SUSTAINING NUCLEAR SECURITY REGIMES THROUGH CONTINUOUS LEARNING EXPERIENCES

A Case Study in Knowledge Management Systems supporting Human Resource Development

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Abstract

As Member States plan, implement, and ultimately sustain their nuclear security regimes, human resource development supporting these regimes are paramount. Human resource development broadly includes programs addressing education, training, and knowledge management. The International Atomic Energy Agency's Implementing Guide, "Sustaining a Nuclear Security Regime," highlights the importance of national-level support for assigning resources that help ensure States are able to develop and retain sufficient human resources in the short, medium, and long term. Determining the resources needed to support education, training, and knowledge management is not an easy task, and knowledge management is a practice often overlooked when States plan for and allocate human resources for a nuclear security regime. The paper highlights the importance of implementing knowledge management practices as part of sustaining a nuclear security regime. Given the availability of secure web-based knowledge management tools, a nuclear security human resource development program should not depend solely on direct human interactions. To that end, the paper will offer an approach for planning and implementing a knowledge management system by using the U.S. Department of Energy/National Nuclear Security Administration's Nuclear Smuggling Detection and Deterrence Knowledge Management Website as a case study. This example offers useful lessons learned for States considering or actively developing their own nuclear security knowledge management efforts and human resource development.

1. INTRODUCTION

Few States question the importance of nuclear security—the threat posed by non-State actors using nuclear or radioactive material out of regulatory control as a weapon of terror ranks among the most serious international security concerns. Significant resources have been, and continue to be, dedicated to reducing the risk posed by nuclear and radioactive materials falling into the wrong hands and to strengthen each State's national-level nuclear security regime. As countries build, enhance, and sustain their nuclear security regimes, security systems are designed and deployed. Staff are trained. Systems are operated. But then, what? Recognizing the threat and then designing and deploying systems and measures to reduce the risks is important. But, once the work is "done," States must consider how to maintain the level of security and confidence that the people, processes, and equipment in place are indeed mitigating the risks.

The challenge of sustaining a nuclear security regime has many facets but sustaining the "people" aspect of the nuclear security regime poses challenges beyond, for example, planning for an equipment maintenance program or the life cycle of an instrument. How can a State continue to grow and mature its nuclear security expertise? Expertise and experience must be shared. How can information be provided to those that need it to perform their jobs efficiently and effectively? Security systems and measures are distributed physically across multiple locations in a country. These systems and measures involve many stakeholders: front line officers (FLOs), maintenance providers, and other decision-makers. All stakeholders need up to date and accurate information to fully support their roles and responsibilities in the State's nuclear security regime. How can stakeholder needs be managed so that nuclear security regimes do not degrade, but only mature and strengthens over time?

The International Atomic Energy Agency (IAEA) recognizes the importance and the challenges of developing human resources that support nuclear security regime functions. Sustainability is fundamental to a State's nuclear security regime, and as part of sustainability, the IAEA recommends that States allocate sufficient human, financial, and technical resources to carry out the organization's nuclear security responsibilities on a continuing basis [1]. The IAEA provides more detailed guidance for Member States when considering sustainability in its Implementing Guide, Sustaining a Nuclear Security Regime. Among other topics, this guide outlines considerations for States in planning, implementing, and sustaining their human resource capabilities. Human resource development, according to the IAEA, includes education, training, and knowledge management [2]. There has been much written about the education and training aspects of human resource development. This paper instead recommends Member States develop a system to support the knowledge management side of nuclear security human resource development. Per the IAEA, knowledge management involves "capturing, structuring, and transferring information to ensure that organizations retain the experience and knowledge gain by their staff over time."[3] This paper includes a real-world example of knowledge management practices, specifically a product developed by the U.S. Department of Energy/National Nuclear Security Administration (DOE/NNSA).

