Waste Information Management System with 2016-17 Waste Streams – 17246

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ABSTRACT

The Waste Information Management System (WIMS) 2016-17 was updated to support the Department of Energy (DOE) accelerated cleanup program. The schedule compression required close coordination and a comprehensive review and prioritization of the barriers that impeded treatment and disposition of the waste streams at each site. Many issues related to waste treatment and disposal were potential critical path issues under the accelerated schedule. In order to facilitate accelerated cleanup initiatives, waste managers at DOE field sites and at DOE Headquarters in Washington, D.C., needed timely waste forecast and transportation information regarding the volumes and types of radioactive waste that would be generated by DOE sites over the next 35 years. Each local DOE site historically collected, organized, and displayed waste forecast information in separate and unique systems. In order for interested parties to understand and view the complete DOE complex-wide picture, the radioactive waste and shipment information of each DOE site needed to be entered into a common application. The WIMS application was therefore created to serve as a common application to improve stakeholder comprehension and improve DOE radioactive waste treatment and disposal planning and scheduling. WIMS allows identification of total forecasted waste volumes, material classes, disposition sites, choke points, technological or regulatory barriers to treatment and disposal, along with forecasted waste transportation information by rail, truck and intermodal shipments. The Applied Research Center (ARC) at Florida International University (FIU) in Miami, Florida, developed and deployed the web-based forecast and transportation system and is responsible for updating the radioactive waste forecast and transportation data on a regular basis to ensure the long-term viability and value of this system

INTRODUCTION

The U.S. Government Accountability Office (GAO) published a report in 2005 that criticized the Department of Energy (DOE) for their lack of life-cycle cost analysis for low level waste (LLW) and mixed low level waste (MLLW) treatment and disposal [1]. Additionally, the National Governor's Association and other stakeholder organizations called for a "national forum" and "formal integration" of DOE waste management plans. The DOE National Low Level Waste/Mixed Low Level Waste Disposition Strategy was issued as a draft advanced copy in 2006 and discussed DOE's long-range strategy for managing and disposing LLW and MLLW [2]. The strategy discussed in the disposition strategy document is consistent with the DOE Strategic Plan [3], DOE Order 435.1 Radioactive Waste Management and the corresponding DOE Manual 435.1-1 Radioactive Waste Management Manual [4], which requires the

integration of waste projections and life-cycle waste management planning into complex-wide decisions for LLW and MLLW.

Accurate estimates of the quantity and type of present and future radioactive waste streams is critical to the development of tools to integrate the complex-wide management of LLW/MLLW treatment and disposal. To meet this need, DOE's Office of Environmental Management (EM) was tasked with developing a new complex-wide LLW and MLLW database and subsequently worked with the Applied Research Center (ARC) at Florida International University (FIU) to develop, deploy, maintain, and update the system [5]. EM collects and validates the waste forecast data from the DOE sites and then provides the data to ARC at FIU for integration and deployment.

The initial direction from EM to ARC 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. EM needed an integrated system to receive and consolidate waste forecast information from all DOE sites and facilities and to make this information available to all stakeholders and to the public. There was not a commercially available off-the-shelf computer application or solution available for creating the requisite disposition maps and forecast data DOE required so FIU developed a custom software system.

The Waste Information Management System (WIMS) 2016-17 is a web-based information management system, designed, developed, deployed and maintained by ARC at FIU for DOE and DOE site waste managers. This system enables stakeholders to easily visualize, understand, and manage the vast volumes, categories, and problems of forecasted waste streams and their associated forecasted shipments. This system integrates waste stream and transportation information from various DOE sites and facilities to waste treatment and disposal facilities. It provides forecasting of waste disposal volumes through the year 2050, filtered by various selection criteria such as waste sites, disposal facilities, year range, and material types. This system can be accessed from the web address www.emwims.org. This is the domain used for deploying WIMS as an independent system over the web. WIMS was first presented at the Waste Management Conference in 2007 [6]. Recent system updates include annual waste forecast data from the DOE sites (for a current total of 36 sites and 32 disposition facilities). There are a total of 725 waste streams in the system for various material types (low level waste, mixed low level waste, unknown, and other material). The forecasted disposal information is available from year 2016 to year 2050. The system also includes the waste transportation forecast plan for 2016 and 2017 for shipments by rail, truck and intermodal.

