DRAFT Infrastructure Framework for a Generic Repository Licensing Organization

Fuel Cycle Research & Development

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SUMMARY

This document is milestone M4FT-15SN0826011: Draft Summary of generic repository licensing infrastructure, the result of efforts under work Package FT-15SN082601 DOE Managed HLW and SNF Research: Establish a generic organization framework for records management, IT infrastructure, quality assurance, and systems engineering – Sandia National Laboratories (SNL). The objective of this effort was to develop this draft document identifying and summarizing the principle elements of a generic repository licensing infrastructure organizational framework. The FY16 follow on work package is FT-16SN050302 Establish organizational framework to meet regulator expectations – SNL, having the consistent objective to 'Develop a draft document identifying and summarizing the principle elements of a generic repository licensing infrastructure and organizational framework.'

This document describes the framework for a generic hypothetical organization with the responsibility to site, characterize, design, license, construct and operate a repository for the disposal of high-level radioactive waste (HLW) and spent nuclear fuel (SNF) managed by the Department of Energy. The organizational framework suggested is intended to be agnostic of the facility location and disposal medium. It is assumed that the facility is to be licensed under U.S. Nuclear Regulatory Commission (NRC) regulation with DOE as the applicant (licensee). Detailed organizational elements reflect a workforce composition and practices that facilitate compliance with NRC expectations and NQA-1 quality standards.

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Acronyms

ADAMS	Agency wide Documents Access and Management System
AEA	Atomic Energy Act of 1954, as amended
AFP	Approved Funding Program
ALS	Automated Litigation Support
ASLB	Atomic Safety and Licensing Board
BRC	Blue Ribbon Commission on America's Nuclear Future
CAP	Corrective Action Program
CDIS	Document Information System
CFR	Code of Federal Regulations
COE	Common Operating Environment
COTS	Commercial off the Shelf Software
DIRS	Development Input Reference System
DOE	U.S. Department of Energy
DOD	U.S. Department of Defense
EA	Environmental Assessment
ECP	Employee Concerns Program
EIS	Environmental Impact Statement
EPA	U.S. Environmental Protection Agency
EVMS	Earned Value Management System
FNR	Foreign National Request
GIS	Geographic Information System
HLW	High-Level Radioactive Waste
HPC	High Performance Computing
HPSS	Hearing Process Support System
IaaS	Infrastructure as a Service
ISP	Internet Service Provider
IT	Information Technology

KMS	Knowledge Management System
LSN	Licensing Support Network
M&O	Management and Operating Contractor
MOW	Members of the Workforce
NARA	National Archives and Records Administration
NEPA	National Environmental Protection Act
NIST	National Institute of Standards and Technology
NQA-1	American Society of Mechanical Engineers Quality Standard for Nuclear Facilities
NRC	U.S. Nuclear Regulatory Commission
NSC	National Safety Council
NUREG	NRC Regulatory Guide
NWPA	Nuclear Waste Policy Act of 1982
NWPAA	Nuclear Waste Policy Amendments Act of 1987
NWTRB	Nuclear Waste Technical Review Board
PA	Performance Assessment
PII	Personally Identifiable Information
QA	Quality Assurance
QAM	Quality Assurance Manager
RAI	Request for Additional Information
RAIDS	Request for Additional Information Development System
RD&D	Research, Development, and Demonstration
RIS	Reference Information System
SaaS	Software as a Service
SAN	Storage Area Network
SCWE	Safety Conscious Work Environment
SNF	Spent Nuclear Fuel
SNL	Sandia National Laboratories
TDMS	Technical Data Management System
TSPA	Total System Performance Assessment

UFD　　　　Used Fuel Disposition

WBS　　　　Work Breakdown Structure

YM　　　　Yucca Mountain

Draft Infrastructure Framework for a Generic Repository Licensing Organization

1. Introduction

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The discussion herein is based on the statutory and regulatory framework existing in the fall of 2015. DOE's 2015 report on defense waste disposal (DOE, 2015) clearly indicates a preference, if not a requirement, for pursuing public acceptability using a 'phased, adaptive, consent-based siting approach'. Nuclear Waste Policy Amendments Act of 1987 (NWPAA) Section 8(b)(3) renders a 'repository for the disposal of high-level radioactive waste resulting from atomic energy defense activities only' (i.e., a defense waste repository) subject to NRC's licensing authority. Under the current regulatory framework a defense waste repository will need to comply with 10 CFR 60, and by reference 40 CFR 191.

The context in which the organization's work would be conducted differs substantially from that conducted in the typical research, development and demonstration (RD&D) environment. First, there are work elements that are not customarily included in RD&D work, such as a Corrective Action Program, among other organizational elements. Secondly, the rigor with which the organizational assurance functions need to be applied and practiced is significantly greater than that which is acceptable in the RD&D environment.

2. Background

In January 2012, the final report of the Blue Ribbon Commission on America's Nuclear Future (BRC, 2012) urged the Administration to conduct a review of the current policy to dispose of defense and commercial high level radioactive waste and spent nuclear fuel in a single repository

or repositories. Based on that recommendation, in 2013, the administration indicated that the policy would be the subject of analysis moving forward, (DOE, 2013).

In 2014, a report on disposal options for DOE managed High-Level Radioactive Waste and Spent Nuclear Fuel (DOE, 2014) was prepared for the Secretary by a team of federal and contractor personnel led by the DOE's Office of Nuclear Energy. The report assesses the technical options for the permanent disposal of HLW and SNF managed by the Department of Energy[1].

Specifically, the report considered whether DOE-managed HLW and SNF should be disposed of with commercial SNF and HLW in one geologic repository or whether there were advantages to developing separate geologic disposal pathways for some DOE-managed HLW and SNF. The report drew heavily on a recently completed DOE report (Sandia, 2014) that summarized the inventory of both commercial and DOE-managed radioactive wastes requiring geologic disposal, organized that inventory into broadly defined waste groups with similar disposal characteristics, and qualitatively evaluated disposal options for each group of waste types. The analyses of alternatives and options related to the treatment and disposal of HLW and SNF presented in Sandia, 2014 are based on technical and programmatic considerations and do not include an evaluation of relevant regulatory and legal considerations.

