Operational Safety Inspection Implementation Status

May 27, 2024

Tokyo Electric Power Company Holdings, Inc.

1. Operational Safety Inspection Objectives

- Following the body contamination that occurred during the cleaning of additionally installed ALPS pipes in October 2023, four incidents occurred in succession.

  ① Body contamination that occurred during the cleaning of additionally installed ALPS pipes (October 2023)
  ② Leak of water containing radioactive substances from the high temperature incinerator building (February 2024)
  ③ Sounding of fire alarm due to water vapor, etc., generated from the additionally installed miscellaneous solid incinerator facility waste storage pit (February 2024)
  ④ Loss of on-site electric power system A and injured person (April 2024)

- Some of the aforementioned incidents are still being investigated, but an underlying factor of all of them appears to be an inadequacy of risk analyses based on ascertained risk factors.

- We believe that, in addition to preventing the recurrence of these incidents, it is essential to unite and enhance work safety at the power station. It was therefore decided to implement operational safety inspections for all tasks being performed at the power station to assess the adequacy of protective measures based on risk factors identified by examining field conditions.

2. Operational Safety Inspection Focus

It appears that an underlying cause of all four of these incidents was an inadequacy of risk analyses based on ascertained risk factors so the operational safety inspection focused on these perspectives.

- **Insufficient deliberation of a broad range of scenarios in which risks manifest that are based on risk factors identified by examining the latest field conditions**
  - ✓ The possibility of manipulation of valves that should not be manipulated (①)
  - ✓ At certain quantities, wood chips could generate excessive heat when left in a pile for a certain period of time (③)
  - ✓ The possibility of damaging cables and/or conduits even during the excavation of surface ground layers (④)
- **Insufficient sharing of risk information amongst workers and all other relevant parties**
  - ✓ Field conditions, such as the open/closed status of valves, etc., differed from procedure manuals (②)
  - ✓ The depth of buried cables was shallow around the hand hole (④)

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3. Operational Safety Inspection Procedure

- Field conditions are examined and risk factors identified in accordance with the work
  (examples)
  a. Body contamination/exposure to radioactive substances → Highly concentrated liquid radioactive substances, etc.
  b. Radioactive substance leak → Highly concentrated liquid radioactive substances, etc.
  c. Electrical injury from contact with live wires, etc. → Live high voltage wires
- Deliberate risk manifestation scenarios while keeping in mind the incidents that should be avoided, such as body contamination and leaks to the external environment
- Joint deliberation between TEPCO and contractors of the suitability of current protective measures while examining procedures
- Reflect areas for further improvement in the revisions to protective measures

Ex.	Incident to avoid	Risk factor	Detrimental impact (risk manifestation scenario)	Current protective measures	Improved protective measures
a	Body contamination/ exposure to radioactive substances (radiation control work)	: Highly concentrated liquid radioactive substances/chemicals : System pressure	• Unforeseen manipulation of valves causes system pressure to rise which in turn causes the secured temporary hose to pop out of the tank and spray highly concentrated liquid radioactive substances onto workers resulting in body contamination	• No description	• Labels prohibiting valve manipulation • Change methods to secure temporary hoses • Work area demarcation and wearing of anorak suits
b	Leak of radioactive substances into the environment (radiation control work)	: Highly concentrated liquid radioactive substances	• Highly concentrated liquid radioactive substances leak into the external environment as a result of boundary valve manipulation errors/misidentification	• Boundary valve isolation is confirmed by two people (peer check)	• TEPCO's operations Department solely manipulates boundary valves, and the Maintenance Department also confirms the configuration • Education on peer check methods • Education on the objectives and importance of confirming the isolation status of boundary valves
		: Highly concentrated liquid radioactive substances : Heavy machinery, etc.	• Heavy machinery, etc. makes contact with pipe in which highly concentrated liquid radioactive substances are flowing causing the pipe to rupture and a leak into the external environment	• No description	• Confirm that there are no pipes in the work area of the heavy machinery, etc.
c	Electrical injury from contact with live wires, etc. (work near live wires, etc.)	: Live high voltage wires, etc.	• Surface paving is excavated to the point where electrical conduits are buried thereby damaging power cables and resulting in burns or electrical injury	• Excavate only the surface layer of the paving	• Improve work methods such as stipulating in advance the amount of pavement to be torn up, shutting off the power, etc.

4. Issues that were considered when implementing the Operational Safety Inspection

➢ **Participation by all workers**

- The operational safety inspections were implemented with everyone involved with the work, including the primary contractor, after organizing all works by “work name" and “work schedule/protection instructions" based on the details of each work.

➢ **Two-way discussions**

- Discussions were held with everyone involved with the operational safety inspections, during which they were asked about things they had noticed and other risk manifestation scenario in an environment that enabled them to speak freely
- During discussions issues were pointed out by workers who were not affiliated with the primary contractor
  → An atmosphere was created that allowed everyone involved with the task to proactively and voluntarily engage in discussion

5. Operational Safety Inspection Progress Status

- The risk reassessments (the operational safety inspections) were implemented prior to the recommencement of works that had been temporarily suspended since the Golden Week holiday.
- These operational safety inspections started on May 7 (some started earlier on May 1). As of May 23, approximately 730 works had been recommenced after the completion of the risk reassessment.