METHODS

ARC built a DOE complex-wide, high performance, n-tier web-based system for generating waste forecast information, disposition maps, GIS maps, successor stream relationships, and custom reports based on the DOE requirements. The system was built on a SQL Server® 2005, SQL Server® 2005 Integration Services and SQL Server Reporting Services®. Visual Studio 2003™, Dream Weaver®, and Adobe Photoshop® were also used as development tools to construct the system.

Waste stream information is collected from various DOE sites and is imported into the centralized database. The data collected for each waste stream include the attributes important to the stakeholders: reporting site, disposition facility name, waste stream name, field stream identifying number, managing program, classified flag, waste type, treatment planned, physical form of waste, greater than Class A classification, status flag, handling code, successor field stream identifying number, starting inventory volume, and forecasted waste volumes.

Waste stream forecast information is presented over the web through an integrated forecasting system based on the established selection criteria and processes. Waste stream data are rolled up based on their attributes and are presented to the users over the web as data tables, disposition maps, and geographic information system (GIS) maps. A few waste streams have special characteristics and are processed through multiple facilities. These streams can be displayed using a successor stream disposition map process. WIMS also provides the ability to generate reports and export forecast information in various standard formats such as Adobe® Portable Document Format (PDF), Microsoft Excel®, and Microsoft Word®.

At DOE's request, a transportation module was also designed, developed and integrated with the existing system to display waste shipping forecast information by transportation mode – rail, truck and intermodal. This module provides transportation forecast information for the next two years.

Upon entrance into WIMS, the information can be filtered in many ways through the provided drop-down menus. The available display filtration choices for each field of data are shown in Tables I through IV.

Table I. Updated Pick-List for Filtering Data – Waste From

Waste From
All Sites
Ames Laboratory
Argonne National Laboratory
Bettis Atomic Power Laboratory
Brookhaven National Laboratory
Energy Technology Engineering Center
Fermi National Accelerator Laboratory
Hanford Site-RL
Hanford Site-RP
Idaho National Laboratory
Kansas City Plant
Knolls Atomic Power Laboratory - Kesselring
Knolls Atomic Power Laboratory - Schenectady
Lawrence Berkeley National Laboratory
Lawrence Livermore National Laboratory
Los Alamos National Laboratory

Naval Reactor Facility
Nevada Test Site
NG Newport News
Norfolk Naval Shipyard
Nuclear Fuel Services, Inc. (cleanup site)
Oak Ridge Reservation
Pacific Northwest National Laboratory
Paducah Gaseous Diffusion Plant
Pantex Plant
Pearl Harbor Naval Shipyard
Portsmouth Gaseous Diffusion Plant
Portsmouth Naval Shipyard
Princeton Plasma Physics Laboratory
Puget Sound Naval Shipyard
Sandia National Laboratories - NM
Savannah River Site
Separations Process Research Unit
Stanford Linear Accelerator Center
Thomas Jefferson National Accelerator Facility
Waste Isolation Pilot Plant
West Valley Demonstration Project

Table II. Updated Pick-List for Filtering Data – Waste To

Waste To
All Facilities
200 Area Burial Ground
746-U Landfill
Area 5 LLW Disposal Unit
Area 5 MLLW Disposal Cell
Clean Harbors
Commercial TBD
E-Area Disposal (SRS)
EMWMF Disposal Cell (ORR)
Energy Solutions - Clive
Energy Solutions - TN
ERDF (HANF)
Impact Services-TN
INL CERCLA Cell
Integrated Disposal Facility (HANF)
New RH LLW Vaults (INL)
ORNL Liquid LLW System
OSWDF (Portsmouth)
Paducah CERCLA
Paducah WW Trt

Perma-Fix Gainesville
Perma-Fix--Diversified Scientific Services, Inc.
Perma-Fix--Northwest
Perma-Fix/Materials & Energy Corp
River Metals
RMW Trenches (MLLW/LLW) (HANF)
RMW Trenches/IDF (HANF)
RWMC (LLW disposal) (INL)
Siemens
Studsvik/RACE LLC
TA 54/Area G (LLW disposal) (LANL)
To Be Determined
Waste Control Specialists

