hot work and temporary electrical equipment are controlled to minimise fire potential.

10. The Storage and management of chemicals is subject to rigorous fire safety risk assessments, compatibility guidelines are robustly adhered to with regular checks carried out by authorised and trained personnel.

11. In-service operational equipment is monitored for degrading conditions, such as overheating and flammable fluid leaks, that could cause a fire, before a fire situation occurs.

Fire Response

12. A well-equipped fire brigade is able to respond to, control and extinguish fires rapidly and to protect plant equipment needed to safely shut down the plant.

13. Fire fighters have a thorough understanding of fire-fighting fundamentals. Knowledge of risk- significant plant systems, structures and components is integrated into the fire response team.

14. Fire response activities are well coordinated and integrated into the organisation.

15. Appropriate fire-fighting equipment is readily available and is well maintained.

16. Fire drills are used to ensure fire fighters are fully capable of dealing with actual fires.

17. Offsite resources are prepared to respond to station fire events, if needed.

Design Features and Equipment Management

18. Active and passive fire protection features and equipment – including those for detection, barriers and suppression – are designed, installed, maintained and tested periodically to verify the capability of mitigating fire events.

19. The design of fire protection features provides early detection, includes compartmentalisation and barriers to minimise the potential for fire to spread and ensures protection for important plant equipment.

20. The aggregate impact of impaired fire protection features and equipment is assessed such that design defence-in-depth is not compromised.

21. Preventive maintenance programmes are established to prevent unplanned failures and improve long-term fire protection equipment reliability.

22. Compensatory measures are established and tracked to ensure degraded fire protection equipment functions are mitigated.

23. Ageing and obsolescence of fire protection features and equipment are addressed.

Fire Protection Personnel Knowledge and Skills

24. Fire protection engineering personnel possess a detailed knowledge of fire protection design and analysis.

25. Fire protection personnel possess sufficient knowledge and skills for maintaining fire protection equipment.

26. Fire fighters are trained on fire-fighting fundamentals, tactics, incident command responsibilities and important plant equipment that must be protected. Qualifications are maintained current for all fire brigade members.

Fire Hazard and Risk Analyses

26. Fire hazard and risk analyses are performed consistent with licensing requirements and industry standards.

27. Fire protection features are designed and configured by personnel who possess a thorough understanding of the hazards the features protect.

28. Fire hazard analyses and fire protection design bases are documented and retrievable.

29. Fire protection equipment and structures are maintained in a condition consistent with design requirements and analyses.

30. Programmes and processes incorporate fire risk insights.

Programme Assessments and Investigations

31. Audits, benchmarking, industry operating experience, and self-assessments are proactively used to identify shortfalls and improve fire safety.

32. Managers routinely observe fire protection activities to monitor performance.

Safe Shutdown after a Fire

33. Safe shutdown strategies and procedures are exercised to ensure safe shutdown can be achieved.

34. The feasibility of safe shutdown actions is routinely validated.

35. Operator training provides the required knowledge and skills necessary to achieve safe shutdown.

36. The equipment necessary to achieve safe shutdown is readily available.

Radiological Safety

Radiological Safety (RS.1)

Performance Objective:

All personnel are aligned to minimise dose, reduce source term and implement controls for radioactive contamination and materials.

Criteria:

1. A radiological safety programme with specific objectives and clearly defined policies, procedures and responsibilities is developed and implemented.
2. Senior managers uphold high standards and expectations and reinforce behaviours that promote excellence in radiological safety.
3. A senior manager, such as the site vice president or plant manager, chairs ALARA committees and challenges boards to achieve a high level of radiological safety.
4. Senior managers develop and implement long-range dose and source term reduction plans to reduce individual and collective radiation dose to as low as reasonably achievable. Long-range planning processes include the development of station and department collective dose goals and actions needed to meet these goals.
5. Managers set challenging individual and team dose goals and supervisors monitor radiological performance. Shortfalls in meeting expectations are evaluated and addressed promptly.
6. Supervisors ensure that supplemental personnel who perform work in the radiologically controlled area maintain the same standards as the plant personnel and are verified to have the specialised skills, training and qualification for the tasks they perform.
7. Personnel are held accountable to follow written and verbal radiological protection instructions and maintain continuous awareness of radiological conditions.
8. Station workers understand the radiological aspects of their work and take ownership for improving radiological safety.
9. Personnel incorporate source term, dose reduction, contamination control and radioactive material control techniques into daily activities. They minimise

radiological risks by reducing or eliminating high radiation areas and contaminated areas.

10. Personnel take a conservative approach in response to changing plant conditions and changes in work plans or work scope that could affect radiological conditions. Personnel do not enter areas until radiological conditions have been established.
11. Personnel identify high-risk radiological tasks early in the work planning process and prepare plans to minimise radiological risk and potential consequences.
12. Work management personnel schedule and sequence work to minimise dose and the spread of contamination.
13. Personnel report, contain and repair leaks from radioactive systems promptly.
14. Personnel store radioactive material safely in designated areas. Container integrity and conditions are maintained properly and are periodically monitored.
15. Project managers include radiological protection personnel in the planning and implementation of high-risk activities such as radiography, radiological area diving and the movement of irradiated components, to ensure proper radiological oversight.
16. Engineers promote radiological safety and dose reduction when preparing plant modifications.
17. Dose reduction benefits are included in project cost/benefit analyses.
18. Operations, chemistry and outage planning personnel develop and implement strategies for normal operations, shutdowns and start-ups to reduce radiation source term. These include the following:
    - Operating the plant to control crud bursts
    - Optimising and enhancing clean-up capabilities for primary systems
    - Maintaining system chemistry within specifications
    - Implementing a comprehensive outage water management plan
19. Operators notify radiological protection personnel prior to changing plant conditions or operating systems that could affect radiological conditions in the plant.

20. Operating and maintenance procedures contain hold points, prior to steps that could change radiological conditions, to ensure qualified radiological protection personnel provide support as needed.

Radiological Protection

Radiological Protection Fundamentals (RP.1)

Performance Objective:

All personnel who perform radiological protection activities apply the essential knowledge, skills, behaviours, and practices needed to implement those activities such that worker and public health and safety are protected.

Criteria:

Knowledge and Skills

1. Personnel acquire and maintain the knowledge and skills to perform assigned radiological protection activities. Personnel obtain and maintain qualifications for the functions they perform.
2. Personnel understand the capabilities and limitations of radiological protection instruments used for personnel, material, and area surveys.
3. Personnel understand radiological principles necessary for, and the risks related to, the work to be performed.
4. Personnel understand the radiological aspects of plant system operations for both normal and abnormal conditions.
5. Personnel understand the importance of documenting radiological information details.
6. Personnel understand relevant radiation protection significant operating experience and the importance of using significant and other job-related operating experience to prevent events.

Monitoring and Communicating Radiological Conditions

7. Personnel conduct and document radiation and contamination surveys with the detail necessary to depict work area conditions accurately.
8. Personnel update area postings and radiological instructions as necessary to reflect current conditions.
9. Personnel select and use the appropriate radiological instruments for the task. They select instruments based on the type and expected quantity of radiation expected. To confirm that instruments are calibrated and are in good working order, they perform required source and pre-use checks.

10. Personnel monitor materials and equipment for release from radiologically controlled areas to control contaminated materials and to prevent the inappropriate release of radioactive material.

11. Personnel identify, contain, and track leaks from contaminated systems to prevent the spread of contamination to areas and personnel.

12. Personnel monitor for airborne radioactivity using installed, portable, and personal air samplers as appropriate for the task.

13. Personnel monitor to identify all types radiological hazards, including potential contributors to internal and external dose.

14. Personnel monitor work activities closely for changing and unanticipated radiological conditions.

Controlling Radiological Work

15. Personnel approve, properly post, and appropriately maintain radioactive material storage areas. Access to the storage areas is controlled to prevent inadvertent entry.

