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"International Atomic Energy Agency (IAEA) Initiatives: Records Management for Deep and Near Surface Geologic Repositories"

by
Peggy J. Warner
Records Manager
Nuclear Waste Management Program
Sandia National Laboratories

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PRESENTATION OBJECTIVES:

To inform the NIRMA community of one international records management initiative.

To inform the attendees of international issues relative to long term (10,000 years) retention of records.

To present the concern that "implied" records and records management activities within international treaties/agreements may not be adequately identified to those parties responsible for their generation, capture, management and retention.

PRESENTATION GOALS:

To clearly present the initiative of the International Atomic Energy Agency so that attendees will be able to apply presentation information to current activities.

To raise the level of awareness of the NIRMA community (particularly DOE and NARA) to retention issues of international concern that must be incorporated into present and future Federal programs.

RECOMMENDED ATTENDEES:

DOE personnel and contractor representatives
NARA personnel and contractor representatives
Anyone interested in international records management initiatives

PRESENTATION

The international scientific community has long had an interest in determining methods by which information regarding nuclear waste repositories, and the inherent danger to humanity, could be passed from generation to generation and society to society. Because nuclear waste will remain radioactive for thousands of years future generations must be warned of the dangers thus eliminating intentional or inadvertent intrusion. Member States of the IAEA have determined that the principle safety of such sites must not rely solely on long term institutional arrangements for the retention of information. It is believed that repository siting, design, operation and postoperation information should be gathered, managed and retained so that this information remains accessible to future societies over a very long period of time. The radionuclide life is 10,000 years; thus the retention of information continues beyond current societies, cultures and languages, and must be continually migrated to new retrieval technologies to assure access.

The International Atomic Energy Agency (IAEA), as a result of this international interest, is conducting consultant and advisory meetings to prepare Technical Documents which are intended to provide guidance to all IAEA Member States (countries) that are currently planning, designing, constructing or operating a deep or near surface geological repository for the storage and protection of vitrified high-level radioactive waste, spent fuel waste and TRU-waste (transuranic).

The United States, and particularly the Department of Energy (DOE) as a federal agency, is a recognized leader in the siting, design, and recordkeeping of deep geologic repository projects. The experience available within the scientific community and the supporting administrative expertise of the DOE is presently and will continue to be an essential resource to Member States of the IAEA. The United States has developed this technical and administrative expertise as a result of the high rigor requirements from the Nuclear Regulatory Commission (NRC)and the Environmental Protection Agency (EPA) to name two regulatory bodies. Thus the United States repository programs require and have established rigorous documentation and record keeping practices.

In an attempt to assure that Member States were planning for and implementing processes to create, collect, manage and retain pertinent repository information, the IAEA embarked upon the development of two Technical Documents. One document deals with and is titled "Maintenance of Records and Documents for Near Surface Waste Disposal Facilities" while the second document is titled "The Maintenance of Records and Documents for Deep Geological Repositories". In October of 1994 the first Consultants Meeting was called for the writing of the deep geological repository paper. Nominated to serve on this committee were representatives of the United States of America, Germany, France and Sweden. The result of a five day meeting was a preliminary draft document.

The next level of IAEA consulting group, an Advisory Group, was called together for a five day working session in December of 1995. Eleven countries were represented and they included: Belgium, Canada, Czech Republic, France, Germany, Japan, Russia, Republic of Korea (South), Russia, Sweden, the United Kingdom and the United States of America. I had the pleasure of being nominated to represent the United States and specifically the Department of Energy (DOE). Additionally, at the request of the IAEA, I was honored to Chair the Advisory Group. The final meeting, a four day Consultants Meeting, was held in May of this year to assure that all Member State review comments were adequately considered and to finalize the Technical Document.

Three primary points were addressed by the IAEA Consultants Meetings and the Advisory Group. These points will be discussed in the presentation.

- identify a hierarchy of information that would be necessary to document and retain for repositories

- design a "Records Management System" within each Member State to assure that High Level Information would be generated and protected

- identify a need for maintenance and decentralization of Member States' records for long term retention at an archival level

I will discuss these points and the possible records management impacts for the Department of Energy, the National Archives and Records Administration, and possibly the Department of Defense.

BACKGROUND:

As initially stated, the scientific community has been studying methods to protect the safety of humanity and thus to preclude the inadvertent access into a geological repository. The following excerpts from two published reports provide examples of scientific community concerns.

