Developing an Evaluation Program for Rapidly Assessing Spent Nuclear Fuel Storage Pool Temperatures

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1. Introduction

Since 2015, Korea Hydro & Nuclear Power (KHNP) has been developing and operating a program called Carepool, which establishes and manages the temperature monitoring and criticality evaluation system for spent fuel storage pool (SFP). However, as additional functions have been integrated into Carepool, such as reflecting the transportation of spent nuclear fuel within the local division of nuclear power plants and the introduction of dry storage facilities, issues have arisen regarding accessibility at power plants and increased evaluation time. Consequently, there is a growing need for a dedicated program that exclusively focuses on temperature and boiling evaluations of SFP.

This study developed the Carepool Light program, which enhances accessibility to stored fuel information, reduces temperature evaluation time, and incorporated a user-friendly graphical user interface (GUI) for more efficient boiling assessments of SFP.

2. Program Improvements

At power plant sites, temperature and boiling evaluations of SFP are primarily conducted to support maintenance of the cooling system and to prepare for power loss due to natural disasters such as typhoons. In the existing Carepool program, users had to manually input various data, including SFP information and coolant properties, which increased the risk of human error. However, the new program automates these processes, significantly reducing the likelihood of such errors.

Additionally, the simulation feature, which was well received in the previous program, has been improved by incorporating the current power plant system, enhancing both the graphics and simulation setting. In particular, new functions such as setting the evaluation reference date, target temperature, and water level were added based on user requirements, improving usability for power plant operators. Furthermore, the new program more than doubles the speed of decay heat calculations by directly retrieving fuel data stored in the power plant system. This improvement has played a crucial role in reducing evaluation time, making the process more efficient and practical. The following figures illustrate the improved Carepool Light system, figure 1 is the temperature evaluation module, and figure 2 is the temperature evaluation simulator.

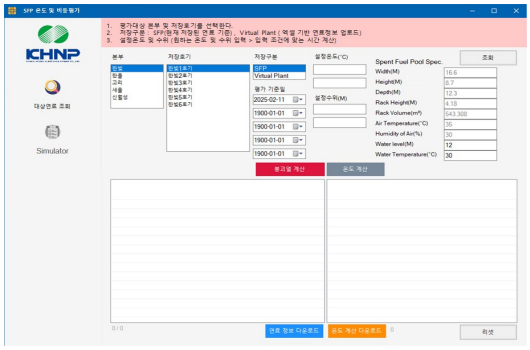
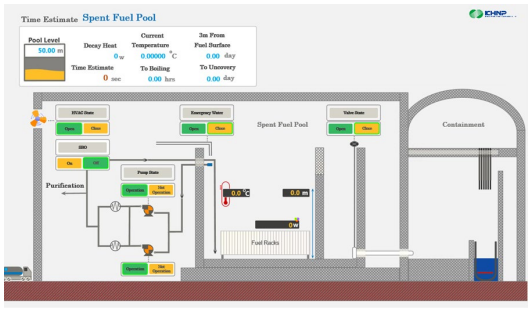


Fig. 1. Equipment Schematic & Load Testing Equipment



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3. Conclusions

The Carepool Light was utilized in approximately 20 technical support cases in 2024. Additionally, two rounds of user training sessions were conducted at power plants to enhance user proficiency and operational efficiency.

Moving forward, the program will continue to be improved by incorporating user feedback and further optimizing the program logic. These enhancements will be increased both processing speed and safety, ensuring that the program can fully meet the evolving demands of temperature and boiling evaluations for SFP.