ENVIRONMENTAL LABORATORY
ELECTRONIC DATA MANAGEMENT

APHL ASSOCIATION OF PUBLIC HEALTH LABORATORIES

ENVIRONMENTAL LABORATORY
ELECTRONIC DATA MANAGEMENT

APHL ASSOCIATION OF PUBLIC HEALTH LABORATORIES

AUTHORS

ENVIRONMENTAL HEALTH COMMITTEE
ENVIRONMENTAL LABORATORY SUBCOMMITTEE
INFORMATICS COMMITTEE

December 2010

TABLE OF CONTENTS

EXECUTIVE SUMMARY

Environmental health laboratories support many local, state and federal programs, such as:

- emergency preparedness and response
- biomonitoring
- food safety
- radiation exposure assessment
- drinking water quality
- waste water treatment
- solid waste testing
- environmental exposure assessment.

In this age of increased electronic communication, it is common for data users to request laboratory data in a standardized electronic format, also known as an Electronic Data Deliverable (EDD). Reporting EDDs saves laboratorians time by sending data directly from a Laboratory Information Management System (LIMS), minimizing and possibly eliminating manual data entry. Additionally, EDDs reduce transcription errors and speed up data delivery in a secure manner. For the data user, EDDs save time by standardizing the data collected from multiple laboratories using multiple analyses. It also allows the use of automated data review software to approve and share data. Overall, EDDs minimize the need to harmonize and cleanse data.

Environmental health laboratories have not developed standardized usage of EDDs for multiple reasons. Perhaps the simplest reason is lack of resources. Additionally, some of the formats are incredibly complex; for example, one EDD has over 400 separate analytical data elements. Many LIMS are unable to collect even a minimum set of data elements. Even those LIMS with the ability to collect and organize such data still cannot directly output a fully populated EDD.

The Association of Public Health Laboratories' (APHL) Environmental Health Committee, Environmental Laboratory Subcommittee, and Informatics Committee are working together to improve environmental LIMS implementation, data exchange and interoperability. Given the extreme diversity in LIMS and the various requirements of response agencies, this effort holds the following goals:

- **Propose a standard EDD based on a minimum list of data elements.**

  The EDD will be appropriate for reporting data to multiple local, state and federal agencies. The data element set must be comprehensive enough to support specific programmatic and data user needs.
- **Develop consensus requirements for LIMS in order to automate production of standardized reports.**
- **Increase the percentage of laboratories that have LIMS not only able to support business needs but also are interoperable and integrated with the broader public health network.**

  The feasibility of a trial will be evaluated to test interoperability of environmental health laboratories with the broader public health network. Such a trial would focus on sharing multi-agency EDDs, lab-to-agency and lab-to-lab, with some similarities to the Public Health Laboratory Interoperability Project (PHLIP[1]).

1 http://www.aphl.org/AboutAphl/publications/Documents/PHLIP_05_07.pdf.

I. INTRODUCTION AND BACKGROUND

The Association of Public Health Laboratories (APHL) works in support of national and global health objectives, and to shape policies and programs that assure continuous improvement in the quality of laboratory practice. As part of this mission, APHL seeks to improve laboratory information management systems[2] (LIMS) implementation, data exchange, and interoperability. This document focuses on environmental health and environmental laboratory data issues, specific to the public sector.

Previous and ongoing APHL informatics efforts focus on infectious diseases such as influenza. Both the Environmental Health Committee and the Informatics Committee identified the need to address environmental data exchange due to its differing requirements and also due to the large number of agencies relying on this data[3].

The Centers for Disease Control and Prevention (CDC), the US Environmental Protection Agency (EPA), the Department of Homeland Security (DHS), and the US Food & Drug Administration (FDA) actively seek environmental laboratory data from state and local laboratories. This data plays an important role in:

- emergency preparedness and response,
- biomonitoring,
- food safety,
- radiation exposure assessment,
- drinking water quality,
- waste water treatment,
- solid waste testing,
- environmental exposure assessment.

