Training Program for
Korea Hydro & Nuclear Power Co. (KHNP)
U.S. Nuclear Waste Management System

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Sandia National Laboratories

February 2008

SAND 2008-1180P

Sandia is a multiprogram laboratory operated by Sandia Corporation, a Lockheed Martin Company, for the United States Department of Energy's National Nuclear Security Administration under contract DE-AC04-94AL85000.

What and Why?

- A Work For Others (WFO) proposal. Approved by DOE/NNSA
- KHNP came to Sandia to teach the U.S. Nuclear Waste management. Based on our:
  - 30 + years experience at WIPP
  - Lead lab at Yucca Mountain
  - Transportation, nonproliferation, security
- DOE benefits by showcasing WIPP success story & supports international WM problems. (Global Nuclear Materials Mgmt)
- Establish firm collaboration with ROK (KHNP et al.) to assist in the country's and region's waste management problems.
- Gyeounju repository

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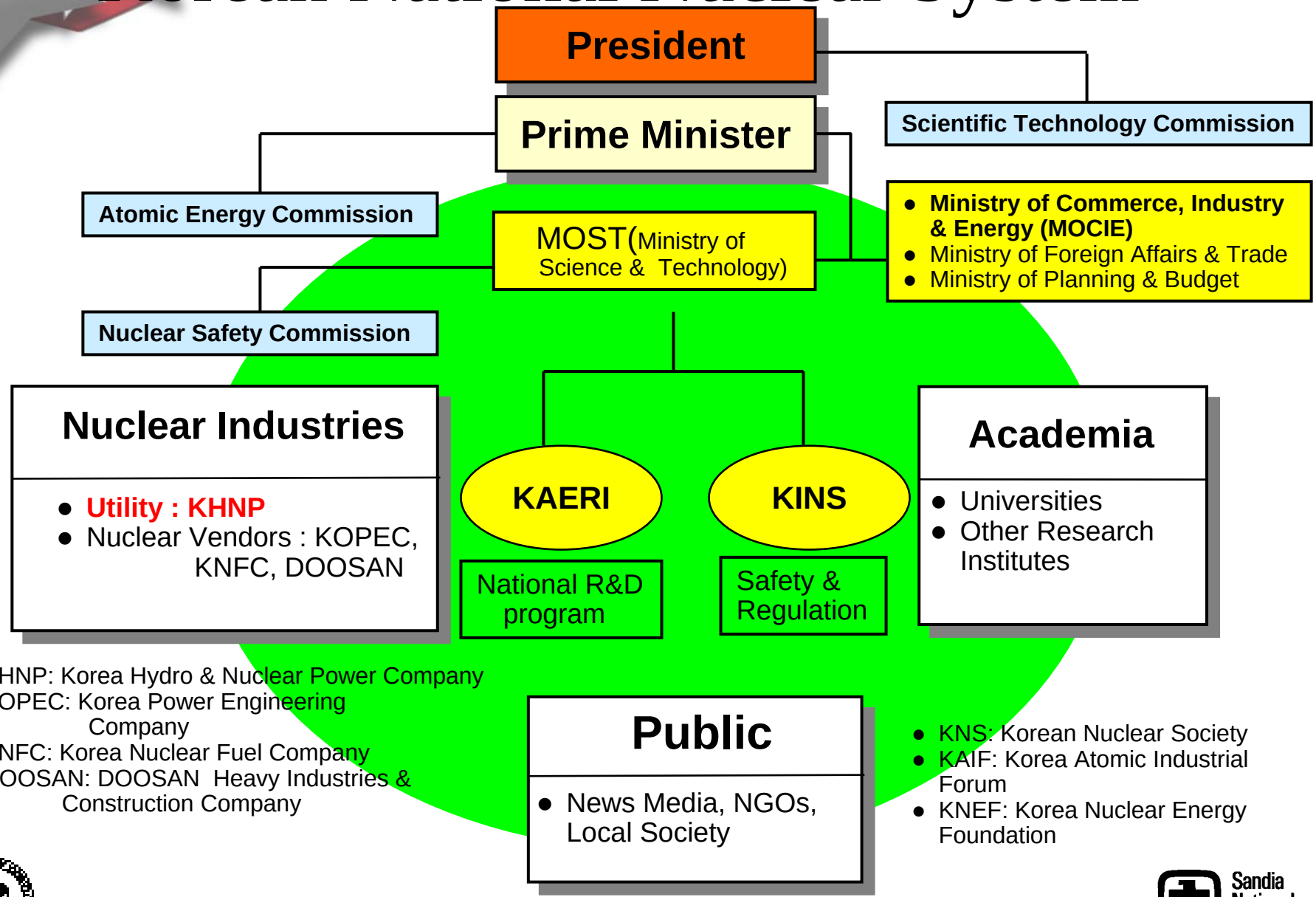
- Location : South-East coast
- Area : 2,098,419 ㎡
- Capacity : 100,000 Drums for Stage 1
  (Total 800,000 Drums)
- Disposal Type : Rock Cavern
- Const. Period : Jan. 2006 ~ Dec. 2009
- Site Geology : Granite rock massive
  Sedimentary rock

