

Takahama Unit 4 Automatic Reactor Trip (No.3)

March 1, 2016

The Kansai Electric Power Co., Inc.

At Takahama Unit 4 (pressurized water reactor, rated electric output: 870MW), the turbine and reactor automatically shut down at p.m. 14:01:27 February 29, 2016 in response to the actuation of “main transformer/generator internal failure” and “PT failure” alarms following generator trip at p.m. 14:01:26 when actions to connect the generator in parallel were being taken.

Subsequently, to determine the causes of “main transformer/generator internal failure” alarm which triggered automatic generator trip, the local relay panel was checked for potential components actuating the alarm to find that the detection circuit indicating a main transformer failure was actuated.

This is supposed to have led to the actuation of automatic generator trip circuit, which caused automatic generator trip.

There have been no fluctuations in the indications of Takahama Unit 4 vent stack monitor and environmental monitors surrounding Takahama Nuclear Power Station. The event has not caused any radioactive release to the surrounding environment.

Plant operating parameters have been showing stable trends after reactor trip.

(As reported in the press release dated February 29, 2016)

1. Status of investigation

(1) Visual inspection of main components after reactor trip

Visual inspection of the generator, main transformer, potential transformer and protective relay M87B has revealed no abnormal conditions. In addition, the operations performed to connect the generator in parallel were re-checked and it was found that a series of operations were conducted in a correct manner.

(2) Status immediately after generator paralleling

The generator transformer protective relay panel was replaced with an upgraded digital panel in August 2011 while Takahama Unit 4 was undergoing the periodic

outage inspection. After the replacement, the use of protective relay G87 for the detection of generator internal failure was made suspended until its integrity was confirmed through initial load tests (at 5% generator output) after generator paralleling.

Besides, the configuration of the protective relay M87B, which was originally intended to detect main transformer internal failure, as well as the protective relay MG87A for the detection of generator internal failure, which also had a function to protect the main transformer through the generator as a package, was changed so that they were able to detect any failure in the generator and main transformer as a backup protective circuit.

Meanwhile, as a result of checking the record of current values flowing through the protective relay M87B, we confirmed that the current flowing into the generator from the transmission line immediately after generator paralleling exceeded the set point at 30%, which triggers the protection and trip of the generator.

We suppose that this has resulted in the actuation of the concerned relay.

2. Ongoing investigation

- We will work on more detailed investigation of the factors causing the actuation of protective relay M87B. For the main components, including the generator and main transformer, for which visual inspection showed no defects, we will perform insulation resistance measurement and other tests to confirm that there are no internal failures.

Takahama units 3 and 4 is KEPCO's first unit that has passed the safety screening against the new regulatory requirements which took effect on July 8, 2013 taking into account the lessons learned from the TEPCO's Fukushima Daiichi NPP accident and latest technical findings collected from across the world.

We will continue to make an utmost effort to improve the safety and reliability of our nuclear power plants by collecting and analyzing latest technical information collected at home and abroad. At the same time, we set our goal at achieving the world's highest level of safety while pursuing voluntary safety improvement measures on a continuous basis even beyond the framework of the new regulatory requirements.

Status of Generator/Main Transformer Protection before/after Generator Paralleling

