Results of Survey of Effects of Damage to Main Condenser Tubes in Hamaoka Nuclear Power Station Reactor No. 5 and Future Plans (Overview)

Attachment

1. Overview of incident

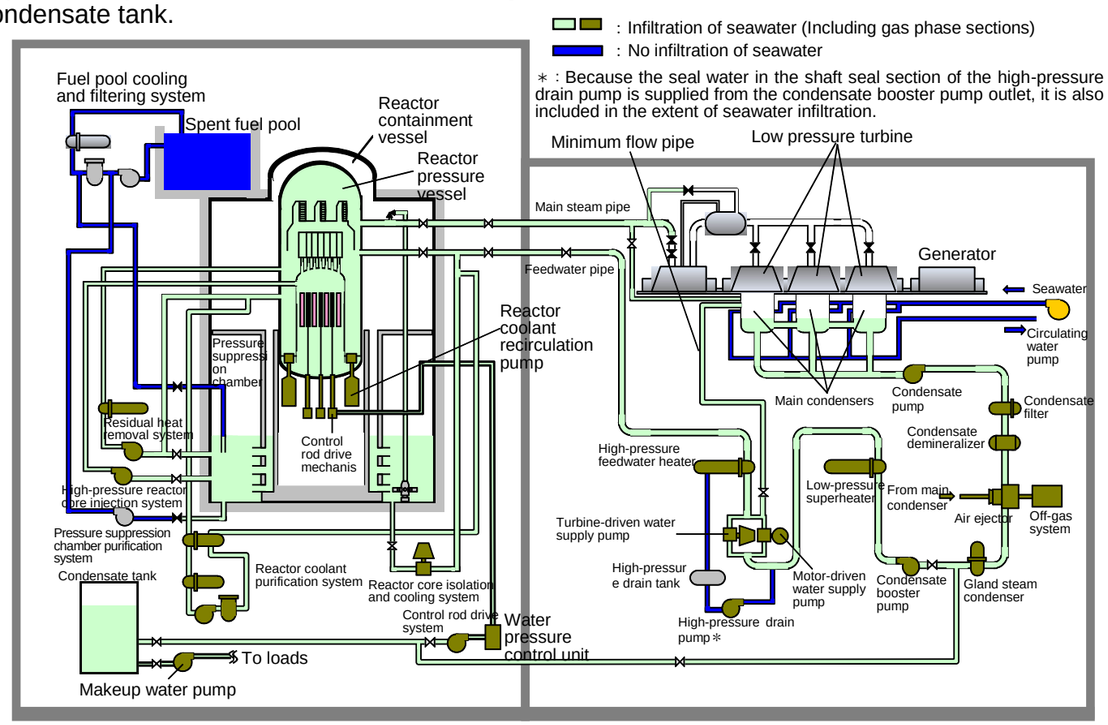
Duing the process of achieving cold shutdown following the shutdown of Hamaoka Nuclear Power Station Reactor No. 5 on May 14, 2011, the readings of conductivity meters monitoring the purity of the water in the main condensers began to rise, and the conductivity of the water in the reactor also began to increase.

After cold shutdown was achieved, the condensers were opened and the cause of the phenomenon was investigated. It was determined that a high volume of seawater had flowed into the reactor facility due to damage to the main condenser tubes.

2. Infiltration of seawater into reactor facilities

The extent of the infiltration of seawater into the reactor facilities was estimated from the operating status of the reactor at the time of the incident and changes in electrical conductivity. Salt removal procedures have been conducted in order to limit the effect of salt on the equipment. The diagram below shows the extent of seawater infiltration.

The volume of seawater that infiltrated the facility in this incident has been calculated as approximately 400 m^3 in total, based on changes in the water level of the main condensers and the condensate tank.



3. Soundness evaluations

Soundness evaluations focusing on corrosion of materials, as described below, have been conducted in order to verify the soundness of the equipment exposed to seawater. These evaluations have been conducted with consideration of the opinions of outside experts.

