Improving Environmental Sustainability and Reducing Greenhouse Gas Emissions by Incorporating Radio Frequency Identification (RFID) Technology to Optimize On-Site Waste Shipping Processes

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About the Presenter

Rodney Kingrea is currently the Manager of Environmental Compliance and Protection for Bechtel Jacobs Company (BJC), LLC in Oak Ridge, Tennessee. He is responsible for the management and direction of BJC's environmental compliance programs, developing and maintaining BJC's Environmental Management System (EMS) including associated performance documents (e.g., policies, procedures, and program descriptions), negotiating environmental permits and associated regulatory interface, managing environmental compliance support subcontractors, conducting environmental assessments and oversight, and tracking and trending environmental metrics and leading indicators. Rodney has B.S. degrees from Purdue University in Environmental Engineering and Meteorology (1984) and a M.S. degree from the University of Tennessee in Environmental Engineering (1993).

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Presentation Outline

- BJC Work Scope Overview
- Environmental Sustainability Considerations
- Problem Statement
- Project Objectives
- RFID Basics
- How it Works
- Overall Benefits
- Environmental Sustainability Benefits
- Summary/Lessons Learned

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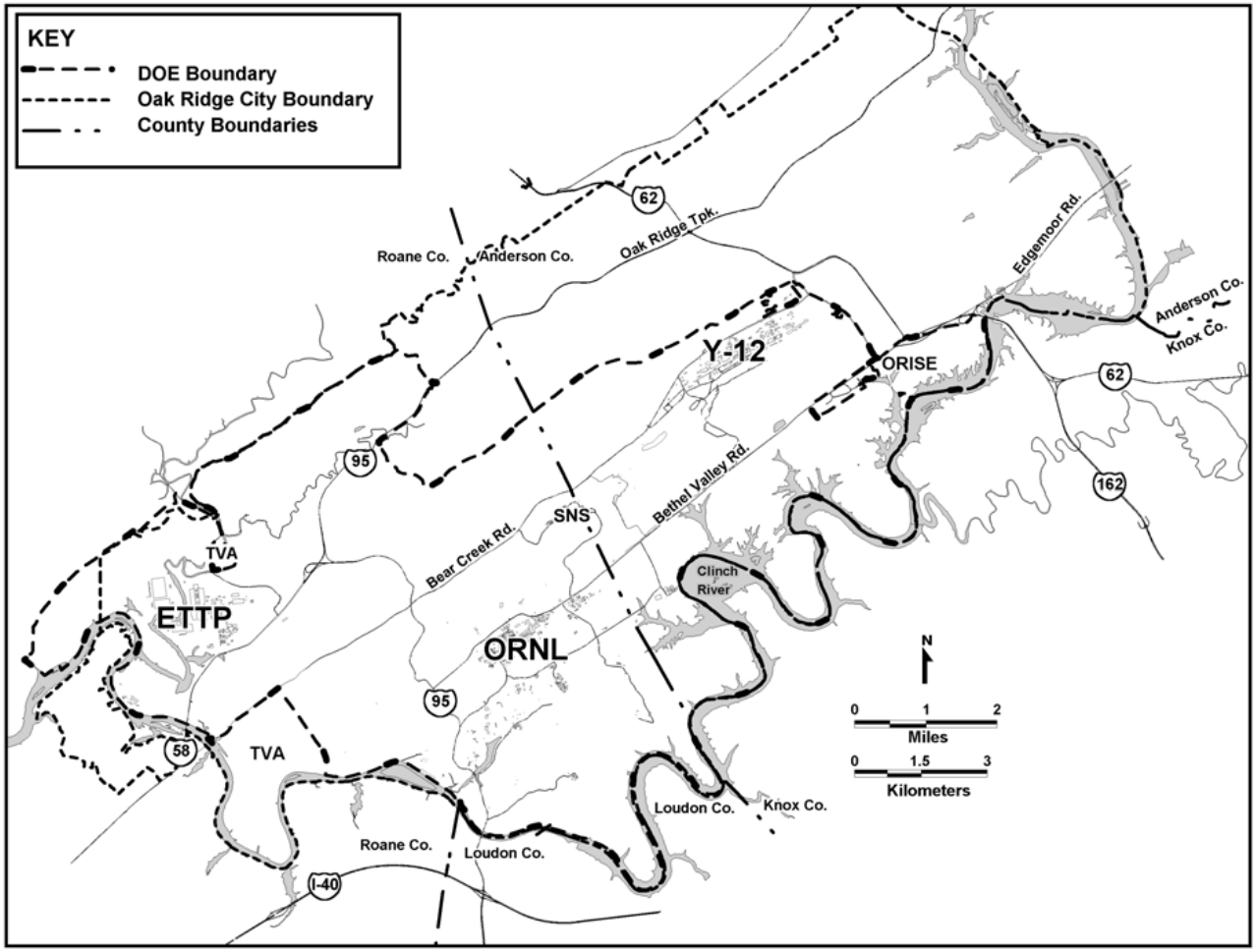
BJC Work Scope

BJC is responsible for cleanup activities within the Oak Ridge Reservation (ORR) to address environmental legacies from the nuclear weapons production and nuclear energy research.

