Accessing, Integrating and Using Existing Data to Make Critical Nuclear and Hazardous Waste Management Cleanup Decisions – 14319

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ABSTRACT

The Integrated Technical Data-mart (ITD) and Portfolio Analysis Center of Excellence (PACE) improve access to a wide array of Hanford Site data for the U.S Department of Energy (DOE), Richland Operations Office (RL). Previously, data had been highly compartmentalized, limiting its effective use. The ITD consolidates this data, enforcing consistency across all groups, while maintaining data integrity. The ITD and PACE enable integration and synthesis of that data and displays the information in an interactive environment to promote faster, more informed decision-making.

INTRODUCTION

The Integrated Technical Data-mart (ITD) is designed to encompass RL lifecycle baseline planning and performance information. It is a suite of planning and reporting applications built on a centralized database. The database is a repository for information generated from contractor systems, applications and other sources at the Hanford site.

PACE is a state-of-the-art technical facility that allows ITD users to collaboratively plan and analyze data reflecting the state of RL's cleanup projects. Teams work in PACE performing what-if analyses in lifecycle planning, to identify significant issues and trends from the data. They also prepare corrective action plans for the Hanford cleanup mission.

Historically, Hanford has generated a wide variety of data to support waste management cleanup decisions. Initially, the data were stored as hardcopy artifacts that were later migrated to electronic systems. Currently, dozens of legacy and transactional systems collect and store information about the cleanup mission. Examples of these data sets include:

- Location and design attributes of existing and planned Hanford Site infrastructure including roads, raw water pipelines, electrical transmission lines and substations;
- Meteorological and environmental data, such as precipitation, soil chemistry, groundwater flow, and river stage;
- Location and chemical and radiological properties of contaminated groundwater plumes;
- Location, physical dimensions and chemical and radiological inventories of waste sites;

- Location and sampling results of environmental monitoring such as groundwater monitoring wells and air monitoring stations; and
- Planned remediation actions such as barriers over waste sites to protect human health and the environment.

Gathering and maintaining these data sets is the responsibility of the organization performing the associated cleanup function. For example, the location and design of the water supply lines are required by the civil works department responsible for water supply. The location and sample results of groundwater monitoring wells are required by regulation and used to remediate groundwater contamination. The location, footprint and makeup of future barriers are required for proper design.

Maintaining these data sets supports remediation work as well as a safe work environment. Owners include three different DOE Offices, six prime contractors and other subcontractors. Systems were created to meet the requirements of different organizations over time and currently meet the operational needs of the owning organization.

However, for RL, there were many challenges for integrated analysis and reporting in this environment. Disparate legacy systems and processes do not provide users with timely integrated, accurate information. Often, it was difficult to determine the authoritative source and most recent data set. Data pulled from different sources had to be manually integrated, introducing inefficiencies and potential errors. The different formats and data collection requirements of the separate data sets typically made integration problematic, with substantial effort devoted to data quality assurance and reconciliation. The amount of data, if it could be integrated, often overwhelmed the ability of workstation displays to provide an effective user interface.

DESCRIPTION

The ITD solves many of the problems associated with collecting and integrating data from multiple sources. The objective of the ITD is to bring together data from these sources that have relevant information contributing to RL's achievement of the site mission. The ITD provides an environment that is separate from the source systems and is designed for RL decision support and reporting.

The ITD leverages existing data sources and technologies on the Hanford Site. The organization responsible for the data continues to manage their own data sets in the source system. The ITD accesses these data sets through a direct interface or periodic import (such as monthly reporting) from the source system. Imported data sets may be conditioned to conform to a common ITD model. When new data sources are identified, the ITD is expanded to include essential information from these sources. The ITD data flow model is illustrated in Figure 1.

