Managing Work Flow and Logistic at Waste Processing Facilities Using the Waste Compliance & Tracking System - 15392

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ABSTRACT

Work flow and logistics at a busy radioactive waste processing complex or permitted treatment, storage, and disposal facility (TSDF) can pose a monumental challenge. An efficient operation requires good communication between engineering, logistics, and waste operators. The Los Alamos National Laboratory (LANL) has implemented an application that facilitates seamless communication of work flow requirements, between engineering, logistics, and waste operations personnel in the field.

The Waste Compliance & Tracking System (WCATS), a comprehensive waste management system designed at LANL, provides four key elements to support logistics: (a) the container work path, (b) directed unit operation requests, (c) notification of pending operations, and (d) real-time status tools for office and field workers. The combination of these elements allows everyone to function as a team, with a shared knowledge of what is needed to accomplish facility objectives.

The first element is like a road map indicating which unit operations are needed and in what sequence they should be performed; this is referred to as a "work path". It automatically routes a waste item or container from operation to operation. For example, a given work path might indicate that waste items require radiological survey, radioassay, and a technical review, in that order. When the work path is assigned to a container, the system enforces the correct order of operations.

Directed unit operation "requests" , the second element, fills a gap between pre-planned, formal "work path" activities and the need for flexibility to direct preparatory operations or deal with unexpected issues, like staging or mining containers in preparation for a shipment or transferring containers from one storage unit to another to clear a path for building maintenance. Logistics engineers prepare these "requests", and the system monitors the status and completion of the work.

The third element, notifications, allows team members to subscribe to and receive notice that an operation is pending, initiated, or complete. This functionality supports a range of communication options, including e-mail, cell phone, pager, or application in-box messaging. Notifications allow waste operations personnel to multi-task, and remain in the loop on the status of facility-wide activities.

Finally, the fourth element provides tools that communicate work path pending operations and directed requests to field workers on their mobile computer, allowing them to mine or pick containers from storage units, and leverage the capabilities of a barcode scanner to avoid selection mistakes. Oversight and summary tools are provided, allowing logistics personnel to monitor work path and request task status, identify workflow bottlenecks, and maximize the efficiency of waste operations.

The Waste Compliance and Tracking System (WCATS) provides an innovative, comprehensive set of tools that allow large-scale radioactive waste processing facilities to manage logistics, maximize efficient use of the workforce, and create a team environment, where everyone from management to the waste handlers have an understanding of the work load and what needs to be accomplished.

INTRODUCTION

Logistics at a waste management facility are straightforward when the number of waste containers, number of unit operations, and number of personnel are relatively small. When considering a single container of radioactive waste, with specified workflow, its easily managed as it moves from operation to operation. For example, a six step process, as shown in Table I, dispositions a container from the point of generation to final disposition at an offsite disposal facility.

TABLE I. LLW container workflow example

LLW Container Workflow Example		
Step 1	Prepare container	• Confirm procurement • Identify calibrated tools • Install filters, liners, and so forth
Step 2	Package waste	• Identify waste items • Partition radionuclides • Record gross weight • Calculate radiological properties • Verify container limits are okay
Step 3	Radiological survey	• Record dose rate results
Step 4	Transfer to storage unit	• Confirm compliance with technical safety requirements (TSR)
Step 5	Radioassay container	• Load radioassay results • Calculate radiological properties
Step 6	Ship waste to disposal facility	• Verify waste acceptance criteria • Prepare manifest(s)

Historically, workflow (i.e., the sequence of operations) is managed in one of two ways. The first and oldest method, and certainly a viable one, is to attach a paper “traveler” to the drum and as each step in the process is performed the transaction is recorded by dating and initialing this document. Anyone who inspects the container can read its traveler, and know what operations remain and which operation is pending. The paper traveler does have some deficiencies, in that (a) it cannot communicate status information to logistics personnel or for that matter anyone unless they are standing next to the container, and (b) procedure or process changes are frustrating because someone must locate and replace or correct the paperwork on each affected container.

