The Improvement for Operational Convenience of Solid Waste Management System

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1. Introduction

The solid waste management system in the nuclear power plant provides the means to collect, segregate, store, process, sample and monitor the radioactive solid waste. Low radioactive level of spent resin and spent carbon in types of solid radioactive waste are processed by the polymer solidification system after short term storage in Low Activity Spent Resin Tank.

Unlike spent resin, which is easily solidified with polymer, the spent carbon has difficulty to be solidified due to the small bid. Then, there is no choice but to pack it in the container such as High Integrity Container (HIC) and disposed. When the spent resin and the spent carbon are mixed, the polymer solidification has inconveniency to solidify. So HIC usage will be increased. In order to resolve this problem, bypass discharge piping for preventing mixing is installed.

2. Body

2.1 Design Concept of Solid Waste Management System

Wet solid radioactive waste, such as R/O concentrate and spent resin, is solidified by polymer and packaged in a waste drum in a form suitable for disposal after drying and dewatering. And all solid waste is packaged in accordance with Nuclear Safety and Security Commission Notice 2014-50.

2.2 Operation of Low Activity Spent Resin Tank

Low radioactive level of spent resin and spent carbon are processed after short term storage in Low Activity Spent Resin Tank. Spent resin discharged from the Low Activity Spent Resin Tank is disposed of after the polymer solidification process, and the spent carbon is packaged in HIC and disposed. When spent resin and spent carbon are mixed, the polymer solidification treatment is difficult and inconveniency. For example, when the spent carbon is introduced into the tank, the spent resin stored in the tank is discharged for treatment and then the tank and piping are washed using demineralized water.

2.3 Installation of bypass discharge piping

Low radioactive level of Spent resin and spent carbon in type of solid radioactive waste is designed to be discharged via a Low Activity Spent Resin Tank. In order to reduce operating cost, it is necessary to install and use bypass discharge piping so that the spent carbon can be bypassed without passing through Low Activity Spent Resin Tank when it is discharged. The spent carbon has a very low radioactive level compared to spent resin because it plays a role of filtering simply. So, it does not require short-term storage in a Low Activity Spent Resin Tank. Therefore, it is discharged through bypass pipe to improve operating convenience. In addition, if the radioactive level is high after measuring the surface dose at the time of discharging

spent carbon, the piping path is provided so that spent carbon flows through the Low Activity Spent Resin Tank by the valve operation to protect the operator.

2.4 Piping Stress Analysis

Stress analysis was carried out for various loads acting on the new piping system from the existing spent carbon transfer piping to the connector, and the integrity of the piping system was evaluated by applying KEPIC MND to the Non-Safety Related, Seismic Category II piping. Stress analysis was performed using the following equation of KEPIC MND. The results of the stress analysis are shown in Table 1.

2.4.1 Sustained Loads.

$$S_{SL} = B_1 \frac{PD_o}{2t_n} + B_2 \frac{M_A}{Z} \leq 1.5 \times S_h \quad (1)$$

2.4.2 Occasional Load.

$$S_{OL} = B_1 \frac{P_{max} \times D_O}{2t_n} + B_2 \frac{(M_A + M_B)}{Z} \leq 3.0 \times S_h \quad (2)$$

2.4.3 Sum of Sustained Loads and Thermal Expansion Loads.

$$S_{TE} = \frac{P \times D_O}{4t_n} + 0.75i \frac{M_A}{Z} + i \frac{M_C}{Z} \leq (S_h + S_A) \quad (3)$$

Table 1. Result of Stress Analysis

Code Equation	Node Point	Maximum Stress (psi)	Code Allowable Stress (psi)	Maximum Stress ratio to Allowable stress (%)
1	890	3,620	19,380	18.7
2	780	27,300	52,680	51.8
3	140	39,800	45,450	87.6

As shown above, the maximum stress value per code equations was compared with the allowable stress of code, all the analysis results have been satisfied the code allowable stress.

3. Conclusion

Bypass discharge pipe has been newly installed to enable bypass discharge without passing through the Low Activity Spent Resin tank when spent carbon is discharged. Therefore, this modification improves operating convenience.

REFERENCES

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