Table III. Updated Pick-List for Filtering Data – Fiscal Year

Fiscal Year
2016
2017
2018
2019
2020
2021 to 2025
2026 to 2030
2031 to 2035
2036 to 2040
2041 to 2045
2046 to 2050

Table IV. Updated Pick-List for Filtering Data – Waste Type

Waste Type
All Materials
Unknown
Low Level Waste
Mixed Low Level Waste
11e(2) Byproduct Material
Other Material

RESULTS

Waste streams currently displayed in WIMS were collected in early 2016 and represents project planning information at that time. The data does not take into account any subsequent changes to forecasts. The information includes low-level and mixed low-level radioactive waste information supplied by all DOE programs. The waste information was successfully updated in May 2016.

Anyone with a computer and internet access may register and gain access to WIMS at the web address www.emwims.org. 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 for WIMS is shown in Figure 1.

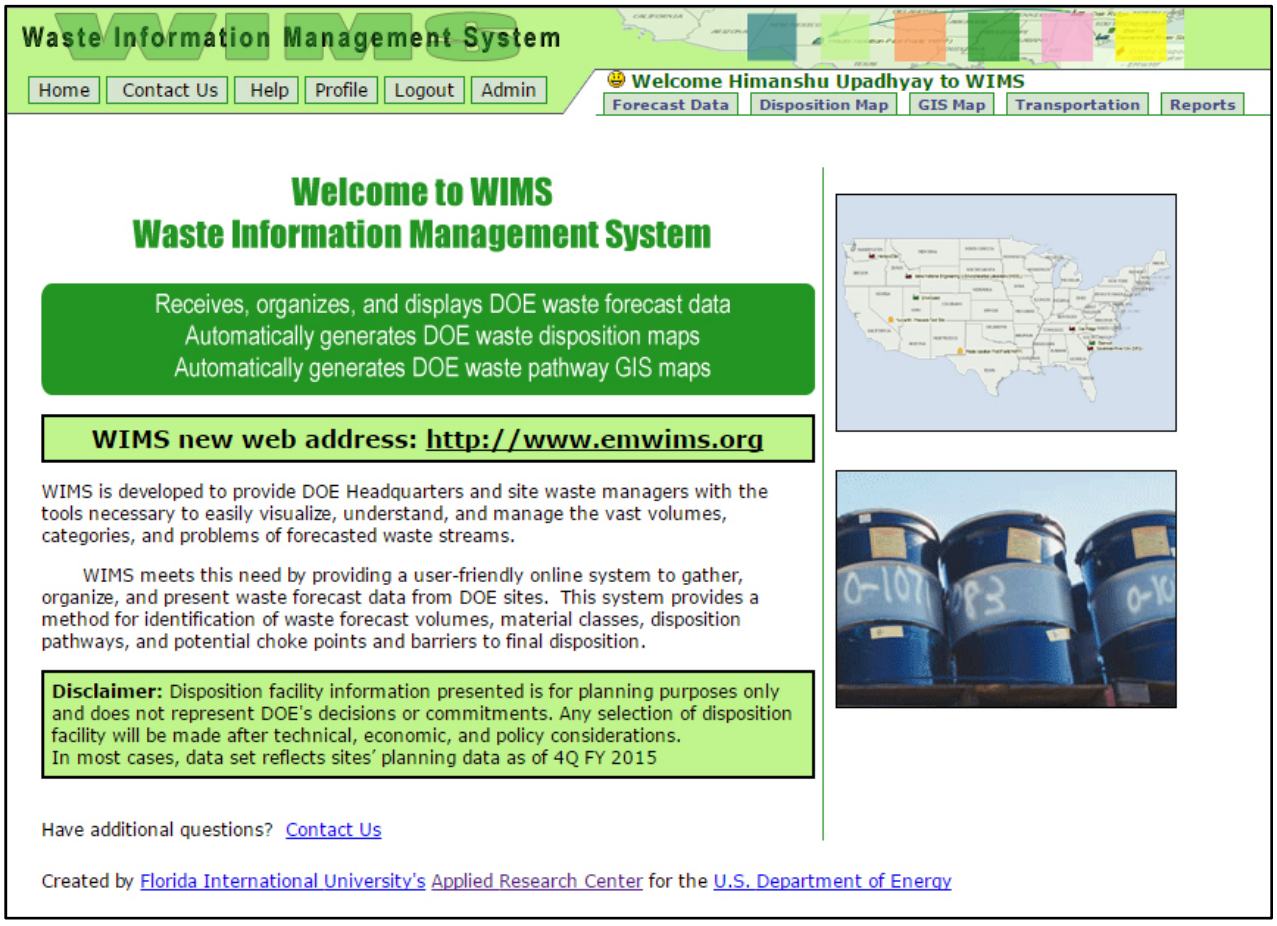


Fig. 1. WIMS home page provides a general description of the system as well as tabs to navigate to the forecast data, disposition map, GIS map, transportation module, and the reports module.

The forecast data screen is accessed by clicking on the forecast data tab at the top of the home screen. 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.

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 displays color coded flags to indicate each waste stream’s status and planned treatment. A green status flag indicates that there are no issues regarding the treatment and disposition of the waste stream while a yellow flag indicates minor issues and a red flag indicates significant issues. The planned waste stream treatment is displayed when the user places the cursor over the treatment flag. A sample disposition map is presented in Figure 2 with the data filtered as shown.

