

The Necessity of Knowledge Management

Appel, Gordon J. and McMahon, Kevin A.
Sandia National Laboratories
PO Box 5800, Albuquerque, New Mexico 87185
gappel@sandia.gov and kamcmah@sandia.gov

ABSTRACT— Knowledge management has multiple applications and is more and more recognized as a valuable contributor for managing large, complex, businesses or projects with lifespans of many years or decades. Sometimes it seems to be one of the last concepts one considers when planning or initiating substantial endeavors. Often it is left until it is nearly too late. This paper suggests those involved in nuclear related work need to change their approach to Knowledge Management so that it is an integral part of a project's structure, from its inception. It can be a vital part of a project during the short, medium and long terms. It can serve multiple needs by improving business processes, offsetting intellectual losses from inevitable departures of particularly knowledgeable personnel, and assuaging public concerns about undertakings, of which they are understandably leery.

Much of this paper is founded in Sandia National Laboratories' (SNL) knowledge management activities near the end of the Yucca Mountain Project (YMP). The Yucca Mountain project effort spanned about 30 years and engaged a core of hundreds, if not thousands, of technical participants. It reached its apogee on June 3, 2008 when a license application seeking authorization to build a geologic repository at Yucca Mountain was submitted by the U.S. Department of Energy (USDOE) to the U.S. Nuclear Regulatory Commission (USNRC). On March 05, 2009, the Energy Secretary announced that Yucca Mountain no was longer a workable option for storing highly radioactive nuclear waste. The President's fiscal year 2011 budget eliminated funding for the YM program. By mid-year 2010 all project activity had ceased, with the exception of static information preservation. The development of the project is briefly summarized. A general description is provided of SNL's efforts undertaken to preserve the information supporting its principal contribution, the Post Closure analysis of the YM nuclear waste repository. This effort was conducted over and extraordinarily compressed timeframe, and has proven to be a resilient and reliable resource for YM science information.

An overview of recent international knowledge management efforts is included to provide topical context. General recommendations are suggested and discussed for those presently engaged in nuclear related projects or those that may be engaged in similar activities in the future. These are based on our lessons learned that we believe are opportunities to be explored, illustrating topics where formally indulging in knowledge management can serve to avoid urgent efforts which are often undertaken under less than perfect circumstances at the last minute.

I. INTRODUCTION

Knowledge management is a comprehensive term generally meant to encompass efforts directed at compiling, organizing, and leveraging an organization's knowledge to support organizational goals, (continuity, profitability, efficiency, etc.). The term includes a diverse range of efforts to identify, analyze, optimize, and apply information that the organization deems important. In the context of repository systems, it spans matters ranging from the purely technical, well understood (certain), physical/chemical characteristics (waste packages materials, waste forms, corrosion, and waste locations); to less well understood (uncertain) characteristics, (natural fluid flow, volcanism, other low probability events); to very poorly definable characteristics, (cultural influences, societal characteristics).

Knowledge preservation is an element of knowledge management. For long term social artifacts, like nuclear waste repositories, its focus is different from that customarily applied, which is largely directed at important information necessary to maintain or improve current business models. Applied knowledge management as generally practiced would be very useful in the operation of a repository system. An example would be using knowledge management techniques to maintain the continuity of procedural processes (technical culture) over the decades of repository operations. However, knowledge preservation consists of efforts to safeguard our understanding of important issues for continuing long-term safety of the repository system by avoiding the loss of institutional and societal knowledge long after its closure.

Knowledge preservation for repository systems envelops both classic subdivisions of knowledge; explicit knowledge, and tacit knowledge.¹ Explicit knowledge is information that is readily codified into a tangible form, i.e., documentary material (reports, analyses, memos, videos, email, databases, etc.) that may be retained in a wide variety of media (paper, film, electronic, etc.). This knowledge is most readily identified and retained, although it is still subject to the customary difficulties associated with dissemination, poignancy, searching, and technological obsolescence.

Endeavors such as development of a nuclear repository are frequently characterized as technical/regulatory matters, whereas they are more appropriately viewed as national policy issues with a science/engineering underpinning. Nonetheless the management of the knowledge needed for success is overwhelmingly driven by regulatory (technical / engineering) considerations. So, recording and preserving the explicit recorded knowledge required to convince a regulator to allow repository operation secures at least a core set of information requiring preservation. However, regulatory submittals likely constitute less than one percent of the recorded information necessary to produce it.