3.   Purpose

The purpose of this draft report is to identify and summarily describe the principle elements of an organizational framework for a hypothetical generic organization and is agnostic of type of geologic media, or the location of the disposal facility. Further elaboration of the roles and responsibilities for individual organizational elements will be the subject of follow-on efforts in FY16.

4.   Scope

The scope of responsibility of the organization considered in this report is to site, characterize, design, license, construct and operate a repository for the disposal HLW and SNF managed by the Department of Energy. This scope is extensive, and will take decades to accomplish. Recognizing that substantial changes will occur over such a long timeframe, this report focuses on identifying the roles and responsibilities of organizational elements that are needed to initiate the work (i.e., those that will support the scientific and engineering endeavors that will actively accomplish the Siting, Characterization, Design and Licensing of the disposal facility under consideration). These elements are shown in Figure 1 as the 'Management' and 'Support Groups' elements. The nature of these management, administrative, business, and technical

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[1] DOE-managed HLW and SNF consists of two principal waste streams: (1) HLW, mostly resulting from atomic energy defense activities but also including a small amount of HLW of commercial origin; and (2) SNF, primarily from atomic energy defense activities (weapons plutonium production reactors and naval propulsion reactors), but also including a smaller amount of SNF from DOE research and development activities and some DOE-managed SNF from commercial sources. (DOE, 2014)

support functions are well enough understood to define with some detail and will need to be firmly established as early as possible in this program to support emerging science and engineering activities. The specific configuration and details of the scientific and engineering organizational elements is beyond the scope of this report; however, there are some general needs that will be identified.
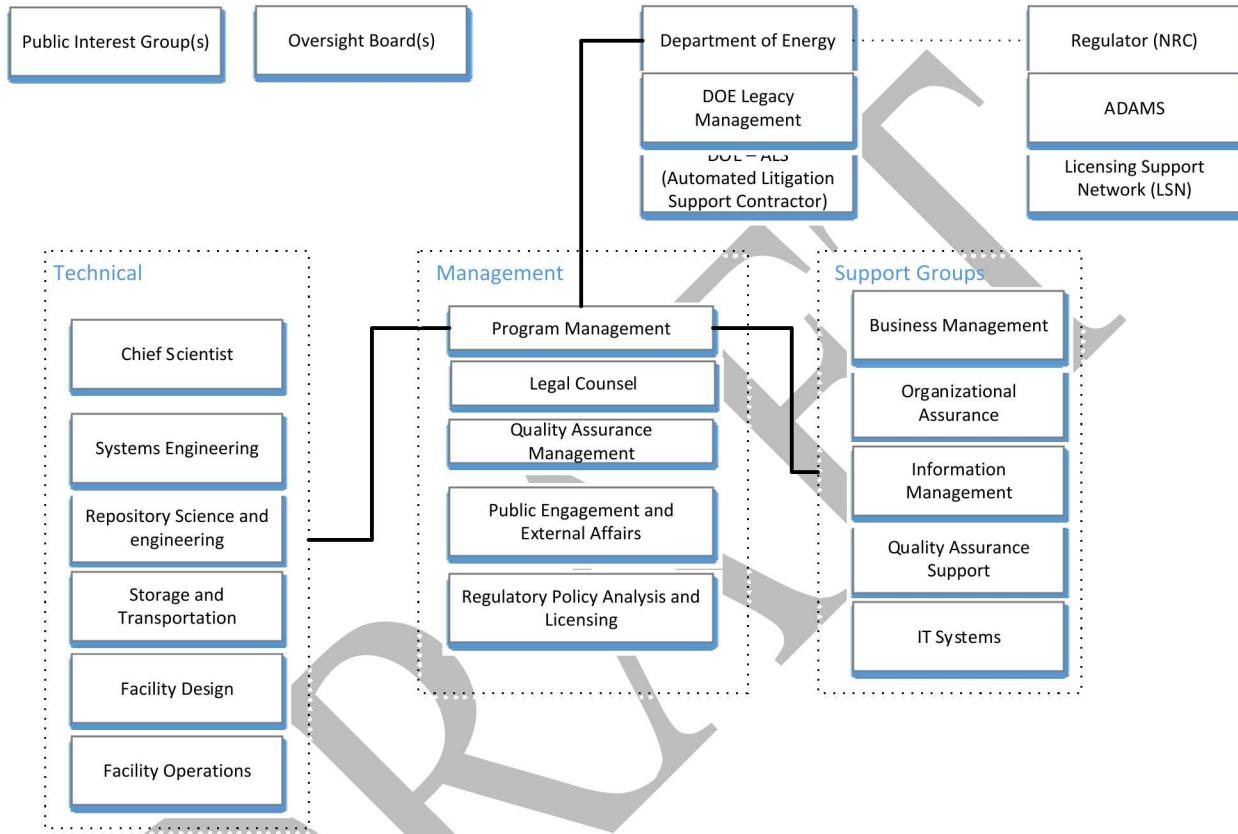
Figure 1 - General Organization

All organizational elements reflect a workforce composition and state of practice that facilitates compliance with U.S. Nuclear Regulatory Commission (NRC) expectations and NQA-1 quality standards. One often overlooked component of any licensing endeavor is the importance of having an outcome-aware technical support and business process organization. A high-quality, regulation-aware, and technically savvy science and engineering team is needed, and it is equally important that they be supported by an experienced, proficient non-technical infrastructure.   The unshaded portions of Figure 2 illustrate the professional non-technical (not Science and Engineering) team elements needed to provide support and business process management to ensure success of a geologic repository project.

Ultimately, this team of professionals provides management with the means to extend policy across the organization, as well as, the context in which operational decisions are implemented.

