Implementation of Waste Tracking System (WTS) for Solidification Process and Management

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1. Introduction

Low and intermediate level of radioactive waste should be solidified to be accepted and delivered to Korea Radioactive Waste Agency (KORAD). This paper provides the design and implementation of WTS (Waste Tracking System), which primarily includes the characteristics testing results and historical data of solidified specimen and its treated drum of sludge-type of radioactive waste from nuclear fuel manufacturing cycle.

2. Requirement of WTS [1]

2.1 The generation and collection of wastes

All the wastes has been collected in a collected drums with identification. This drums will have radioactive waste management process in Fig. 1. All the data acquired in the generation and collection of wastes should be logged into WTS also, which should have function of input, search, retrieval and report generation including visualization like trend, graph and any other mean to indicate the statistical data.

2.2 Treatment of radioactive wastes

Theoretically the treatment process has various sub-processes and technologies such as solidification, vitrification, incineration and etc. In this project, the treatment of solidification using solidification agent [5] is hired and its specimen and treated drums are tested to verify if those results of characteristics testing for solidified radioactive waste meet the acceptance criteria of KORAD.

Unexpectedly the information generated from this treatment process is relatively huge, which should be kept in WTS for internal as well as external utilization to maintain the traceability of wastes.

2.3 Characteristic testing

This process performs the characteristics testing that requires compressive strength, thermal cycling, leaching and immersion, free standing water, and test analysis necessary to identify the chemical and radiological features. The result of all kind of these tests should meet the acceptance criteria [3].

2.4 Disposal and delivery

The specimen and its relative treated drum should pass the conformity test. Also WTS should generate certificate and reports.

This WTS as part of KNFC Manufacturing Execution System (MES) has linked with review and approval function for these consecutive tests.

3. Implementation of WTS

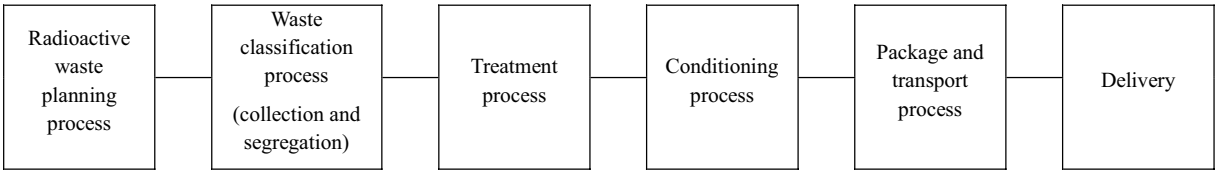

Fig. 1. Radioactive waste management process (ISO TC 85 SC5 proposal).

3.1 Development environment

This project expands the legacy MES to have capability to keep and manage the bulky data generated through the radioactive waste treatment and characteristics testing partly described in Section 2.2.

Thus legacy of client and server environment and the utilization of commercial 3rd party tools based on .NET infra has been maintained.

3.2 Database design and implementation

Legacy radioactive information system in KNFC uses the Oracle-based database management system. Thus the new database necessary to manage the process data also has been designed and implemented using Oracle DBMS and its relative tools such as Toad and others.

New database and query design is truly based on the analysis information acquired from the ongoing solidification and characteristics testing activities, and database normalization to get rid of an anomalies of insertion, deletion, update and retrieval.

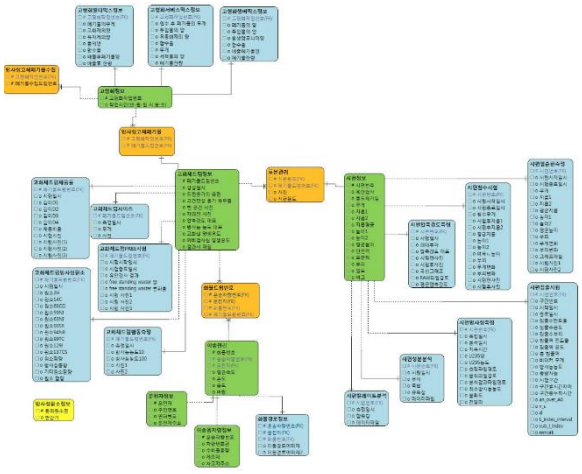

Fig. 2. Logical ERD.

According to the solidification batch, the relation between collected drum and treated drum, and its relative test specimens are established for logical schema and physical schema of database, which is indicated in Entity-Relationship Diagram (ERD) of Fig. 2.

3.3 Query, MMI and SDLC design

Query design of WTS is conducted based on the User Interface (UI) requirements such as primarily report generation and data visualization like graph and trend based on the secure coding guide [4].

This WTS implements the UI requirements in Section 3.3 and the requirements of user who operates this WTS in order to enhance the accessibility and efficiency.

All of the design and implementation activities described so far is adhered to the Software Development Life Cycle (SDLC) in order to software verification and validation [2] that could be conducted in final testing and evaluation phase.

4. Conclusion

An automatic data acquisition and upload is necessary with the support of industrial Internet of Thing (IoT). It is highly expected that Waste Certification Program (WCP) by independent 3rd party is activated reliably for simplification of waste inspection and delivery.

REFERENCES

[1] Request for Proposal for Establishment of Radioactive Waste Tracking System, 2017.05

[2] IEEE 1012: 2010 Software Verification and Validation

[3] Safety Analysis Report for LILW disposal facilities (SAR)

[4] Ministry of the Interior and Safety, guide of Software Development Security