Korean National Nuclear System



- KHNP: Korea Hydro & Nuclear Power Company
- KOPEC: Korea Power Engineering Company
- KNFC: Korea Nuclear Fuel Company
- DOOSAN: DOOSAN Heavy Industries & Construction Company

- KNS: Korean Nuclear Society
- KAIF: Korea Atomic Industrial Forum
- KNEF: Korea Nuclear Energy Foundation

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The KHNP Trainees and Key SNL people

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Curriculum and Schedule

- Contract approved in April 2007
- Six trainees arrived 19 May 2007.
  - Four people for 6 months: Until 2 Dec 2007
  - Two people for one year: Until 25 May 2008
- Currently in 41st week (OJT)
- The twelve month contract includes:
  - 31 weeks of classroom lecture
  - 20 weeks of on-the-job training activities
- Multi-organizational effort to give complete immersion into WIPP processes

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What resources does it take?

More than 150 Sandia personnel including:

- Staff and Management
- Contractors
- Various Locations
  - Carlsbad, NM (WIPP)
  - Las Vegas, NV (YMP)
  - Albuquerque, NM
- Great Instructors!
- Good coordination and Planning

Other WIPP organizations:

- DOE/CBFO leadership/staff
- URS Washington Division (formerly Washington Tru Solutions)
- CAST Specialty – Transportation company
- Navarro (Carlsbad Technical Assistance Contractor CTAC)
- Los Alamos – Carlsbad Operations

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Chronological Summary

	Topic	*Duration (weeks)*
1.	Quality Assurance/ Regulatory Requirements	2
2.	Fundamental Principles of Ionizing Radiation	1
3.	Waste Characterization and Classification	1
4.	Repository Siting and Characterization	4
5.	Performance Assessment and Repository Modeling	1
6.	Packaging and Transportation of Nuclear Waste	2
7.	Assembly of a Safety Case	4
8.	Environmental Monitoring	5
9.	Repository Operations, Design, and Closure	3
10.	Tour of Yucca Mountain and the Nevada Test Site	1
11.	Interim storage of spent fuel	2
12.	Transportation of spent fuel and high level waste	2
13.	Safeguards and nonproliferation	1

Quality Assurance

Lecture topics included:

- Overview of WIPP QA Program
- Historical and regulatory basis for QA program
- Regulatory requirements
- ISO 9000 quality assurance guidelines

