

**Knowledge Management Initiatives Used to Maintain Regulatory Expertise in  
Transportation and Storage of Radioactive Materials – 12177**

Haile Lindsay, Norma Garcia – Santos, Pierre Saverot, Neil Day, Kimberly Gambone Rodriguez,  
Luis Cruz, Alexis Sotomayor – Rivera, Lucieann Vechioli, John Vera, and David Pstrak  
United States Nuclear Regulatory Commission  
Mail Stop EBB-03D-02M, 6003 Executive Boulevard, Rockville, MD 20852

**ABSTRACT**

The U.S. Nuclear Regulatory Commission (NRC) was established in 1974 with the mission to license and regulate the civilian use of nuclear materials for commercial, industrial, academic, and medical uses in order to protect public health and safety, and the environment, and promote the common defense and security. Currently, approximately half (~49%) of the workforce at the NRC has been with the Agency for less than six years. As part of the Agency's mission, the NRC has partial responsibility for the oversight of the transportation and storage of radioactive materials. The NRC has experienced a significant level of expertise leaving the Agency due to staff attrition. Factors that contribute to this attrition include retirement of the experienced nuclear workforce and mobility of staff within or outside the Agency. Several knowledge management (KM) initiatives have been implemented within the Agency, with one of them including the formation of a Division of Spent Fuel Storage and Transportation (SFST) KM team. The team, which was formed in the fall of 2008, facilitates capturing, transferring, and documenting regulatory knowledge for staff to effectively perform their safety oversight of transportation and storage of radioactive materials, regulated under Title 10 of the Code of Federal Regulations (10 CFR) Part 71 and Part 72. In terms of KM, the SFST goal is to share critical information among the staff to reduce the impact from staff's mobility and attrition. KM strategies in place to achieve this goal are: (1) development of communities of practice (CoP) (SFST Qualification Journal and the Packaging and Storing Radioactive Material) in the on-line NRC Knowledge Center (NKC); (2) implementation of a SFST seminar program where the seminars are recorded and placed in the Agency's repository, Agencywide Documents Access and Management System (ADAMS); (3) meeting of technical discipline group programs to share knowledge within specialty areas; (4) development of written guidance to capture "administrative and technical" knowledge (e.g., office instructions (OIs), generic communications (e.g., bulletins, generic letters, regulatory issue summary), standard review plans (SRPs), interim staff guidance (ISGs)); (5) use of mentoring strategies for experienced staff to train new staff members; (6) use of Microsoft SharePoint portals in capturing, transferring, and documenting knowledge for staff across the Division from Division management and administrative assistants to the project managers, inspectors, and technical reviewers; and (7) development and implementation of a Division KM Plan. A discussion and description of the successes and challenges of implementing these KM strategies at the NRC/SFST will be provided.

**INTRODUCTION**

The NRC was established in 1974 to regulate the civilian use of nuclear materials for commercial, industrial, academic, and medical uses in order to protect public health, safety, and the environment, and promote the common defense and security [1]. The NRC is responsible for the regulation of the following: (1) commercial nuclear power plants; (2) research and test reactors; (3) nuclear fuel cycle facilities; (4) medical, academic, and industrial uses of

radioactive materials; (5) the decommissioning of these facilities and sites; and (6) the transport, storage, and disposal of radioactive materials and wastes. The NRC's regulations are designed to protect both the public and occupational workers from radiation hazards and knowledge management allows maintaining an efficient and effective process when making regulatory decisions.

At the NRC, knowledge management is the one of the critical ways to transfer and retain essential knowledge in order to maintain continuity and uniformity of future regulatory activities. Three important reasons why knowledge management is critical at the NRC are the following:

- Experienced nuclear workforce staff is retiring,
- Mobility of staff within the Agency to support recent growth of NRC in reactor program areas, and
- As of fiscal year 2010 (FY10), approximately half (49%) of the workforce at the NRC has been with the Agency for less than six years.

According to Barclay's article entitled "What Is Knowledge Management?" knowledge management is defined as a business activity with two aspects in mind:

1. Treating the knowledge component of business activities as an explicit concern of business reflected in strategy, policy, and practice at all levels of the organization, and
2. Making a direct connection between an organization's intellectual assets — both explicit [recorded] and tacit [personal know-how] — and positive business results [2].