Technical support, business and quality processes need to be requirements- and assurance-based, as well as, quality assurance-informed.
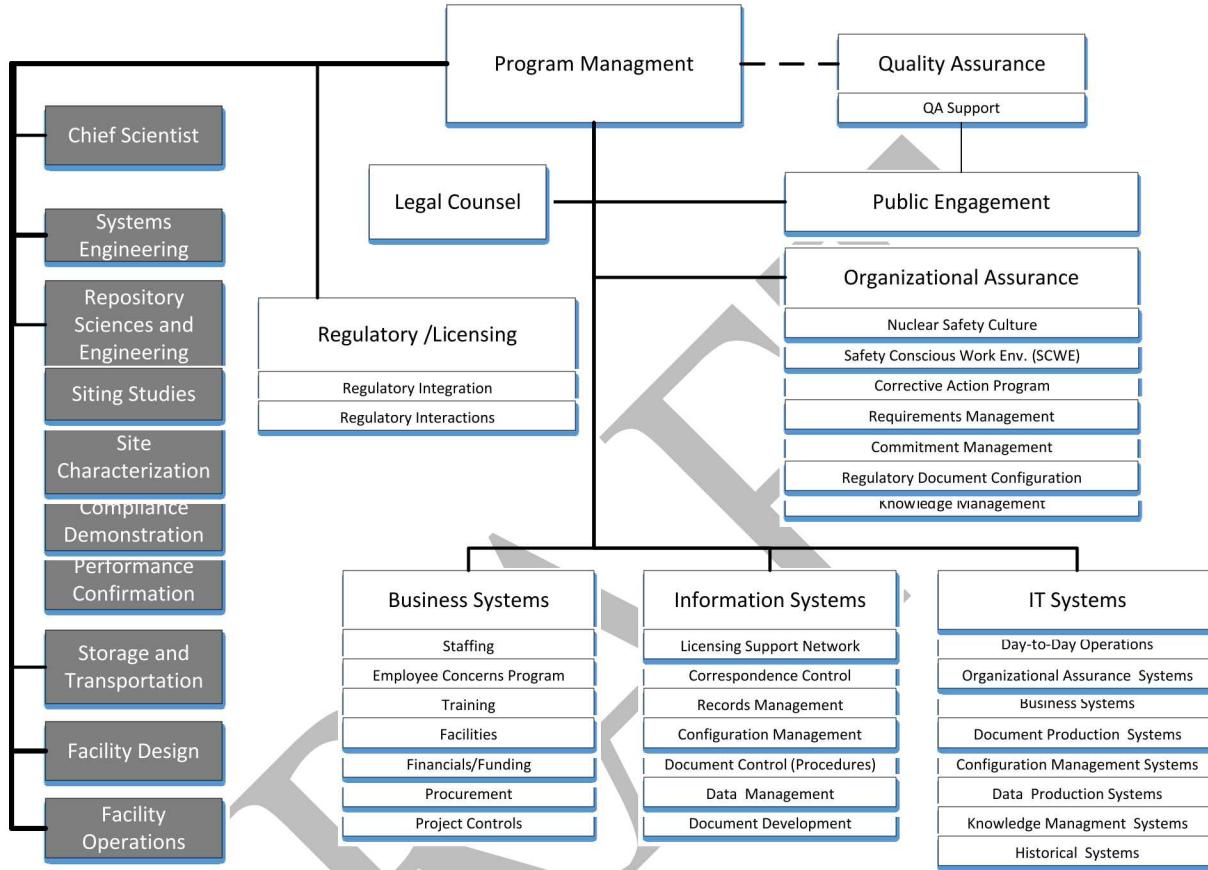
Figure 2 - Organizational Support Elements

5.   Principles, Concepts and Terms

For clarity, several principles, concepts and usage of terms are applied throughout this report. Policies are promulgated by Program Management to provide overall direction to the organization. Organizational elements perform their function(s) in accordance with policy direction. In most cases, organizational elements also perform their function(s) in accordance with a management plan that it has produced and has been approved by Program Management. If necessary procedural controls are identified in the plan for activities that require a more rigorous level of definition.

6.   Time Frame

The schematic timeline shown in Figure 3 is intended to illustrate the timeframes involved in the activities discussed here and to underscore that the initial focus is on establishing the support infrastructure as opposed to the science and engineering organizational elements.
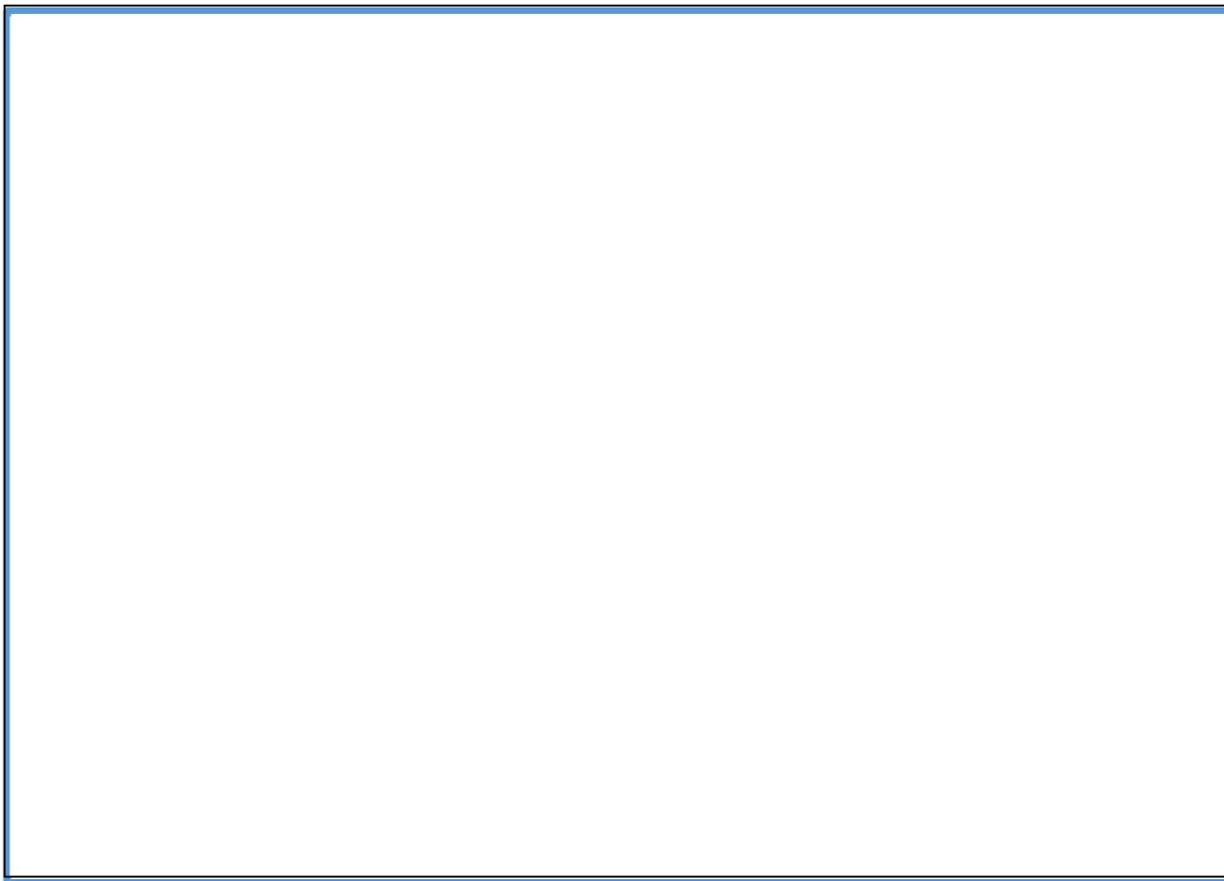
Figure 3 - Schematic Timeline