Unfortunately, all of these agencies use different reporting requirements and systems, placing a large burden on these laboratories and reducing the overall efficiency of the system. Even within agencies, there can also be multiple technical implementations of a data standard[4]. Ultimately, the result may be slower reactions to public health threats, possibly resulting in increased morbidity and mortality.

2 A LIMS is a software program that manages information related to laboratory samples, such as: user, sample conditions, instrument, test method, standards, data report, customer, etc. A LIMS may also incorporate other business processes such as billing, quality control, sample collection, disposal and inventory control.

3 An Interoperable and Integrated Federal Data Exchange Network for Environmental and Environmental Health Data (http://www.aphl.org/policy/Documents/2010/Policy_2010March_DataExchangePositionStatement.pdf).

4 As an example, EPA uses: SCRIBE, eDWR, SDWIS, SEDD, and ERLN (including WLA).

This project aims to develop a plan for electronic flow of environmental and environmental health data directly from laboratories to multiple state and federal agencies.

Components of this goal include:

- Support the overall response to public health threats by facilitating the reporting of high quality and timely laboratory results,
- Support the development of affordable and versatile LIMS,
- Develop tools to extract data from LIMS and export it easily to a laboratory network,
- Improve connectivity of environmental laboratories, including public and private laboratories at the federal, state, and local levels.

Although this effort cannot address all of the obstacles to achieving these goals, it is important to acknowledge them: they include the need for staff, capital allotment, training, and supply budgets. During these difficult times, many environmental laboratories are implementing strict measures to reduce costs. Those federal programs requesting environmental laboratory data do not have funds to support state and local infrastructure and resource needs. Potential solutions include increased public/private partnerships, open-source LIMS, and sharing innovations between LIMS vendors and multiple laboratories.

THE SAGA OF A HAMBURGER

A significant obstacle to the development of consistent data exchange deliverables are the sheer number of networks and reporting requirements. Following public consumption of a tainted hamburger, a laboratory must:

- Send the data to FDA if it's the lettuce, ketchup, mayo or bun.
- Send the data to USDA if it's the meat.
- Send the data to CDC and the laboratory's state if someone became ill.
- If it is a biological contaminant, send the data to one CDC network.
- If it is a chemical contaminant, send the data to a different CDC network.
- Send the data to the EPA if the food was contaminated due to environmental causes.
- Different EPA networks exist for water, waste, air and response mitigation.

Agency needs differ, both in content and in formatting of the data. The laboratory results must reflect these different program needs. Similar analytical data must be reformatted for each program (often manually) and then sent through multiple networks requiring logging into different networks on different server connections.

II. THE NEED FOR MODERN LIMS

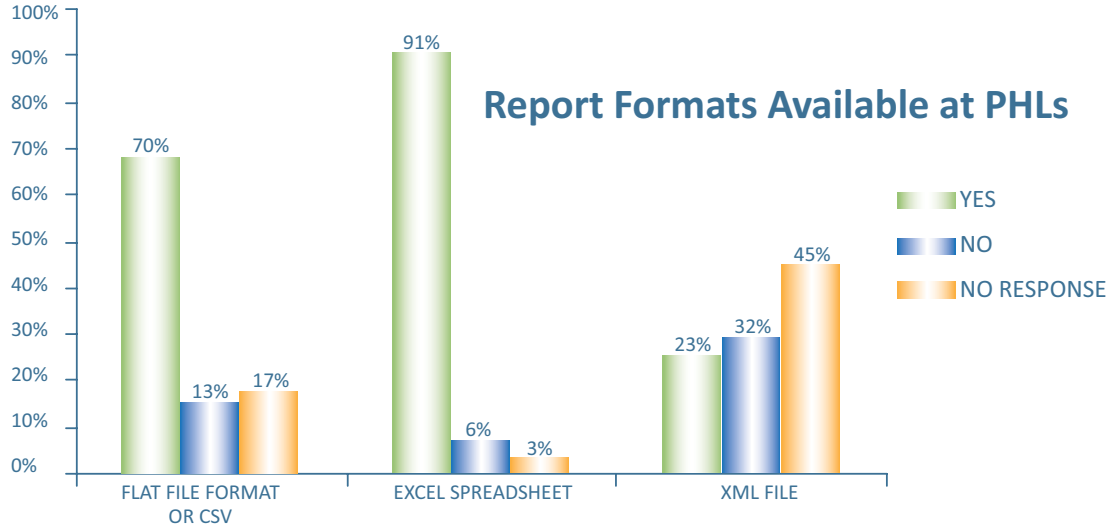
A laboratory information management system (LIMS) is a key component to a modern laboratory, as it helps create electronic messages to be sent from the laboratory to a data exchange network. APHL's Informatics Committee has listed eight primary business needs to justify LIMS implementation[5]. These include:

