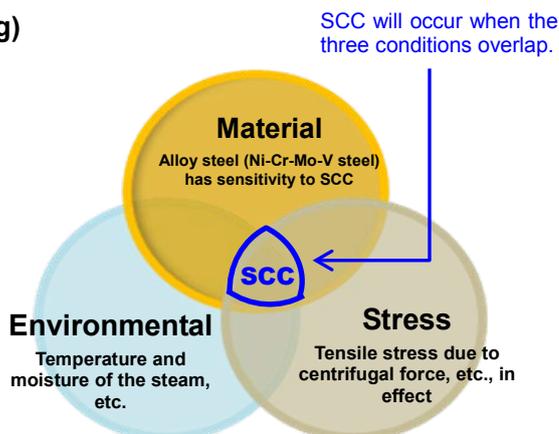


## Plan Changes to Countermeasures against the Fracture of Moving Vane Mounting Assembly in the Hamaoka Nuclear Power Station Unit 4 Low-Pressure Turbine

### 1. The Factor that Caused (SCC: Stress Corrosion Cracking)

For the 10th to 12th stages of the Unit 4 low pressure turbine, in which fracture presumed to be due to stress corrosion cracking occurred, detailed investigation showed that the environment (temperature and moisture of the steam) and stress were highly sensitive to stress corrosion cracking. It is assumed that stress corrosion cracking occurred with these overlapping conditions.

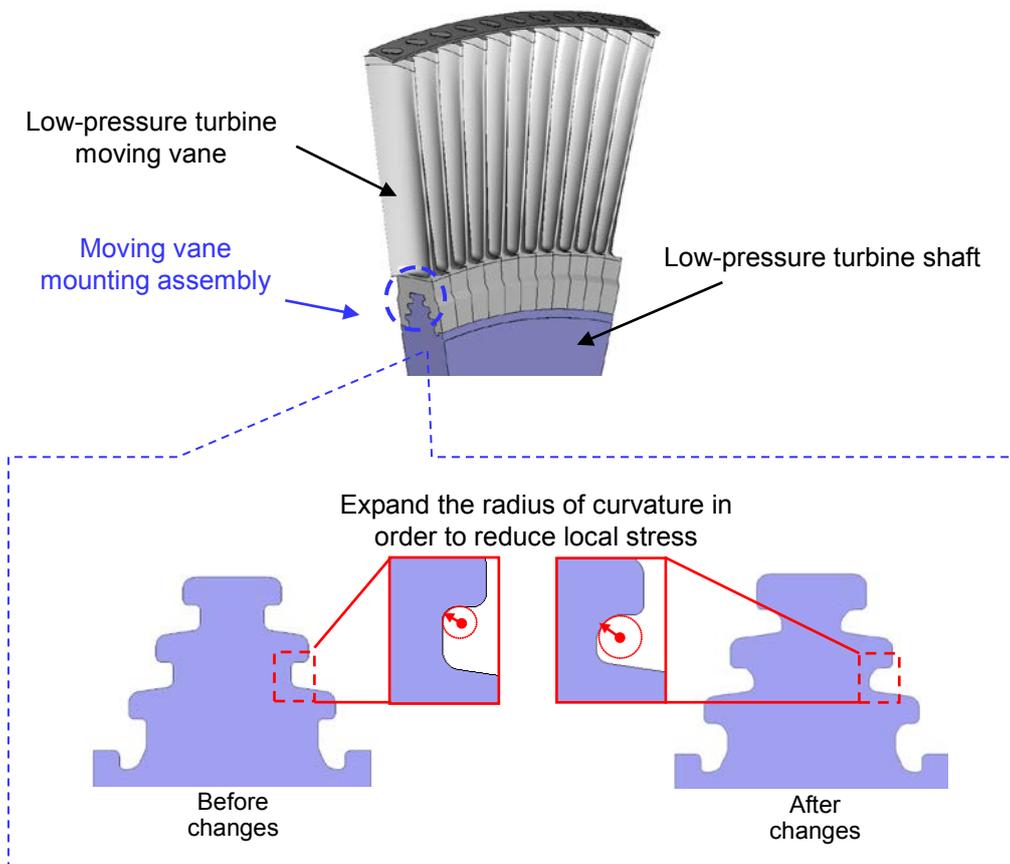


### 2. Measures against Stress Corrosion Cracking

As stress corrosion cracking occurs when the three factors overlap (material, environment, and stress), Chubu Electric will carry out measures on the "stress" factor in the following manner to suppress the occurrence of stress corrosion cracking for the new low pressure turbine shaft.

#### (1) Changes in the moving vane shape

For the 10th to 12th stages of the Unit 4 low pressure turbine (A) - (C) in which fracture was confirmed due to stress corrosion cracking, stress concentration will be mitigated by increasing the radius of curvature regarding the hooked root of the moving vane mounting assemblies (on the shaft side).



Changes in the blade groove shape of the moving vane mounting assembly (shaft side) (12th stage as an example)

## **(2) Application of surface compression residual stress**

In order to reduce tensile stress, a factor of stress corrosion cracking, shot peening (\*1) shall be conducted for the 7th - 12th stages, and for the 13th and 14th stages in which shot peening is difficult to conduct, burnishing (\*2) shall be conducted, thereby applying compressive residual stress to the material surface.

## **3. Schedule**

After being subjected to the required examination period, shaft production shall begin for the filed construction plan. Restoration of the low-pressure turbine is planned to be completed by the end of September 2015, along with a new replacement of all moving vanes.

※1Shot peening is a surface processing method in which steel balls are collided with metallic materials at high speeds. It is conducted in order to improve fatigue strength and the tolerance toward stress corrosion cracking through the application of compressive residual stress and stiffening of the material surface.

※2Burnishing is a processing method to create minute plastic deformations on the surface layer through rolling contact of a hard, smooth roller on a metal surface. It is conducted in order to apply compressive residual stress, similar to shot peening.