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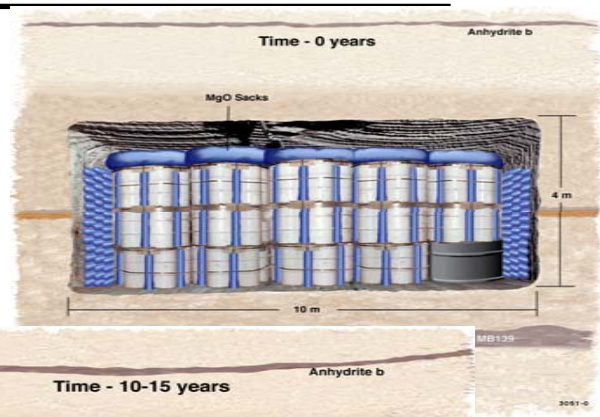
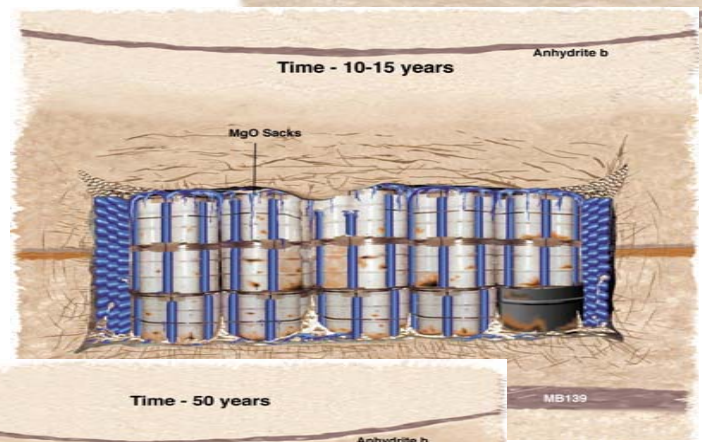
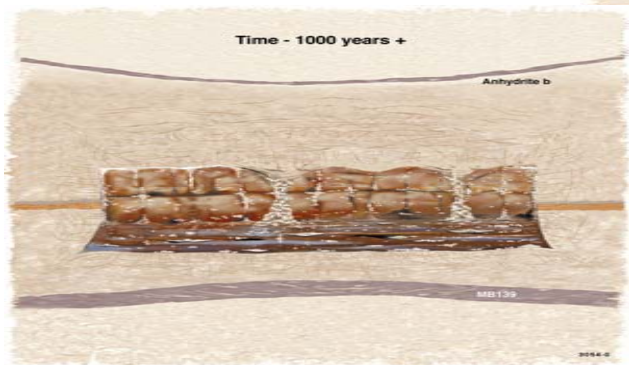
Regulatory Requirements
WIPP and Yucca Mountain

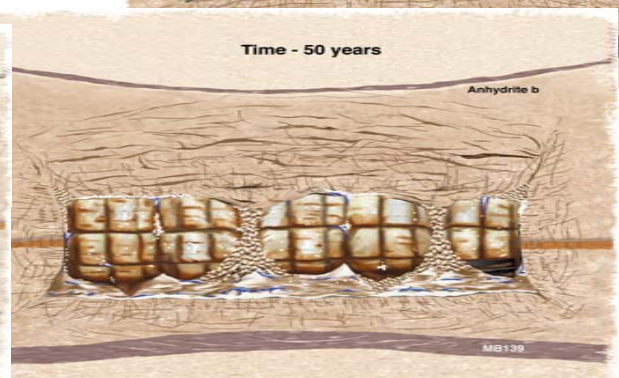
Lecture topics included:

- Organizational framework
- Regulatory framework
- Regulatory processes
- Public acceptance efforts









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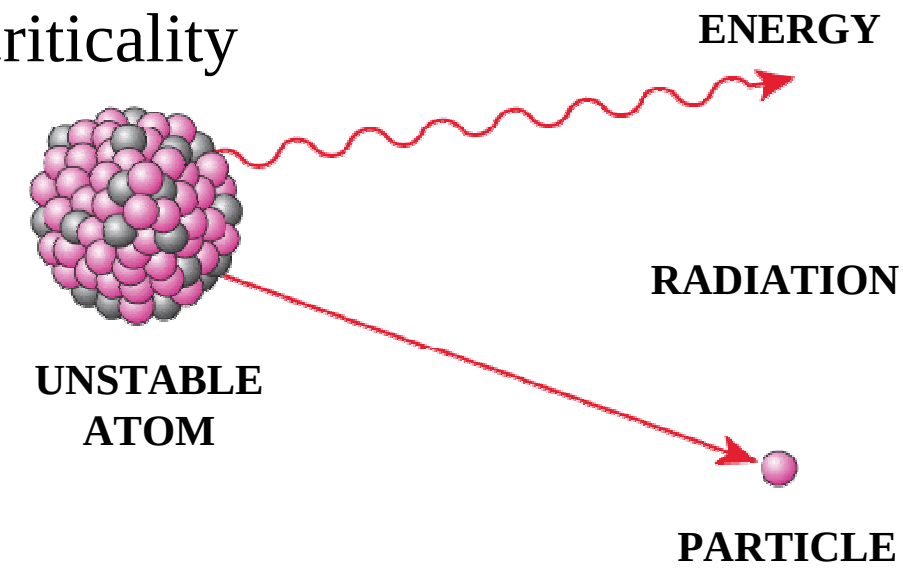
Fundamental Principles of Ionizing Radiation

