Nuclear Energy

1 Development of Operation Monitoring Method to Improve Plant Availability

The Sixth Strategic Energy Plan of the Ministry of Economy, Trade and Industry, approved by the Cabinet in October 2021, set the goal of 20–22% nuclear power generation in the domestic power supply mix by 2030. To achieve this, it is important not only to restart existing plants, but also to shorten periodic inspections and operate long-term cycles to improve their availability.

To meet these needs, Hitachi has been developing the Hitachi Advanced Plant Performance Diagnosis System (HAPPS), which monitors and diagnoses plant performance during operation to enhance reliability and efficiency. Unlike methods based on statistical analysis of data, HAPPS is based on plant design information. It can constantly monitor equipment deterioration and instrument abnormalities during operation and helps improve the reliability and efficiency of nuclear plants by providing various values, such as drift monitoring of various flow meters; detection of steam leakage from normally closed valves; improvement of heat output calculations; extension of the instrument calibration period due to long cycle operations; reduction of calibration volume; and optimization of auxiliary power for large-capacity loads.

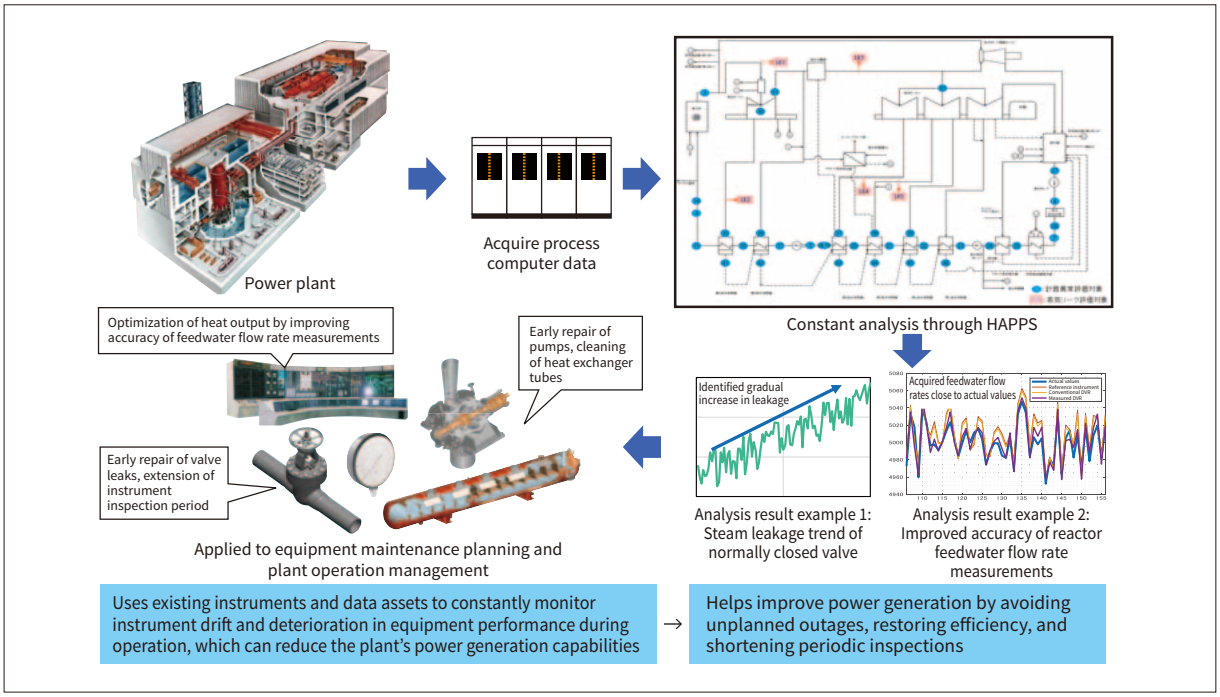
To help plants operate with high efficiency after being restarted, Hitachi is promoting collaborative creation with customers.

(Hitachi-GE Nuclear Energy, Ltd.)

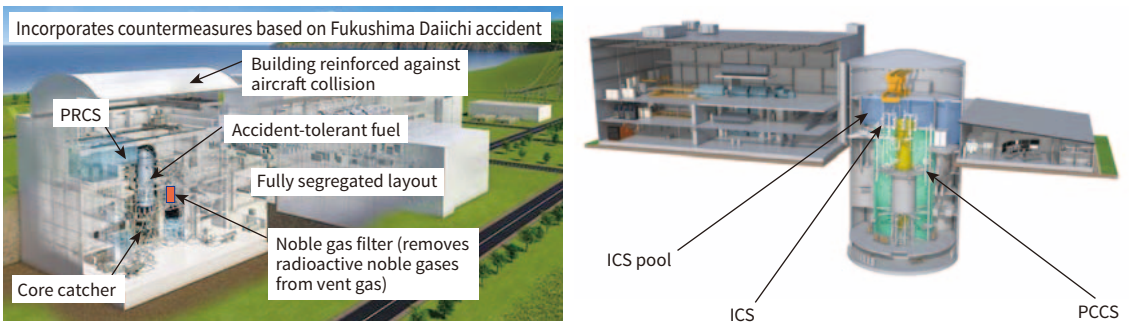
2 Development of Innovative New Reactors that Contribute to Carbon Neutrality

As the goals of carbon neutrality and a stable energy supply rapidly gain societal importance, Hitachi has been developing various innovative new reactors, ranging from large to small reactors.

