DESIGN OF SYSTEM AND PROTOTYPE FOR THE RADIOACTIVE WASTE MANAGEMENT

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ABSTRACT

Radioactive waste which is generated by Korea Atomic Energy Research Institute (KAERI) has a various type, nuclide, and a characteristic which is generated irregularly. To manage and control this kind of radioactive waste, it comes to the front the systematic management of it's record and necessity about researching efficiently and quickly statistic. Getting information about radioactive waste which is generated and stored by KAERI is the basic factor to construct the rapid information system for national coordination management of radioactive waste. Radioactive Waste Management Integration System (RAWMIS) of KAERI finished a logical plan through the conceptual data modeling which is aimed at 1) management of its record: offers function of management of its record and tracking, which include generation, gathering, transfer, treatment, and storage, 2) uplifting the efficiency of management : simplifying office procedure and saving human resources, 3) connection of coordination safety supervision of national radioactive waste after starting research development, and started the construction. It is the purpose of this paper to introduces the analysis results of radioactive waste management, data, treatment process on the basis of user requirements, and explains the design which is constructed logically and physically.

INTRODUCTION

A The characteristic of a radioactive waste to be generated is different in KAERI according to the purpose of research. A type kind and nuclide of the waste to be happened are various and each waste happens some so that it is irregular. Due to the increase recently of a nuclear fuel cycle facility and research development subject, efficient management of the waste by the manual is reaching the limit. The waste to have such characteristic causes the difficulty at the treatment and the efficiency of the document and task of the waste management which is run through to the manual is fallen.

A Radioactive Waste Management Integration System (RAWMIS) is being constructed to manage the information of radioactive waste in the KAERI and to support WACID(Waste Comprehensive Integration Database System) which was a national radioactive waste integrated safety management system.

In order to establish the scope of the RAWMIS, user requirements and system configuration for radioactive waste management were analyze and investigation about a domestic and foreign similar system(8 nation, 18 systems). Range and structure of system were decided on after carrying out this user requirement analysis and investigation similar system.

The major information extracted from user requirements are solid waste, liquid waste, gaseous waste, and waste related to spent fuel which include generation, gathering, transfer, treatment, and storag information. Specially, data to be happened in an a series of treatment process about a waste of solid and liquid were included, and was designed.

System is composed of database, software(interface between user and database), and software for a manager and it was designed with Client/Server structure.

DOMESTIC AND FOREIGN SIMILER SYSTEM RESEARCH

A domestic and foreign similar system determined 18 systems to total eight nation, and data were secured, and investigation did a construction purpose of a system and a function, range of management data, H/W and S/W about system configuration and the present situation, a system maintenance matter and reference.

A construction purpose of a similar system and a function mostly disposed, and data security on management and an offer of information were tied up.

As for the management range of a similar system, configuration became the waste package unit generated, temporary storage, treatment process, volume reduction, item about disposal, personal history after disposal, worked with transportation and contents about a transfer, worked by physical information of a waste (volume, weight, etc.), chemical information (nuclide, filling materials, and etc.), radiology information (radioactivity, dose, and etc.), and worked with contents about facilities information in case of solid and common waste. The management range of a similar system was composed of a discharge and a management item about release in case of liquid and gasous waste.

Configuration of a system was mostly client-server structure, and investigation became a reward to compose a separate task-force team in regular maintenance and redevelopment.

We are by management of a solid waste besides contents mentioned at the front, and reference to reflect in a system design of this study introduces a bar-code system, and a work ruler is the reward that an input and output does information of a waste through wireless mobile scanning device in the spot. Also, reference to reflect in a system design of this study is inclusion gets a management item, and to operate measurement data information by process about a radioactive waste disposal process in a two similar system.

Basis of matter income and expenditure study worked in efficiency expansion of management business and a treatment process of a radioactive waste, and these rewards therefore reflected this in a system design.

USER REQUIREMENTS

In order to define of development environment and design of system, collected and analyzed about common requirements, kind(solid, liquid, gasous, and spent fuel) of a waste of a user(a working-level official in charge of an KAERI organization waste management) requirement.

Most of them are business oriented and related to the overall process in the organization starting from the mission and ending with the final outcome. The general method is based on 1) reviews of current reports, 2) conducting research that is already done, and 3) visiting similar system installations. Foundations of the individual method are interviews, observations, questionnaires, and prototype systems.