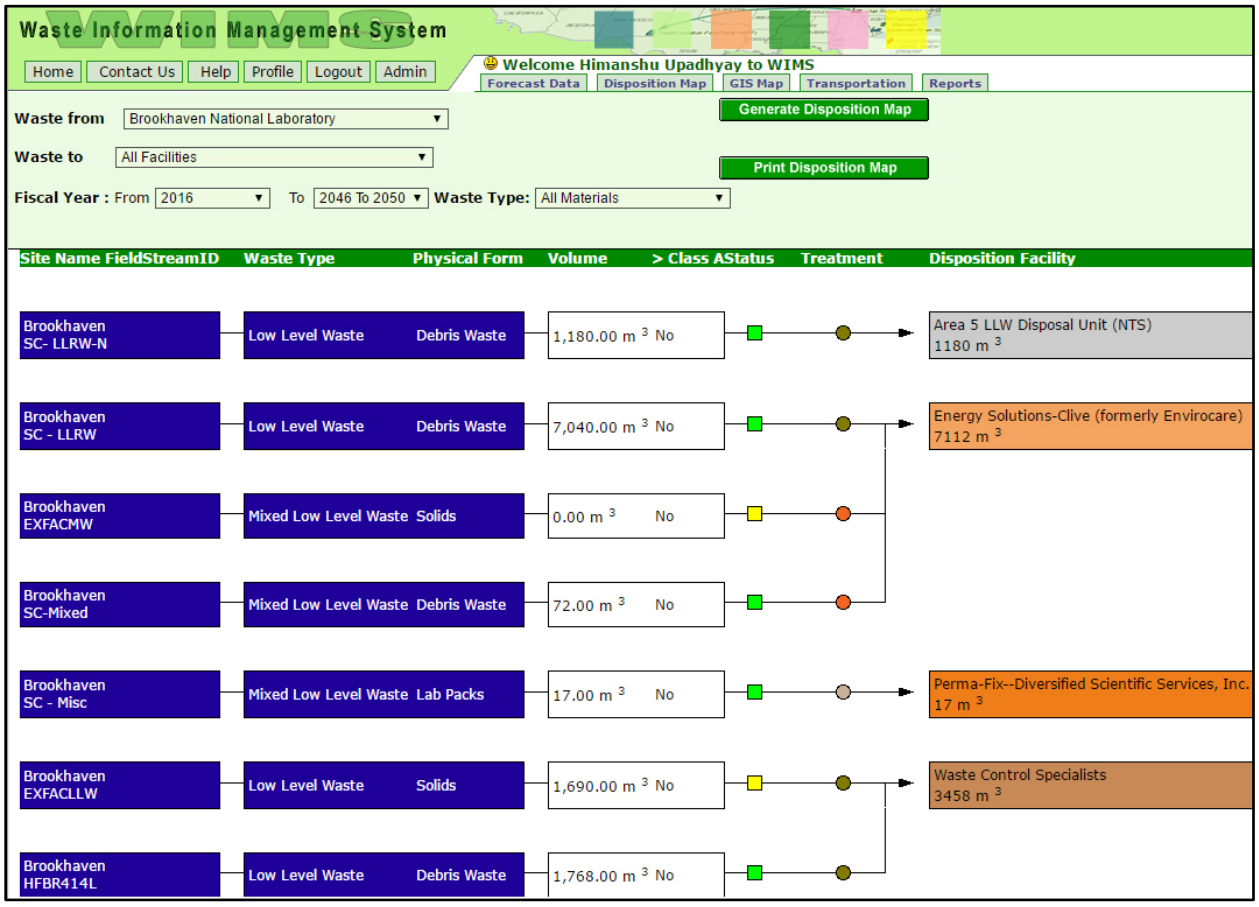


Fig. 2. The disposition map screen shot is displaying a sample of the waste forecasted to be shipped from Brookhaven for disposition between the years 2016 and 2050.

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 3 displays an example of the feature of the GIS map indicating forecasted waste going to the Waste Control Specialist facility with the same data filter choices as used for the previous figure. The total volumes are indicated directly on the map.