Lecture topics included:

- Characteristics of ionizing radiation
- Dose conversion factors
- Fissile materials & criticality
- Neutron activation
- Health effects



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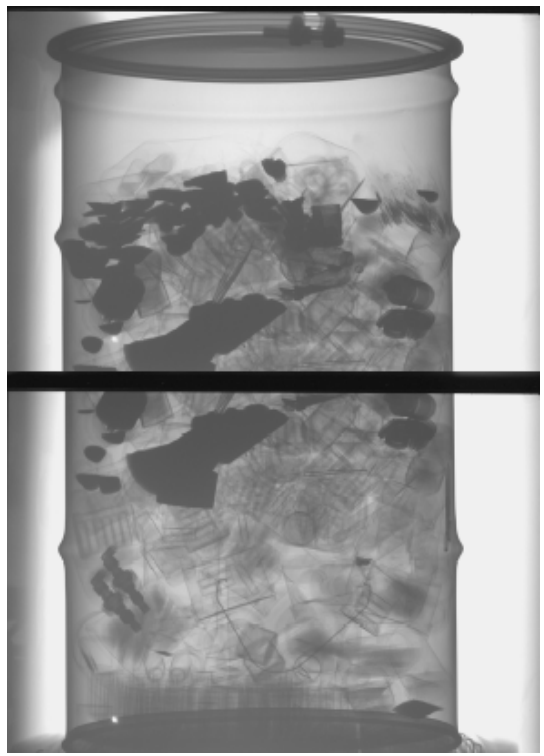
Waste Characterization and Classification

Lecture topics included:

- U.S. Department of Energy waste types and examples
- U.S. commercial radioactive waste types and examples
- International waste types and examples
- Regulatory framework
- Waste characterization exercises



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Repository Siting and Characterization

- Lecture topics included:
  - Siting criteria for low, intermediate, and high level waste
  - Site characterization plans
  - Site characterization methods
  - Data integration
- Extensive homework assignment on site characterization for repositories in South Korea