In terms of large reactors, based on the already constructed advanced boiling water reactor (ABWR), Hitachi continues to develop countermeasures and new safety techniques considering experience from the Fukushima Daiichi Nuclear Power Station accident, with the goal of realizing the high innovative ABWR (HI-ABWR), a large light-water reactor that implements these safety mechanisms.



1 Diagram of HAPPS applied to power plant



Large innovative light-water reactor HI-ABWR

Highly economical small light-water reactor BWRX-300

PRCS: passive reactor cooling system ICS: isolation condenser system PCCS: passive containment cooling system

2 Innovative new reactors developed by Hitachi

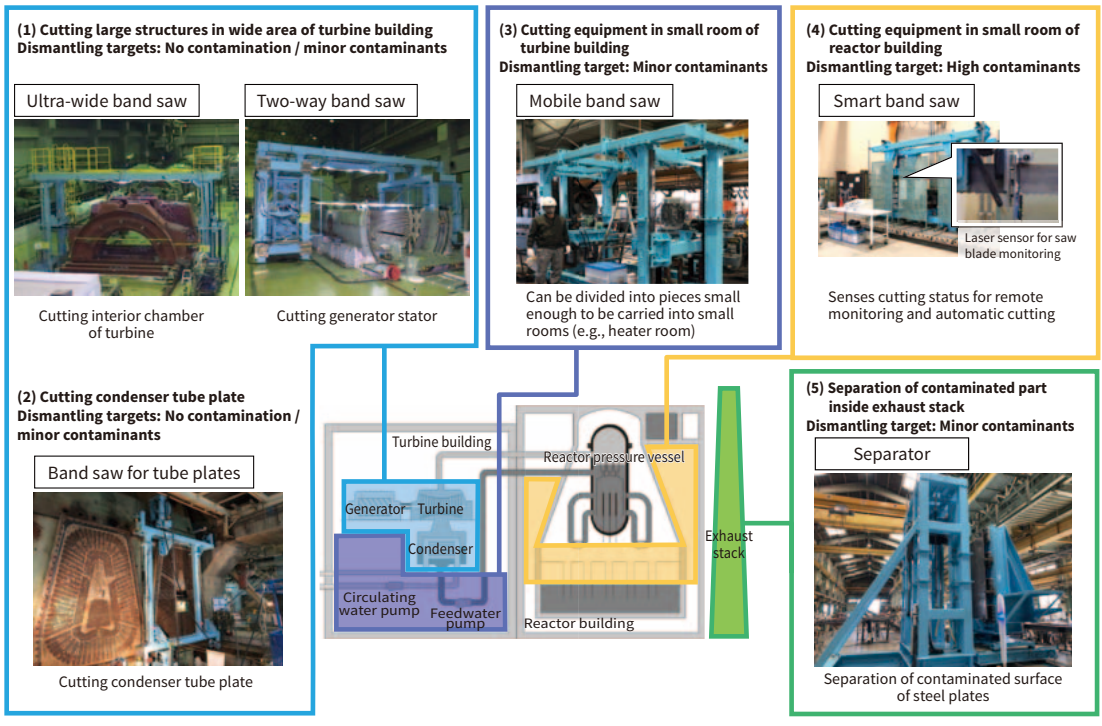
At the same time, in collaboration with its US partner, GE Hitachi Nuclear Energy, and overseas academia, Hitachi is developing BWRX-300, a highly economical small light-water reactor; resource-renewable BWR (RBWR), a light-water-cooled fast reactor that utilizes quasi-domestic resource plutonium through fast neutrons; and power reactor innovative small module (PRISM), a metal-fueled sodium-cooled fast reactor. Of these, the BWRX-300 combines a novel reactor pressure vessel isolation valve design with a passive safety system to achieve a high level of safety. Design is ongoing, with the goal of completing construction of the first unit in Canada as early as 2028.

(Hitachi-GE Nuclear Energy, Ltd.)

3 Initiatives to Reduce Radioactive Waste in Nuclear Power Plant Decommissioning

Of the 60 nuclear power plants in Japan (including those under construction), 18 (excluding Fukushima Daiichi) have been designated for decommissioning, which is the process of dismantling a nuclear power plant that has finished generating power and reducing its radioactive waste. Hence, it is necessary to reduce the large amounts of radioactive waste that will be generated in the future.

The facilities to be dismantled include large equipment, such as turbine generators installed in controlled areas, which must be cut into sizes that can be carried out from the installation area. However, conventional flame



3 Fire-free mechanical cutting and separating equipment

cutting using gas causes contaminants on the surface of the equipment to spread inside it when cut. Accordingly, Hitachi developed a mechanical band saw that cuts without using fire and can handle various conditions, such as the size, shape, and installation location of the object, and expanded its models for different applications.