The second approach, now common in industry, uses a database application, where field workers record their transactions via mobile computers with barcode scanners. When an operation is performed, radioassay for example, essentially an electronic traveler records the transaction, and logistics personnel can begin considering the next step in the process. Now, work flow can be changed on the computer application, and there is no need to retrieve and correct paper travelers attached to individual containers. However, one glaring problem remains; the logistics person knows the status of the container, but the field worker, depending on the sophistication of the software application, may not know what subsequent operations are now available for the container. This impacts the productivity of operations personnel, who perform transactions that were specified at the beginning of their shift based on information current at that time, but do not experience a continuous flow of logistics information throughout their shift.

When the number of containers to manage is in the thousands, unit operations in the dozens, and the number of supporting operations and logistics personnel in the hundreds, the efficient communication and coordination of work at a busy facility poses a daunting challenge. The Waste Characterization and Tracking System (WCATS) was designed to address this problem using the concept of (a) work paths, (b) directed requests, (c) automated notifications, and (d) bi-directionally communicated transactions between a central database and the mobile computers in the field.

THE “WORK PATH” PROVIDES CRADLE TO GRAVE DIRECTIONS

In WCATS, a “work path” is assigned to each container, indicating the sequence of operations planned to disposition the waste. A work path can be simple or complex (see Figure 1), with unit operations ordered in serial or parallel configurations to match a facility’s waste acceptance criteria and procedures. The system will automatically route the assigned container from the first operation to the last, and prevent operations from occurring out of order.

Operations displayed in parallel can be specified as concurrent operations or 1-of-n operations. Concurrent operations are independent activities that can be started without regard to the status of the other unit operations. For example in Figure 1, the “Disposition Request” and “Nuclear Material Discard Review” are parallel operations where both activities must be completed to perform the subsequent transport operation, but they can be started simultaneously and have no interdependencies. Another type of parallel configuration is referred to as a 1-of-n operation, where any one of the “n” activities can be performed to satisfy the work path. For example, maybe there are three radioassay units designated as NDA-1, NDA-2, and NDA-3, and the first available assay machine can process the container.

Work paths are built visually in the application, according to waste type (e.g., LLW) and assigned to individual containers. A range of work path properties allow the administrator to configure the work path to be strictly enforced, allow storage unit movement, incorporate optional unit operations, repeatable operations, rework, or to engage logistics personnel oversight at designated decision points in the workflow. This flexibility is necessary to accommodate the wide range of workflow and logistics issues encountered at large treatment, storage, and disposal facilities.