Current scope includes environmental remediation, decontamination and decommissioning (D&D) of radioactively-contaminated facilities, and disposition of the waste.

ORR

- Established in 1943 during Manhattan Project
- Located in Tennessee Valley
- 20 miles west of Knoxville, TN
- 3 Main Sites
- 33,000 Acres



East Tennessee Technology Park (ETTP) Cleanup

ETTP ——— 50,000 shipments ——→ EMWMF

~ 8 miles apart

- **Demolished 220 facilities**
- **Reduced footprint by about 1.2 million ft²**
- **Deactivated 295 facilities**
- **Characterized 277 facilities**

- **CERCLA Disposal Cell**
- **LLW/RCRA/TSCA Waste**
- **Wastes from ETTP, Oak Ridge National Laboratory (ORNL), and Y-12 National Security Complex (Y-12**

Environmental Sustainability Considerations with Waste Transportation

- DOE Order 450.1A, *Environmental Protection Program*
- Executive Order 13514, *Federal Leadership in Environmental, Energy, and Economic Performance.*
- Waste transportation has several environmental aspects that must be addressed:
  - Air emissions (including greenhouse gases)
  - Energy/fuel usage (natural resource depletion)
  - Paper/ink usage (natural resource depletion)

Problem Statement

- **Ensure that the Environmental Management Waste Management Facility (EMWMF) disposal cell can efficiently accommodate up to 240 trucks a day during peak periods.**
  - Improve continuous daytime operations to maintain vehicle flow and communication/harmonization between projects.
  - Establish staging areas for pre-loaded trucks and staggered shifts.
  - Streamline shipping documentation.
  - Security – expediting limited area ingress/egress.

- **Environmental sustainability benefits were not initially recognized or fully understood.**

Project Objectives

Use Six-Sigma Process to

- **Minimize the Cycle Time for the disposition of waste from the K-25 Project to/from the EMWMF.**
- **Implement a truly paperless shipping process using RFID technology that will reduce or eliminate the paperwork associated with shipments.**
- **Automate on-site observations and scale operations ensuring consistent data quality.**
- **Improve operational efficiency and reduce environmental impacts associated with transportation activities.**

Radio Frequency Identification Basics

Radio frequency identification (RFID) is a method of remotely storing and retrieving data using devices called RFID tags. A RFID tag is a small object, such as an adhesive sticker, that can be attached to or incorporated into a product. RFID tags contain antennae to enable them to receive and respond to radio-frequency queries from an RFID transceiver.

How It Works

1. A RFID tag is attached to the vehicle and a Transportation Specialist uploads the truck's ID number and tare weight to the tag.

RFID Tag

How It Works (continued)

2. As the truck is loaded with waste, a Transportation Specialist inputs real-time shipping information into the tag using the handheld device.

Truck Number: 103459
Load Time: 08:34:45 AM
Depart Time: 08:45:55 AM
Gross Wt: 2925 LB
Tare Wt: 2475 LB
Waste Type: ACM
Route: ___
….

How It Works (continued)

3. Portable RFID sensor units along the route retrieve the truck's tag information and then pass the information along to BJC transportation management system.

4. Loaded vehicle is weighed and gross/net weight is automatically recorded as it crosses scales.

How It Works (continued)

5. Project and EMWMF personnel monitor the system's interactive dashboard which show real-time vehicle locations and transmit estimated arrival times to EMWMF.

BECHTEL JACOBS — Radio Frequency Identification Transport System — RFITS

Data Last Refreshed: Thursday, June 17, 2010 at 13:37:29 **Records Returned:** 22

