NAC INTERNATIONAL

NAC International Technology Update

INMM Spent Fuel Management Seminar, Washington DC

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Marketing and Business Development

NAC International Technology Update

- NAC Background and Experience
- NAC Multipurpose Canister System (MCS) Technology Updates
  - UMS, MPC Deployment
  - MAGNASTOR Deployment
  - MAGNATRAN Status
- New Technology Directions
  - Drivers, Determinants, Decisions

NAC Background and Experience
Proven Nuclear System and Service Solutions

Norcross

Tokyo

London

Moscow

Wholly Owned Subsidiary of USEC

40 Years in Nuclear Fuel Cycle Consulting

Numerous Cask Technologies Licensed

U.S. Commercial SF Transportation Leadership

More than 320 Storage and Transport Systems Delivered

Nuclear Fuel Cycle Project Engineering

43 Years of Nuclear System and Service Solutions Experience

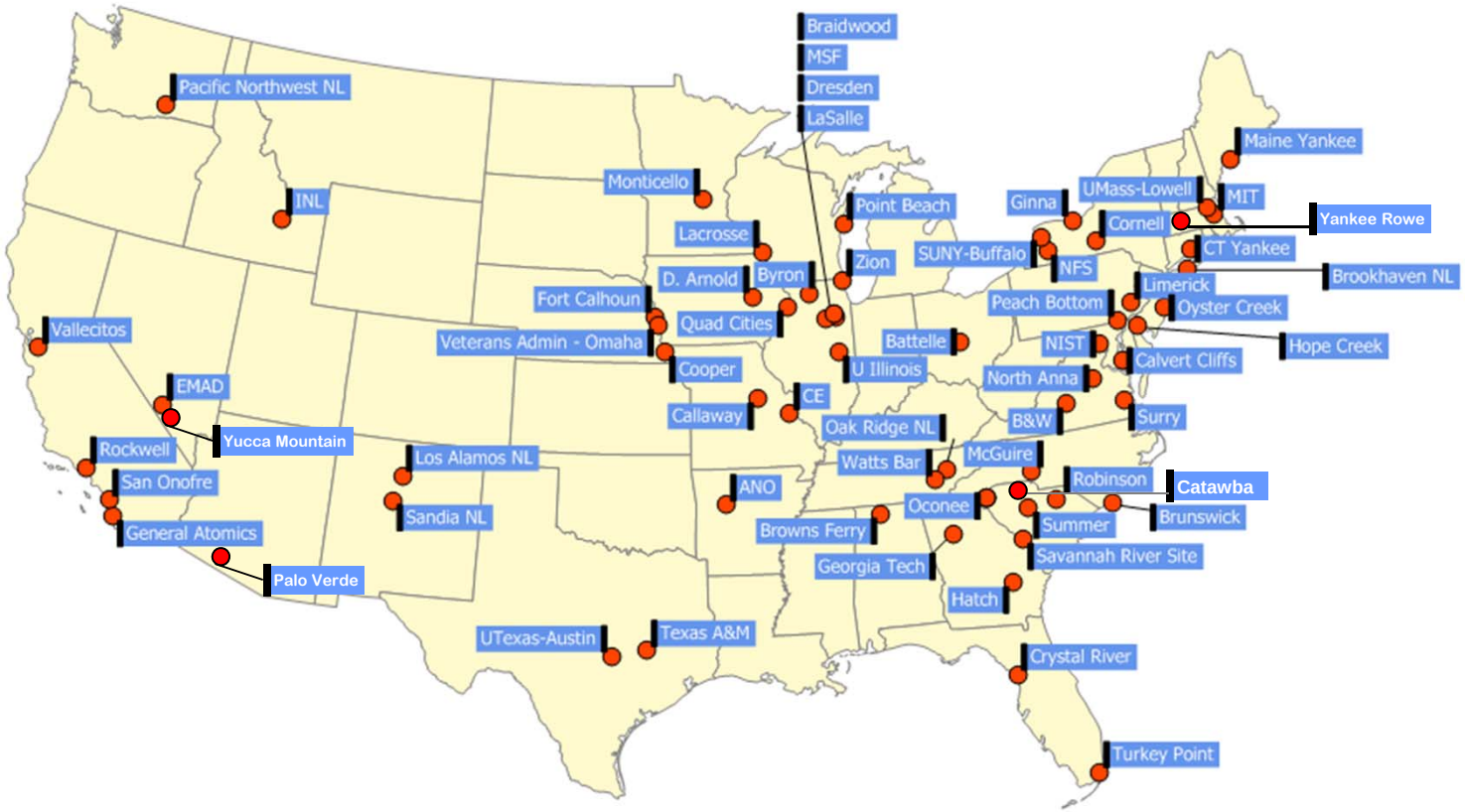
Robust and Proven Technology

NAC's history of proven and successful storage/transport technology development

NAC INTERNATIONAL Spent Fuel Management Technology Progression

NAC-LWT → NAC S/T → NAC-STC → NAC-MPC → NAC-UMS → MAGNASTOR

NAC Nuclear Site Experience in U.S.



Dry Storage and Transport System Technology: Key NAC Projects

