A Study on Structural Integrity Evaluation of CANDU Type SRT

Lee Young-Yoon [a*], Lee Hong-Pyo [a]
[a] KHNP CRI(Central Research Institute), Yuseong-daero 1312beon-gil, Daejeon, Korea
[*] *Corresponding author: yyoon.lee@khnp.co.kr*

1. Introduction

The Spent Resin Storage Tank(SRT) is a reinforced concrete structure that stores spent resins generated from the ion exchangers. SRT is supported by reinforced concrete foundations, and the space between the foundations is filled with backfill material. It is necessary to check structural integrity considering change of the design conditions due to long-term operation. For example, if the backfill material settles for some reasons such as fluctuation of the groundwater level, the bearing capacity for the SRT may decrease. Therefore, in this study, the structural integrity evaluation of the SRT structure will be conducted assuming that the backfill material is in a state of subsidence.

2. Methods and Results

For structural integrity evaluation, a finite element analysis software, ABAQUS was used. The evaluation method consists of three steps: model creation, input load condition, and structural analysis.

2.1 Model Creation

The SRT is located in a basement of the auxiliary building. It is composed of three tanks which store spent resins and fluid and foundations that support the structure. To create a model, the concrete was designated as an 8-node solid element and rebar as a 2-node truss element. The model was created by referring to design drawings and bending schedule. The backfill material was excluded from the model, to assume a situation that it can't support the lower slab of SRT due to subsidence.

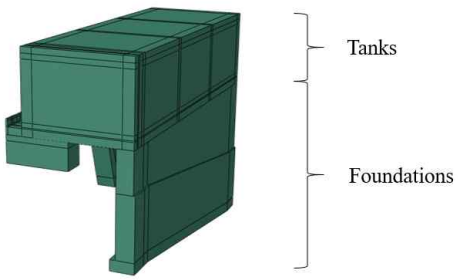

Fig. 1. SRT model

2.2 Input Load Condition

The individual input load conditions are a weight of a structure, an upper load, a spent resin load, and an internal fluid pressure. The integrity was evaluated by comparing the stress caused by load combinations and design strength. A temperature load was not considered, as the temperature is constant inside the auxiliary building where SRT is located. When calculating the self-weight and upper load of the structure, design drawings and standard specifications were used. In case of the spent resin load, waste resin status data of plant was used. The internal fluid was expressed as a hydrostatic load.

2.3 Structural Analysis

Static analysis was performed on the SRT model created under load combinations in section 2.2. For the concrete and rebar, the design strength and maximum stress in three axes (x, y, z) were compared. All maximum stresses in the 3-axis direction of concrete and reinforcing bars were below the design strength in the both compression and tension areas.

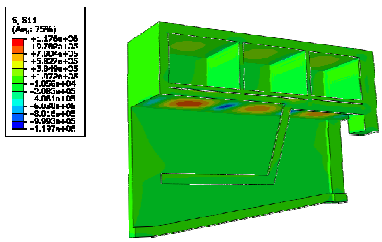

Fig. 2. Result of the structural analysis in x-axis(concrete)

3. Conclusions

Performing static structural analysis of the SRT based on the model created and input load conditions, it was confirmed that the maximum tensile and compressed stresses of concrete and rebar are within the design criteria. Therefore, it is estimated that the SRT can maintain its structural soundness even if the backfill below SRT subsides due to long-term operations.

REFERENCES

[1] Dassault System, ABAQUS ver. 2018 Manual.