High Quality Applications

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November 21, 2008

Quality of Application

Overall quality of a requested licensing action may impact the staff's ability to complete the technical review in a timely manner.

Staff Observations/Trends Identified

- NRC Expectations in the Level of Detail
  - Sufficiency of Information
  - Use of Approved Guidance
  - Use of Precedent
- Consistency of NRC Reviews
- Requests for Additional Information (RAIs)
- Communications

NRC Expectations in the Level of Detail

- Comprehensive Application
- Sufficient Justification
- Detailed Analyses
- Stand Alone Applications
- Adequate Quality Assurance Review

Sufficiency of Information

- Complete and Detailed Safety Analysis Report (SAR)
- References
- Basis for Approach

5

Use of Approved Guidance

- Use of approved guidance is encouraged
  - Standard Review Plans (SRPs)
  - Interim Staff Guidance (ISGs)
  - Regulatory Guides
  - Regulatory Issue Summaries
  - Industry Codes and Standards
- Use of alternatives to NRC review guidance

6

Use of Precedent

- A previous precedent of approval can assist in the review process
- The application must provide its own justification
- An appropriately used precedent may provide resource and time savings

7

Consistency of NRC Reviews

- Continuity
- Experience
- Guidance

8

Requests for Additional Information

- RAIs are used for various reasons
- RIS 2007-09 is intended to assist applicants in minimizing RAIs
  - Burnup and Source Term
  - Use of Computer Codes

9

Communications

- In addition to the RAI process, other forms of communication are used and encouraged.
  - Pre-Application Meetings
  - Clarifying conference calls
  - Meetings to discuss RAIs

10

Summary

- Well-Written Application
- Sufficient Information
- Ample Guidance
- Communication

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Regulatory Requirements of 10 CFR Part 71 Applicable to the Shielding Review

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November 21, 2008

10 CFR Part 71 - Shielding Review

- **The package design must be described and evaluated to demonstrate that it meets the shielding requirements of 10 CFR Part 71.**

§ 71.31 Contents of Application

§ 71.31(a) - An application for an approval under this part must include, for each proposed packaging design, the following information:

- (1) A package description as required by § 71.33;
- (2) A package evaluation as required by § 71.35

§ 71.33 Package Description

The application must include a description of the proposed package in sufficient detail to:

a. identify the package accurately
b. provide a sufficient basis for evaluation of the package.

§ 71.35 Package Evaluation

The application must include a demonstration that the package satisfies the standards specified in Subparts E and F of this part.

a. Subpart E outlines the Package Approval Standards (Sections 71.47 and 71.51)

b. Subpart F describes Evaluation Tests (Sections 71.71 and 71.73)

5

Regulations & Guidance 10 CFR Part 71

§ 71.47 External radiation standards for all packages:

(a) Under conditions normally incident to transportation the radiation level does not exceed 200 mrem/hr at any point on the external surface of the package.

(b) Exclusive use shipment maximum dose rates:

- ≤200 mrem/hr on package surface (≤1000 mrem/hr if in closed transport vehicle)
- ≤200 mrem/hr on outer surfaces of vehicle
- ≤10 mrem/hr at 2 meters from vehicle outer surfaces
- ≤2 mrem/hr in any normally occupied space (truck cab)*

*This provision does not apply to private carriers, if exposed personnel under their control wear radiation dosimetry devices.

6

Regulations & Guidance 10 CFR Part 71

§ 71.51 Additional requirements for Type B packages:

- (a)(1) Under Normal Conditions of Transport (NCT) tests (§ 71.71), no significant increase in external radiation levels
- (a)(2) Under Hypothetical Accident Condition (HAC) tests (§ 71.73), external radiation dose rate ≤ 1000 mrem/hr at 1 meter from the package surface

7

Regulations & Guidance: Standard Review Plans (SRPs)

- NUREG-1617, "Standard Review Plan for Transportation Packages for Spent Nuclear Fuel"
  - Chapter 5, Part 71 shielding review

8

Regulatory Requirements of 10 CFR Part 72 Applicable to the Shielding

(Certificate of Compliance & General License Provisions Only)

Michel Call, Nuclear Engineer
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SFST/NMSS
November 21, 2008

10 CFR Part 72

- The cask design must be described and evaluated to demonstrate that it meets the shielding requirements of 10 CFR Part 72 to be granted a Certificate of Compliance.

2

§ 72.238 Issuance of an NRC Certificate of Compliance

- "A Certificate of Compliance for a cask model will be issued by NRC on a finding that the requirements in § 72.236 (a) through (i) are met."