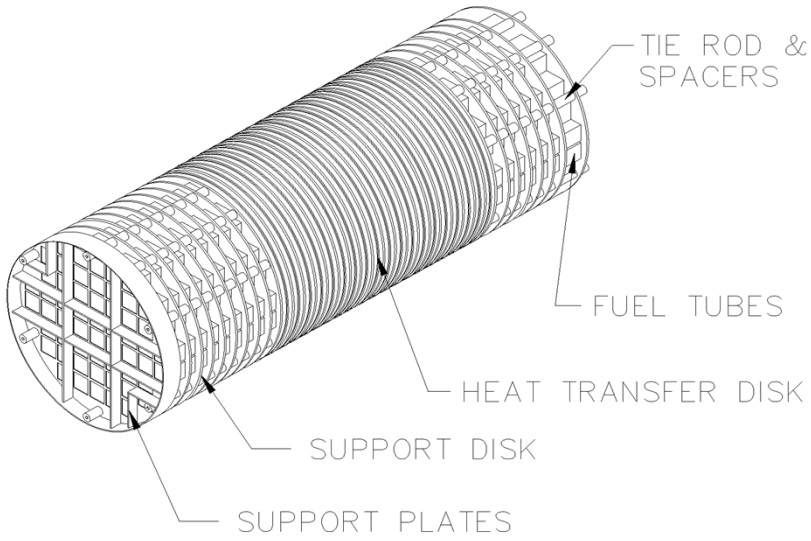
Customer	Technology	Systems
Various - Transport	NAC-LWT	8
Dominion - Surry	ST	2
ENSA – Spain	DPT	License
HZ-Japan	ST/STC	License
Yankee Atomic - Rowe	MPC	16
Connecticut Yankee	MPC	43
Maine Yankee	UMS	64
APS – Palo Verde	UMS	124
Duke Energy - McGuire	UMS	28
Duke Energy - Catawba	UMS	24
China Nuclear EIC	STC	2
License to INER, Taiwan	UMS	25
Dairyland Power - BWR	MPC	5
Duke Energy – McGuire	MAGNASTOR	20
Duke Energy - Catawba	MAGNASTOR	24
Zion – Energy Solutions	MAGNASTOR	65
Taiwan Power - Kuosheng	MAGNASTOR	27
Totals		> 500

NAC MCS Technology Updates

Cask Designation	U.S. NRC CoC Number or Docket Number	License Amendment Number / Application	Number of Projects, Systems Ordered
MAGNASTOR	72-1031 Transport Pending	2/Storage, Transport Application	4 Projects, 136 Systems
UMS	71-9270 72-1015	2/Transport, 5/Storage	5 Projects, 265 Systems
NAC-MPC	71-9235 72-1025	9/Transport, 4/Storage	3 Projects, 64 Systems
NAC-STC	71-9235 72-1013	9/Transport, 0/Storage	1 Project, 2 Systems
NAC-LWT	71-9225	55/Transport	8 Systems
NLI-1/2	71-9010	41/Transport	5 Systems
NAC-1	71-9183	13/Transport	6 Systems
NLI-10/24	71-9034	9/Transport	2 Systems
NAC-I28 S/T	72-1020	0/Storage	2 Systems
NAC-C28 S/T	72-1003	0/Storage	0 Systems
NAC-I26 S/T	72-1002	0/Storage	26+ Systems