Tacit knowledge is knowledge that we as individuals possess, but is not readily codified. Skills like playing musical instruments, woodworking and welding are examples, as are inherent personal abilities like writing and mental arithmetic. Tacit knowledge is much more difficult to codify, if possible at all. However, this knowledge class also includes information that is not clearly explicit, but can be codified to a certain extent. Examples are technical, societal, or cultural processes that pertain to substantial organized efforts (large engineering projects). This knowledge can be captured by interrogating participants and transcribing or recording the conversations.

Notably, the form of the preservation media is a pervasive problem that overshadows all attempts at knowledge preservation, especially those attempting to preserve knowledge for centuries or even millennia² as in the case of repository post-closure information. Paper objects have traditionally served as the media for important information. However, our technological advances are clearly directing preservation efforts to electronic forms. For example, while the ease of web-based publishing has greatly enhanced the dissemination of information, the inevitable changes in the web construct have led to international efforts to secure continued access to scientific and technical literature in the nuclear field.³ This illustrates the difficulty of maintaining accessibility to electronically preserved knowledge, even over a time span as short as a few decades. Recording conversations with key leaders

and experts is another way to capture knowledge, but this approach faces similar durability and poignancy challenges over long times.

In the U.S., the National Archive and Records Administration (NARA) accepts records in electronic formats.⁴ Yet advances like these are not without their own obsolescence related issues. Notably, the technological durability and usability of the preservation media is a pervasive problem that overshadows all attempts at knowledge preservation, especially those attempting to preserve knowledge for centuries or even millennia as in the case of repository post-closure information.

II. YUCCA MOUNTAIN KNOWLEDGE PRESERVATION

Investigation of Yucca Mountain as a repository location began in the mid-to-late 1970s, and became progressively more directed with the 1980 passage of the Nuclear Waste Policy Act and its amendment in 1987. As illustrated in Figure 1, site investigations progressively improved the understanding of the site and its projected performance until in June of 2008. At that time the DOE submitted a license application (LA) to the U.S. Nuclear Regulatory Commission (NRC) for a construction authorization for a high-level waste repository located at Yucca Mountain, Nevada. This culminated more than 20 years of scientific investigations into the feasibility and safety of disposal of high-level radioactive waste and commercial spent nuclear fuel at this location.

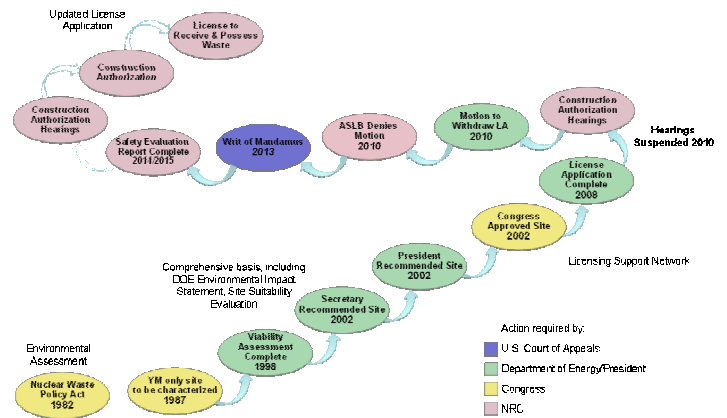


Figure 1 - Yucca Mountain Repository History

On February 1, 2010, the U.S. Administration announced its Fiscal Year 2011 Budget Request to the U.S. Congress reflecting discontinued support for the Yucca Mountain Project (YMP) LA submitted to NRC. DOE began to terminate YMP activities in March, 2010. By the end of July 2010, all YMP site-related technical studies had

ended. Because the licensing proceeding had not come to a clear cut conclusion, several involved organizations, including SNL, moved to preserve the scientific, technical and procedural information from the project.