A knowledge management definition used at the NRC is "continuous, disciplined, and timely process of identifying, collecting, and using information to effectively accomplish a task, project, or program." This definition recognizes that KM is a continuous process, but it should happen in a timely manner in order to be successful. Three types of knowledge are:

- **Explicit knowledge:** Defined as apparent knowledge that can be found or captured in manuals, reports, files, or other documentation. It could describe a process or a set of steps to be used in order to complete a task and can be conveyed readily to others.
- **Critical knowledge:** Necessary information needed to complete a specific task.
- **Tacit knowledge:** Comprises of unique skills, expertise, and perspectives developed by an individual or a group over time and through experience. This knowledge can be placed in an organization's culture and is often known to only one, or a few individuals. This knowledge cannot be readily available through procedures, training, or documentation. In some cases, those possessing tacit knowledge may not even be aware of its existence or importance to the organization [3].

At the NRC, SFST has implemented several KM initiatives to counteract the trends taking place within the Agency. These initiatives include the following:

- i. Develop and maintain online resources including a SFST Qualification Journal Community of Practice, a Packaging and Storing Radioactive Material CoP on the NRC Knowledge Center (NKC);
- ii. Implement a SFST seminar program;
- iii. Implement a technical discipline group program to share knowledge in specialty areas;
- iv. Develop specific procedures to document administrative processes as well as “Lessons Learned” and revise technical guidance documents;
- v. Use of mentoring strategies for experienced staff to train new staff members;
- vi. Use of Microsoft SharePoint portals to capture, transfer, and document knowledge for staff across the Division; and
- vii. Develop and implement a Division KM Plan.

The focus now shifts to a more elaborate discussion of these initiatives, their development, and their respective successes and challenges. The successes and challenges are summarized in terms of implementation of KM in the transportation and storage program at the Nuclear Regulatory Commission within SFST.

### **#1: Development of Online Resources**

The SFST Qualification Journal is part of a formal process to qualify Division staff to perform their specific jobs (e.g., technical reviewer, project manager, and inspector). In 2008, SFST management and staff revised the training requirements in the SFST Qualification Journal for project managers, technical reviewers, and inspectors. Some of the greatest challenges of completing the Qualification Journal is locating the required documentation, taking time to read and understand the required documentation, completing journal assignments, and signing up for the training classes.

In March 2008, SFST management and staff also decided to integrate a newly hired staff person, along with an experienced staff person, to develop a website, known as a Community of Practice or CoP, on the on-line NRC Knowledge Center (NKC). This Community of Practice is entitled “SFST Qualification Journals.” The philosophy of the Qualification Journal Community of Practice is to make it a “one stop shop” for staff locating certain documentation, information about training or signing up for a class on the Agency’s website (i.e., iLearn). This site allows Division staff to use its time more efficiently to complete the qualification process because the majority of the information needed to complete the qualification process is available electronically in one place. Fig. 1 depicts a snapshot of the SFST Qualification Journal CoP on the NRC Knowledge Center.

**NRC KNOWLEDGE CENTER**  
Collaborate, Capture, and Share Knowledge to Build Organizational Memory

**SFST Qualification Journals**

**Charter**  
A reference for the SFST Qualification Program for Technical Reviewers, Project Managers, and Inspectors

**Welcome**  
This Qualification Journal contains a qualification summary sheet, and signature cards. The qualifying staff member is expected to complete only the signature card(s) applicable to his/her assigned work group. It may not be necessary to complete every requirement. At the supervisor's discretion, requirements may be deleted, or added, depending on the staff member's previous experience. The SFST staff member is expected to use the most current version or revision of each document cited in this Journal. Most of the documentation is readily available either on the 1246 Section VI 09/24/08 NRC's internal web site, NRC's Agency wide Documents Access and Management System (ADAMS), SFST's library, or at this website. It is recognized that some of the required formal training courses may not be immediately available. The supervisor may substitute an alternative course or substitute another method to meet the requirement, or delete the requirement altogether. Changes should be documented in your Qualification Journal. The time necessary to complete this Qualification Journal will vary; depending upon the new staff member's previous experience and education, but within 18 months is SFST management's expectation. The availability of required training courses and the new staff member's assigned workload may also prolong the time period.

**Active Members**  
Haile Lindsay (2 items)

**Top Ranked**  
Qualification Journal Progress Sheet for TCB Staff  
SFST New Employee Checklist  
Qualification Journal Progress Sheet per Branch - SFST Staff  
SFST - 20: Review of Foreign-Approved Transportation Packages  
SFST - 7 - Part 7.1 Guidance  
Qualification Journal Progress Sheet for LD Staff  
NRC Timeliness Goals, Prioritization of Incoming License Applications and Voluntary Submittal of Schedule for Future Actions for NRC Review  
SFPO 1 - Office Instructions  
SFPO 2 - Safety Evaluation

Fig. 1. Front Page of the SFST Qualification Journal CoP on the NRC Knowledge Center

