Examination Criteria for Verification into the Implementation Status of Emergency Safety Measures

Nuclear and Industrial Safety Agency

Fukushima Dai-ichi NPS accident, a result of the recent 2011 Off the Pacific Coast of Tohoku Earthquake, has caused unprecedented nuclear damage to Japan.

While the occurrence of extremely large tsunami caused by an earthquake of this scale is quite rare, based on the extent of damage these could inflict on a reprocessing facility, NISA determined the necessity of emergency safety measures to enable recovery of function in event of total loss, through tsunamis and other phenomena, of all systems that supply AC power, all systems that remove decay heat from radioactive material and all facility for preventing an accumulation of hydrogen in those systems at risk of generating hydrogen (hereinafter referred to as “all AC power supply functions”), and have instructed reprocessing operators to that end.

NISA will stringently verify the implementation status of these emergency safety measures by each operator in order to ensure implementation of these measures by operators. The examination criteria and process associated with the verification are as follows.

1. **Scope of examination**
   The measures below indicated in 04/28/2011 N No. 72 “The Implementation of Emergency Safety Measures at Reprocessing Facilities Taking into Account the 2011 Accident at Fukushima Dai-ichi and Dai-ni Nuclear Power Stations (Instructions)” dated May 1, 2011, fall within the scope of this verification.
   
   (1) Regarding emergency safety measures that take tsunamis and other phenomena into account
   1) Implementation of emergency checks
      Implementation of emergency checks of equipment and systems geared for responding to emergencies brought on by
tsunamis and other phenomena.

2) Examination of emergency response plan and implementation of drills

Examination of emergency response plan and implementation of drills, assuming loss of all AC power supply functions.

3) Securing of emergency power supply

Securing of alternative power supply that provides needed power on a mobile basis in event of loss of electrical power to the reprocessing facility and inability to secure emergency power.

4) Long-range measures against loss of all AC power supply functions in emergencies

Long-term measures for recovery of all AC power supply functions in event of loss of all regular AC power supply functions.

5) Implementing response measures needed for the time being, taking into account physical structures and other aspects of each reprocessing plant

NISA will also verify the validity of in-scope facilities, which forms the premise for carrying out the above emergency safety measures 1)-5), as well as the validity of assessment.

6) Validity of facilities that fall into the scope of emergency measures and of the assessment results

(2) Ensuring multiple emergency generators on standby

Operational safety programs should be reviewed and a plan for deployment drafted in order to ensure that there are 2 emergency generators, capable of supplying AC power to emergency bus, on standby at all times (if there are multiple buildings within the same reprocessing facility, include the number of units needed when it is
possible to supply power to the necessary emergency bus from emergency generators installed in another building).

In addition, if a certain amount of time is required before the emergency generators can go online, then all applicable plans should include a response for this duration.

2. **Examination Criteria and Verification Items**

The emergency safety measures will be checked against individual verification items in light of the below examination criteria, to determine whether the measure is being implemented in an appropriate manner. Regarding emergency safety measures that take tsunamis and other phenomena into account

1) **The implementation status of emergency inspection**

   - That the equipment, systems and material needed for emergencies are already organized and prepared, and being maintained and managed appropriately
     - That the checks of equipment to be used in emergencies has already been completed
     - That the equipment needed for recover of all AC power supply functions has been specified, and is also being maintained and managed appropriately

2) **The implementation status of emergency response plan checks and training**

   - That the emergency response manual is systematically organized, and is known to and has been learned by all relevant parties
     - That an emergency response plan that takes into account assumed damage from tsunamis and other phenomena has been drafted
     - That the emergency response manual is systematically organized, and the necessary topics have been appropriately included
     - That the emergency response manual indicates
instructions for use and other details as needed, and is stored in such a way as to be easily accessed

- That the emergency response manual is known to all relevant parties, and that training is being implemented

- That the manual clearly lays out responsibilities and chain of command, and can be carried out within the necessary amount of time

  - That the emergency response manual clearly lays out the responsibilities and chain of command structure within the organization, and can enable appropriate and precise response within the needed time, in accordance with pre-assigned roles, even in the event of an emergency
  
