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Why is a National Environmental Methods Index needed?

The National Water Quality Monitoring Council (NWQMC) and the Methods and Data Comparability Board (MDCB) were chartered under the Federal Advisory Committee Act (FACA) in 1997. This was in response to a statement issued by the United States Office of Management and Budget requiring the review and evaluation of national water quality monitoring activities and the development of recommendations for improvements. The NWQMC and MDCB are to review and evaluate national water monitoring activities, recommend improvements, and develop a voluntary, integrated, nationwide water quality monitoring strategy. The MDCB is a partnership of water quality experts from federal agencies, states, tribes, municipalities, industry, and private organizations.

The selection of analytic methods is a critical part of environmental monitoring program

The MDCB will provide the framework and the forum for comparing, evaluating, and promoting monitoring approaches that can be implemented in all appropriate water quality monitoring programs.

planning. During planning, monitoring objectives lead to criteria for the monitoring program. Field procedures and analytic methods are selected based upon these criteria, often in conjunction with sampling designs. Once these procedures are selected and monitoring has begun, the process is reevaluated, often continually, to ensure that the desired result is attained. It is critical that each part of this process supports the others, and the limitations of analytic techniques often determine the analytic powers of the entire program.

A high priority recommendation of the MDCB is the development of a compendium of method summaries to support monitoring program planning. The proposed National Environmental Methods Index (NEMI) will allow rapid communication and comparison of methods, thus ensuring that the consideration and reconsideration of analytic methods is a more active part of the planning and implementation of programs.

Who are the typical users of NEMI?

- Regulators, analysts, engineers, and managers from government regulatory agencies
- Scientists from the regulated community
- Scientists from the laboratory and engineering support communities
- Volunteer monitoring groups
- Academic researchers
- The international monitoring community
- Watershed planning organizations

What are the benefits of the NEMI approach?

- NEMI is proposed as part of a larger effort to improve comparability of water quality data nationwide.
- NEMI will provide a user-friendly, unified methods database searchable over the World Wide Web, thus ensuring that users from a wide range of locations receive up-to-date information with only a standard Internet connection and browser.
- Involvement of the MDCB will ensure that data on method precision, accuracy, ruggedness, and cost receive multi-agency review and consensus and be included in the database.
- Powerful equipment or sophisticated software is NOT needed to access the information.
- Future updates to the database can be done centrally.
- Because the software will be compatible with a multitude of computer platforms, after NEMI is developed it could be physically located almost anywhere for long-term storage and maintenance.

What information will be in NEMI?

- The first phase of NEMI will include the most frequently used water analytical method summaries from various sources including the Environmental Protection Agency, U.S. Geological Survey, Department of Energy, Department of Defense, American Society for Testing and Materials, AOAC (formerly the Association of Official Analytical Chemists), U.S. Army Corps of Engineers, and Standard Methods.
- The methods in the prototype will cover sample preparation for laboratory and field analyses for both organic and inorganic analytes. Later versions of NEMI will include radiochemical, biological and microbiological, and field sampling methods.

- These method summaries would link directly to full methods on the Internet when available.
- Metadata will be included in both tabular and text format where appropriate. Tabular format facilitates comparison of multiple analytes and methods, and text format enhances understanding by putting those data into context with the method abstract.
- There will be at least 26 data fields in NEMI, including precision, accuracy, relative cost, and ruggedness for chemical methods. (Additional data fields will be necessary for biological and other methods that will be added to later versions of NEMI).

How will users be able to search for and compare information in NEMI?

By:

- Chemical/biological parameter
- Multiple chemicals
- Method
- Matrix (although in the first phase only water analyses will be included)
- Key word
- Metadata (precision, accuracy, ruggedness, etc.)

How will NEMI be developed?

A steering committee that will include representatives of different agencies and the private sector will provide recommendations on an ongoing, iterative basis. In the first phase, the database will be populated with a small selected set of water analytical methods, populated with metadata recommended through interagency consensus. Many of the important decisions that need to be made during the development of NEMI will be facilitated through this multi-agency approach, thus facilitating rapid acceptance and use of NEMI. The steering committee and the MDCB will recommend the conceptual database framework for NEMI, as well as provide guidance on normalization of metadata that exists in several different formats in existing methods summaries.

Why not use existing methods summaries to meet the Board's goals?

