

Waste Information Management System: A Web-Based System for DOE Waste Forecasting

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ABSTRACT

The implementation of the Department of Energy (DOE) mandated accelerated cleanup program has created significant potential technical impediments that must be overcome. The schedule compression will require close coordination and a comprehensive review and prioritization of the barriers that may impede treatment and disposition of the waste streams at each site. Many issues related to site waste treatment and disposal have now become potential critical path issues under the accelerated schedules. In order to facilitate accelerated cleanup initiatives, waste managers at DOE field sites and at DOE headquarters in Washington, D.C., need timely waste forecast information regarding the volumes and types of waste that will be generated by DOE sites over the next 25 years. Each local DOE site has historically collected, organized, and displayed site waste forecast information in separate and unique systems. However, waste information from all sites needs a common application to allow interested parties to understand and view the complete complex-wide picture. A common application would allow identification of total waste volumes, material classes, disposition sites, choke points, and technological or regulatory barriers to treatment and disposal. The Applied Research Center (ARC) at Florida International University (FIU) in Miami, Florida, has completed the development of this web-based forecast system.

INTRODUCTION

The Applied Research Center (ARC) has developed a Waste Information Management System (WIMS) to receive and organize the DOE waste forecast data from across the DOE complex and to automatically generate waste forecast data tables, disposition maps, and other displayed reports. This system offers a single information source to allow interested parties to easily visualize, understand, and manage the vast volumes of the various categories of forecasted waste streams in the DOE complex. The successful web deployment of WIMS complete with waste information from all DOE sites occurred in May 2006. Individuals may visit the web site at: <http://wims.arc.fiu.edu/wims>, choose the desired DOE facility, and view the projected volumes of waste that the facility plans to treat or dispose through the year 2030. The waste forecast information may be sorted or filtered in a variety of ways and presented in a tabular format, exported to other applications such as MS Excel[®], or displayed with a disposition map, a geographical information system (GIS) format, or in a printable report. The data may also be viewed in a 'reverse' format that displays the volume of forecasted wastes scheduled to arrive at a specific treatment or disposal location from any or all generation sites. WIMS has been designed to be extremely flexible for future additions and enhancements. WIMS has been labeled DOE's tool-of-choice for waste forecasting.

The challenges in developing this system included:

- gathering this detailed information from the local DOE sites in a quick and efficient manner
- converting and organizing each site's data into a consistent and usable format
- providing quality assurance checks of the data for accuracy and appropriateness
- importing the data into a computerized database
- designing and implementing computer applications capable of creating the necessary data displays
- incorporating the same look and feel of the previous hand-drawn disposition maps, and

- adding the functionality of data filtering, sorting, several display options and custom report formats.

The benefits of WIMS include:

- assisting DOE and local sites in meeting individual site goals and milestones,
- achieving improved efficiencies of scale when outsourcing treatment and disposal services by providing information regarding complex-wide waste streams,
- providing information to technology vendors regarding DOE waste needs to plan future technology capabilities and capacity, and
- sharing site-to-site resources and treatment capabilities to allow the sites to leverage capacity and expertise.

This paper will present the functionality of web-based DOE waste forecast data through the year 2030 and demonstrate how the information can be sorted, filtered and displayed in a variety of tables, disposition maps, GIS formats and custom reports.

MATERIALS AND METHODS

The initial requirement from DOE Headquarters (HQ) was to consolidate waste forecast information from separate DOE sites and build forecast data tables, disposition maps and Geographical Information System (GIS) maps on the web. This information needed to be available and understandable to all stakeholders. Each DOE site had its own proprietary system for building these features. An integrated system was needed to receive and consolidate waste forecast information from all DOE sites and facilities. There was no off-the-shelf computer application or solution available for creating disposition maps and forecast data.

To meet this challenge, ARC established waste managerial contacts and obtained actual waste forecast data from two DOE sites, the Oak Ridge Reservation and the Savannah River Site. ARC designed a prototype web-based system as a pilot project. MSMicrosoft.Net technology was selected as the application for the development prototype to handle the information provided by these two sites.