The NAC-MPC System

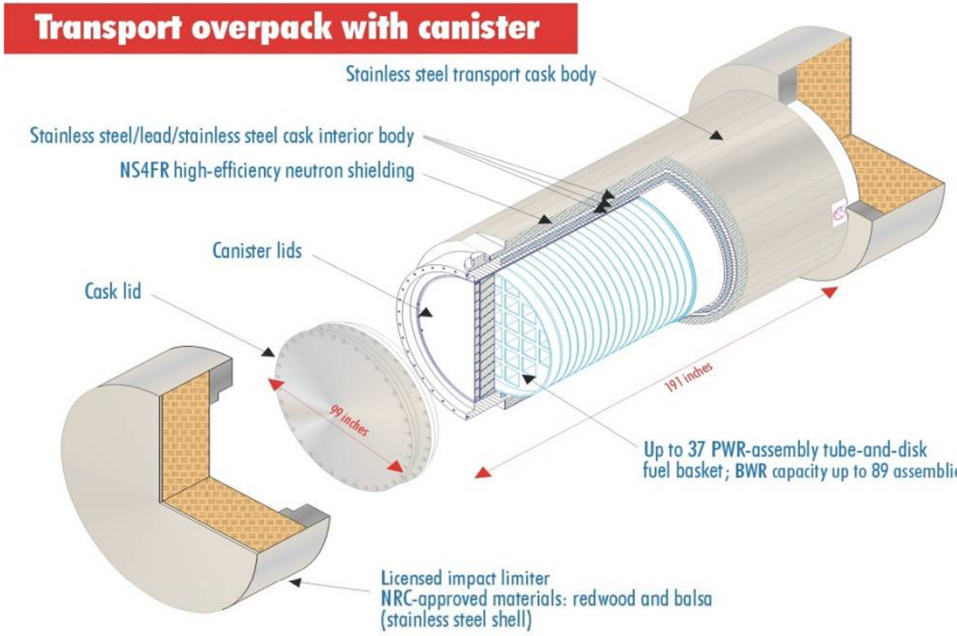
- Mid-1990's MCS design for use with non-standard, older fuel
- Uses tube-and-disk basket design
- 59 systems loaded and in use
  - 15 Yankee Rowe (YR) systems and 1 GTCC canister
  - 40 Connecticut Yankee (CY) systems and 3 GTCC canisters
- 5 Dairyland Lacrosse (LAC-BWR) systems in process, loading begins in 2012
- Improvements since YR, CY projects:
  - More sophisticated models, analyses
  - Enhanced fabrication, operations procedures
  - Technology: e.g., single lid closure; approved designs for BWR damaged/debris fuel