Radioactive waste arising from KAERI is very small in quantity, and has diverse characteristics. For this reason, it has been difficult to analyze the radioactivity of the solid radioactive waste and α, β nuclide included in liquid radioactive waste due to a lack of funds. To solve this dilemma, we must focus on the establishment of a database system that can classify systematically the radionuclide and activity concentration included in solid and liquid radioactive wastes. For instance, asphalt solidification needs to be included in a system that can assess all the nuclides collected during an operation.

The management process of radioactive waste in KAERI is shown in Fig. 1.

According to the methods of user requirements, a diversity report in relation to radioactive waste was collected and reviewed, also interviews with expert groups such as radioactive waste managers, radiation safety managers, and radioactive waste supervisors were carried out. The following are the principle contents that were extracted from user requirements:

- Radioactive waste consists of small packages and is managed in containers
- Radioactive waste managed by a small package may contain various nuclide and contents
- A stored container has to be measured by repackage and relocation
- Changed container information should be able to track
- A record of the changed information should be kept as a history
- A container can be reused after removing its ID
- Radionuclide, contents, and radioactivity concentration in container must be measured
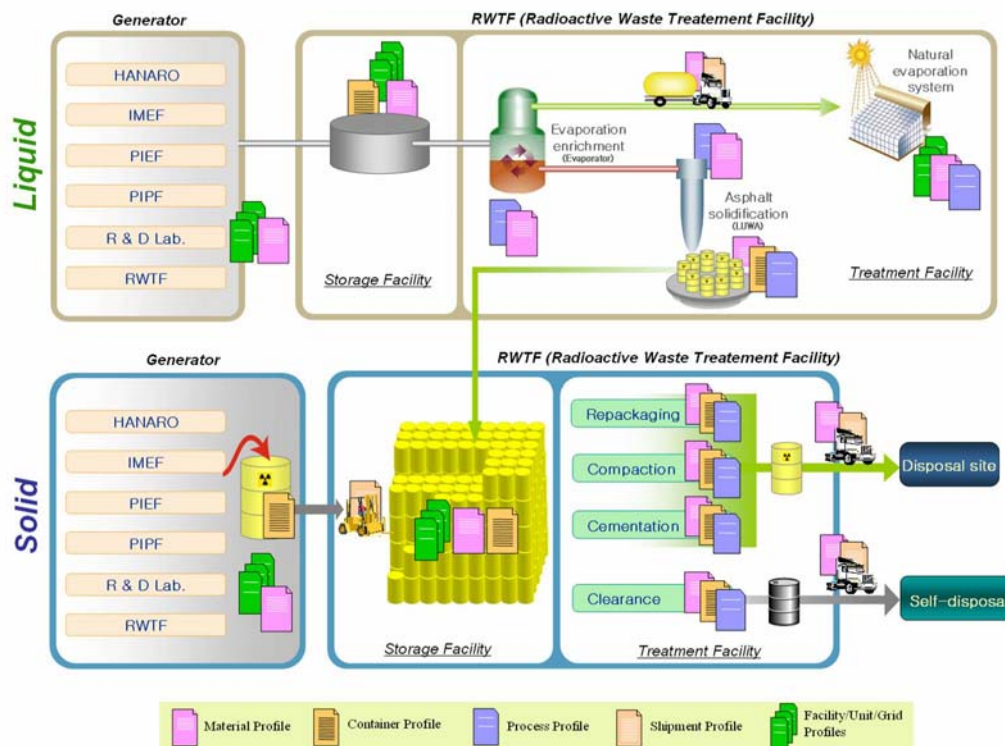- The standardization for compatibility with WACID system will be observed

Fig. 1 Management process of a radioactive waste in KAERI

Management of solid radioactive waste

Figure 1 such as the generation of waste, collection, temporary storage, treatment were made in a solid radioactive waste officer and process scope business analysis. A drum was set up as a basic unit, the each attached document and a data item which material, container, process, facility, and etc. profiles about packages of a waste were decided on according to a organization rule. Also, the procedures that were expected when bar-code system introduction was examined, and it was spent on business did consideration.

The process for solid wastes that are loaded into drums and moved to the disposal repository. Drums loaded with solid radioactive waste have information such as serial number, types of contents, date of generated, dose rate, contamination level, nuclide, and radioactivity rate.

Management of a liquid radioactive waste

A liquid waste does not discharge it according to a principle of a research organization. Fig. 1 shows liquid waste process stream. A liquid waste is stored in a tank, it is passed through evaporation concentration, bituminization(asphalt) solidification and a process of nature evaporation. Data measured by a process were added to a management item.

Design of database and prototype

The methodology for a personal history track of a waste gave to a start date along specific state and end work of a waste. A segment personal history management way to keep according to a

change of data so that a chase was possible was applied. Data are modified or added, it is not deleted. And the data that end work is the largest manage it so that currently data of state work. A track keeps data except him according to a change of a series of data to manage a personal history so that it is possible.

