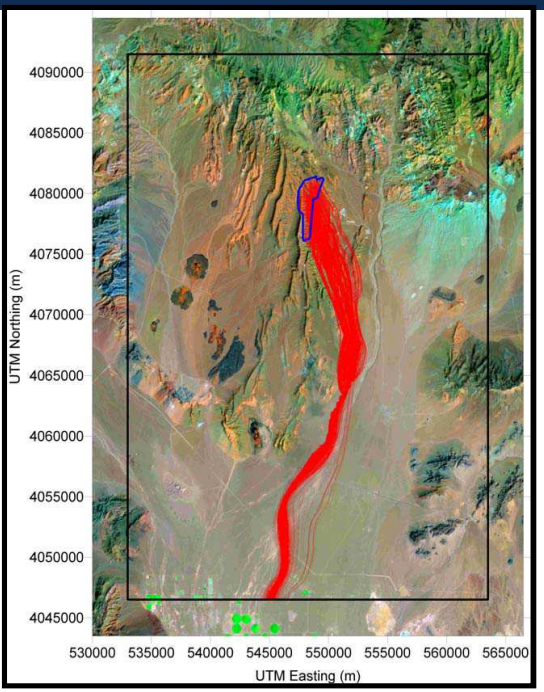
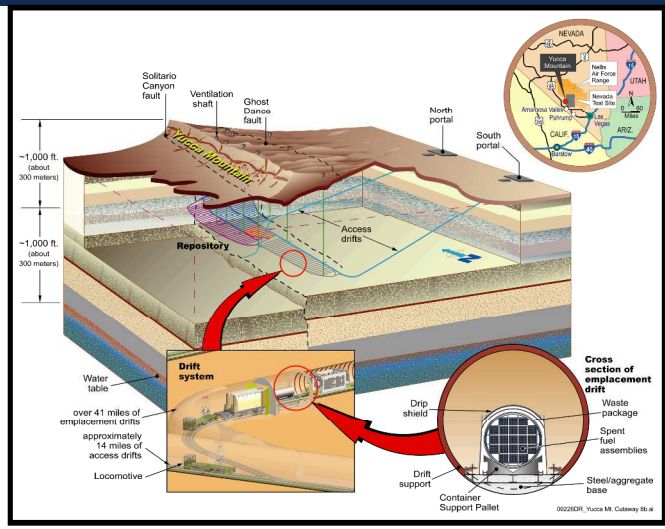
SAND2015-7419C

Exceptional service in the national interest

Sandia National Laboratories



Knowledge Management Insights from Yucca Mountain



Gordon Appel, Sandia National Laboratories, Albuquerque, NM, USA
Kevin McMahon, Sandia National Laboratories, Albuquerque, NM, USA

Global 2015 Conference, September 20-24, 2015, Paris, France

U.S. DEPARTMENT OF ENERGY

National Nuclear Security Administration

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 under contract DE-AC04-94AL85000. SAND NO. 2011-XXXXP

Knowledge Management

- Knowledge Management - efforts directed at compiling, organizing, and leveraging an organization's knowledge to support organizational goals, (continuity, profitability, efficiency, etc.)
  - directed at important information necessary to maintain or improve current business models.

- Knowledge Management in Repository Systems Context
  - purely technical, well understood (certain), physical/chemical characteristics (waste packages materials, waste forms, corrosion, and waste locations);
  - less well understood (uncertain) characteristics, (natural fluid flow, volcanism, other low probability events);
  - very poorly definable characteristics, (cultural influences, societal characteristics).