3

§ 72.236 Specific Requirements for Spent Fuel Storage Cask Approval and Fabrication

- (a) – Spent fuel contents specifications must be provided
  - Type, enrichment limits, burn-up, etc.
- (d) – Radiation shielding and confinement features sufficient to meet requirements of § 72.104 and § 72.106

4

§ 72.104 Criteria for Radioactive Materials in Effluents and Direct Radiation from an Independent Spent Fuel Storage Installation (ISFSI) or Monitored Retrievable Storage (MRS)

- (a) – Dose limits for *real individual* beyond controlled area boundary under normal and off-normal conditions
  - ≤25 mrem/yr whole body
  - ≤75 mrem/yr thyroid
  - ≤25 mrem/yr any other critical organ
- (b) – Operational restrictions for As Low As is Reasonably Achievable (ALARA)
- (c) – Operational limits to meet dose rate limits in 72.104(a)

5

§ 72.106(b) Controlled area of an ISFSI or MRS

- Individual beyond controlled area boundary under design basis accident:
  - More limiting of TEDE ≤5 rem or $H_e+H_{T,50}$ to individual organ ≤ 50 rem
  - ≤ 15 rem to lens of the eye
  - ≤ 50 rem H_s
- Minimum distance from cask or facility to controlled area boundary = 100 meters

6

General Licensee Responsibilities

7

§ 72.126 Criteria for Radiological Protection

- (a) Systems, structures and components (SSCs) … must be designed, fabricated, located, shielded, controlled, and tested so as to control external and internal radiation exposures to personnel. The designs must include means to…
  - (6) Shield personnel from radiation exposure.

8

§ 72.122 Overall Requirements

- (b) - Protection against environmental conditions and natural phenomena
  - SSCs must be designed to withstand the *effects of natural phenomena*
- (c) - Protection against fires and explosions
  - SSCs must be able to perform their safety functions under credible fire and explosion exposure conditions

9

§ 72.212 Conditions of General License Issued Under § 72.210

The general licensee shall, prior to use:

- (b)(2)(i)(C) – *perform written evaluations* that establish that the requirements of § 72.104 have been met.
- (b)(2)(ii) – evaluate any changes to the written evaluations required by this paragraph using the requirements of § 72.48(c).
- (b)(3) – determine whether or not the reactor site parameters are bounded by the cask design bases in the Safety Analysis Report and NRC Safety Evaluation Report

10

Regulations & Guidance: Standard Review Plans (SRPs)

- NUREG-1536, "Standard Review Plan for Dry Cask Storage Systems"
  - Chapter 5, shielding evaluation
  - Chapter 10, radiation protection – occupational exposures & doses to public
  - Chapter 11, accident analysis – dose consequences of accident events
- Interim Staff Guidance (ISG) documents
  Ex: Fuel Condition (1), Real Individual (13), *Supplemental Shielding* (14)

11

Radiation Protection

Elizabeth Thompson, CHP
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November 21, 2008

Radiation Protection

- Licensee
- Certificate holder
- NRC

2

Industry-NRC Meeting on Dry Cask Shielding Analyses

Everett Redmond II
Nuclear Energy Institute
November 21, 2008

The purpose of this meeting is

- for NRC staff and vendor staff to have an open dialog on shielding analysis
- to ensure that all stakeholders understand the regulations and what is necessary to demonstrate compliance by the vendors and the general licensees/users
- to discuss the practical application of the information in the SAR

The purpose of this meeting is

- to discuss technical issues
- to discuss operational experience
- to reach a common understanding of the level of detail necessary in shielding and radiation protection chapters

The purpose of this meeting is NOT

- to discuss specific licensing actions or RAIs
- to discuss review schedules

What is the expected outcome?

- Improved efficiency in both vendor SAR preparation and NRC review
- Hopefully, a reduced number of RAIs in the long term
- Possible action items

Future Meetings

- Meetings on other disciplines
- Additional meetings as necessary
  - Change in staff
  - Change in guidance
  - Emerging issues

A Common Understanding

- The shielding chapters in the storage and transport SARs provide reasonable assurance that the performance objective can be met
- Performance Objective
  - Shielding features should limit the dose from direct radiation so that dose remains within regulatory requirements in the field

A Common Understanding (continued)

- Ultimate responsibility for compliance with the regulations lies with the users of the transport and storage casks
- The SAR for transport can demonstrate that the cask meets the regulations
- The FSAR for storage provides assurance that the system will perform as intended; compliance with 72.104 may not be demonstrated in the FSAR

A Common Understanding (continued)