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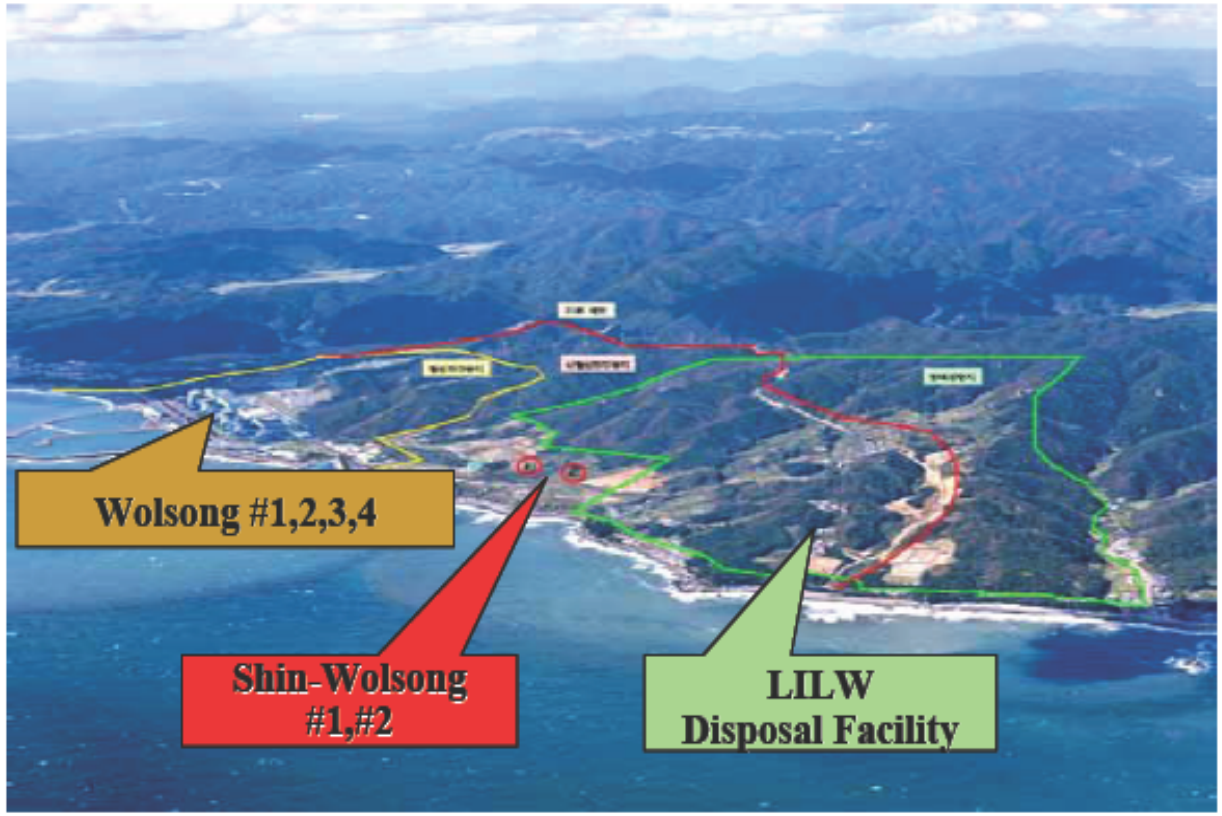
Location of the Facility



Bong-Gil Ri, Kyoung-Ju

(Next to Wolsong NPP Site)

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Packaging and Transportation of Nuclear Waste

Lecture topics included:

- Regulatory overview and requirements
- Package design, performance, & handling
- Package development
- Risk analysis
- Operational processes
- Emergency response & physical protection

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Packaging and Transportation of Nuclear Waste

Attended:

- Tour of the Sandia Radioactive Mixed Waste Management Facility
- Tour of Structural and Thermal Testing Facilities
- Tour of Laboratory of Transportation Department
- Drop test
- Burn test


Sang-Gyoo Joo
Eung-il Lee
Jin-Goo Huh
Byeoung-Jik Kim
Gang-Su Sung
Dong-Hyeun Hwang
OPEN POOL
TEST AREA
2S
CMC

Assembly of a Safety Case

- Lecture topics included:
  - Overview of safety cases
  - WIPP performance objectives
  - Features, Events, and Processes development
  - Scenario development
  - Waste inventory and forms
  - Performance assessment methodologies
  - Probabilistic framework
  - Conceptual and numerical models in performance assessment
- Extensive exercise in selecting Features, Events, and Processes for South Korean repositories

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Environmental Monitoring

- A short course taught at NMSU – Carlsbad through the Carlsbad Environmental Monitoring and Research Center (CEMRC), a division of New Mexico State University (NMSU)
- Lecture topics included:
  - Environmental monitoring
  - Risk assessment
  - Extensive exercise on repository planning and development

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Repository Operations, Design, & Closure

- Lecture topics included:
  - Repository design
  - Natural and engineered barriers
  - Performance confirmation
  - Shaft seal systems
  - Site closure plans
- URS (WTS) gave invaluable insight into the operations of the facility
- OJT is scheduled to build upon these lectures.
- Requests for operational documents: Important.