The DOE/NNSA Nuclear Smuggling Detection and Deterrence (NSDD) program works with international partners to strengthen capabilities to detect, disrupt, and investigate the smuggling of nuclear and other radioactive materials before they can be used in acts of terrorism.[4] The NSDD program and its predecessor organizations have worked for the past two decades with over 100 partners in more than 70 countries to enhance nuclear security detection capabilities.[4] To build sustainable capabilities with partnering agencies distributed globally, the NSDD program devoted considerable resources to developing and maintaining a knowledge management system. This NSDD Knowledge Management Website (KMW) makes critical information accessible to partner countries. This information is required to operate the nuclear security detection systems and measures that the NSDD program deploys. This information also helps to develop and enhance their training and maintenance programs. At its inception in 2015, the KMW was viewed as a web-based platform that would support partnering countries with their human resource development efforts. The objective of the KMW is to assist NSDD international partners in the implementation and sustainability of their radiation detection programs by providing easy access to current, non-sensitive information including training materials, maintenance procedures, technical service bulletins, operating procedures, how-to videos, and eLearning modules. Since its launch in 2015, more than 60 countries have signed up for, and actively use, the KMW.

Currently, the KMW is a resource that houses important information for sustaining nuclear security regimes. The KMW evolved over time as an important knowledge management tool for the NSDD program and its partners. The KMW offers a useful case study for how a knowledge management system supports nuclear security human resource development. Although its content is specific to nuclear security detection, the planning, operation, management, and lessons learned from the KMW are applicable to nuclear security knowledge management practices more broadly.

This paper identifies key planning considerations for designing and launching the KMW, including engaging prospective users to identify requirements and content, choosing the publishing platform, and strategic decisions to partner with the NSDD training organization for the KMW launch. Additionally, this paper highlights topics to consider for managing and operating the KMW (e.g., assigning roles and responsibilities for content management, ensuring and maintaining current documentation, adapting to changes, analysing user data, and growing user communities). This paper also offers lessons learned from deploying and maintaining the KMW. This paper concludes by summarizing the future evolution of the KMW and efforts to position the KMW as a resource that partner countries use as they grow and mature their nuclear security detection programs, as detection technology evolves, and as new detection equipment is deployed.

2. THE CASE FOR KNOWLEDGE MANAGEMENT SYSTEMS IN SUPPORT OF SUSTAINING A NUCLEAR SECURITY REGIME

As a key component of sustaining a nuclear security regime, the IAEA advises Member States to address human resource development by ensuring the continued availability of appropriate numbers of staff with the necessary competencies and expertise. Further, the IAEA advises that Member States allocate resources to support programs in education, training, and knowledge management for the short, medium, and long term [5]. The required staff with appropriate competencies and expertise should remain available to meet the needs of a nuclear security regime, even given complexities of staff turnover. Viewing security as a team effort is not a new concept, the idea being that security systems and measures are only as strong as their weakest link. Nuclear security is no exception; it is as important to have trained, capable nuclear security professionals as it would be to have properly calibrated and maintained detection instruments. Developing a thoughtful and deliberate knowledge management system supporting the roles and responsibilities in the nuclear security regime enables continued reliance on, and resilience in, the systems and measures a State develops to address nuclear security threats.

Nuclear security professionals must be well prepared to assess nuclear security threats and effectively respond during a nuclear security event. Having the information needed to make decisions in response to a given threat in a timely manner is important. Additionally, this information needs to be available at many locations across a Member State. Given this distributed nature of FLOs and other individuals supporting the detection of and response to nuclear security events, knowledge management systems should be developed to support just-in-time information needs at the point of use.

Studies in organizational culture can be applied to knowledge management for nuclear security human resource development. Such studies identify that simplifying access to learning resources is critical to future success. There are two categories to continuous learning experiences—those that involve direct human interaction and those that do not. Widespread collaboration among co-workers has become a recognized good practice to foster the sharing of knowledge. In short, “workers are knowledgeable only to the extent that they have access to other knowledge workers.”[6] Direct human interaction with experienced knowledge workers, or more generally subject matter experts (SMEs), is an effective practice for knowledge transfer but requires co-location of the SMEs to the learner. However, this is an important limitation. Knowledge management systems that do not require direct human interaction promote more efficient connections to learning resources for gaining knowledge at any time or place. A web-based knowledge management system reduces the need for in-person training activities, leading to cost-savings for an organization. Therefore, given the widespread availability of secure web-based knowledge management tools, a nuclear security human resource development program should not depend solely on direct human interactions.