  - That the access routes to operationally-necessary locations have been diversified, and the procedure as well as chain of command for implementing water injection from storage tanks has been clarified

- That training has been planned and implemented, that the improvements based on training results have been reflected in the manual, and that a PDCA spiral for ongoing improvements has been prepared or is already in operation

  - That training has been implemented on loss of all AC power supply functions due to tsunamis and other phenomena, and the implementation procedure has been established
  
  - That improvements based on training results have been reflected in the manual, and that a PDCA spiral for ongoing improvements through constant review has been prepared or is already in operation
  
  - That in event of changes to conditions used in drafting the emergency response manual (for example, resumption of operation or facility completion), there is an established mechanism for reexamining the manual
3) The status of emergency power supply

- That the capacity of power source vehicles is sufficient for the load, and the connection cable is of sufficient length. That these are stored or installed in appropriate places at no risk of being impacted by tsunamis, earthquakes or fires.

  - That the capacity and number of power source vehicles are whatever is necessary for purposes including the sustenance of the main control room's surveillance capability
  - That sufficient fuel given the length of operation will be provided to the power source vehicles, and a refueling facility will be in deployment at all times
  - That the cable is long enough to ensure connection between the power source vehicle and the connection point, with enough slack to circumvent rubble if necessary
  - That the cable connection point, connection method and transmission route have been thought out in such a way as to eliminate the risk of being impacted by tsunamis, and that the connection point is being appropriately maintained and managed
  - That the storage location of power source vehicles, cables and refueling facility have been thought out in such a way as to eliminate the risk of tsunamis, earthquakes, fire and other phenomena
  - That power source vehicles, cables and other equipment are sufficiently durable given the duration and circumstances of use
  - That details such as cable resistance and power source vehicle's load characteristics have been considered for systems which are connected to power source vehicles and cables
  - That in establishing a permanent emergency power supply facility or in utilizing an existing facility, care has been taken to eliminate the risk of tsunamis, earthquakes, fire and other phenomena
• That the time needed to move power source vehicles and connect them has been verified through drills
  - That an accurate understanding of the time needed for connection has already been gained, by conducting a drill where power source vehicles kept on high ground and other locations are actually moved and connected by cable
  - That there is a check plan that includes a direct or indirect method, such as a drill, to verify whether electrical transmission can actually be achieved

• That the pump can secure enough flow rate as well as discharge pressure for cooling, with sufficiently long temporary hose and multiple as well as amply-supplied water sources. That this equipment is stored in appropriate locations, at no risk of being impacted by tsunamis, earthquakes, fire and other phenomena.
  - That the applied water pressure, performance capability and number of fire trucks and pump trucks are whatever is necessary for purposes such as removal of decay heat
  - That sufficient fuel given the length of operation will be provided to the pump trucks and other vehicles
  - That the temporary hose is long enough to ensure connection between the water source and the injection point, with enough slack to circumvent rubble if necessary
  - That a water source of sufficient capacity be secured, and that the hose be long enough to ensure injection
  - That multiple water sources, including seawater, be secured
  - That the pumps, temporary hose, water source connection point, connection method and injection route have been thought out in such a way as to eliminate the risk of being impacted by tsunamis, and that the connection point is being appropriately maintained and managed
That the storage location of pumps, temporary hoses and pump truck refueling facility have been thought out in such a way as to eliminate the risk of tsunamis.

That pumps, temporary hoses and water sources are sufficiently durable given the duration and circumstances of use.

That details such as hose pressure drop, water level difference and pump GH characteristics have been considered for systems which are connected to pumps, temporary hose and water sources.

That securing of equipment such as pumps is being planned for earliest completion possible.

- That nitrogen tanks and transportable compressors needed to prevent hydrogen accumulation have been secured. That this equipment will be stored or installed in appropriate locations, at no risk of being impacted by tsunamis, earthquakes, fire and other phenomena.

- That the capacity and number of nitrogen tanks, transportable compressors and other equipment are whatever is necessary for hydrogen elimination.