Several months after developing the SFST Qualification Journal CoP, the staff saw the need for another community of practice to capture the knowledge within our experienced staff within our Division. Thus, the Packaging and Storing Radioactive Material (PSRM) CoP was developed to capture knowledge within the various disciplines including Thermal, Containment/Confinement, Criticality, Shielding, Dose Assessment, Structural Mechanics, Materials, licensing of transportation packages and storage systems, and rulemaking, inspections, and operations. When this community of practice was in the process of being developed, the SFST KM Team was formed to devise strategies in designing the appearance and content of this particular community of practice. In addition, the team facilitates and implements initiatives in SFST related to KM. The team comprises of an interdisciplinary group of SFST staff: Luis Cruz, Neil Day, Norma Garcia-Santos, Haile Lindsay, Kimberly Gambone, Pierre Saverot, Alexis Sotomayor-Rivera, John Vera, and Lucieann Vechioli. The SFST KM Champion is David Pstrak, whose charge with providing guidance and management help in order to complete KM projects.

Both Communities of Practice received positive feedback from SFST management. Some challenges encountered have been the newness/flexibility of this software and availability of Division staff to participate in providing key information or placing information to the communities due to their work assignments. In addition, since some staff is completing the qualification process, the staff participates more actively in the SFST Qualification Journal CoP.

### #2: SFST Seminar Program

The SFST Seminar Program has served as a cornerstone to the Division’s KM program. The seminars began in 2005 during the leadership of our then Division Director, Mr. E. William Brach. The seminars occur monthly where staff, internal or external to the Division, discusses topics of interest within the realm of our Division or the NRC. The Division’s Knowledge Management Team coordinates the seminars with the presenters, contacts the Audiovisual Department to record the seminar, takes care of the logistics (date, time, location, teleconference connections, computer needs, etc.), and provides the staff with copies of the presentation for their view prior to the seminar. In addition, the team places the recorded seminars, with closed-captions, along with the slides into ADAMS in order to capture this knowledge for staff’s perusal in the future. These seminars are received well by staff and management, but the challenge to maintaining the seminar program is to find presenters due to schedule priorities and traveling of Division staff. It may take an average of 10 hours, approximately, to prepare a seminar.

### #3: Technical Discipline Group Meetings

As previously stated in the section entitled Development of Online Resources, SFST contains seven technical disciplines. These disciplines are thermal, containment/confinement, structural mechanics, materials, criticality, shielding, and dose assessment. These technical discipline groups meet monthly to discuss challenges encountered during work assignments within a given technical discipline and use the time to provide guidance or solutions to these issues. These technical groups are comprised of experienced staff and new staff and exchange of information is encouraged during these meetings. Table 1 depicts the technical disciplines and the names of their respective groups.

Table 1. SFST’s Technical Disciplines and Their Group Names

Technical Discipline	Technical Discipline Group Name
Thermal	Sizzlers
Containment/Confinement	Leakers
Structural Mechanics	Structural Maniacs
Materials	Heavy Metal
Criticality	Grand Criticality Council
Shielding	Dose Busters
Dose Assessment	

These meetings facilitate resolution of major challenges encountered during work assignments. In 2010, an overarching group formed from the chairpersons of the working groups depicted on Table 1 and known as the Working Group Committee or WGC. The purpose of the Working Group Committee includes:

- Discussing technical issues from a multidisciplinary perspective and considering potential impacts on inspection, licensing and/or technical review;
- Identifying potential cross-cutting areas or of generic applicability for each issue discussed in the WGC;
- Issuing agreement or objections on proposed paths forward on issues;
- Addressing comments or questions on areas identified as lacking; and
- Signing the issue summary; signifying that the appropriate Working Group has no objection to the proposed path forward.

Successes for this particular initiative include the facilitation of resolution of major casework issues and resolution of major non-casework issues. The challenges of the technical discipline groups and WGC meetings include focusing on the issue in order to find the appropriate path forward and the occasional “dropping the ball” in completing study/research into a given subject due to higher priority work.

#### **#4: Development of Key Documentation for Staff**

In order to regulate transportation of radioactive material, NRC staff uses and develops the regulations (e.g., CFR) and regulatory guidance such as office procedures; standard review plans (SRPs), interim-staff guidance (ISGs), and regulatory guides. This documentation is critical because regulations and standards may change throughout the years, thus it is necessary to capture this “informal” knowledge. In the case of knowledge transfer for transportation, most of the documentation was developed from 10 CFR Part 71 (and vice versa for 10 CFR Part 72 for storage) that focuses on transportation of radioactive material and from dealing with the various types of packages and material being transported. The staff develops office procedures, SRPs, and ISGs, which follow a concurrence process with SFST management, other pertinent offices within the Agency, and public comment, if needed. This documentation provides success in completing reviews and answering critical questions to vendors and/or licensees. The challenges with this guidance are updating them and completing the concurrence process within a sufficient amount of time. In the case of the regulations, the staff documents the public comments as well as the rationale behind the regulatory requirements.