After the initial development of the web-based prototype, it was demonstrated at DOE HQ and successfully highlighted ARC's capabilities to design and build the full-featured version of a WIMS. The application was able to provide information and displays on forecast data, disposition maps, GIS maps, successor stream maps and custom reports.

ARC is currently in the process of building a DOE complex wide, high performance, n-tier web-based system for generating waste forecast information, disposition maps, GIS Maps, successor stream relationships, summary information and custom reports based on DOE requirements. This system is being built on Microsoft.net framework1.1 and SQL server 2000. Visual Studio 2003, SQL server reporting services, Dream Weaver and Photoshop are also being used as development tools to construct this system.

RESULTS AND DISCUSSION

Anyone with a computer and internet access may register and gain access to WIMS at the web address <http://wims.arc.fiu.edu/wims/>. The registration link is located on the WIMS home page and the process only requests a name and basic contact information. Once registered, logging in with an email address and password is all that is required and each user will have full access to the functional modules of the application. The home page also contains links to the project and technical contacts for answers to questions. The home page for WIMS is shown in Figure 1.



Fig. 1. WIMS website home page.

Upon entrance into WIMS, the first stop for information is the 'Forecast Data' screen. The forecast data screen is accessed by clicking on the forecast data tab at the top of the home screen. The information for display on the forecast data screen can be filtered in many ways through the provided drop-down menus. The filtration choices for each field of data are shown in Table I.

Table I. Pick-List Choices for Filtering Data

Waste From		Waste To
All Sites		All Facilities
Argonne National Laboratory		LLW Disposal Cell (FEMP)
Ashtabula Environmental Management Project		ERDF (HANF)
Battelle Columbus Laboratories		Integrated Disposal Facility (HANF)
Bettis Atomic Power Laboratory		RMW Trenches/IDF (HANF)
Brookhaven National Laboratory		Area 5 LLW Disposal Unit (NTS)
Energy Technology Engineering Center		Area 3 LLW Disposal Unit (NTS)
Fernald Environmental Management Project		Pit 3 (Area 5) MLLW Disposal (NTS)
Hanford Site-RL		TSCA Incinerator (ORR)
Hanford Site-RP		EMWMF Disposal Cell (ORR)
Idaho National Laboratory		E-Area Disposal (SRS)
Knolls Atomic Power Laboratory Schenectady		TA 54/Area G (LLW disposal) (LANL)
Lawrence Livermore National Laboratory		TRU Storage (LANL)
Los Alamos National Laboratory		Waste Isolation Pilot Plant
Miamisburg Environmental Management Project		Commercial-1
Nevada Test Site		Commercial-2
Oak Ridge Reservation		Commercial-3
Paducah Gaseous Diffusion Plant		Commercial-4
Portsmouth Gaseous Diffusion Plant		Commercial-5
Rocky Flats Environmental Technology Site		Commercial-6
Sandia National Laboratories - NM		Commercial-7
Savannah River Site		Commercial-8
Separations Process Research Unit		Commercial-13
Waste Pilot Plant		Commercial TBD
West Valley Demonstration Project		To Be Determined
Fiscal Year From		
Fiscal Year To		
Waste Type		
2006	2006	All Materials
2007	2007	Unknown
2008	2008	Low Level Waste
2009	2009	Mixed Low Level Waste
2010	2010	11e(2) Byproduct Material
2011 to 2015	2011 to 2015	Other Material
2016 to 2020	2016 to 2020	Transuranic Waste
2021 to 2025	2021 to 2025	
2026 to 2030	2026 to 2030	
2031 to 2035	2031 to 2035	

Once the desired filtration choices have been made from the available drop down menus, clicking on the “Display Forecast Data” button will generate a table that displays the requested data. A sample forecast data table is presented in Figure 2 with the data filtered as follows:

From: Oak Ridge Reservation
 To: All Facilities
 Fiscal Year From: 2006
 Fiscal Year To: 2008
 Waste Type: All Materials

The actual data table display is wider than a computer monitor is capable of displaying. Within WIMS, the viewer will use a scroll bar at the bottom and side of the data to view all of the available data. For this figure, the data has been merged into one figure.