- That sufficient fuel given the length of operation will be provided to transportable compressors.

- That nitrogen tanks and transportable compressors are sufficiently durable given the duration and circumstances of use.

- That details such as hose pressure drop and water level difference have been considered for systems which are connected to nitrogen tanks and transportable compressors.

- That nitrogen tanks and transportable compressors are stored on high ground and other locations at no risk of being impacted by tsunamis.

- That there is an established method of monitoring a spent fuel pool’s water level, temperature and other characteristics.
as well as the temperature and operational status of the coolant water system for the cooling of high-level liquid waste.

- That there is an established method of monitoring a spent fuel pool’s water level, temperature and other characteristics as well as the temperature and operational status of the coolant water system for the cooling of high-level liquid waste, even in the event of loss of all AC power supply functions.

4) The content of long-range measures against loss of all AC power supply functions in emergencies

- That there is response planned for loss of all AC power supply functions in emergencies, from a long-term perspective.

5) Implementation of response measures needed for the time being, taking into account structures and other aspects of each reprocessing plant

- That as tsunami response assuming even larger tsunami, there is a plan to deploy enhanced flooding measures for buildings and otherwise improve watertightness, at the earliest opportunity.

- That flooding measures are in place to ensure that equipment to be used in event of loss of all AC power supply functions is protected from effects of tsunamis.

- That the plan further enhances emergency safety measures by isolating equipment important to safety or equipment needed for response measures, from the effects of tsunamis, through maintenance of tide embankment and seawalls, rendering the perimeter of the building watertight and other measures.

- That these are planned in such a way that a tsunami height necessary in planning protective measures are assumed and the necessity or lack thereof of checklist items assessed, before they are integrated in a suitable fashion to establish an effective tsunami countermeasure.
6) Validity of facilities that fall into the scope of emergency measures and of the assessment results

- That facilities that fall into the scope of emergency measures have been identified in a valid fashion, and the plan calls for the implementation of measures that are in line with assessment results such as the time required until solutions reach their boiling point or until hydrogen concentration reaches the upper explosive limit

- That every facility currently in use that also requires decay heat removal or that generates hydrogen whose accumulation requires prevention, has been identified
- That assessment results, such as the time required until solutions reach their boiling point, are valid for facilities requiring decay heat removal
- That for facilities requiring decay heat removal, the plan calls for the implementation of measures that are in line with assessment results such as the time required until solutions reach their boiling point
- That assessment results, such as the time required until hydrogen concentration reaches the upper explosive limit, are valid for facilities that generate hydrogen whose accumulation requires prevention
- That for facilities that generate hydrogen whose accumulation requires prevention, the plan calls for the implementation of measures that are in line with assessment results such as the time required until hydrogen concentration reaches the upper explosive limit
- That additional effects of loss of all AC power (such as the effect of loss of all AC power while the glass-melting furnace is in operation) are assessed as needed

(2) Ensuring multiple emergency generators on standby

- That additional emergency generators are planned for installation at the earliest possible opportunity, for increased
power supply reliability

- That operational safety programs are planned for review and a plan for deployment drafted, in order to ensure that there are 2 emergency generators, capable of supplying AC power to emergency bus, on standby at all times (if there are multiple buildings within the same reprocessing facility, include the number of units needed when it is possible to supply power to the necessary emergency bus from emergency generators installed in another building)
- That if a certain amount of time is required before the additional emergency generators can go online, then all applicable plans should include a response for this duration

3. Points of Note in Drafting Emergency Safety Measures

During the examination process NISA will verify whether the operators are ensuring the deployability of their emergency safety measures by considering the below points of note in drafting the contents of these measures.

