Laboratory Information Management Strategy for Vitrification Support - 11143

Aruna V. Arakali, Thomas A. Lane, Jill C. Johnston, Robert C. Shannon
Hanford Tank Waste Treatment and Immobilization Plant Project
Richland, WA 99354, USA

ABSTRACT

The Hanford Tank Waste Treatment and Immobilization Plant (WTP) is being designed and constructed for the U.S. Department of Energy by Bechtel National, Inc. and subcontractor Washington Group International, Inc. a subsidiary of URS Corporation (under contract # DE-AC27-01RV14136). WTP will process and vitrify radioactive waste stored in underground tanks at the Hanford Site. The facilities under construction include a pre-treatment facility (PT) for treating / separating the low activity waste (LAW) and high level waste (HLW) feeds; a LAW vitrification facility for converting the LAW feed into glass product; a HLW vitrification facility for converting the HLW feed into glass product; a laboratory facility (Lab) for monitoring the WTP plant operations; and operational support facilities (BOF) for providing critical support systems and site-wide maintenance.

The selection of the best demonstrated laboratory information management system (LIMS) for managing laboratory operations was based on requirements and specifications for activities within the laboratory. And, also on the need to integrate with other WTP information systems for process monitoring and control, waste management, and environmental compliance. The strategy consisted of the evaluation of various LIMS software packages from different vendors, and selection of a vendor that met the core requirements for LIMS implementation. Following this evaluation and selection, an opportunity for "savings through sharing" was investigated. This opportunity was to evaluate the LIMS software already in use on the Hanford Site by the Tank Operations Contractor (TOC) and to consider consolidation of software licenses for potential WTP cost savings. The software in use at the site laboratory was evaluated using a three-phased approach that involved discussions, observations, and input from developers and users.

This evaluation resulted in the recommendation for implementation of the TOC LIMS because the software met all core requirements. In addition, the WTP Project will benefit from consolidated licensing, vendor / user support, and customized software modules / procedures for sample tracking, analyzing, and data management. Details of the evaluation and selection will be discussed during the presentation.

INTRODUCTION

The Hanford Tank Waste Treatment and Immobilization Plant (WTP) is being designed and constructed for the U.S. Department of Energy (DOE) by Bechtel National, Inc. and subcontractor Washington Group International, a subsidiary of URS Corporation (under contract # DE-AC27-01RV14136). WTP will process and treat approximately 200 million liters of radioactive waste stored in underground tanks at the Hanford Site in southeastern Washington.

The WTP laboratory operations will be conducted in accordance with the sampling and analytical requirements for monitoring and control of waste pretreatment and vitrification processes. At various steps in these processes, samples will be taken and analyzed in an

on-site Analytical Laboratory that is under construction in the WTP complex. In order to support the laboratory data handling and tracking for the analytical processes, laboratory information management system (LIMS) requirements have been specified for selection and implementation.

REQUIREMENTS

The selection of a best demonstrated LIMS software package focused on the development of core requirements to satisfy WTP programmatic needs and management of laboratory activities. This included integration requirements with analytical data acquisition systems and sample tracking within the laboratory, and interfacing with other WTP information systems for process monitoring and control, waste management, and environmental compliance.

The software description for core requirements was split into the following categories:

Global Functions
- audit trail feature
- chain-of-custody feature
- multiple user levels
- authorized user functions
- system login feature
- electronic signatures/records
- display material safety data sheet (MSDS) information

Sample Log-in
- interface with other information systems
- facilitate work schedule/resource allocation
- perform tracking and reporting functions
- mechanism for defining all parameters associated with sample
- ability to customize fields
- generate alphanumeric sample identification (ID)
- link sample ID to track/report derived samples and associated data
- capability for method selection

Tracking
- receive data from bar code reader
- sample position identification
- sample location and status
- sample inventory
- analysis progress and status
- link quality controls (QCs) and sub-samples
- track samples scheduled for off-site analyses
- generate unique IDs for waste container tracking
- track waste containers
- interface with waste tracking inventory system
- estimate waste collection by workstations based on samples
- generate labels and maintain inventory of standards / reagents
- flag expired standards/reagents to prevent inadvertent use
- calculate chemical usage and track inventory
- store certificates of analysis and link to standards

Data Analysis
- capable of storing, maintaining, and displaying standard operating procedures (SOPs)
- mechanism for storing and maintaining all records in the laboratory
- provide context-sensitive 'Help' system
- perform pre-programmed calculations
- compare input data and calculated results
- recall similar data from previously reported analytical results
- allow acceptance of out-of-specification data (privileged override)
- audit trail feature
- prompt for approval of results including different levels
- link series of tasks and/or methods
- ability to reject, approve, or tag a sample
- maintain trail on corrections or changes to previously recorded data
- perform standard statistical calculations
- perform time comparisons for analysis (performance indicator)
- configurable mechanism for importing data