- Ability to meet multiple customer data needs
- Ability to meet rapid response times associated with emergency response
- Ability to achieve better management and efficiency in storing and retrieving large amounts of analytical data
- Ability to standardize laboratory data collection and reporting of measurement quality objectives
- Ability to better manage laboratory fiscal and business needs
- Ability to manage the increased complexity associated with laboratory deliverables
- Ability to integrate complex analytical instrumentation and automation into data collection and reporting
- Ability to provide sample tracking and legal audit trails for data collected and reported

Not much appears to have changed since a 2003 Electronic Storage and Sharing of Laboratory Information Challenge Grant Project study suggested deficiencies in environmental laboratories' abilities to use LIMS to provide data electronically. The study surveyed 156 public and private laboratories that submit laboratory information to New Hampshire, Maine, Rhode Island, Vermont and New Jersey. This survey identified that public environmental laboratories significantly trailed the private sector in the ability to provide electronic data that contains measurements of both targets and quality control data.

APHL's 2006 survey of state public health laboratories regarding LIMS (see Appendix A) also indicated that many public environmental laboratories do not have a LIMS capable of providing or exchanging rich electronic data necessary for emergency response (see chart below).

Does your laboratory have resources available to produce a report in the following formats?



5 Additional information can be found in the September 2003 publication *Requirements for Public Health Laboratory Information Management Systems: A Collaboration of State Public Health Laboratories, the Association of Public Health Laboratories and the Public Health Informatics Institute.*

In 2010, a verbal survey of the APHL Environmental Health Committee, Environmental Laboratory Subcommittee and Informatics Committee members indicated that few are capable of automatically producing an electronic data deliverable used by EPA for emergency response.

A goal of this project is to provide a standard electronic data deliverable that can meet multiple agency/client needs. Laboratories participate in multiple federal response networks, requiring them to communicate analytical results in a standardized, interoperable and secure format. Such communication is particularly important during times of emergency. Each of the federal agency laboratory response networks (CDC, FDA, USDA, EPA) require different EDDs from laboratories. This report emphasizes the need for a standardized EDD accepted across multiple agencies, which can be shared with LIMS vendors and developers.

MEASUREMENT QUALITY DATA IN ELECTRONIC DATA DELIVERABLES

Modern environmental LIMS can typically collect and store significant amounts of data. This requires a great deal of programming and development since complex relationships must be made between database tables containing metadata and quality control data.

While environmental laboratories do collect and manage both quality control data and measurement quality objectives (MQOs), the storing and reporting of this data is a major stumbling point. Many public environmental laboratories can only export flat files, often lacking quality data. Increasingly, data users are requesting electronic data deliverables (EDDs) that include the raw measurement quality data and which can meet unique MQOs. The inability of a LIMS to automatically include measurement quality data in the electronic message compromises the ability of these laboratories to produce EDDs that satisfy MQOs.

In the private sector, clients require EDDs that include measurement quality data, and out of necessity, these laboratories have built LIMS capable of producing robust analytical data files. Examples of EDDs that are currently being used and contain measurement quality data are:

- ERLN (Emergency Response Laboratory Network) used by EPA for emergency response,
- SEDD (Staged Electronic Data Deliverable) used by the EPA (Superfund, and Great Lakes National Program Office) and the US Army Corps of Engineers,
- ERPIMS (Environmental Resources Program Information Management System) utilized by the Air Force Center for Environmental Excellence.

Public laboratories often rely on certification or accreditation as a substitute for providing measurement quality data.

