The Development of Quality Assurance and Visualization for Safety Assessment System

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ABSTRACT

Site Information and Total Environmental data management System (SITES) is an integrated program for overall data acquisition, environmental monitoring, and safety analysis. SITES is composed of three main modules such as site database system, safety assessment system and environmental monitoring system named SECURE, SAINT and SUDAL, respectively. SAINT abbreviated for Safety Assessment INTegration system is the integrated interface for the radioactive waste safety assessment codes in the SITES. SAINT is developed for the application and analysis of data from SECURE and for the systematic management of the resulted data from the safety assessment. The Quality Assurance module in SAINT is implemented to enhance the reliability of safety assessment results. The visualization in SAINT is purposed of reliability, comprehension of safety assessment results and user's convenience which can easily recognize the assessment results using the geographic information.

INTRODUCTION

During the last four years, Site Information and Total Environmental data management System (SITES) has been developed in Korea. SITES is an integrated program for overall data acquisition, environmental monitoring, and safety analysis. SITES is composed of three main modules such as Site Environment Characterization database for Unified and Reliable Evaluation (SECURE), Safety Assessment INTegration system(SAINT) and Site Useful Data Analysis & ALarm system (SUDAL). Fig.1 shows the schematic diagram of sub-modules in SITES, which describes the connection of the relational data among SECURE, SAINT, and SUDAL.
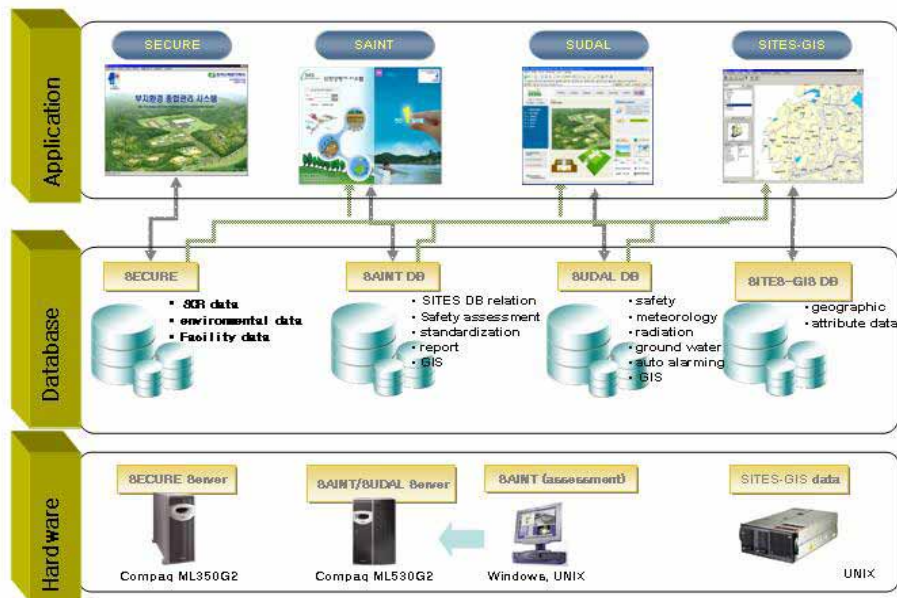
Fig. 1 The schematic diagram of sub-modules in SITES [1]

SAINT is an integrated interface for the radioactive waste safety assessment codes in SAINT introduced in the previous papers [1, 2, 3]. SAINT is developed for multi-users concurrently to perform safety assessment using many codes which are operated under various OA systems i.e. DOS, Windows and UNIX. Also, SAINT can use pre-operating data of the repository from SECURE as input of assessment codes. The main function of SAINT is an interface for the assessment codes to control input and output data by graphic user interface, to produce report and communicate between client PC and other OA systems. On the other hand, SAINT has other auxiliary functions as like quality assurance and visualization for safety assessment. The quality assurance function is developed to obtain reliability safety assessment results. Besides, Visualization function is for user's comprehension and easily recognizing assessment results. Fig. 2 shows functional diagram of SAINT that describes overall data process in SAINT. This paper is to introduce the development method of quality assurance and visualization in SAINT.
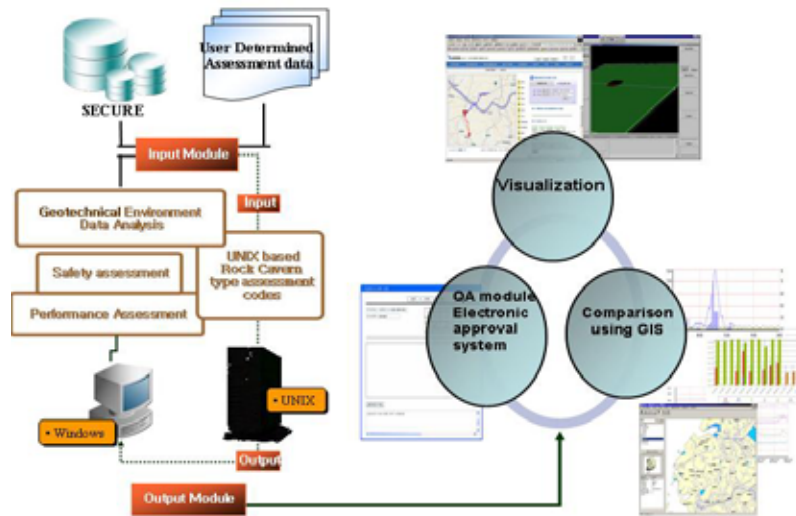
Fig.2 The functional diagram of SAINT