One advantage YMP had over most similar projects was that NRC's rules required population of a Licensing Support Network (LSN) to facilitate legal discovery for NRC's adjudicatory licensing hearing.⁵ The LSN is was an electronic system, established by the NRC and operated by the NRC's Atomic Safety and Licensing Board (ASLAB) panel, which held about 3.6 million documents at the time of the license submittal.⁶ Its purpose was to provide internet access to documents that may be used as evidence in the NRC's review process and associated licensing proceedings. This meant that the information to support the licensing hearing was preserved by the regulator, in addition to the licensee and its support organizations.

Interestingly, this information was preserved, but not publically available as originally designed. Public access to the LSN was terminated in August, 2011.⁷ The Licensing Support Network (LSN) document collection is fully available to NRC internal users in a nonpublic library of the NRC's Agencywide Documents Access and Management System (ADAMS). Although the Commission has directed that the LSN document collection should be loaded into a publicly accessible library in ADAMS, this has not yet happened.⁸

Another advantage was the rigorous records management provisions followed by participants throughout the project. The collection of information maintained by DOE's Legacy Management office is the most comprehensive YMP collection. It contains more than 62 million records, including over 3 million project documents in the LSN collection, as well as other artifacts (computer programs, etc.) related to research conducted in DOE's Civilian Radioactive Waste Management program over at nearly three decades.^{9, 10}

Knowledge from Yucca Mountain Project is preserved in the following systems:

- NRC ADAMS (Agency Document and Management System) Collection
- NRC ASLAB LSN (Licensing Support Network) Collection
- DOE Legacy Management Collection
- Yucca Mountain Project Lead Laboratory Archive (SNL)
- Other Proceeding Participant Collections (e.g., State of Nevada)

Sandia was DOE's lead national laboratory for the project principally responsible for post-closure analyses of the YMP repository system. Sandia archived project information in a more integrated fashion than the legacy

project systems allowed. Figure 2 illustrates the general YMP information relationships. The shaded boxes represent independent project information systems that were largely isolated from each other. Without understanding the relationships among these information systems one would be unable to interpret the coding and metadata that relates the knowledge preserved (documents, data files, etc.) to the process from which it originated.

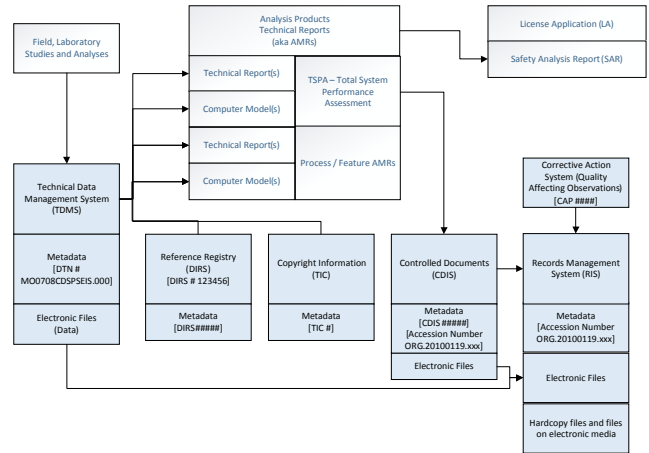


Figure 2 – General YMP Information Relationships

Using SharePoint© technology, conventional file storage, and the general information model shown in Figure 3, Sandia developed two integrated tools to access project information; the Licensing Support Warehouse (LSW) and the Search and Report Center (SRC) (Figure 4). LSW allows searches of an electronic warehouse for data and documents collected from YMP information systems. SRC allows creating, distributing, and managing business information from information systems using existing or tailored reports.

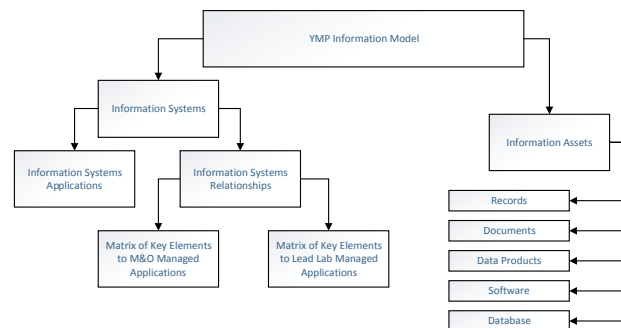


Figure 3 - YMP Lead Lab Information Model

These tools provide several benefits with respect to accessing project information:

- Access to information that was scattered among multiple, diverse systems, not often operated by SNL
- Access to large collections of documents that are more conveniently searched collectively.