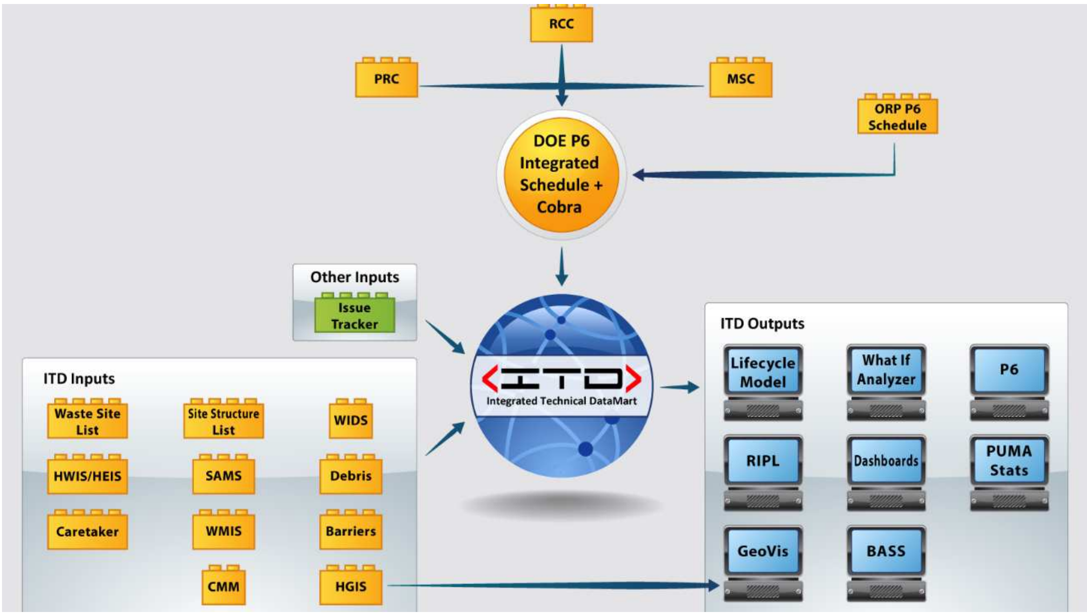

Fig. 1. Displays the current ITD Data Flow Model. Data sources are listed as inputs.

The ITD toolkit consists of a set of application tools for managing, displaying and reporting on information from the database. (Applications are listed in Figure 1 as ITD outputs.) The current ITD toolkit contains applications that perform:

- **Geo-Visualization**

  The GeoVis tool is a web-based mapping application that interfaces to the ITD, as well as the Hanford Geographic Information Systems (HGIS). It is currently used for viewing cleanup objects (structures, waste sites, wells, barriers, and debris sites) on and around the Hanford Site and their spatial relationships. Users are able to query the ITD for objects based on any type of data available in the ITD, and combine these queries with HGIS to create map displays with data annotations, color codes and other display attributes.

- **Interactive Web Display and Report Output**

  ITD includes several applications that allow users to perform standardized queries and reports through a web interface. An example is the Budget Analysis Scheduling System (BASS), which was initially developed for the budgeting and finance functions of DOE-RL. An authorized user can select data sets and then filter the datasets on key parameters. The results can be output to standard reporting formats such as Excel and PDF.

  The technology behind BASS is now being modified to support non-budget functions that are modeled in the ITD (e.g. performance data). New implementations are separate web applications or portals. Access through these applications is controlled at the both the application and database level.

- **Dashboards**

  The Portfolio Management (PFM) team has implemented a series of dashboards that display information from the ITD as well as other site sources. (These sources range from customized output created by client to links to other databases and Microsoft SharePoint® systems.) The dashboards are typically a single screen user interface that graphically presents such items as cost, schedule, or performance metrics for a project. The dashboards convey project status (either through representation of work flow, performance data or key performance indicators) to managers or department staff responsible for monitoring the project.

- **Ad-Hoc Query Analyses**

  The purpose of the ITD is to collect information from a variety of Hanford sources, and retain information from these sources to support historical analyses and trend reporting. Authorized users are able to perform ad-hoc queries on the underlying data tables. An ITD context diagram is illustrated in Figure 2.

