Data Quality Objectives for Direct LAW Feed Acceptance and Qualification – 17122

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ABSTRACT

The Hanford Tank Waste Treatment and Immobilization Plant (WTP) Low-Activity Waste (LAW) Facility has been designed to operate under two scenarios. In the primary operating scenario, the Pretreatment Facility configuration, waste is first processed through the WTP Pretreatment Facility. Then the low-activity liquid is transferred to the WTP LAW Facility for vitrification. Alternately, under a direct feed operating scenario, known as Direct Feed LAW (DFLAW), the supernatant portion of the tank waste, referred to as the LAW feed, is treated in a Low-Activity Waste Pretreatment System (LAWPS) prior to transfer of treated feed to LAW Facility. The DFLAW scenario is a strategy to begin treating Hanford tank wastes as soon as 2022.

A program has been established as part of One System to integrate and align the waste feed acceptance and qualification requirements for processing in the LAWPS and the LAW facility. One key activity of the program is the development of integrated data quality objectives (DQO) using U.S. Environmental Protection Agency guidance for the DQO process. [1] The integrated approach focused on one sampling event that will provide sufficient and necessary data to meet both LAWPS and LAW Facility criteria. Existing data and historical information were taken into account to develop sampling and data collection requirements necessary to meet waste acceptance criteria and processing requirements for both LAWPS and LAW Facility. Using a conceptual model for the sampling and decision process, the seven steps of the DQO process were completed. This paper discusses the details of the integrated DQO process.

INTRODUCTION

The Hanford Tank Waste Treatment and Immobilization Plant (WTP) facilities are being constructed for the U.S. Department of Energy - Office of River Protection (ORP), by Bechtel National, Inc. (BNI) and BNI principal subcontractor, URS, to process and vitrify mixed waste that is currently stored at the Hanford Site in underground tanks. The stored waste is composed of highly radioactive solids and liquid fractions in the form of sludge, saltcake, and supernatant liquid. The WTP Low-Activity Waste (LAW) Facility has been designed to operate under two

scenarios. In the primary operating scenario, the Pretreatment Facility configuration, waste is first processed through the WTP Pretreatment Facility and then the low-activity liquid is transferred to the WTP LAW Facility for vitrification. Alternately, under a direct feed operating scenario, known as the Direct Feed LAW (DFLAW), treated LAW feed is transferred directly to the LAW Facility if the feed meets LAW acceptance criteria. The Tank Operations Contractor (TOC), Washington River Protection Solutions (WRPS), has the responsibility to retrieve, stage, treat, and deliver feed directly to the LAW Vitrification Facility. The LAW feed generally refers to the solubilized salts and supernatant portion of the tank waste. The DFLAW scenario is a strategy to begin treating Hanford tank wastes as soon as 2022. The TOC plans to treat the staged feed in a Low-Activity Waste Pretreatment System (LAWPS) prior to the transfer to the WTP LAW Facility.

As part of the One System organization, several activities have been initiated with joint participation by DOE-Office of River Protection (ORP), WTP and TOC personnel to develop a program to integrate and align the waste feed acceptance and qualification programs for processing in the LAWPS and the WTP LAW facility. [2, 3] The need for an integrated DFLAW feed qualification program and data quality objectives (DQO) process is documented in the integrated flowsheet maturation plan. [4]

The DQO development was based on acceptance criteria and processing requirements for the LAWPS and for LAW facility operations. Inputs from existing data and historical information were taken into account for determining the required data collection. The team effort between ORP, WTP, TOC, SRNL and PNNL representatives led to successful completion of the DQO development process.

This report details the activities associated with the development of the DQO to meet acceptance criteria for transfer of staged feed to the LAWPS and treated feed to the LAW Facility. The integrated approach was to focus on an initial, comprehensive sampling event that collects samples to obtain sufficient and necessary data for qualifying the staged feed. The goal was to consolidate program requirements thereby reducing planning time, minimizing radiation exposure, and decreasing the work load of the sampling crew and laboratory personnel. A second sampling event was specified to collect data on five key parameters to verify the waste treated in the LAWPS meets the LAW facility acceptance criteria and can be vitrified as LAW glass.