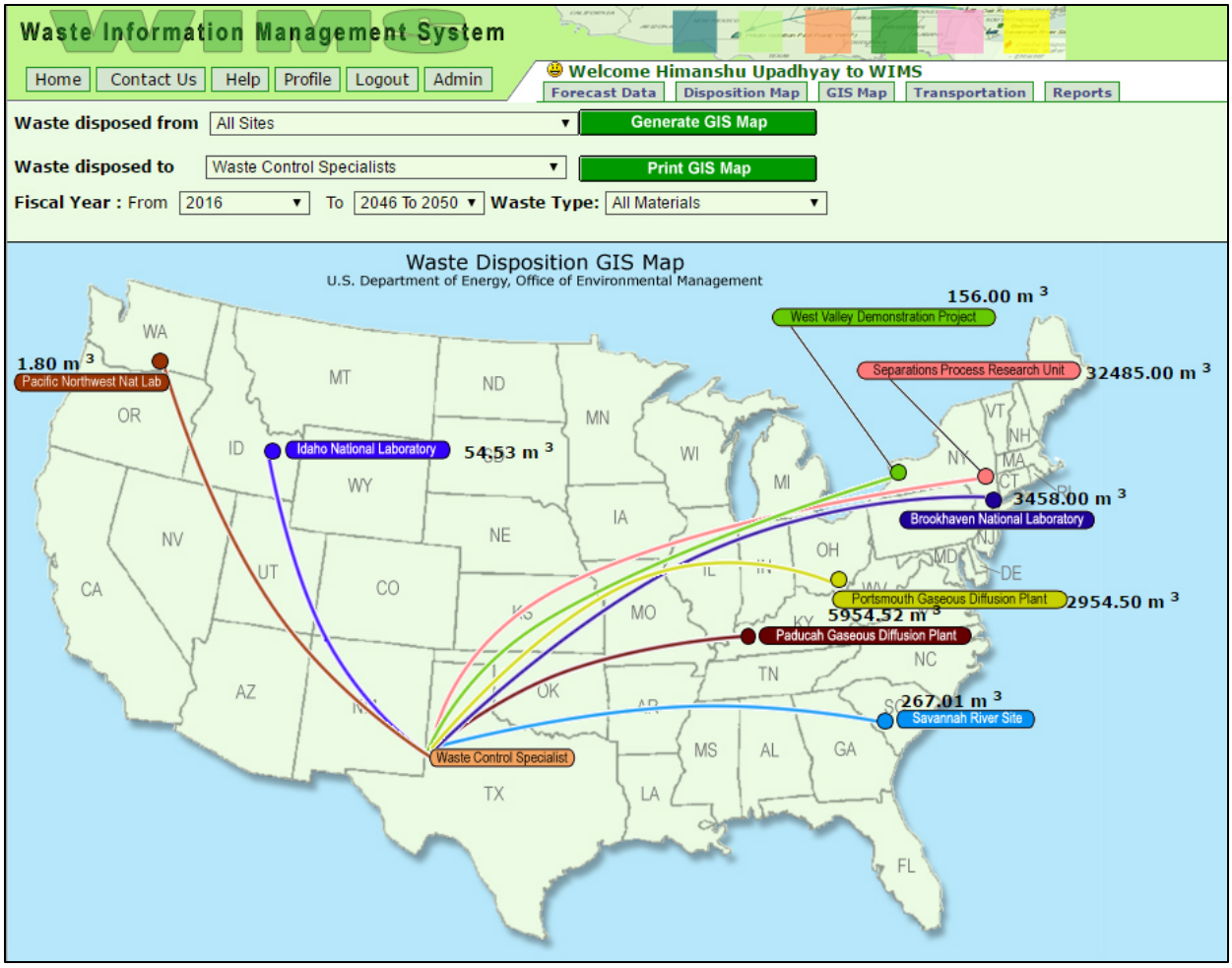
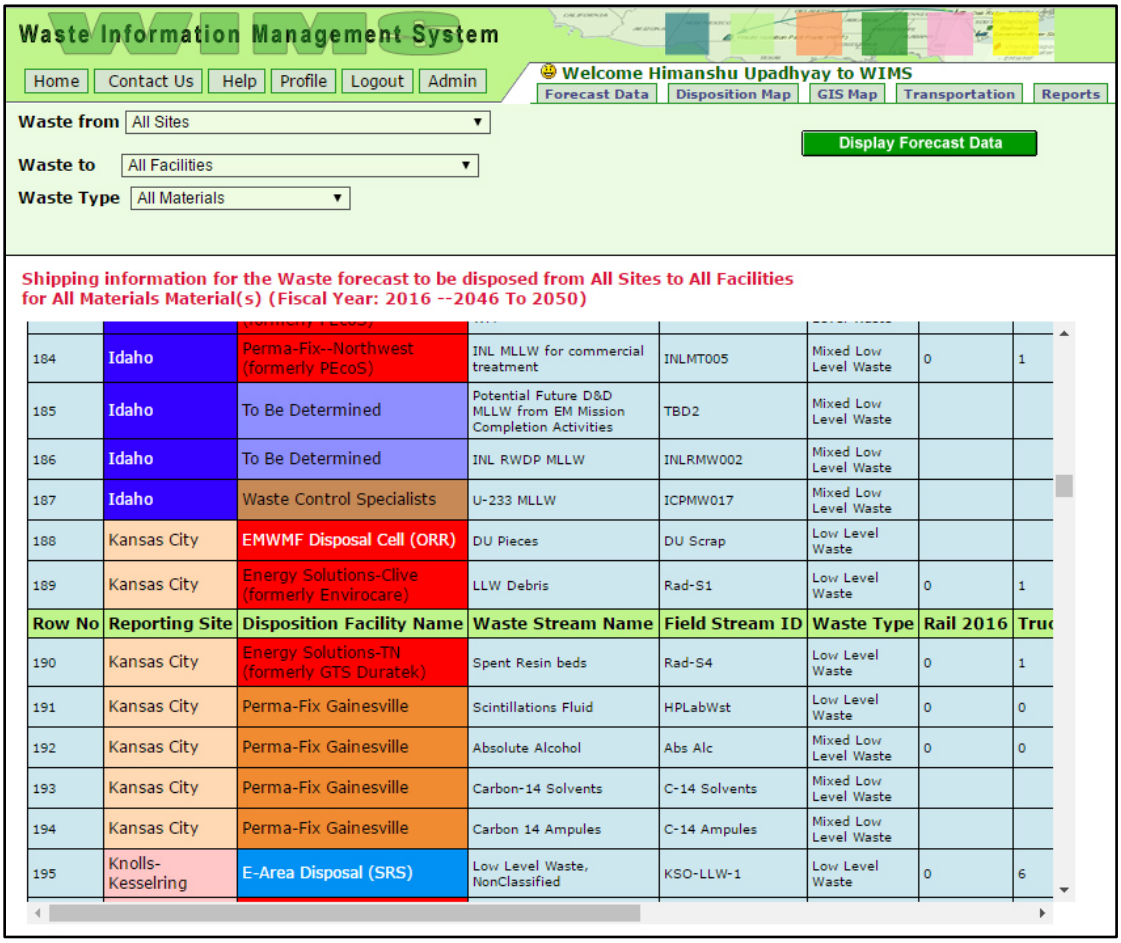


Fig. 3. The GIS map screen shot is displaying the waste forecasted to be sent from all DOE sites to the Waste Control Specialist between the years 2016 and 2050.