16. Personnel perform their work and ensure others perform work in accordance with approved procedures, radiological plans, and radiation work permits.

17. Personnel model correct behaviours by using personal protective clothing, respirators, and dosimetry as prescribed. They also ensure that other workers comply with these requirements.

18. Personnel verify that dosimetry is appropriate for the work expected and is worn properly and that alarm setpoints provide early warning of unexpected or changing conditions.

19. Personnel use multiple controls and barriers to prevent unplanned dose events.

20. Personnel maintain radiologically controlled areas clean and free of contamination to the extent practicable.

21. Personnel oversee and assist in the contamination monitoring of personnel exiting from radiologically controlled areas, to prevent the release of contaminated personnel or radioactive materials.

22. Personnel use engineering controls, such as high-efficiency particulate filtration units, decontamination, and containments, to minimise the spread/release of airborne radioactivity and the spread of contamination.

23. Personnel use engineering controls such as shielding, robots, long-handled tools, and remote monitoring to limit worker dose.

24. Personnel maintain reliable equipment for off-site monitoring and verify that testing and calibrations are performed at appropriate periodicities.

25. Personnel routinely monitor, challenge, and coach radiation workers to verify the radiation workers understand radiological conditions and precautions.

26. Personnel use approved techniques when performing personnel and area decontamination activities.

Managing Radiological Risks

27. Personnel, through decisions and actions, demonstrate a commitment to radiological safety. They prioritise radiological safety over production. Actions include the use of stop work authority when faced with uncertain or unexpected plant radiological conditions, to protect workers and the environment.

28. Personnel provide input to radiological safety policies and ensure the effectiveness of radiological controls.

29. Personnel anticipate and question conditions that are out of the ordinary or unexpected or that could result in unplanned dose or contamination.

30. Personnel have a low threshold for identifying and addressing radiological risk.

31. Personnel identify, document, communicate, and correct potential radiological issues.

Conduct of Radiation Protection (RP.2)

Performance Objective:

Radiation protection programs, processes, and activities are implemented in a manner that promotes sustained high levels of health and safety for workers and to the public.

Criteria:

Radiation Dose Control

1. Procedures and quality control programs are used to verify that individual internal and external dose is determined accurately and is tracked.

    - Radiological standards provide guidance for the accurate determination and control of the radiological hazard from radiation to minimise external and internal radiation exposure.

    - A process is established for determining the radionuclide composition of intake (real and potential) and is used for internal dose calculations.

    - Traceable standards, reflecting the radionuclide composition of the station source term, are used to calibrate radiation detection equipment.

    - Counting room equipment and internal monitoring equipment such as whole-body counters are calibrated to accurately identify and quantify isotopes that may be present.

    - Procedures are in place to accurately determine dose using in-vitro methods. The capability should exist, either on site or off site, to analyse for alpha- and beta-emitting radionuclides such as transuranics, tritium, and strontium/yttrium 90 using in-vitro measurements.

2. Radiation work permits, ALARA plans, and work packages establish and communicate radiological protection requirements and engineering controls for optimising dose.

    - Work is planned to minimise total effective and equivalent doses to the worker from both internal and external sources.

    - Radiological standards require that controls, such as continuous coverage, timekeeping, and planning, are used for tasks for which personnel could be exposed to high dose rates or doses.

- Engineering controls, such as shielding and the use of equipment to maximise distance and minimise time in the area, are employed to reduce total dose.

3. Radiological procedures specify posting and control requirements for high radiation areas to prevent inadvertent entry. Access to these areas is controlled through administrative and physical barriers.

4. Controls for high-risk work activities, including radiological diving, radiography, and work with irradiated materials and sources, are specified to avoid inadvertent exposure.

5. A formal method is established to provide accurate radiological information to workers before they enter radiologically controlled areas. Controls are also in place to ensure workers are notified of changing radiological conditions.

6. A dose improvement programme is maintained to limit individual and collective radiation dose to as low as reasonably achievable.

    - Challenging dose goals are established for individual activities, functions, and groups, as well as for the station.

    - Radiological protection personnel work with other station groups to identify and implement radiological source term reduction initiatives.

    - Radiological protection personnel help work groups develop innovative approaches to reduce collective dose.

    - Station managers are held accountable for meeting dose goals.

Radioactive Contamination Control

7. Whole-body contamination monitors with sufficient beta and gamma-sensitivity are used at the egress of radiologically controlled areas to monitor for personnel contamination.

    - For satellite areas, where it is not feasible to install whole-body contamination monitors, a hand and foot frisk is performed as a minimum, followed immediately by monitoring at the nearest whole-body contamination monitor.

    - Personnel contamination monitors are set to detect and alarm at a minimum radioactivity level consistent with current industry guidelines.

    - Personnel pass through a gamma-sensitive monitor at the primary radiologically controlled area exit points and again prior to exiting the

plant protected area to avoid unexpected contamination spread into and then out of the plant protected area. Vehicles also pass a vehicle contamination monitor prior to exiting the radiologically controlled area.

8. Radiological protection personnel prescribe the correct engineering controls and personal protective clothing to minimise the number of personnel contamination events. Personnel contamination events are evaluated and trended. Corrective actions are implemented to improve performance.

9. Radiological protection managers and plant managers are actively involved in any decisions to release personnel or equipment from the radiologically controlled area if normal contamination monitors cannot be cleared.

10. Areas, equipment, materials, tools, and other items are monitored with instruments able to detect radioactive contamination at or below levels described in current industry guidelines.

11. Contamination controls are employed for areas, equipment, materials, tools, and other contaminated or potentially contaminated items.

12. Contaminated or potentially contaminated areas are surveyed routinely to ensure appropriate contamination controls are in place. Areas outside of radiologically controlled areas are surveyed periodically to verify that no detectable contamination is present.

13. Accurate, timely information on contamination levels and on protective measures specified for entry is provided to personnel entering contaminated areas.

14. Contamination is controlled at the source to minimise its spread. Plant areas are accessible without the need for personnel to wear protective clothing to the extent practicable.

15. Blowers, fans, ventilation units, and vacuum cleaners are controlled to prevent the spread of contamination.

Radioactive Material Control

16. Monitoring and controls are in place to prevent uncontrolled or unmonitored release of radioactive material from radiologically controlled areas.

17. Radioactive materials are handled properly and are stored safely in designated areas.

- Container integrity and conditions are maintained to prevent the spread of contamination.
- Packages and containers are properly identified and labelled.

18. Volume reduction techniques, including decontamination, compaction, and incineration or concentration, are used to minimise radwaste volumes.
19. Work activities are planned and conducted in a manner to minimise solid radioactive waste generation.
20. Appropriate controls are used when radioactive material containers are opened in non-radiologically controlled areas for special situations, such as security inspections.
21. Radioactive sources are inventoried and controlled.
22. Detailed procedures and training are provided to personnel involved in shipping and receiving radioactive material.
23. Controls are in place to ensure that radiological shipments are properly prepared and surveyed. Methods are specified to ensure that shipping packages and containers are secured to minimise the shifting of radioactive material during transport.
24. Radiological protection managers have a process to limit or control the storage of radioactive materials outdoors. Procedures are developed and implemented to ensure that the containers are secured to prevent release of contamination to the environment in anticipation of harsh environmental conditions.

Industrial Safety

Industrial Safety (IS.1)

Performance Objective:

High standards are maintained for industrial work practices and the work environment to achieve high levels of personnel safety.