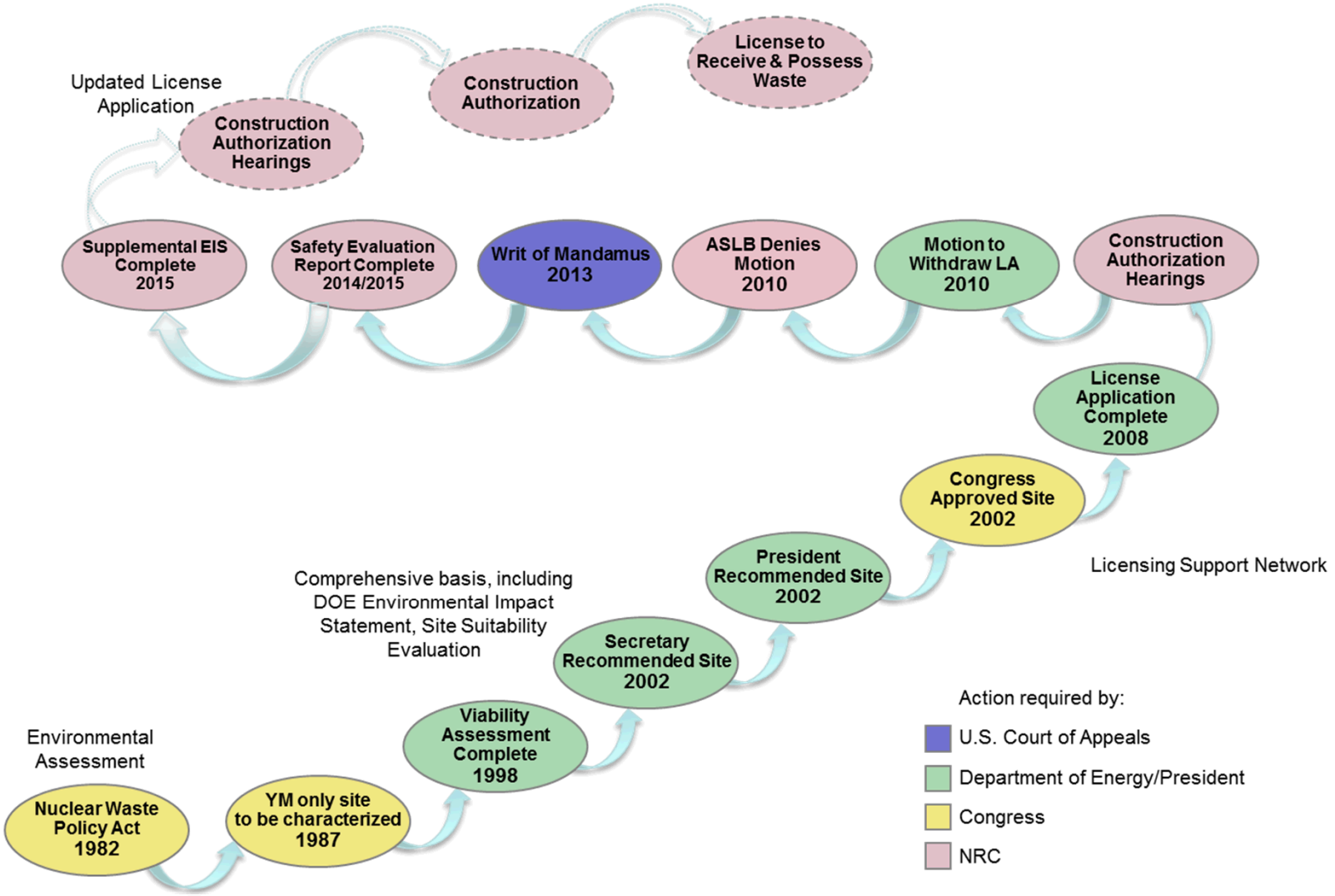
Knowledge Preservation

- Knowledge Management for Repositories - using knowledge management techniques to maintain the continuity of procedural processes (technical culture) over the decades of repository operations
- Knowledge Preservation for Repositories - 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
  - 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.)
  - Tacit knowledge is knowledge that we as individuals possess, but is not readily codified - technical, societal, or cultural processes that pertain to substantial organized efforts (large engineering projects)

Yucca Mountain Knowledge Preservation

Sandia National Laboratories

Yucca Mountain Project Timeline



Yucca Mountain Knowledge Preservation

- Current Status
  - Licensing Proceeding is not concluded… future unceratain
  - SNL, DOE, and NRC preserved scientific, technical and procedural information from the project