- Access to multiple tracking systems (databases) addressing the same or similar subjects
- Reduced time to establish the traceability of information
- Reduced time to find needed information
- Results provide direct access to available content
- Assist memory capabilities of participants
-

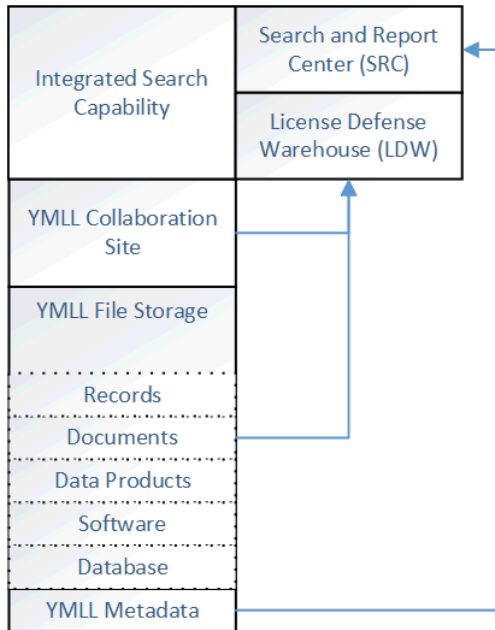


Figure 4 - Integrated YMP Lead Lab Search Model

The approach described herein made the basis for SNL's post-closure analyses of the YMP repository system information readily searchable and available. Similarly efforts were made before project closure to retrieve physical samples and test specimens from various research locations and return them to the YMP Sample Management Facility. Custody of this facility was returned to DOE in mid-2010.

There was a limited effort to collect and preserve the intrinsic knowledge of a small sub-set of the hundreds of Project participants. In July 2009, a set of focus group discussions with the YMP technical Staff were conducted.¹¹ Project insiders who understood the initiators as well as the processes and methods employed to manage professional, organizational, and cultural change over time at the YMP were involved. The study addressed the way the YMP policy and organizational changes affected perceptions of the organizational environment, views of the role and nature of the technical work, and understandings of the norms and expectations for career scientific and technical professionals, over the nearly three-decade evolution of the project. It concluded that one of the most significant concerns expressed by the YMP workforce was

the loss of radioactive waste management expertise, suggesting that a sustained institutional, organizational, and personnel effort to address the national radioactive waste problem was needed, one that is not necessarily focused on a particular location, or maybe even a particular waste class or form.

III. KNOWLEDGE MANAGEMENT RECOMMENDATIONS AND SUGGESTIONS

Our YM experience, as well as that from SNL efforts in other areas (weapons development) have contributed greatly to our appreciation of the need for what is commonly called 'knowledge management'. This topic is of particular importance in the context of long-duration nuclear endeavors, which may inevitably extend beyond the career durations of 2-3 generations of the workforce. The conventional practice of knowledge management can improve day-to-day operations; however, its practice in the context of long-term endeavors may offer the only available approach to overcome the 'tribal knowledge' syndrome. This is a syndrome where the only readily available avenue for understanding the nature of technical, quality and business support practices is to be indoctrinated in the process for a substantial portion of one's career (years).

Another aspect of knowledge management must focus on establishing a knowledge base and history that will endure for hundreds of years. It is deceptively easy to presume that nuclear endeavors will proceed along a pre-ordained timeline, when demonstrably this is not the case. For example, one might not have thought that long-term knowledge management was necessary in 1987; after all, YM was to receive waste in 1998. The fallacy in such presumptions is readily apparent thirty years later. One way to address this problem is to create a position responsible for knowledge management, and maintain their involvement over the life of the project. This position requires awareness of the technical, social and political circumstances surrounding the endeavor. Their job includes infusing day-to-day operational management with knowledge management principals as well as building an on-going historical record of program-related events and processes for future reference. That is, to make a record of important processes, activities or events. Today's multi-media tools make this much easier than in the past.