Criteria:

1. An industrial safety programme with specific objectives and clearly defined policies, procedures and responsibilities is developed and implemented.
2. Safety committees are established that include participation by personnel at all levels of the organisation.
3. Managers provide the resources, training and equipment needed to implement the organisation's industrial safety programme properly.
4. Leaders promote industrial safety by setting strategic goals and objectives and by monitoring and coaching workers to improve safety performance. They actively communicate with the workforce, enforce established standards and are held accountable for the industrial safety performance in their work groups.
5. Personnel understand what is expected of them regarding industrial safety and perform work in accordance with established industrial safety standards and expectations. They are accountable for their behaviours and actions related to industrial safety.
6. Supplemental personnel are accountable to the same (or equivalent) standards as utility personnel. A communication process is established to ensure supplemental workers understand industrial safety standards and performance expectations. Service contracts include industrial safety requirements; and the selection of a supplier is, in part, based on an evaluation of the supplier's ability to deliver the product or service safely.
7. Personnel receive training to acquire the necessary skills and knowledge to perform work in a safe manner. Initial and continuing training topics include industrial safety programme requirements, protective clothing and equipment use and hazard recognition and mitigation to prevent injuries.

8. Industrial safety is integrated into station planning processes, including the work control and engineering design change processes. Plant modifications are designed and installed as needed to improve personnel safety.

9. Permanently installed and portable safety equipment – including fume hoods, safety showers, eyewashes and fire protection equipment – is maintained, inspected and tested periodically to confirm it is readily available and functions properly.

10. Personnel protective equipment and clothing – including items such as respirators, safety harnesses, fire-rated clothing, hard hats and work gloves – are available, stored appropriately, maintained and inspected prior to use.

11. Personnel select the correct safety equipment for the task. Personal protective equipment and other safety equipment are used appropriately.

12. Prior to work, personnel ensure that the appropriate warnings and barriers to injury are in place for their safety and the safety of others. This includes ensuring that equipment is in a safe condition and that appropriate permits and permit requirements are in place.

13. Personnel select and use the appropriate tools for the work being performed.

14. Materials and equipment in work areas are stored and controlled to maintain safe housekeeping standards and minimise the potential for injuries.

15. Bulk chemicals, compressed gases, corrosive agents, organic chemicals and cleaning agents are labelled properly and are controlled and handled consistent with the hazard classification and safety data sheets to prevent improper use and to protect personnel.

16. Safety hazards are identified and reported using appropriate station programmes, such as the corrective action process, so they are visible to both workers and managers. Hazards are evaluated in a timely manner and actions to mitigate or correct hazards are developed and given the appropriate priority.

17. All injuries and near-miss events are reported and evaluated, as appropriate. The causes and corrective actions of investigations are communicated as appropriate to reduce the potential for repeat events. Corrective actions are developed to prevent recurrence and improve the industrial safety programme.

18. Individuals proactively report low-level incidents, coach co-workers and correct conditions when substandard behaviours or conditions are identified.

19. Benchmarking, self-assessments and audits are used to evaluate and improve industrial safety and performance.
20. Industry operating experience is reviewed regularly and is used to improve performance and the industrial safety programme.

Emergency Preparedness and Severe Accident Management

Emergency and Severe Accident Preparedness Leadership (EP.1)

Performance Objective:

Leaders align the organisation to prepare for and respond to emergencies and severe accidents, mitigate plant damage, achieve a long-term safe stable state and protect the health and safety of onsite personnel and the public.

Criteria:

Management and Leadership

1. Senior managers establish and reinforce high standards and expectations for emergency preparedness/response and severe accident management. The station personnel are held accountable for meeting these standards and expectations. Shortfalls in meeting these standards and expectations are evaluated, understood and addressed promptly.
2. Managers actively support emergency preparedness and severe accident management by participating as emergency response managers, providing oversight of emergency planning and preparedness activities and maintaining cooperative relationships with offsite authorities that have emergency responsibilities.
3. Managers ensure on-shift and augmented emergency response and severe accident management positions are fully staffed with trained, qualified and knowledgeable personnel.
4. Managers take responsibility for the qualification of the personnel involved in emergency response and severe accident management and use training to improve performance.
5. Personnel identify and promptly report deficiencies, near misses and precursor events related to emergency response and severe accident management (SAM). Managers encourage the identification of opportunities for improvement by rewarding and publicising good catches, thereby contributing to a low-threshold reporting culture. Managers take action and use station processes to resolve emergency and severe accident preparedness issues within their technical areas.
6. Managers ensure that station equipment important to emergency response and severe accident management is maintained, using the work management process.

7. Managers ensure equipment important to emergency response and severe accident management, which is maintained by offsite response organisations, is integrated into the station emergency and severe accident response programmes.

Emergency and Severe Accident Response Organisation and Interfaces

8. Roles and responsibilities for all personnel and departments involved in emergency preparedness/response and severe accident management are clearly defined, documented and communicated.

9. Managers ensure that sufficient on-shift personnel are available and are capable of carrying out emergency and severe accident response duties, including collateral duties, until the emergency and severe accident response organisation is staffed.

10. Managers establish clear priorities for completing time-sensitive emergency and severe accident response actions and they test the ability to satisfy time requirements under a variety of conditions.

11. Off-shift personnel are continuously available, in sufficient depth, to ensure timely augmentation and support of the emergency and severe accident response organisation.

12. Managers ensure that the emergency and severe accident response organisation possesses the skills and capabilities for carrying out sustained emergency and severe accident response duties during prolonged events or severe accidents.

13. Managers and staff involved in the severe accident management programme development and implementation demonstrate a broad knowledge of their areas of responsibility and integrate the severe accident management programme with station departments and corporate organisations.

14. Managers establish arrangements and interfaces for the coordination of emergency and severe accident preparedness and response actions with offsite organisations including support groups, official safety and civil authorities as well as with the onsite and offsite emergency response and preparedness groups. These arrangements and interfaces are clearly defined and effective to fulfil emergency and severe accident response needs, and are maintained current and accurate.

15. The personnel involved in emergency preparedness/response and severe accident management engage station line managers and personnel to leverage

site capabilities and to promote and support line ownership of emergency and severe accident response.

Emergency and Severe Accident Preparedness (EP.2)

Performance Objective:

Personnel, plans, procedures, facilities and equipment are maintained ready to respond to emergencies, from minor events to severe accidents.

Criteria:

Emergency Response Plan, Process and Procedure Development

1. Emergency plans, procedures, processes and severe accident management documentation address, on a plant-specific basis, conditions ranging from minor events to severe accidents, including beyond-design-basis, multiple unit, multiple station and external events.
2. Radiological assessment processes are maintained current and include the ability to assess multiple source terms and release points.
3. Emergency response processes provide clear guidance to authorise, implement and communicate potential changes in normal work processes and requirements, such as work planning, equipment clearance, radiation work practices and industrial safety work practices.
4. Alternative methods are developed for performing key response functions that could be precluded by disruptions to infrastructure or to the availability of resources.
5. Processes support the timely and continuing augmentation of on-shift personnel resources by the emergency response organisation, including responses to long-term events.
6. All elements of the emergency plan and severe accident management programme are reviewed on a periodic basis, including re-evaluation of possible severe accidents and their magnitudes, and a feedback loop is used to identify best practices and weaknesses to continuously improve. International industry operating experience is included in the review. Station processes are used to track and resolve issues.
7. Assessments and benchmarking are used proactively to improve performance in emergency and severe accident preparedness, with industry operating experience incorporated where applicable. Self-assessment criteria are established to review performance in response to emergencies and severe accidents during and after drills and exercises.

8. Emergency and severe accident preparedness/response procedures and supporting documents, including checklists, job aids and SAM guidelines, are readily available, controlled, clear, up-to-date, and technically accurate. Backup controlled copies of procedures and other relevant documents are available to replace electronic or primary copies that may not be available under accident conditions. These documents provide correct guidance to facilitate timely decision-making and meet station procedure standards, including confirming their quality and usability through review, verification and validation.