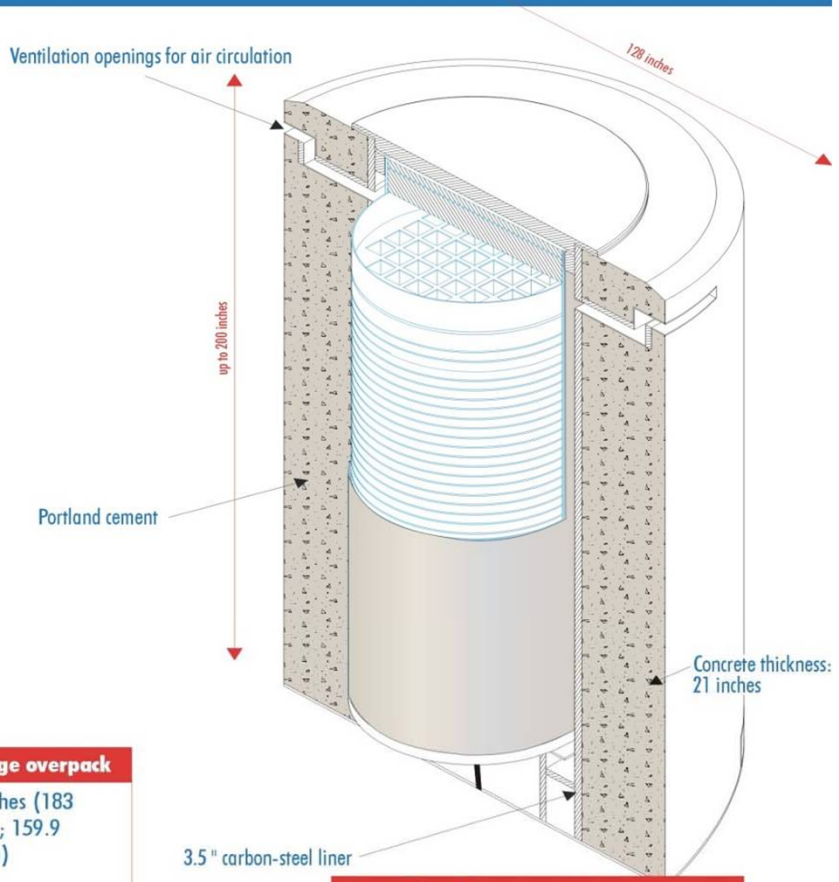


NAC-MPC MCS Summary

NAC's Multi-Purpose Canister system for spent fuel storage and transport

Transport overpack with canister



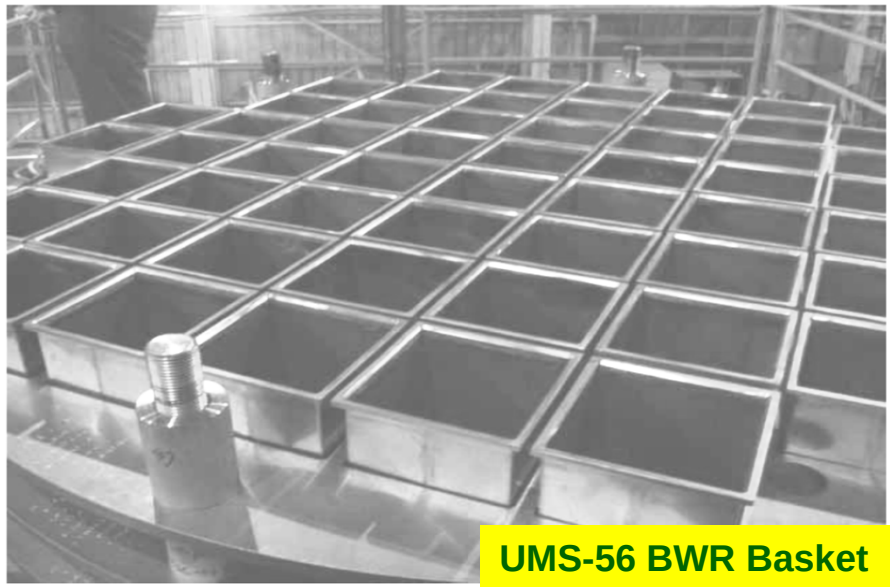


Vertical concrete storage overpack with canister

Transportable storage canister	Transport overpack	Vertical concrete storage overpack
Length: up to 145 inches (Inches for NAC-MPC (D); 122.5 inches for (NAC-MPC (Y))	**Length:** 191 inches	**Length:** up to 200 inches (183 inches for NAC-MPC (D); 159.9 inches for NAC_MPC (Y))
Diameter: 70.64 inches	**Diameter without impact limiters:** 99 inches	**Diameter:** 128 inches
	Weight fully loaded: 125 tons	

The NAC-UMS System

- Late-1990's MCS design for use at facilities with standard fuel designs
- Uses tube-and-disk basket design similar to MPC's
- 205 systems loaded and in use
  - 64 at Maine Yankee
  - 91 at Palo Verde
  - 28 at McGuire
  - 24 at Catawba



UMS-56 BWR Basket

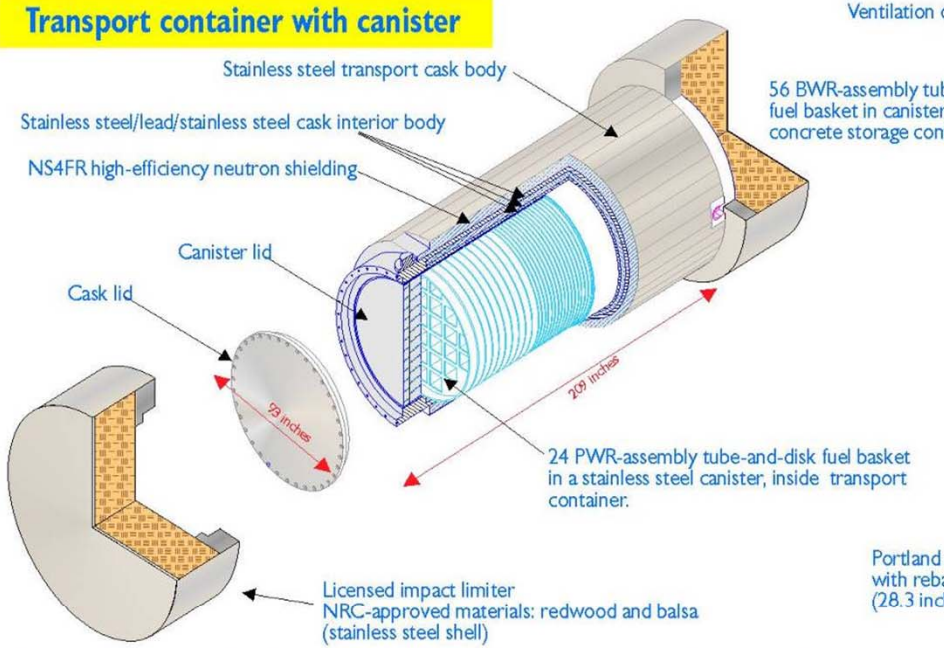
- 25 at Chinshan (TaiPower) begin loading this year
- Improvements since earlier projects:
  - More sophisticated models, analysis
  - Enhanced fabrication, operations procedures
  - Technology: e.g., single MAGNASTOR-type lid; damaged/debris fuel cans