A transportation module was designed, developed and integrated with the existing WIMS. This module shows the shipping details on waste volume as forecasted number of shipments by truck, intermodal, and rail. This module shows the information that was collected in early 2016 and reflects the shipping forecast information at that time. Any subsequent forecast changes are not reflected here.

Figure 4 displays an example of the transportation feature indicating forecasted waste going to multiple facilities from Idaho and Kansas City site for 2016 and 2017 in rail, truck, and intermodal shipments.



Row No	Reporting Site	Disposition Facility Name	Waste Stream Name	Field Stream ID	Waste Type	Rail 2016	Truc
184	Idaho	Perma-Fix--Northwest (formerly PEcoS)	INL MLLW for commercial treatment	INLMT005	Mixed Low Level Waste	0	1
185	Idaho	To Be Determined	Potential Future D&D MLLW from EM Mission Completion Activities	TBD2	Mixed Low Level Waste		
186	Idaho	To Be Determined	INL RWDP MLLW	INLRMW002	Mixed Low Level Waste		
187	Idaho	Waste Control Specialists	U-233 MLLW	ICPMW017	Mixed Low Level Waste		
188	Kansas City	EMWMF Disposal Cell (ORR)	DU Pieces	DU Scrap	Low Level Waste		
189	Kansas City	Energy Solutions-Clive (formerly Envirocare)	LLW Debris	Rad-S1	Low Level Waste	0	1
190	Kansas City	Energy Solutions-TN (formerly GTS Duratek)	Spent Resin beds	Rad-S4	Low Level Waste	0	1
191	Kansas City	Perma-Fix Gainesville	Scintillations Fluid	HPLabWst	Low Level Waste	0	0
192	Kansas City	Perma-Fix Gainesville	Absolute Alcohol	Abs Alc	Mixed Low Level Waste	0	0
193	Kansas City	Perma-Fix Gainesville	Carbon-14 Solvents	C-14 Solvents	Mixed Low Level Waste		
194	Kansas City	Perma-Fix Gainesville	Carbon 14 Ampules	C-14 Ampules	Mixed Low Level Waste		
195	Knolls-Kesselring	E-Area Disposal (SRS)	Low Level Waste, NonClassified	KSO-LLW-1	Low Level Waste	0	6

Fig. 4. The transportation forecast data screenshot displays a sample of the waste forecasted to be sent to multiple facility, for disposal from Idaho and Kansas site by number of rail, truck and intermodal shipments.

CONCLUSION

WIMS continues to successfully accomplish the goals and objectives set forth by DOE for this project. It has replaced the historic process of each DOE site gathering, organizing, and reporting their waste forecast information utilizing different databases and display technologies. In addition, WIMS meets DOE's objective to have the complex-wide waste forecast and transportation information available to all stakeholders and the public in one easy-to-navigate system. The enhancements to WIMS made since its initial deployment include the addition of new DOE sites and facilities, an updated waste and transportation information, and the ability to easily display and print customized waste forecast, the disposition maps, GIS maps and transportation information. The system also allows users to customize and generate reports over the web. These reports can be exported to various formats, such as Adobe® PDF, Microsoft Excel®, and Microsoft Word® and downloaded to the user's computer.

Future enhancements will include database/application migration to the next level. A new data import interface will be developed to integrate 2017-18 forecast waste streams. In addition, the application will be updated on a continuous basis based on DOE feedback.

REFERENCES

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2. Department of Energy, *DOE National Low Level Waste/Mixed Low Level Waste Disposition Strategy,* Rev. 0, Draft-Advanced Copy, August 2006.
3. Department of Energy, *The Department of Energy Strategic Plan*, September 2003.
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5. Upadhyay, H., L. Lagos, W. Quintero, P. Shoffner, D. Roelant, "*Waste Information Management System with 2013-14 Waste Streams*" , WM14 Conference Proceedings, March 2014
6. Geisler, T., P. Shoffner, H. Upadhyay, W. Quintero, "*Waste Information Management System: A Web-Based System for DOE Waste Forecasting*," WM'07 Conference Proceedings, February 2007.