Severe Accident Management Programme

9. The severe accident management (SAM) programme has been developed and is implemented as one of the objectives to enhance safety by providing resources, facilities, equipment and documentation for activities that are conducted by trained and knowledgeable personnel to manage severe accidents in an effective and reliable manner.

10. The severe accident management programme considers internal and external initiating events that potentially lead to nuclear fuel damage and large radioactive releases including, but not limited to, external beyond-design-basis impacts, indirect initiating events, multi-unit accidents, loss of all AC and/or DC power and/or loss of ultimate heat sink.

11. Adequate capabilities are ensured to accomplish the main SAM objectives:

    - Avoid or mitigate core damage or spent fuel damage
    - Terminate the progress of core damage and/or spent fuel damage once it has started
    - Maintain the containment integrity for as long as possible
    - Prevent or minimise significant releases of radioactive products into the environment
    - Achieve a long-term safe stable state

12. Programme controls, ownership and oversight are in place to ensure that station actions in support of severe accident management are not negatively impacted due to plant changes, such as plant modifications, changes in station layout, procedure and training programme changes. Similarly, provisions are made to ensure that changes for severe accident management purposes made in plant systems, procedures, or personnel do not have a negative effect on the ability of the designed plant to perform the designed functions.

Severe Accident Management Strategies

13. Strategies have been developed for the prevention and mitigation of severe accidents potentially arising from beyond-design-basis events. These strategies are coordinated with the emergency preparedness and emergency response under which they would be deployed if beyond-design-basis events occurred.

14. The SAM strategies consider all design capabilities of the plant, using both safety and non-safety systems (including the possible use of some systems beyond their originally intended function and anticipated operating conditions, and outside their design basis) as well as dedicated facilities and equipment designed to fulfil the SAM strategies.

15. The SAM strategies are available for each individual significant challenge or plant vulnerability that are identified to obtain a comprehensive set of insights on the behaviour of the plant during beyond-design-basis events and severe accidents. Suitable analytical methods and new environmental information or modelling that becomes available are used to support identification of plant vulnerabilities. Information on new external and internal challenges and vulnerabilities as well as information which indicates a significant increase in risk from the existing challenges or vulnerabilities is reviewed, resulting in new or modified prevention and mitigation strategies and recommendations for their implementation.

16. Whenever the existing equipment and guidelines are demonstrated to not ensure success of the SAM strategies against the identified vulnerabilities, the strategies are modified to include modifications (plant systems, structures and environmental barriers), the use of additional and diverse equipment readily available onsite or offsite, or alternate guidelines or procedures.

17. Strategies with respective guidelines are in place to maintain and restore core cooling, containment integrity, spent fuel pool integrity, cooling and reactivity control using installed and portable equipment during the initial response to an extended loss of electrical AC power, without offsite support. These strategies make it possible to cope for extended periods with little or no supplies from offsite.

18. At a multi-unit site, strategies are in place to address beyond-design-basis and severe accidents simultaneously at each unit, including a loss of all AC and/or DC power and/or loss of ultimate heat sink simultaneously at each reactor and each spent fuel pool.

Severe Accident Management Guidelines

19. SAM guidelines are in place to provide a set of actions to mitigate the consequence of severe accidents according to the chosen SAM strategies.

20. The SAM guidelines are consistent with the emergency operating procedures, have clear and unambiguous entry and exit points, and provide guidance on the actions for recovery.

21. The SAM guidelines address beyond-design-basis faults, external events and all possible plant operating states (power operation, shutdown, refuelling, etc.) depending on the type of the reactor or nuclear facility.

22. The SAM guidelines provide instructions for the use of necessary equipment, including connection points, and the list of available resources that can be used for accident management.

23. The precursors and symptoms of core damage during loss of core cooling in each plant state as well as the precursors and symptoms of fuel damage in the spent fuel pool are determined, included in the SAM guidelines and available to the control room operators.

24. The SAM guidelines for spent fuel pools provide actions to monitor and maintain the spent fuel pool inventory, sub-criticality and cooling to prevent fuel damage, including during a loss of AC and DC power.

25. The SAM guidelines provide methods to limit the release of radioactive products in the event of damage to facilities and equipment used for fuel storage (e.g. canisters for dry fuel storage).

Staffing, Training and Qualification

26. The personnel involved in emergency preparedness/response and severe accident management are trained and qualified, and are capable of performing their assigned functions in a wide range of conditions, including multi-unit events. To enhance teamwork, the composition of groups involved in emergency and severe accident response takes into account various skills, experience and expertise.

27. Training for the emergency and severe accident preparedness/response personnel reflects industry standards based on position-specific responsibilities and is developed, conducted and updated using a systematic approach to training.

28. The personnel involved in emergency preparedness/response and severe accident management have sufficient knowledge and skills in their assigned areas to anticipate, recognise and assess accident conditions; to recognise the

potential for further degradation, equipment damage and personnel injury; and to recommend appropriate actions.

29. Lessons learnt from emergency and severe accident preparedness performance gaps and weaknesses, such as those identified during drills and exercises, are documented and included when future training is developed.

30. The personnel involved in emergency preparedness/response and severe accident management are focused on opportunities for improvement and learning through activities such as working groups, task forces and benchmarking.

31. Clear criteria for the transitions between various stages of minor events and severe accidents have been established and communicated to operating and technical personnel so that they understand the nature and timing of interventions described in SAM guidelines, the estimated timeframes during which those interventions may be successful, and actions to be taken beyond those timeframes, including termination of accident response actions and initiation of recovery actions.

32. Operations, maintenance and supporting personnel with appropriate technical expertise in specialised areas such as radiation protection, security, dose assessment, training, and accident assessment and mitigation are identified and made available to augment the existing staff during beyond-design-basis events and severe accidents. This includes site access requirements and consideration of potential accessibility issues and expectations as to the time for the augmented resources to respond.

33. Simulators (e.g. desktop and full-scale simulators) are used to assist operators in preparing for beyond-design-basis and severe accidents within the capabilities of the software program. Tabletops are used to supplement the scenario as needed to meet the drill objectives.

34. All personnel involved in the decision chain are aware of the different human performance challenges associated with altered approaches taken during severe accidents (command and control shift, override of design-basis operating rules due to core disassembly and extreme threats to containment).

Drills and Exercises

35. Emergency drills and exercises are conducted to prepare the station for emergencies and severe accidents, mitigating plant damage, achieving a long-term safe stable state and protecting the health and safety of onsite personnel

and the public. The drills and exercises cover the initial response and issues that would be required to be addressed if the event is prolonged.

36. Drills and exercises are as realistic as reasonably achievable and conducted per challenging scenarios developed by multidiscipline teams. These scenarios establish evaluation criteria to support drill and exercise objectives and cover a wide range of realistic and challenging conditions including radiological protection issues and long-duration events. Limited scope drills are used to develop proficiency and assess preparedness in specific, focused areas.

37. Drill and exercise critiques evaluate performance and plans against established standards and criteria and engage all participants. Learnings from drills and exercises are used to improve performance. Shortcomings are identified and resolved through station processes.

38. Offsite response organisations participate in station drills and exercises to maintain proficiency and evaluate interfaces and integrated response capabilities ranging from receiving emergency notifications to fully demonstrating response capabilities.

39. All emergency and severe accident response personnel participate periodically in drills and exercises.

40. Drill controllers and evaluators are trained, qualified and prepared to conduct challenging drills and exercises and to evaluate participant performance and the implementation of emergency plans and procedures.

Facilities and Equipment

41. Emergency and severe accident response facilities are clearly designated, routinely monitored, tested and maintained ready to ensure continuous, long-term response to a wide range of conditions including beyond-design-basis events, severe accidents, multiple unit, multiple station and external events. Those facilities, as well as associated equipment and external services important to emergency and severe accident response, are managed within station programmes and processes for configuration control, corrective and preventive maintenance, work management and corrective actions to ensure they are available and operable.