ENVIRONMENTAL LABORATORY DATA COMPLEXITY

An example of the complexity of the data generated by environmental laboratories is demonstrated in the analytical sequence, which contains the combined results of the target analyte data and the quality control data associated with an analytical run. In a batch of ten unknown samples being tested for a single analyte, it is not uncommon for the quality control samples to include as many as ten additional quality control substances. Each result for the quality control substances must possess a unique reference number, time of run, and complete information as if it were a target sample.

The analytical results associated with the analysis of a batch of targets and quality control samples is known as the analytical sequence. Different methods and different programs or clients may require different analytical sequences. Below is an inclusive example of what might be included in one analytical sequence:

- Instrument Blank
- Initial Calibration
- Initial Calibration Validation
- Lab Reagent Blank or Method Blank
- Lab Fortified Blank or Laboratory Control Sample
- Matrix Spike
- Matrix Spike Duplicate
- Target Samples (typically 10)
- Continuing Calibration Verification
- Continuing Calibration Blank
- Target Samples (typically 10)
- Continuing Calibration Verification
- Continuing Calibration Blank

If the EDD can be envisioned in a simplistic spreadsheet, there would be a row for each target analyte and a row for each quality control parameter. The number of rows adds up very quickly.[6] If non-target data is included, the amount of raw data increases dramatically.

Without a LIMS that can manage and link this data, laboratories must manually input the quality control data into the results message. This adds a significant burden not only on the reporting laboratory but also on the data user, and increases the chances of errors in the data.

STANDARD DATA ELEMENTS

The acceptance of a single, nationally-standardized laboratory reporting format will greatly serve the environmental laboratory community and also benefit both LIMS vendors and developers. Unfortunately, this is not an easy accomplishment. Not only is the reporting of quality control data a barrier for many LIMS, there are additional data elements that complicate standardization. Often these are data elements associated with particular programmatic needs that may not be laboratory driven, such as demographic or geographic data.

6 As an example, suppose a client wishes to have ten samples analyzed for lead. The minimum results package would have ten rows, one for every result. If the laboratory ran lead in batches of ten, with ten quality assurance and control (QA/QC) samples in every batch, a complete data package must link all ten QA/QC results to each lead sample. If the lead samples were not all run in the same batch (a different batch for each sample being the most extreme possibility), it is possible that up to 110 rows of results would be necessary to provide a complete data set. If two metals were run for every sample, each of these metals would require its own unique set of results for the quality control data associated with each metal.

LIMS are best used to manage and share laboratory data, which does not traditionally include other information such as sample collection location. This information may be critical to program or client needs, but keeping it separate from the laboratory data elements is important to facilitate the standardization of laboratory EDDs. An example of such metadata is the large amount of information associated with the Safe Drinking Water Act (such as well depth, location, regulatory identifiers, etc.). Another example is environmental health tracking data where unique fields are added to the EDD to identify health conditions that may be associated with environmental exposure or contamination. Such program needs may vary between local, state or federal agency. Adding such variable sample data to LIMS requires modifying data entry screens and reporting formats. While there is a need for a mechanism to include this non-laboratory data in EDD, this data will not be addressed here.

STANDARDS-BASED MINIMUM DATA ELEMENT SETS

An example of one agency's effort to create data standards using a business-process approach, the Environmental Data Standards Council was formed as a partnership between EPA, the states and tribal partners. The Council focused on the development of mutually-acceptable data standards for environmental information collection and exchange. The result was the ESAR (Environmental Sampling and Analytical Results) data standard (www.envdatastandards.net).

For laboratories that provide data to EPA, the desired technical implementation of the data standard has been defined in multiple data exchange templates (DETs) and data element sets. Requirements for LIMS includes a common minimum data set (a subset of all elements); the specific data elements of which still need to be defined. **For a set of data elements to possess usefulness to laboratories and review agencies alike, a multi-media approach is highly recommended.**

Here are some important features to consider:

- Emphasize laboratory-generated data.
- Focus less on the actual electronic message (Excel, XML, HL7) at this stage and more on the set of data elements collected and available for reporting[7]. A future goal is to move away from spreadsheets and towards machine-to-machine language.
- Develop a robust EDD, which can later be easily minimized by those laboratories needing a less robust version.
- Invest efforts upfront to create a comprehensive EDD report in LIMS. This saves effort on the back end by allowing vendors and programmers to work in conformity, setting the stage for interoperability.
- Coordinate with LIMS vendors and developers to develop a strategy for rapid implementation of a standardized EDD.