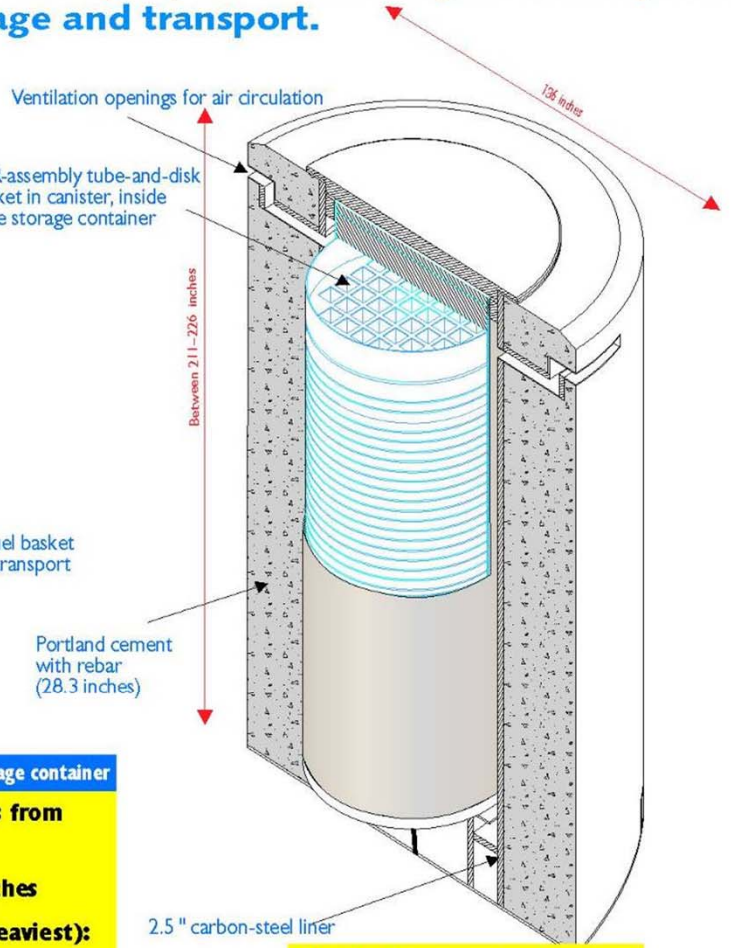
NAC UMS MCS Summary

The Universal MPC System

NAC Multipurpose Canister system for spent fuel storage and transport.

Transport container with canister



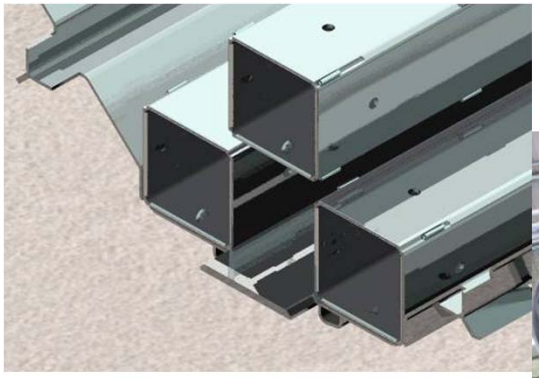


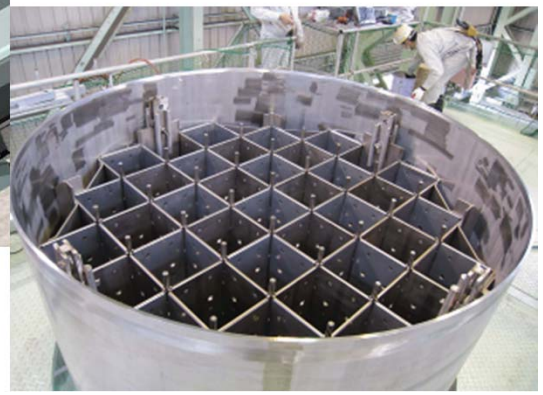
Vertical concrete storage container with canister