7. Organizational Elements

7.1 Program Management

Program Management provides the vision, the management approach, program policies and identifies procedures for the assembly and operation of the organization. The entire organization's activities need to be conducted in accordance with nuclear safety culture principles reflected in a safety conscious work environment and implementing a Quality Assurance (QA) program consistent with DOE expectations, and those of the regulator.

Because of the regulatory compliance orientation of the organization's work products, the organization's approach will provide centralization of function and responsibility. The organization's focus will be on planning, monitoring execution, work performance evaluation and documentation of results included in all the functional areas listed below.

The fulfillment of the organization's mission will require interactions and integration with DOE operating (M&O) contractors, National Laboratories, other waste management organizations and various external review and advisory groups, as well as, State, local and tribal governments in addition to the general public.

7.1.1   Legal Counsel

Legal Counsel provides support to the Program Manager on the wide variety of legal issues that will inevitably arise. Counsel also provides a direct interface with DOE's Office of General Counsel.

7.1.2   Quality Assurance

The Quality Assurance Manager (QAM) defines the program level requirements necessary to formulate a high quality and streamlined Quality Assurance program to satisfy NQA-1 2015 (Quality Assurance Requirements for Nuclear Facilities Applications) required by NRC licensing rules.   The QAM serves as the focal point for the organization's QA activities, providing coordination with the DOE to ensure program quality-affecting activities are conducted according to DOE policies, guidance and objectives, and in compliance with standards and regulations. To this end non-quality-affecting activities must facilitate and be synchronized with QA's interests. The QAM is responsible for identifying overall QA requirements and confirming the satisfactory operation of the QA program through audits and surveillances; however, the workforce itself is responsible for the design and implementation of QA processes to enable implementation of the QA program.

7.1.3   Public Engagement

Public engagement planning is necessary to define, design and implement processes for public engagement in organization activities. Public engagement is not just for public information dissemination; rather it needs to be directed toward active public involvement throughout the program. Public engagement activities present opportunities to inform potential stakeholders and engage them intellectually in the operations of the program so that they have the opportunity to become an advocate after direct involvement.

Consent Based Siting is included in this organizational element. This area includes activities necessary to define, design and implement processes to enable a phased, adaptive, and consent-based approach to siting waste management facilities. Consent based siting is expected to ensure safe and secure operations, gain trust among stakeholders, and adapt operations based on lessons learned, consistent with national goals.

The lead for this element is responsible for coordination of consent based siting activities among the different organizational elements, and with the DOE. They will provide Program and DOE management with technical and integration recommendations regarding consent based siting. These activities will include interactions with DOE to formulate project direction, mitigate complex issues involving internal and external organizations, present project-related material in upper management forums, approve technical and non-technical products and documents, and allocate resources to the performance of regularly scheduled work and rapid response tasks associated with consent based siting.

7.1.4   Regulatory/Licensing

This element addresses activities necessary to manage the regulatory support activities conducted by the organization, regardless of the regulator's identity (e.g. NRC, EPA, or State entities). Regulatory activities will include interactions with DOE to formulate project direction, mitigate

complex issues involving internal and external organizations, present project-related material in upper management forums, approve technical and non-technical products and documents, and allocate resources to the performance of regularly scheduled work and rapid response tasks associated with regulatory matters. The strategic response development for regulatory issues as well as the planning for and preparation of witnesses would be managed from this element. Working with Program Management, this element will ensure consistency and coordination among other organizational elements during regulatory review proceedings.

Typically there are two functions in this area: regulatory integration; and regulatory interactions. Regulatory integration entails coordination of regulatory activities among the various other organizational elements (e.g., systems engineering, transportation and storage) and with the DOE regulatory affairs. Both Program Management and DOE will receive technical and integration recommendations regarding regulatory matters from this source. Regulatory interactions provide the interface with and support DOE regulatory affairs, in interactions with regulators and responses to regulatory requests. The Regulatory Interactions lead is also responsible for supporting DOE regulatory affairs, the regulator's onsite representative, and any inspection program as it relates to the organization's scope of work.

7.2   Business Management

Business Management includes the activities that enable a workforce to accomplish its objectives using established work processes, and business management Information Technology (IT) systems. The work force and financial controls are supplied via business management processes.

7.3   Staffing

Handling the on-boarding and off-boarding of personnel to and from the enterprise is essential to its existence, functionality, and changing emphasis. Much of the information gathered and used by this function may contain Personally Identifiable Information (PII) that requires rigorous protection.

