

## **Development and Implementation of the Waste Management Information System to Support Hanford's River Corridor Cleanup**

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### **ABSTRACT**

This paper describes development of a Waste Information Management System (WMIS) to support the waste designation, transportation, and disposal processes used by Washington Closure Hanford, LLC to support cleanup of the Columbia River Corridor. This waste, primarily consisting of remediated burial sites and building demolition debris, is disposed at the Environmental Restoration Disposal Facility (ERDF), which is located in the center of the Hanford Site (an approximately 1460 square kilometers site). WMIS uses a combination of barcode scanning, hand-held computers, and strategic employment of a radio frequency identification (RFID) tag system to track each waste shipment from waste generation to disposal.

### **INTRODUCTION**

This document evaluates the WMIS program from an operational perspective and documents how the program, as designed, has enhanced each major step of the waste management process. This evaluation primarily evaluates these steps in terms of timesaving; however, some of the steps in the process will be evaluated in relative terms (e.g., then vs. now).

### **BACKGROUND**

In 2000, it was recognized by Bechtel Hanford, Inc, the Environmental Remediation Contractor (ERC) at Hanford, that manual data entry caused numerous errors in the documentation process associated with waste management by the Environmental Remediation Contractor, at the time. Bechtel Hanford, Inc. managed the ERC until August 2005, when it was replaced with the River Corridor Closure Contract, now managed by Washington Closure Hanford, LLC (WCH). A Six Sigma process improvement project (PIP) completed during fiscal year (FY) 2001 indicated waste management processes were redundant and could be made considerably more efficient.

The recommended actions from the PIP included development of an integrated, automated waste management system. The basic waste management work process steps include generation, designation, treatment, packaging, transportation and disposal.

## **PROGRAM DEVELOPMENT**

WMIS was developed using a phased approach, as described below:

### **WMIS Phase I**

The objectives of Phase I was to automate manual form generation and to automate the routing of forms regularly used in the waste management process. It was determined that the automation of this system would reduce errors and cycle time, and in return save the Contractor valuable time and money. The WMIS system was intended to provide the users of the system a “one-stop” shopping page with links to the computer systems being used, including the Hanford Environmental Information System (HEIS), the Hanford Site Solid Waste Information Tracking System (SWITS), and the Waste Information Data System (WIDS), which is used to track ‘as generated’ hazardous waste.

### **WMIS Phase II**

WMIS Phase II focused primarily on ERDF disposal requirements and addressed the following processes:

- Acquisition, archiving, management, and storage of shipment data for all ERDF shipments
- Automated process of generating the Onsite Waste Tracking Forms (OWTF) (waste manifest) for the movement of waste from a generator (i.e., burial site, demolished building) to the ERDF.
- The creation of an extensible template based storage system to handle both large volumes of shipped containers per day as well as highly complex mixtures per waste shipment
- The flow of data of all isotope and chemical constituent data to their appropriate waste profiles and waste designations
- Reduce errors and potential problems (i.e., illegible writing, duplication and transcription errors) when documenting the excavation and hauling of waste
- Better track the waste from cradle to grave
- Provide an up to date and stable program that will accurately track ERDF containers
- The reduction of data entry errors, vehicle-weighing errors, and to streamline the process, thereby removing any foreseeable bottlenecks.
- Allow simultaneous access to any number of authorized users to the new system.
- Integration of radio-frequency identification (RFID) tags on all containers and trucks to track the waste shipments from the time they are loaded until the point that they are disposed
- Replace the aging and non-supported database system developed by the ERDF Operations Subcontractor to maintain the ERDF waste disposal history, and bring the data bringing it under the Contractor’s umbrella of standardized systems.

The culmination of this effort occurred on May 2, 2005, when the WMIS program became operational.

## **WMIS OPERATIONAL METRICS**

In order to assess performance of the new WMIS program and to determine if system operation meets design objectives, the following areas have been evaluated:

### **Waste Designation & Profiles**

Waste designations are developed based on process knowledge and physical sample data, driven by the Data Quality Objective/Sampling and Analysis Plan process for a given waste site. The waste profile is developed from the designation and establishes maximum waste loading per shipment that will comply with the ERDF waste acceptance criteria. WMIS generates the waste profile from the designation.