Instrument Interface
- method for automatic and manual data entry for various instruments
- capability to define a wide range of quality assurance/quality control (QA/QC) samples
- link individual samples with respective quality control samples
- perform statistical quality control calculations and/or accept QC data
- flag on out-of-range QC sample results
- capability of automatic and manual query
- report or accept data from interfaces
- maintain instrument records
- store instrument settings and calibration data
- confirm assigned technician to verify qualification status
- confirm analytical instrument availability and active status

Reporting
- mechanism for generating reports with required fields
- analytical parameters
- QA/QC data
- read-only access
- tool to design user-configurable reports
- tool to perform ad-hoc queries
- integrate with other Microsoft® Office products and WTP interfaces
- capable of viewing and saving reports prior to printing
- capable of printing to network printers

Lab Management
- capable of generating summary reports
- allow laboratory administrators to configure system security
- monitor and flag for time sensitive steps

- tools to monitor sample load and prioritize
- generate a work list for the logged sample
- automatically track and chart lab parameters
- define and assign individual lab personnel to specific work.

The above core requirements were identified in WTP engineering specifications for the LIMS package that was included as part of the request for proposal in the procurement process.

APPROACH

The evaluation of various LIMS vendors was conducted in accordance with specifications to select a software that satisfied WTP needs. A vendor was identified and a software license was procured in order to develop and configure the LIMS program for WTP implementation. This software development was put on hold due to a change in programmatic needs. The project revised the strategic approach for assessing and managing risks in 2009 by defining "Opportunities" as positive impact risk. This strategy created an opportunity to consider consolidation of existing software licensing agreements, and to investigate the potential WTP cost savings by leveraging software already in use by the DOE Tank Operations Contractor (TOC). The TOC manages the radioactive waste storage tanks at Hanford site, and will ultimately be responsible for providing the waste feed material to the WTP.

The evaluation of TOC software was conducted in three phases to understand the software application and seek end-user input on performance/vendor support. The approach was as follows:

- Meet with the LIMS vendor at the production facility for a tour and discussion session.
- Meet with experienced LIMS users at their work location (Hanford site laboratory and technology integration staff, TOC) for a demonstration and feedback.
- Stage the LIMS software in a WTP test environment based on the TOC software configuration, and test the software using TOC Laboratory procedures.

A LIMS software evaluation team comprising subject matter experts (SMEs) within the WTP organization (Plant Operations Lab Group, Software Applications Group, and Training & Procedures Group) was established to complete the three-phase investigation. The team completed the investigation, documented observations and discussed the outcome from various perspectives with a focus on core requirements for WTP implementation. Individuals who were key resources to the LIMS evaluation were interviewed by the team members.

The environment for testing LIMS computing capabilities was created by WTP Software Applications Group. This included setup of designated workstations with operating system and test software. Authorized users were identified from the evaluation team.

EVALUATION RESULTS

The software evaluation results were compiled together and compared with evaluations obtained from the TOC Laboratory LIMS administrator and software vendor personnel. These results in turn were evaluated against the documented results for the earlier selected software that was put on hold. The final compilation was used to determine the best available software for WTP needs.

Some of the core requirements could not be evaluated due to the need for functioning communication interfaces to other laboratory systems. The evaluation results for these cases were based on either the demonstrations at the TOC Laboratory and vendor facility or the vendor's self-assessment of whether the software could be modified to meet the requirement. Also, data reporting functionality of the LIMS software could not be tested due to test environment limitations. However, the team witnessed the generation of LIMS data reports and reporting capabilities during the software demonstration at the user facility.

The team concluded that the TOC software is capable of meeting core requirements as listed in the WTP engineering specification for the LIMS procurement.

The results are summarized as follows:

- Software uses a standard Microsoft® Windows® operating system, Oracle® software, and is compatible with WTP computing hardware
- Demonstration of excellent knowledge and understanding of software capabilities by end-users (TOC)
- Access to procedures, calculation worksheets, elements of QC batching, and analytical methods to expedite implementation of LIMS
- Availability of 'lessons learned' information to avoid pitfalls
- Hanford site LIMS licensing agreement can be leveraged for use at WTP
- Evaluation of reporting capabilities was based upon demonstration at end-user facility, and not on hands-on testing results.

This evaluation resulted in the recommendation for implementation of the TOC LIMS for the WTP because the software met all core project requirements. In addition, the WTP Project will benefit from consolidated licensing, vendor/user support, and customized software modules/procedures for sample tracking, analyzing, and data management. Details of the core requirements, matrix comparison, and evaluation will be discussed during the presentation.

ACKNOWLEDGEMENT