- The goal for NEMI is water methods comparison; other methods summaries were developed for different reasons (for example, to provide accurate citations for regulatory programs' purposes).
- A state-of-the-art, Internet-accessible search engine and web-based query display system is desired for NEMI; search engines for known methods summaries lack this combination of features. Existing methods summaries are in miscellaneous formats (CDs, paper copy, etc.)
- Normalized data (metadata) for precision, bias, cost, etc. are needed for methods comparison. These data are often lacking or not normalized in existing methods summaries.
- Links from methods summaries to full methods are recommended for NEMI.
- Metadata in both tabular and text data formats are desired for NEMI.

A cooperative approach that utilizes existing expertise at the EPA Office of Water and their consultants including WPI, working in concert with the USGS Oracle development staff, will develop the software necessary to deploy the NEMI database on the Internet. The development team will coordinate the collection of requirements, develop the database design and loading routines, and organize and perform prototype testing. The development team will also create the interface to make the database searchable over the Web and facilitate the transfer of the database (if desired) onto the final system.

There are a number of existing methods summaries—these include the EPA's Environmental Methods Monitoring Index (EMMI), WPI's (formerly known as Waste Policy Institute) Environmental Methods Summary Database (EMSD), and others in miscellaneous formats (CDs, paper copy, etc.). NEMI will rely heavily

on the information in and structure of these existing databases. EMMI is the largest source of methods summary data for NEMI; it contains more than 3,500 chemical and biological methods (various methods, not just water). While smaller, EMSD is available on the Internet and contains method abstracts and information for 36 methods. EMSD is important for NEMI as it contains information for most data fields desired for NEMI, including precision, accuracy, applicable concentration range, ruggedness, and cost. Other methods summaries provide other information that can be utilized for the development of NEMI. On an ongoing basis, the MDCB will recommend enhancements of NEMI that include the addition of methods as well as the population of data fields that are now currently vacant.



Future enhancements of NEMI

- Field sampling methods will be added in the future.
- Development of a user-friendly Data Quality Objectives-based front end is planned to increase NEMI's usefulness in the future.

What software will be used for NEMI?

NEMI will be developed in Oracle¹ from the ground up. Existing legacy systems (EMMI, EMSD, others) will be used for data model reference and to provide source data. By using Oracle technology from the outset, it will be easier to develop a tightly integrated system.

This software provides a large number of sophisticated features and tools for the development of NEMI. These include tools that can search text documents such as NEMI methods and method summaries for the existence of words, synonyms, themes, fuzzy matches, and a host of other characteristics. A full method can

thus be reduced to a summary page that can then be manually cleaned up (i.e., make corrections to grammar), resulting in a significant time savings over manually producing summary pages. In addition, this data cartridge allows the combination of standard SQL queries with text-searching queries at the same time. This capability is not present with most third party text-searching software, and greatly simplifies the creation of search algorithms.

In addition, NEMI would likely benefit from the use of several other Oracle products. Products exist to aid in the creation of the database model and assist in the generation of customized web programs to interface into the database (i.e., the search program). The extraction, transformation, and loading of new methods into the database can be greatly simplified using available software. The web site and interface programs into the database can also be easily created using existing software.

¹ Use of trade names is for identification purposes only and does not constitute endorsement by the U.S. Geological Survey, U.S. Environmental Protection Agency, or any other agency or organization

Participating agencies and organizations

- American Water Works Association
- Assn. of Metropolitan Sewerage Agencies
- Assn. of Public Health Laboratories
- Argonne National Laboratory
- Arizona Dept. of Environmental Quality
- Agricultural Research Service
- American Society of Testing and Materials
- California Department of Toxic Substances
- Center for Disease Control
- Chemical Manufacturer's Assn.
- Colorado State University
- Delaware River Basin Commission
- Department of Energy
- DynCorp Information and Enterprises Technology, Inc.

- East Bay Municipal Utility District
- Eastman
- Environmental Technology Communication Center
- Hach Company
- Hampton Roads Sanitation District
- IDEXX Laboratories, Inc.
- Kansas State University
- Merck and Company, Inc.
- Montgomery Watson
- Natural Resources Conservation Service
- National Environmental Laboratory Accreditation Conference
- New Jersey Geological Survey
- New York Department of Health
- National Institute of Standards and Technology
- NOAA
- Research Triangle Institute
- Standard Methods
- Tetra Tech Inc.
- U.S. Army Corps of Engineers
- U.S. Department of Agriculture
- U.S. Environmental Protection Agency
- U.S. Fish and Wildlife Service
- U.S. Geological Survey
- U.S. Navy
- VG Elemental
- Virginia Department of Environmental Quality
- Wisconsin Department of Natural Resources
- WPI (formerly Waste Policy Institute)

For more information about NEMI and other activities of the MDCB, visit the MDCB website at:

<http://wi.water.usgs.gov/pmethods/>