7.3.1   Employee Concerns Program (ECP)

The Employee Concerns Program (ECP) is integrally tied into the Safety Conscious Work Environment (SCWE) program and the broader concept of a Nuclear Safety Culture, because it provides the means by which any Member of the Workforce (MOW) can express concern without fear of retaliation. Information maintained by the ECP requires rigorous protection because it may contain particularly sensitive information. Also, any confidentiality breach would endanger the essential strict compact between the individual and the ECP, thereby endangering the program's effectiveness.

7.3.2   Training

The training function is integrally tied to the program's operations and Quality Assurance. MOW must be trained to perform certain functions in a high-quality, regulation-aware business and technical team. Providing or arranging for the necessary training from either internal or external sources, and maintaining the related records is key to demonstrating that MOW are qualified to perform program-specific work. Some of the information gathered and used by this

function may be considered Personally Identifiable Information (PII) that requires rigorous protection.

7.3.3   Procurement

Acquiring material or services is always necessary in performance of any endeavor. These functions are necessary to ensure that procurements are conducted in accordance with the applicable Federal rules. There is a very direct connection between QA and procurement when it comes to acquiring quality-affecting items or services. An initial review of any procurement must include a determination of whether it involves quality-affecting items or services. Also, contracts for services affecting quality must include appropriate QA provisions.

7.3.4   Facilities

Regardless of the nature of the venture, acquisition of property will be necessary to achieve its objectives. The functions of the Facilities element are directed at all the post-purchase (or rental) management needs required to account for the various property.

7.3.5   Financials/Funding

This function provides for annual budgeting, including cost estimating, and fund management, as well as, receiving and verifying the Approved Funding Program (AFP) to meet government requirements.

7.3.6   Project Controls

This function establishes a work breakdown structure (WBS), which provides a structure for planning, managing, controlling, and monitoring the cost, schedule and performance of a project. Typically this function is responsible for establishing and certifying an Earned Value Management System (EVMS) for the program.

7.4   Organization Assurance

Organizational Assurance includes the activities necessary to oversee the organization's operational and functional fidelity to assure integration and appropriate conduct of operations, including the concepts and processes listed below.

7.4.1   Nuclear Safety Culture

This function is responsible for development and implementation of the organization's nuclear safety culture philosophy by:

- Promoting a nuclear safety culture (Table 1) within the organization similar to that of other high performing nuclear organizations consistent with the expectations of NRC (NRC, 2011).

- Developing and guiding implementation of the program plan for ensuring and independently verifying that the nuclear safety culture permeates all organizational elements and monitoring how well the organization exhibits the requisite nuclear safety culture.

Table 1 - Traits of a Positive Nuclear Safety Culture

Traits of a Positive Nuclear Safety Culture	
Leadership Safety Values and Actions	Leaders demonstrate a commitment to safety in their decisions and behaviors.
Problem Identification and Resolution	Issues potentially impacting safety are promptly identified, fully evaluated, and promptly addressed and corrected commensurate with their significance.
Personal Accountability	All individuals take personal responsibility for safety.
Work Processes	The process of planning and controlling work activities is implemented so that safety is maintained.
Continuous Learning	Opportunities to learn about ways to ensure safety are sought out and implemented.
Environment for Raising Concerns	A safety conscious work environment is maintained where personnel feel free to raise safety concerns without fear of retaliation, intimidation, harassment, or discrimination.
Effective Safety Communication	Communications maintain a focus on safety.
Respectful Work Environment	Trust and respect permeate the organization.
Questioning Attitude	Individuals avoid complacency and continuously challenge existing conditions and activities in order to identify discrepancies that might result in error or inappropriate action.

7.4.2   Safety Conscious Work Environment

Safety Conscious Work Environment (SCWE) (NRC, 2004) is responsible for development, implementation, and assessing the organization's work environment where:

- employees are encouraged to raise safety concerns
- concerns are promptly reviewed,
- concerns are given the proper priority based on their potential safety significance, and
- concerns are appropriately resolved with timely feedback to the originator of the concerns and to other employees as appropriate

7.4.3   Corrective Action Program

The Corrective Action Program (CAP) function develops and implements the organization's corrective action program and system consistent with current regulatory guidance. Specific areas of review for a licensee's CAP program are:

- policies, programs, and procedures

- identification, reporting, and documentation of safety and security issues
- significance classification and causal evaluation of safety and security issues
- development and implementation of corrective actions
- assessment of corrective action and program effectiveness

7.4.4   Requirements Management

Requirements Management develops and implements the organization's requirements management effort and process consistent with current corporate guidance. It provides a means to identify, record, allocate, implement and track the organization's requirements independent of their source.

7.4.5   Commitment Management

This function is responsible for the development and implementation of a commitment management process to facilitate the tracking and resolution of the organization's commitments, whether they originate in program policies, administrative directives, or technical or regulatory instruction. It provides a means to record and track resolution of items identified by management. A component of the process could track corrective actions.

7.4.6   Regulatory Document Configuration Management

This element addresses development and implementation of the organization's regulatory document configuration management process. Its purpose is to facilitate and maintain rigorous configuration management for formal regulatory documents. This is a special case of document development. All official documents produced by the organization should be managed and produced via the document development element. For regulatory documents (e.g., EAs, EISs, License Applications, etc.) meticulous attention must be paid to their composition and configuration. In effect, such documents can often represent large collections of commitments. As an example, NRC requires information provided to the Commission to be 'complete and accurate in all material respects' (10 CFR 60.10). This prescription is not to be taken lightly.

7.4.7   Knowledge Management

The Knowledge Management function is responsible for development and implementation of the organization's effort directed at compiling, organizing, leveraging, and preserving the organization's knowledge base(s) to support organizational goals and anticipated future needs. It 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 Management functions can be categorized into two broad areas; applied knowledge management and knowledge preservation. The purpose of applied knowledge management is to design processes to ensure the promulgation of current information to the workforce. Such processes are useful operational tools, and are largely directed at information necessary to maintain or improve current business models. An example would be using knowledge

management techniques to maintain the continuity of procedural processes (technical culture) over the decades of repository development and operations.

