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Development and Operation of Equipment Master List for Soundness Confirmation of Long-term Storage Equipment in the Ohma NPP

Masakazu Shimooka[1], Kozo Miyao[2], and Keita Nomura[3]

[1] Group Leader, J-Power (Electric Power Development Co., Ltd.), Tokyo, Japan (masakazu_shimooka@jpower.co.jp)
[2] Sub Leader, J-Power (Electric Power Development Co., Ltd.), Tokyo, Japan (kouzou_miyao@jpower.co.jp)
[3] Group Member, J-Power (Electric Power Development Co., Ltd.), Tokyo, Japan (keita_nomura@jpower.co.jp)

ABSTRACT

Construction work of the Ohma Nuclear Power Plant started in May 2008, but we are currently undergoing a compliance review with the new regulatory standards enforced in July 2013, and there are restrictions on construction work. Therefore, we have implemented long-term storage measures for equipment that has already been delivered to the site for over 10 years, with the cooperation of equipment suppliers.

Now, we are planning to confirm the soundness of the long-term storage equipment as a release point for normal construction work so that the long-term storage is completed, and construction resumes. Soundness confirmation requires our company to manage a huge amount of information, including various plans and achievements by numerous equipment suppliers, and we need to implement it steadily step by step.

Regarding the soundness confirmation of the long-term storage equipment, before resuming construction, we plan to conduct a visual inspection of the exterior to confirm whether there are any abnormalities, and after resuming construction, we plan to disassemble and inspect the equipment, replace consumables, conduct the functionality and performance tests after reassembly, etc. Through these efforts, we will confirm step by step that the equipment is in a state where it can perform its designated functions.

We decided to develop an equipment master list from the construction stage so that we could ensure the process management, management of the plan formulation, management of the implementation results, etc. at each step of the soundness confirmation, and so that we could draw up plans for the maintenance after the start of operation by referring to this soundness confirmation information. Additionally, we have developed “Equipment Management System” as its operating environment.

This allows the plans and achievements of the soundness confirmation to be shared among related parties in a timely manner, contributing to smooth construction progress, and it is also expected to contribute to draw up plans for the maintenance after the start of operation by referring to this soundness confirmation information.

LONG-TERM STORAGE MEASURES FOR MECHANICAL AND ELECTRICAL EQUIPMENT

As shown in Figure 1, construction of the Ohma Nuclear Power Plant started in May 2008 and was originally scheduled to start commercial operation in 2014, but construction work was suspended due to the Great East Japan Earthquake in March 2011. The construction progress rate at that time was 37.6%. Due to the suspension of construction work, equipment that was scheduled to be brought into the building was exposed to the outdoor environment, and as the building was still under construction, equipment that had already been brought into the building was also exposed to an inappropriate environment.