DQO PROCESS

The DQO process is a systematic planning tool for collecting data necessary to make critical decisions. This process establishes sampling and analytical requirements for data collection. The decision for acceptance of qualified feed to the LAWPS for pretreatment and subsequent acceptance to the LAW Facility for vitrification requires sample data.

The DQO planning team consisted of decision makers, facilitators, data users, supporting function providers (statistician and laboratory chemists), and observers from WTP, TOC, ORP, SRNL and PNNL. A pre-job briefing was held with all the team members to discuss the integrated scope and planning for the DQO development. A Core Team was identified during the pre-job briefing to work on the DQO development. The Core Team consisted of facilitators, decision-makers, data users, and statisticians. The facilitators developed a DQO straw man which was used to guide the DQO discussions. The Core Team followed the DQO process steps to develop initial DQO sampling and analysis objectives. These objectives were developed by compiling information from the requirements source documents along with inputs from subject matter experts. Historical data were used to predict data uncertainty associated with sample results to be collected and to estimate the minimum number of samples required to satisfy the data needs. This initial set of data objectives were presented to and discussed with the full DQO team. A DQO report was then distributed for review and concurrence by the full team. The Decision Makers participated in the DQO development process and were key in developing and concurring with the decision rule. DQO Process Observers participated in the Core Team meetings to independently observe the DQO process and provide inputs as needed.

The DQO team chose to conduct the DQO process in accordance with the TOC procedure [5] which follows the U.S. Environmental Protection Agency guidance [1] on using the DQO process for systematic planning for collecting sample data. The TOC procedure includes some modifications to accommodate specific Tank Farms plant design, safety, processing, and regulatory compliance requirements. The development process was documented in meeting minutes. Action items were identified by the DQO planning team during the course of DQO development. These items were identified and tracked to closure prior to issuing the DQO report.

DQO Seven Steps

Using a conceptual model for the required sampling and data collection (Figure 1), the seven steps of the DQO process were completed as follows:

1. State the Problem – The problem was defined as needing necessary and sufficient sampling data required to meet the acceptance criteria and satisfy qualification requirements for LAWPS to receive staged feed and for the LAW Facility to receive treated feed.

2. Develop Decision Statements – Principal study questions were identified such that when the questions were answered using feed qualification sample data the defined problem would be resolved. The questions were linked with alternative actions for creating choices to manage the decision for transfer of LAW feed and the treated LAW feed.

3. Identify Inputs – Required sample analyses were identified from requirements source documents and input from subject matter experts. Approximately 230 analytes including regulatory constituents were identified and ranked as High, Medium, and Low. The parameters ranked 'High' were considered as key decision parameters.

4. Define Study Boundaries – Spatial boundary was assigned to staged feed in the double-shell tank and the treated feed in the LAWPS lag storage tank. Temporal boundary was applied to DFLAW operation.

5. Develop Decision Rules - The rules for using sample data to make decisions and to choose among alternative actions were established for High, Medium, and Low ranking analytes.

6. Define Error Tolerances – Defined acceptable uncertainties for high-ranking parameters to support the decision. Acceptable uncertainties for mistakenly accepting the feed that should be rejected (Type I alpha error) and for mistakenly rejecting the feed that should be accepted (Type II beta error) were established. A minimum number of three samples were estimated from statistical analyses of existing data and defined error tolerances

7. Develop Plan for Obtaining Data – An optimized sampling and analysis approach was designed based on the results of previous steps.