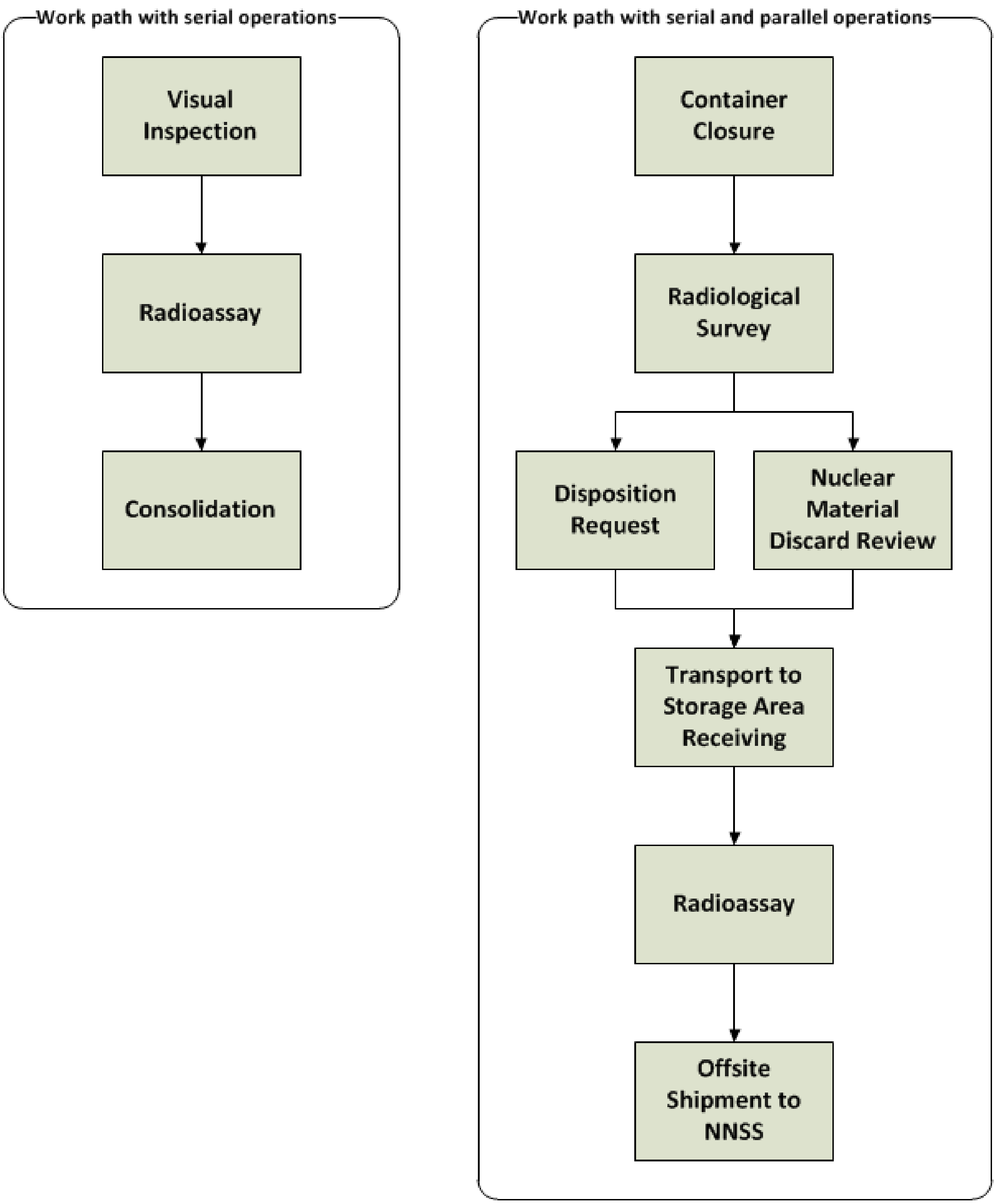

Fig. 1. Two work path examples, one simple (left) and one more complex (right)

DIRECTED REQUESTS INITIATE ONE-OFF OPERATIONS

The work path is a great tool for implementing and managing established work flow, but it's poorly suited for the one-off activities that occur at a waste management facility. On a daily basis, containers are moved or undergo unique activities to support facility maintenance, safety, or staging operations. For example, maybe the floor of two storage units A and B are undergoing an annual inspection and sealing, and while that work is underway, containers need to be moved back and forward between the two storage units. In this, one-off situation, logistics personnel can submit a directed request, which would indicate that containers in storage unit A must be moved to storage unit B. In this example, the directed request is communicated to operations personnel, and the application will automatically track the work to completion, even if it requires multiple transfers spanning multiple shifts.

NOTIFICATIONS KEEP WASTE MOVING

The computer system may know the progress of each container and what operation is needed to move it forward in its work path, but that information doesn't lead to an efficient operation unless it's somehow communicated (i.e., pushed) to the person who owns the unit operation with pending work. Notifications are automatically generated by the application, and sent as emails, SMS messages, pager notifications, or in-application messages to the user.