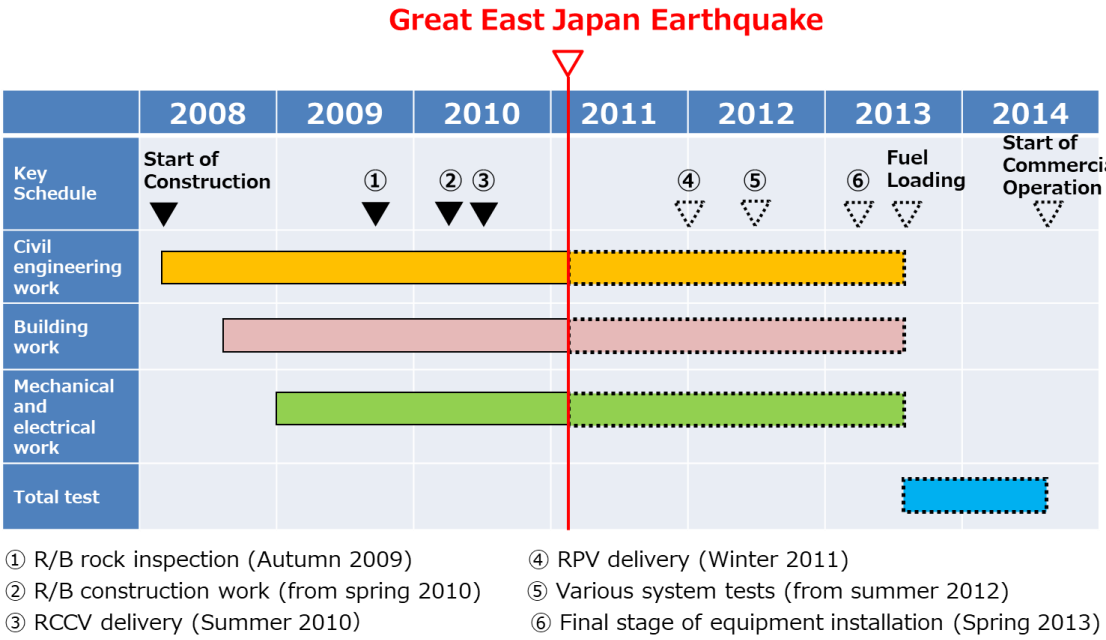


Figure 1. Original construction schedule of the Ohma NPP

After the Great East Japan Earthquake, construction work resumed in October 2012 to the extent that it was not affected by the new regulatory standards. Equipment that had been exposed to the outdoor environment was stored in dedicated storage or temporary warehouses, and the storage environment of equipment that had already been brought into the building was improved by installing temporary roofs, constructing ceiling structures, and closing openings in buildings.

From 2014, considering storage periods would be extended, we analysed deterioration events and deterioration factors for each model of the equipment, established long-term storage measures to eliminate deterioration factors based on the analysis results, and started to implement quality maintenance measures as voluntary activities for such as dehumidification and rust prevention. For details on the long-term storage measures, please refer to the reference by Furukawa et al.

Additionally, from 2016 to 2017, we confirmed the effectiveness of the long-term storage measures by removing the protective sheet and disassembling representative mechanical and electrical equipment.

After the enforcement of the new regulatory inspection system in April 2020, we received approval of "Nuclear Facility Safety Regulations" complying with the new regulatory inspection system in September 2020. Above mentioned long-term storage measures were positioned as "Special Maintenance Plan" under the facility management plan stipulated in "Nuclear Facility Safety Regulations", and we have continued to implement these measures.

SOUNDNESS CONFIRMATION FOR LONG-TERM STORAGE EQUIPMENT

Figure 2 shows the overall picture of the facility management plan stipulated in "Nuclear Facility Safety Regulations". The light blue part is "Design and Construction Plan", which represents a normal construction

work process. The orange part is “Special Maintenance Plan”, which includes above mentioned long-term storage measures for the long-term storage equipment. We have been implementing the long-term storage measures, and now we are planning to confirm the soundness of the long-term storage equipment as a release point for normal construction work under “Design and Construction Plan”, aiming for resuming construction.