7 There are many relatively inexpensive third-party tools and data brokers that can convert one message type to another, so long as the data elements exist in both messages.

III. RECOMMENDED MINIMUM DATA ELEMENT SET

Data users and environmental laboratories both recognize the need for a more comprehensive set of data elements. One of APHL's goals is to work with LIMS developers on a single, comprehensive (yet still minimum) data set that can satisfy multiple programs' requirements. A good starting point is the multiple electronic data deliverables already in production (see Table 1 for examples).

Developing a data standard that is able to address the analytical needs of multiple local, state and federal agencies would make the job of LIMS development and implementation much easier for often resource-poor public environmental laboratories. To get there, laboratories first need an all-encompassing data exchange template (DET), and the various agencies need to agree on data standards content, nomenclature and formats.

Given the extreme diversity in laboratory information management systems and the various formats and reporting requirements of response agencies, the creation of a standard to address analytical reporting of environmental health and environmental results is critical. A standard reporting format must possess the following capabilities:

- Be flexible in order to meet multiple program needs and new requirements,
- Be usable by many data recipients,
- Contain relevant field information and provide data standards for the content of laboratory data and sample information/demographics,
- Unambiguously link sample results to laboratory quality control information (as needed),
- Be amenable to review by automated systems (if needed).

In order to begin to address the needs identified in this document, **LIMS vendors need an EDD to be defined in a data exchange template (DET), along with a document type definition (DTD) that includes the structure of the EDD and its data elements.** A goal is to move away from spreadsheets and pdf files and move towards machine-to-machine related xml language[8] and data exchange.

8 The use of XML (eXtensible Markup Language) files provides a mechanism to report data that require a relationship in order to accurately represent the data. Different XML files and even flat spreadsheet files can be converted from one to the other easily so long as the data elements exist in the input and the output files.

TABLE 1: LIST OF MAJOR REPORTING SYSTEMS AND DATA SETS FOR ENVIRONMENTAL LABORATORIES

EPA Reporting Systems

- Safe Drinking Water Information System (SDWIS) - Contains information about public water systems and their violations of EPA's drinking water regulations, limited laboratory sample data, but no quality control data.
- Scribe - Used within EPA for on-site coordinators to accept laboratory results but contains no quality control data.
- EXES -The web-based Electronic Data Exchange and Evaluation System is used by contract laboratory program customers and laboratories to perform data assessment and contract compliance screening.
- WebEDR - EPA's Emergency Response Laboratory Network provides detailed reporting requirements with enhanced flexibility and simplified web tools[9].

EPA EDDs

- eDWR (electronic Drinking Water Results) - Allows states to electronically send drinking water data directly from laboratories and water systems to the state drinking water programs, quality control data is not mandated but can be included.
- Water Laboratory Alliance (WLA) EDD - Designed by EPA as a simple first step to electronic data submission[10] but contains no quality control data.
- Staged Electronic Data Deliverables - Robust EPA data submission standard used by EPA (Superfund, Great Lakes National Program Office) and US Army Corps of Engineers. Also understand that WebEDR will be able to process SEDD files.
- Emergency Response Laboratory Network (ERLN) - Data submission that adds enhanced and normalized data structure to other EPA EDDs, is built to support consensus standards developed by states and EPA, and is not process or procedure specific, allowing expansion for new programs.

Other Federal Programs

- CDC utilizes the Laboratory Response Network C (LRN C) with Results Messenger, which is complete with a data standard and messaging system for environmental health data used for tracking chemical terrorism.
- FDA, USDA/FSIS, Department of Defense-VETCOM utilize the Food Emergency Response Network (FERN) complete with a data standard and messaging system (eLEXNET) for sharing food-related laboratory measurements.