#### **#5: Implementation of Mentoring Strategies**

As a means of transferring critical knowledge from an experienced staff member to a newer (or junior) staff member, SFST has implemented two informal mentoring strategies. One mentoring strategy is for the newer staff to engage in quality conversation and/or seek advice from an experienced senior staff person in regards to a particular subject. For example, if a newer staff

member needed to understand more about hydrogen generation, he/she would search the subject matter expert (SME) within the division to discuss this issue. The other mentoring strategy employed in transferring critical knowledge is through peer review. In SFST, a junior staff member may be assigned to complete a review or an assignment and alongside a peer review leader (i.e., an experienced staff member). As the junior staff member progresses in the review, the junior staff member can pose questions to the peer review lead in order to obtain a better understanding in a subject matter. Upon completion of the junior staff member's review, the peer lead examines their review and provides necessary feedback before submitting their potential RAIs to their immediate supervisor. The benefits of the peer review process include the following:

- Dialogue between junior and senior staff,
- Improve quality of the review, and
- Share of tacit knowledge for future assignments.

Some challenges of peer review process include making sure that both parts complete their respective assignments timely and that the exchange of information between the junior staff and the peer review lead occurs before the input is due.

#### **#6: Use of Microsoft SharePoint Portals to Capture, Transfer, and Document Knowledge**

In 2010, in an effort to stay on course with the other offices and divisions in the Agency, SFST developed a set of SharePoint websites (also referred as portals) under the main NRC SharePoint portal in order to capture, transfer, and document knowledge throughout the Division. Our Division's portals correspond to the five branches, special events, and initiatives within the Division. In addition, other pieces of important information including Office Instructions, organization charts, guidance for travel, guidance for inputting time, and information from international travels from Division staff are included within the SFST main SharePoint portal (i.e., Spent Fuel Portal). The successes of SharePoint include:

- Frequently used amongst staff,
- Capability of seeing individual biographies,
- Can be integrated with other Microsoft products (e.g., Outlook), and
- A strong capability to search throughout the infrastructure of the Agency.

The challenges of using SharePoint include:

- Websites rights need to be granted in order to view other portal sites,
- Video files cannot be larger than 100 MB,
- Limitations when updating documents when they are being edited by other staff,
- Requires more than basic training in order to use it properly, and
- Retrieval of information is highly dependent on how the information is stored at the site

Fig. 2 depicts a snapshot of one of the portals on the Spent Fuel Portal on SharePoint.