- How the user demonstrates compliance with the regulations:
  - Transportation: measurements
  - Storage: calculations and measurements
    - Calculations may or may not be performed by the cask vendor
  - NRC Regions may perform inspections

Regulatory Efficiency

- Regulatory activities should be consistent with the degree of risk reduction they achieve. (NRC Principles of Good Regulation)
- A reduction in the margin to the limits may result in additional questions

Regulatory Efficiency (continued)

- Storage FSARs: Limits are never challenged
- Transportation SARs: Analysis may show calculated dose rates just below regulatory limits – however measurements verify compliance before shipment

Implementation and Loading Of A Dry Cask Storage System

Everett Redmond II
Nuclear Energy Institute
November 21, 2008

Disclaimer

- The following is a general discussion of how a nuclear power plant may implement a new dry cask storage system at their site
- No commitments are made in this presentation

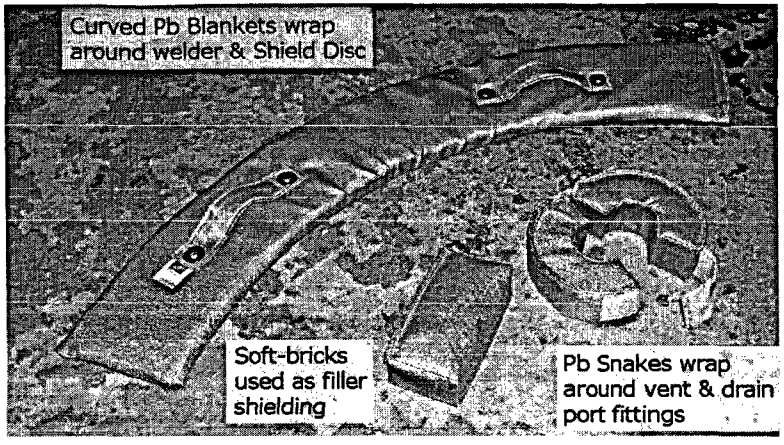
What is the expected dose field?

- New system – no experience
- FSAR provides bounding numbers (typically very high)
  - May use these as is or adjust to account for burnup and cooling time
- May obtain new estimates from contractor

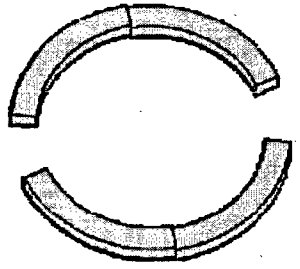
ALARA Planning

- Extensive planning and development for loading campaigns
  - May contact other plants using the system to benefit from their experience
  - Develop specialized shielding to reduce dose rates (continually evolving)
  - Develop procedures and work plans accordingly (continually evolving)

Examples of Temporary Shielding



Examples of Temporary Shielding



TSC Curved Borated Poly (4)

These sections of poly are for neutron shielding. They will *probably not be needed until the TSC if FULLY drained* (based on industry info). These sections sit on top of the curved Pb blankets. Once installed, there should be no need to remove the poly or Pb blankets until that 2nd lid (structural lid) is installed.

Minimize Exposure

- Personnel access to the work area is controlled
- Proximity to cask limited based on need
- Areas may be cordoned off to prevent unauthorized access
- Use of video cameras, remote equipment, long handled tools

10 CFR 20 Definitions

Term	Definition
Radiation Area	> 5 mrem/hr at 30 cm
High Radiation Area	> 100 mrem/hr at 30 cm
Very High Radiation Area	> 500 Rad/hr at 1 m

New Evolutions

- Loading the very first cask is a new evolution
- Many factors determine spent fuel to be stored in first cask
  - Previous experience with dry storage
  - Learning curve
  - Spent fuel pool management

Operations

- Pre-job briefs held at the beginning of shift – safety and ALARA discussed
- Plants may develop total personnel exposure targets for a cask loading
- Personnel exposure may be tracked on a daily basis with electronic dosimeters (TLDs processed at longer intervals)

Example of Tracking Dose

RWP/Sub Task Description	Dose (mrem)	Entries	Dose/Entry (mrem)
TRANSFER CASK/DRY SHIELDED CANISTER TO TRACK ALLEY			
RADIATION PROTECTION COVERAGE (DFS)	25.5	6	4.2500
CRANE*RIGGING /TRANSFER TRAILER ACTIVITIES	7.5	3	2.5000
LOADING SUPERVISORS (DFS)	14.3	14	1.0179
LABORERS SUPPORT (DFS)	14.8	6	2.4583
QC/NDE SUPPORT (DFS)	7.0	2	3.5000
IRON WORKERS SUPPORT (DFS)	28.8	4	7.1875
MANAGEMENT OBSERVATIONS (DFS)	1.0	2	0.5000
	98.8	37	2.6689