The IAEA advises that knowledge management should include capturing, structuring, and transferring information with the overall goal to ensure that organizations retain the experience and knowledge gained by nuclear security staff over time [5]. States should develop knowledge management programmes that include succession planning and knowledge transfer to continuously improve the human resources necessary to sustain the nuclear security regime [5]. Knowledge management systems should be a part of an organizational strategy for building a culture of learning. The NSDD program and its partnering organizations recognized the importance of maintaining and retaining the knowledge of experienced staff over time. Significant resources were involved in planning and delivering training to operate and maintain detection systems, but if training could only be delivered once or maybe twice a year at a remote site, or perhaps at a centralized location like a training academy, what additional tools could be available for staff to access the information they needed?

These challenges which the NSDD program faces in human capacity development are analogous to those a State faces in that both have limited resources to apply to education, training, and knowledge management. Such challenges are exacerbated for the NSDD program by considering factors such as the wide geographical distribution of the organizations, working across more than 30 languages, and evolving curriculum materials. To work leaner and smarter, the NSDD program challenged itself to foster continuous learning experiences across its partner country collaborators. The NSDD program determined that establishing a knowledge management system that provided user-friendly access to a comprehensive set of information for the operation, maintenance, and training of nuclear security

detection systems and measures was critical to human resource development. The KMW was envisioned as a knowledge management system that would support partner countries' long-term sustainability of nuclear security detection system capabilities.

Developing and launching the KMW was important for a few additional reasons. First, the KMW allowed training products and procedures to be distributed "just in time," meaning the information was available and accessible to those that needed it, when they needed it. FLOs operating the detection equipment or the maintenance provider troubleshooting the detection instruments would not have to wait for the next available in-person training course—they could log on and find the information they needed, when they needed it. Second, the KMW would empower external NSDD program partner country collaborators to pull materials themselves as they are published. Prior to the KMW, internal NSDD program stakeholders provided materials to external NSDD program partner country collaborators through site visits and digital communication. Partner country collaborators could not pull information directly. Third, the KMW was a cost-effective mechanism to disseminate information to end users located around the world, providing ready access to materials for the NSDD program's foreign partners in a secure, user-friendly environment.

3. PLANNING CONSIDERATIONS FOR DEVELOPING AND LAUNCHING THE KMW

Once the NSDD program decided to develop the KMW, several important planning considerations were identified. This section describes broadly the main planning actions that the NSDD program addressed when developing the KMW, which included the following:

- Engaging with prospective user communities to understand their needs;
- Defining the functional requirements of the KMW;
- Choosing a suitable platform for publishing materials for access by NSDD program partner countries;
- Aligning KMW development with NSDD program training program strategy;
- Defining a strategic roadmap for development and deployment.

3.1. Engaging with prospective user communities to understand their needs

An assessment of the needs of the various user communities that would leverage the KMW was an important step in defining functional requirements. User communities can also be thought of as target audiences, which focuses more on the content needs of users. In 2014, when the planning activities were under way, the NSDD program already had 15 years of experience in conducting its mission and, thus, an extensive network of external and internal stakeholders to draw from. External user communities included international agency partners and external partner country stakeholders such as management, FLOs, maintenance providers, trainers, and expert support personnel. Internal user communities included NSDD stakeholders (e.g., DOE federal managers, contractors, and support staff in various roles including trainers, curriculum development staff, maintenance technicians, help desk technicians, project managers, and other SMEs). The planning team engaged proactively with these external and internal stakeholders to identify good practices and recommendations. This input ultimately led to the NSDD program deciding to leverage a web-accessible platform for secure, simple, and streamlined access. The needs assessment represented the start of an ongoing conversation with user communities regarding their needs and how the KMW could meet them.

3.2. Defining the functional requirements of the KMW

After conducting the needs assessment with the prospective user communities, the feedback was consolidated. The development team reviewed this feedback to help develop the requirements for system functionality for the KMW, along with identifying constraints, to help determine what platform would be most suitable for the NSDD program. A few of these requirements included the following:

— Provide a simple user interface that enables users to quickly find and download information anywhere that supports a specific detection system operation or maintenance task;
— Minimize development and maintenance cost to support sustainability;
— Leverage a free, open source, database-driven, content management system (CMS) that allows content to be easily organized, managed, and published with opportunities for customization;
— Multimedia support for on-page videos, photos, graphics, documents, and computer-based training materials;
— Multiple-language support in the system navigation and content;
— Mobile device support;
— Visual design flexibility for usability;
— Platform and content must be transferrable to another organization in the future.