DEVELOPMENT METHOD OF QUALITY ASSURANCE

During safety assessment, a number of input data and output assessment results are produced but several approved input data and results are only available to the assessment process. Therefore, Quality assurance function of SAINT is purposed to certify input data and safety assessment results in SAINT. To develop the QA function, an electric approval system is used. After an assessment through the process using SAINT that was introduced in the previous papers [1, 2, 3], the appropriate output files to specific codes are converted to result reports as the type of Excel, Word or Chart file for user convenience.

For the QA process, assessors produce one final report using the input data and output reports and request verification and approval for senior assessors in the e-approval system. After verification and approval, the final report with input files and output results of the assessment are stored at the same time in SAINT database. It is impossible to revise the stored data. This process can help easily to verify and confirm the report for senior assessors. It makes the follow–up survey possible from any assessment errors arisen. The Quality Assurance module in SAINT will enhance the reliability of safety assessment results. Fig.4 shows the diagram of QA process in SAINT.
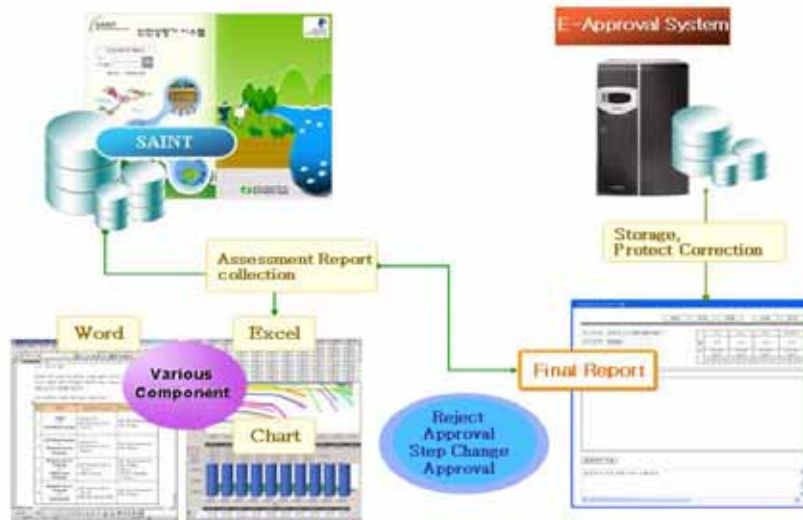
Fig.4 The diagram of QA process in SAINT