Transportable storage canister	Transport container	Vertical concrete storage container
Length: five sizes from 175–192 inches	**Length: 209 inches**	**Length: five sizes from 211–226 inches**
Diameter: 67 inches	**Diameter without impact limiters: 93 inches**	**Diameter: 136 inches**
Weight empty (heaviest): 19 tons	**Weight empty: 83 tons (w/o impact limiters)**	**Weight empty (heaviest): 121 tons**
Weight loaded (heaviest): 38 tons		**Weight loaded (heaviest): 160 tons**

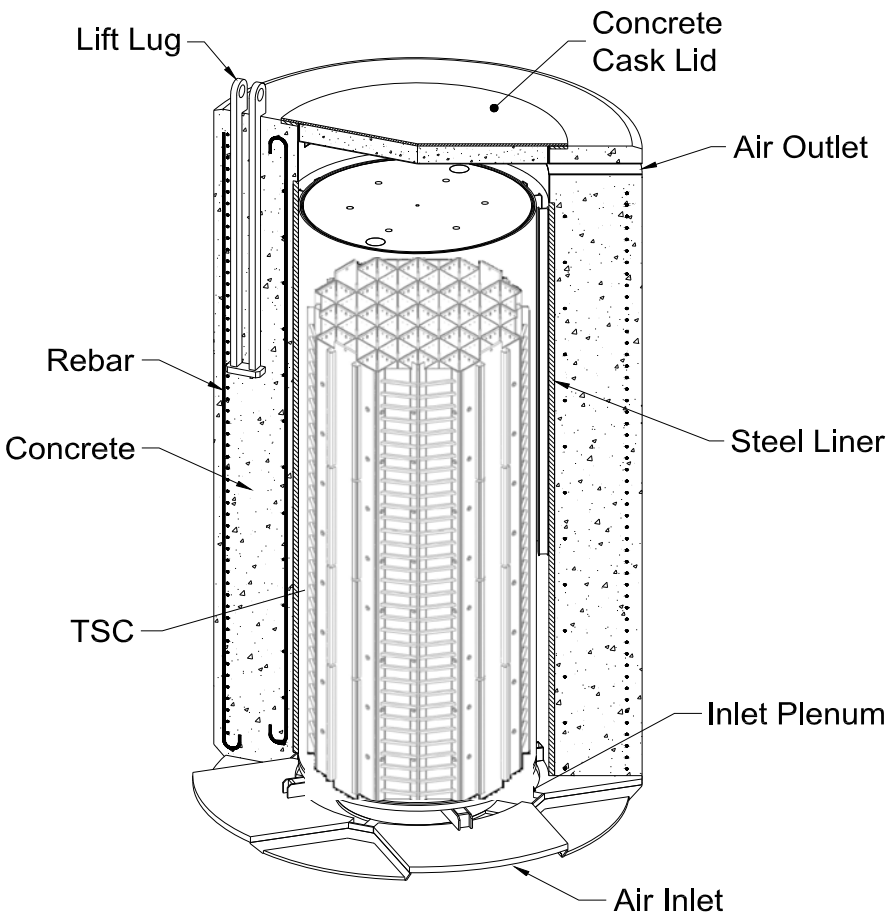
The MAGNASTOR System

- 2005 MCS design for use with standard fuel
- Uses unique, first-of-kind, developed cell basket design
- 136 systems ordered
  - 20 for McGuire
  - 24 for Catawba
  - 65 for Zion
  - 27 for Kuosheng (TaiPower)
- Improvements since earlier designs:
  - More sophisticated computer models, analysis
  - Enhanced fabrication, operations methods
  - Technology: developed cell basket, single closure lid, convective heat transfer in TSC, handling methods





