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Applications of Knowledge Management Strategies for Improving Nuclear Materials Management and Facility Operations in the R&D Environment

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Abstract:

The Savannah River National Laboratory (SRNL) is a rapidly growing multidisciplinary laboratory under the Office of Environmental Management and recently became the Department of Energy's newest independent national laboratory. Part of this transition to an independent laboratory was to take a close look at current practices to ensure that the facilities and resources can accommodate the increase in program growth. One major focus was ensuring the work in the main campus's hazard category II nuclear facility continued to have the capacity available to support the anticipated program growth after startup of the Mark-18A target recovery line. An assessment of the current practices was performed to identify opportunities for improvement in the facility with the goal of integrating other efforts across the laboratory to ensure a cohesive management strategy. A lot of attention has been given to knowledge management initiatives in recent years with a focus on knowledge transfer and retention to offset knowledge loss from retirements. The assessment discovered that these same practices and concepts can also be utilized to improve strategies for managing nuclear material inventories as well as facility operations in the R&D environment. Popular knowledge management strategies like knowledge capture, information repositories, data analysis, and information availability will be discussed in the context of improving the management of physical nuclear material inventory holdings as well as facility operations for the R&D environment.

Introduction:

The Savannah River National Laboratory (SRNL) is a rapidly growing multidisciplinary laboratory located at the Savannah River Site (SRS) in Aiken, SC. Founded in 1951 as the Savannah River Laboratory to support the cold war nuclear material production mission of SRS, the lab has grown its mission outside of SRS and earned the title of a national laboratory in 2004. Since then, SRNL has continued to grow and serves as the only national laboratory operated by the Office of Environmental Management (SRNL, 2022). In December of 2019 the Department of Energy (DOE) recognized that the continuing mission of SRNL was unique from the existing missions of SRS and made the decision to begin the procurement process to separate the laboratory into an independently operated entity with a focus on the enduring research mission (Marshall, 2019). In December of 2020 Battelle Savannah River Alliance (BSRA) was awarded the new managing and operating contract of the laboratory to make it officially an independent national laboratory for the first time (DOE Awards Savannah River National Laboratory Management and Operating Contract, 2020). This formal separation from the production missions of SRS kicked off a new opportunity for SRNL to have a more dedicated focus on research along with the flexibility to control policies to enable new mission development.

The majority of the work with accountable nuclear materials happens in the main campus's hazard category II nuclear facility that includes a variety of laboratory spaces including gloveboxes and shielded cells (SRNL, 2022). As SRNL looks forward to future laboratory growth, the capacity of this facility becomes a delicate balance of resource sharing. With large programs in the works like the Mk-18A program processing irradiated targets in the facility (Swift, 2019), it will reduce the overall facility capacity available for existing programs and other growth. Raising the facility capacity would require expensive capital investments in the form of either a new facility or extensive modifications retrofitting a cold-war era structure. This kicked off an initiative to look for near term solutions that don't require physical facility modification.

This initiative was an assessment of the options to improve nuclear materials management of the facility to determine if there were strategies that could reduce unnecessary load on the facility and effectively increase the available capacity. This paper will discuss the methods employed by SRNL to assess how to more actively manage facility utilization and capacity of accountable nuclear materials.

<u>Initial Condition Assessment:</u>

The first step in understanding how to improve the current methodology of managing facility operations always needs to be understanding current operations (Weidner, 2018). Research and development facility organizations in particular tend to be highly matrixed to allow for a single researcher the flexibility to work on multiple programs and support multiple customers (SHRM, 2022). Individual researchers or small groups have the ability to apply for their own funding and self-manage with future scope being dependent on the results of previous projects. This creates unique challenges in managing the nuclear material inventory and makes the system much more complex.

Traditional management attempts relied on researchers and their direct management to manage their inventory as part of managing their programs and scope. If a program had the funding and could identify a space appropriate for the work, they would be approved. This can be effective for smaller facilities with excess capacity or larger facilities supporting dedicated programs but begins to fail when programs and groups start competing for shared resources. If two programs have approved work scope under that directive but require the use of the same resources, a new regime of prior coordination is required to enable the facility to operate effectively as a whole.