FIELD WORKERS WITH A MOBILE COMPUTER LOCATE AND IDENTIFY CONTAINERS

Up to this point, we have discussed work paths and directed requests, so the application knows the sequence of operations and what work is needed to move each container forward in its work flow, and we have identified notifications as a mean of communicating that a container(s) is pending a unit operation, but we have not addressed how the field worker, who is not sitting at a desk, will efficiently accomplish the work. Ideally, the field worker, via a mobile computer (i.e., barcode scanner) would be aware of which containers are pending operations, whether that be via a work path or directed request, and the device would assist the field worker in locating, mining, and accomplishing the necessary transaction. In order for this to happen, there must be a central information system and field computers that can communicate information or transactions bidirectionally, as shown in Figure 2. This allows logistics personnel, the operations center, and field workers to all be aware of a container's current status, regardless of their location, and whether they are using a desktop workstation or a mobile computer with a barcode scanner.

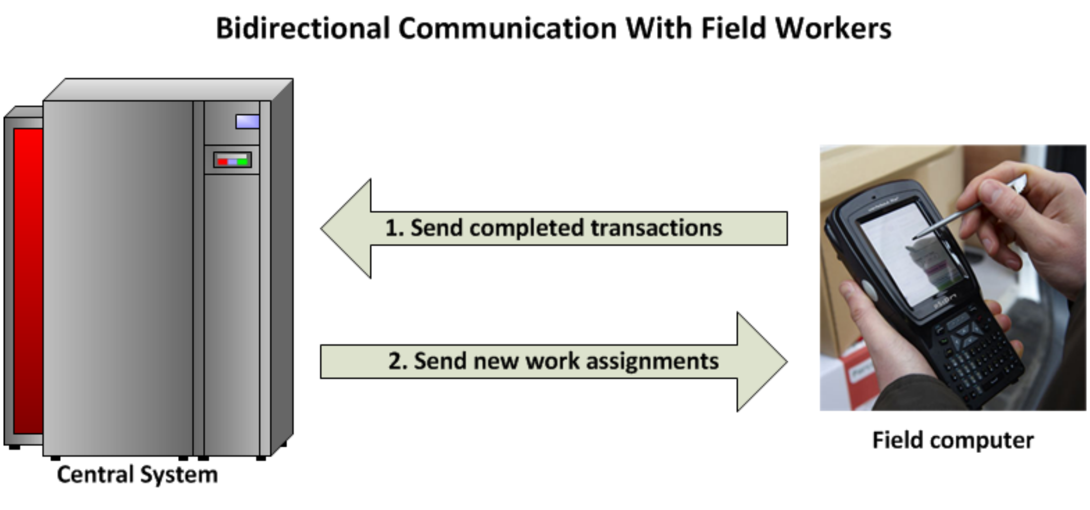

Fig. 2. Transactions are communicated bidirectionally between the system and field computers.

Consider the work path diagram shown in Figure 3, where each container must undergo (1) inspection, (2) flammable gas analysis, (3) real-time radiography, and (4) radioassay in that order. Assume that operations #1 and #2 are complete, and just as soon as operation #2 is complete the logistics personnel want the system to automatically request operation #3, real-time radiography (RTR). At that moment, the system will generate a notification to the RTR operator and others as necessary to indicate that containers are ready for that process. And, the field workers, will see, via their mobile computer, which containers are ready for that operation (similar to the user interface screen shown in Figure 3), where those containers are currently located, and receive confirmation that they have mined, staged, transported, and processed the correct containers for RTR.