3.3. Choosing a platform for publishing materials

The decision-making process for which CMS would be most appropriate to meet the KMW objectives focused on identifying a platform which met the functional requirements defined above. A CMS is a system that manages the creation and modification of digital content, typically focused on web-based publishing. There are numerous CMS options available for making information available through secure access controls. These platforms have varying degrees of system administration complexity, licensing costs, and security. The question was which platform: SharePoint, static website, WordPress, Drupal, etc.

To define the appropriate CMS to use and develop a prototype that met the requirements, internal NSDD stakeholders from training, curriculum development, and sustainability were consulted to identify the taxonomy around which the materials would be organized on the KMW. This would dictate how end users would find materials on the KMW. Defining the taxonomy early was important because it provided the structure for how the materials on the KMW would be categorized. Categorizing materials into a taxonomy allows the end user to find the information they need more easily; the terminology in a taxonomy is where metadata tags are sourced to allow for documents and information to be surfaced in searches in addition to full text of the documentation. To get it right, the development of such a taxonomy requires input from multiple stakeholders such as training and curriculum development SMEs. An example taxonomy for the equipment type category is shown in Figure 1.

Equipment Type	Communications	Central Alarm Station	
		National Communications System	
		Network	
	Detection	Handheld	High-resolution Radioisotope Identification Device
			Personal Radiation Detector
			Radioisotope Identification Device
			Survey Meter
		System Type	Mobile Detection System
			Radiation Portal Monitor
			Spectroscopic Portal Monitor
	Identification	Cameras	
		License Plate Reader	
		Optical Character Recognition	
	Infrastructure	Other Infrastructure	
		Power	
		Traffic Control	

FIG 1: Example Taxonomy for Equipment Type

3.4. Aligning KMW development with NSDD training program strategy

In 2014 when the KMW planning was underway, the NSDD program was also incorporating instructional systems design methodologies into its existing curriculum development processes. Through a needs assessment

process, the NSDD program training team identified that a mechanism to distribute the newest information products to partner countries more efficiently was required. This team was eager to have a web-based tool that could consolidate and push future curriculum revisions to partner countries. The KMW offered a platform by which partner countries could more readily access the latest training products and curriculum. The timing was right for the KMW to be approved for development. The KMW was incorporated as a critical component in the future delivery of NSDD program curriculum to partner countries.

3.5. Defining a strategic roadmap for KMW development and deployment

Direct engagement with NSDD program leadership at multiple levels was critical to acquiring the resources needed to develop and launch the KMW. Documenting a strategic roadmap illustrated the process for developing functionality in response to user requirements to management. This strategic roadmap was a useful communication tool to validate that the KMW functions were aligned with organizational objectives. This strategic roadmap was reviewed by NSDD program training and organizational management and helped the KMW team ensure that the KMW product aligned with NSDD program organizational strategy. This document also helped identify and justify the resources needed for project management, software development, and content management.

4. MANAGING AND OPERATING THE KMW

The KMW was first made available to NSDD program partner countries in June 2015 and to representatives from IAEA Member States with nuclear security responsibilities in 2016. The KMW now serves over 60 NSDD program partner countries by providing access to information supporting the sustainability of deployed radiation detection systems. The section below highlights the key factors for managing and operating the KMW. Operating and managing the KMW requires the assignment of roles and responsibilities for content management, including maintaining tight integration with the training organization, continued and active engagement with user communities, the ability to adapt and change to meet the needs of stakeholders, analysis of usage data, and a focus on growing the user communities.

4.1. Assigning a content manager

Operating the KMW with excellence requires assigning a content manager for maintaining the repository of current materials accessible in a user-friendly format. The content manager is responsible for both identifying new content to be published to build the library on the KMW and keeping existing content fresh through practicing sound configuration management practices. To do this, the content manager collaborates with materials development staff to understand the current state of materials. This includes understanding how materials should fit within the taxonomy and where taxonomy updates are required. Keeping the content fresh requires a thorough understanding of what the current state of NSDD program materials are, and which materials are on the KMW so that they can be updated or removed as circumstances dictate.