Example of Tracking Dose

DOSE PER CASK BY ACTIVITY (MREM)
All casks are approximately 14 kW

CASK	15	16	17	18	19
XFER TO ISFSI	116.1	115.9	106.0	82.6	60.4
DECON	28.4	28.1	35.8	27.6	33.8
WELDING/NDT	233.9	217.2	175.3	200.6	224
LOADING	51.8	40.9	51.1	37.3	37.4
MINOR WORK	21.9	23	13.4	11.3	8.8
TOTAL	452.1	425.1	381.6	359.4	364.4

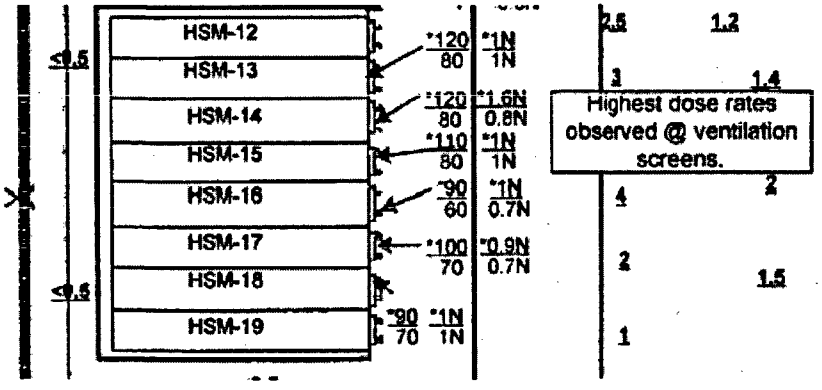
Other Operational Considerations

- Area radiation alarms in vicinity of cask movements may need to be temporarily adjusted
- Typically, additional portable area radiation monitors are used during loading

Radiation Protection Practices

- Radiation Protection technicians are trained to look for and record the highest dose rate found.
- In addition, other required locations (CoC) will be surveyed

Portion of Radiological Area Status Sheet



Total Dose For Loading NUHOMS at Plant A

Cask No.	Actual Dose (mrem)	Heat Load (kw)
10	227	13.4
11	206	13.4
12	758	13.9
13	318	15.7
14	327	15.7
15	291	15.6
16	261	15.6
17	219	14.6
18	222	16.2

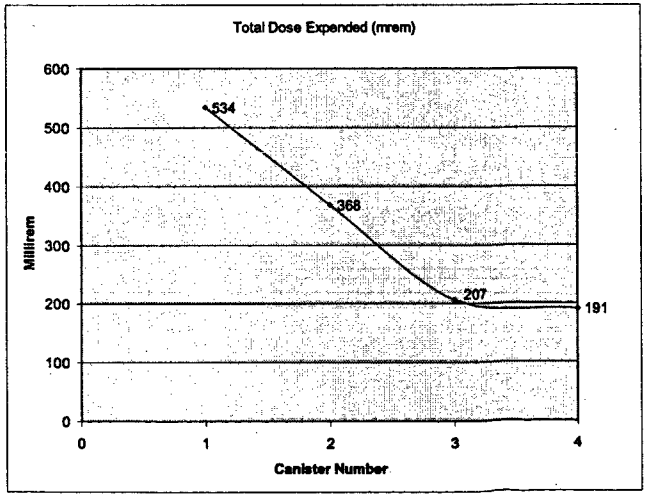
Total Dose For Loading HI-STORM at Plant B

Cmpgn	Loading Order	Min Cool Time (yrs)	Heat Load (kw)	Dose (mrem)
1	1	8.5	21.4	647
	2	11.2	18.7	449
	3	8.5	21.4	432
	4	8.5	21.4	422
	5	11.2	18.8	370
2	1	7.8	24.4	676
	2	8.4	26.5	564
	3	8.4	23.9	441
	4	9.3	23.8	419
	5	8.4	25.4	384
	6	13.8	17.7	209

