

DEEMS 1995 TO 1999

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ABSTRACT

The Department of Energy Environmental Management Electronic Data Deliverable Master Specification (DEEMS) was developed by the U.S. Department of Energy's (DOE's) Office of Environmental Management (EM) to provide a common specification for transmission of environmental analytical data in an electronic format between laboratories, DOE sites, and other Federal agencies. Version 1.0 of DEEMS was issued in June 1995. Potential users of the specification have begun to develop implementation guides for common technology-based electronic data deliverable (EDD) formats. In addition, an effort is currently underway to determine the feasibility of incorporating DEEMS-based EDD requirements in new contracts with commercial analytical laboratories. This paper provides a summary of the DEEMS development process, its current implementation status, and the future role DEEMS is expected to play toward standardization of electronic transmission formats.

INTRODUCTION

In June 1995, the U.S. Department of Energy (DOE) released Version 1.0 of the DOE Environmental Management Electronic Data Deliverable Master Specification (DEEMS). DEEMS was developed in response to the need to standardize data transmission formats among both the commercial and Federal laboratory community. Since its release, DEEMS has generated considerable controversy throughout the Federal and commercial laboratory community due to its consideration as a potential specification for developing site-specific electronic data deliverable (EDD) formats. Prior to 1995, DOE's Office of Environmental Management (EM) made several attempts to standardize laboratory transmission protocols using existing EDD formats. Adopting a common EDD format was believed to be infeasible because of the reluctance of users to change to a format different than currently used in their organizations. Therefore DOE-EM chose an alternative approach which was to build a master specification to design EDD formats. The result of this effort was the development of DEEMS.

A multi-agency DEEMS advisory committee representing DOE, the U.S. Environmental Protection Agency (EPA), and the U.S. Army Corps of Engineers (ACE) was created in the spring of 1998. This group was formed to champion the continued development and implementation of DEEMS as a potential candidate to standardize analytical laboratory data transmission. Those on the advisory group are committed to the standardization of analytical data transmission formats. The advisory group does accept that success of data standardization may come in a form different from DEEMS.

This paper provides a summary of the DEEMS development process, its current implementation status, and the future role DEEMS is expected to play toward standardization of electronic transmission formats.

DEEMS: THE PROBLEM

An EDD format is a complete set of rules for representing all of the analytical data sent from a laboratory. In most cases the laboratory is contractually bound by its clients to report requested information in a client-defined format. These formats differ in both structure and content, which places unnecessary development and maintenance requirements on laboratories. It is not uncommon for a commercial laboratory to support over 100 different EDD formats among its clients. Data inconsistency among EDD formats also inhibits the portability of information among users within the environmental community.

DEEMS: DEVELOPMENT

EDD format development represents a large number of choices. DEEMS provides a context for making these choices and a template for the structures that comprise a well-designed EDD format. DEEMS was developed for DOE but is suitable for use by any agency, business, or organization requiring electronic delivery of laboratory data. DEEMS provides users with a common syntax for describing diverse laboratory activities and reporting analytical data; allows users to link analytical data to underlying laboratory activities and processes to provide full traceability for data; and provides a means for reporting complex analytical relationships.

Whereas most EDD formats are developed in response to a specific analytical need, DEEMS uses a sophisticated model of analytical activities, the linkages between them, and the data these activities produce as a starting point for requesting data deliverables. DEEMS can be used as the basis for designing an EDD format regardless of the types of analyses associated with the data. The DEEMS analytical model is not reliant on a per-sample record. Instead, it provides information grouped on the basis of a "sample and method". This is because the notion of a "sample" is ambiguous in cases involving multiple methods, handlings, and reanalyses. DEEMS also recognizes that each sample analyzed by one method typically has several "results", one for each analyte determined by the method. These results depend on measurements made during one or more analyses. As needed, details about each analyte can be reported.

The key to the success of DEEMS as a cornerstone for standardization of EDD formats lies in the data element dictionary. Version 1.0 of the dictionary provides over 400 standardized data elements and associated definitions and formats. The use of a common syntax for referring to data required from laboratories is the single most important step towards standardizing reporting. Users of DEEMS have been encouraged to develop additional names and definitions for incorporation into updated versions of the Specification. In November of 1998, Version 2.0 of the DEEMS data elements dictionary was submitted to EPA to be incorporated into its Environmental Data Registry (EDR). This is a first step toward "standardization" of a common data elements set for transmission of analytical data. It is anticipated by the DEEMS advisory

committee that the EDR will provide broad access and acceptance to the terms and definitions proposed by Version 2.0 of the DEEMS data elements dictionary. Version 2.0 of the master specification is also nearing completion. Changes to the master specification include: (1) revision to chapters 1-3 to update examples in line with SW-846; (2) revisions to the data dictionary; and (3) update of example implementation guides to include SW-846. Draft versions of both the data dictionary and master specification can be found under the National Analytical Management Program (NAMP) web page at <http://www.em.doe.gov/namp>.