4.2. Active engagement with the end users

A good practice in software development is continued and active engagement with user communities to identify evolving needs and to keep pace with user expectations. After the launch of the KMW, engaging with the end users led to continued improvements such as new content being published and functional requirements. The KMW team identified the risk that if user communities could not easily find the information they needed, they would not actively use the system. To address this, the NSDD program prepared trainers and facilitators already traveling to NSDD partner countries to conduct demonstrations for such activities to gather direct feedback on the KMW. Additionally, users and trainers identified requested manufacturer manuals be made available. Manuals were added, after consulting with manufacturers to assess whether they should be posted directly within the KMW, or a link to the manufacturer’s

website was more appropriate. This outreach helped to make improvements to the KMW, addressing the risk of users not using the full benefits of the system or not using the system.

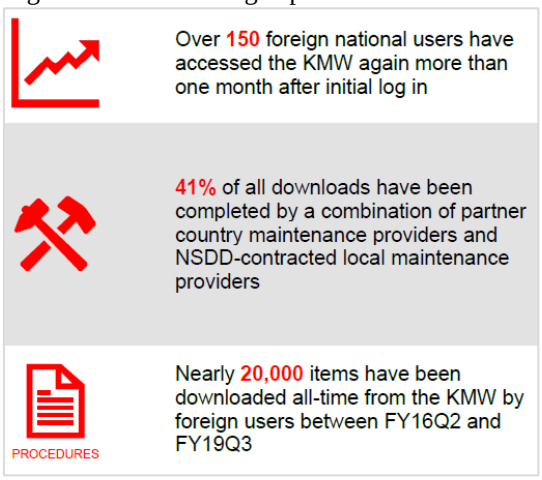
4.3. Adapting the KMW to evolving user requirements

End-user engagement is important to understand what changes may be needed to the KMW, but the KMW team also needs the ability to make these changes easily and quickly. Using agile software development practices, the KMW team readily adapts the KMW to evolving user requirements. An iterative development process is followed. Principles of agile software development focus on collaboration with the customer in response to changing user requirements.[7] For example, two years after the KMW launch, the NSDD program completed updated eLearning modules and the training curriculum development team identified that they expected these modules to be accessible by partner countries on the KMW. However, the KMW only allowed for eLearning modules to be available for download. This required changes to the design and functionality of the KMW. This was resolved through reprioritizing development activities and adapting the KMW to host the eLearning modules for use directly on the system.

4.4. Conducting data analysis

The KMW, as with most web-based knowledge management systems, collects and stores usage data. Through analysing anonymized usage data, trends are identified in how and to what extent users are leveraging the tool. The KMW team creates statistics indicating how many users are accessing the system, how often users are leveraging the system, and what materials they are accessing most often. Trending these statistics measures the value of the system. The data collection and analysis are conducted within the boundaries of appropriate information security regulations where applicable, such as the European Union General Data Protection Regulation.[8]

Through anonymized user usage analysis, the KMW team uses these statistics to justify the cost of managing, operating, and maintaining the system. Usage analysis is conducted periodically. Figure 2 shows how KMW data is used to trend KMW usage over time (i.e., the U.S. government fiscal year, or FY). The example below in Figure 3 show quarterly statistics the KMW team compiles and shares with NSDD program stakeholders. This information helps illustrate the utility of the KMW to management and the importance of continued investment in this tool supporting continuous learning experiences in a secure manner.



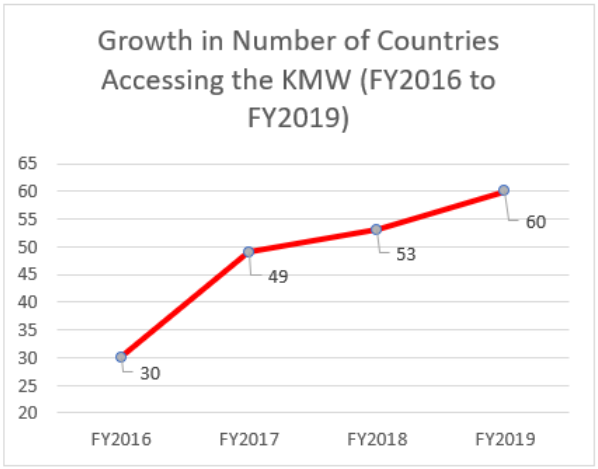


FIG 2. Example of KMW usage trending over time. FIG 3. Example of quarterly KMW usage statistics

4.5. Adhering to security requirements

Managing the KMW requires strict adherence to security requirements regarding the information included in the system and the security of access controls. A series of processes and security requirements were implemented to ensure that only non-sensitive documents are made available via the KMW, and only to approved users. These

processes involve a series of security reviews for individual content items, and a comprehensive review of the entirety of the KMW library available on the website. Regarding access controls, there are security requirements for system access based on the sensitivity of the information. Additionally, the KMW team follows a process to vet user access requests, including confirming the identities of prospective users with NSDD program project teams. Security certificates are also renewed annually. The series of processes in place are reviewed periodically by project and organizational management, at minimum annually.