42. Alternative emergency response facilities are clearly designated, equipped, maintained, and exercised to ensure emergency response capabilities for minor events to severe accidents, including beyond-design-basis, multiple unit, multiple station, and external events.

43. Station work management processes ensure deficiencies associated with facilities and equipment important to emergency response and severe accident management are identified, evaluated, prioritised and resolved promptly to minimise out-of-service time.

44. Compensatory actions are planned and implemented as necessary when facilities and equipment important to emergency response or severe accident management are removed from service or are discovered to be out of service or degraded. Whenever emergency response facilities are used for other purposes, such as outage control centres, they remain ready to support emergency response functions.

45. Managers involved in emergency and severe accident preparedness/response, including operating shift managers, are notified promptly when facilities or equipment important to emergency response is removed from service, or is discovered to be out of service or degraded.

46. Reliable and diverse primary and self-contained backup communication and notification systems and processes are available and are exercised for promptly notifying station personnel and offsite authorities of emergencies and to accommodate severe accident management needs, including during a loss of normal power supplies.

47. Facilities and methods are in place to obtain and monitor critical parameters needed for situational awareness and decision-making – by use of robust instrumentation, alternate powering schemes, or alternate methods to obtain the critical information.

48. Facilities, equipment and instrumentation used for severe accident management are regularly reviewed for their ability to perform as required under severe accident conditions, and alternate means are provided if needed. This includes proactively addressing new developments in science in technology, obsolescence and events to see if any additional modifications or upgrades are needed to support preparedness for severe accident management.

49. Backup control facilities (e.g. a remote shutdown panel) are available for emergency response and severe accident management in situations when the main control facilities fail or become uninhabitable.

50. Software tools to simulate plant behaviour during severe accidents are available in engineering/analytical simulators to allow for plant-specific analyses, training of the technical support centre personnel and to assist operators in preparing for severe accident management.

51. Inventories of on-site material and accident response equipment are maintained, and procedures and protocols are developed for sharing them with other sites during an emergency.

Emergency and Severe Accident Response (EP.3)

Performance Objective:

Emergency and severe accident response actions protect the health and safety of the public and station personnel, mitigate plant damage, achieve a long-term safe stable state and support response actions by offsite authorities and emergency organisations.

Criteria:

Initial Response

1. Emergency conditions are identified and classified accurately and promptly. Personnel who support emergency response managers are knowledgeable of classification levels and assist managers in recognising when a threshold is approached or crossed.

2. Emergency and severe accident response personnel, relevant offsite organisations and station personnel are notified promptly and accurately following emergency classification. Emergency notifications include appropriate information regarding emergency conditions and alternative response locations.

3. Emergency and severe accident response personnel staff and activate emergency and severe accident facilities in a timely manner following emergency declaration, from minor events to severe accidents.

4. Emergency and severe accident response personnel are notified and staged in advance as appropriate if severe conditions, such as severe weather, are expected. Relevant offsite agencies are notified of expected conditions and station contingency actions.

Emergency Response Managers

5. Emergency response managers are qualified and authorised to make all necessary emergency response decisions and to implement emergency plans and procedures. Qualifications and authority extend to the full range of manager actions that may be needed in case of delays in response by off-shift responders or delayed activation of emergency response facilities.

6. Emergency response managers maintain oversight roles and avoid distractions by assigning delegable tasks to qualified personnel. Emergency response managers execute the emergency response and provide direction through the following:

- Establishing priorities and strategies and aligning response activities
- Communicating priorities and strategies
- Monitoring performance and the status of response efforts
- Obtaining and assigning additional personnel and equipment resources as needed
- Ensuring timely and accurate communication, verification and documentation of critical information, such as plant conditions, assessments and decisions that can influence the response to the event

7. Emergency response managers establish, maintain and transfer command and control rigorously and formally; communicate and reinforce performance expectations; conduct thorough, focused briefings and updates; and provide thorough turnovers to oncoming relief personnel.

8. Emergency response managers are knowledgeable of the criteria for the transitions between various stages of minor events and severe accidents, such as the criteria to terminate accident response and initiate recovery actions, including coordinating with relevant authorities, approval processes and communications with emergency and plant personnel.

9. Managers take actions to ensure safety of personnel executing the emergency and severe accident response tasks during emergencies and severe accidents.

Emergency and Severe Accident Response Actions

10. Appropriate to their roles, emergency response personnel make an accurate and prompt initial and (if appropriate) updated assessment of the event, develop and take practical and effective actions to mitigate the event, and determine recovery strategies. As a result, transition from emergency operating procedures (i.e. procedures for management of design-basis accidents) to SAM guidelines is effective.

11. Response actions are appropriately prioritised and adjusted to focus on maintaining or restoring critical safety functions, such as continuity of core cooling. Emergency response actions protect the health and safety of the public and of plant workers and prevent or mitigate plant damage.

12. Changes to normal work processes, such as work planning, equipment clearance, configuration control, radiation exposure limits, and safe work practices, are authorised at the appropriate level and are clearly documented

and communicated during emergencies to maintain or restore core cooling, to stop an off-site release in progress, or if fuel damage is imminent without action.

13. Emergency response personnel monitor plant and environmental conditions and promptly communicate changes, including abnormal or unexpected indications.

14. Emergency and severe accident response teams are briefed and deployed in a timely manner, consistent with the urgency of expected actions and the need to execute actions in a safe and effective manner, and with radiological protection and other hazard protection as appropriate. Response team locations and the statuses of their actions are tracked. Changes in plant conditions and priorities and information from field observations are communicated accurately and in a timely manner between response teams and emergency facilities.

15. Emergency response personnel continuously monitor radiological conditions and project contamination and dose levels and they identify protective measures for workers and protective action recommendations for the public.

16. Emergency response activities are coordinated with local emergency services and authorities, ensuring accident response is well coordinated.

17. Emergency responders ensure effective response actions by promptly sharing accurate emergency information with offsite emergency response organisations.

18. Emergency response personnel provide the public and news media appropriate accessibility and timely, accurate and understandable information. Information is provided to broad audiences through the appropriate use of conventional and up-to-date processes and technology.

19. Emergency response managers transition from normal operation using effective command and control in response to emergency events up to severe accidents during the assessment, mitigation and recovery phases.

20. Onsite personnel are capable of carrying out initial severe accident response duties until the full severe accident response force is deployed.

21. Information from activities in the field is communicated to the severe accident control centre or emergency response centre in a timely and effective manner.

22. Plans are developed to address family/personal needs of responders who are unable to leave the site.

Corporate Areas

Corporate Leadership (CO.1)

Performance Objective:

The corporate organisation provides the strategic direction and leadership for the nuclear stations to continuously improve and sustain high levels of safe, reliable operation and emergency response.

Criteria:

1. The corporate chief executive officer communicates a clear, unambiguous message that nuclear safety is the highest priority.
2. The corporate chief executive officer and the chief nuclear officer (or equivalent) foster open communications to promote strong organisational alignment to operational excellence and a full understanding of information pertaining to nuclear station and corporate operations.
3. Corporate leaders monitor, communicate and demonstrate, through their behaviours and actions, the importance of corporate and station nuclear safety culture. Identified nuclear safety culture weaknesses are addressed with a sense of urgency.
4. Corporate leaders routinely and effectively communicate information regarding the safety and reliability of the nuclear station to key stakeholders, including regulators, the board of directors, station personnel and the public.
5. Corporate leaders foster commitment to the organisation's governance or management model at the corporate and station level. They use the organisation's processes consistently to oversee and support plant safety and reliability
6. Executive leadership, ownership and involvement reinforce accountability in each functional area as well as reinforcing the importance of maintainingthe governance and oversight roles while concurrently supporting station operations.

7. Corporate leaders remain knowledgeable of rising industry standards, significant operating experience, emerging regulatory issues and other external factors. They ensure these factors are considered in business planning, goal setting, improvement initiatives and key performance measures. Leaders coordinate station and corporate responses to major external issues.