> "Building on Existing Institutions to Perpetuate Knowledge of Waste Repositories", Abraham Weitzberg, August 1982, NUS Corporation, ONWI-379
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> The foreword of this report notes that the Department of Energy sponsored a multidisciplinary task force to study the potential of human interference with radioactive waste repositories. As a result of this study the task force identified communication as one principle means of reducing the likelihood of human interference. They further examined the structure of the message, the content and the method of transmission into the future.

"Permanent repositories for radioactive waste will be designed and constructed to withstand natural phenomena, but their capability to isolate the waste from the biosphere may be diminished by human activities that inadvertently interfere with the repositories... Unfortunately, it is apparent that human activities--such as the search for, and the extraction of, water, petroleum, or mineral resources--could affect the integrity of the repository medium. One way to reduce the likelihood of human interference is to communicate knowledge of the repository far into the future, and therefore special communication systems will be established for each repository...In order for a communication system to effectively transmit information about waste repositories far into the future, it must contain messages that are durable, detectable, and understandable to future generations. Site markers and offsite information archives are two of several methods that could be employed."

The themes identified in this first document are those that the IAEA established for the writing of two guidance documents which in the terms of the IAEA are Technical Documents. The two primary themes are that one, information must be retained for the use of future societies and two, that an archival system is the best method of preservation. The following excerpt from a second publication emphasizes the need for a system of record keeping.

"Expert Judgement on Markers to Deter Inadvertent Human Intrusion into the Waste Isolation Pilot Plant", Kathleen M. Trauth, Stephen C. Hora, Robert V. Guzowski, SAND92-1382 Printed November 1993

"This study had two purposes, one qualitative and one quantitative...The qualitative purpose was developing design guidelines for markers and messages to communicate with future societies about the location and danger of the buried wastes at the WIPP (the Waste Isolation Pilot Plant located in Carlsbad, New Mexico). Such information is intended to deter inadvertent human intrusion...Other passive institutional (such as a records system or a protective barrier system) need to be developed and could also be effective in deterring inadvertent human intrusion."

Eleven countries of the international community are presently in various stages of siting, designing, or constructing deep geologic repositories. Member States of the IAEA have determined that the principle safety of such completed and operational sites must not rely solely on long term institutional arrangements for the retention of information. It is believed that repository siting, design, operation and postoperation information should be gathered, managed and retained in a manner that will provide information to future societies over a very long period of time.

As noted in both of these studies the need to collect and retain a specific body of information is a common theme. Each country may have a different way of conducting their licensing process thus their body of information may not be as great as other countries. For instance the licensing process in the United States, as identified in the Nuclear Waste Policy Act of 1982, established a three-year process which included eighteen months for litigation. While in contrast in Germany a single contract has already been issued to a contractor for all repository activities, licensing through operation and closure as one process. As you can see a much larger volume of records will be required to support the licensing and litigation process in the United States.

HIERARCHY OF INFORMATION:

The first IAEA Consultants utilized the principles of a hierarchy of information to be prepared, collected and managed within a records management system which concluded with final protection for future societies in an archive facility. These principles can be drawn directly from the various scientific publications created in the United States and internationally (see examples in Appendix C).

The final draft of the deep geological repository Technical Document depicts this hierarchy as containing three levels of information. The Primary Level Information, which is continuously developed during the lifetime of the repository program, depends on the repository system selected, national laws and regulations, and the need for public involvement. Therefore it is expected that relevant information will include siting, construction, operation and closure.

The middle level of the hierarchy is the Intermediate Level Information consisting of condensed information to ensure understanding of the repository system. These records support legislatory and licensing requirements throughout the repository lifecycle. There may be references to specific bodies of information which reside in the Primary Information Level (PLI) as well as the location of the PLI.

The top level of greater condensed information is the High Level Information. This level provides sufficient information to provide a fundamental understanding of the repository system to meet the needs of future societies. This level also contains the required records for IAEA Safeguards (associated with the "Treaty on the Non-Proliferation of Nuclear Weapons"). Appendicies A and B identify specific records recommended for placement into the HLI. The HLI body of information should be placed into a national and/or international archive for very long term protection.

You will note that many studies deal with possible methods to assure the preservation of a body of information about the repositories to ensure safety of future societies. The placement of the HLI information into archival protection is a measure to add confidence that information will be preserved even as political, social, and economic changes occur in Member States. Placement of this information into the Member State archive and an international archive creates added protection through duplication (further discussion regarding archival needs follows).

RECORDS MANAGEMENT SYSTEM:

The second area of IAEA concern is that in order to capture this body of information which is to be placed into the High Level Information (HLI) a Member State system of record keeping must be planned and implemented at the earliest possible stage of repository design.