Stability and security anger were considered by a foundation, and, in the development environment, it was decided on contents and a specialist opinion of reward analysis. As for the operating system of server, the Microsoft Windows 2000 Server, DBMS selected ORACLE Discoverer on development and a data management tool of database with MS Visual Basic 6.0 on an ORACLE9i Enterprise Edition, client-server environmental software development tool. Fig. 2 shows logical & physical structure of RAWMIS.

A prototype was designed, a input/output matter of data was decided on with a manager, and this was supplemented, input/output application software was implemented. And Because matters such as waste management business or waste treatment facilities expansion can hold the occurrence later, it is designed with structure to be flexible in order to be extensible of a system. Figure 3 shows simply entity-relationship diagram(ERD).

As for the applied program, it was composed user authority and a code with a system management module, solid/liquid/gas waste and spent fuel management with a waste management module, treatment process(cementation, evaporation concentration, bituminization, and nature evaporation) of a waste with a waste treatment process control module, and report output by inner document and grade (general output is displayed immediately, user definition output) with a document management module to give an enema to.
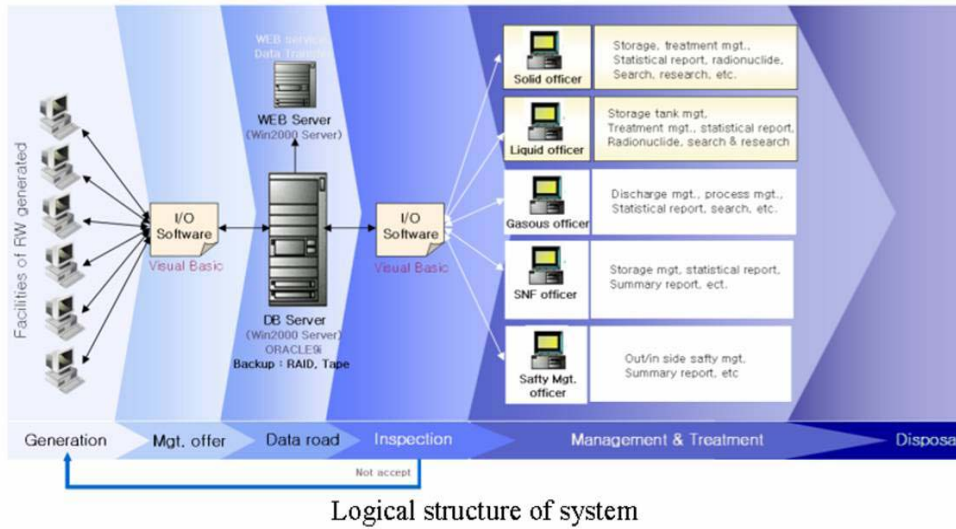
Logical structure of system
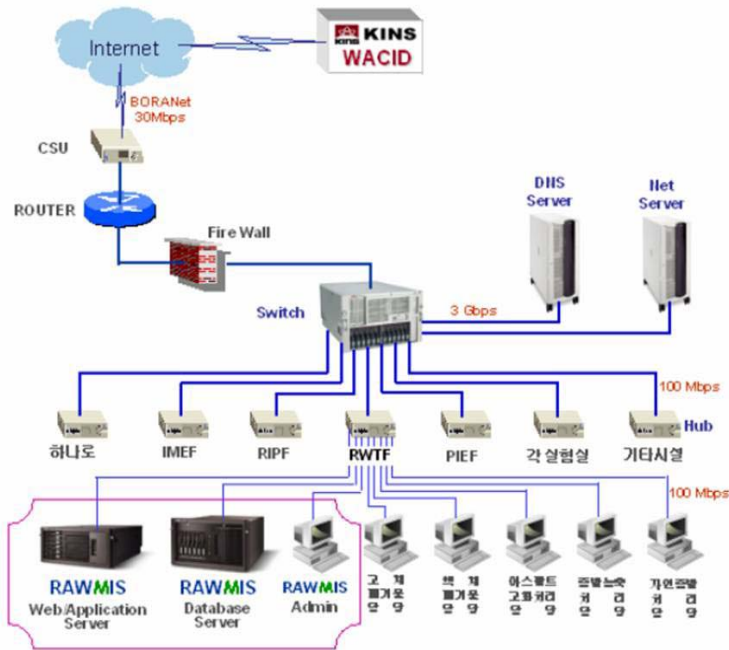
Physical structure of system