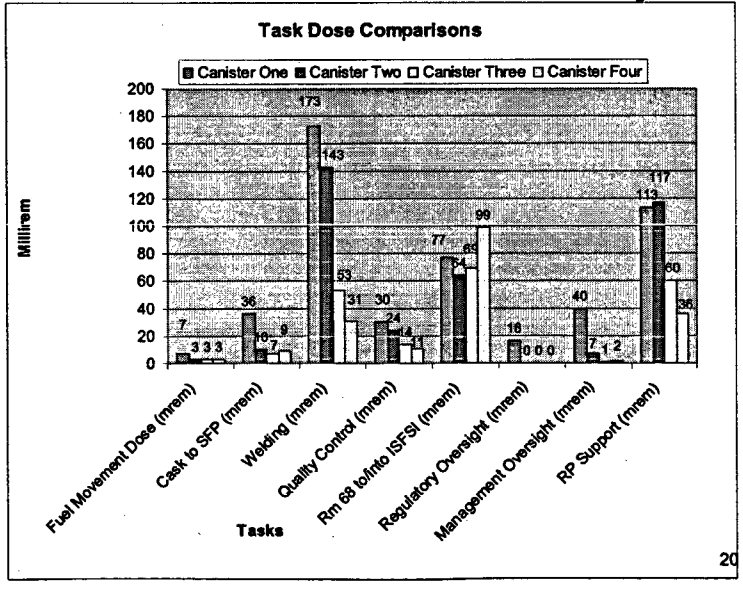
Total Dose For Loading HI-STORM at Plant B (continued)

Cmpgn	Loading Order	Min Cool Time (yrs)	Heat Load (kw)	Dose (mrem)
3	1	8.6	18.6	337
	2	8.6	20.2	328
	3	9.5	19.3	248
	4	10.1	6.2	32
	5	7.9	9.2	49
	6	13.1	8.3	46

Fort Calhoun – A Success Story



Fort Calhoun – A Success Story



On-Site Considerations

- Buildings near the ISFSI may be of more concern than controlled area boundary
- Quantity of shielding can be varied in some systems (e.g. density or thickness of concrete) to reduce dose

Compliance with Regulatory Requirements for Radiological Dose

Presentation to NRC

November 21, 2008

10CFR72.104 criteria for radioactive materials in effluents and direct radiation during normal operations are:

- **During normal operations and anticipated occurrences, the annual dose equivalent to any real individual who is located beyond the controlled area, must not exceed 25 mrem to the whole body, 75 mrem to the thyroid and 25 mrem to any other critical organ.**
- **Operational restrictions must be established to meet as low as reasonably achievable (ALARA) objectives for radioactive materials in effluents and direct radiation.**

10CFR72.106 radiation dose limits at the controlled area boundary for design basis accidents are:

- **Any individual located on or beyond the nearest boundary of the controlled area may not receive from any design basis accident the more limiting of a total effective dose equivalent of 5 Rem, or the sum of the deep-dose equivalent and the committed dose equivalent to any individual organ or tissue (other than the lens of the eye) of 50 Rem. The lens dose equivalent shall not exceed 15 Rem and the shallow dose equivalent to skin or to any extremity shall not exceed 50 Rem. The minimum distance from the spent fuel or high-level radioactive waste handling and storage facilities to the nearest boundary of the controlled area shall be at least 100 meters.**

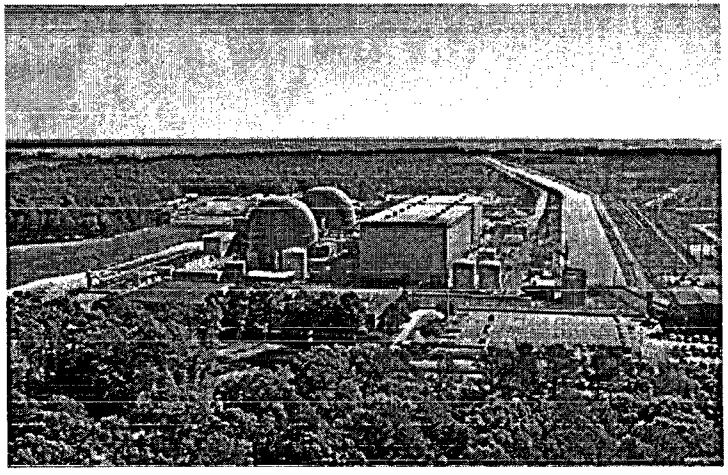
The system FSAR analyses ensure the system will meet regulatory requirements for generic storage configurations. These analyses may not demonstrate specific site compliance with regulatory requirements due to variations in:

- **ISFSI size and configuration**
- **Distances to controlled area boundaries or general public**
- **Proximity to other fuel cycle operations**

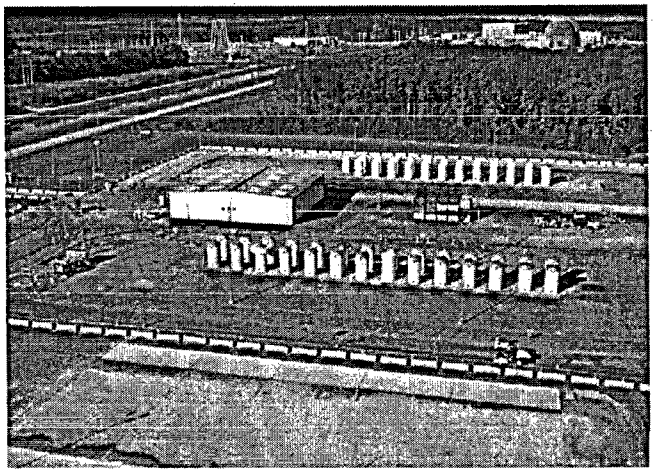
The users must ensure compliance with regulatory requirements for their site.