#### *Developing Designations*

Because record copies of regulatory-driven documents are retained in hard copy, development of designations has not resulted in timesavings. On the contrary, once the designation is developed, the Waste Designation Specialist (WDS) is required to enter completed designation information into WMIS, either by manual entry or utilization an import tool that takes the designation spreadsheet and replicates the information into WMIS. This additional task takes approximately 30 minutes per designation. With 135 original designations currently entered into WMIS, an additional 67.5 hours has been expended by WDS personnel. It is important to note that this time spent by WDS personnel replaces time that was spent by the ERDF operations subcontractor to enter individual designations into their database (net zero gain/loss).

#### *Revising Designations*

When a designation is revised within WMIS, the designation is simply copied and the changes inserted. This normally takes approximately five minutes per revision. As 68 of the 203 designations entered in the WMIS database are revisions to current designations, 5.6 hours was expended by waste designation personnel to revise designations. This is offset by the amount of time previously spent by ERDF operations subcontractor personnel. Previously, a designation revision would require a complete re-entry of the data into their database. These 68 designation revisions would have taken 34 hours to enter into their database, which has thus far resulted in a net savings of 28.4 person-hours.

#### *Approval Process*

Similar to the designation process described above, the designation review and approval process within WMIS is an added step, but a necessary one that tells the waste transportation specialist (shipper) that the waste profile generated by WMIS, based on the designation, is valid and approved for use. There are four review and approval steps within the waste designation process, similar in WMIS (check, review, approval, and validation by ERDF personnel). Each of these reviews adds approximately five minutes to the process and is required regardless of whether a designation is being generated or revised. Based upon 203 designations within WMIS thus far, this has added 60.9 hours of review and approval effort.

### *Next Step in the Waste Designation Process*

There are a number of planned upgrades to WMIS that will significantly improve the efficiency of waste designation process, including:

- Ability to feed waste site sampling data directly from the sampling database into the WMIS waste designation module
- Develop characterization programs within WMIS to support DOT classification and hazardous chemical information directly into WMIS to support non-radioactive designation.

If data is only input one time, the potential for errors will be further reduced. In addition, if sample data can be fed directly into the WMIS designation module without manual data entry error potential will be further reduced. The side benefit is that the process will likely work more efficiently.

### **Waste Transportation Specialist (WTS) Activities**

Waste Transportation Specialists (shippers) are the primary benefactor of WMIS from timesaving perspective, as described below:

#### *Developing Transportation Templates*

Transportation templates are developed based on individual waste profiles and percentage of profile values. For example, a WTS may develop a series of templates for ranges of waste container dose rates that relate to a specific waste stream. A percentage of profile would be represented by each dose rate range.

Each WTS used templates prior to WMIS implementation, developed as EXCEL spreadsheets. When WMIS was initially populated with data, an import tool was developed by our computer technology department that allowed spreadsheet information to be loaded directly into WMIS, saving approximately one hour per template. As there may be as many as 5 templates per waste profile, and 135 original profiles, it is estimated that 270 hours was saved in template generation under WMIS.

#### *Revising Templates*

Under the ERDF Operations Subcontractor's system, when a waste designation/profile was revised, a new template was required to be generated. Under WMIS, when a profile is revised, the template is copied and updated. The one-hour task prior to WMIS implementation now takes about ten minutes. As 68 profiles have been revised under WMIS, the program has saved 56 hours.

#### Generating shipping papers

Under the previous program, an approval number was required to be issued by the ERDF operations subcontractor for each shipment. An On-site Waste Tracking Form (OWTF) was generated for each approval number. If 50 shipments per day originated from a particular waste site, 50 separate transactions would be required. Under WMIS, a transportation template is

selected, the number of shipping papers required is entered, WMIS assigns shipment numbers, and prints out the specified number of OWTFs. This saves each WTS up to two hours per day, depending on the number of shipments scheduled.

At 200 shipments per day on average, WMIS saves 24 person-hours per day. This timesaving allows each WTS to spend more in the field observing waste containers being filled, aiding project personnel to ensure adherence with applicable regulatory and ERDF waste acceptance criteria requirements.

