Development of Nuclear Control and Management Information Treatment System

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1. Introduction

To implement obligations, as shown in Figure 1, under the Non-Proliferation Treaty (NPT) and the bilateral agreements more effectively, we proposed a computerized system named the Nuclear Control and Management Information Treatment System (NCAMITS) as a part of the Nuclear Transparency Enhancement Project at the Korea Atomic Energy Research Institute (KAERI) [1,2]. The database system is designed not only to undertake the facility-level accounting for and control of nuclear material at KAERI, but also to meet the requirements of the State (National) System of Accounting and Control (SSAC) [3,4]. Since the NCAMITS will provide services for the facility operators as well as the safeguard information managers at KAERI, the development of the system is supposed to accommodate the end-user's convenience and the manager's sophisticated specifications as well.
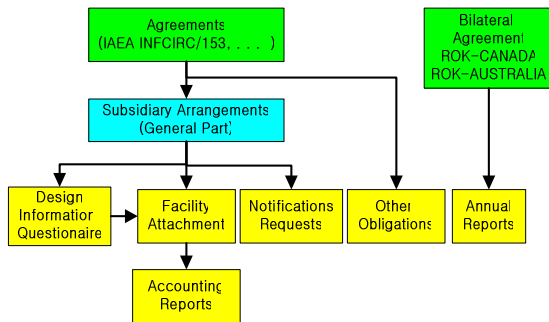

Figure 1. Structure of safeguard related agreements and obligations such as reports, notifications, and requests.

2. Conceptual Design of NCAMITS

In this section we outline the key features of the NCAMITS considered in conceptually designing the database system. The description deals mainly with the nuclear material accounting, even though there are many other aspects to be considered in building the safeguard information management system successfully.

The concepts of the NCAMITS can be defined in two levels: the facility operator level, the safeguard information management level, in general, where the management level establishes the criteria required by the SSAC and the operator level implements the system in compliance with those criteria.

In NCAMITS, the facility operators and the safeguard managers are working together on the network. Figure 2 shows a schematic of the NCAMITS server system on the network environment, where Java application server (Java A/S) undertakes user interface

(UI) services in web application server (WAS) system and controls the relational database management system (RDBMS) [5,6].
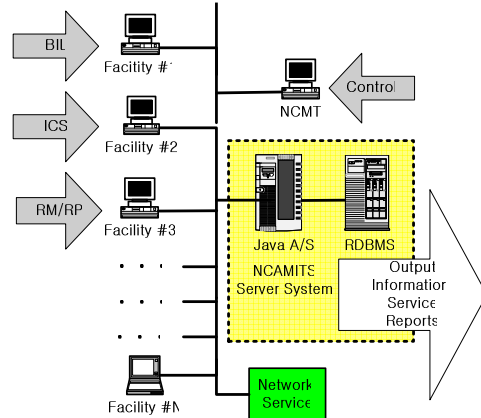

Figure 2. Schematic of the NCAMITS server system on the network environment.

To lessen the operator's burden in loading input data, we introduce two types of input slips: the inventory change slip (ICS) and RM/RP slip. The safeguard managers provide the control data such as the design information questionnaire (DIQ) and the facility attachment (FA). Note that the system provides the operators and managers with the book inventory list (BIL), in near-real time, as a current inventory status.

With these input data the NCAMITS undertakes very complex chores to prepare supporting documents such as the inventory change documents (ICD), a list of items from the updated BIL, and the managements of the files of accounting records. Figure 3 summarizes the process steps from the data input to the generation of the accounting reports.
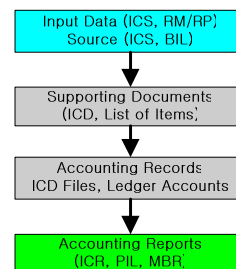

Figure 3. Sequential flow of accounting data processing.