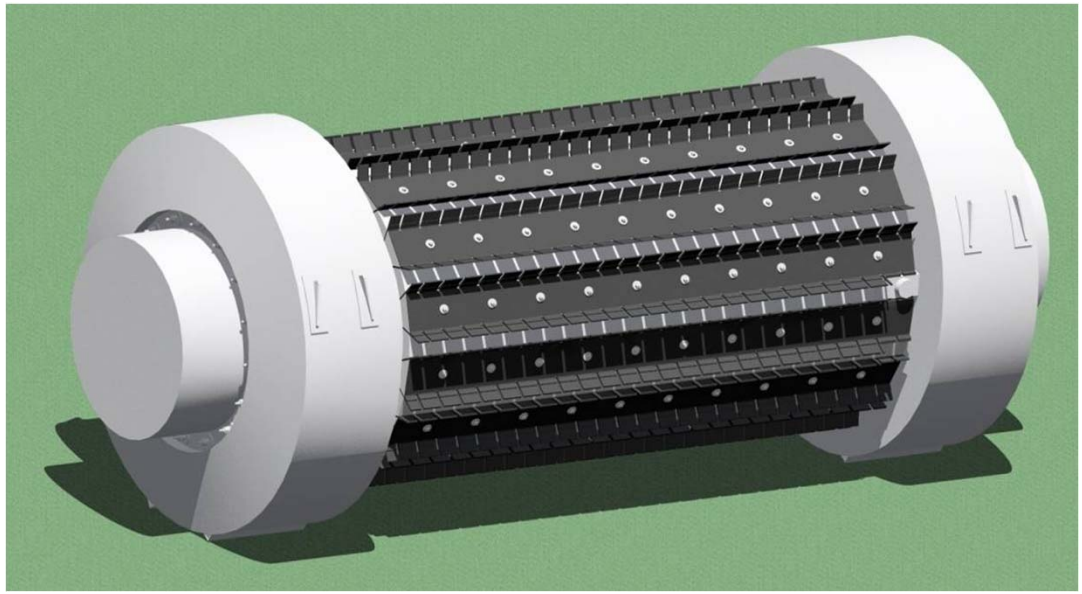
MAGNASTOR System



First VCCs poured at McGuire

Transport Packaging : The NAC MAGNATRAN Cask

- Transport package with capability for all NAC canisters
- Designed to meet USNRC, DOT and IAEA (-96) requirements
- License application in 2011 and testing in 2012
- Anticipated CoC in 2013



New Technology Directions: Drivers

- 2012 may begin a transition by industry to new technology
  - Administration efforts to eliminate YM: huge time uncertainty for dry storage/transport and for its technology
  - New repository: new requirements? Old repository: old requirements or new requirements?
  - Current regulations are very conservative for applying to systems needed for 300 years in storage then transport
  - Extended storage and transportation (EST) of spent fuel may require changes in regulations and approach.
- EST may be the Ghost of Spent Fuel Future, offering a foreboding outlook that storage and transport will become far more difficult.
- Hyper-conservative regulations and staff positions must be modified for such a protracted, uncertain future.
- Utilities will find it difficult to accept the costs imposed by EST due to current regulations and further conservatisms anticipated.

New Technology Directions: Determinants

- NRC's Draft Report for EIS – Long Term Waste Confidence Update (December 2011) says the update will assume regulatory oversight is "at least as stringent as the current regulatory requirements" and might adjust the EIS scope for "additional safety and security measures."
- Current regulatory/licensing issues impose technical burden without safety enhancement; EST makes this burden beyond acceptable for dry storage/transport technology under current regulatory conditions:
  - Ready retrievability: spent fuel vs. canister
  - Staff-imposed, conservative criticality calculations: methods, administrative margin, etc.
  - Moderator intrusion (ModInt)
  - High burnup fuel
  - Reasonable burnup credit.

New Technology Directions: Decisions

- For example:
  - ModInt does not make technical or safety sense for spent fuel, in light of modern package design. History shows that bases of current §71.55(b) regulatory requirements do not now apply
  - EPRI shows ModInt under accident conditions is beyond improbable and regulations should be revised for a more rational treatment, especially for MCS technology
  - Industry and NRC must enable a more rational regulatory framework for ModInt and MCS systems under EST.
- EST investigations will drive uncertainties under current regulations and dry storage/transport may become very difficult
- New regulations/staff positions will make new MCS technology more future-friendly, more economical with equal safety.
- Industry needs to push for this as EST determinations proceed. This will likely begin in 2012.

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