- Knowledge from Yucca Mountain Project is preserved in the following systems:
  - USNRC ADAMS (Agency Document and Management System) Collection
  - USNRC ASLAB LSN (Licensing Support Network) Collection
  - USDOE Legacy Management Collection
  - Yucca Mountain Project Lead Laboratory Archive (SNL)
  - Other Proceeding Participant Collections (e.g., State of Nevada)

Yucca Mountain Knowledge Preservation

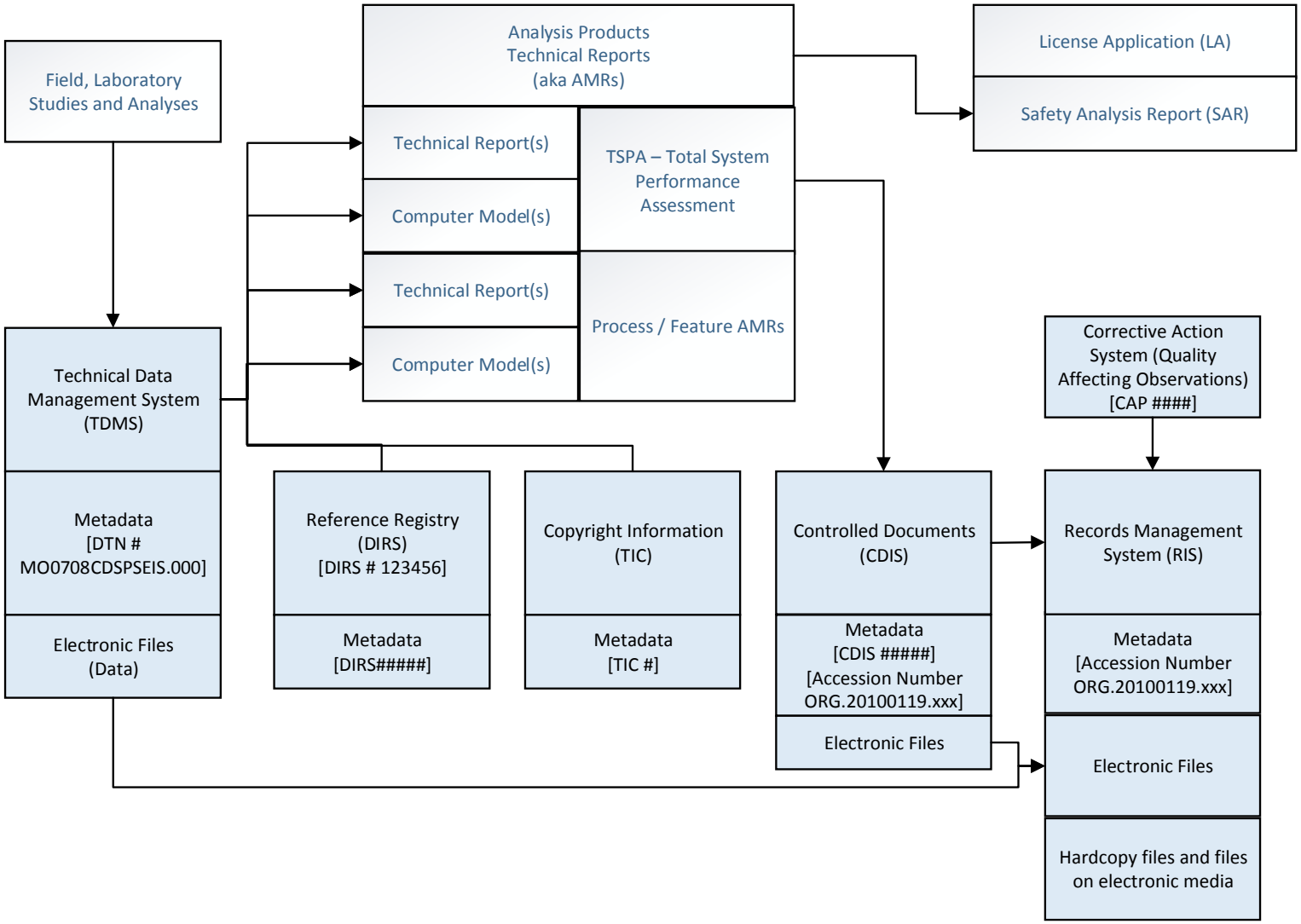
Sandia National Laboratories

- DOE's Legacy Management office has most comprehensive YMP collection
  - More than 62 million records, including:
  - over 3 million project documents in the LSN collection:
  - other artifacts (computer programs, etc.) related to research conducted in USDOE's Waste Management program over 30 years
- USNRC 'Licensing Support Network' (LSN)
  - Electronic system, established by the NRC and operated by the NRC's Atomic Safety and Licensing Board (ASLAB) to provide internet access to documents that may be used as evidence in the licensing proceedings
  - 3.6 million documents at the time of the license submittal
  - Public access to the LSN was terminated in August, 2011
  - USNRC committed to transfer this document collection to a publicly accessible library FY15

