INFORMATION CLEARANCE REVIEW AND RELEASE APPROVAL

Part I: Background Information

Title:	Information Category:
Collaboration, Automation, and Information Management at Hanford High Level Radioactive Waste (HLW) Tank Farms	☐ Abstract ☐ Journal Article ☐ Summary ☐ Internet ☐ Visual Aid ☐ Software ☐ Full Paper ☒ Report ☐ Other
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Part IV: WRPS Internal Review

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Part V: IRM Clearance Services Review

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Other:	☐	☐	

Comments:

- Please consider suggested edits – RROX
- Not sure commas are needed with bullet comments SB

RROX
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Prepared for the U.S. Department of Energy
Assistant Secretary for Environmental Management

Contractor for the U.S. Department of Energy
Office of River Protection under Contract DE-AC27-08RV14800

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Collaboration, Automation, and Information Management at Hanford High Level Radioactive Waste (HLW) Tank Farms – 14210

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ABSTRACT

Washington River Protection Solutions (WRPS), operator of High Level Radioactive Waste (HLW) Tank Farms at the Hanford Site, is taking an over 20-year leap in technology, replacing systems that were monitored with clipboards and obsolete computer systems, as well as solving major operations and maintenance hurdles in the area of process automation and information management. While WRPS is fully compliant with procedures and regulations, the current systems are not integrated and do not share data efficiently, hampering how information is obtained and managed.

INTRODUCTION

In its transition to a first-class operations company, WRPS is spending considerable time and resources upgrading tank farm structures, systems and components. WRPS is developing and overseeing process-control computer systems and implementing process-software automation solutions, including wireless technology to modernize and improve conduct of business. WRPS will see significant savings in operations cost during the maintenance lifecycle while increasing productivity as the result of standardizing process systems, leveraging technology, and most importantly collaborating across the DOE complex. These improvements are planned with a forward-looking vision to support seamless integration with the Waste Treatment Plant (WTP) ensuring that WRPS is well prepared to support systems integration with the vitrification plant.

While WRPS is fully compliant with procedures and regulations, the current systems are not integrated and do not share data efficiently, hampering how information is obtained and managed. Even though the data is available, there is not an equivalent amount of usable information. Too much time is spent collecting and analyzing data to produce information that leads to informed decisions. The WRPS vision for automation and information management is to collect and effectively package the data as reliable information to support timely and efficient decision-making. WRPS is integrating its automation and information management systems and ensuring the systems implemented can share data and information.

Strategically deploying the new systems and platforms at tank farms has significantly increased the reliability and availability of the tank farm support systems.

DISCUSSION

Collaboration

These automation and information management systems, including technology deployment, at Hanford Tank Farms are being developed in collaboration with the Waste Treatment Plant (WTP), Savannah River Remediation (SRR) and URS Professional Services, including Hanford's Lockheed Martin Services Inc. (LMSI) and Mission Support Alliance (MSA). This collaboration includes but is not limited to sharing of system design and software development standards, safety instrumented system design, training simulators, and wireless solutions, including consolidation of control room best practices. By integrating data sources and mobilizing information through putting mobile devices into the hands of workers, so they can access plant or business information in the tank farms, WRPS is improving conduct of operations and maintenance, including work management.

Plant Monitoring and Control

Plant Monitoring Solutions

For the last several years, WRPS has been implementing a strategy for a seamless waste processing stream through consolidation and replacement of legacy Programmable Logic Controller systems and Distributed Control Systems into a single platform to support services across the Hanford Tank Farms, Waste Feed Delivery, and Waste Treatment Plant complex.

The introduction of common hardware/software architecture allows the Hanford Waste Feed Delivery and Waste Treatment Plant to realize the following added values:

- Increases in facility operation time due to the use of reliable industry proven products
- Decreased maintenance costs due to consolidated training and more efficient craft utilization
- Minimized human error through the use of similar graphical and engineering software development environments
- Increased availability of process information for engineering analysis in pursuit of further process improvements
- Common operator graphical interface between facilities resulting in a more versatile and flexible workforce
- Increased instrumentation monitoring for predictive maintenance and automated asset monitoring
- Reduced startup/shutdown time for controlled processes
- Fewer spare parts to procure and maintain
- Decreases in overall lifecycle cost to process waste streams

Control System Upgrades

Currently, all WRPS Process Control Systems are General Service (GS) systems. However, updates to the control strategy in the Documented Safety Analysis (DSA) is causing some functionality to be considered Safety Significant (SS). In response, WRPS is implementing a contractual requirement to apply ANSI/ISA 84.00.01 (ISA-84), Functional Safety: Safety Instrumented Systems for the Process Industry Sector, and establishing procedures to ensure the appropriate lifecycle management of process control systems that support and perform a safety function. In some cases, this has required evaluating and dedicating existing field equipment for performance of a safety function, and in others, WRPS has provided a separate Safety Instrumented System to provide the required function.

