

“Maintaining Environmental Sustainability through Application of Environmental Knowledge Management at the SRS” – 11400

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ABSTRACT

The Savannah River Site (SRS) has managed environmental compliance for many years using an expert based organization that applied their knowledge on an as needed basis. With the knowledge that this experienced staff would some day retire or transfer from their environmental expert positions, Savannah River Nuclear Solutions (SRNS) developed a new approach to knowledge management that focused on documentation, proper evaluation, field involvement, qualification, development of a knowledge portal and assessment. This presentation will provide insight into how the SRNS Environmental Integration & Environmental Services (RI&ES) organization makes sustainable environmental decisions using updated integrated processes and techniques.

INTRODUCTION

SRS is a 310 square mile National Environmental Research Park (NERP) that is currently managed with the use of over 500 environmental permits containing 10 to 100 requirements each that are ever changing. In addition, there is constant change in site operations and project activity. This situation is further complicated by having multiple contractors responsible for environmental management at the SRS. The current count is seven prime contractors. The starting point for identifying the knowledge needed to successfully manage SRS was defined by the current resources assigned to the environmental organization. RI&ES defined the resources needed to accomplish the scope defined in the SRNS contract by developing Work Packages through a disciplined Work Breakdown Structure approach. The scope was further defined by developing forty plus Activity Planning Worksheets that listed scope, resources, and cost associated with detailed environmental functional support for SRS facilities and programs. RI&ES then created a Knowledge Map that identified current and future scope associated with all SRS activities. Critical knowledge linked to the scope was identified and gaps were identified (see Figure 1). A plan is being developed to address the gaps to ensure no critical knowledge is lost as a result of retirements or transfer of technical resources.

Programs/Projects	Scope Definition	Knowledge Guardian (SME)	Knowledge Guardian (Alternate)
Asbestos	Known	Yes	Yes
Clean Air Act	Known	Yes	Yes
Clean Water Act	Known	Yes	Yes
Comprehensive Environmental Response, Compensation Liability Act	Known	Yes	Yes
Environmental Management System	Known	Yes	No
Environmental Monitoring	Known	Yes	Yes
Federal Facility Agreement	Known	Yes	Yes
Green House Gas	In Progress	Yes	No
National Environmental Policy Act	Known	Yes	Yes
Pesticides	Known	Yes	No
Polychlorinated Biphenyl	Known	Yes	No
Radioactive Waste Management	Known	Yes	Yes
Resource Conservation & Recovery Act	Known	Yes	Yes
Site Treatment Plan	Known	Yes	No
Area Completion Project	Known	Yes	Yes
Construction	Known	Yes	No
Deactivation and Decommissioning	Known	Yes	Yes
E-Area	Known	Yes	Yes
F Canyon	Known	Yes	No
H Canyon	Known	Yes	Yes
Infrastructure Services	Known	Yes	Yes
K-Area	Known	Yes	Yes
L-Area	Known	Yes	Yes
Liquid Waste Operations	Support	Yes	Yes
Mixed Oxide	Support	Yes	Yes
Plutonium Disposition Comprehensive	In Progress	Yes	No
Salt Waste Processing Facility	Support	Yes	Yes
Savannah River National Lab	Known	Yes	Yes
Tritium	Known	Yes	Yes

Figure 1. RI&ES Knowledge Map of Current and Future Environmental Scope

REGULATORY INTEGRATION ALIGNMENT WITH KNOWLEDGE MANAGEMENT

In addition to SRNS environmental responsibilities, SRNS was also selected as the site integrator for all regulatory interactions. RI&ES managed this responsibility by creating a Senior Environmental Management Council (SEMC) that conducts business using a shared knowledge approach to environmental risk identification, evaluation, prioritization and management. The synergy between seven contractors has been nothing less than excellent when you consider the diversity of their activities and their contract responsibilities. Each contract/project has a unique ‘knowledge’ baseline that has been developed to meet the specific need of the project. Some knowledge

has short term use while other sustainable aspects of the projects have long term use. In either case, as knowledge is developed and shared, the knowledge is used to resolve issues/problems and as each issue/problem is resolved, it is recorded in a risk management Challenge Opportunity and Resolution (COR) database portal for later use by all parties. This knowledge sharing has opened the door to a transparent, synergistic, and sustaining practice that is both supported and respected by the customer. The COR database portal is integral to the larger SRNS Knowledge Portal and will be explained more fully later in this paper.

