The Study on the Conceptual Design of National Nuclear Spent Fuel Database System

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1. Introduction

The systematic data management of nuclear spent fuel history is needed to assure transparency and safety of nuclear spent fuel generated in domestic nuclear power plants. This paper describes the nuclear spent fuel database system state-of-the-art in foreign counties, and describes the result of conceptual design for the national nuclear spent fuel database system that can be used to monitor history of spent fuel storage, transport, burnup by the licensee, regulatory agency, or government in the future.

2. The Review of Database System in Foreign Countries

The representative nuclear spent fuel or radioactive waste database systems in foreign countries are CID (Central Internet Database), ISNFDS (Integrated Spent Nuclear Fuel Database System), Fuel-Trac Database, etc.

2.1 CID

CID is the database system that contains information on spent fuel and radioactive materials generated in US industry and managed by DOE. CID contains following types of information :

 - Location of site/radioactive material
 - Volume or mass of radioactive material of waste, contaminated environmental media, spent nuclear fuel, and contaminated facilities
 - Chemical constituents
 - Radioactivity of materials
 - Generator of waste or contaminated materials
 - Waste disposition plans and waste transfers.

2.2 ISNFDS

ISNFDS is detailed spent fuel database system that contains storage information, fuel type, canister type, specification of storage equipment, etc. It contains more than 250 fuel types information.

2.3 Fuel-Trac Database

Fuel-Trac is international database system managed by NAC international which is non-governmental organization, and contains international information related to fuel-cycle, fresh fuel, spent fuel, etc.

3. The Result of National Database System Conceptual Design

The base structure of nuclear design database system was designed preliminarily in this study by reviewing the database system in foreign countries, and regulatory requirements of domestic and foreign countries, and discussing with the experts specialized in nuclear spent fuel management, research, or regulation. The base modules and contents that will be included in national nuclear spent fuel database system is shown in table 1.

Table 1. The Module Name and Contents in Database System

Module Name	Contents in Module
Spent Fuel Assembly Information Module	ID, location/burnup history data, and design data of spent fuel assembly
Fresh Fuel Assembly Information Module	ID, location history, and design data of fresh fuel
Reactor Information Module	Design data, fuel storage and burnup data in reactor
Spent Fuel Storage Facility Information Module	Design data, fuel storage and cooling data in the wet or dry spent fuel storage facility
Spent Fuel Storage Disposal Site Information Module	Design data, fuel storage and cooling data in the wet or dry spent fuel disposal site
Spent Fuel Treatment Facility Information Module	Design data, fuel storage and treatment data in the spent fuel treatment facility (pyroprocessing facility, etc)
Spent Fuel Transport Equipment Information Module	The design and fuel storage data of in-site and out-site transport equipment (cask, etc)

Additionally, the ER (Entity-Relation) diagram as shown in figure 1 is developed for the design of data structure. ER diagram is required before making database system, because it defines the relationships of various kinds of data (for example, the data of fuel assembly ID versus the data of enrichment of fuel).
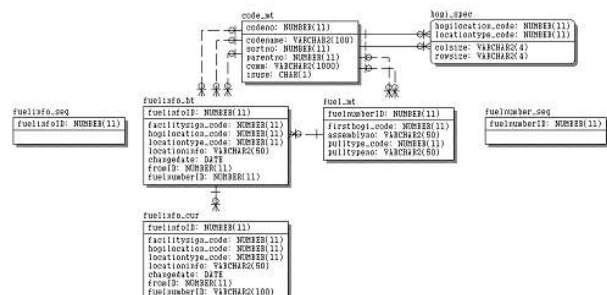

Figure 1. The ER Diagram of the National Nuclear Spent Fuel Database System (example)

The database system will be composed of application server, backup storage and fire wall as well as central database server, as shown in figure 2, to enhance reliability and security of database system.
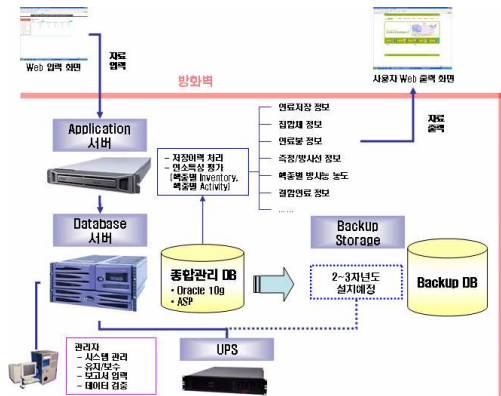

Figure 2. The Conceptual National Nuclear Spent Fuel Database System Structure

The location or burnup data of each fuel assembly in reactor core and spent fuel storage facility will be provided to user as shown in figure 3 and 4. The database system will be developed in web-based system, and user can identify the FP(fission product), and MA(minor actinide) inventory of each fuel assembly as well as the storage history of each fuel assembly.
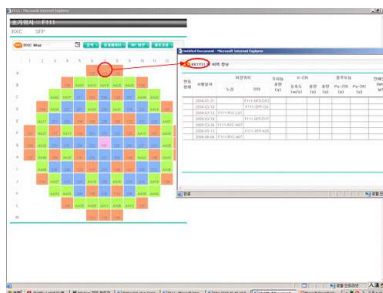

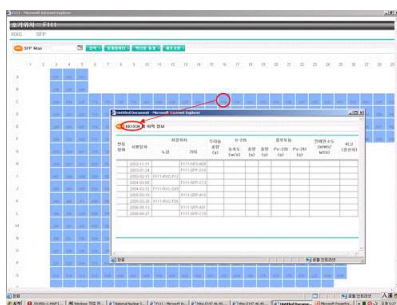Figure 3. The Web Screen for Nuclear Fuel in Reactor Core

Figure 4. The Web Screen for Nuclear Fuel in Spent Fuel Storage Facility

4. Conclusion

This paper described the state-of-the-art of nuclear spent fuel database systems in foreign counties, and the result of conceptual design for the development of the national nuclear spent fuel database. The web-based pilot database system will be developed in the future by collecting storage and burnup history data of nuclear spent fuel.

Acknowledgement

REFERENCES

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