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Safeguards and Nonproliferation

- Nuclear nonproliferation
- Nuclear Nonproliferation Treaty
- International Atomic Energy Agency
- International Safeguards Regime
- United Nations Security Council Resolution (UNSCR) 1540
- Supply-side nonproliferation approaches
- Cooperative monitoring
- A review of physical protection

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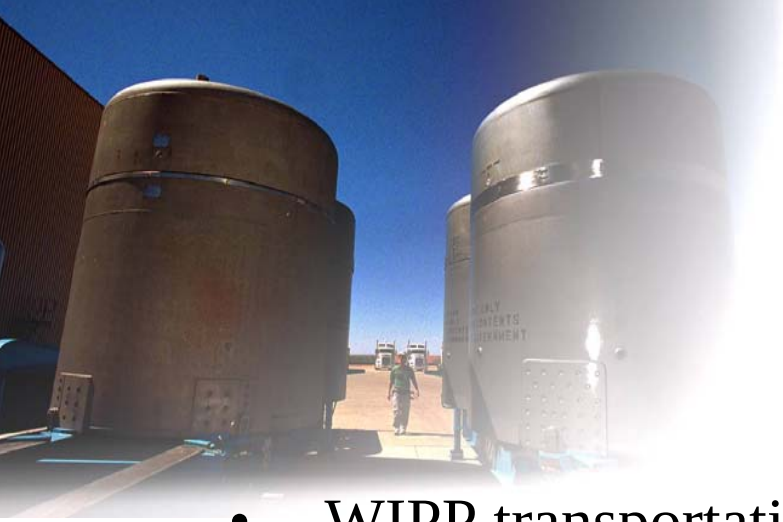

Transportation of spent fuel & high level waste

- WIPP transportation packages
- Transportation computer codes
- Regulatory testing, extra-regulatory testing,
- Acquisition/analysis of numerical & test data
- Package development and risk analysis
  - Technology development
  - Regulatory oversight
  - Package development
  - Transportation program plans
  - Public hearings and communication

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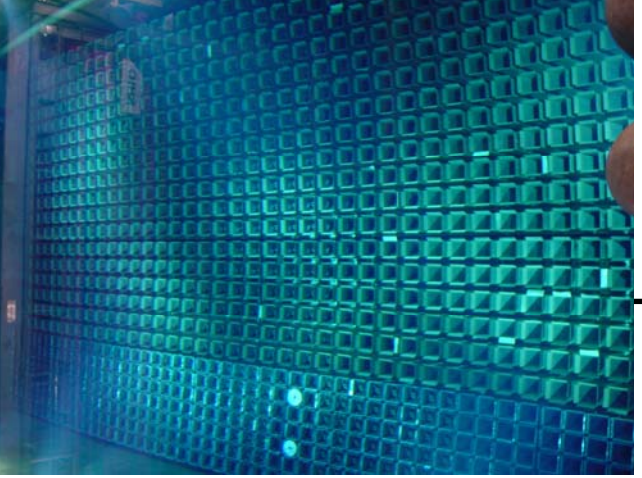
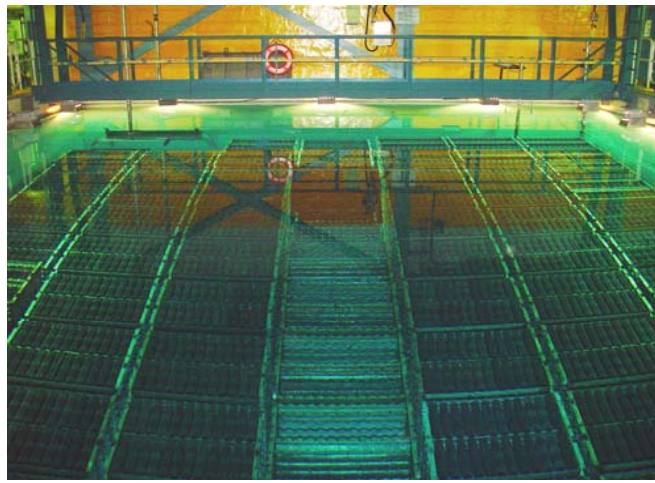


Interim storage of spent fuel



Requirements including:

- Existing U.S. storage systems
- Technical and economic issues
- Legal, institutional, and economic issues, case studies
- Siting, licensing, integration of storage and transportation, operations, systems analysis, facility capabilities
- GNEP

Financial Administration

- Structure of the United States Govt & Constitution,
- Annual federal appropriations, continuing resolutions
- Budget proposals, forecasts, negotiations, WBS & scheduling
- Formation and justification of Activity Based Costing (ABC) Sheets, collaborating on WIPP life cycle budget through 2035
- Balancing between sharing financial information and maintaining proprietary data, particularly labor rate information
- Managing WIPP through the appropriations, continuing resolution and funding processes.

