Development of Information System for Nuclear Fuel Cycle Facilities at Neighboring Countries

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1. Introduction

Nuclear accidents due to extreme natural disasters such as severe earthquake or flood, which occurred at Fukusima nuclear power plant on March 11, 2011, can make a severe effect on the Korean peninsula if they occur at neighboring countries. This effect must be evaluated as soon as possible to prepare the actions to be taken to minimize its effect. To do this, the necessary information for the evaluation should be collected in advance and the web-based system containing the information needs to be established for easy implementation in time.

In this paper, information database for nuclear fuel cycle facilities is collected for Japan, China, Russia, Taiwan and North Korea. The information database contains the location, design capacity, process, current status and so on. Based on the database, the web-based information system is established to promptly obtain the details of the nuclear fuel cycle facilities at neighboring countries.

2. Organization of Information

The nuclear fuel cycle, also called nuclear fuel chain, is the progression of nuclear fuel through a series of different stages. It consists of steps in the front end, which are the preparation of the fuel (uranium mining and milling), steps in the service period in which the fuel is used during reactor operation (uranium conversion, enrichment, fuel fabrication), and steps in the back end, which are necessary to safely manage, contain, and either reprocess or dispose of spent nuclear fuel (spent fuel storage, reprocessing and recycling) [1].

For the nuclear fuel cycle facilities at the neighboring countries, the number of operational, stand by, under construction is summarized in Table 1 [2].

Figure 1 shows a distribution of the nuclear fuel cycle facilities [3]. The facilities in Russia were excluded in Fig. 1 due to their locations which are far from the Korean peninsula.

In Japan, totally 16 nuclear fuel cycle facilities are operating now. Among these facilities, 10 facilities are located in Tokai-mura, 2 facilities in Rokkasho-mura, 2 facilities in Fukusima-1 NPP site, the others in Kurihama, Kumatori-Machi.

In China, totally 14 nuclear fuel cycle facilities are operating now, and are distributed through the whole region. Among these, the Lanzhou nuclear fuel complex has uranium conversion, enrichment, spent fuel storage, spent fuel reprocessing facilities.

Table 1. Nuclear fuel cycle facilities at neighboring countries (Operational / Standby / Under construction)

Nuclear Fuel Cycle Facilities	Japan	China	Russia	North Korea	Total
Uranium Mining and Milling	0/0/0	8/1/0	2/0/1	0/2/0	10/3/1
Uranium Conversion	0/0/0	1/0/0	3/1/0	0/0/0	4/1/0
Uranium Enrichment	1/0/0	2/0/0	4/0/0	0/0/0	7/0/0
Uranium Fuel Fabrication	5/0/0	2/0/0	5/0/0	0/1/0	12/1/0
Spent Fuel Storage	5/0/0	1/0/0	6/0/0	0/0/0	12/0/0
Spent Fuel Reprocessing	5/0/1	0/0/1	4/0/0	0/1/0	9/1/2
Total	16/0/1	14/1/1	24/1/1	0/4/0	54/6/3

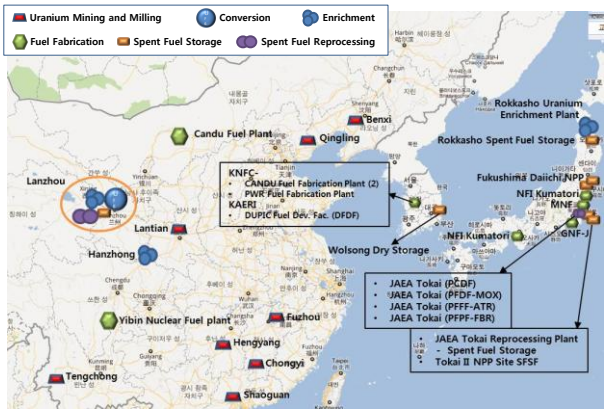

Fig. 1. Distribution of operating nuclear fuel cycle facilities

In Russia, totally 24 nuclear fuel cycle facilities are operating now. However, most of facilities are located in the west side of Russia (near Moscow). Their locations are far from the Korean peninsula. So, it is estimated that the facilities in Russia has little effect on the Korean peninsula.

In North Korea, there is no operating facility. However, 2 uranium mining facilities are standby in

Sooncheon and Pyeongsan, and 1 spent fuel reprocessing facility is standby in Yongbyon.

Taiwan is also one of the significant neighboring countries, but there is currently no operating, under construction, planned facility.

3. Information Database System

Many parameters are required for analyzing nuclear accidents and for preparing actions to be taken to minimize its effect. Through this study, detailed general information such as location, type, design capacity, status, start of operation, process, and company information are compiled and summarized as shown in Table 2.

Table 2. Example of compiled information

Type	Uranium Mining and Milling	Uranium Conversi -on	Uranium Enrichme -nt	Uranium Fuel Fabricatio -n	Spent Fuel Storage
Name	Lantian	Lanzhou	Lanzhou 2	Candu Fuel Plant	Centraliz -ed Wet Storage Facility (CWSF)
Location	Lantian, Shaanxi	Lanzhou Nuclear Fuel Complex, Gansu	Lanzhou Nuclear Fuel Complex, Gansu	Baotou City, Inner Mongolia	Lanzhou Nuclear Fuel Complex, Gansu
Design Capacity	100 (t U/yr)	3000 (t HM/yr)	500 (MTSW U/yr)	200 (t HM/yr)	500 (t HM/yr)
Start of Operation	1993	1980	2005	2003	2003
Process	Heap &Acid Leachin g/IX	UF6	Centrifuge	PHWR Fuel Fabrication	Pool, PWR, HWRR
Feed Material	Uranium Ore	UO2	Natural UF6	U3O8	PWR, HWRR
Product Material	Yellow Cake	UF6	Low Enriched UF6	UO2 (PHWR Fuel)	PWR, HWRR
Owner	CNNC	CNNC	CNNC		CNNC
Operator		CNEI		Baotou Nuclear Fuel Element Plant	Lanzhou Nuclear Fuel Complex
Status	Comm. Operation	Comm. Operation	Comm. Operation	Comm. Operation	Comm. Operation

And also through this study, the information of nuclear fuel cycle facilities is organized and then it is possible to establish web-based database [4]. Web pages contain geographical data such as location of facilities at Google satellite map [3]. Meteorological information such as wind velocity, temperature, monthly average rainfall is marked on the Google map. This web page contains the general information as shown in Table 2.

To get the information of a specific facility, first of all, it is necessary to select the country in a map and then to point the facility. These sequences can access the information of the nuclear fuel cycle facilities for neighboring countries. The example of web page containing information system for nuclear fuel cycle facilities is shown in Fig. 2.

Fig. 2. Web page of information system for nuclear fuel cycle facilities

4. Summary

Nuclear information database system of nuclear fuel cycle facilities for neighboring countries is established on a web basis as a part of developing evaluation system of nuclear accident occurring in neighboring countries. This system includes the detailed information of the nuclear fuel cycle facilities for neighboring countries to the Korean peninsula.

Following the result of this study, when the nuclear accident occurs in nuclear fuel cycle facilities of neighboring countries by a severe natural disaster, it is possible to estimate the damage due to disaster and minimize it. And also it is possible to prepare the actions to be taken due to nuclear accident based on the database system as soon as possible.

REFERENCES

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