	As of 5/1-5/7	As of 5/7-5/9	As of 5/10-5/13	As of 5/14-5/16	As of 5/17-5/20	As of 5/21-5/23
Number of works that have been recommenced	Approx. 120	Approx. 310 (Increase of Approx. 190)	Approx. 430 (increase of Approx. 120)	Approx. 550 (increase of Approx. 120)	Approx. 610 (increase of Approx. 60)	Approx. 730 (increase of Approx. 120)
Number of works for which protective measures were improved	Approx. 40 (Approx. 30%)	Approx. 150 (Approx. 48%)	Approx. 250 (Approx. 58%)	Approx. 340 (Approx. 62%)	Approx. 380 (Approx. 62%)	Approx. 450 (Approx. 62%)

- Currently, work that requires significant revision has not been identified as a result of the reassessment.
- However, field improvements for further enhancing work safety in light of the most recent field conditions are identified during the reassessment and work procedure improvement and clarification of radiation protection equipment usage instructions, etc., have been implemented.

6. Protective Measure Improvement Example 1/4 (Work procedure improvement)

◯ Example of procedure improvement for how power is turned on to power panels during electric facility installation

＜Identified risk＞

Authorized personnel or other parties come to contact with live wires, etc.

＜Risk scenario＞

Electrical injury from contact with live wires, etc.

Detailed discussion of risk scenario that focuses on live and dead wires, etc. in the same location.

＜Improved protective measures＞

- Procedures now note that schematics clearly showing what wires, etc. are live are to be created, and that this information is to be conveyed to all related personnel during toolbox meeting and safety briefing
- Live power panels are to be kept locked at all times to prevent non-authorized personnel from touching them

The old procedures just talked about turning on power, so the procedures have been improved so that it is clarified what wires are live or dead, and so that live wires, etc. are kept locked to prevent risk scenarios involving electrical injury of authorized or unauthorized personnel by coming in contact with live wires, etc.

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6. Protective Measure Improvement Example 2/4 (Clarification of radiation protection equipment usage instructions)

◯ Example of improvement for how to switch radiation protection equipment when working in areas that have been designated as G zones.

＜Identified risk＞

Risk of contamination even though the work is being performed in G zone

＜Risk scenario＞

Radioactive substances may accumulate on the drift and contamination may be transferred to the bodies of workers

The surfaces around Unit 2 have been paved and the area has been changed from Y zone to G zone, which indicates reduced risk, however risk scenarios were identified based on the fact that there are many Y zones in the vicinity of Units 1-4 where contamination exists, and on cases of body contamination that occurred during other task in the vicinity.

＜Improved protective measures＞

Ground surfaces will be covered to secure safe work environment, and at each step in the work process all workers shall put on a new pair of rubber gloves

In order to further reduce the risk of contamination, the ground surface, which is a potential contamination source, will be covered, and new rubber gloves will be put on at each step in the work process thereby reducing the risk of face, etc. contamination.

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6. Protective Measure Improvement Example 3/4 (Areas for improvement at work sites to enhance work safety)

◯ Example of labeling containers used for carrying

＜Identified risk＞

Container (heavy object) being carried is dropped on the foot of a worker.

＜Risk scenario＞

Container that is used to carry objects during the course of daily tasks is dropped on the foot of a worker thereby injuring him/her

While cleansing tank maintenance is a daily task and the possibility of dropping a container used had been brought to the workers' attention orally during toolbox meetings and safety briefings, the discussion highlighted the need to clarify how the containers should be held and the quantity of material with which they should be filled.

＜Improved protective measures＞

When carrying with two people, tape has been used to mark where the workers should hold the containers so as to prevent them from losing their grip. Tape has also been attached to the outside of the containers to make it easier to see the level to which they should be filled.

Improvements were made to prevent accidents by labeling the actual containers rather than just noting what should be done in procedures or through oral instructions.

6. Protective Measure Improvement Example 4/4 (Confirmation through actual work)

◯ Example of improvement for transfer method during the cleaning of existing ALPS crossflow filters with chemical agents

＜Identified risks＞

Body contamination by cleaning waste liquid, leaks to the external environment

＜Risk scenarios＞

Body contamination occurred when hoses are inserted/withdrawn from temporarily installed plastic tanks, and external environment is impacted due to the damage to existing hoses, etc.

The discussion addressed the risk scenarios in detail by focus on body contamination and leaks to the external environment

＜Improved protective measures＞

Body contamination countermeasures ※ have been applied to this work and confirmed through actual work.