8. Corporate leaders actively engage the workforce to stimulate innovation and develop continuous plant improvement initiatives. A means exists to encourage, monitor and address employee feedback on business initiatives.

9. Corporate leaders ensure that the nuclear station and the corporate personnel have the necessary resources and that the resources are applied to achieve and sustain safe, reliable plant operations. Resource needs, such as funding, staffing, training, equipment, repair parts and information, are allocated to support emergent and long-range station issues.

10. Corporate leaders focus the corporate and station personnel on resolving important emergent and long-standing operational and equipment issues. Owners are designated to resolve these performance issues and corporate personnel monitor progress.

11. Corporate leaders focus the corporate and station personnel on successful recovery of stations that have experienced significant declines in operational performance.

12. Corporate leaders establish high standards of emergency preparedness and response performance and align the organisation to manage emergencies, mitigate plant damage and protect the health and safety of the station workforce, supplemental personnel and the public.

13. Corporate leaders are engaged in developing future leaders and ensure the succession planning process enables the organisation to fill critical positions and develop a group of qualified candidates to meet changing organisational priorities.

14. Corporate leaders take active roles in important industry-wide support organisations and forums.

Corporate Governance (CO.2)

Performance Objective:

Corporate governance provides the needed organisational structures, policies, processes and programmes to establish and implement high standards for the operation, maintenance and organisational support of the nuclear stations.

Criteria:

1. A documented and controlled management model defines the corporation's strategic objectives, typically through the mission, vision, values, guiding principles and fundamentals of the organisation. The corporate leadership team aligns itself and the organisation to the model.
2. A well-defined organisational structure implements the operating model to support governance, oversight and execution of activities that support nuclear plant operation.
3. The chief executive officer holds the chief nuclear officer (or equivalent) accountable for all matters related to nuclear station performance.
4. The chief nuclear officer (or equivalent) holds station management accountable for the safe and reliable operation of the nuclear station.
5. Station line management is accountable and responsible for operational decisions and safe and reliable operation of the nuclear stations.
6. A document hierarchy and operating guidelines are in place to develop and implement management controls and to ensure consistency among the station organisations. The organisation establishes a clear policy on the required level of standardisation and on the approval authority for deviations.
7. Roles, responsibilities and decision-making authorities of all groups in the corporate and station organisations are defined to ensure accountability at every level and to enhance the organisational capacity to identify and resolve problems.
8. The decision-making process is defined to maintain consistency with corporate policies and standards.
9. Roles and responsibilities for the continuity of corporate business operations are clearly established for recovery from significant events.

10. Interfaces with corporate organisations responsible for functions that affect the nuclear station – such as transmission and distribution, grid operations, human resources and business planning – are clearly established and understood. Interactions among operating companies, co-owners, asset owners and service alliances ensure that the nuclear station receives appropriate support.

11. Corporate policy clearly defines unacceptable risk conditions and includes procedures to cope with risk by identifying, assessing and mitigating risk. Integrated risk considerations include, but are not limited to, nuclear, radiological, industrial and environmental safety. Specifically:

    - Corporate leaders create a culture of risk awareness and effective risk management.
    - Nuclear risk relating to management of the reactor core and barriers to the release of radioactivity is understood and is mitigated to the extent practicable; and residual risk is managed to achieve safe, reliable nuclear plant operation.
    - High standards for risk recognition, management and mitigation are embedded in corporate and station policies, programs and processes. The risks associated with low-probability but high-consequence events are considered.
    - Corporate processes identify short-term operational risk, provide a means to identify off-normal situations, and identify long-term and enterprise risk over the life of the nuclear plants.
    - Accountability for minimising and managing risk is clearly defined and includes the accountability for short-term operational risk and long-term risk.

12. Strategic initiatives are supported by business planning and goal setting. Measurable goals, with a comprehensive set of indicators and targets, drive continuous improvement and reflect the highest levels of industry performance.

13. Corporate managers develop long-range strategies in collaboration with nuclear station personnel. Corporate and station business plans are integrated and are prioritised to maintain focus on safe, reliable and sustainable operation of the nuclear plants.

14. Business plans consider functional area performance gaps based on specific

performance measures. Desired outcomes with associated performance indicators for functional areas, including corporate functions, are well defined.

15. Well-defined management processes are established for business, policy and organisational changes. The scope, pace, risks, resource requirements and effectiveness measures for change initiatives are managed to sustain and improve performance in plant operations.

16. A clearly defined process is used to identify and develop appropriate corporate responses to early signs of performance decline.

17. Incentive and rewards programmes promote nuclear safety.

18. Appropriate and timely adjustment of goals and expectations supports continuous improvement at the stations, with a focus on nuclear safety.

19. Corporate managers embrace continuous improvement through activities such as self-assessments, corrective actions and training.

20. Corporate managers with line responsibility for training ensure the development, training and qualification of corporate and station personnel. For utilities associated with the National Academy for Nuclear Training, actions are taken to maintain programme accreditation.

21. Corporate managers establish an effective programme to ensure that learning from internal and external operating experience is actively promoted and sustained to prevent similar events at their stations.

22. Personnel support and participate in industry activities and benchmarking to understand, promote and establish best practices. Formal guidance is used to coordinate and focus these efforts to achieve results.

23. Senior managers establish high standards for emergency preparedness/response and severe accident management. A corporate emergency response organisation and response plan are in place and training is provided to manage significant events, including natural disasters that may affect multiple stations. Specifically:

    - Roles and responsibilities of corporate personnel regarding emergency response are clearly defined and communicated, including interfaces with nuclear station organisations and off- site agencies during emergencies. Corporate personnel participate in station drills and exercises to maintain proficiency and evaluate interfaces and response capabilities.

- Emergency facilities and resources are designed, equipped, maintained and exercised to ensure effective emergency response capabilities and to remain functional during natural disasters.
- Guiding documents clearly state that the needs of the nuclear stations are given the highest priority.
- The emergency public information programme and practices provide timely dissemination of accurate, reliable and understandable information.
- The traumatic human impacts of extreme external events on responders and the surrounding communities are considered in contingency plans and training activities.

Corporate Oversight and Monitoring (CO.3)

Performance Objective:

Corporate management oversight and monitoring are used to strengthen safety and reliability, and respond promptly to signs of performance decline. Plant safety and reliability undergo constant scrutiny through techniques such as assessments, performance indicators and periodic management meetings.

Criteria:

1. The chief executive officer monitors and/or receives briefings on performance indicators, key independent internal and external assessments and key issues that affect the nuclear station.
2. The chief nuclear officer (or equivalent), corporate managers and corporate personnel directly responsible for nuclear activities, are personally involved in overseeing, monitoring and assessing those activities within the corporate organisation and in support of the nuclear station. Station assessment activities are coordinated with corporate assessment activities to identify broad, organisation-wide issues.
3. Information from various sources, such as performance indicators, self-assessments and independent assessments, quality assurance reports and corrective action trends, is integrated and focused to identify and allow early correction of adverse performance of the nuclear station. This information provides an objective view of performance and is routinely provided to corporate managers and board members. Desired outcomes and metrics are clearly defined to reflect industry standards for each functional area.
4. Corporate managers monitor station and corporate performance through a variety of activities. For example, they interact with workers, participate in station performance review meetings, coordinate peer group activities, monitor performance indicators to detect adverse trends, review initiatives to ensure timely completion and conduct first-hand assessments of station performance through frequent visits.
5. Periodic reviews, such as chief nuclear officer (or equivalent) meetings with station management teams and/or corporate personnel, are used as forums to better understand and challenge functional and cross-functional performance that does not meet expectations and to determine what corporate support is needed.