- **Site Specific License - ISFSI FSAR analyses**
- **General License - 10 CFR 72.212 Evaluations**

Compliance with Regulatory Requirements



Compliance with Regulatory Requirements



Compliance with Regulatory Requirements

NUHOMS HD Technical Specifications require implementation of the following programs by the system user:

- Safety Review Program
- Training Program
- Radiological Environmental Monitoring Program
- Radiation Protection Program
- HSM Thermal Monitoring Program

Compliance with Regulatory Requirements

NUHOMS HD Technical Specifications

- Radiological Environmental Monitoring Program
  - A radiological environmental monitoring program will be implemented to ensure that the annual dose equivalent to an individual located outside the ISFSI controlled area does not exceed the annual dose limits specified in 10CFR 72.104(a)
  - Operation of the ISFSI will not create any radioactive materials or result in any credible liquid or gaseous effluent release

NUHOMS HD Technical Specifications

- Radiation Protection Program
  - The Radiation Protection Program will establish administrative controls to limit personnel exposure to As Low As Reasonably Achievable (ALARA) levels in accordance with 10CFR Part 20 and Part 72.
  - As part of its evaluation pursuant to 10CFR72.212, the licensee shall perform an analysis to confirm the limits of 10CFR 20 and 10CFR 72.104 will be satisfied under the actual site conditions and configurations considering the planned number of DSCs to be used and the planned fuel loading conditions.

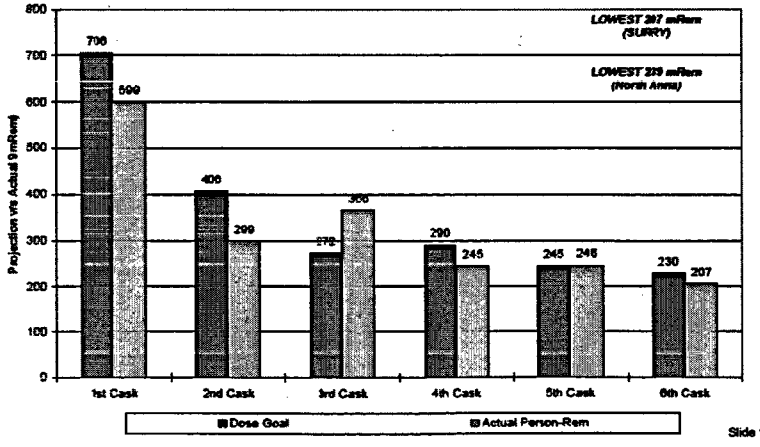
NUHOMS HD Technical Specifications

- Radiation Protection Program (continued)
  - A monitoring program to ensure the annual dose equivalent to any real individual located outside the ISFSI controlled area dose does not exceed regulatory limits is incorporated as part of the environmental monitoring program in the Radiological Environmental Monitoring Program
  - Following completion of welding of inner top cover/shield plug, siphon and vent cover plates, these welds are leak tested to demonstrate the welds meet the "leak-tight" criterion as defined in ANSI N14.5-1997 "American National Standard for Leakage Tests on Packages for Shipment of Radioactive Materials.

NUHOMS HD Technical Specifications

- Radiation Protection Program (continued)
  - Following placement of each loaded Transfer Cask into the cask decontamination area and prior to transfer to the ISFSI, the DSC smearable surface contamination levels on the outer top 1 foot surface of the DSC shall be less than 2,200 dpm/100 cm2 from beta and gamma emitting sources, and less than 220 dpm/100 cm2 from alpha emitting sources.