The second area, 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. This includes establishing a long-term historical record of the program participant's and program developments. Preservation of the historical record will be important, considering that the program's objectives will span 2-3 workforce generations.

Knowledge preservation envelops both classic subdivisions of knowledge; explicit knowledge, and tacit knowledge. 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.). Development of a repository 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 (e.g., recording conversations with key leaders and experts).

7.4.8   Self-Assessment

The Self-Assessment function is to develop and implement the organization's process to regularly perform self-assessments consistent with corporate requirementsand other Quality Assurance and regulatory requirements. Self-Assessments are integral to most Organizational Assurance functions, as it provides the means by which the program evaluates and documents its conformance with authoritative direction.

7.4.9   Risk Management

Risk Management develops and implements the organization's general programmatic risk evaluation and management processes, consistent with corporate requirements. It provides a means to identify, record, allocate, implement and track the organization's requirements needs.

7.5   Information Management

Information Management includes activities that enable a workforce to accomplish its objectives using program-wide information processes and IT Systems. Information Management has been separated from Business Management because of the importance of this element to the outcome of a compliance oriented program. Information managed via this element is the organizational,

technical, regulatory, and quality assurance related documentation and information (documentary evidence) necessary to confirm the integrity of the organization's work products. Information Management oversees the processes that generate, transmit, and store information. Information Management, with the assistance of IT Systems, operates and maintains the electronic systems required to process, store and access program information in the principle areas listed below.

7.5.1   Records Management

Records Management is the unique process for capturing all information related to the effort, independent of its origin or form. A records management accession number (i.e., unique identifier) is applied to records management information and is used in all other information systems. For example, a separate identifier is not applied in Correspondence Control or Document Control. Conceptually, all other information systems consist of metadata only, and refer to the underlying information by the records management accession number. This mirrors the approach taken by NRC in its Agency wide Documents Access and Management System (ADAMS).

7.5.2   Document Control

Document Control is an element of records management providing for the necessary control of certain documents essential to conduct of operations. Document Control is the means of assuring the availability and use of the current authoritative version of information, whether it is a report, policy, plan, procedure, list, drawing, image, etc.

7.5.3   Correspondence Control

Correspondence Control is an element of records management providing for centralized receipt of official program correspondence and its distribution. Its effective implementation is essential to the successful operation of the program's administrative processes, and is frequently overlooked. As an example, proper control of correspondence from the government oversight bodies, the licensee (applicant), the regulator, and the public is essential to maintaining a rigorous record of written commentary or written direction influential to the program's direction.

7.5.4   Data Management

Data Management is also an element of records management, because all data generated within the program undoubtedly meets the definition of a record. Data management provides a process specifically designed to handle the special needs of data management, which often involves large complicated electronic files, and requires assignment of important metadata. Such data files are often critical references that must be accounted for in a process/system designed to track references included in program documents.

7.5.5   License Support Network

License Support Network (LSN) is a critical element of records management that provides processes and protocols designed to satisfy the procedural requirements of 10 CFR 2, subpart J of NRC's licensing rules. Nominally, the purpose of this rule is to facilitate the discovery process for an eventual NRC evidentiary proceeding. Substantively it requires any documentary evidence that is 'relevant' to an applicant's submittal, be provided for posting on the LSN within 90 days. The importance of LSN compliance cannot be understated, as the Applicant must

certify it is in compliance with the rule at least six months before submittal of the license application. The processes to assure compliance with LSN requirements can be complicated, involving record material in many different forms, and very importantly includes email. Also, in other programs the submittal of documents to the LSN first required submittal to the applicant's Automated Litigation Support (ALS) contractor for review and classification before upload to the LSN.

7.5.6   Reference Registry

Tens (could be hundreds) of thousands of references will be cited in documentation produced on the program, consisting of both public and copyrighted information. Reference registry processes and systems for documenting (and retaining copies) of all references is critical to assuring the integrity of program documents. Careful attention should be paid when defining the metadata requirements for cited references. It should not be acceptable to cite entire documents unless that is really the case, for example, when referring to a broad concept. Specific page citations should represent the norm.

7.5.7   Email Considerations

The importance of proper management and attention to maintenance of email processes/systems cannot be overstressed. The indoctrination and training of program MOW must stress that use of the program email system forfeits any right to privacy and that all emails are RECORDS (granted the retention period will vary according to the content).

7.6   It Systems

The IT Systems function includes activities necessary to define, design, implement, and maintain IT systems to support the organization's processes and functions. Systems that are developed to support the business and technical efforts are critically important to the overall success of the project and generally fall into two categories: a) information systems; and b) high performance computing systems. The purpose of information systems is to collect and store administrative and technical information and its associated metadata for day-to-day use. High performance computing systems purpose is to provide the calculation capability or other data intensive systems to support science and engineering efforts. IT Systems are the tools supporting the processes that are the responsibility of other organizational elements, thus their categorization closely mirrors the general organizational element functions.