Human Performance Improvement (HPI) Tools for Operations and Engineers

Development and Testing Systems

Within tank farms, WRPS has invested in deploying engineering hardware and software development and testing systems. The use of development systems that mirror the production control system in hardware and software functionality provides the following added values:

- An offline platform for designing, debugging, and testing control system modifications before installation into the production control system
- Increased robustness of new control loop designs through offline testing
- An offline system for testing vendor patches and upgrades prior to introduction into the production control system
- Sharing of software code and libraries amongst software development efforts

- Reduction in testing requirements and quality related risks by use of commercially proven software libraries,
- Reduction in upgrade compatibility issues for future control system releases and patches.

Operators Training Simulator Systems

WRPS is implementing operators training simulators to improve conduct of operations and enhance operator proficiency. The goal for the simulators is to provide operators with realistic rehearsals for situations which require an operator to respond instinctively with competence and confidence. In addition, the simulator is used to maintain operator qualifications and the site is no longer required to process a water run, saving tank space and operating costs. The use of process simulation systems provides additional added value by:

- Providing a safe platform for Operator training and qualification
- Improved operator responses to abnormal conditions
- Shortening total implementation time by providing immediate feedback that simulates plant conditions
- Providing capability to evaluate and reduce production system disturbances
- Providing a platform for procedure development, review and validation

Leveraging Technologies

Wireless Monitoring and Control

WRPS is establishing wireless infrastructure in the Tank Farms to utilize proven technology and simplify data communication from the instruments. Wireless systems to collect safety-significant and non-safety data in tank farms, such as leak-detection and temperature monitoring systems, are being piloted, tested and field deployed. Ultimately, wireless applications will be fully implemented to transfer data between the field/instrument level, control networks, and enterprise networks thus reducing significant project cost.

Safety Significant Wireless Monitoring

The WRPS wireless solutions have been further investigated to demonstrate use of General Service wired and wireless (Wi-Fi) Ethernet based communications in support of a Safety Significant application, while still using readily available equipment and established communications protocols. The safety components and safety communications protocols are commercially available using equipment which already has Technischer Überwachungs-Verein (TÜV)™ certification to international safety standards including IEC 61508. The use of a fail-safe communications protocol in the recommended approach allows the safety data to be communicated between PLCs, and between PLC & safety I/O over General Service components such as Wi-Fi clients, Wi-Fi access points, Ethernet cables and Ethernet switches. Using the safety pedigreed communication protocol, for this application, only the Safety PLC and I/O at either end which uses the data need to be Safety Significant.

Alarm Standardization and Rationalization

Nuisance alarms are a distraction to effective operations, causing potentially critical alarms to be missed while dealing with nuisance low priority alerts. WRPS has reduced nuisance alarms in the tank farms by more than 3,000 alarm events over the past three years implementing guidance from ISA 18.2, Management of Alarm Systems. Adding filters, fixing field equipment, removing alarms from decommissioned equipment, categorizing process and system alarms including programs for periodic

alarm review and analysis are just a few examples of methods used to reduce nuisance alarms in tank farms. With the reduced noise and distractions, operations can now analyze the real causes behind alarms and respond appropriately, rather than reacting to an overwhelming number of nuisance alarms. The next planned improvement is in the areas of facility alarm standardization and alarm rationalization.

Preventive Maintenance and Asset Monitoring Systems

For Tank Farms, maintenance costs are estimated at thirty percent of operations expense (OPEX). Predictive maintenance, based on remote monitoring and automated equipment health status in the field, will enhance the current preventive programs that are based on a fixed maintenance schedule and can significantly reduce maintenance cost. WRPS is piloting predictive maintenance and automated remote asset monitoring in order to decrease the burden of current Preventive/Planned Maintenance tasks relating to the tank farm assets including reduced maintenance time spent inside the farms that can be radioactive contamination and/or radiation areas.