SURRY CASK TRENDS



Compliance with Regulatory Requirements

Dose Experienced for Various Operations

Cask	Prep/Load/ Test	Welding Lid and NDE	Vacuum Dry, Install Vent Port Covers, Prep for Movement	Transport and Place into Storage	Total
	mrem	mrem	mrem	mrem	mrem
3	66	54	90	156	366
4	44	24	92	85	245
5	49	49	71	77	246
6	31	16	111	49	207

Slide 13

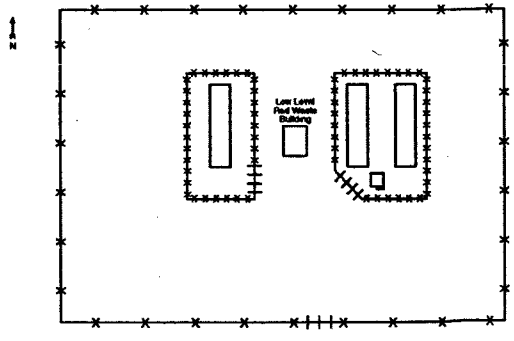
Compliance with Regulatory Requirements

Dominion Compliance

- **Monte Carlo radiation transport code (MCNP) is used to calculate dose rates at several locations for our site specific geometry. These include an ISFSI perimeter fence, site controlled area boundary, and location of the nearest permanent resident.**
- **Using design basis information from the system FSAR analyses and results, Dominion determines appropriate surface source terms for input to MCNP model of our site storage system arrays and configuration.**
- **Measurements at the ISFSI perimeter fence show the design basis results which have significant margin to the regulatory limits, are very conservative to actual conditions.**

Slide 14

Compliance with Regulatory Requirements



Slide 15

Compliance with Regulatory Requirements

ISFSI Perimeter Fence Dose Rates

Fence Line	Calculated Average Dose Rate (mrem/hr)	Calculated Peak Dose Rate (mrem/hr)	Dose Rate From Quarterly TLD Measurement (mrem/hr)
North	1.683	2.282	0.171
South	0.500	0.610	0.051
East	0.763	1.051	0.039
West	1.589	2.53	0.229

Slide 16

NUHOMS HD Technical Specifications

- HSM-H Dose Rate Evaluation Program
  - This program provides a means to help ensure that the DSC is loaded properly and that the facility will meet the off-site dose requirements of 72.104(a).
  - As part of its evaluation pursuant to 10CFR 72.212, the licensee shall perform an analysis to confirm that the limits of 10 CFR Part 20 and 10 CFR 72.104 will be satisfied under the actual site conditions and configurations considering the planned number of HSMs to be used and the planned fuel loading conditions.

NUHOMS HD Technical Specifications

- HSM-H Dose Rate Evaluation Program (continued)
  - On the basis of the analysis, the licensee shall establish a set of HSM-H dose rate limits which are to be applied to DSCs used at the site. Limits shall establish peak dose rates for:
    a. HSM-H front surface
    b. HSM-H door centerline, and
    c. End shield wall exterior

HSM Dose Rates

Location	FSAR Dose Rate (mrem/hr)	HSM 1 Maximum Measured Dose Rate (mrem/hr	HSM 3 Maximum Measured Dose Rate (mrem/hr	HSM 4 Maximum Measured Dose Rate (mrem/hr	HSM 5 Maximum Measured Dose Rate (mrem/hr)	HSM 6 Maximum Measured Dose Rate (mrem/hr)
Door Centerline	1.6	0.03	0.06	0.8	0.7	0.8
Front Birdscreen	752	72	86	83	76	83
North End Shield Wall	1.4	0.28	0.07	0.27	0.23	0.22
South End Shield Wall	1.4	0.14	0.06	0.23	0.22	0.22
Roof Centerline	15.1	0.9	2.5	3	10	2
Roof Birdscreen	170	26	32	30	20	27.6

NRC Inspections

- Inspection Procedure 60855.1

Questions

Shielding and Radiation Protection in Dry Storage and Transportation

Presentation to NRC
November 21, 2008
By NEI Dry Storage Vendor Taskforce

Overview

- Introduction
- Regulatory Requirements
- Compliance in FSAR and at the site
- Specific Issues
- Discussion / Conclusions

Introduction

- Goal of this meeting: Gain a common understanding on what information needs to be included in the SARs.
- In the past, the number and scope of RAIs in the shielding and radiation protection area appear to show that there are different or changing views on the content of the SARs in that respect. This leads to an inefficient licensing process.

Introduction

- In no other discipline do we struggle so much with the question of the level of detail that needs to be evaluated and/or provided
- The level of detail appears to vary on an application by application / RAI by RAI basis.
- That is why we asked for this meeting, outside of any licensing activity, and with all parties at the table.

Comparing the Technical Evaluations

- Let's compare the disciplines
  - Structural, Thermal, Criticality: Design and evaluations protect the public health and safety against release of radioactive material. Performance can not easily be monitored.
  - Shielding: Design and evaluations protect public health and safety from direct radiation. Performance can be monitored.

