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Preheater Degasification

Removal of Radiolysis Gases from Feedwater Preheaters

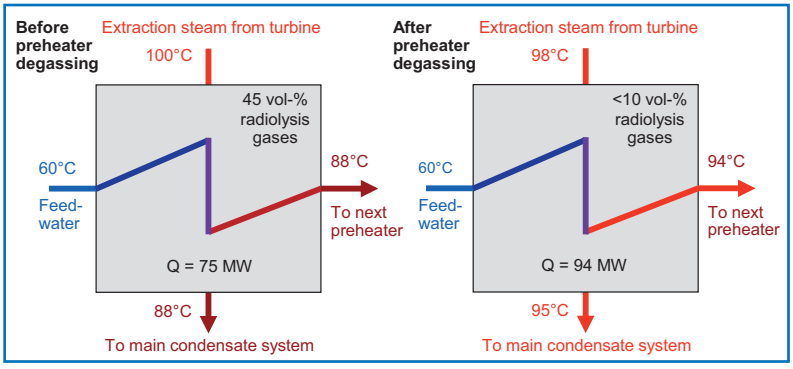
Preventing the accumulation of radiolysis gases to increase plant efficiency

Challenge

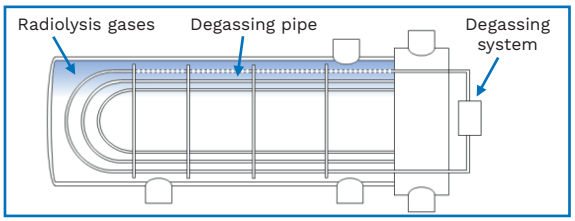
In all boiling water reactors, radiolysis gases are found in systems which convey main steam. These gases can accumulate in equipment such as feedwater preheaters, which causes their heat transfer performance to decrease significantly. Often, only 50% of the total heat exchange surface is being used in existing feedwater preheater tube bundles. The result of the reduced heat transfer capability is a diminished electrical net power output of the plant.

Solution

Improved feedwater preheater degassing during plant operation allows the radiolysis gases to be extracted from the preheaters directly at the point where they accumulate. By removing the radiolysis gases from the preheaters, the heat transfer rate inside the preheaters increases by up to 25%. As a result, the plant efficiency increases. Furthermore, the plant becomes safer, as the risk of hydrogen accumulating and combusting in the system is minimized.



Example of improved heat balance by preheater degassing



Preheater with one tube replaced by a degassing pipe

Technical information

After localizing the gas bubbles, an optimized concept for degassing is developed. Tubes are cut out from the heater bundle at exactly pre-calculated low-pressure locations. They are replaced by degassing pipes which are inserted directly into the tube bundle.

The fraction of radiolysis gases is decreased to less than 10%. Consequently, the effective heat exchange surface increases to 90%.

The preheater “draws” more steam from the lower pressure stage of the turbine and, therefore, the following preheater requires less steam flow from the turbine in order to reach the same outlet temperature.

The plant’s efficiency is raised by up to 1%, as each optimized preheater increases the plants electric power output by 2 MW.

Customer benefits

- Increases plant efficiency by up to 1% of net power output
- Improves plant safety by minimizing risk for hydrogen accumulation and combustion
- Low investment cost

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