### **Waste Transportation and ERDF Scale Activities**

Before the development of WMIS, drivers were required to perform the following steps at the ERDF scale:

- Exit their vehicles and go into the ERDF scale house
- Hand enter their tractor and ERDF container numbers into the scale indicator box
- Print out a weight ticket for the driver
- Complete shipment log - Hand enter into a log all applicable information (truck number, ERDF container number, driver name, date/time, OWTF approval number, weight)
- Complete dispatching log - Hand enter into a dispatching log where the load originated
- Return to their truck and exit the scale.

This process, on a per truck basis, generally took four minutes per transaction. In addition, if a number of trucks arrived at ERDF simultaneously, the wait for the last truck in line was typically up to 15 minutes. This is significant because of the unproductive time spent by each truck waiting at the scale, especially when truck traffic averaged 200 loads per day across the scale (best operation equated to 800 minutes of wait time per day, and additional wait time if a backup occurred at the scale).

### *Radio Frequency Identification Tag Operation*

The use of radio frequency identification (RFID) tags for identification of transportation resources (e.g. trucks and ERDF roll-off containers) and linking them to the waste to automate the vehicle weighing process has become a huge success. RFID is linked to ERDF scale operations and WMIS, allowing waste weight for specific shipments to be determined and inserted automatically into WMIS.

From an operational perspective, when the transport vehicle enters the ERDF scale, each RFID tag activates and sends its unique signal to the scale controller/indicator, which interfaces with WMIS. WMIS verifies the data and sends verification back to the scale in the form of a message displayed on a 1.5 meter x 2 meter message board located within the driver's vision. This is an important step because WMIS has been preloaded with the tare weight of each piece of transport equipment.



Fig. 1 Truck at ERDF Scale (Note RFID Tag Locations)

In addition, wireless barcode scanners have been installed in each of the 18 waste transport trucks that allow the driver to link the OWTF to the waste container and waste weight without having to exit their trucks to complete log sheets. Incorporated into the wireless barcode scanners is an alpha-numeric keypad and viewing screen. If an RFID tag does not read, the driver can manually enter information using the scanner. These enhancements have resulted in reducing scale transaction times from four minutes per transaction to approximately 30 seconds.

One invaluable feature of WMIS is the ability to generate a custom report from any data the system collects. This has allowed personnel to track RFID tag performance and determine whether a specific tag is not working properly. Over the first six weeks of WMIS operation, it

was determined that two RFID tags were not reading properly most of the time. Others were reading better, but still not at an acceptable rate and the tags were replaced.

#### *ERDF Scale Activities*

After the first three weeks of WMIS operation, 15 trucks were timed as they traveled through the scale. This evaluation was conducted three weeks after implementation to allow the drivers sufficient time to become comfortable with the new process. Drivers were not aware they were being timed. Timing started when the truck started to enter the scale and stopped when the truck started to roll off the scale. These 15 trucks averaged one minute, fifty-three seconds, an improvement of over two minutes as compared to operations prior to WMIS. It was interesting to note that there was a wide range of performance. Some of the drivers exited the scale within 1:40. Others took up to 2:15 to perform the same function.

On July 7, 2005, ten trucks were timed as they traveled through the scale in a similar manner as above. Not only did the drivers average 1:39, the range did not vary by more than four seconds of this average. That indicates all of the drivers timed are very comfortable with the new system.

Based on 200 shipments per day, WMIS has saved 8 person-hours per day, if there is no backup at the scale, and reduced backup time from 15 minutes to 5 minutes.

### **Dump Ramp Operations**

#### *Disposal Coordinates*

Previously, dump ramp personnel recorded disposal coordinates on the OWTF for a specific shipment. Subsequently, ERDF operations subcontractor personnel hand entered the coordinates from each shipment in to the Open Roads database.

With WMIS, the requirement remains to hand enter the disposal coordinates on each OWTF; however, with WMIS, the OWTF is barcode scanned using a Dolphin™ personal data assistant (PDA) and the disposal coordinates are entered into the PDA where the information is retained in memory. On a daily basis, the stored information is uploaded into WMIS where the waste management cycle is completed. Use of the PDAs at the dump ramp has increased the workload of dump ramp personnel by one minute per shipment; however, ERDF disposal operations are not affected because of the way waste trucks flow through dump ramp operations.