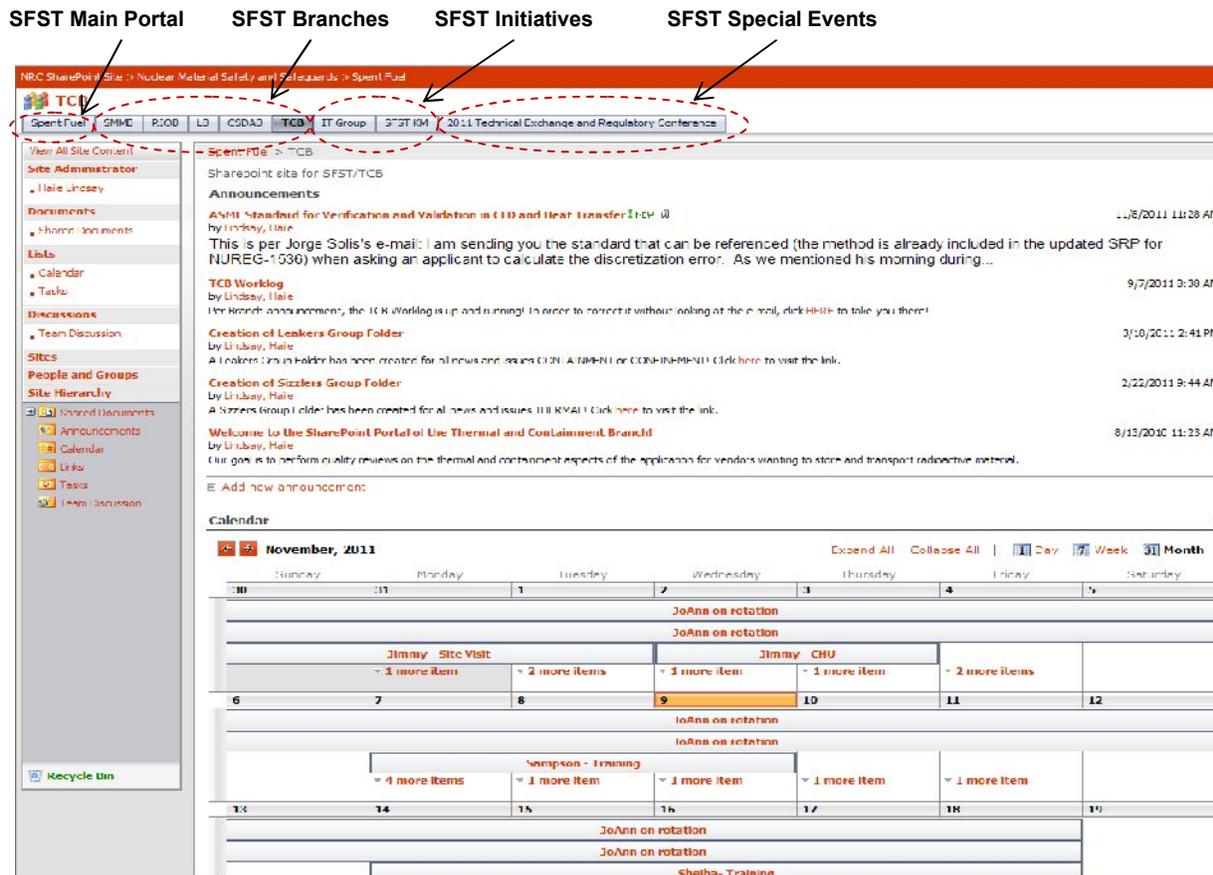


Fig. 2. Thermal and Containment Branch Portal on the Spent Fuel SharePoint Portal

## #7: Development and Implementation of a Division KM Plan

As a means to implement the various KM initiatives in SFST, the SFST KM Team developed a draft Division KM Plan in 2011. The plan included the following information:

- A message from Division Management,
- Alignment between KM activities and the Agency's goals,
- The Division's KM vision,
- The Division's KM mission,
- The Division's KM goals,
- Definitions of terminology used in the plan,
- The roles and responsibilities related to KM within the Division,
- The KM points of contact,
- The KM tools used by the Division, and
- Proposed performance measures of the Division's KM tools.

Within the next calendar year, the intent is to implement this Division KM Plan and keep a diligent look at our performance against the goals and the tools we use. The successes include completion of a draft KM Plan, provide a KM “roadmap” for staff within the Division, define role and responsibilities regarding KM in the Division. The challenges include the implementation due to awaiting NMSS direction and managing a cultural change towards KM in the Division given the amount of changes in the organization.

## CONCLUSION

Within the NRC, about half (~49%) of its workforce have been in the Agency six years or less. As we move on into the next decade, knowledge management strategies need to be implemented in a timely manner. Timely transfer of knowledge from experienced staff to junior staff is needed in order to continue being an efficient and effective regulator of the transportation and storage of radioactive material.

In SFST, strategies have been implemented to transfer critical knowledge. These strategies include the following:

- Development of online resources (SFST Qualification Journal and Packaging and Storing Radioactive Material CoPs on the NRC Knowledge Center),
- Implementation of a SFST Seminar Program,
- Monthly technical discipline group meetings and WGC meetings,
- Development of regulatory documentation,
- Implementation of mentoring strategies (discussions with SME and peer review between junior and experienced staff),
- Use of Microsoft SharePoint to capture, transfer, and document knowledge, and
- Development and soon-to-be implementation of the Division KM Plan.

These strategies have been successful and need to be refined as the workforce and the environment changes in the NRC. Despite the challenges, the SFST staff continuously strives for improving KM practices in our work environment to better serve the public and protect the environment.

## REFERENCES

- 1) “Strategic Plan: Fiscal Years 2008 – 2013”. <http://www.nrc.gov/reading-rm/doc-collections/nuregs/staff/sr1614/v4/sr1614v4.pdf>, United States Nuclear Regulatory Commission, 2008.
- 2) Barclay, Rebecca. “What Is Knowledge Management?” <http://www.media-access.com/whatis.html> , Knowledge Management Associates, 1997.
- 3) Hickok, John, “Knowledge Sharing, Communities of Practice, and Learning Asset Integration – DAU’s Major Initiatives,” Defense Acquisition Review Journal, Vol. 12, No. 1, 2005.