9 Laboratories participating in the Environmental Response Laboratory Network, which includes the WLA, receive a request from EPA in accordance with the *Laboratory Requirements Document* and the technical specification included in each project's analytical service request.
10 Data is populated in a spreadsheet composed of 29 data elements. Each element is a column, which is to be populated. Some of the columns, such as LabName, will be very repetitive. Each row shall contain the results for one analyte or parameter. QC data, such as surrogate and spiked sample results are reported as analytes.

RECOMMENDED DATA SUBMISSION REQUIREMENTS

The Draft Version 1.4 of the EPA document "Requirements for Environmental Response Laboratory Network (ERLN) Data Submissions"[11] is an example of a DET that meets modern goals for environmental electronic data delivery. This DET defines specific data elements applicable to multiple submission types, offering several levels of data submittal. An entry transition level, the ERLN Type 1t is very similar to the WLA EDD that is used by public water testing laboratories; both allow a spreadsheet data export and include measurement quality objective data elements. The ERLN 1t level is a transition step towards electronic data exchange; the ERLN Type 2 level data submission is a longer term goal for electronic data exchange because it supports a more machine-to-machine approach to data exchange using XML. The ERLN Type 2 submission includes additional quality control data and utilizes an XML reporting standard, which allows conversion between multiple formats.[12]

Type 2 data submission includes the following:

- Field-generated samples
- Laboratory-generated (positive and negative control) samples
- Target and non-target substances
- Some batching information
- Instrument performance
- Optional calibration information

Type 2 submission requires the following data elements: result information for target and non-target substances in field-generated and lab-generated samples (calibration samples are optional)

- Project Details
- Date Format
- Laboratory Qualifiers Definition
- Organization Details
- Method Details
- Sample Details
- Sample Chain of Custody Identifier
- Sample Matrix
- Analysis Details
- Analysis End Date
- Analysis Type
- Laboratory Analysis Identifier
- Substance Identification Details
- Reporting Limit
- Reporting Limit Units
- Result Units
- Substance Type
- Data Package Identifier
- Laboratory Narrative
- Project Identifier
- Organization Identifier
- Method Identifier
- Sample Identifier
- Sample Collection End Date
- Sample Type
- Analysis Batch Identifier
- Analysis Start Date
- Instrument Identifier
- Method Identifier
- Exclusion Indicator
- Reporting Limit Type
- Result
- Substance Name
- Run Batch Identifier

The robust ability of the ERLN Type 2 standard to exchange laboratory environmental data makes it a potential candidate to be used as a data standard for other federal and state programs as well.

11 http://www.aphl.org/aphlprograms/eh/drinkwater/Documents/DRAFT_EH_2010Jan_EPA_ERLNDataSubmissionsReq.pdf
12 SEDD Stage 2, although older, may also be considered as a candidate for data submission because it is robust and includes associated QC data; WebEDR can accept SEDD Stage 2 files.

IV. IMPROVING LIMS IMPLEMENTATION, DATA EXCHANGE AND INTEROPERABILITY

It is important for laboratorians to recognize that laboratory informatics goes far beyond LIMS. Laboratory informatics is like a three-legged stool. One leg is the hardware, software and data; this is the leg most often associated with the word "LIMS." The second leg is the policies, procedures and management support. And the third leg is a trained, competent staff and users. Without any one of the legs, the stool will fall apart.

Policies, brokering and nomenclature details are critical technical issues for electronic data exchange and may be even more difficult than those elements already addressed. Policies are necessary to address security issues. Recording content and messaging protocols are necessary to provide significant security constraints on EDDs. Data standards that include nomenclature, content, analyte valid values, etc. need to be understood before mapping between multiple formats is possible. It is also very important that laboratories produce the EDDs as part of their routine operations and not just during an emergency.

Any LIMS implementation must address valid values for each data element. These constraints on the value sets define the allowable values for an EDD. For older laboratories with a legacy of method names and allowable values, these valid values may require complex translators to migrate data. Newer implementations between agencies may resolve brokerage by allowing a direct LIMS-to-LIMS data exchange where the valid values are part of the interface. More typically, data is exchanged from separate systems and requires an intermediate stage using translators to broker data exchange. These translators can be on the data generator or the data consuming end: internal facing or external facing.