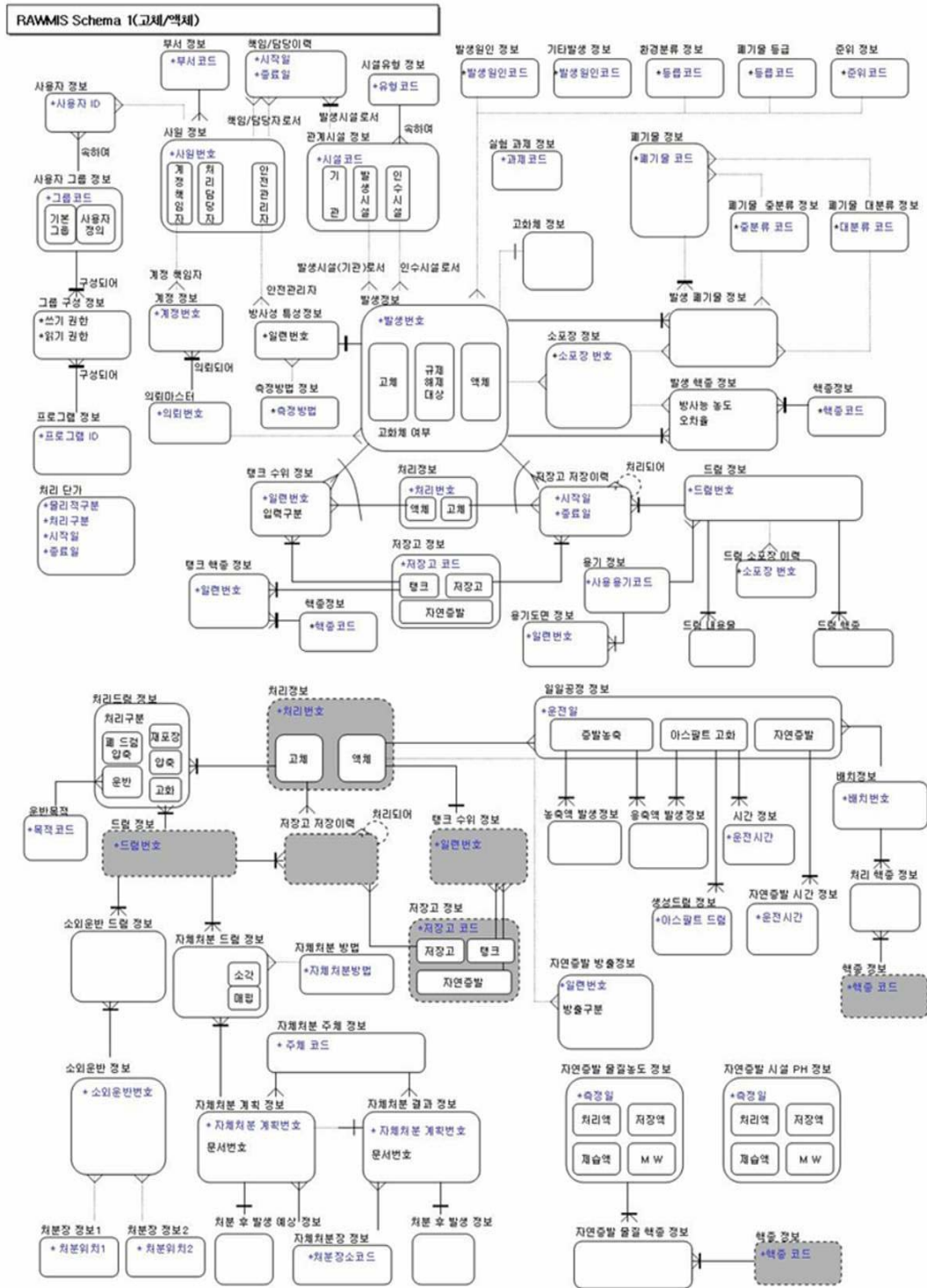Fig. 2 Management process of a radioactive waste in KAERI

Fig. 3 Schema of RAWMIS database

A grade of an applied program along business makeup of job is set up, and it is provided only a screen about relevant business by the each business person in charge.