The Code 10 of the Subsidiary Arrangements established the accounting report format in two types: the fixed format and the labeled format [2]. Basically, the two formats of the accounting reports are the same in bookkeeping point of view. The fixed format reports can be safely migrated into the labeled format, while the reverse is not guaranteed. The internal structure of the

NCAMITS is designed on the basis of the labeled format so as to accommodate two formats in one system.

3. Implementation of NCAMITS

The work scope of the NCAMITS development is configured in Figure 4. The information system analysis begins with normalizations of the input and output data that enable a database system to manipulate with table structures, and then specifies the procedures with which the NCAMITS processes the safeguard information and generates relevant reports automatically. The system analysis phase establishes the logical structures of the database system in detail.
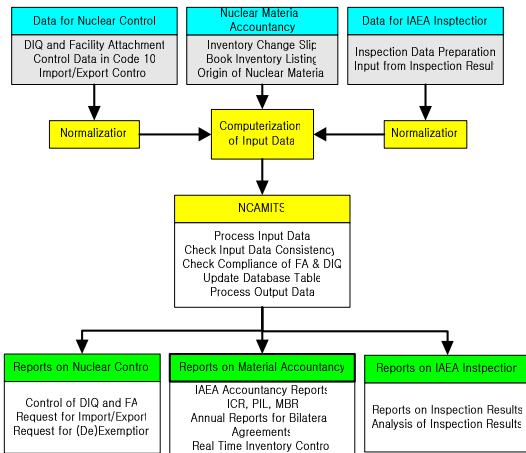

Figure 4. Work scope configurations in the development of the NCMITS.

On the bases of the logical structures, the physical structure is designed to fabricate the database system in the computer system. Figure 5 outlines the deployments of the modules and the processes in the NCAMITS.
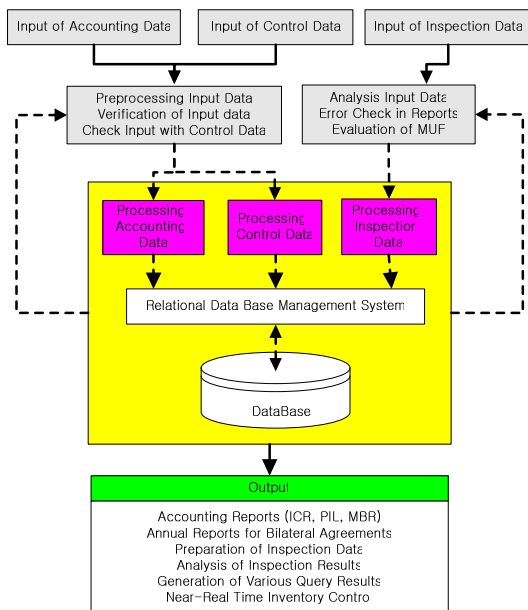

Figure 5. Implementation of the database system in the NCMITS.

The NCAMITS will be fabricated in graphic user interface (GUI) environment to make the end-users feel comfortable in doing their job. Also, the GUI will help the users understand the system intuitively without consulting with user's manuals. Thus, the GUI with intuitive and user-friendly environment will greatly reduce the human errors and enhance efficiencies.

The database management system (DBMS) adopted in the NCAMITS takes all hard works in handling the data tables and records, and in processing information and reports. The DBMS enables one to build the system in object-relation environment with which the software development is very simple and intuitive [7]. Also, the DBMS can offer rich query capabilities that can be used by the managers to process various safeguard related information at will.

4. Concluding Remarks

The installation of the NCAMITS will enhance the capability of the safeguard information management system at KAERI. One of the advantages of NCAMITS is that its internal database structure is designed on the basis of the labeled format in order to generate the accounting reports in labeled format as well as in fixed format. The system will be implemented in graphic user interface (GUI) environment in order for the facility operators to learn and to use at ease. Also, the NCAMITS will be operated in network environment which enables the facility operators to update the input data in near-real time and the safeguard information managers to access the data directly as well. The experience obtained from the development of the NCAMITS may be helpful in designing an information management system for national SSAC in future.

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