Because of the way barcode scanners operate, there are occasional delays at the dump ramp, especially on very bright, sunny days where barcode reading can be difficult. There is significant time savings for ERDF operations subcontractor personnel that used to hand enter disposal information into the Open Roads database; normally 1.5 hours of savings per day.

#### *Disposal Coordinates Process Improvement*

One potentially significant improvement being evaluated is the use of a global positioning system (GPS) to pinpoint the placement of containerized waste within the ERDF cells. Currently, waste is only required to be located within a 30 foot x 30 foot area within a specific lift (nominally 35 feet). This is not an issue with bulk waste placed in the ERDF; however, if containerized waste is required to be retrieved for some reason, looking in a 31,500 cubic foot

area would be difficult and likely result in excess personnel radiation exposure received. If the location of containerized waste were pinpointed using GPS, packages would be easier to find.

## **Reports**

Under the previous system, data was acquired in the Open Roads database by the ERDF operations subcontractor. On a case-by-case basis, applicable portions of the data were provided to individuals with responsibility for generation of periodic reports. These individuals then populated either an Excel spreadsheet or Access database to generate the specific report.

### *Routine Reports*

Previously, only four routine reports were generated from Open Roads, which were manipulated by users. Generally, it had taken approximately one week to obtain any of these four reports. Then, the data had to be manipulated through either Access or Excel.

Within WMIS, 20 routine reports are available to system users, formatted similar to the final reports users generated in either Access or Excel. As WMIS has removed the intermediate step of the data user to take raw data and convert it to a usable form, this has saved five person days (40 hours) per month.

### *Custom Reports*

Previously, custom reports required a task order to the ERDF operations subcontractor in order to have them develop the report (the data resided within their preview) and could take a few weeks.

With WMIS, if the information resides within the program, a request is made to IS&T to compile the data into the desired format. Depending on the priority, this can happen within the same day of the request. WMIS has saved at least two weeks per request, in addition to the cost of the ERDF operations subcontractor performing the work.

## **FUTURE ENHANCEMENTS**

As with many new software programs, once the users and their management see the advantage of having the program, additional system functions are identified. As a result, the following enhancements are being added this fiscal year:

- Identification of specific shipments that require incoming vehicle surveys and live-time tracking to assure the surveys are completed prior to waste disposal. Included is the use of hand-held computers for radiological controls technicians to document these surveys
- Tracking and document of waste package maintenance requirements and package performance
- Documentation of precise waste locations within the disposal cell using global positioning



## **SUMMARY**

This paper documents that the development and operation of the River Corridor Closure Project's Waste Management Information System has proven to significantly improve operational efficiency, waste tracking, and documentation requirements associated with shipment of waste from remediation projects to the Environmental Restoration Disposal Facility (see Table I and Figure 2 below.)

Table I. Summary of Efficiencies Achieved by WMIS

Activities	Before WMIS	After WMIS		
	ERDF Operations Subcontractor Database	WMIS Operations	Savings	Comments
Waste Designation and Profile <sup>1</sup> Development	Entry by Duratek	Entry by WCH	Zero net gain	All Information now entered by WCH Waste Designation Specialists
Revision Approval	340 hr 0	566 hr 135 hr	284 hr (135 hr)	WMIS electronic approvals are in addition to hard copy approvals
Waste Transportation Specialist Template Development Template Revision <sup>2</sup> Shipping Paper Generation <sup>2</sup>	675 hr 68 hr	405 hr 12 hr	270 hr 56 hr 24 person- hr/day	Import tool savings 2 person-hours/day saved in developing shipping papers (x 12 Waste Transportation Specialists)
Transportation Activities ERDF Scale Operations <sup>2</sup>	13.3 hr/day	5.3 hr/day	8 hr/day	
Disposal Ramp Operations <sup>2</sup> Documenting Disposal Coordinates	N/A	1 minute per shipment	1.5 hr/day	Extra time at dump ramp does not effect operations. Timesaving is due to elimination on disposal data entry by hand
Reports <sup>2</sup> Routine Reports Custom Reports Data Manipulation			40 hr/month 3 wks/report	WMIS eliminates data manipulation Excludes subcontractor cost. WMIS takes hours, not weeks Included above