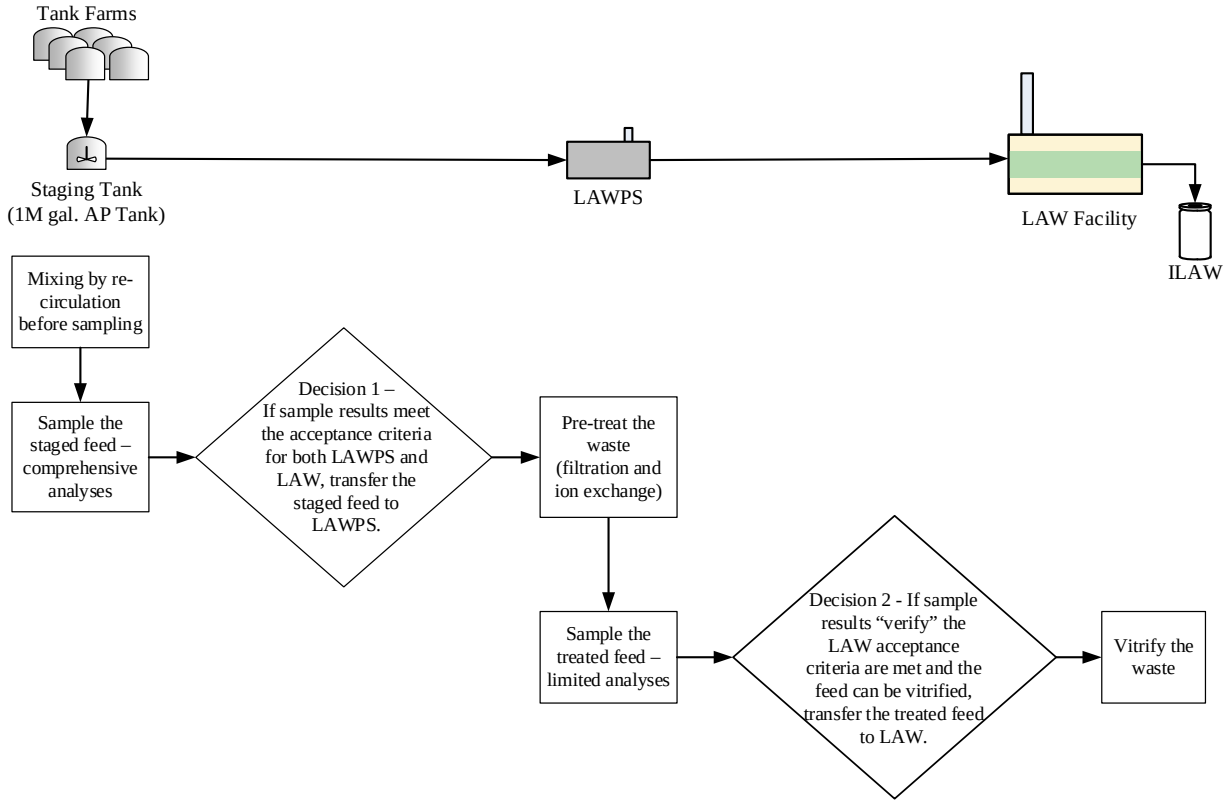

Fig. 1: Conceptual Model for Sampling – Decision Process

Sampling Design

As mentioned previously, statistical analyses of existing data and acceptable error tolerances indicate that a minimum of three (3) samples would be needed. Additional samples were identified to account for the use of existing data to predict uncertainty in feed qualification sample results and as contingency for unexpected sample losses (e.g., due to breakage or spillage). A total of five (5) samples were specified for data collection for both LAWPS and LAW Facility feed acceptance. A Tank Sampling and Analysis Plan (TSAP) detailing the sample collection, analysis, and data reporting requirements will be developed per this DQO for sampling each staged feed campaign in support of decision to transfer and accept the staged feed. The volume of each sample depends largely on the analyses and process tests specified in this DQO and on the radioactivity of the sample material. Because the majority of sample analyses are typically performed in radiochemical fume hoods, the amount of sample to be used for each analysis is limited by its radioactivity to minimize radiation exposure to the analyst. The required volume will be specified in the TSAP. A separate test plan will be developed to provide instructions for the processability testing of unit operations using waste feed samples. The analytes of interest, test instructions, and data reporting requirements for processability testing will be specified in the test plan. In addition, a separate sampling and analysis plan

will be developed to provide instructions for sampling and data collection on verification parameters for the treated feed.

The waste to be sampled from the staged waste feed tank is primarily liquid, possibly with trace amounts of suspended solids. Therefore, the American Society of Testing and Materials weighted bottle method [6] as described in TOC procedure [7] is used to obtain samples of this matrix. The batch QC and required measurement sensitivity for DQO constituents are specified in the report to ensure the needed data quality for sample analyses. Similar requirements are specified for sampling of the treated feed for the analyses of five verification parameters that are affected by pretreatment in LAWPS.

CONCLUSION

The One System team effort resulted in successful completion of the DFLAW DQO process for sampling and data collection to meet acceptance criteria for transfer of staged feed to the LAWPS and treated feed to the LAW Facility. The completed DQO process was documented in a report that was issued in September 2016.

REFERENCES

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