DEEMS IMPLEMENTATION

On June 14, 1995, Randal S. Scott, Deputy Assistant Secretary for Compliance and Program Coordination, issued a policy directing DOE-EM use DEEMS as guidance for developing EDD formats. This policy statement stated:

"We recognize that an effective system for organizing this analytical data relies, in large part, on management of data in electronic form. Moving data electronically from the analytical laboratory to the site requesting the data is a critical piece of this system. Accordingly, we are establishing the policy in EM to transmit laboratory analytical data in electronic form, where practical, to ensure full data integrity and traceability and to streamline data handling. Specifically, it is EM policy that sites use the attached DOE EM Electronic Data Deliverable Master Specification (DEEMS) as guidance for developing Electronic Data Deliverable (EDD) formats."

Feedback from commercial and federal laboratories indicated that DEEMS appeared to be more powerful than EDD formats generally in use. All indications were DEEMS would be readily adopted within DOE. DOE-EM concluded that an active campaign to "market" the implementation of DEEMS was not necessary. Today, however, DEEMS has not been readily adopted by the analytical community. DEEMS faces much controversy and resistance to implementation specifically because of the size of its deliverable, its structure being hierarchical verses relational, and the breadth of information DEEMS is capable of transmitting is not readily available electronically through current Laboratory Information Management Systems (LIMS).

Figure 1 indicates the relationship of a site-specific format to DEEMS. A site-specific EDD format is created by an analytical laboratory after being provided both the DEEMS master specification and laboratory statement of work (SOW) as guidance. This package is sent to the analytical laboratory as a DEEMS "implementation guide". DEEMS implementation guides provide users the flexibility to specify which of the DEEMS records and data elements are specifically required. Standardization among the EDD formats is achieved by retaining a common DEEMS structural backbone among the deliverables and data elements dictionary. The objective of the DEEMS developers was to build a library of DEEMS implementation guides which would serve as a resource to the user community. This library would provide new users the opportunity to expedite the development of their EDD by using laboratory-tested formats.

In 1999, the DEEMS advisory committee plans to sponsor several meetings supporting the implementation of a Federal analytical data transmission protocol. In February 1999, the American Council of Independent Laboratories (ACIL), ACE, and DOE plan to sponsor a

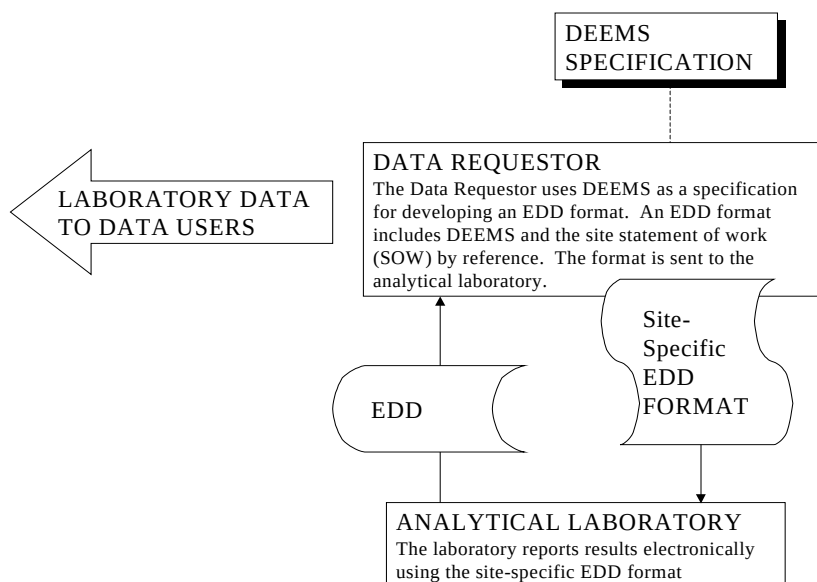


Figure 1: Relationship of a Site-Specific Format to DEEMS

workshop in Washington, DC to bring in key individuals from the commercial and Federal laboratory community to address current and future analytical data transmission needs. This meeting will not focus on DEEMS as the only alternative to solving Federal data transmission issues. DEEMS is one solution which was developed in response to and with the support of both the Federal and commercial analytical communities. This workshop will address issues that have been raised concerning federal data transmission needs. Working groups will be formed to support issues raised during this meeting.

Instrument manufacturers play an important role in the future of data transmission protocols. A significant concern in the implementation of DEEMS has been its ability to transmit information that may not be readily available via current LIMS. In March of 1999, the DEEMS advisory committee will host a session at Pittcon '99. The focus of this meeting will be to introduce the next generation of the DEEMS master specification and its data elements dictionary in an effort to target requirements for the next generation of LIMS. Hopefully, by specifying target requirements, industry will respond to the need.

Standardization of any transmission protocol will be difficult without a common set of analytical terms and definitions. The DEEMS data elements dictionary regardless of the DEEMS master specification's acceptance is a critical step in the standardization process. The advisory board, working thorough EPA, has registered Version 2.0 of the data elements dictionary within the EPA's EDR. The EDR is accessible through the world wide web at <http://www.epa.gov/edr/>.

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CONCLUSION

The DEEMS advisory committee will continue to play a critical role in the development of a Federal electronic transmission standard. The DEEMS master specification will continue to be a candidate as long as it remains a viable solution to the Federal data transmission needs. The DEEMS data elements dictionary will play a critical role in analytical data standardization, regardless of the acceptance of the DEEMS master specification.