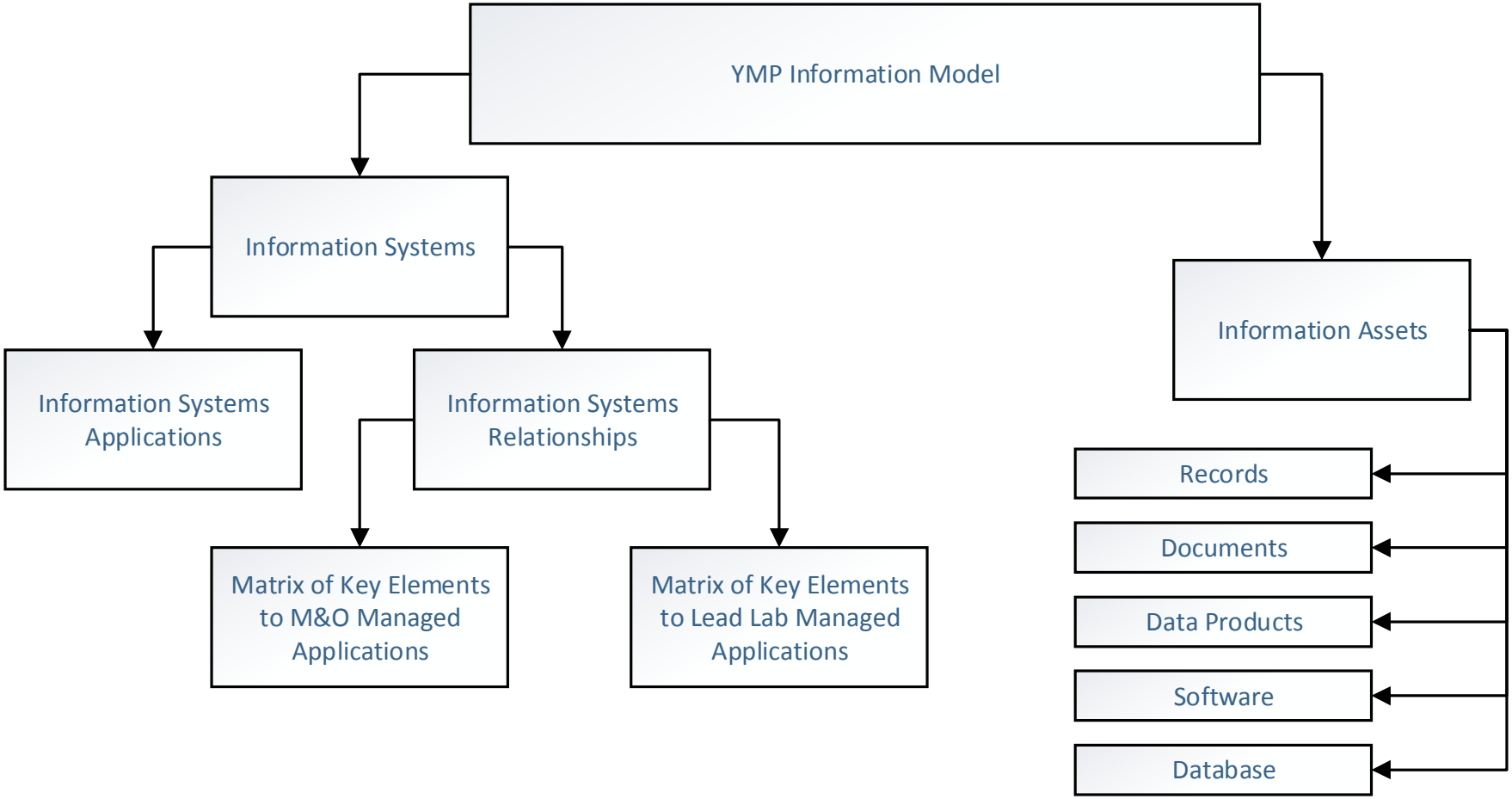
Lead Laboratory Archive

- Yucca Mountain Project Lead Laboratory Archive
  - Sandia National Laboratories (SNL) was DOE's lead national laboratory for the project,
  - principally responsible for post-closure analyses of the YMP repository system.
- SNL developed two integrated tools to access project information using SharePoint© technology, conventional file storage, and the YMP information model
  - License Support Warehouse (LSW) - allows searches of an electronic warehouse for data and documents collected from YMP information systems.
  - Search and Report Center (SRC) - allows creating, distributing, and managing business information from information systems using existing or tailored reports