Information systems employed, whether for technical support or business purposes, need to be unified, with a common operational basis. Electronic file storage should be limited to one networked location, with provisions made for regular (nightly) backups to a remote location. Plan for the aging (obsolescence) of these systems and keep them current. Information management systems tend to receive short-shrift over time because program success is often

seen as lying just beyond the next program milestone. This view is markedly short-sighted, because often the objective slips into the future and the aging of information systems are ignored.

Information systems will, of course, have multiple components, but they all need to be able to share information easily. Integrate compliance systems (e.g., Corrective Action and Quality Assurance systems) with the technical support and business systems to minimize manual transfer of information. For example, the corrective action to resolve an issue may be revision of a QA procedure. The metadata in the Corrective Action program system, the QA procedure, and the document or records management systems should reflect this relationship.

Records management, document control, and correspondence control are all processes that contribute greatly to explicit knowledge management. Often they are subjected to disproportionately severe impacts attendant to substantial programmatic changes. To avoid re-inventing the wheel, this information and the systems in which it resides need to be maintained so that the information is accessible. Plan on funding such resources, they are very difficult to reproduce.

Given the opportunity to repeat our YM role, we would organize our explicit knowledge management around three fundamental IT components: a collaborative software package, a robust database, and a very substantial file storage capability. The collaboration software would serve general workforce collaboration needs such as document development, as well as, metadata relationship functions for document control, correspondence control, and records management. All final (record copy) files would be electronically stored in a separate file storage, not in the collaborative tool. All information would be assigned a single unique accession number independent of the nature of the information (e.g., documents, correspondence, email, software, data packages, and physical items (objects)). Databases would be used to maintain the metadata relationships among the various stored items.

Great care and effort would go into defining the relationships between the various types of information. The resulting metadata schema will be of fundamental importance and assiduously enforced. The ad-hoc assignment of identifiers leads to confusion, frustration, and extensive (and expensive) manual tracking. Complete metadata on uploading files (information) to electronic systems would be mandated, and its verification would be designed into the system architecture.

For example, a technical document usually relies on other information:

- References internal to the endeavor.
- Reference external to the endeavor (some of which will be copyright materials that need special handling).
- Data packages, sometimes of enormous size
- Specific versions of software packages
- References to samples (or other physical objects)

It is essential to maintain the metadata describing the relationships among such components, in addition to the metadata necessarily descriptive of the component itself. Should significant changes be introduced into one component, one needs to understand which other components relied on that information in order to evaluate if they were affected.

E-mail is a special subject and the endeavor should use a single e-mail system and retain all email. Today, like it or not, e-mail is the principle means of technical, business and policy communication. Train the workforce not to use e-mail for frivolous uses. Discovery of Aunt Sally's cookie recipe among the day-to-day correspondence makes the workforce look distracted. Make sure the entire workforce understands that all e-mail will be retained and that ultimately their own communication(s) may be subject to discovery by other than the addressees. Someone's offhand and ill-considered remarks can lead to very costly efforts to address issues that should have never arisen. YM experienced two very costly excursions that arose out of emails.

Categorization of e-mail can also be a useful facet of knowledge management. Because of LSN regulatory requirements, Sandia developed an add-on to Microsoft Outlook© that allowed the workforce to categorize each e-mail for both regulatory and corporate security and legal purposes. Categorizations for other purposes can be readily foreseen (e.g., records management, controlled distribution, and segregation of personal messages).

Knowledge management is not just about objects and documents. Keep track of people, their involvement and roles in the endeavor. One might even consider going as far as to relate charge numbers to specific tasks. Then, the accounting information could provide a record of what members of the workforce were doing and when they were doing it. Plan for the succession of key members of the workforce (including the knowledge management personnel), and make recordings of exit interviews. Take the time to recognize important processes, interview the personnel involved, and record the interviews. It will be important to recall who was involved in a particular activity and people's memories are fragile.

IV. RECORDS, KNOWLEDGE AND MEMORIES – REPMET

There is international consensus that geologic repositories represent the best known method for permanently disposing of used nuclear fuel and high-level radioactive waste, without putting a burden of continued care on future generations.¹² Although geologic repositories are conceived to be intrinsically safe, there should be no intention to forgo, at any time, knowledge and awareness of the repository or waste that it contains.¹³ Preservation of records, knowledge and memories need to be integral parts of the phases of repository development process from pre-siting all the way through site characterization, licensing, operations of waste emplacement and post-closure monitoring and management. The challenge to knowledge preservation for repository development phases is exacerbated by the time frames from start to finish, which may extend over hundreds of years.