Moreover, the company developed and applied a new separator that significantly reduces radioactive waste. After separating the contaminated surface (e.g., exhaust stacks), the separated waste is treated as contaminants and the remaining material is no longer considered radioactive waste.

Utilizing its core technologies of fire-free equipment cutting and separation, Hitachi will continue to support decommissioning projects of high social value while promoting collaborative creation with customers.
(Hitachi Plant Construction, Ltd.)

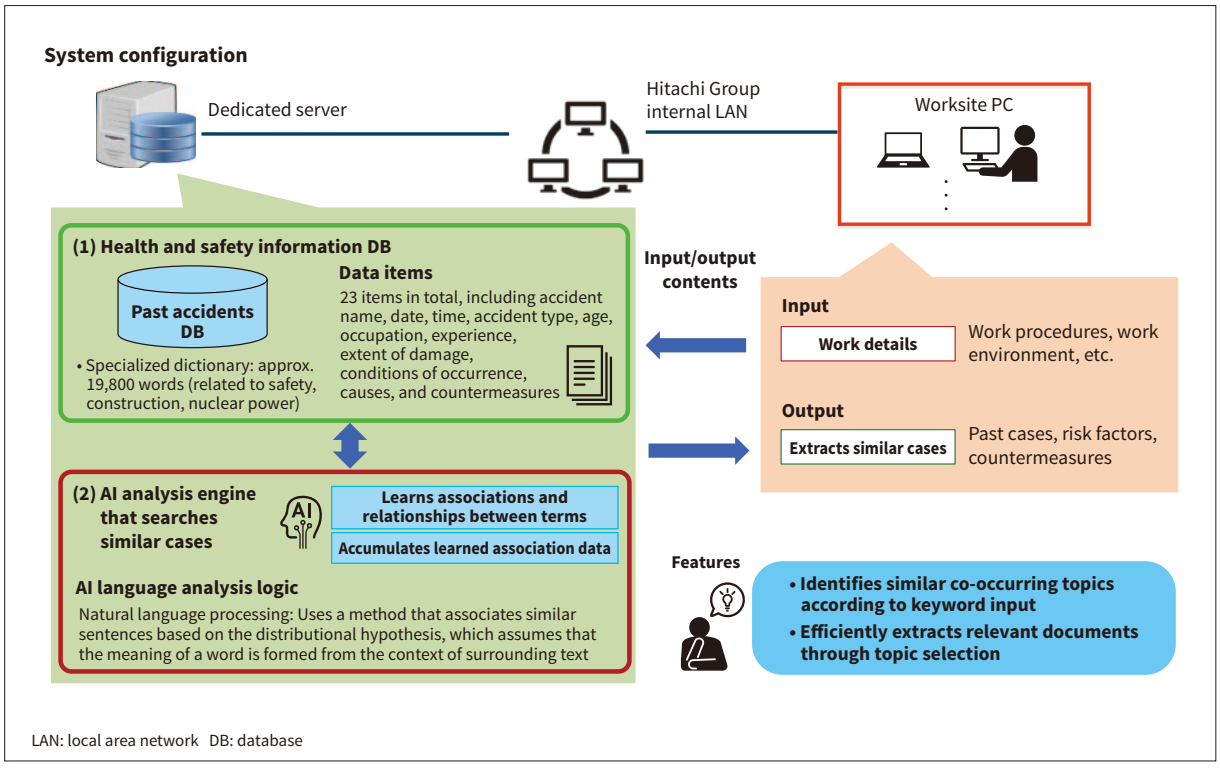
4 Industrial Accident Search Navigation and Safe Behavior Support to Improve Construction Site Safety

The construction industry has recently seen a decrease in skilled engineers and an increase in the number of inexperienced workers. Consequently, ensuring safety at construction sites and reducing the occurrence of occupational accidents has become a pressing and top-priority business challenge.

Accordingly, Hitachi is accelerating its digital transformation (DX) efforts to completely eliminate accidents and has developed an industrial accident search navigation system that uses natural language processing artificial intelligence (AI) to efficiently search past accidents and effectively determine relevant accident risk factors and countermeasures. Thus, by referring to past accidents that occurred in similar work, operators can identify hazards and comprehensively review corresponding countermeasures before performing work, leading to much safer work planning and procedure selection.

Hitachi also developed a safe behavior support system using AI object detection technology, which detects and issues alerts when people enter dangerous areas on site. The system uses a control device with edge AI processing and cameras to detect when people enter restricted zones or dangerous work areas such as elevated locations and openings on site, and then issues an alert.

Hitachi will continue to utilize this system at power plant construction sites and worksites, and further deploy it to various companies within the Hitachi Group to help achieve fundamental workplace safety.
(Hitachi Plant Construction, Ltd.)



4 Configuration of industrial accident search navigation system and input/output contents and features