

The Characteristics of Condensate Polishing Demineralizer Regeneration Process in the Nuclear Power Plants

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1. Introduction

The Condensate Polishing Plant, which removes impurities and corrosion products from the secondary system of the nuclear power plant using ion exchange resin, is used to maintain the integrity of the steam generator and extend the service life by improving the secondary system corrosion environment, and performs the following functions, including rapid removal of impurities.

Removal of corrosion products at initial start-up and restart of plant, Continuous operation when leakage of small quantity of condenser, Reduction in the number of steam generator outlets, Removal of silica and volatiles, Removal of CO₂ due to condenser air leakage

CPP is usually operated by connecting a cationic demineralizer and a mixed-phase demineralizer in series[fig. 1]. The cationic demineralizer mainly removes ETA from the system water and removes F, Cl, SO₄ etc. from the mixed-phase demineralizer.

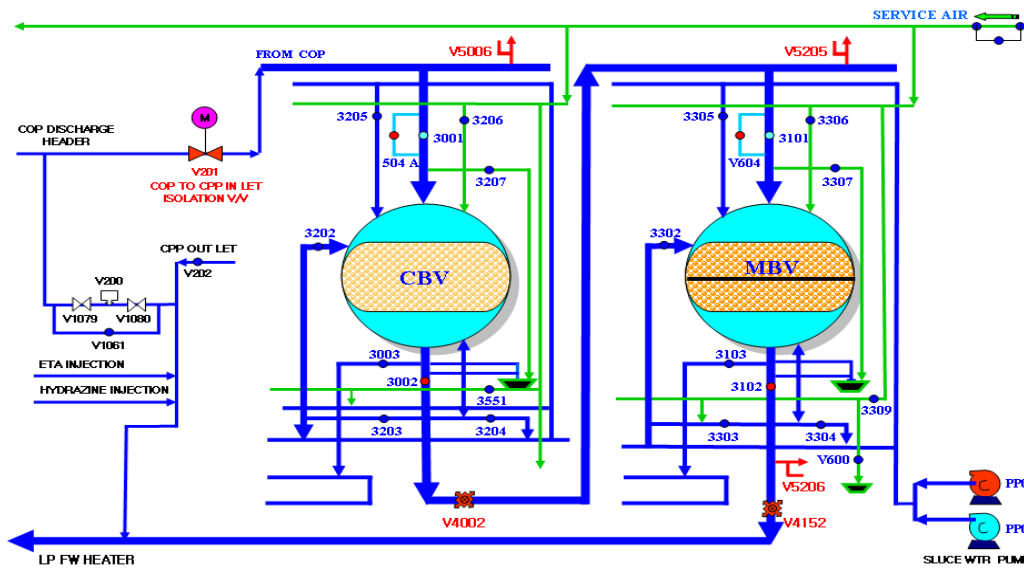
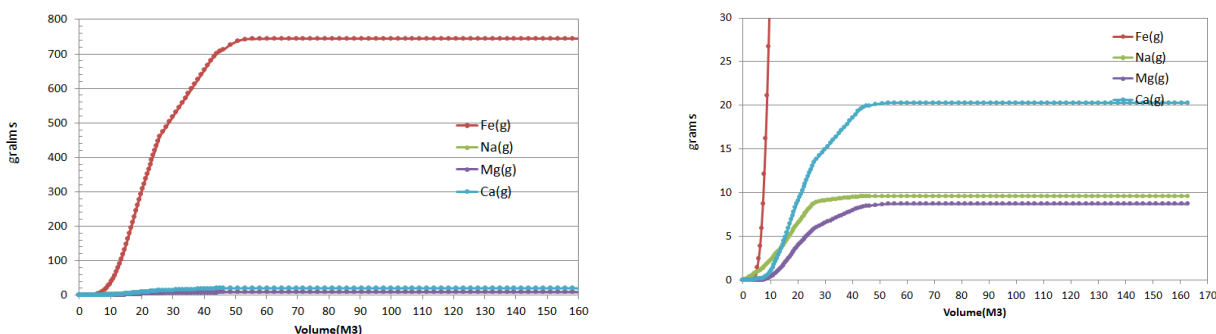


Fig. 1 Condensate Flow of CPP in the Secondary System of NPP

2. Results and Analysis

Fig. 2 The amount of Na, Fe, Ca, and Mg ions in the sulfate ion regeneration process

In the resin washing process, ion concentrations of Na, Fe, Ca, Mg and the like hardly appear. It can be seen that



most of the metal ions are discharged together with the regenerated water in the sulfuric acid injection and replacement process.