4.6. Growing the KMW user base

Lastly, an important part of operating and managing the KMW is continuing to grow the user base. Achieving growth required establishing a communication plan, which encompasses a broad range of organizational activities and is helpful in managing expectations for NSDD program partner countries as to what capabilities are addressed by the KMW. The KMW team implemented a coordinated communication campaign to raise awareness about the existence of the KMW and educate users about how it could help support continuous learning experiences in NSDD program partner countries. Publishing the KMW without a communication plan would have prevented user communities from knowing about its existence. The KMW communication plan focused on no-tech, low-tech, and high-tech mechanisms for communicating. This included a one-page flier and a structured demonstration plan with paper printouts, Microsoft PowerPoint slides, or live online demonstrations. The plan also included approaches for communicating with internal NSDD stakeholders, helping to establish a requirement that all NSDD program training, workshops, and exercises activities would include an information session on the KMW. As implemented in the communications plan, users granted access to the KMW are added to email announcements, which are sent each time new content is made available in the system. User usage analysis shows an increase in usage after these email announcements are distributed, further growing the KMW user communities. Managing KMW communications helped reinforce the continuance of end-user feedback loops and grow the user base leveraging the KMW.

5. LESSONS LEARNED FROM DEPLOYING AND MAINTAINING THE KMW

Looking back from the initial concept, to planning the launch, and considering the ongoing management and operation of the KMW, several lessons learned are outlined below. These lessons summarize the experience the NSDD program offers as countries consider how they might structure, implement, and sustain their own knowledge management systems and measures that support nuclear security human resource development efforts. The following lessons learned are shared for consideration.

5.1. Adopt a graded approach

Applying a graded approach to the implementation of a knowledge management system balances the resources needed for the maintenance of a system with the value the organization would derive from it. A system should meet user requirements without burdening the organization with expensive software maintenance costs. Defining software maintenance costs in terms of licensing and human resources must be completed prior to the acquisition of a new software product. Consider also, existing software platforms in use that meet knowledge management needs. An analysis of alternatives should be conducted to determine what platform would meet an organization’s requirements. For example, leveraging an existing SharePoint site may be sufficient for an organization if all identified user communities have access to this single resource.

5.2. Clearly identify user communities

User needs should drive the content to be included in the knowledge management system and the system’s functionality, which means the user communities need to be clearly defined early. Determining who needs access to the information, when, and how often will drive the system requirements, including access controls and security

protocols for information sharing. Identifying the user communities also helps to engage stakeholders early in the planning process and will help in better understanding the requirements for system functionality.

5.3. Define performance metrics

Performance metrics help define what success looks like for system performance and usage. They are also helpful in justifying continued and future investments in knowledge management systems and measures. Defining system usage metrics early helped the NSDD program understand KMW utilization. These metrics became important indicators to management of the value of the system. Identifying performance metrics early in the process will inform software selection.

5.4. Obtain organizational management sponsorship

Having organizational management invested in the success of developing a knowledge management system facilitates overcoming bureaucratic and financial barriers. Consistent engagement with management from requirements analysis through the management and operation of the system is important to sustaining support.

5.5. Integrate with nuclear security training curriculum or materials development programs

Any knowledge management system must plan for and develop a strategy to provide up to date and relevant information to end users. An effective strategy for the KMW and for other knowledge management systems supporting nuclear security human resource development is to partner with training programs responsible for developing materials for competent authorities with roles and responsibilities in the nuclear security regime. Further, while the content on a similar system will naturally grow over time if properly curated, having a critical mass of content available at initial launch is important for users to find the site useful and worth returning to for future reference.

5.6. Develop a comprehensive and living taxonomy

Through collaboration across organizational management and user communities, a taxonomy should be defined around which the content can be logically organized and searched. A taxonomy is structured metadata. A taxonomy informs, but does not define, the structure of a knowledge management system. The software product chosen for a knowledge management system should leverage this taxonomy for surfacing content through search and be flexible to allow for future changes.