DEVELOPMENT METHOD OF VISUALIZATION

The purpose of visualization helps users understand safety assessment results due to indicate these on the site map. The groundwater flow and radionuclide transport are just visualized among the many assessment results in various codes because those data are meaningful in visualization. The visualization of safety assessment results for radioactive waste repository is performed to two types. One method compares the safety assessment results of SAINT with the environmental monitoring values of SUDAL in various geographical positions of radioactive waste repository using GIS. The other is to link commercial visualization codes (i.e. Visual Mode Flow, AVIZIER) to SAINT [4]. The codes are used for visualization of assessment results from MODFLOW and NAMMU which are assessment codes already linked with SAINT as shown in fig.3.
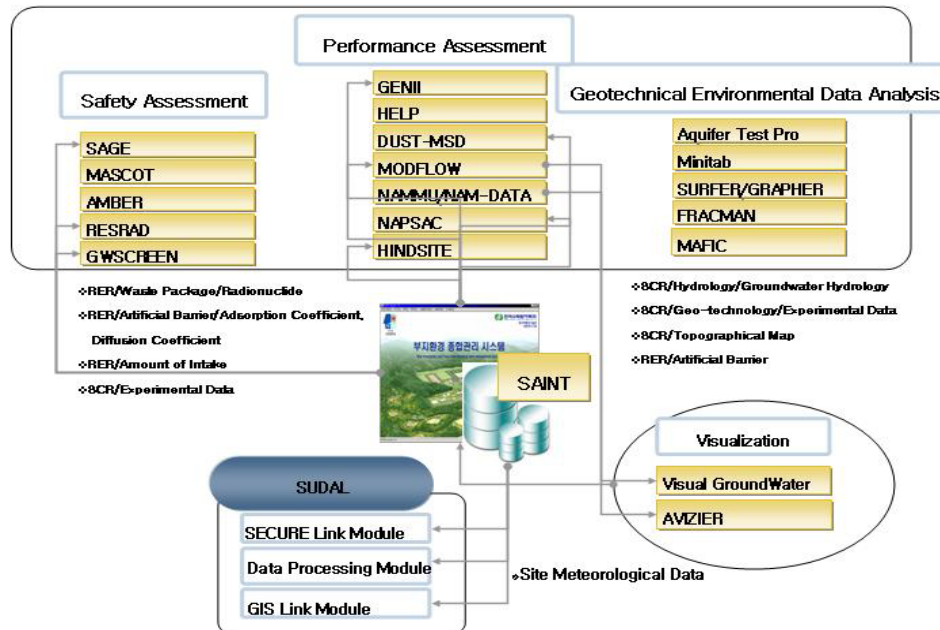
Fig.3 Visualization Structure Diagram of SAINT

Comparison between Assessment Results of SAINT and Monitoring Results of SUDAL

Each system that is SECURE, SAINT and SUDAL in SITES is independent functionally. However, all sub systems are integrated with SITES, because each system is partially related with each other. Especially, the comparative method between SAINT and SUDAL are one of the integration methods of SITES. Also it is one of the visualization concepts of SAINT. Among various assessment results, radionuclide concentration change vs. time in repository is important results for safety assessment. Therefore, it is needed to compare the forecasting concentration change vs. time from safety assessment with the really monitored data from SUDAL.

The radionuclide concentration maps, which are assessment results produced from MODFLOW, are represented at geographical position in the repository using GIS. Also, the radionuclide concentration-time curves from SAGE/AMBER are expressed in the specified geographical position of repository. On the other hand, the radionuclide concentrations at the repository boundary, which are assessment results of SAGE and AMBER, are realized at the geographical position [6, 7, 8]. The compared data can be analyzed by calculating difference between forecasting and real data. Using the results of analysis, users can modify the input data of safety assessment process [9].

The Linkage of Codes for Ground Water Flow with SAINT

To realize another concept of visualization, two visualization commercial codes which are Visual Groundwater Flow and AVIZIER are linked to SAINT. The assessment results from MODFLOW and NAMMU can be used as input files of the visualization codes. MODFLOW and NAMMU are executive codes to assess the groundwater flow in SAINT. The assessment results performed by MODFLOW and NAMMU can be linked to the two visualization codes Visual Groundwater Flow and AVIZIER individually. In order to keep its own typical function of SAINT that is multi-user accessibility to the assessment code, the remote control function for visualization process from client PC is designed. Special link program (X-manager) is set up to meet the requirements of SAINT function because NAMMU and AVIZIER are used in the UNIX system that is not able to be controlled by SITES directly [9].

CONCLUSIONS

SAINT is the interface program for the radioactive waste safety assessment codes. The development of quality assurance and visualization functions using assessment results is implemented for the practical use of safety assessment results in SAINT. Quality assurance function is developed for obtaining the reliability without modifying stored data by using e-approval system. The visualization in SAINT is developed on two types. The comparison of the safety assessment results with monitoring data is one of the visualization methods in SAINT. The other is the linkage of visualization codes to SAINT.

Presently, SAINT is being used for safety assessment of the radioactive waste repository in Korea. In the future, SAINT will be used periodic safety assessment of the repository. The QA function of SAINT will enhance the reliability of safety assessment results of the repository. Also the visualization function will be useful to users because it helps recognize the assessment results by using the geographic information.

ACKNOWLEDGEMENTS

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