The previously mentioned OECD RK&M Project, initiated in 2010, identified specific products and actions over the years 2010-2014 in three phases.

Phase I (2010 – mid 2011): Scoping of the issue

Surveys to participants were administered, a glossary of terms was started to provide common vocabulary and a draft collective statement was produced on fundamental questions that are faced in the waste area.

Phase II (2011–mid 2012): Improving our understanding

Based on two project workshops, one in October 2012 and one in April 2012, the glossary of terms was augmented with more work on short-, medium- and long-term issues, a bibliography and additional questionnaires to participants resulted in the finalization of the collective statement and a progress report.

Phase III (2012 – early 2014): Consolidating the lessons learned and reaching out to different communities

The goal is to produce a menu-driven document that will allow identification of elements of a strategic action plan for RK&M preservation. This work is still in progress.

In October, 2012, at the OECD NEA's Integration Group for the Safety Case of Radioactive Waste (IGSC) 14th Annual Meeting in Paris, a presentation that included a proposal for data management was made.¹⁴ The presentation recognized the RK&M project aims of formulating and developing knowledge preservation methods that endure the longest possible timeframe. However, also identified was the usefulness of a review of the data types and preservation methods that different national programs are currently using. This review would

allow a meta-database, similar to the NEA Features, Events and Processes (FEP) database, to be developed.¹⁵ From this proposal, the data management (DaMa) project was initiated.

At the first meeting of DaMa, held in Paris during September, 2013, a review of existing approaches adopted by waste management organizations was conducted. Participating representatives of waste management organizations from Belgium, France, Germany, Hungary, Japan, Spain, Sweden, the United Kingdom and the United States provided input through presentations and discussions. The following vision statement was developed:

“...Aim of this project is to create a metadata registry that can be used by national programmes to manage their repository data and records in a way that is harmonized internationally and is suitable for long-term management...”

After continued collaborations and communications following the first meeting of DaMa, it was decided to rename the project RepMet (for repository metadata). The vision statement was rearranged to improve clarity, but the changes were mostly on how the material is presented than in the substance.

In January of 2014, the first RepMet meeting was held in Paris. A Summary Record of the First Meeting of the Radioactive Waste repository Metadata Management Initiative was published.¹⁶ Topics addressed in the January RepMet meeting included:

Standards in the field of metadata,

- INSPIRE¹⁷ Infrastructure for SPatial Information in Europe, was considered for adoption by RepMet as an organized approach to defining and structuring metadata,
- CASPAR¹⁸, Cultural, Artistic and Scientific knowledge for Preservation, Access and Retrieval, developed a set of methods and tools and applied them in diverse areas of scientific data, cultural heritage and performing arts, and
- RK&M project and the status of the phases (discussed above).

The scope of the RepMet project includes:

- Identification of methods and protocols for the data and metadata gathering and management and the persistence of the methods and protocols over time;
- Justification of the sufficiency of the set of metadata describing the identified data.
- The role of metadata in 'handshake' between data providers (e.g. site characterization or waste producers) and data users (e.g. modelers or strategic decision makers).

- Guidelines for proposed data/metadata management.
- The role of controlled vocabularies and policy as a means of ensuring consistency and reliability of data and its cataloguing.

Following the January 2014 RepMet project meeting, an exploratory questionnaire regarding metadata collected for waste packages in storage and ready for disposal was distributed to the participants in June of 2014 for completion by August, 2014. The questionnaire implemented comments received from RepMet participants. The purpose of the exploratory questionnaire was, in Phase-I of RepMet, to develop a common list of metadata for waste packages in storage and ready for disposal, using an agreed and shared terminology as well as to understand commonalities and differences in practices among participating organizations. The exploratory questionnaire was a basis for discussions at the September 2014 RepMet meeting.

Following the June 2014 exploratory questionnaire, a decision to issue a second questionnaire was made at the September 2014 meeting of RepMet. Improvements to structuring and completeness could be made based upon the feedback received from the exploratory version, and data was requested from additional facilities. The second questionnaire is requested to be completed and returned by April 3, 2015.