KNOWLEDGE FORUMS

Due to the rate of change associated with the landscape, priorities and regulatory requirements, RI&ES endorsed the continuance of technical forums designed to address technical issues and ensure appropriate venues for communication. The forums are made up of new and experienced technical staff and technicians in all media areas. The variety of these forums is designed to ensure comprehensive coverage of the main technical areas of focus. These forums are referred to as Working Groups in which everyone is encouraged to share their knowledge and engage in problem solving. The result is sharpened skills, awareness of issues, mentoring opportunities, and consistent problem solving. Discussions are captured in Meeting Minutes and Actions are tracked to completion. Some of the forums are listed below:

- 1) Joint National Environmental Policy Act (NEPA) Working Group
- 2) Asbestos Working Group
- 3) Water Working Group
- 4) Radioactive Waste Management Basis Working Group
- 5) Environmental Innovation Working Group

BALANCING THE KNOWLEDGE BASELINE

RI&ES maintains sustainability at SRS by aligning the development and sharing of its knowledge with the needs of the site. As the needs for new knowledge increase, so does the need for the environmental experts to increase their knowledge. As the need decreases, RI&ES shifts its focus or reduces the knowledge base to align with the site's needs. This is accomplished by holding the RI&ES management team accountable for aligning SRS current baseline scope as defined in RI&ES work packages and activity planning worksheets.

KNOWLEDGE SHARING IS REWARDED

The adage that “knowledge is power” was alive and well at SRS. It is believed that this culture had been around for many years at SRS due to the many reductions in workforce campaigns. It was a self preservation action to learn the specifics of a job or project and to keep all knowledge with one or two individuals so that they would be in demand. The concept developed by RI&ES was to recognize and respect the knowledge guardians, but at the same time assure them that the long term success of the site was dependent on a reduced operation leading to the possibility of new programs. This reduced operation required the refocus of their current knowledge management from long term maintenance to short term maintenance for some older subject matter and the learning of new subject matter for newer programs/projects. The organization began to realize that if their old practices were not altered, their knowledge would no longer be needed by the organizations or projects that were also changing as a result of changing missions. If an organization or project no longer needed old knowledge, then it was not going to be used or funded. Knowledge Guardians had knowledge sharing added to their performance objectives and an on-the-spot (OreoTM) recognition campaign began to show positive results for a quality branded organization.

KNOWLEDGE PORTAL

The resources working on environmental compliance are significant at SRS; therefore the need to capture the knowledge so that it can be used in a consistent manner with consistent results is vital to the success of the site. This portal is known as the RI&ES Environmental Knowledge Portal located on the RI&ES Website. This portal is managed by the environmental librarian reporting to the Director of RI&ES. The portal contains historical files, documents, and reports that are vital to decision making. Contents are updated periodically to align with changing laws and regulations. The portal also contains site level and program specific procedures to the tune of 195. A campaign to evaluate the adequacy and applicability of the knowledge contained in each procedure was pursued over a six month period of time. The evaluation concluded that a consolidation and reduction was required to make the procedures usable for present and future use. The subject matter experts (SMEs), knowledge guardians, were challenged with this responsibility since they used the procedures on a frequent basis. The evaluation had a slow start until the Director of RI&ES reminded the SMEs that the quality of their work will determine the success or failure of the organization due to the comprehensiveness of the evaluation. When the SMEs

finally saw the opportunities that the updates were providing in terms of correcting outdated knowledge and creating clarification and direction, they became energized and engaged. The efforts resulted in a teaming approach that produced incredible results. 195 procedures were reduced to 94. Ten Manuals were reduced to two. The effort now allows the organization to focus on the essential knowledge necessary to operate and manage environmental requirements. The changes will provide invaluable direction to the current and future users of the environmental knowledge contained within the procedures.

In addition, due to the many adjustments that the environmental authorities at the state and federal levels pursue on an annual basis, RI&ES has developed a fluid set of guidelines that capture knowledge that is considered “work in progress” as negotiations, consent orders, and commitments evolve. This information/knowledge is available in real-time to enhance the communication across functional and contractual boundaries and is referred to as an Institutional Memory Compendium (explained more fully below) that is stored in the RIES Environmental Knowledge Portal.