6. A well-defined process is in place for communicating performance gaps that require higher-level manager or executive attention. Corporate leaders encourage the escalation of performance gaps that are not resolved at lower levels of the organisation. Long-standing or repetitive issues are escalated, as appropriate and are resolved.
7. Assessments are used to review and evaluate the adequacy and effectiveness of corporate and station programmes, processes and activities. Industry peers participate in assessments when appropriate, particularly those assessments that are broad in scope.
8. The corporate staff ensures that station personnel have action plans to address performance gaps. Corporate increases monitoring in response to declining performance, or when performance assessments from diverse inputs conflict.
9. The overall effectiveness of corporate governance is periodically assessed and corrective actions are taken for performance shortfalls. Corporate line managers self-assess processes for missed opportunities to detect or prevent performance declines and correct methods or behaviours as necessary.

Corporate Independent Oversight (CO.4)

Performance Objective:

Independent oversight provides the chief nuclear officer (or equivalent) and senior corporate leaders – up through the board of directors – with an ongoing perspective of performance at the nuclear stations and in the corporate organisation compared to the industry, with a principal focus on nuclear safety, plant reliability and emergency response effectiveness.

Criteria:

1. Responsibilities, accountabilities and authorities for those providing independent oversight are clearly defined, understood and implemented. The established scope of independent oversight activities is informed by considering the extent of monitoring that are provided by line management.
2. Independent nuclear oversight managers establish high standards of performance for the oversight organisation to provide effective monitoring, assessment and audit activities.
3. Independence is maintained between independent oversight personnel and line management. The station-level independent oversight organisation reports directly to a corporate executive or senior manager. Independent oversight does not undermine line management authority.
4. The independent oversight organisation assesses organisational effectiveness, as well as the effectiveness of the corporate support organisation, to achieve and maintain high industry standards. This includes observing individual and organisational behaviours and providing insights to management on the causes of behaviour performance issues.
5. The organisation's use (at all levels) of the corrective action programme, self- assessment and benchmarking programmes, operating experience and the training programme, is assessed to identify and correct problems, compare actual performance to high industry standards and achieve continuous improvements.
6. Independent compliance-based audits and performance-based assessments are planned and performed in accordance with quality assurance programme requirements to aid management by identifying problems, potential causes and insights.
7. Corporate leaders demonstrate support for independent oversight. The

oversight organisation is staffed with personnel who have the knowledge, skills and experience necessary to identify performance shortfalls and are qualified in accordance with utility quality assurance programme requirements.

8. Performance issues are communicated to corporate and station line management and appropriate management action is tracked to completion, or is escalated by the independent oversight organisation if not properly addressed.

9. A process is in place to assess the effectiveness of independent oversight activities. Independent oversight self-assesses missed opportunities to detect or prevent performance declines and correct methods or behaviours as necessary.

10. Some personnel from outside the utility, who are highly experienced in nuclear plant operations, are involved in the independent oversight process to ensure effective input to senior corporate executives from outside the line organisation.

11. The chief executive officer, the chief nuclear officer (or equivalent) and the board of directors receives comprehensive information, including performance trends and input from the independent oversight process. This information reflects station- and fleet-level performance relative to the nuclear industry, with a principal focus on nuclear safety.

12. The board of directors includes or has direct access to independent personnel with the expertise necessary to understand the special and unique nature of nuclear operations.

13. The board of directors is informed of changes in low-probability, high-consequence nuclear risk issues.

14. Board and external oversight committee members periodically visit the nuclear stations to communicate directly with station personnel and to observe activities and plant conditions.

Corporate Support Services (CO.5)

Performance Objective:

Corporate managers and staff support the nuclear facilities in matters related to safe and reliable plant operation by providing resources and services to organisations that execute or perform activities at the stations.

Criteria:

1. Corporate support is provided in areas that require unique technical expertise, for emergent issues beyond the technical capabilities or resources of the stations and to augment the nuclear station resources for special issues or projects. These support groups can also include centralised maintenance or engineering groups, supply chain, information technology, human resources, and business planning.
2. Corporate managers ensure appropriate oversight is maintained to deliver a high standard of support activities in accordance with the management model.
3. Corporate personnel recognise when they have assumed a perform role and clearly communicate their role to station managers. In a perform/execute role, the corporate personnel manage and provide resources, schedules, scope and detailed procedures to implement plans and to deliver quality work products.
4. Corporate services groups, the corporate staff and nuclear station personnel exhibit behaviours that support a strong nuclear safety culture. They understand station issues, coordinate and communicate effectively and exhibit teamwork to address these issues.
5. Corporate support groups, the corporate staff and nuclear station personnel coordinate and communicate effectively and exhibit teamwork to address issues that affect the station.
6. Corporate managers and personnel assist in solving problems, as needed and critically challenge assumptions and decisions that can affect nuclear safety. Decision-making processes are defined in station and corporate procedures.
7. Corporate personnel have the experience, education and training as well as the necessary information to perform their work competently and proficiently to support nuclear station.

8. Corporate managers ensure the supply chain supports the station to maintain and repair plant equipment during on-line and outage periods. Parts and materials are procured to meet quality and design specifications and they are controlled and stored to maintain traceability and quality.

9. Corporate managers establish, communicate and implement a structured project management process to select, plan and implement projects with predictable quality, scope, schedule and cost performance.

10. Corporate personnel employ controls to maintain and protect the configuration and operation of digital assets that may have special requirements, including those relating to cyber security.

11. High expectations and standards for engineering activities are established, communicated and reinforced. Personnel are held accountable for implementing these standards. The design authority is clearly defined and designated. Shortfalls in meeting expectations are evaluated and addressed promptly. Specifically:

    - The organisation strives for failure-free fuel performance.
    - Engineering programmes are kept current with industry standards and operating experience to support safe, reliable equipment operation.
    - Roles and responsibilities for design activities performed by supplemental personnel are clearly defined, including corporate support duties, to ensure engineering products receive appropriate input and support. Engineering products provided by supplemental personnel and equipment manufacturers receive challenge reviews or acceptance testing to demonstrate acceptable performance before implementation.

12. Corporate leaders set and reinforce high expectations and standards for training activities. Station managers are held accountable for implementing these standards. Shortfalls in meeting expectations are evaluated and addressed promptly. Specifically:

    - Training managers demonstrate a broad knowledge of their areas of responsibility and integrate training actions with the functions and activities of other station and corporate groups.
    - Corporate training managers support the line organisation by

maintaining an awareness of industry training issues, identifying similar precursor conditions and implementing appropriate training solutions.

Corporate Human Resource Management and Leadership Development (CO.6)

Performance Objective:

Corporate managers, in partnership with human resource personnel and line managers, anticipate nuclear station personnel needs and work with line managers to recruit and retain competent, knowledgeable and skilled personnel to support safe, reliable and sustained operation of the nuclear station and emergency response.

Criteria:

1. Corporate and station leaders place high priority on and are personally engaged in developing current and future leaders. Talent management and succession planning processes enable the organisation to fill critical positions and develop a group of qualified candidates to meet projected losses of knowledge and experience.
2. Future staffing needs are identified and tracked through an ongoing workforce planning process. A long-term operations workforce plan is in place to maintain sufficient operations staffing at the nuclear stations. Timely action is taken to fill vacancies when they occur.
3. Individual and team leadership assessments and development activities, based on a comprehensive set of competencies, are used to improve leader skills and to inform succession planning at corporate and station levels.
4. New or transitioning managers undergo an integration process that includes an understanding of the organisation's culture, leadership behaviour expectations, management model and roles/responsibilities.
5. High-potential candidates are identified, and use leadership development plans for preparation as future station and corporate leaders.
6. The potential effects of organisational changes and personnel reductions are considered and addressed before such changes are initiated.
7. Strategies for knowledge transfer and retention are executed to preserve unique knowledge and skills that could be lost through attrition or planned staffing changes.
8. Expertise is provided to establish and maintain effective management-to-

workforce relations.