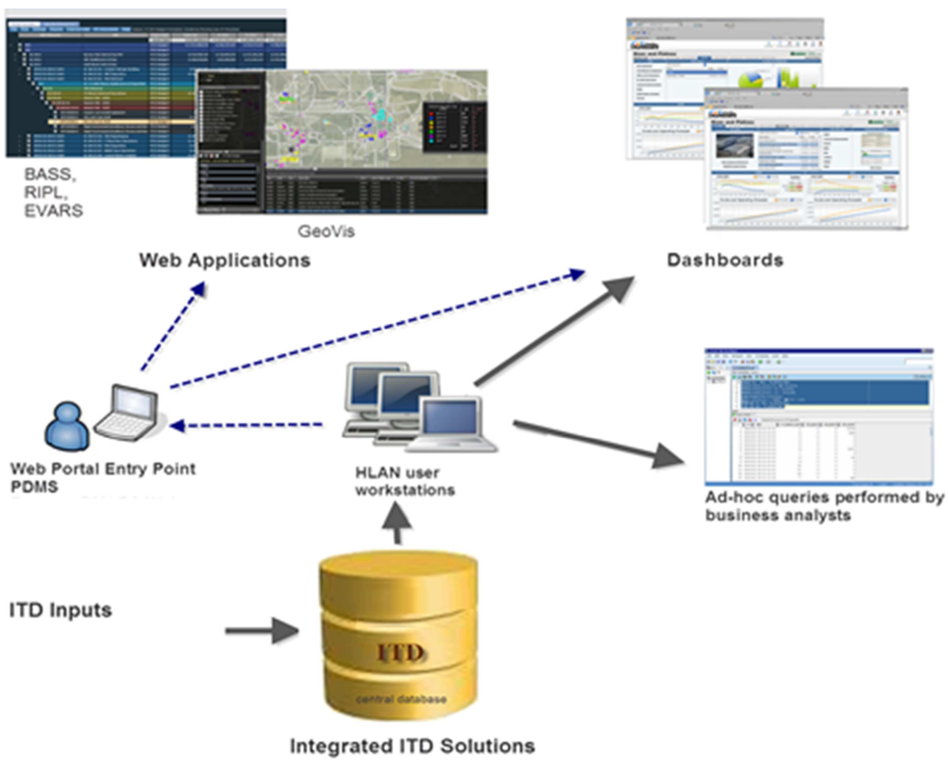

Fig. 2. Displays a context diagram of the full ITD solution[1].

[1] EVARS-Earned Value Analysis Reporting System; HLAN-Hanford Local Area Network; PDMS-Project Data Management System; RIPL-Ranked Integrated Priority List

The ITD provides the following benefits of data integration:

- **Referenced**—All source data are referenced and are fully documented. The ITD standardizes data definitions and data structures by using a common conceptual schema across sources. As integration with other data sources occurs, reference updates and configuration control are used to insure data accuracy and consistency.

- **Quality and Consistency**—Data sets are transformed from disparate sources to a common format (data model). The ITD applications produce results that are consistent across the site. Data quality checks find missing or miscoded data from the source that can be reported back to the data owner.

- **Timely Access to Data**—The ITD toolkit provides responsive mechanisms for delivering accurate data to users. The ITD enables RL to access data from many different sources through a single user interface, when they need it.

- **Traceability**—The method used to collect data, uncertainty definitions and any calculations performed on the data are fully documented and open to review.

- **Scalability**—A final advantage of the ITD and its data conditioning process is that it is scalable and can integrate data from a variety of sources. Structured change control associated with data collection reduces the degree of fragmentation in database development and uncertainty definition. Comparisons to baseline/dictionary values on an individual level as well as at the global level can be done to minimize inconsistency. Modular database design allows for verification and checking at several stages along the way to identify risks and discrepancies in data collection at various locations.

PACE

When using PACE, various model inputs and outputs can be evaluated and refined quickly, leveraging the collective subject matter expertise of the staff in the facility. Discovery information that emerges from collaboration regarding waste stream types/quantities, processing/logistic information, field data, or changes in project variables (scope, schedule, cost, and risk) can be verified quickly, providing actionable information to develop appropriate plans for implementation. An example PACE display setting is shown in Figure 3.

Fig. 3. Picture of PACE.

Numerous features allow an immersive, interactive and collaborative experience including:

- Robust multimedia sound system;
- High-definition video conference system;
- Large integrated monitor screens;
- Dedicated network-accessible computers and ability to use additional lap-top computers that can route to large monitors; and
- Remote desktop connection capabilities.

This combination of tools and expertise in a highly collaborative facility can promote faster, more effective decision-making.

CONCLUSIONS

The combination of the ITD and PACE allows large groups with diverse responsibilities to access authoritative, integrated and current data. Design information can be displayed geospatially, graphically or in report formats. Users are able to access sampling and analysis data that quantifies hazards in context (e.g., the nature and extent of groundwater plumes, waste sites, future barriers, current and planned infrastructure), cleanup project performance, status and life-cycle planning.