Set Waste Disposition Defaults | Display Generic Dashboard

Edit	Truck ID	Waste Profile No.	Site	Scale Departure Time	ETA (minutes)	Cell Arrival Time	Cell Operation (minutes)	Asbestos	Shipment No.	X	Y	Z	Tracking Code	Dump Ramp	
	10800022	155.1	ETTP	13:21:45	4			None	1080-22-100617-13	S	16	L2		Cell	ETTP RA
	10800015	155.1	ETTP	13:22:47	5			None	1080-15-100617-13	S	16	L2		Cell	ETTP RA
	10800012	6.999	ETTP	13:23:46	6			ACM - Bulk Debris	1080-12-100617-13	V	19	L2	FIXATIVE	Side	K-25 Bui
	10800011	155.1	ETTP	13:25:22	8			None	1080-11-100617-13	S	16	L2		Cell	ETTP RA
	10800014	155.1	ETTP	13:26:58	9			None	1080-14-100617-13	S	16	L2		Cell	ETTP RA
	10800003	6.999	ETTP	13:26:10	9			ACM - Bulk Debris	1080-3-100617-13	V	19	L2	FIXATIVE	Side	K-25 Bui
	10800023	155.1	ETTP	13:28:04	11			None	1080-23-100617-13	S	16	L2		Cell	ETTP RA
	10800031	6.999	ETTP	13:29:23	12			ACM - Bulk Debris	1080-31-100617-13	V	19	L2	FIXATIVE	Side	K-25 Bui
	10800005	6.999	ETTP	13:30:51	13			ACM - Bulk Debris	1080-5-100617-13	V	19	L2	FIXATIVE	Side	K-25 Bui
	10800032	6.999	ETTP	13:31:57	14			ACM - Bulk Debris	1080-32-100617-13	V	19	L2	FIXATIVE	Side	K-25 Bui
	10800028	6.999	ETTP	13:33:39	16			ACM - Bulk Debris	1080-28-100617-13	V	19	L2	FIXATIVE	Side	K-25 Bui
	10800007	6.999	ETTP	13:34:50	17			ACM - Bulk Debris	1080-7-100617-13	V	19	L2	FIXATIVE	Side	K-25 Bui
	10800002	6.999	ETTP	13:04:57		13:33:09	4	ACM - Bulk Debris	1080-2-100617-12	V	19	L2	FIXATIVE	Side	K-25 Bui
	10800019	6.999	ETTP	13:06:12		13:33:25	4	ACM - Bulk Debris	1080-19-100617-12	V	19	L2	FIXATIVE	Side	K-25 Bui
	10800029	6.999	ETTP	13:13:48		13:34:36	3	ACM - Bulk Debris	1080-29-100617-13	V	19	L2	FIXATIVE	Side	K-25 Bui
	10800021	6.999	ETTP	13:12:47		13:34:26	3	ACM - Bulk Debris	1080-21-100617-13	V	19	L2	FIXATIVE	Side	K-25 Bui
	10800020	6.999	ETTP	13:15:51		13:35:47	2	ACM - Bulk Debris	1080-20-100617-13	V	19	L2	FIXATIVE	Side	K-25 Bui
	10800010	6.999	ETTP	13:14:53		13:35:40	2	ACM - Bulk Debris	1080-10-100617-13	V	19	L2	FIXATIVE	Side	K-25 Bui
	10801044 HTI44	6.999	ETTP	13:09:29		13:36:02	1	ACM - Bulk Debris	1080-1044-100617-13	V	19	L2	FIXATIVE	Side	K-25 Bui
	10801054 HTI54	6.999	ETTP	13:08:47		13:36:39	1	ACM - Bulk Debris	1080-1054-100617-13	V	19	L2	FIXATIVE	Side	K-25 Bui

How It Works (continued)

6. Upon arrival at EMWMF, operators read the RFID Tags with the handheld readers and enter disposition data back to the tag.

7. Data is transferred to the Waste Transportation Management System.

Overall Benefits of RFID

- **Six Sigma Performance Improvement Project (PIP) estimated the savings to the K-25 Project alone to be $7.6M in cost avoidance.**
  - **Transportation Specialists are in the field longer, creating more shipments.**
  - **Access to 'real-time' data enables efficient use of fleet.**
  - **Eliminates 100% vehicle searches at Security Inspection Station.**
  - **Cycle time reduced by 25 minutes per roundtrip shipment.**
- **Elimination of paper shipping documents.**

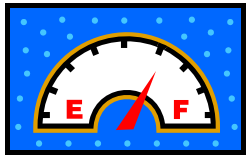
Overall Benefits of RFID (continued)

- **Rapid verification of shipment data.**
  - **Waste lot number**
  - **Waste characteristics**
  - **Handling requirements**

- **Facilitates data input.**
  - **Information directly uploaded into database**
  - **Eliminates manual database input**
  - **Reduced error rate**

Environmental Sustainability Benefits (initial 14 months/30,000 shipments)

- Use of over 10,000 gallons of diesel fuel has been avoided.



- Carbon dioxide and nitrogen oxide emissions reduced by over 230,000 and 4,000 pounds, respectively.

- Use of over 250,000 pages of paper has been avoided
  - Prevented release of hundreds of pounds of air pollution.
  - Saved 30 trees.
  - Avoided use of 12,500 gallons of water and 5,000 kilowatts of electricity.
  - Avoided use of 25 toner cartridges.

- RFID has been expanded to other ARRA projects identified at ETTP, ORNL and Y-12. Expansion to other DOE sites in progress.

Summary/Lessons Learned

- **Environmental sustainability benefits are almost always inherent in business efficiencies.**

- **Make use of and leverage Six-Sigma Process to identify environmental benefits.**

- **RFID will continue to be expanded in waste transportation and other applications in the future.**

Questions?

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