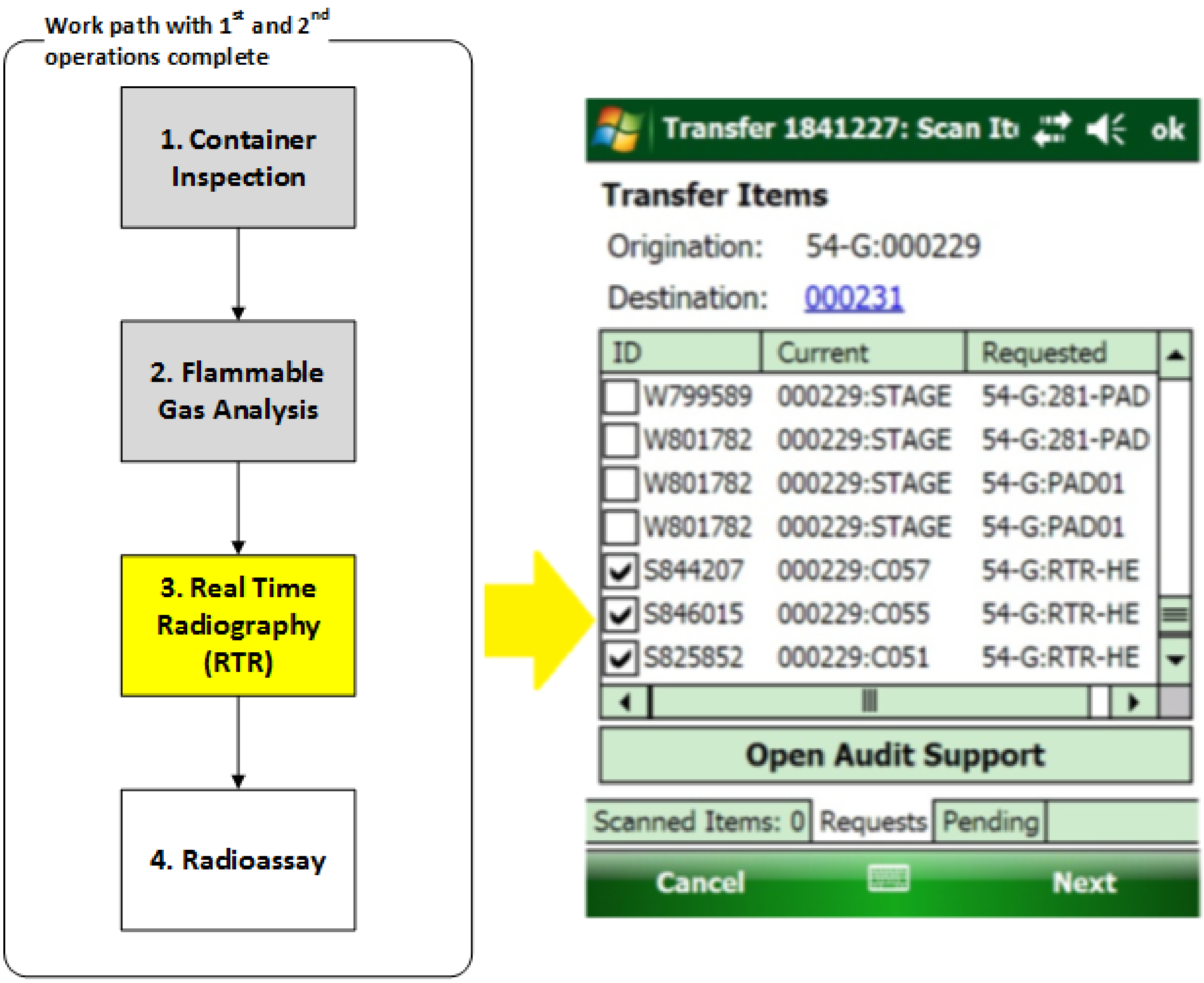

Fig. 3. Pending operations are transmitted to mobile computer in the field.

CONCLUSION

By integrating the capabilities of work paths, directed requests, automated notifications, and mobile computers for field workers, the WCATS application provides a logistics tool that goes beyond capturing basic treatment, storage, and disposal transactions, allowing large waste management facilities to improve the efficiency of operations by automating the communication of workflow from logistics engineers to the operations center and field workers. Everyone can see the current state of operations and what needs to be done, and work together as a team to efficiently accomplish operational goals.