This system may be comprised of several actual organizations or groups of records. The 1995 IAEA Advisory Group was in consensus that the value of and societal need for these records was high enough to warrant the identification and collection during all phases of design, development and operation, and preservation over the 10,000 year period.

It was interesting to observe that all Advisory Group participants and Consultants had a clear understanding that records were important and that a system of keeping them was necessary, however, I was the only Records Manager nominated to serve on these committees. Most other participants were either Project Managers or Quality Assurance Managers. Thus the immense record collection and management requirements of a life cycle records management program was not clearly understood. It was also not clearly understood that a Records Management System within a country like the United States may need to collect and manage records for the High Level Information set from more than one federal agency (e.g. Department of Energy and the Environmental Protection Agency).

MEMBER STATES ARCHIVE AND AN INTERNATIONAL ARCHIVE:

Archival retention and protection of records of the Member States was addressed. Member State records may be vandalized during civil unrest or war, or present day countries may not exist in the future (as we have witnessed during the end of the cold war). The retention of a body of information which can be communicated to future generations is a basic need of any deep geological repository program. The design of such a system must be predicated on the concept that technology as we know it today will surely not be the same 10,000 years from now. Yet, the conveyance of the High Level Information is of utmost importance to each Member State.

The consensus was that additionally an International Archive be established to which a second copy of the Member States High Level Information (HLI) would be submitted for long term retention to guard against war, natural disaster and loss of societies. Discussion was held regarding the possible location of the international archive at the IAEA as a neutral location and because Member States already submit Safeguards report documents to the IAEA. It was recommended to the IAEA that a study of the feasibility to establishment an International Archive may be appropriate.

In the United States it is uncertain whether the National Archives and Records Administration (NARA) would act as the archive for the USA High Level Information sets for the various geologic repositories as it is presently not a specific activity within the mission of the archive. This is a specific area of communication and agreement which is needed between the Department of Energy (DOE) and NARA.

Studies have been conducted throughout the world regarding the need for archival storage. Mikael Jensens publication "Conservation and Retrieval of Information" specifically addresses various archival issues. Specific topical areas include: archives vs markers, archival media and various international archives. The Nordic Study, as it is referred to, studies previous archival resistance to war, cultural and societal changes, and natural disasters. Some of the historically surviving archival references are the German Archive, the Vatican Archive with a more recent reference to the present Mormon Archive which is located in the United States but does not have the history of longevity.

CONCLUSIONS:

The areas outlined below should be addressed within the Department of Energy, and in concert with any other regulatory organizations or governmental agencyies involved with the deep geologic repositories, to assure that the United States properly reviews the IAEA guidance and establishes appropriate methods to implement record keeping and archival practices which will assure the identification and retention of High Level Information.

Resultant policy should be passed on to the next representative of the United States that is involved with further development of these discussed documents and the development of similar IAEA guidance documents. Effective discussion of these recommendations would best be served through active partnership including Sandia National Laboratories (the previous IAEA nominated participants), the Department of Energy, the National Archives and Records Administration, and possibly the Department of Defense.

- Will the Department of Energy need to design and implement processes to support the creation and management of the High Level Information (HLI) records for 10,000 years or has this been designed but not communicated to todays record keepers?

- Will the Department of Energy need to establish a Records Management System (RMS) that is at the headquarters level to collect and manage the High Level Information (HLI) records as they are created by various organizations and agencies?

- Will the Department of Energy need to establish a retention period with the National Archives and Records Administration (NARA) to assure that the High Level Information is accepted into the care and protection of NARA for 10,000 years?

- Will the National Archives and Records Administration (NARA) need to alter their mission to allow for the long term retention of this specific body of information for each of the projects within the United States that will have the archival need.

- How can the Department of Energy establish records management needs at the highest level of repository planning to assure that required High Level Information records are identified early and assure the capture and maintenance of these records over 10,000 years or more?

- Will the Department of Energy provide guidance to the next IAEA representative regarding the position of the United States for preparation of other Technical Documents?

APPENDIX A

Identification of Potential Records for the High Information Level

Information, including Safeguards requirements (Appendix B), should not be more detailed than that provided to the licensing authority. The HLI information to be collected and retained in the Member States archive and an international archive should cover the following subjects:

Description of the Records Management System (RMS)

Cross referencing to the location of the original records

Site description, including descriptions and maps
- geology
- hydrology
- geochemistry
- thermomechanics
- biosphere

Source term
- waste form
- inventory of radionuclides
- inventory of chemical species
- Safeguards: as with all re-batching operations, an adequate audit trail be maintained starting with arrival of spent fuel assemblies from the reactor site. An adequate audit trail includes the capability to perform a 'two way search' to indicate which assemblies are in a given container and also the location of a specified assembly if requested.