KNOWLEDGE MANAGEMENT AND INSTITUTIONAL MEMORY COMPENDIUM

Institutional memory is a collective set of facts, concepts, experiences and know-how gained by translating historical data into useful knowledge and wisdom. Within RI&ES, this refers to a collective set of opinions, interpretations, decisions, and policies that have been established but are not formalized in published procedures. Cognitive learning is evident through the application of the knowledge in a situational dependant environment. Over time this process has developed and the knowledge guardians have wisdom with respect to how to address the situation at hand. This knowledge and wisdom is important to the continued effectiveness of the organization. Preserving this knowledge ensures retention of the institutional memory. The purpose of the process described herein is to identify, preserve, and disseminate institutional memory for use within the organization.

The first step that RI&ES pursued was to identify candidate materials which may be considered institutional knowledge. Institutional knowledge consisted of documented information that was readily replicated, distributed, and preserved for memory. The documents placed in the compendium were typically memos, letters, and other correspondence. It was important to ensure that each document was dated to reflect the date of origin. Sequencing the

documents in chronological order also enabled future readers to follow the development of the knowledge and recognize related information which may be incomplete.

The next step was to screen the collected materials for suitability. Some of the documents placed into the compendium provided clear decisions, interpretations, or guidance that will be applicable and/or useful in the future. Conversely, some of the documents were rejected if they provided an opinion that is no longer acceptable, superseded by different knowledge objects, or may have been determined to be inaccurate based on new conditions. The documents were categorized and arranged chronologically and were segregated by subcategories to manage a large number of documents.

Since the documents comprising the compendium are used to make regulatory decisions, an important step was to perform a review by the Legal department to ensure the policies and opinions represented in the assembled documents were appropriate and acceptable. The documents in a compendium of institutional knowledge typically consisted of the following:

- Interpretive letters to and from regulatory agencies
- Regulatory agency internal policy memorandums
- Subject Matter Expert interpretations to individual facilities/projects
- Legal position papers
- Letters explaining policy or interpretations
- Interpretive correspondence from third-parties which is not copyrighted

The last step was to maintain the credibility of the compendium. The subject matter expert responsible for maintaining the compendium periodically reviews the materials to ensure they remain relevant and applicable. A separate compendium was prepared for each unique regulatory topic. Each document is uniquely numbered for quick reference. When a document is removed from the compendium then its identification number is retired and the document removed from the active portion of the compendium to prevent inadvertent use. Using a shared intranet database simplifies the process of managing availability and provides universal access.

ENVIRONMENTAL KNOWLEDGE USED IN FIELD EVALUATION

The most critical role played by the environmental organization is the role of environmental impact evaluation. This evaluation ensures that all site actions or

proposed activities are in alignment with all applicable laws and regulations associated with the SRS. This role can only be adequately performed if the evaluator:

- a) Is properly trained and qualified
- b) Is engaged early in the process
- c) Produces an evaluation that is thorough
- d) Produces an evaluation that is properly documented
- e) Properly follows up on environmental impacts (i.e. new permits, permit changes, site clearance, etc.)

Training was evaluated by the organization and found to be less than adequate due to changing requirements and dependency on expert based systems. The organization developed generic and specific Roles, Responsibilities, Accountabilities and Authorities that defined job specific courses and required reading. Gaps were identified as a result of the evaluation and personnel are currently maturing their knowledge by attending courses and reading appropriate material assigned to their positions. This type of evaluation takes the burden off of the individual for knowing what knowledge to pursue based on feedback from their mentors or on what they are asked to do day-to-day.

The organization also evaluated the manner in which they used their knowledge to support site actions or proposed activities. The tools used for evaluation are the Environmental Evaluation Checklist, Site Use / Site Clearance Permits and the Assisted Hazard Analysis processes. These processes were expert based, self managed, non integrated, non automated and had limited quality control and validation. The organization embarked on automating the review processes, updating the documented requirements, educating the evaluators, getting closely connected to the facility plan of the weeks, and closing out essential environmental documents. RI&ES also developed a listing of milestones based on the knowledge of facility needs. These milestones, along with the documented impacts, make up the set of environmental actions that keep SRS compliant with all laws and regulations. These actions changed the way environmental knowledge was viewed for significance and sustainability.

KNOWLEDGE ASSESSMENT

As environmental processes and procedures are exercised, RI&ES works diligently to assess the manner in which the environmental staff performs their assignments. The assessments are in the form of Management Field

Observations, Self Assessments, and Employee field walk downs. As findings and opportunities for improvement are identified during these assessments, appropriate feedback is provided to the organization so that knowledge is gained and improvements are made to the existing policies and procedures.