<sup>1</sup> Based upon WMIS activities from May 2, 2005

<sup>2</sup> Based upon ongoing operations

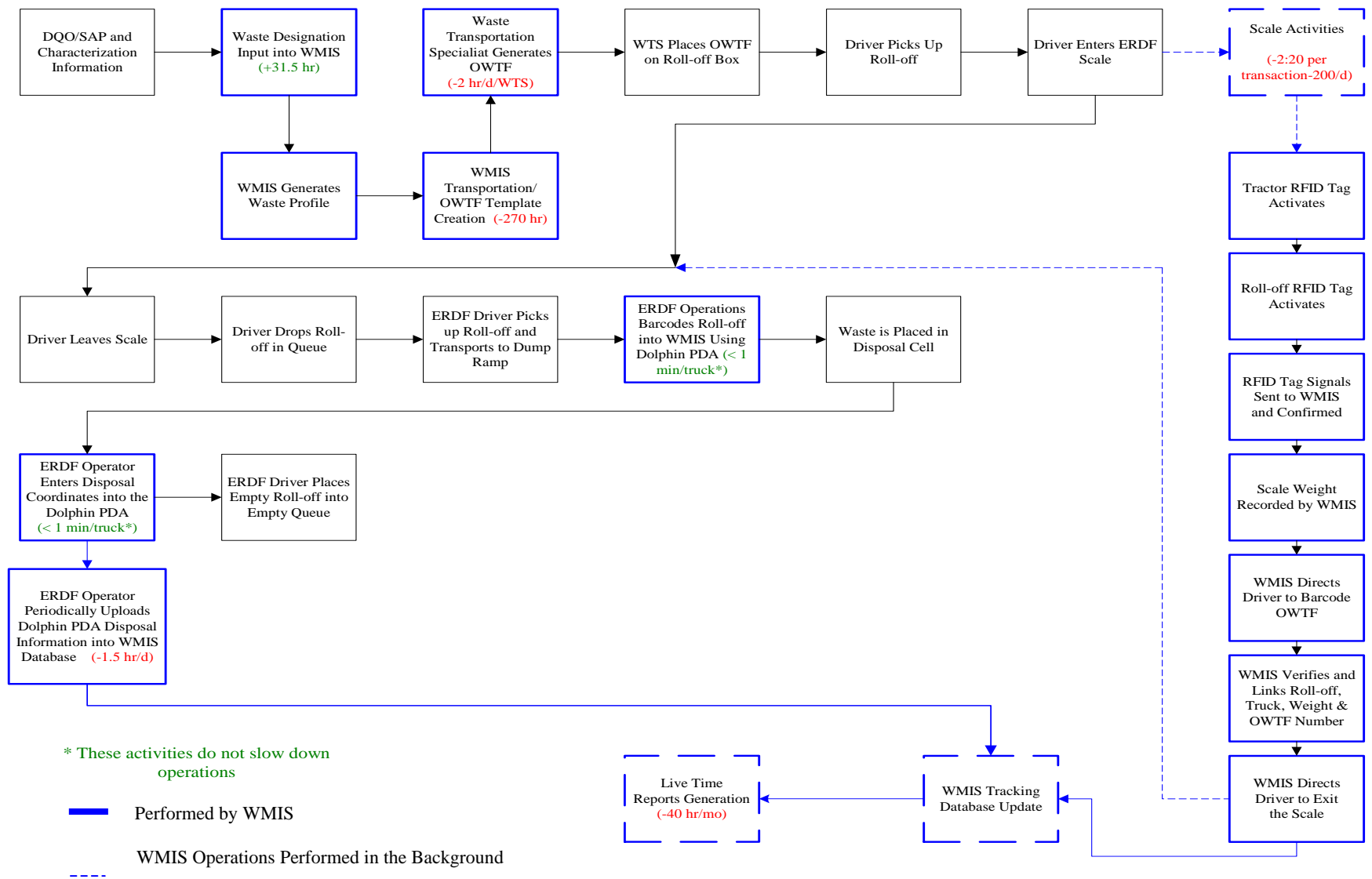


Fig. 2. Waste Management Process Flow