- Safeguards: in the case of consolidation, there is a record of which assemblies wen into which consolidated container.

System description
- barrier systems (natural and engineered)
- design and layout (Safeguards: detailed 'as built' drawings and technical descriptions of the areas, facilities, and equipment in the repository that are in relevance to Safeguards)
- marker or warning system
- monitoring systems
- raw data for safety assessments
- Safeguards: physical location of each container containing Safeguarded nuclear material, this information will also support safe heat loading

System performance

performance assessments

safety assessments

Safeguards: verify material transfer using a unique, hard to modify, container characteristic (e.g. container number, weld signature, radiation characteristic)

NOTE: Post closure phase: The IAEA and the State should retain all safeguards relevant documentation and information (i.e. records of the complete inventory of nuclear material and/or previous operations of the repository) deem necessary. These records should be kept for at least as long as Safeguards exist for the nuclear material in the repository.

APPENDIX B

Safeguards Documentation Requirements

The following information is excerpted from a presentation given by Mr. Abdul Fattah, IAEA Safeguards, at the IAEA Advisory Group meeting in Vienna, Austria on December 19, 1995.

Safeguards are applied by the IAEA to assure non diversion of nuclear material from peaceful activity. For materials to be disposed in geological repositories these include spent fuel and waste material containing nuclear material, as these will not qualify for termination of safeguards even after the closure of the repositories. The basic safeguards approach for the repository will be a combination of design information verification (DIV) and application containment of surveillance (c/s).

Design Information Verification (DIV) is an important safeguards measure to be applied during excavation and continuing during the operational phase. It should confirm the integrity of the repository area and aim at detecting undeclared activities such as the presence of sensitive equipment or tunneling in the neighborhood. As the repository design will change during excavation, for example to adapt to geological findings, the application of DIV must be a flexible, ongoing process.

DIV should be an ongoing activity. The design information of the underground facility should include maps and information about all excavations. The IAEA should verify that the excavation areas are as declared and that there are no undeclared excavations. The IAEA should also provide assurance of the absence of undeclared underground reprocessing, and an assurance of no undeclared operational capability underground which could facilitate substitution between containers.

DESIGN INFORMATION

- identification of the facility
- form, location & flow of nuclear material
- layout of important items of equipment
- features related to material accountancy and containment of surveillance
- procedure of nuclear material accountancy and control

NUCLEAR MATERIAL ACCOUNTANCY

- activities to establish quantities of nuclear material present within defined areas and changes in defined periods (essential elements: accounting areas, material measurements, record keeping, preparation and submission of accounting reports, verification and analysis of accounting data to determine correctness and accuracy)

RECORDS SYSTEM

- establish a national system of accounting for and control of nuclear material
- records in respect of each material balance area
- Member State: facilitate the examination of records
-records consists of: accounting and operating
- latest international standards

ACCOUNTING RECORDS

- all inventory changes to permit book inventory
- all measurements results used for physical inventory
- all adjustments and corrections
- all inventory changes and physical inventories shall show material identification, bath data and source data separately for each batch and material category

OPERATING RECORDS

- operating data used to establish changes in the quantities and composition of nuclear material
- procedures to control quality of measurements
- sequence of actions for physical inventory taking to ensure its correctness and completeness
- actions taken for any accidental or unmeasured loss

REPORTS SYSTEM

- provide the agency with reports based on records kept in accordance with agreements: initial report, inventory changes, material balance report based on physical inventory
- specific reports: unusual circumstances leading to loss of nuclear material, containment unexpectedly changed to the extent that unauthorized removal of nuclear material possible

PRE-OPERATIONAL PHASE I

- draft plan
- description of possible exploratory underground works
- local buildings, which may later hide covert activities
- old local mine workings
- formal design information 180 days before construction

PRE-OPERATIONAL PHASE II

- detailed "as built" drawings and technical descriptions of areas, facilities and equipment in the repository
- Member States' response to design information questionnaire (DIQ)
- reports from design information verification (DIV) inspections

OPERATIONAL PHASE

- for each emplacement container: container identify, date of receipt, weight of total and fissile U and total Pu, location of each emplacement container, date of emplacement, date of backfilling, date of backfilling of the cavern

- continuous update of DI and DIV as built
- for each contained fuel assembly/rod: type, ID, date of discharge, burn-up, total and fissile U, total Pu, isotopic composition of U and Pu

POST CLOSURE PHASE

- the Member State should retain: all Safeguards relevant documentation and information, complete inventory of nuclear material, records of operations of the repository
- records should be kept as long as Safeguards agreements are in force