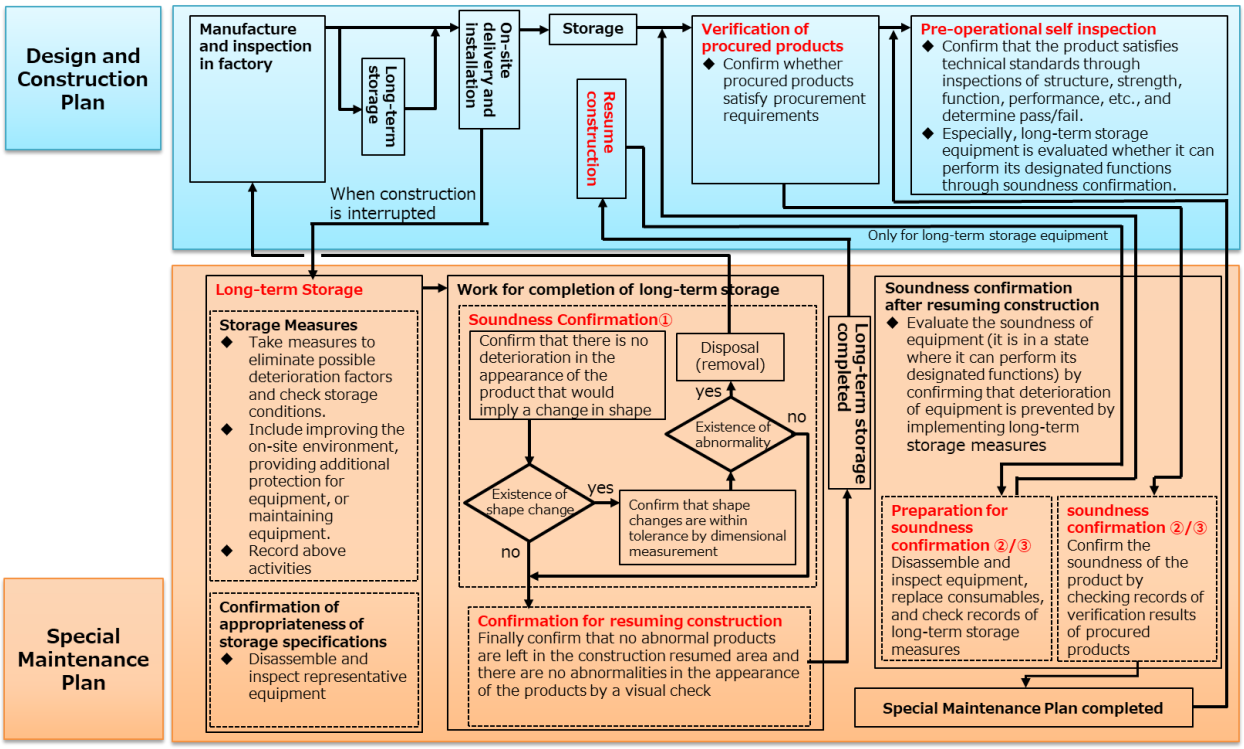


Figure 2. Overall picture of the facility management plan

Figure 3 shows a schematic flowchart for the soundness confirmation of the long-term storage equipment. Before resuming construction, we plan to conduct a visual inspection of the exterior to confirm whether there are any abnormalities, and after resuming construction, we plan to disassemble and inspect the equipment, replace consumables, conduct the functionality and performance tests after reassembly, etc. Through these efforts, we will confirm step by step that the equipment is in a state where it can perform its designated functions as follows.

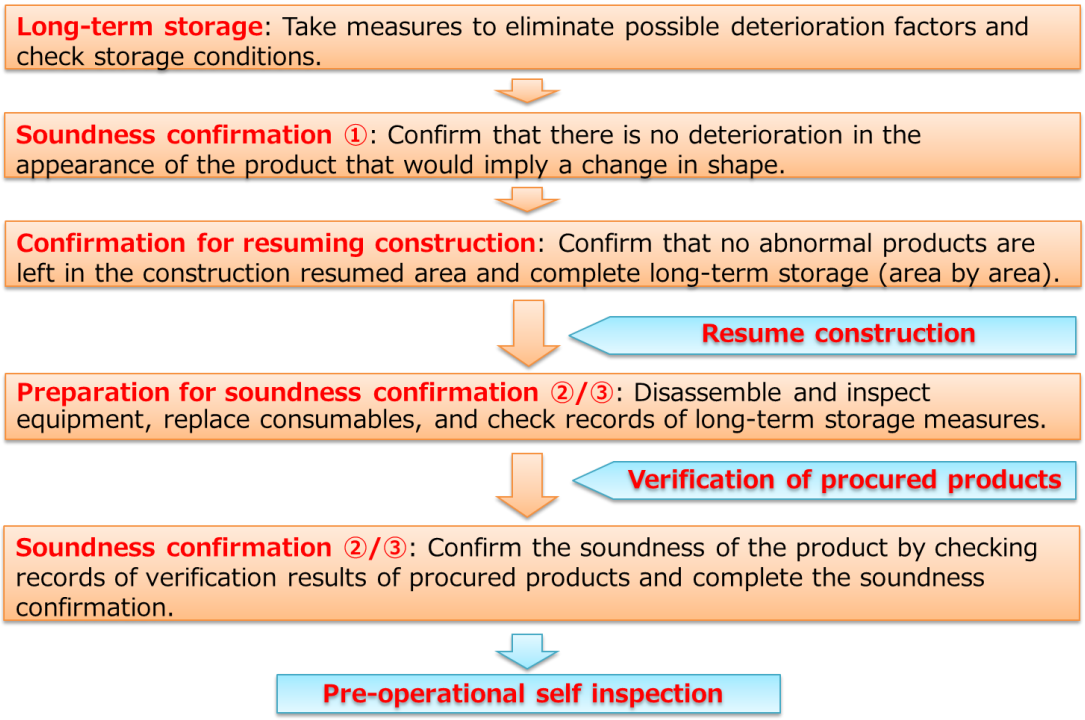
- **Long-term storage:** Take measures to eliminate possible deterioration factors and check storage conditions, which is currently being implemented.