7.6.1   IT Systems Architecture

To the extent practicable, the system architecture will be based on interconnected internet (cloud) technologies (Figure 4). Cloud computing is a model for enabling ubiquitous, convenient, on-demand network access to a shared pool of configurable computing resources (e.g., networks, servers, storage, applications, and services) that can be rapidly provisioned and released with minimal management effort or service provider interaction (NIST, 2011). The intent is to take advantage of interconnectivity, ease of access, scalability and economies of scale by employing Infrastructure as a Service (IaaS), Storage, and Software as a Service (SaaS) technologies that are readily available from commercial sources. Where not possible because of real security concerns, some reliance on on-premises resources may be unavoidable.
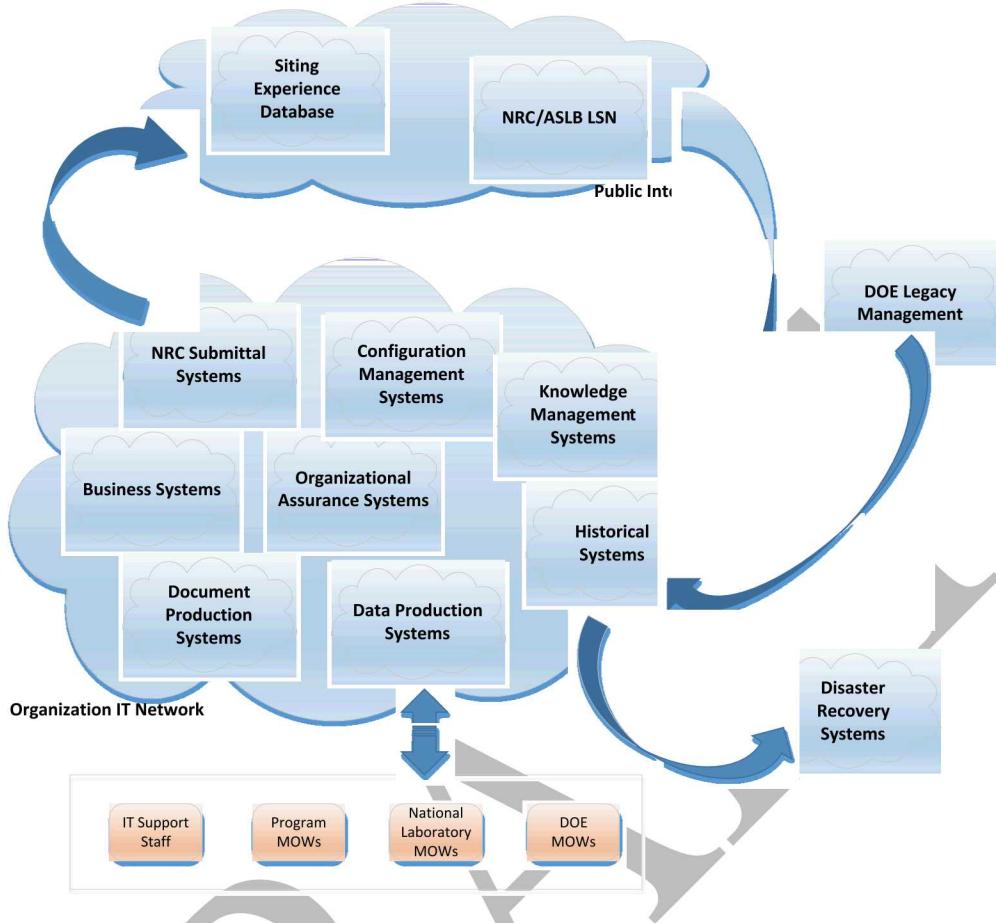
Figure 4 - Schematic IT Architecture

7.6.2   Day-to-Day Program Operations

These are IT Systems that provide the IT infrastructure necessary for any business. They would likely be provided by the program's designated IT organization. In addition, these systems will be able to support all of the software applications required for day-to-day operations.

- Desktop Support - maintain project COE for all desktops and provide customer support ticketing and resolution documentation (help desk)

- Email – Commercial off the Shelf Software (COTS) messaging system that will support instant messaging, calendars, etc.

- Collaboration (External & Internal) - systems that will support workflow, approvals, and communication capability with both internal and external entities

- Content backup - automated back-up for designated software applications and data per program requirements

- Communications Capabilities (phone, audio/visual (A/V)): Contract communication and video capability

- High Performance Computing capability (Modeling Support) - hardware and software system support for the clusters

- Hardware (server and desktop) Support - maintains and manages all hardware and refurbishment efforts

- Access control - security authorization for all access for each system (userids, metagroups, etc.)

- Software License Management - tracks licenses and ensure legal obligations are met for all server and desktop software Network Storage - Large SAN (storage area network) storage capacity

- Networking and Infrastructure Support - network presence with internal and external access capability; system administration assistance with network and hardware components; contract for an ISP presence

7.6.3   Organizational Assurance Systems

IT System capabilities to support Organizational Assurance requirements address the following areas:

- Safety Conscious Work Environment (SCWE) - enable the workforce in identifying and correcting safety risks.

- Corrective Action Program (CAP) - systems that track areas of concern and document the measures taken to resolve them

- QA - support for administrative and procedural activities implemented in systems that assure requirements and goals for a product, service or activity will be fulfilled

- NRC Information Submittal Systems - Systems that provide IT capability to transmit data and documents to NRC:
  - o Manage content specifically to meet Atomic Safety and Licensing Board (ASLB) requirements for posting on the LSN publically accessible website
  - o Manage content specifically to meet NRC requirements for submittal to NRC's ADAMS

7.6.4   Business Systems

Systems that will provide the business infrastructure to manage training, logistics, financials, procurement and contracts management, asset management, and all human resource functions. They are the generally applicable systems for any business and would likely be provided by the program's IT organization.

- Staffing Management - monitors the hiring, separations and benefits for program employees and contractors

- Employee Concerns Program - monitors the reporting and resolution of all reported employee concerns

- Training - assigns, tracks and documents all training requirements

- Facilities - manages and monitors the physical locations for the program

- Financials / Funding / Payroll - manages all program funding

- Project Controls/Management - manages the schedule, resources, costs of the program

- Procurement - provides the ability to purchase necessary assets and resources

- Contracts Management - tracks and provides legal oversight to ensure the contractual obligations are met

- Asset Management - tracks all physical assets

- Foreign National Request (FNR) Access Control - provides security authorizations for all foreign national employees and contractors

- Travel Records/Expenses: tracks all travel and expenses related to the program

7.6.5   Document Production Systems

These are Systems that support the Program's documentation products.   These systems are used for collaboration, technical editing, bibliographic documentation and graphic support. The system will meet mandated requirements on document creation standards and metadata.

- Reference Registry - system that will manage and provide access to all purchased copyright documents, as well as bibliographic materials

- Copyrighted Reference Registry - track and manage the purchase of copyright materials

- Graphics - software systems that will provide graphics for all documents per the program's requirements

- Document Development - workflow that will enable electronic approvals and version control

7.6.6   Configuration Management Systems

These are systems that support managing and versioning of all program artifacts (software, data, documentation, etc.)

- Regulatory Document Configuration Management - provides a controlled environment for storing and accessing documentation provided to NRC and other regulatory entities

- Correspondence Control - provides a controlled environment for storing and accessing all formal correspondence related to the program.