In the regeneration process of cation resin, the most careful and manageable Na in water quality management is the lowest ion selectivity, so it is first started to be discharged and discharged. The cumulative amount of discharge in the discharge process is about 10 g respectively.

Ultimately, resin regeneration is an ETA removal process rather than removing Na, which is harmful to the steam generator.

washing process wastewater should be disposed of at the wastewater treatment plant rather than subject to treatment.

That is, the standard for separating the high-concentration COD wastewater should be selected by drawing the sampling time of the wastewater during the regeneration process at the end of the representative resin regeneration vessel, the cumulative regeneration quantity at the time of sampling, COD and T-N analysis result.

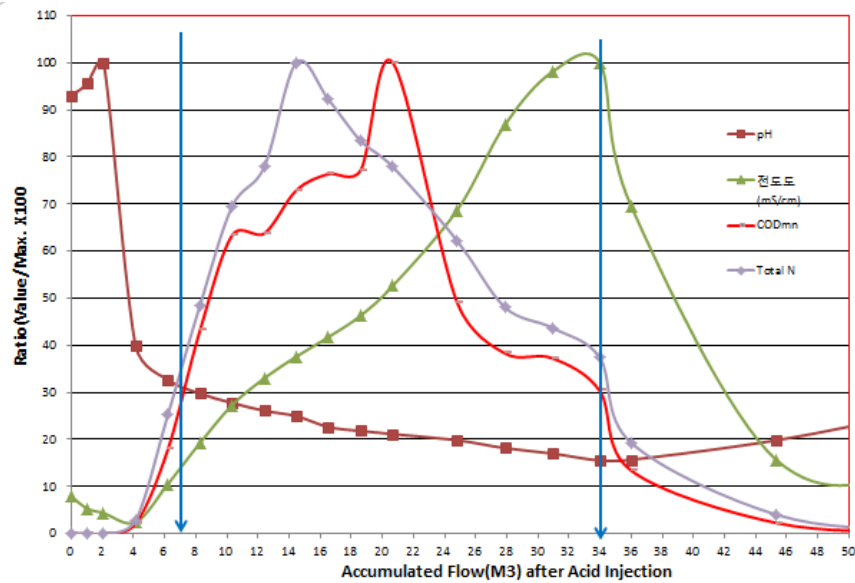


Fig. 3 The profile of pH, Cond., COD and T-N with acid injection in Vessel Regeneration process

3. CONCLUSIONS

In the regeneration process of ion exchange resin, the previous water is drained downward and gradually replaced with sulfuric acid, pH, COD and the total nitrogen content value increase. The characteristics of these species in the regeneration process are shown in the following

- **pH** is no change because the existing process water is discharged until 4 min after the sulfuric acid injection. However, after 5 min of gradual replacement of the process water with sulfuric acid, the pH rapidly drops to 1.2 or less

- **Conductivity** is slightly reduced, but not significantly, because the existing process water is discharged up to 4 min after the sulfuric acid injection as in pH. However, gradually the process water gradually increases and rises to 150 mS / cm after 5 min when the process water is replaced with sulfuric acid. In the resin washing process, Conductivity decreased initially in the resin washing process

- **Na, Fe, Ca, Mg ions**

The Fe curve starts to rise at a large rate, and other Na, Ca, and Mg ions gradually rise. In the resin washing process, ion concentrations of Na, Fe, Ca, Mg and the like hardly appear. It can be seen that most of the metal ions are discharged together with the regenerated water in the sulfuric acid injection and replacement process.

- **COD, T-N**

Sulfuric acid injection process COD_{Mn}, T-N concentration trends were similar to Fe, Ca, and Mg ion concentrations during sulfate regeneration. The maximum ion concentration of COD, Na, Fe, and Ca was about 30 ~ 40 min after the injection of sulfuric acid. Sulfuric acid replacement process, the tendency of COD and T-N concentration due to ions and ETA pushed out from the resin gradually decreases. At this time, Na, ETA (COD) and T-N with low selectivity of ions drop first, and Ca, Mg, Fe, etc. decrease rapidly afterwards. And In the resin cleaning process, COD and T-N are almost discharged and show a low concentration level. Therefore, the washing process wastewater should be disposed of at the wastewater treatment plant rather than subject to treatment.