a. Equipment, material and facilities

<table>
<thead>
<tr>
<th>Equipment &amp; material installability</th>
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<tbody>
<tr>
<td>✓ Can the equipment or material be physically installed?</td>
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<table>
<thead>
<tr>
<th>Equipment &amp; material connectability</th>
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<tbody>
<tr>
<td>✓ Can the equipment and material be connected to the facilities they must work with, successfully constituting a system capable of achieving its goal?</td>
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<thead>
<tr>
<th>Operability of existing facility</th>
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<tbody>
<tr>
<td>✓ If an existing facility is being depended on to operate, can a power source be secured for it?</td>
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<tr>
<th>Manual operability of existing facility</th>
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<tr>
<td>✓ If an existing facility is being depended on to operate, can it be operated manually if no other options are available?</td>
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b. Work (labor)

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<tr>
<th>Work structure</th>
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<tr>
<td>✓ Have personnel with skills needed for the work been secured?</td>
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<tr>
<td>✓ Has a structure been established?</td>
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<thead>
<tr>
<th>Work-related equipment &amp; materials</th>
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<tr>
<td>✓ Have work-related items such as work gear (including dosimeter and radiation suits), work tools, devices, instruments, fuel, tanks and keys for securing and accessing been prepared?</td>
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<tr>
<th>Work environment</th>
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<td>✓ Has the work environment, consisting of such things as working areas, lighting, air conditioners and communication methods, been organized?</td>
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<tr>
<th>Work completion time</th>
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<tr>
<td>✓ Has the time required to complete necessary work been determined and considered?</td>
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<tr>
<th>Accessibility</th>
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<tr>
<td>✓ Are the necessary equipment and supplies accessible? Can workers reach their destinations?</td>
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<tr>
<th>Hazard prediction</th>
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<tr>
<td>✓ Have dangers (radiation, collapse, subsidence, flying objects, short circuit, leakage of water/fuel/gas/chemicals, the dark and high locations) associated with work in the time of emergency been predicted, and dealt with?</td>
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c. Process

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<tr>
<th>First response</th>
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<tr>
<td>✓ Has the initial step of the first-response process in the event of a tsunami been made clear? Is the series of response following this designed for rapid deployability?</td>
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<tr>
<th>Targets, decision criteria &amp; flow</th>
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<tr>
<td>✓ Have the targets, criteria for decision-making and workflow been decided ahead of time for the process, in order to carry out the work efficiently in limited time?</td>
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d. Drills (training)

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<tr>
<th>Verification of deployability</th>
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<tr>
<td>✓ Has the deployability of the measures been verified through drills that use the actual equipment and materials, structure and process to carry out actual operation and work?</td>
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<tr>
<th>Identification and utilization of problems</th>
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<tr>
<td>✓ Have problem areas been identified through drills, and the solutions to these problems explored then reflected in the equipment and material, structure and process?</td>
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e. General

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<tr>
<th>Grasp of the situation</th>
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<tr>
<td>✓ Have the facilities, equipment &amp; materials, structure and process been established so that the situation at the reprocessing facility may be ascertained as much as possible?</td>
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<th>Consideration of hypothetical external factors</th>
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<td>✓ Have outside factors that delay the implementation of necessary measures been hypothesized, and duly considered?</td>
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Some examples of outside factors:
- Earthquake (aftershock)
- Tsunami (secondary waves)
- Weather (typhoon, heavy snowfall, thunderstorm, heavy rain, high winds, dense fog)
- Climate (cold climate areas)
- Seasonal events (New Year, Obon)
- Time of day (early morning, late night)
- Region-specific factors (terrain, public transportation, roads)
- Obstructions (fallen debris, flotsam, rubble, cars, building and other materials)
- Congestion (large groups of people working at the same time, multiple units being worked on at the same time)
- Maintenance (auto inspection, equipment maintenance)
- Etc.
Back up
✓ Have the necessary facilities, equipment & material, structure and process already been organized to enable a response in the event of an unforeseen situation (non-operation, facility damage/destruction, disaster progression, worker injury, etc.)?

Impact assessment
✓ In reorganizing facilities, equipment & material, structure, process and training, has the impact of additions and changes caused by emergency safety measures been assessed, and care taken to ensure that facilities, processes and other aspects suffer no adverse effects?

Consolidation of know-how
✓ Has the know-how regarding emergency situations been consolidated through constant data collection, and reflected in facilities, equipment & supplies, structure, process and training?