Operational YMP Information Relationships

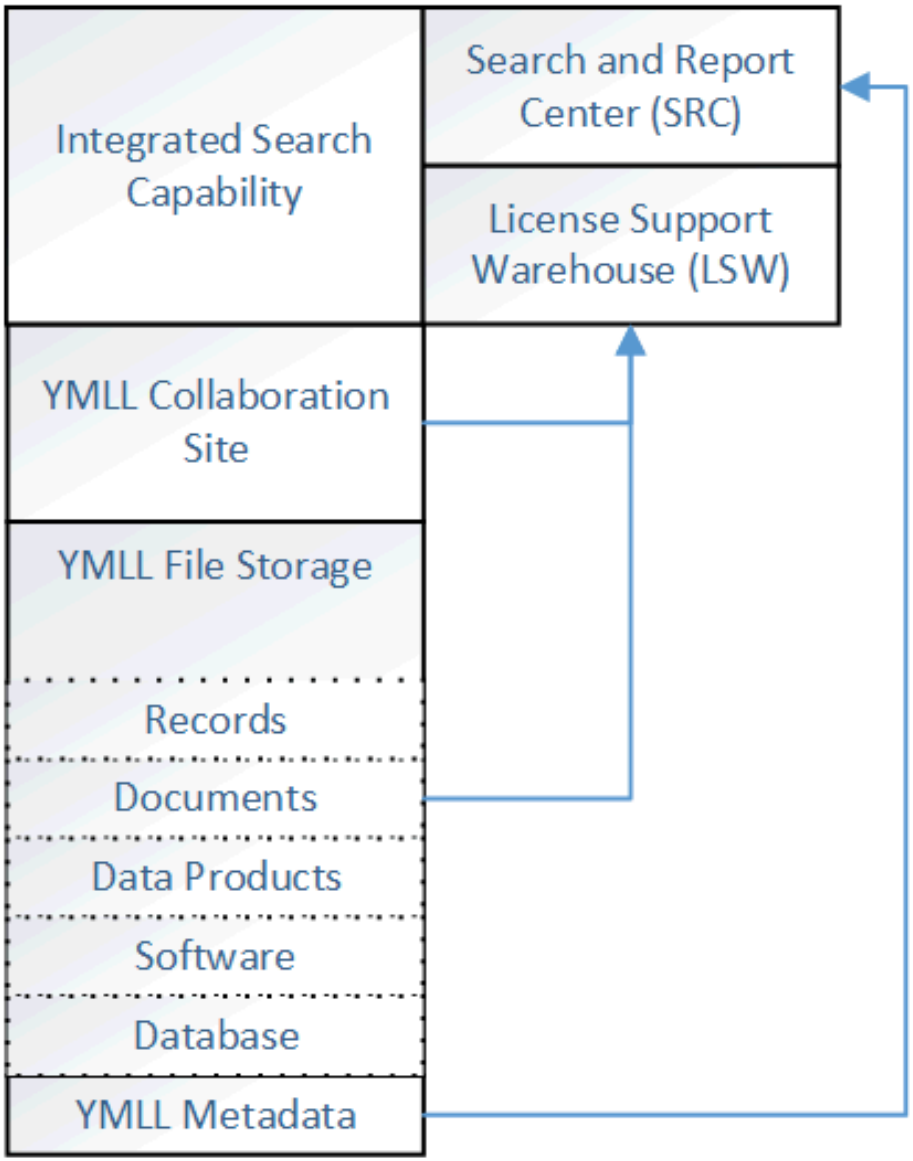


YMP Lead Lab Information Model



The information model was developed to structure and integrate the information from the YMP 'Stove-piped' systems

Integrated YMP Lead Lab Search Model



Recommendations and Suggestions

Sandia National Laboratories

- The YM experience, and other (weapons development) increased our appreciation of the need for what is commonly called ‘knowledge management’.
- Particularly in the context of long-duration nuclear endeavors
  - likely to extend beyond the career durations of 2-3 generations of the workforce.
- Conventional practice of knowledge management can improve day-to-day operations;
- In the context of long-term endeavors it may offer the only available approach to overcome the 'tribal knowledge' 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).

Recommendations and Suggestions

Sandia National Laboratories

- Less Conventional Knowledge Management
  - establish a knowledge base that will endure for hundreds of years
- Why is this necessary?
  - We often presume that nuclear endeavors will proceed along a pre-ordained timeline (How's that working out so far?)
- The US example:
  - In 1987 did we think Knowledge Management was necessary?
  - YM was to receive waste in 1998 (What year is it now!?)
- One approach: create and maintain a position responsible for knowledge management
    - Requires awareness of the technical, social and political circumstances surrounding the endeavor
    - Need to infuse day-to-day operational management with knowledge management principals
    - Builds a historical record of program-related events and processes for future reference.

Recommendations and Suggestions

Sandia National Laboratories

- Information Systems
  - Need to be unified, with a common operational basis (both Business and Technical systems)
  - Limit electronic file storage to one networked location