- **Soundness confirmation ①:** Prior to confirmation for resuming construction in the latter stage, confirm that there is no deterioration in the appearance of the product that would imply a change in shape by visual inspection.

- **Confirmation for resuming construction:** Confirm that no abnormal products are left in the construction resumed area as the final check, complete the long-term storage by area, and proceed to resume construction.

● **Preparation for soundness confirmation ②/③:** Disassemble and inspect equipment, replace consumables, check records of long-term storage measures, and proceed to the verification of procured products.

● **Soundness confirmation ②/③:** Confirm the soundness of the product by checking records of verification results of procured products, complete the soundness confirmation, transit from "Special Maintenance Plan" to "Design and Construction Plan" and proceed to pre-operational self inspection.



Definition of Terms

- **Verification of procured products:** Confirm whether the product satisfies procurement requirements.
- **Soundness confirmation ②:** Structural inspection such as installation inspection, appearance inspection, pressure resistance inspection, etc.
- **Soundness confirmation ③:** Function/performance inspection such as single device operation test, system operation test, etc.
- **Pre-operational self inspection:** Confirm that the product satisfies technical standards through inspections of structure, strength, function, performance, etc. and make a pass/fail judgment. Especially, the long-term storage equipment is evaluated whether it can perform its designated functions through soundness confirmation.

Figure 3. Schematic flowchart for the soundness confirmation of the long-term storage equipment

DEVELOPMENT AND OPERATION OF EQUIPMENT MASTER LIST

Soundness confirmation requires our company to manage a huge amount of information, including various plans and achievements by numerous equipment suppliers. Therefore, we decided to develop an equipment master list from the construction stage so that we could ensure the process management, management of the plan formulation, management of the implementation results, etc. at each step of the soundness confirmation, and so that we could draw up plans for the maintenance after the start of operation by referring to this soundness confirmation information.

The equipment master list contains information for each equipment such as equipment information (System No., Tag No., etc.), manufacturing information (Manufacturer, Date of manufacture, etc.), equipment specifications (Safety importance, Classification, etc.), storage information (Location, Condition, etc.) and soundness confirmation information (Inspection schedule, Inspection results, etc.). There are currently approximately 30,000 equipment registered. Table 1 shows an image of the equipment master list.

Table1: Image of the equipment master list

【Equipment name】	【Equipment info.】 Tag No., System No., etc.	【Manufacturing info.】 Manufacturer, Date, etc.	【Specification】 Safety importance classification, etc.	【Storage info.】 Location, Condition, etc.	【Soundness confirmation info.】 Plan and results, etc.
Pump					
Valve					
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Additionally, as for the operation of the equipment master list, in order to ensure collective management of input data from each supplier, data input responsibilities of each supplier, and timely data updates, we have developed “Equipment Management System”, allowing for the following environment. Figure 4 shows an image of “Equipment Management System”.

1. Input data from each supplier are aggregated into a database on a cloud server.

We need to have each supplier perform the soundness confirmation in a cross-sectional and consistent manner based on “Special Maintenance Plan” stipulated in “Nuclear Facility Safety Regulations” and need to manage all the suppliers collectively. Therefore, we built a database of the equipment master list on a cloud server for aggregating data from each supplier into the database on the cloud server.