On-the-Job-Training

- Tour WIPP, YMP, NTS Facilities
- Stakeholder Interactions (e.g., peer review)
- Additional activities: Technical and Admin jobs
  - Reviewing material for presentations
  - Setting up appointments to see people and interview them
  - Reading and homework assignments
  - Research regarding subjects of interest
  - Job Shadowing
- Put the trainees to work: Help us solve problems!
- Presentations on applicability of course material

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Backup slides

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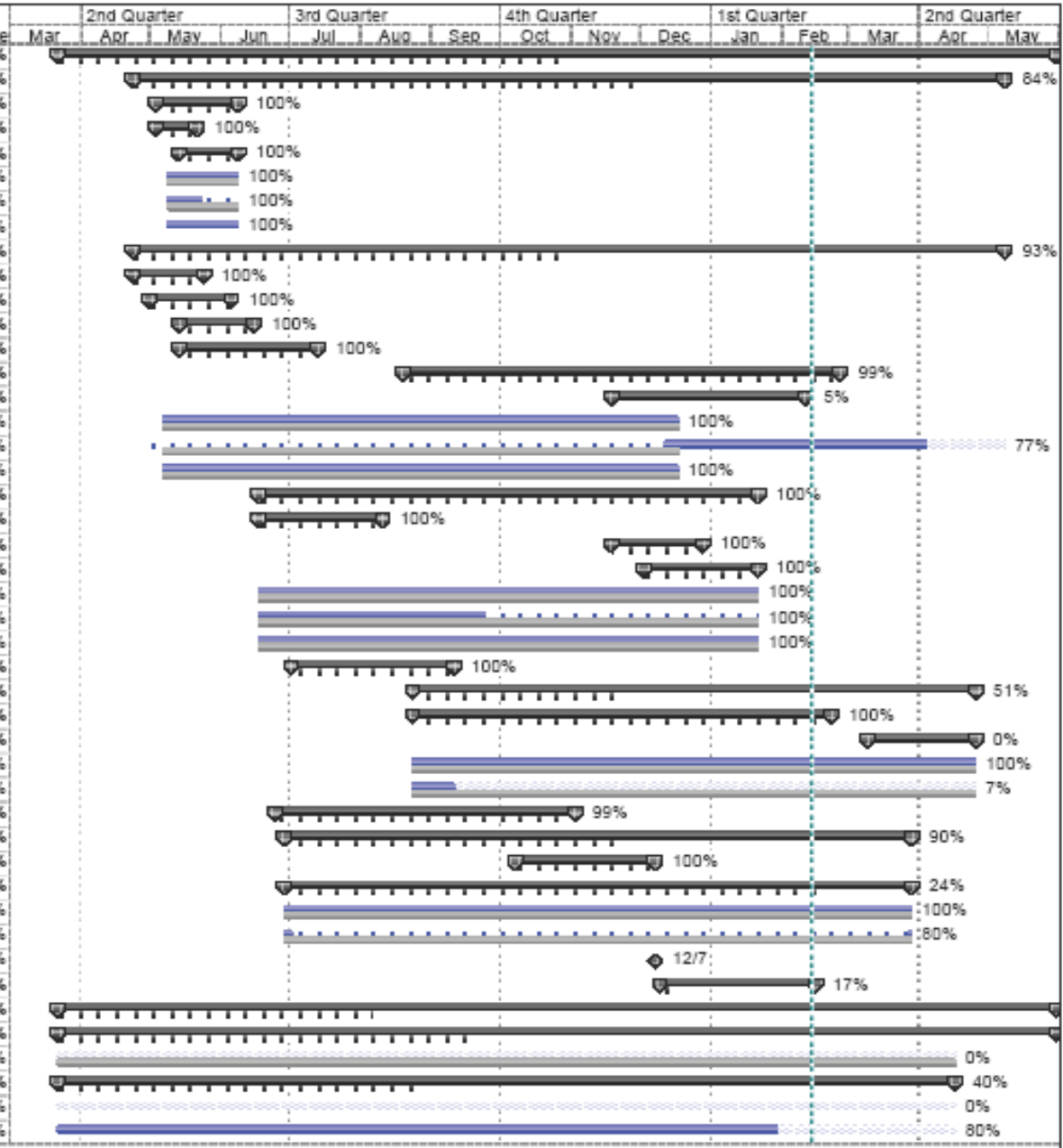
ID	odu	Task Name	% Complete
1		Project Total	66%
2		Training Modules	84%
3	1	Task 1.01	100%
4	1	Orientation	100%
8	1	Radiation Physics & Measurement	100%
12		Travel	100%
13		Labor	100%
14		Purchases	100%
15	2	Task 1.02	93%
16	2	QA Overview & Sample Exercise	100%
20	2	Overview of Regulatory Requirements & Pc	100%
24	3	Waste Characterization & Classification	100%
28	4	Repository Siting	100%
32	8	Repository Operation and Closure	99%
36	11	Fund Administration of the LLW & HLW Dis	5%
40		Travel	100%
41		Labor	77%
42		Subcontract Labor (from Pur & Chargbks)	100%
43	5	Task 1.05	100%
44	5	Packaging and Transportation	100%
48	12	Interim Storage of Spent Fuel	100%
52	13	Transportation of Spent Fuel and HLW	100%
56		Travel	100%
57		Labor	100%
58		Charge backs	100%
59	6	Task 1.06 -- Performance Assessment	100%
65	7	Task 1.07	51%
66	7	YMP	100%
70	16	Studies on High-Level Radioactive Waste (	0%
74		Travel	100%
75		Labor	7%
76	9	Task 1.09 --Environmental Monitoring and Proc	99%
82	10	Task 1.10	90%
83	10	WIPP	100%
87	15	OJT of the WIPP Operation	24%
92		Travel	100%
93		Labor	80%
94		Short Term Trainees Depart	100%
95	14	Task 1.14 -- Safeguard and Nonproliferation	17%
101		Task 2.0 -- Administrative & Management Tasks	41%
102		Task 2.01 -- Project Organization & Developmer	57%
117		Task 2.02 -- Management Reserve	0%
118		Task 2.03 -- Visiting Scholar	40%
119		Labor	0%
120		Purchases	80%