Brokering implementation guides for EDDs are typically provided by federal agencies. For example, CDC has an implementation guide available to LIMS vendors that desire to support the exchange of chemical terrorism results through the LRN-C. EPA utilizes requirement documents and Data Exchange Templates for the design of data transfer.

Lastly, there is a desire for data review software that can serve as a data checker to ensure that data meets formatting and nomenclature requirements. Data review software is also useful for data users that seek to rapidly review reported results against client requests and measure quality objectives.

V. NEXT STEPS

Given funding, APHL hopes to partner with multiple federal response agencies and LIMS vendors to build a more comprehensive and standardized approach for collecting data from LIMS. In the interim, to begin working toward improving environmental LIMS implementation, data exchange and interoperability, APHL will:

1. **Circulate the position statement "An Interoperable and Integrated Federal Data Exchange Network for Environmental and Environmental Health Data."**

2. **Provide training and education to environmental laboratories on informatics and LIMS implementation.**

3. **Partner with multiple agencies (i.e., EPA, CDC and FDA) to define a single, comprehensive Data Exchange Template (DET) and Document Type Definition (DTD) for Electronic Data Deliverables.**

4. **Discuss with vendors a coordinated strategy to implement LIMS that are able to automatically support the capture and reporting of agency-required electronic data deliverables.**

5. **Explore new opportunities for LIMS implementations and enhancements.**

6. **Provide a plan for a trial EPHLIP environmental data exchange between multiple environmental laboratories and laboratory data users.**

7. **Develop an up-to-date survey of LIMS capabilities within environmental laboratories.**

APPENDIX A - 2006 APHL SURVEY OF LIMS FOR STATE LABORATORIES

QUESTIONS RELATING TO PUBLIC ENVIRONMENTAL LIMS

5. Does your environmental laboratory have a Laboratory Information Management System (LIMS)?

_Yes – 40 labs
_No – 8 labs

6. Please indicate the type of LIMS your laboratory has.

_LIMS developed in-house – 13 labs
_Commercially developed – 27 labs

7. Please specify your lab's LIMS vendor name.

Accelerated Technology Laboratories
Aspen System-vendor changes
Blaze, Inc.
ChemWare
Custom built
Epic Systems, Madison, Wisconsin
GLIMS
HP-Agilent
LabWare
LITS Plus, CDC
Microsoft Access and Excel
NW Analytical
Perkin Elmer
Perkin Elmer, Labworks
Promium Element
RLIMS from the USEPA
Seedpak by Lab Vantage
STARLIMS
Telecation

9. Has your laboratory facility adopted the use of nationally recognized electronic data standards?

_Yes, please specify – 15 labs
_No – 33 labs

Specifications:

- HL7
- HL7, LOINC
- According to NELAC standards
- edd with EPA, eDWR
- Staged Electronic Data Deliverables
- Web-based text files and html
- SDWIS
- ESAR
- PHIN, in-progress
- HL7 messaging using 2.32 in StarLIMS, standard terminologies such as LOINC & SNOMED, standard security mechanisms like PKI, standard transport mechanisms like PHIN MS and SFTP

APPENDIX B - GLOSSARY

Analytical Sequence

Raw data associated with an analytical batch that contains target substance results and quality control data. The results are reported in the real-time order that the samples were run.

Customer

Individual or organization directly responsible for requesting analytical services and data from the analytical laboratory. Examples of customers include federal, state, or local agencies; private engineering or environmental firms; etc.

Data Element

A basic unit of information built on standard structures having a unique meaning and distinct units or values.

Data Exchange Template (DET)

Organizes data elements into groups to associate individual pieces of information to an object that adequately describes the group of information.