RepMet is affiliated with the NEA IGSC and maintains a strong connection to the RK&M Project. The RepMet project fills a unique and important niche in the broader programs on knowledge preservation that are conducted nationally and internationally.

IV. CONCLUSIONS

The preservation of knowledge related to an eventually successful nuclear repository project should be planned from the very beginning of such a project. We need to recognize the particular importance of the topic in the context of long-duration nuclear endeavors, which are likely to extend beyond 2-3 career generations of the workforce. Projects like this require dedicated positions explicitly responsible for knowledge management and knowledge preservation. They also require a defined process for capturing intrinsic knowledge from participants. We should take action to avoid putting ourselves in the position of having to re-invent the wheel numerous times and wonder: 'Now, how did this mass of information contribute to the ultimate safety decision?'

ACKNOWLEDGMENTS

Sandia National Laboratories is a multi-program laboratory managed and operated by Sandia Corporation, a

wholly owned subsidiary of Lockheed Martin Corporation, for the U.S. Department of Energy's National Nuclear Security Administration. With main facilities in Albuquerque, N.M., and Livermore, C.A., Sandia has major R&D responsibilities in national security, energy and environmental technologies, and economic competitiveness.

NOMENCLATURE

None

REFERENCES

1. Hilsop, D. 2013, Knowledge management in Organizations: A Critical Introduction, Oxford University Press, pg23
2. Cloonan, M.V., 1993, The Preservation of Knowledge, Library Trends, Vol. 41, No. 4, Spring 1993, pp 594-605.
3. IAEA, 2008, Web Harvesting for Nuclear Knowledge Preservation, IAEA Nuclear Energy Series No.NG-T-6.6, Vienna.
4. Code of Federal Regulations, Electronic records, Title 36 Section 1228.
5. Code of Federal Regulations, Procedures Applicable to Proceedings for the Issuance of Licenses for the Receipt of High-Level Radioactive Waste at a Geologic Repository. Title 10 Section 2, Subpart J.
6. USNRC, 2008, Licensing Support Network Program Administration - Semiannual Report, SECY-08-0104, July 23, 2008, ML082050061.
7. USNRC, 2011, Shutdown of Licensing Support Network, Memorandum from Daniel J, Graser to Construction Authorization Board 4 Administrative Judges, July 26, 2011, ML11207A590.
8. USNRC, 2014, October 2014 monthly status report on the U.S. Nuclear Regulatory Commission (NRC) activities and use of unobligated carryover funds appropriated from the Nuclear Waste Fund, November 25, 2014 Memo from Alison Macfarlane (USNRC) to the Honorable Fred Upton (U.S. House of Representatives), ML14303A304.
9. U.S Nuclear Waste Technical Review Board, Report to Congress and the Secretary of Energy, Review of the U.S. Department of Energy Activities to Preserve Records Created by the Yucca Mountain Repository Project, August 2013.
10. U.S. Department of Energy, Office of Legacy Management, Program Update January-March 2012.
11. Sandia National Laboratories, 2010, The Dynamics Of Technical Communities Through The Multiple Phases Of A Nuclear Waste Management Project, SAND2010-8483C, Albuquerque, NM, December 2010

12. USDOE, January 2013, Strategy for the Management and Disposal of Used Nuclear Fuel and High-Level Waste <http://energy.gov/downloads/strategy-management-and-disposal-used-nuclear-fuel-and-high-level-radioactive-waste>
13. NEA-OECD , October 2011, Vision for the RWMC Project on Preservation of RK&M Across Generations, NEA/RWM(2011)6/REV2, <http://www.oecd-nea.org/rwm/docs/2011/rwm2011-6.pdf>
14. Nagy, Zoltan, Leader Geologist, PURAM, Hungary, “Proposal for Data Management” presented at IGSC 14th Annual Meeting
15. NEA FEP database, https://www.oecd-nea.org/rwm/igsc_coprojectactivities.html
16. NEA-OECD. 20-21 January, 2014, Summary Record of the First Meeting of the Radioactive Waste Repository Metadata Management (RepMet) Initiative, NEA/RWM/IGSC(2014)3
17. INSPIRE, <http://inspire.ec.europa.eu>
18. CASPAR, <http://www.casparpreserves.eu/>