9. When commissioning a new reactor unit, or restarting units from long-term shutdowns, the corporate personnel oversee and support the plans to ensure readiness of plant operating crews to test, commission and operate the unit.

Corporate Communications (CO.7)

Performance Objective:

Communications managers and personnel, through direct and ongoing interactions with corporate and station management, develop and implement an integrated communications strategy that supports the organisation's mission, operational focus areas and strategic initiatives, and reinforces nuclear safety.

Criteria:

1. Leaders develop an integrated communications strategy that identifies key objectives, messages and tactics to align personnel to the organisation's mission, nuclear safety culture and business initiatives. This strategy addresses the needs of both internal and external stakeholders, and emphasises the role of managers and first-line supervisors as the primary source of information and feedback for employees.
2. Communication managers and personnel work closely with corporate leaders and plant management in an ongoing basis to ensure alignment of communications messages and programmes that drive awareness, understanding and support of the organisation's strategic goals and objectives and business initiatives.
3. Corporate leaders and plant management continuously develop and reinforce effective communications skills that actively engage employees and build trust. They provide timely and accurate information to corporate and station personnel about significant business and performance issues.
4. Mechanisms are in place for determining effectiveness of communications and obtaining feedback on messages, initiatives and concerns. Feedback is regularly reviewed by communication staff, corporate leaders, and plant management, and identified gaps to effective communications are addressed.
5. Public information programmes and practices are in place to provide timely dissemination of accurate, reliable and understandable information in response to crises, events of potential public interest and declared plant emergency events. The effects of web-based information and social media activity are considered.

Glossary

The performance objectives included in this document are standards for station and corporate performance, intended to promote excellence in the operation, maintenance, support and governance of operating nuclear electric generating stations. Each station and corporate organisation may have its own unique structure. The following definitions are provided to explain how these terms are used in the performance objectives and are not a mandate of any particular organisational structure.

INDEPENDENT OVERSIGHT – the activities performed by personnel and groups, either internal or external to the organisation and outside of the particular functional area.

LEADER- an individual assigned to a managerial or supervisory position who displays the leadership attributes that inspires others to achieve nuclear excellence.

LEADERSHIP – the behaviour of an individual, irrespective of level, who takes the initiative to inspire by example, to coach, influence and shape behaviours of people to strive for nuclear excellence.

LINE MANAGER- a person who directly manages other employees while reporting to a higher-ranking manager. The line manager term is often used interchangeably with "direct manager".

MANAGER – an individual assigned to a managerial or supervisory position.

MANAGEMENT – the responsibilities of an individual to control, direct, plan, organise, coordinate and staff the organisation to achieve safe, reliable station operations. To monitor performance and adjust programmes and processes as necessary to achieve excellence.

MANAGEMENT SYSTEMS – the programmes and processes including but not limited to work management, corrective action, succession planning, system health and observations programmes that support achievement of the organisation's mission, vision and goals.

MANAGEMENT MODEL - the choices made by a company's top executives regarding how they define objectives, motivate effort, coordinate activities and allocate resources; in other words, how they define the work of management.

NUCLEAR PROFESSIONAL – all personnel who perform work at or support the safe operation of the nuclear station. This includes supplemental personnel who perform work at the station.

SENIOR MANAGERS – personnel comprising the senior site executive(s), plant manager and their direct reports who are responsible for the execution of business activities.

SEVERE ACCIDENT – a beyond-design-basis accident involving significant damage to nuclear fuel, risk of containment failure and the possibility of large radioactive releases to the environment.

SEVERE ACCIDENT MANAGEMENT – the taking of a set of actions during the evolution of a beyond-design-basis event including extreme natural events and indirect initiating events, (a) to prevent the escalation of the event into a severe accident, (b) to mitigate the consequences of a severe accident and (c) to achieve a long-term safe stable state.

SUPERVISOR- a term that refers to the first level of management that interfaces directly with plant workers on a daily basis or is in charge of a workplace or process.

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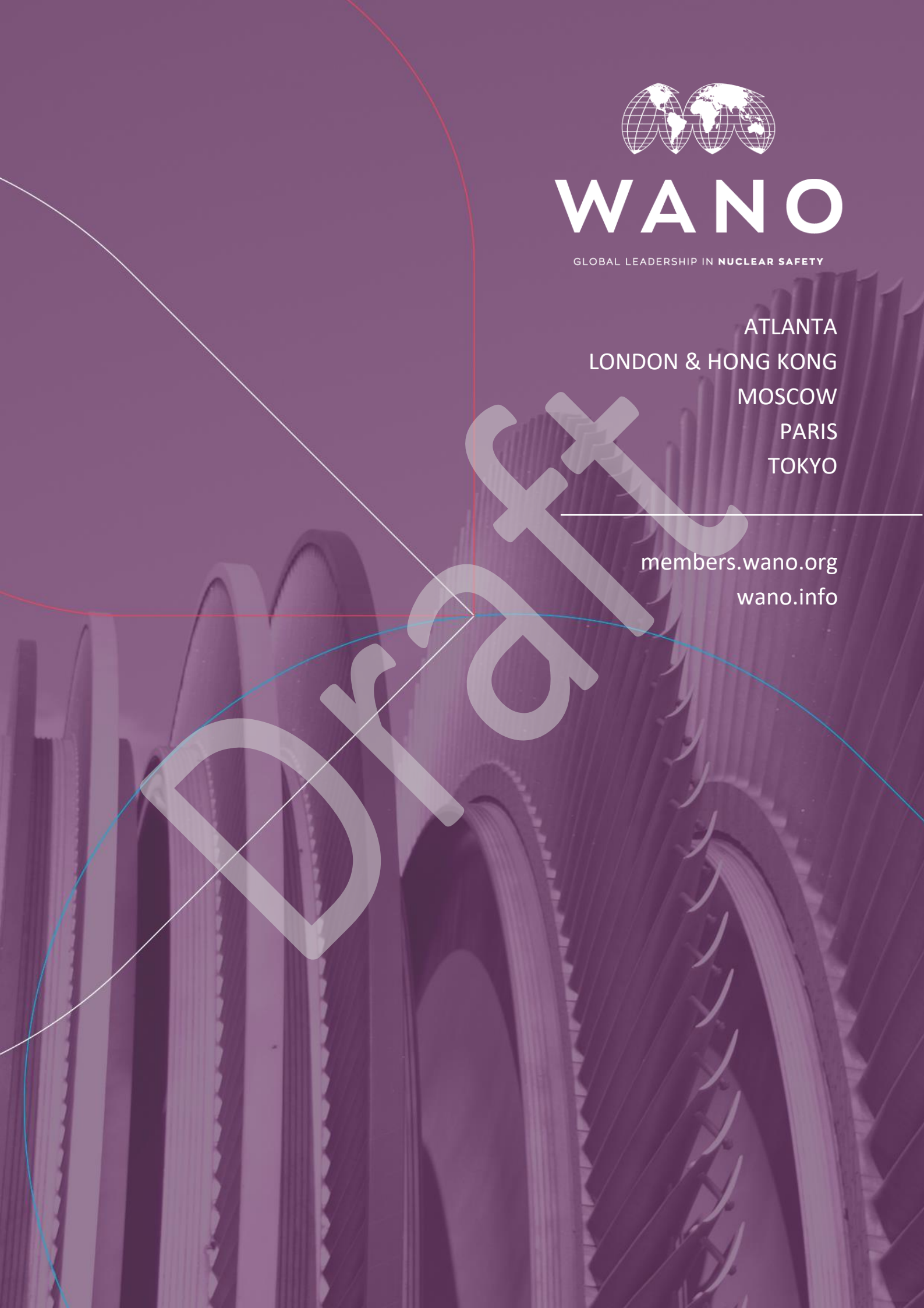

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