Storage Regulatory Requirements

- The 10CFR72.104 criteria for radioactive materials in effluents and direct radiation during normal operations are:
  - During normal operations and anticipated occurrences, the annual dose equivalent to any real individual who is located beyond the controlled area, must not exceed 25 mrem to the whole body, 75 mrem to the thyroid and 25 mrem to any other critical organ.
  - Operational restrictions must be established to meet as low as reasonably achievable (ALARA) objectives for radioactive materials in effluents and direct radiation.

Storage Regulatory Requirements

- The 10CFR72.106 radiation dose limits at the controlled area boundary for design basis accidents are:
  - Any individual located on or beyond the nearest boundary of the controlled area may not receive from any design basis accident the more limiting of a total effective dose equivalent of 5 Rem, or the sum of the deep-dose equivalent and the committed dose equivalent to any individual organ or tissue (other than the lens of the eye) of 50 Rem. The lens dose equivalent shall not exceed 15 Rem and the shallow dose equivalent to skin or to any extremity shall not exceed 50 Rem. The minimum distance from the spent fuel or high-level radioactive waste handling and storage facilities to the nearest boundary of the controlled are shall be at least 100 meters.

Compliance in the FSAR

- The FSAR must show that the system is capable of meeting the 10CFR72.104 (normal dose rates) requirements. However, compliance for a specific site may not necessarily be demonstrated in the FSAR
- The FSAR must show that the system is in compliance with 10CFR72.106 (accident dose rates)

Compliance at the Site

- Site evaluations must show that the system as deployed is in compliance with 10CFR72.104 (normal dose rates)

Transportation Regulatory Requirements

- The 10CFR71.47 criteria for radioactive materials in effluents and direct radiation during normal operations are:
  - No package surface dose rates in excess of 200 mrem/hr
    - Exclusive use limit - 1000 mrem/hr
  - 2 meter from transport vehicle dose rate limit is 10 mrem/hr
    - If package meets 10 mrem/hr it will meet surface limits
  - 2 mrem/hr in a normally occupied space

Transportation Regulatory Requirements

- The 10CFR71.55 radiation dose limits for accident conditions:
  - 1 rem/hr at one meter from package
- Transport index
  - 1 meter dose rates

Compliance in the SAR

- Detailed normal and accident dose calculations demonstrating compliance on a per package basis
- Specifies material configuration (including minimum cool time / maximum source) that may be transported

Compliance at the Site

- Detailed measurements over package surface and required regulatory distances
- Includes 1 meter dose measurements for establishment of transport index
- Detailed dose maps
  - Neutron and gamma
  - Includes mapping any radiation hot spots
- The cask may not be transported unless the measurements are below the regulatory limits

Specific Issues

- Level of Detail in FSAR
- Bounding calculations and results
- What is a small change? What has a small effect?
- Burnup and Cooling Times vs Heat Load
- Tech Spec Dose Rates

Example of Level of Detail in FSAR

- Holtec's FSAR Chapter 5 contains a total of 65 tables, some with 5 columns and 10 rows.
- Holtec's FSAR Chapter 10 contains 38 pages with extensive information on operational dose rates. Actual operational dose rates are about factor 10 lower, and depend more on the operational situation at a plant than on the specific system.
- Is this extensive level of information necessary to conclude that there is reasonable assurance that the system will be able to satisfy the regulatory requirements?

Bounding Calculations and Results

- Analyses that are clearly bounded by other analyses should be easier to review (e.g transfer cask dose rate of 300 mrem/hr compared to 2 R/hr)
- Regulatory activities should be consistent with the degree of risk reduction they achieve.

What is a small change? What has a small effect?

- How do we deal with situations that are judged to have a "small" effect. What is a "small" effect?
- Not too long ago, being within a factor of 2 in calculated dose rates was considered to be accurate and acceptable
- Now we are asked to look at situations that have dose rate effects of 20% or even less. Examples:
  - Axial Burnup Distributions
  - Axial Enrichment Distributions
  - Damaged Fuel
  - Fresh versus burned fuel in shielding models
  - Use of different codes

Burnup and Cooling Times vs Heat Load

- Heat load requirements are required in the CoC as a result of the thermal analyses (sites demonstrate compliance with these limits)
- Burnup and cooling time combinations are based on heat load requirements in CoC (these are redundant for storage)

Tech Spec Dose Rates

- Dose rate technical specifications that contain multiple dose locations may not be consistent with ALARA practices
- Dose rate technical specifications will not necessarily detect a misloading
- Dose rate technical specifications may not ensure compliance with 72.104

Discussions / Conclusions