5.7. Streamline content management practices

Simplifying the approach to content management using a general rule of only managing information once promotes efficiency and cost-savings. Staff maintaining the configuration of documents in only one location, rather than multiple, prevents duplication of work. A knowledge management system should provide materials for all user communities from one centralized resource where it is approved by management for use once and then accessed for many purposes. The software should allow different user capabilities (e.g., read, write, and edit) to be applied to user communities and individuals with different roles within the organization. The system must also allow for change control and change tracking for optimal configuration management. For example, the roles of trainers, operators, maintenance providers, content managers, and curriculum developers have different capability needs. An efficiently designed knowledge management system would allow curriculum developers to deposit completed content in the same location where trainers can access the content for training delivery.

6. FUTURE OF THE KMW AND NEXT STEPS

The KMW has been in operation for five years; thinking about the next five years, there are a few ways the KMW will expand and grow. A CMS with responsive design was chosen for the KMW. This capability was important because many FLOs and maintenance providers are not always working at a desktop computer; they require access to materials on mobile devices with various screen sizes. However, locating content downloaded on a mobile device can be challenging. In response to this user-identified need, a mobile application shown in Figure 4 has been developed for iOS and Android to make content more easily accessible on mobile devices. This mobile application will be made available to KMW users soon.

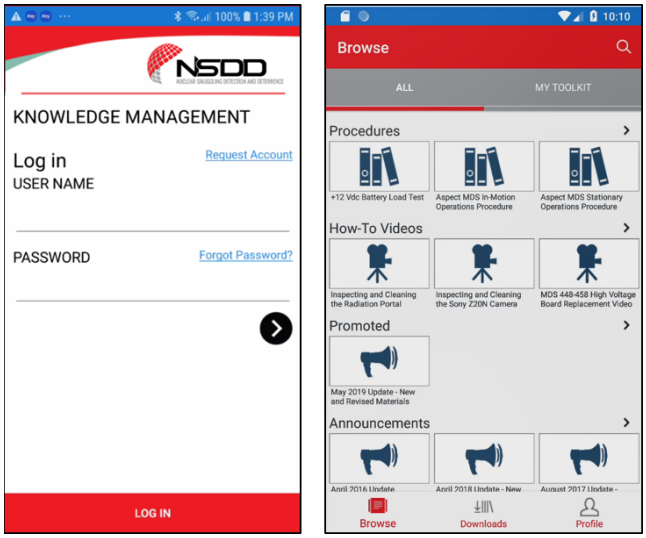


FIG 4. KMW mobile application screen images

In addition to the mobile application, the KMW team will continue to manage the content by retiring information that is outdated or no longer useful (using feedback from the user communities) and updating with the latest systems and technologies the NSDD program deploys. In fact, as the NSDD program deploys new technologies and detection systems, the KMW can be positioned as a resource before equipment is deployed. Early engagement with the KMW promotes sustainable deployments through building an understanding that NSDD partner countries have the autonomy to access critical materials themselves. For example, eLearning modules hosted on the KMW are being used as prerequisites to in-person training activities. The KMW has become ingrained into the capacity building activities of the organization such that partner countries are informed about this resource early and often. The future vision is that materials should always be on the KMW before new radiation detection equipment is deployed to meet the needs of all NSDD program partner countries.

7. CONCLUSION

Every day across the world, FLOs and other authorized persons with nuclear security responsibilities perform critical nuclear security activities. Implementing knowledge management systems and measures as part of States' human resource development objectives are an important part of sustaining nuclear security regimes. The case study of the KMW is useful for States and other organizations interested in developing similar nuclear security knowledge management systems and offers lessons learned gleaned from planning, managing, and continuing to operate an important information resource available to over 70 countries. Moving forward, the KMW will continue to evolve, engage user communities, and provide relevant and timely nuclear security detection information to NSDD partner country collaborators. Ultimately, a knowledge management system that fosters the continuous development of

nuclear security expertise without depending solely on direct human interactions need not be overly complex or prescriptive. If carefully planned with the end user in mind, knowledge management is an achievable capability as States and broader international community come together to prevent, detect, and respond to nuclear security events.

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