- Records Management - certified records management system that meets DOD 5015 requirements for electronic records and NARA requirements for paper documentation

- Document Management/Control - electronic document system that provides controlled submission, version control, and access to formal program products

- Data Management - systems that will provide access, metadata and version control (this will include multiple repositories) for both structured and unstructured data

- Requirements Management - will track requirements via processes and procedures as well as all IT systems configuration requirements

- Commitment Management - tracks milestones and deliverables

- Software Configuration Management System - track all software and licenses used by the program

- Data Management System – systems designed to store technical data

- Licensing Support Network (LSN) Content Transmittal - electronic workflow that enables the timely transmission of all licensing support relevant documentation to the designated contractor

7.6.7   Data Production Systems

These are systems that are necessary to deliver data that are integral to some of the principal products of the program. For example, data generated from performing total systems assessments and modeling simulations, as well as using geographic information systems.

- Modeling support - systems required to support all modeling software applications and required records requirements
- Simulation support - systems required to support all simulation software applications and required records requirements
- Total System Performance Assessment (TSPA) - systems to support COTS applications that support the HPC capabilities
- GIS capabilities - systems to support COTS applications that support geographic information systems for the program

7.6.8   Knowledge Management Systems

The purpose of a knowledge management system is to support compiling, organizing, leveraging, and preserving the organization's knowledge base(s) to support organizational goals and anticipated future needs, including information systems supporting the 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. These systems will need to accommodate very large quantities of traditional information (documents), as well as audio and video recordings.

7.6.9   Disaster Recovery Systems

These capabilities provide data and application backups both locally and at a remote site. They are critical and mitigate the risk of data and service loss in the event of a local disasters or application failures. They would provide basic services at a remote site in the event of a site disaster. Typically these capabilities are provided by the program's lead organization's IT organization.

- Off Site Backup: per program requirements, automated movement of back-ups to a designated off-site location
- Disaster Recovery Plan: documented plan that identifies the process for recovery; includes hardware and software that will enable recovery per the program's requirements

7.6.10   Historical Systems

Historical Systems provide Information from past programs. These systems will include, but are not limited to:

- Siting Experience Database - provides an archive of documentation regarding efforts to site nuclear waste facilities, both in the United States and abroad.

- DOE Legacy Management – repository of all Yucca Mountain (YM) information systems

- YM License Support Warehouse – search capability that extends to information in the YM Lead Laboratory information archive

- YM Report Center – a search tool that provides quick and easy access to YM data such as TDMS, DIRS, CDIS, CAP, and RIS

- YM Request for Additional Information Development System (RAIDS) – information system dedicated to the development of responses to RAIs from NRC

- YM Hearing Process Support System (HPSS) - system dedicated to the development of information to support the applicant's participation in NRC adjudicatory hearings for YM

7.7   Science/Engineering

All Science and Engineering activities will include interactions with DOE to formulate program direction, mitigate complex issues involving internal and external organizations, present project-related material to upper management, approve technical and non-technical products and documents, and allocate resources to the performance of regularly scheduled work and rapid response tasks associated with repository sciences and engineering.

7.7.1   Chief Scientist

This function is responsible for advising the Program Manager and other members of the organization's management team on the adequacy and completeness of produced scientific and engineering information and working to ensure technical work performed by and for the organization is sound, credible and meets the highest standards of scientific integrity.

The Chief Scientist is also responsible for providing technical and operational integration between the organization's regulatory office and other technical groups in the development of regulatory responses, condition report planning and execution of design integration, software configuration management and oversight of ongoing science activities. Another principal responsibility of the Chief Scientist is ongoing maintenance and fostering of relationships with internal and external national science interests, DOE and its legal counsel, and oversight groups (NWTRB, NSC, etc.).

7.7.2   Repository Science and Engineering (Science and Technology)

This element manages the repository sciences and engineering activities conducted by the organization, consistent with various approaches that may be defined by DOE. In addition to general Repository Science efforts, this element is responsible for Siting, Site Characterization, Performance Assessment and Performance Confirmation

7.7.2.1   Siting Studies

This sub-element of Repository Science and Engineering manages the siting studies related activities conducted by the organization. Neither the NWPA (Nuclear Waste Policy Act) nor the AEA (Atomic Energy Act) establish a specific process for locating, evaluating, and selecting sites for repositories for DOE-managed SNF and HLW. Siting a repository pursuant to the Department's AEA authority could be done using a consent-based approach, consistent with the Strategy (DOE 2013a) and the BRC recommendations (BRC 2012). DOE's 2015 report on

defense waste disposal (DOE, 2015) clearly indicates a preference, if not a requirement, for public acceptability using a 'phased, adaptive, consent-based siting approach'. Consistent with recent international experiences, DOE will include an initial phase of consultations with stakeholders about the design of a consent-based process at the beginning of the repository siting effort.

7.7.2.2   *Site Characterization Studies*

This sub-element of Repository Science and Engineering manages the site characterization activities conducted by the organization. Such activities typically involve environmental and geophysical surveys as well as exploratory drilling.

7.7.2.3   *Compliance Demonstration (Performance Assessment)*

This sub-element of Repository Science and Engineering manages the performance assessment activities conducted by the organization.

7.7.2.4   *Performance Confirmation*

This sub-element of Repository Science and Engineering manages the performance confirmation activities conducted by the organization.

7.7.3   Systems Engineering

This element manages the systems engineering activities conducted by the organization and is responsible for evaluating the potential for waste management system optimization based on various characteristics including, waste location, waste inventory, waste characteristics (thermal properties), canister and container characteristics, etc.

7.7.4   Storage

This element manages the waste storage conducted by the organization, consistent with the various approaches that may be defined by DOE.

7.7.5   Transportation

This element manages the transportation activities conducted by the organization, consistent with the various approaches that may be defined by DOE.

7.7.6   Facility Design

This element manages the facility design activities conducted by the organization.

7.7.7   Facility Operations

This element manages the facility operations activities conducted by the organization.

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