KNOWLEDGE CYCLE

Figure 2 below depicts the lifecycle of knowledge in the organization. It begins with scope associated with SRS. The magnitude of the scope determines how many and what type of knowledge guardians are required to support the missions. The knowledge is assigned to the appropriate number of guardians using roles, responsibilities, and accountabilities and authorities (R2A2) as the basis of the minimum requirements needed to maintain scope management and decision making capability. Once the number is defined, then you train the staff against the scope to make them viable and effective. Staff then develops knowledge working with existing experienced staff and by developing new knowledge based on new scope. As the staff executes its knowledge they will be creating historical data that is recorded in the environmental knowledge portal/library. As the staff matures, they are required to mentor to a subordinate that will receive this new knowledge and in turn pass it on as appropriate. Knowledge capture is routinely monitored and assessed for accuracy and alignment with SRS scope to ensure it remains current and useful. Knowledge is now being effectively managed due to the significance placed on it by management, the knowledge guardians, and those that depend on capture of the knowledge for use in the future.

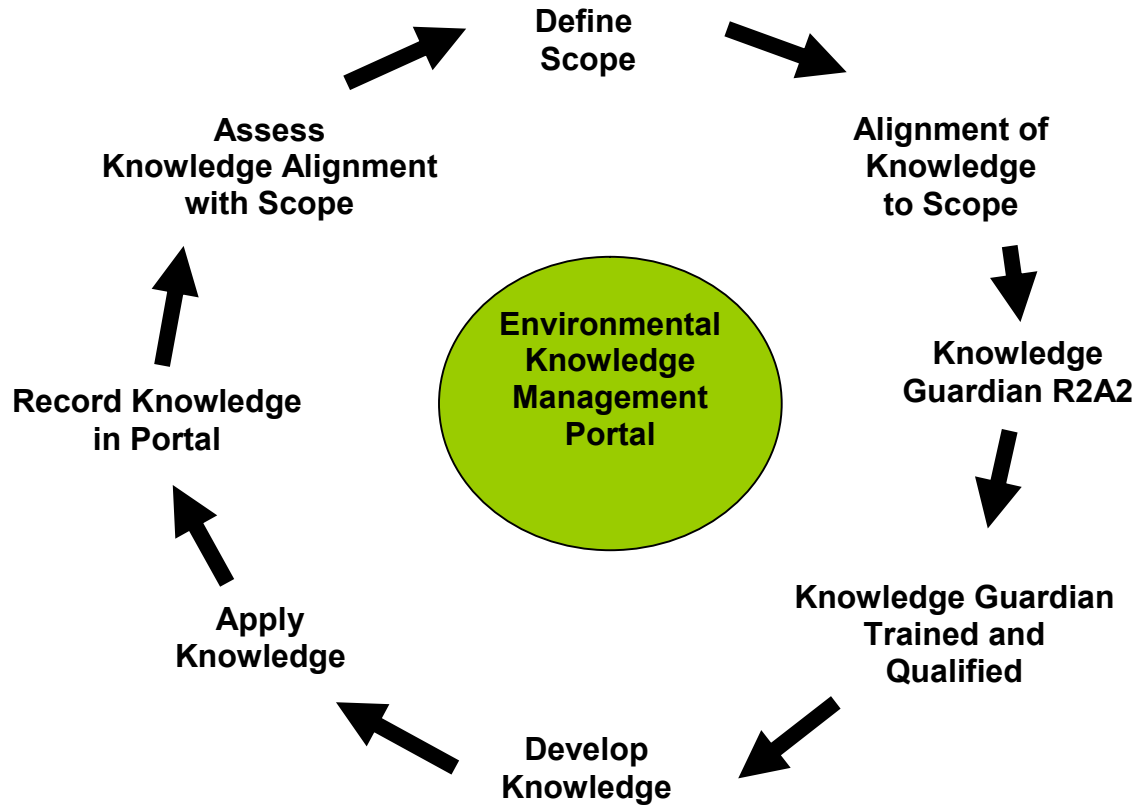


Fig. 2. Environmental Knowledge Cycle

KNOWLEDGE TRANSFER

Through the efforts of a disciplined approach to knowledge management, the transfer of knowledge occurs through several vehicles:

