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 on-site personnel and the public.

Criteria

Management and Leadership

1. Senior leaders 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. Leaders actively support emergency preparedness and severe accident management by participating as emergency response leaders, providing oversight of emergency planning and preparedness activities and maintaining cooperative relationships with off-site 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). Leaders 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, that is maintained by off-site 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 off-site organisations including support groups, official safety and civil authorities as well as with the on-site and off-site 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 actively maintain cooperative, supportive relationships with off-site response organisations.

16. 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, technically accurate and duplicated with controlled backup hard copies. 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 minimize 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 on-site or off-site, 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 off-site support. These strategies make it possible to cope for extended periods with little or no supplies from off-site.

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 comply with the emergency plan and 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 detailed instructions for the use of necessary temporary and non-dedicated equipment (i.e. not originally planned to manage accidents), 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 learned 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 staff 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. Desktop and, if appropriate, full-scale simulators are used to assist operators in preparing for beyond-design-basis and severe accidents.

34. All personnel involved in the decision chain, as well as in the implementing line, 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 on-site 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. Records of the learning from drills and exercises are maintained and used to improve performance. Shortcomings are identified and resolved through station processes.

38. Off-site 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 supplies 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 off-site 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. Protected and habitable backup control facilities are provided for severe accident management in situations when the main control facilities (e.g. main control room and backup control room) 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 staff and to assist operators in preparing for severe accident management.

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 off-site 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 off-site 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 off-site 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 during emergencies, are authorised at the appropriate level and are clearly documented and communicated.

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 off-site 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. On-site 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.