3.1 Soundness evaluations

Based on the results of examinations of actual equipment and materials tests, as described below, we will conduct soundness evaluations at the equipment level and the system level.

(1) Soundness evaluation at equipment level

Devices will be inspected externally, will be opened and disassembled, and will be subjected to operating tests, etc., and their soundness will be determined based on the results.

(2) Soundness evaluation at system level

Following verification of the soundness of equipment, the operation of the systems those devices comprise will be checked; the appropriate functioning of the systems as a whole will be comprehensively examined.

3.2 Examination of actual equipment

In order to determine the status of corrosion in actual equipment, pumps, heat exchangers, valves, measurement devices, etc. selected as samples with consideration of structures and other factors were opened and disassembled, and the effects of seawater infiltration have been studied. Examples of the results of examinations conducted up to the present are shown below. The corrosion and other damage discovered up to the present will not have any effect on the functions necessary to maintaining the present state of the reactor's cold shutdown.

・Overall, more adhesion of foreign matter and more corrosion was discovered than in previous inspections, but this was able to be removed by maintennace procedures.

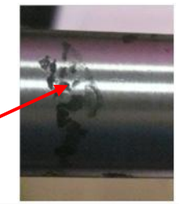
・In the case of the control rod drive mechanism, corrosion was discovered in parts including nitrided parts.

・In the case of the control rod drive water system, corrosion was discovered in parts including some of the valves in the makeup water system.

・In the case of the condensate tank, holes were discovered in and around the welded section of the lining.

（Examples of results of examination of actual equipment）

Control rod drive mechanism ball screw	
Before maintenance	After maintenance
 Foreign matter adhering discovered	

Makeup water system valve shaft	
After maintenance	Magnified
 Corrosion discovered	

3.3 Materials tests

Corrosion tests that reproduced or simulated the environment to which actual equipment was subjected (salt concentration and water temperature after the infiltration of seawater) have been conducted on materials in order to increase our knowledge regarding the status of corrosion of equipment exposed to seawater and the effects of corrosion in the event that that equipment continues to be used.

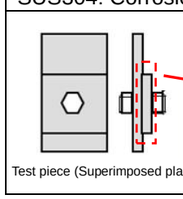
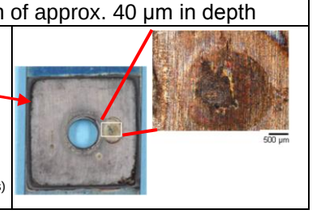
The tests conducted to date have indicated the following.

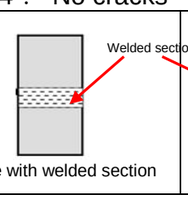
・Corrosion tests using test pieces consisting of superimposed plates showed that corrosion formed on stainless steel plates.

・Stress corrosion cracking tests using test pieces that simulate the welded sections indicated that no cracking occurred in the stainless steel plates.

・Corrosion tests conducted using test pieces that simulate the structure of the pump shaft and impeller section showed that corrosion formed in the gap between the stainless steel shaft, the impeller, and the key.

（Examples of results of materials tests）

Results obtained using test pieces composed of superimposed plates	
SUS304: Corrosion of approx. 40 μm in depth	
 Test piece (Superimposed plates)	

Results obtained using test pieces simulating a welded section	
SUS304： No cracks	
 Test piece with welded section	 Welded section

4. Future plans

In the future, we will open and disassemble the equipment exposed to seawater, and evaluate its soundness based on the results of these inspections. These inspections and soundness evaluations will be conducted on the basis of the results of the examinations of actual devices and the materials tests.

With regard to the holes in the condensate tank, we will elucidate the causes and formulate measures to prevent a reoccurrence. At present, we are engaged in repairing the affected areas. Following the repair of the condensate tank, we will open the reactor and verify the soundness of the internal equipment.