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Planned Training Modules

1. Principles of Radioactivity & Ionizing Radiation in Radioactive Waste
2. Regulatory Requirements & Quality Assurance
3. Waste Characterization & Classification
4. Repository Siting & Characterization
5. Packaging & Transportation of Nuclear & Hazardous Waste
6. Assembly of a Safety Case
7. Tour of Yucca Mountain Facility
8. Repository Operation, Design & Closure
9. Environmental Monitoring & Risk Analysis / Nuclear Waste Repository
10. On-the-Job Training, WIPP Activities
11. Fund Administration of Nuclear Waste Disposal
12. Interim Storage of Spent Fuel
13. Transportation of Spent Fuel and High Level Waste
14. Safeguard and Nonproliferation
15. On the Job Training, WIPP Activities
16. On the Job Training, High Level Waste Activities

Safeguards and Nonproliferation

Physical Protection

- Roles & responsibilities
- Categorization of threats
- Facility characterization
- Threat definition and design, implementation
- Evaluation of systems
- Tools, approaches, applications & issues
- Intrusion detection, alarm assessment, entry control & access delay
- Radiation sources & detectors
- Repository safeguards
- Activities related to spent fuel & high level waste
  - Reducing proliferation risk
  - Decommissioning waste facilities
  - Risk analysis
  - material attractiveness
  - transportation & storage
- Transparency and monitoring
- Application of proliferation risk & resistance assessment to:
  - Storage facilities
  - Repositories
  - Fuel cycle service systems

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