    - Provide for regular (nightly) backups to a remote location
  - Plan on system aging (obsolescence) and keep them current

- System Integration
  - Integrate compliance systems (e.g., Corrective Action and Quality Assurance systems) with the technical support and business systems to minimize manual transfer of information.
  - Records management, document control, and correspondence control are all processes that contribute greatly to explicit knowledge management and need to be completely integrated

Recommendations and Suggestions

Sandia National Laboratories

- Employ organized and explicit knowledge management
  - Three fundamental IT components: collaborative software, a robust database, and very substantial file storage
- All information 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)
- Define Metadata schema with great attention to detail
- E-mail - use a single e-mail system and retain all email
- Keep track of people: their involvement and roles in the endeavor

Records, Knowledge Management and Memories - RepMet

Sandia National Laboratories

- Vision for the RWMC Project on Preservation of RK&M Across Generations, NEA/RWM(2011)
  - "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."
- Phase I (2010 – mid 2011): Scoping of the issue
- Phase II (2011–mid 2012): Improving our understanding
- Phase III (2012 – early 2014): Consolidating the lessons learned and reaching out to different communities
- RepMet (for repository metadata) (2012 – Present)

Records, Knowledge Management and Memories - RepMet

Sandia National Laboratories

- RepMet Scope
  - 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.
- RepMet Status
  - questionnaire regarding metadata collected for waste packages in storage and ready for disposal

Conclusions

- The preservation of knowledge related to a nuclear repository 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.
- 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?’