Construction of a waste management system was left greatly to the inside (Intranet, Client/Server environment) and the outside (Internet, Web environment), and a section was composed, and a change of statistical data and damage of data were considered on prevention. Figure 4 shows implementation of interface between user and database of application software.
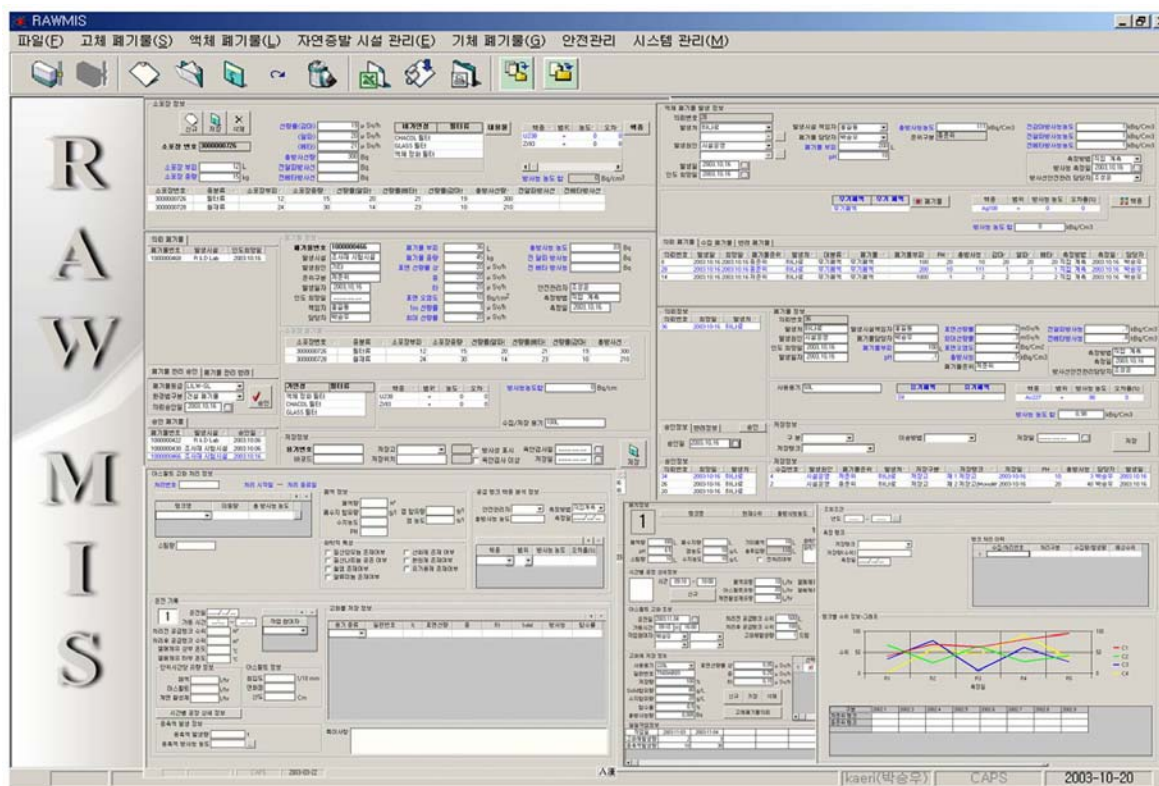

Fig. 4 Implementation of prototype and input/output application software

It was designed so that an inner system managed all process that reached the storage that included information of an each waste disposal process from the occurrence of a waste in a research organization, and a warrior established a chase management system of the waste which let there be a little it.

The external system developed in Web environment was made in order useful statistical data were generated to a ground, and to be able to report data managed in the inside to a related organization. Also, it was designed in order to be composed of a format it was brought download, and data were received from database server, and to transmit from Web server when data were transmitted to WACID. At this time a tool to use is SQL*PLUS and PL/SQL built in ORACLE9i, layer of data warehouse concept was used so that various statistical analyses as multidimensional data analysis of drill-down, drill-up were possible. This was considered in the purpose that was going to establish data infrastructure.

WACID SYSTEM

WACID is being developed to manage a function of safety management and statistical data and to make up for the weak points in the application of regulations about the overall radioactive

waste process. The organizations that participated in WACID are Korea Hydro&Nuclear Company (KHNP), KAERI, Nuclear Environment Technology Institute (NETIC), and KEPCO Nuclear Fuel Company (KNFC).

CONCLUSION

Conceptual data modeling of the whole radioactive waste management process for the establishment of a radioactive waste management database was carried out. The major information related to solid and liquid radioactive waste from the user requirements was extracted. The hardware system for the radioactive waste database, a client/server system that has outstanding security features was selected. The software elements that will be used is RDBMS, has wide use and an ability to manage huge amounts of data.

These results are used to create a basic data-user interface and prototype design. The RAWMIS will be a useful tool to analyze radioactive waste management and radiation safety management. Also, this system is developed to share information with associated companies. Moreover, it can be expected to support the technology of research and development.

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