

ELEMENTS OF VULNERABILITY ASSESSMENT
FOR SPENT FUEL DRY STORAGE

POPULATION OF STORAGE CONTAINERS

- Single Container/Cask
- Double Container/Cask and Canister
- Number Now in Use
- Number in Future Use
- Number at a Given Site
- Materials of Construction

CONTAINED/STORED SOURCES

- Spent Fuel Type and Quantity
 - PWR
 - BWR
- Max. Initial Enrichment
- Max. Burnup
- Heat output
- GTCC Material Type and Quantity/Activity

"Consequence" Curve.

etc.

INDUCED ENVIRONMENT/LOADINGS

- Pressure vs Time
- Temperature vs Time
- Mass and Velocity of
- Geometry and Physical Properties of

CASK BREACHING

- Cask Failure Modes
 - Gross Overpressure from
 - Crash Impact of Deformable Objects
 - Gross High Temperature/Fire
- Breached Cask Opening Size/Geometry
- Internal Cask Conditions Created by Cask Breach

CANISTER BREACHING

- Canister Failure Modes
 - All Cask Failure Modes as Continuation for Canister
 - (Generated by Cask Breach)
- Breached Canister Opening Size/Geometry

Portions Ex2 E/7

ELEMENTS OF VULNERABILITY ASSESSMENT
FOR SPENT FUEL DRY STORAGE

I. Executive Summary

A. Background and Purpose

- As a consequence of the September 11, 2001, terrorist events in New York City and on the Pentagon, the NRC reassessed the potential threats for dry storage of spent nuclear fuel.
- Threats are defined by Intelligence Agencies
- Threats are reassessed on a frequent basis (e.g., 6-months period)
- As threats change, NRC evaluates their consequences and need for additional measures
- The following storage casks were selected as representative of the industry's products: HI-Storm, HI-STAR, NUHOMS, TN-68, ...
- Selection of the casks were based on the following criteria:

B. Analyses Results

- The staff assessed threats resulting from the following categories:
 - i.
 - ii.
 - iii.
 - iv.
 - v.
- Guidelines were developed for assessing radiological sources resulting from postulated threats
- The following summarize the results:
 - i. ...
 - ii. ...
 - iii. ...
 - iv. ...

Ex 2

C. Recommendations

II. Description of Independent Spent Fuel Storage Installations

A. ISFSI Overview

- Pads
- Transfer / Fuel Loading Buildings

Ex 2 portions

- Transfer mechanisms

B. Dry Storage Casks

- Metal casks with canister
- Metal casks without canister
- Concrete casks with canister
- Concrete bunkered casks with canister
- **POPULATION OF STORAGE CONTAINERS**

Single Container/Cask
Double Container/Cask and Canister
Number Now in Use
Number in Future Use
Materials of Construction

classification

- List and/or description of packages (packaging and contents) in each
 - spent nuclear fuel rods/assemblies
 - control rods
 - ...

C. Number storage sites

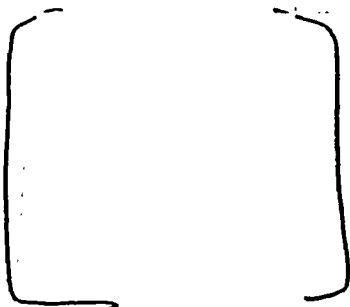
D. Criteria for cask selection used in this study

- ...
- ...
- ...
- ...

II. THREATS/SCENARIOS

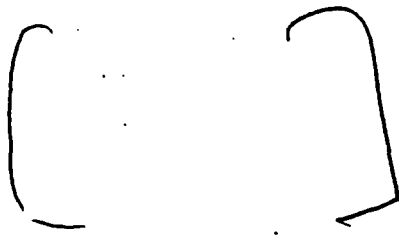
A. Pre November 11, 2001 Threats (list of weapons versus consequences)

B. Post November 11, 2001 Threats



Ex 2

Ex 2 portions



III. Assumptions

- A. Weapons
- B. Structural
- C. Source Terms
 - Use SNL Panel Guidance Document
- D. Radiological consequences
- E. Environmental Costs

IV. Analyses

- a.
 - i. Assumption and Bases for Assumptions
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Ex 2 portions

- **CANISTER BREACHING**
 Canister Failure Modes
 All Cask Failure Modes as Continuation
 Generated by Cask Breach
- **DAMAGE TO CONTAINED/STORED SOURCES**
- **DISPERSAL OF SOURCES**
- **CONSEQUENCES OF SOURCE RELEASES**
 - I. Radiological
 - II. Property Damage

- ii. Event-1
- iii. Event-2
- iv. Event-3
- v. Event-4
- vi.
- vii.

b.) Ex 2

~~MS And Case~~

- i. Assumption and Bases for Assumptions
 - **INDUCED ENVIRONMENT/LOADINGS**
 Pressure vs Time
 Temperature vs Time
 Mass and Velocity of
 Geometry and Physical Properties of
 - **CASK BREACHING**

Ex 2

Ex 2 portions

ME -) Ex 2

Assumption and Bases for Assumptions

- INDUCED ENVIRONMENT/LOADINGS

Pressure vs Time
Temperature vs Time
Mass and Velocity of
Geometry and Physical Properties of

) Ex 2

- CASK BREACHING

Cask Failure Modes
Gross Overpressure from

) Ex 2

Crash Impact of Deformable Objects
Gross High Temperature/Fire
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- DAMAGE TO CONTAINED/STORED SOURCES

- DISPERSAL OF SOURCES

- CONSEQUENCES OF SOURCE RELEASES

- I. Radiological
- II. Property Damage

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Ex 2 portions

vi.

vii.

d.
a.

EX2

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EX2 portions

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h

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