Document Type Definition (DTD)

Defines the allowable fields and structure in which data can be reported, by providing the set of rules for specific XML EDD formats. These rules are established by the customer and the EDD structure. DTDs specify the allowed elements in each document file and describe what kinds of elements and data can be included in allowed elements. The DTD defines attributes and sets of valid values for methods, analytes, units, and other data elements. Users can define common sets of valid values for these data elements. DTD is the oldest schema format for XML. While DTD support is ubiquitous due to its inclusion in the XML 1.0 standard, it is seen as limited for the following reasons:

- It has no support for newer features of XML, most importantly namespaces and attributes.
- It lacks expressiveness. Certain formal aspects of an XML document cannot be captured in a DTD.
- It uses a custom non-XML syntax, inherited from SGML, to describe the schema.

DTD is still used in many applications because it is considered the easiest to read and write.

APPENDIX B - GLOSSARY

Electronic Data Deliverable (EDD)

An electronic file created by a data generator (usually the analytical laboratory) for transmitting and reporting analytical data.

Environmental Response Laboratory Network (ERLN)

A network of laboratories capable of providing analytical services in response to environmental incidents; used by EPA.

Electronic Drinking Water Results (eDWR)

Data exchange allowing states to implement an electronic flow of drinking water data directly from laboratories and water systems to the state drinking water programs. It also allows access to laboratory data in XML format for EPA programs and the general public.

Food Emergency Response Network (FERN)

A network of laboratories capable of providing analytical services in response to foodborne emergencies; used by FDA and US Department of Agriculture.

Laboratory Response Network

A network of laboratories capable of providing analytical services in response to terrorism or other public health emergencies; used by CDC.

Laboratory Information Management System (LIMS)

A software program that manages information related to laboratory samples.

Method

Procedures for measuring the presence and concentration of physical and chemical pollutants.

Measurement Quality Objective (MQO)

Performance and acceptance criteria that clarify WebEDR objectives, and specify tolerable types of potential decision errors that will be used as the basis for establishing the quality and quantity of data needed to support decisions.

APPENDIX B - GLOSSARY

Matrix

The environmental media from which samples are taken; can include air, soil, water, building materials/debris, tissue, etc.

Safe Drinking Water Information System (SDWIS)

Contains information about public water systems and their violations of EPA's drinking water regulations, as reported to EPA by the states.

Scribe

Software tool developed by EPA to assist in the process of managing environmental data. Scribe captures sampling, observational, and monitoring field data. Scribe can import electronic data deliverables (EDD) from analytical laboratories, location data from a global positioning system (GPS), or data generated using real-time analytical methods. An associated program called Scriblets is used to capture and import sampling and monitoring data collected on handheld portable data assistants (PDA).

Staged Electronic Data Deliverable (SEDD)

Format used to convert local database data into an eXtensible Markup Language (XML)-compliant file for delivery to EPA. The SEDD specification defines a common structure and dictionary of data elements.

XML (eXtensible Mark-up Language)

Standard devised by the World Wide Web Consortium (W3C) for a common approach to conveying information on the Web. XML is a language for describing data. It was developed as an extension to HTML (Hypertext Markup Language) for complex document creation and to provide a better vehicle for the transfer of information between databases. XML is not owned by any one vendor and thus remains an open standard. XML is text-based; therefore, it is processable using any platform. Data is transferred in SEDD as an XML document.

Water Laboratory Alliance (WLA)

The WLA provides the drinking water sector with an integrated nationwide network of laboratories with the analytical capability and capacity to respond to intentional and unintentional drinking water contamination events involving chemical, biological, and radiochemical contaminants. This network operates in conjunction with the EPA's Environmental Response Laboratory Network (ERLN).

APHL ASSOCIATION OF PUBLIC HEALTH LABORATORIES

This publication was supported by Cooperative Agreement Number #U60/CCU303019 from the Centers for Disease Control and Prevention (CDC). Its contents are solely the responsibility of the authors and do not necessarily represent the official views of CDC.

This publication was developed under Assistance Agreement Number 83252101 awarded by the U.S. Environmental Protection Agency. It has not been formally reviewed by EPA. The views expressed in this document are solely those of the authors, and EPA does not endorse any products or commercial services mentioned in this publication.

Association of Public Health Laboratories
8515 Georgia Avenue, Suite 700
Silver Spring, MD 20910