Fig. 2 Waste forecast data display from WIMS.

On the far right of each data line is a 'Status/Comment' field. Clicking on this field will display the comments, assumptions/procedures or general information provided by the reporting location for that waste stream.

WIMS also has the ability to display viewer selected data in the form of a disposition map. To view a disposition map, click on the 'Disposition Map' tab at the top of any screen and then make filtration selections for the desired disposition map display. The disposition map uses the same color key scheme for individual sites throughout the application. In the example provided in Figure 3, Richland RL is displayed in black text with a yellow background. This color legend is visible at the bottom of all data screens.

The disposition map displays color coded flags to indicate each waste stream's status and planned treatment. The information for these flags is viewed by placing the cursor over the flag. Any information provided by the reporting site for this field will be displayed in a pop-up box. The color key definitions are provided in Table II.

Table II. Color Keys for Treatment and Status Flags

Treatment	Color key
Compaction/supercompaction	light salmon
Metal/surface decontamination	magenta
Incineration	tan
Macro encapsulation	orange-red
Metal melting	blue
Multiple/various	red
Neutralization	gray
None	brown
Other	yellow
Other thermal treatment	pink
Sanitization	lime green
Sort/segregate	turquoise
Stabilization/solidification	cornflower blue
To be determined	orange
Vacuum thermal desorption	sea green
Status	Color Key
No significant impediments to treatment/disposal	green
Minor to moderate impediments to treatment/disposal	yellow
Significant impediments to treatment/disposal	red

For illustration purposes, several pop-up information boxes are displayed on Figure 3.

Some waste streams displayed on the disposition maps will contain a white 'S' in a blue background. This symbol indicates that this waste stream has a successor stream, a portion of the waste stream that splits off or is generated, usually from the treatment process, to form a separate waste stream. Placing a cursor over the S symbol will indicate the field stream identifier for this successor stream which can then be traced independently.