2. By building a dedicated database for each supplier in the cloud server, each supplier is responsible for input while maintaining confidentiality among suppliers.

Since the Ohma Nuclear Power Plant is currently under construction and the supplier is responsible for delivering the equipment, it is necessary to make the supplier responsible for the accuracy of the various data input to the equipment master list. Therefore, by building a dedicated database for each supplier in the cloud server, which the other suppliers cannot access, we ensured the responsibility for the accuracy of input by each supplier, while maintaining confidentiality among suppliers.

3. Inspection results can be input from each supplier's terminal, allowing for timely updates, and since we have access to the database of each supplier, we can confirm information in a timely manner.

In order to ensure that soundness confirmation is carried out and managed in accordance with the progress of construction, a huge amount of information needs to be updated in a timely manner and can be checked by all concerned parties. Inspection results can be input from each supplier's terminal, allowing for timely updates, and providing our company with access to all the suppliers' database enabled us to confirm information in a timely manner.

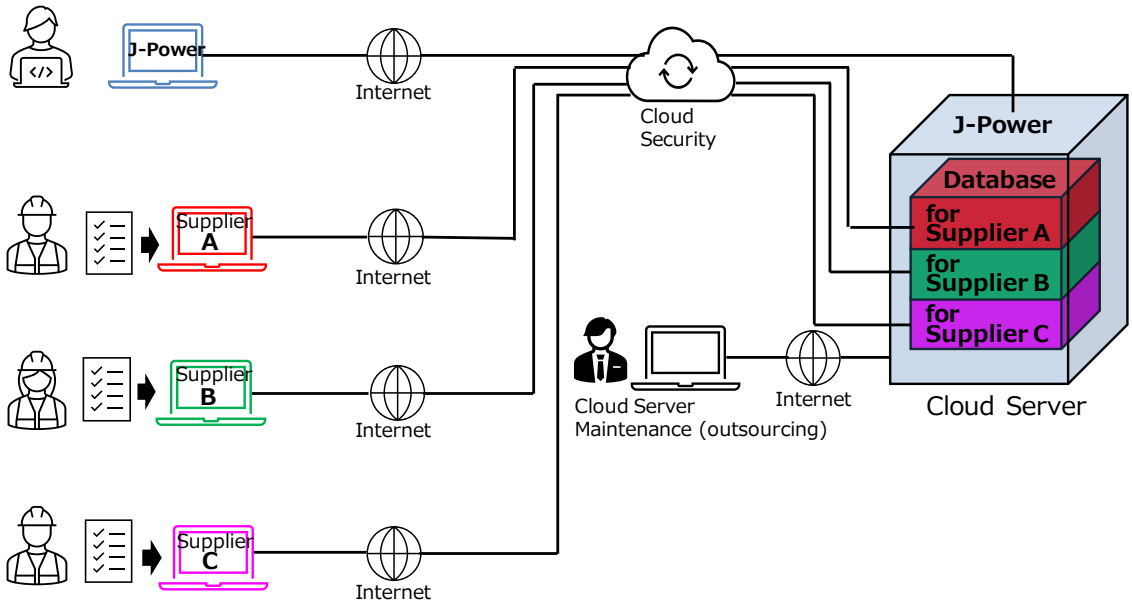

Figure 4. Image of "Equipment Management System"

CONCLUSIONS

We are planning to confirm the soundness of the long-term storage equipment as a release point for normal construction work so that the long-term storage is completed, and construction resumes. We decided to develop an equipment master list to ensure managing a huge amount of information about the soundness confirmation according to the progress of construction work, and we have developed "Equipment Management System" as an operating environment. This allows the plans and achievements of the soundness confirmation to be shared among related parties in a timely manner, contributing to smooth construction progress, and it is also expected to contribute to draw up plans for the maintenance after the start of operation by referring to this soundness confirmation information.

REFERENCES

Furukawa, T., Hayakawa, K. and Umeoka, T. (2023). "Ageing Management of Ohma Nuclear Power Plant During Delayed Construction," *30th International Conference on Nuclear Engineering*, JSME, Kyoto, Japan, 1584.