Radioactive Waste Tracking System (WTS) for the Decommissioning of Nuclear Power Plants

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1. Introduction

With the advent of decommissioning and decontamination of nuclear power plants, Korean Energy Technology Evaluation and Planning (KETEP) has organized the project called radioactive Waste Tracking System (WTS) [2] to develop the database system with friendly User Interface (UI) in 2017, which is to manage all the internal and external data generated from waste generation up to disposal process for nuclear power plant decommissioning. WTS will be developed during 4 years, actually 36 months. Now detail software design specification is being prepared and refined step by step.

Most of requirements for WTS for nuclear power plants are based on the IAEA TECDOC, decommissioning plan, and examples of foreign experiences and a sort of specific needs from utility. In addition to those resources, MIRAE-EN Co., Ltd. is suggesting the ISO TC85 SC5 WG5 standard[1] describing the requirements of radioactive waste management life cycle, which is also obviously crystal guideline for WTS development and would be good aids and basis for waste certification for disposal. This paper addresses the development progress of WTS based on [2].

2. Development strategy for WTS

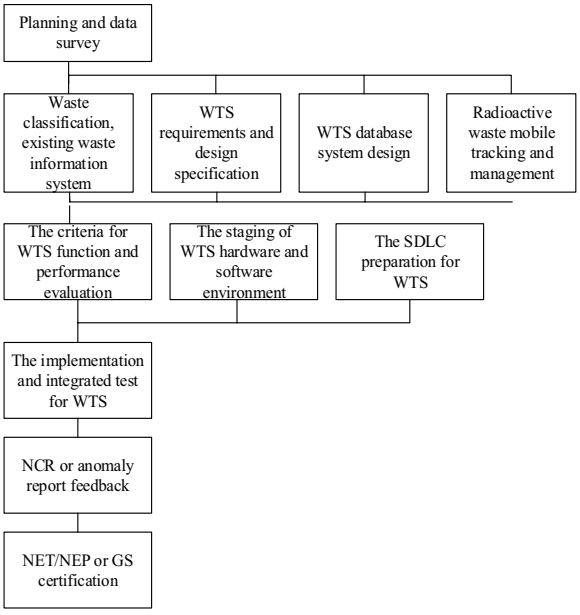

Fig. 1. A strategy for WTS development.

Especially for survey of site waste management system and experiences of oversea waste management, Project leading group has visited the Ulchin 5&6 site and reviewed the management system for Ulchin 1 & 2 NPP, and had a workshop in the title of "WTS – Waste Acceptance Criteria (WAC) and Waste Certification Program (WCP)" with TÜV SÜD operating the Reststoff-Verfolgungs und Kontrollsystem (RevK), the WTS for decommissioning of nuclear power plants. In addition to this, this project has reviewed IAEA and BRIMS in UK and many others also.

3. WTS development life cycle (SDLC)

3.1 Documents development

For the development of SDLC documents, project leader has document production schedule selectively from IEEE 1012. Those are as below with standard reference, and not limited to this;

1) WTS software system development plan (IEEE 1074),
2) Configuration plan and procedure (IEEE 828),
3) Software verification and validation plan (IEEE 1012),
4) Software requirement specification (IEEE 830),
5) Software Design Specification (IEEE 1016),
6) Unit test procedure and report (IEEE 829),
7) Site conformance test and report (as necessary),
8) The 3rd party independent verification and validation report
9) Operational guideline and manual (including others)

Especially the plan/procedure and the report of verification and validation is to be conducted by separate organization independent technically as well as organizationally

3.2 WTS hardware staging

The selection of WTS DB system hardware and software environment is a critical factor to implement and operate for a long time while decommissioning. Thus the most important factor to select the commercial hardware and software is the market share, and then ease of use and maintenance, and performance has been considered for long time operation and maintenance.

Operating System (OS) for WTS DB system will be using Linux series of open sources, Oracle Database Management System (DBMS) as a skeleton

platform, and other application software like Visual Basic and C# and graphic tools.

3.3 WTS DB implementation

The critical design of WTS is the establishment of DBMS based on the procedure below;

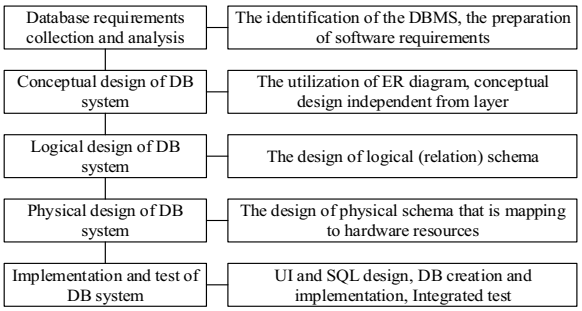

Fig. 2. WTS DB implementation flow.

In addition to this implementation flow, UI include the function of graphic, chart, data calculation and composing and statistics for report generation and other purposes. Also in case of integration with conventional waste information system already operated in each organization, data import and export UI will be available too.

As we all aware of, the design and operation of UI is one of the typical criteria of WTS, which means UI should be implemented as friendly, ease of use and efficient for easy access and navigation.

4. Design considerations

4.1 META data implementation [3]

Typically radioactive waste management life cycle requires large amounts of data across multiple disciplines (e.g. engineering, geoscience, waste management) and for multiple purposes (e.g. site characterization and selection, numerical modelling, licensing, repository design, construction and operation, waste packaging, safety case, environmental impact assessment etc.). Thus *contextual and detail meta data*, "data about data", plays a fundamental role in the long-term management of waste management data

4.2 Constant DB implementation and management

In order to operate the WTS, there are many constant DB implementation and management for information such as classification of isotopes and their half-lives, the type of containers and etc. Thus the information shall be provided for easy access of WTS also.

4.3 Other technical issues

4.3.1 On-line direct upload of waste process data. This topic is not the scope of this project. But judging from the past experiences from the characteristics testing in solidified radioactive waste, there are a lots of test and measure results that is not currently directed to WTS server. It means the test and measure data is logged in excel file temporarily at first time, and put in the WTS server database manually, which causes a waste of time in WTS data management. Considering the amount of data generated during radioactive waste management life cycle, thus it is highly recommended that the communication middleware between radioactive measuring instruments and WTS server to directly upload the test and measured data into WTS server should be implemented and equipped with system.

4.3.2 WCP activation by WTS and repository information. In a sense that this WTS is intended for KHNP to track the radioactive waste management data in nuclear power plant decommissioning, the view of repository owner (e.g. KORAD) is after delivery is not a critical requirements of this WTS. However considering that this WTS needs to provide the radioactive waste tracking information, those two systems sometime might interface for complete mission of national radioactive waste management with the activation of WCP utilizing this WTS.

5. Conclusions

As of today, conducting the 2nd year of KETEP project it is expected that there're lots of requirements for specific technologies for waste treatment, process and management, and for a specific needs from utility (waste generator). Thus the iterative consultations, meetings and evolutions of WTS is a corner stone of WTS success.

ACKNOWLEDGEMENT

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[2] Radioactive Waste Tracking System for Nuclear Power Plants Decommissioning and Non-Reactor Nuclear Facilities (NRNF), PN: 20171510300710, the project proposal by MIRAE-EN Co., Ltd., KETEP.

[3] OECD/NEA RepMet(Radioactive Waste Repository Metadata Management) Initiative, Massimo Ciambrella, RepMet Technical Secretary, IAEA Third International Conference on Nuclear Knowledge Management, 7-11 November 2016.