※ Changes made to this work in light of the body contamination incident

- The use of temporarily installed plastic tanks has been stopped and now a drain line is configured by attaching a temporary hose to the permanent drain tank. A double-lined temporary hose is also used.
- Up until now the water level of the permanent drain tank had been monitored by standing close to the tank, but changes have been made to prevent body contamination so now the monitor looks out from a small window in a temporarily constructed shed.
- All workers, including monitoring personnel, wear anorak suits.

Up to now there had been risks of workers coming in contact with waste liquid or having their bodies contaminated by spraying liquid, but we have eliminated any chance of touching waste liquid, and implemented protective measures to prevent body contamination even in the event of spraying liquid by temporarily constructing a shed that protects workers.

6. Protective Measure Improvement Example 4/4 (Realizations through actual work)

◯ When cleaning liquid was transferred to the permanent drain tank, workers monitored the water level of the permanent train tank as noted in the work procedures. However, start up of the drainage pump was delayed slightly and liquid was not transferred to the drainage tank in time, resulting in an overflow of approximately 5L within the weirs.

◯ Improvements have been made to protective measures, such as revisions to drainage line configuration, monitoring methods, and radiation protection gear, upon identifying body contamination risks and the risk of leaks into the external environment thereby avoiding body contamination and leaks into the external environment.

◯ Since having a quantitative perspective in the work procedures makes the tasks clearer, we will improve the procedures going forward.

7. Evaluation to date from operational safety inspections

1. Confirming the ease of identifying risk factors and risks

- By giving detailed examples of risk factors it is now easier to identify risks compared to when risk assessments were conducted in the field from scratch.

2. Examination of a broader range of scenarios

- Through detailed identification of risk factors the range of scenarios has broadened and discussion has deepened.

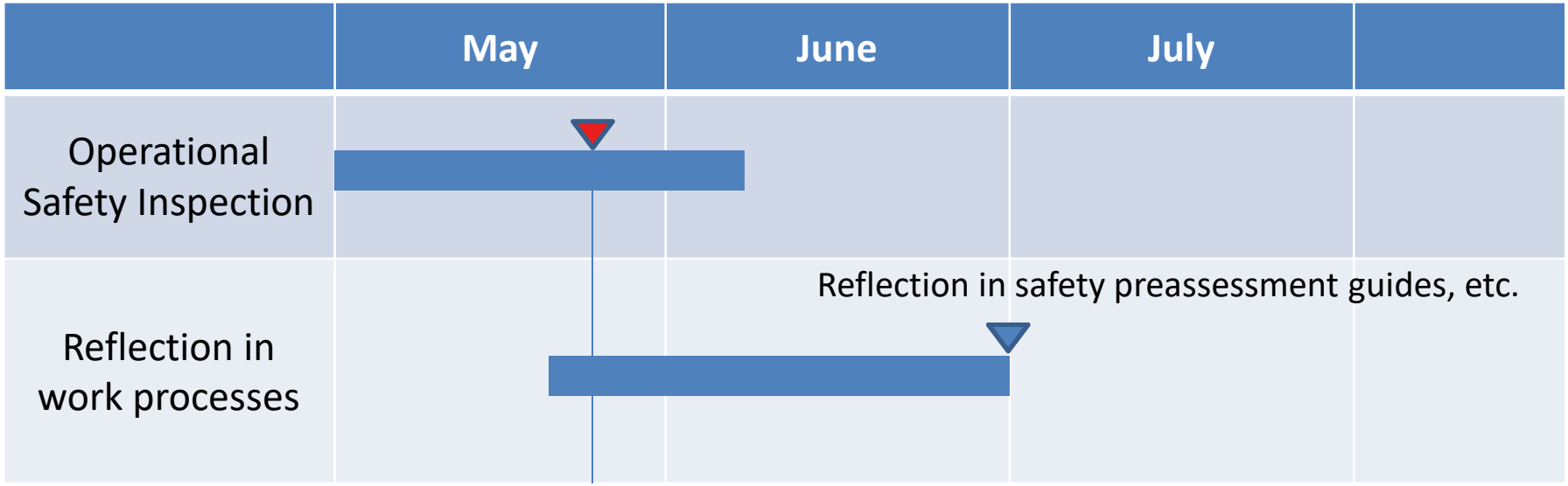
3. Importance of having all parties involved in the work understand the risks

- We have reaffirmed the importance of being aware of risk factors and identifying/deepening the understanding of the risks through joint examinations conducted by all contractors and TEPCO employees engaging in works in the field.

We believe that using these methods to analyze risks in light of the most recent field conditions will be effective to prevent recurrence of incidents, such as body contamination and impact to the external environment.
However, since areas for improvement were identified during the operational safety inspections, each of these improvements shall be made going forward.
Furthermore, issues noticed during these operational safety inspections will be compiled and reflected in the process of safety preassessment, etc. to make continuous improvements.

8. Future schedule

➢ We aim to complete Operational Safety Inspections by the first week of June and making continual improvements by making changes to work processes in light of the inspection results.



< Reflection in work processes >