It is critical to analyze the full lifecycle of nuclear material in the facility to identify optimum ways to coordinate future work, without placing an undue burden on researchers that will restrict growth. Examples of existing processes that should be considered are:

- Proposal Coordination: Is there a process in place to coordinate what researchers are committing the facility to in their funding requests before they make a commitment to a customer to ensure the work can be executed?
- Supply Chain: How are materials can be purchased, what is the process, and what lead times can be expected?
- Receipt Coordination: What processes are in place for coordinating material receipts at the facility beyond purchasing?
- Material Control and Accountancy: What safeguards systems are in place for materials in the facility and what information do they collect?
- Safety Monitoring Systems: Are there additional systems in the facility that collect and monitor information in the facility related to safety and accident analyses?
- Research Documentation: What systems are in place and what information is required to be collected about activities performed with the material and process history?
- Waste Generation: What processes exist in the facility to manage waste? What happens if a program produces waste that does not have a current waste stream within the facility? Who pays for waste disposition after a program ends and is this included in proposals?
- Material Retention and Storage: Is there a system for managing material retained after work is performed for future use? Is there a process for programs requesting to store material to support future work?

Identifying Areas For Improvement:

Once the current systems are understood, is now possible to start charting a course for what improvements are realistic based on the current facility operations. The second step of this process is determining what gaps exist in the current process and interfacing with the effected stakeholders to ensure the new solution meets everyone's needs (Weidner, 2018). For example, it's common for an initiative to be spearheaded by one group with a specific background and focus that suggests improvements that cause an additional burden and disruption outside of their area of expertise. SRNL decided to recruit a diverse focus group to work together on a path forward that would benefit the institution as a whole. This generated a lot of positive feedback within the organization as well as much greater engagement and approval of the staff because they felt their voices were heard.

It was found that the primary concern facing SRNL, like most research and development organizations, was a lack of coordinated institutional ownership of the function. Each department had their own process and paperwork for managing their functions and minimal information was shared outside of the group. It was left up to the researchers and their management to interface with each support function individually and limited the ability for facility management to produce useful metrics and be engaged. This results in the researcher effectively owning the comprehensive knowledge about the material, making it just like the more classic issues confronted by knowledge management professionals and susceptible to the same techniques and best practices.

Implementing Knowledge Management Strategies:

Implementing common knowledge management strategies can drastically improve accessibility of information with a value well beyond managing attrition in organizations struggling with institutional information ownership (Weidner, 2018). Various common methods will be discussed with examples of potential applications for common facility operations and planning issues.

Information Repositories:

Information repositories are already commonly used in facility operations for things like material control and accountancy, nuclear materials management, and safety monitoring, but integrating these isolated systems and expanding them can expand opportunities. Having additional searchable repositories available for things like laboratory notebooks that can be tied to the samples can offer valuable process history that persists long after the project is over. This can include things like digitizing and consolidating request forms to reduce data entry errors from multiple duplicate requests to different departments. This information could then be readily available to all stakeholders and future researchers reducing the odds of information loss during personnel transition.

Knowledge Capture:

Targeted knowledge capture is also an important technique to consider. Legacy materials inherited by researchers without associated records are a large liability for any facility. Including forms and creating a structure to gather and maintain information on materials through personnel changes can prevent the accumulation of future legacy liabilities. This can also be an important mechanism to protect rare and unique samples for further retention by documenting the justification of value to enable future research.

Information Availability:

Information availability is something that is very important to consider for the knowledge captured in information repositories. All the work of collecting and inventorying that information is useless if it's not available to those who need it. This can be a delicate subject for many facilities because some information about materials and active research and development efforts may be sensitive in nature. This sensitivity concern has contributed significantly to compartmentalization at many facilities, but targeted efforts to share specific vetted pieces of information can be very advantageous while still complying with information security concerns. For example, if material is considered excess by a program, information can be shared about general properties of the available material to enable future work, without sharing all history of the material or the relationship to the prior program that produced it.

Data Analysis:

Data analysis is the most important technique that is enabled by the previous knowledge management methods and benefits the most from any improvements in information management.

Applying data analysis techniques can create new metrics especially if isolated systems are integrated. Integrating previously separate data sources can provide valuable insights for supporting facility operations. Some examples include being able to analyze program impacts on safety and security limits, track waste accumulation, and quantify the impact of items with no current disposition path. Additional opportunities could include monitoring supplies of stock solutions to evaluate usage rates and optimal order size and sending an automated notice to trigger procurements when supplies reach a certain level based on the usage rate and estimated lead time. With a truly comprehensive information management system, some additional research and development opportunities could even be realized by enabling meta-analyses of previous research results.

Conclusion:

In conclusion a lot of common issues with facility operations in a research and development environment can be improved by applying common knowledge management strategies. Many research facilities deal with competing research priorities leading to issues with a lack of centralized institutional ownership. These can be remedied by intentionally organizing policies and procedures with a focus on integration and cooperation to reduce redundancy and increase institutional ownership of knowledge and information.

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