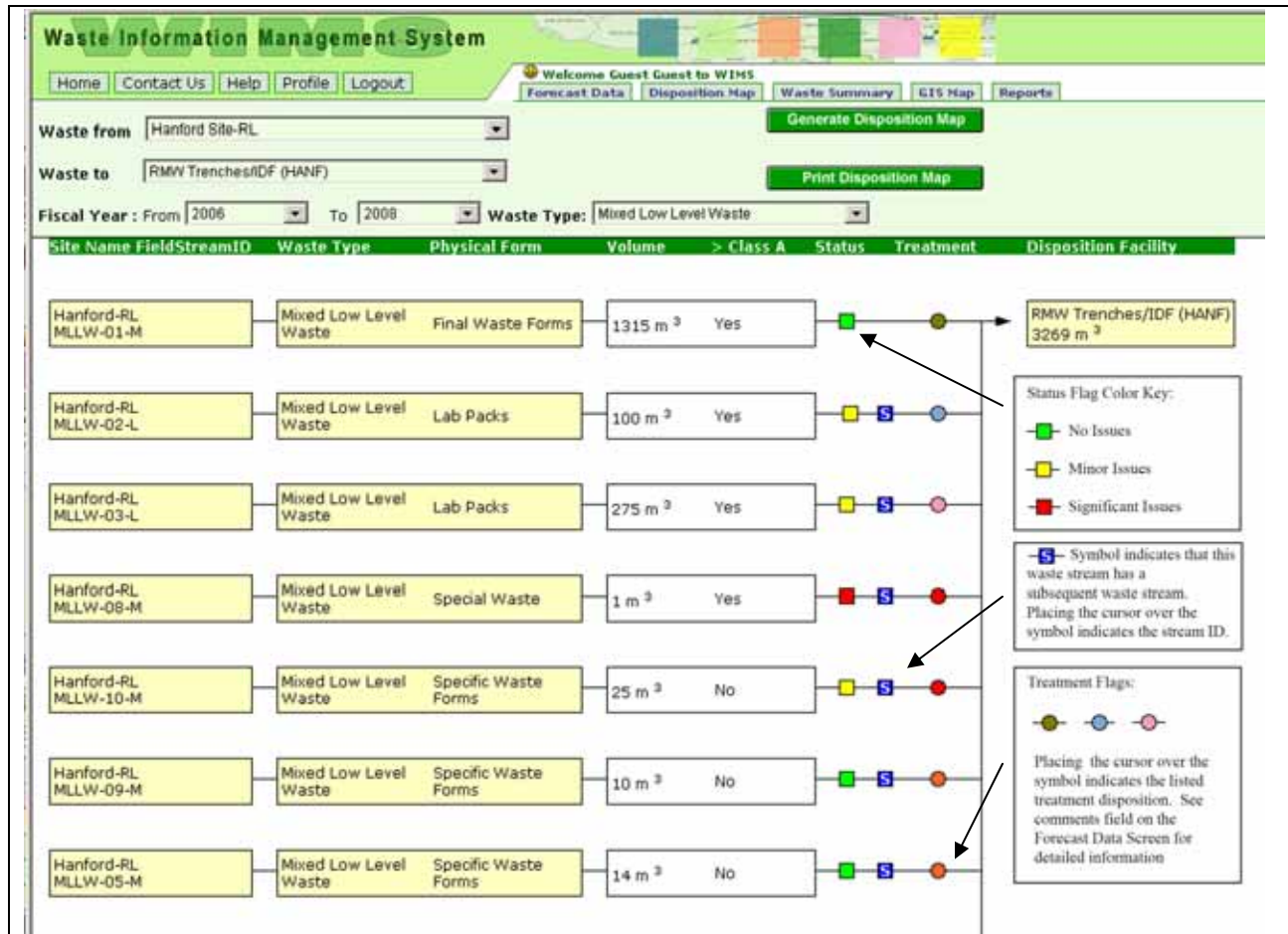


Fig. 3. Disposition map.

WIMS has the ability to generate a GIS map of forecasted waste from the point-of-origin to the intended treatment or disposal site. The displayed information is filterable in both a forward direction (from the generation site to the treatment/disposal site) and a reverse direction (forecasted waste coming to a specific site from one or more selected sites). Figure 4 indicates an example of the reverse feature of the GIS map indicating forecasted waste going to the Waste Isolation Pilot Plant (WIPP) from all data sites during a time period from 2006 to 2035 and a waste selection of 'All Materials'. The volumes are indicated directly on the map and the colors of the transport lines are consistent with the site legend. A 'Print Disposition Map' button has been included to allow each viewer who desires to print maps to individually customize the application to their printing hardware and software.



Fig. 4. Reverse GIS map from WIMS.

Finally, WIMS is designed to produce custom reports of selected data in multiple exportable formats such as:

- HTML
- MS Excel
- Web Archive
- Adobe Acrobat (PDF)
- TIFF
- CSV (comma delimited) and
- XML

CONCLUSION

WIMS has successfully accomplished the goals and objectives set forth by DOE for this project. ARC interfaced with DOE headquarters to learn the necessary requirements. Historically, each DOE site gathered, organized and reported their waste forecast information utilizing different database and display technologies. The task of integrating and normalizing the vast volumes of data in different formats was accomplished by the WIMS project.

Replicating the look and feel of the previous hand-drawn IPABS disposition maps was a larger and more complicated issue. Utilizing the latest, state-of-the-art information technology by ARC's highly trained and experienced IT designers; disposition maps that were virtually indistinguishable from the originals were developed. The value of this new map generating technology is that the maps and other displayed data may be quickly and efficiently updated. No longer will this information be years old with undeterminable inaccuracies. Anytime DOE wishes to input new data, the web-based data can be updated and provide instant, decision making information to anyone with a computer and an Internet connection. In addition, anyone searching this web application will be able to filter and sort the data so as to provide only the information in which that person is interested. The data can be exported into various electronic and printable formats. Future enhancements will allow the ability to customize reports for inclusion in documents, presentations, and graphic displays.