- 1) Site Environmental Training
 - a. Laws and Regulations
 - b. Environmental Compliance Authority
 - c. Polychlorinated Biphenyl (PCB)
 - d. Waste Management & Disposal DOE Order 435.1
 - e. Resource Conservation & Recovery Act (RCRA)
 - f. Comprehensive Environmental Response, Compensation Liability Act (CERCLA)
 - g. General Employee Training / Consolidated Annual Training
- 2) Lessons Learned

- 3) Customer Communications
 - a. Monthly Report
 - b. Bi weekly status meetings
- 4) Internal Communications
 - a. Website (knowledge portal)
 - b. Documents
 - c. Lunch and Learns
- 5) Communications with SEMC
- 6) Communications with Facilities
- 7) New Categorical Exclusions
- 8) Updated Essential Environmental Documents
 - a. Permits
 - b. Procedures
 - c. Training
 - d. Guidelines

Environmental compliance is maintained through the use of this knowledge transfer due to the focused management attention and willingness of the knowledge guardians to share their knowledge for the benefit of the environmental organization.

To get the Knowledge Guardians to share, the guardians are approached with —
“The benefit to you for sharing knowledge is to....

- be recognized as an expert in your field”
- become a patriot for SRS Knowledge Management (KM) movement”
- leave your legacy”
- partner with a Protégé”
- improve business performance”
- minimize repeat questions”
- improve communication”

PILOT EVALUATION OF KNOWLEDGE TRANSFER

RI&ES pursued a pilot project to determine if knowledge could be successfully transferred within the organization. The knowledge selected for the pilot was Environmental Monitoring. Staff was selected for the pilot project, interviews were conducted, field visits were performed, provisions were made for capturing knowledge, and knowledge was captured. Lastly, new knowledge recipients were interviewed to determine the effectiveness of the knowledge

transfer. The interviews consisted of a review of a Environmental Management procedure followed by a set of questions and answer sessions to capture tacit and implicit knowledge.

Results of Knowledge Capture of Environmental Monitoring (EM)

Continuous improvement opportunities were identified by management and work force based on the maturing level of trust in the department. The effort and focus placed on the importance of capturing the existing knowledge not only resulted in understanding the key business functions that need to be captured in a transferable format but also set the stage for key growth in other areas as well.

The following questions are a subset of the interview questions used to capture and transfer knowledge:

Process/Procedure: 3Q1-1002, *“Review Of Environmental Monitoring and Analysis Log Books”*

When EM First Line managers or the Program Administrator review logbooks in accordance with 3Q1-1002 they are examining logbook records of the sampling event, equipment operations, and “related activities.” What are the “related activities” that should be expected to be documented?

Process/Procedure: 3Q1-1002, *“EM Response during Non-Routine Occurrences”*

During a non-routine occurrence the EM Incident Coordinator may be called upon to determine the potential on-site and off-site impact of the release, to develop an appropriate survey plan, or to determine the EM resources required to provide an adequate response. What tools or resources are available to assist in performing these duties?

Process/Procedure: 3Q1-2001, *“Calibration of Wildlife Hunt Monitors”*

What things have been learned that make this process more efficient and trouble-free? Are there any special considerations which are not mentioned in the procedure?

Process/Procedure: 3Q1-3001 thru 3012

Environmental Monitoring Technical Support is responsible for providing technical guidance in the application of these procedures. What type of technical guidance is needed for various situations?

Environmental Monitoring First Line Manager (FLM) is responsible for providing oversight of the technicians performing these procedures. What kind of things does the FLM look for? Are there any areas that should be monitored more closely?

Process/Procedure: 3Q1-3008, *“Foodstuff Collection”*

A listing of the foodstuff suppliers’ contact information is maintained in the back of the field logbook for future sampling. Is there a list of potential suppliers that have been contacted in the past and should NOT be contacted in the future for any reason?

CONCLUSION

Knowledge Management is critical to site operations and the employees of the SRS. Both employees and management have benefited from the pilot study, improvements in training and procedures, upgrades to documentation of learned knowledge, user friendly information technology for storing knowledge, and engagement in sharing knowledge. As a result of these improvements, RI&ES is able to make sustainable environmental decisions using updated integrated processes and techniques. The approaches used to explain and gain acceptance of the importance of knowledge capture and transfer underscores the value the leaders of the company place on the legacy created by the staff. The demonstrated value of the importance of the legacy and the role the employees have in perpetuating the successes for the customers is incredibly powerful in gaining momentum in changing the culture of an existing workforce. Capturing and transferring knowledge cannot be accomplished without a strong and trusting relationship between the employees and leaders of the company.