Centralized Control Room

WRPS recognizes that consolidating control rooms has multiple benefits. A central location improves efficiency and effectiveness of operations and maintenance tasks in addition to significantly improving plant status control. Multiple control rooms are being centralized in a common location for centralized process monitoring and status control of tank farm systems. This will ultimately replace control rooms in six different locations. Figure 1 shows the conceptual rendering of the centralized control room.

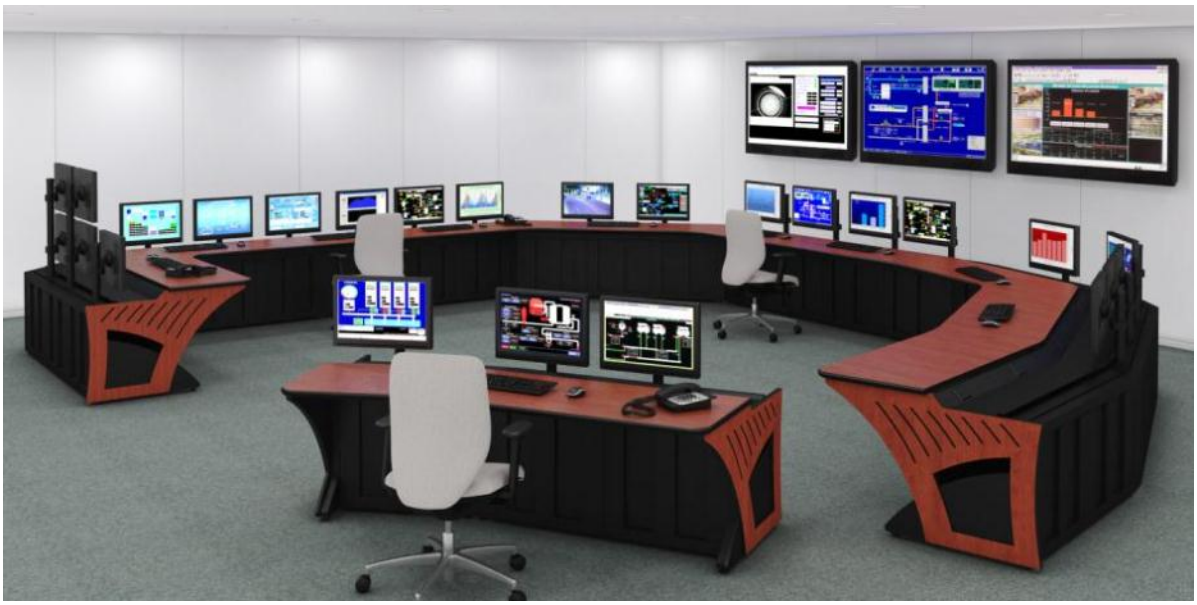

Figure 1: Rendering of Centralized Control Room

Status Control – Information Management

Web-based software solutions are developed to enhance information availability and to link data sources in consolidated dashboards available to Operations, Engineering, Maintenance, and management. Because they are web-based, the end user has plant information at their fingertips for informed decision making.

WRPS develops software tools using standard practices permitting site-wide implementation. All tools are either web-based or on a path to be upgraded to be web-based and hosted on servers maintained by the Mission Support Services/Lockheed Martin Services Incorporated (MSA/LMSI) site contractor. These value added tools provide the following benefits:

- support Human Performance Improvements (HPI)
- provide for ease of information access
- make information readily available for operations
- reduce paperwork / improve operator efficiency
- improve conduct of operations
- minimize operator error
- increase availability / usefulness of data as information
- minimized operations procedures development
- enhance software configuration management and status control, and
- provide for better standardization

CONCLUSIONS

Over the last several years, WRPS has been taking planned careful steps to invest in and implement process automation and information management system that will provide significant long-term cost savings. Whether you are in business management, plant engineering, radiological control, environmental, or in the field conducting maintenance, the benefit of collaboration, reliable systems, efficient information management, and systems sharing data, is required for improved productivity, cost avoidance/savings, timely and efficient decision making.

REFERENCES

1. International Society of Automation (ISA), ISA-84.00.01, *Functional Safety: Safety Instrumented* Systems for the Process Industry Sector, (2004).
2. International Society of Automation (ISA), ISA-18.2, *Management of Alarm Systems*, (2009).
3. International Electrotechnical Commission (IEC), 61508, Functional Safety of Electrical/Electronic/Prgorammable Electronic Safety-related Systems, Edition 2.0 (2010).