



**Reactor Decommissioning
Recent Experience & Global Outlook**

INMM Spent Fuel Management Seminar
January 13, 2015

Introduction





- Outline
 - US experience base
 - Current experience – Zion D&D
 - Global outlook – a few thoughts

"Those who cannot remember the past are condemned to repeat it."


- George Santayana, Spanish philosopher

EnergySolutions US Track Record







Big Rock Point
1998 – 2005




Yankee Rowe
2003 – 2005




Connecticut Yankee
1999 – 2005



Fermi 1
2007- 2012



SMUD
2007- 2011




Zion
2010 - 2020

Experience & lessons learned
from all major reactor D&D's
for over a decade




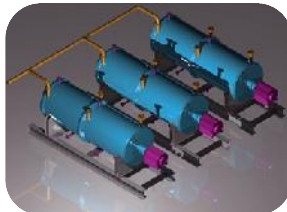
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Vertically Integrated Nuclear Services




Provide a broad range of nuclear services within a single platform that provides greater flexibility to manage risk

- Nuclear power plant operations
- Specialized nuclear services
- Design & engineering
- Applied engineering & technology
- Proprietary facilities and technology
- Spent fuel management
- Onsite waste management services
- Transportation and logistics
- Waste Processing & Disposal
- Decontamination & decommissioning

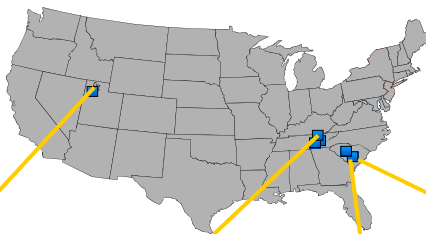

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Waste Management Infrastructure – Facilitates Risk Management




- Largest waste processing capability in the US
- 2+ comprehensive processing facilities
- Full control of Logistics Operations

- 2 major Disposal Facilities





Clive Disposal




Clive, UT

Bear Creek Operations




Oak Ridge, TN

Barnwell Processing



Barnwell, SC

Chem-Nuclear Disposal



Barnwell, SC


Current Experience – Zion Nuclear Station



- Two Unit Pressurized Water Reactor (PWR) Site
 - 1080 megawatts each
- Located 40 Miles North of Chicago in Zion Illinois
- Located immediately between North and South Portions of Illinois Beach State Park
- Both Units were Licensed for Operation in 1973
- Permanently Shut Down in January 1998
- Placed in SAFSTOR Status until September 1, 2010




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Zion Approach – Different by Design 

- EnergySolutions acquired the Zion plant on September 1, 2010
 - 10 CFR 50 Licenses transferred from Exelon to ZionSolutions (wholly owned subsidiary)
 - NDT funds transferred to ES/ZS Trustee
- 10-Year Maximum Completion Schedule
 - 12 years earlier than Exelon’s previous schedule
 - Current plan is to finish in 8 years

	Exelon’s Schedule	ZionSolution’s Schedule
D&D Planning Start	2013	2010
D&D Operations Start	~2015	2010
Site Restoration Complete	2032	2020 2018

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Zion Approach – Different by Design 

Why is the Zion plan the best model in the industry.....

- Utilities want to focus on core business of electricity generation, not Decontamination and Decommissioning (D&D)
- Transfer risk for D&D – not the same old failed contract model
- SAFSTOR is not a low risk model
 - Disposal space is finite
 - Regulatory baselines can change (Fukushima)
 - Plants continue to need managing – cost money
 - Stakeholders do not like “mothballing” the problem
- We have demonstrated that accelerated cleanup can be safely achieved at a much lower cost
- For ES it provides a long term projects order book and early waste management and disposal– a good fit with our skills and aspirations




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Zion Project – Work Phases



Major Phases of Work:

- Phase 1 - Spent Fuel Transfer from Fuel Pool to Dry Storage
 - 2,226 fuel assemblies
 - 61 canisters
- Phase 2 - License Termination (D&D)
 - Reactor vessel removal
 - SSC removal
 - Building dismantlement
 - License termination
- Phase 3 - Non-Rad Site Restoration
 - Landscaping, grading, etc.

Preparations for Fuel Loading



- SNF inspections, repair, and loading plans
- Crane upgrades and facility mods









Storage cask construction



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Zion's First Fuel Canister In Processing



Transfer Cask Being Lowered into Spent Fuel Pool

Robotic Welding on First Fully Loaded Fuel Canister



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Zion ISFSI – A Model in Action



ISFSI on 9-9-14 with 37 of 61 Dry Storage Casks in Place
Spent Fuel Loading is 100% Complete as of 8 Jan 2015!

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Reactor Vessel Internals Segmentation



- Unit 1 and Unit 2 internals finished Dec 2014
- Unit 2 Greater Than Class C Waste (GTCC) is currently being processed. First of Two GTCC TSCs is installed in its cask and at the ISFSI
- Reactor vessels will be thermally cut after water is removed
- Reactor Vessel Segmentation is scheduled for completion by Dec 2015



Cutting on Upper internals and lower core barrel from Unit-2

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Unit 2 GTCC Processing



Each Unit Will Generate 2 GTCC Canisters That Will Be Stored at the ISFSI



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Onsite Waste Handling and Shipment



Safely and Efficiently Handling Segmented Reactor Vessel Internal Components for Future Shipment



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Internal Building Preparations/Legacy Equipment Removal



	592' Level		542' Level Auxiliary Building Area – North End
	Auxiliary Building Area	Main Steam Room	
Before			
After			

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Zion Project – End State



- End State Conditions Include:
 - All structures removed to 3 ft below grade
 - Lake Intake and Discharge Piping abandoned in place
 - All Class A,B & C waste disposed off site
 - Spent Fuel & GTCC in Dry Storage on ISFSI
 - ISFSI, switchyard, roads, rail & fences remain
- Land restored to allow unrestricted use of the site IAW NRC criteria with the exception of the ISFSI
- The NRC License revised for ISFSI only and transferred back to Exelon
- Land returned to Exelon for future beneficial re-use

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Summary



- *Zion Solutions* is going well !!
 - High risk project areas close to completion
 - Opportunity for savings in traditional D&D area going forward
 - We will deliver for the value of the trust fund as agreed
- *Energy Solutions* is committed to the “risk transfer” model
 - Uniquely qualified and focused nuclear company
 - Vertically integrated with expertise in all areas of reactor D&D
 - Track record of success & innovation
- We are in a position to help customers optimize the path forward using Zion “real time” baseline information

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Global Decommissioning Outlook



- Each reactor decommissioning and site decontamination / remediation project is a significant, long term program
 - Knew it would happen “someday,” but political, economic, and natural events drivers have accelerated the timeline in many instances
 - The long term nature of the work, along with the fact that this work is not what the utilities are in business to do, makes the programs challenging and point to a different way to do this business

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Global Decommissioning Outlook



- Issues and concerns
 - Relatively little experience
 - Rapidly expanding market
 - Adequacy of decommissioning funding
 - Availability of disposal for LLW & ILW, and SNF
- Wide variation in approaches
 - Turnkey
 - Piecemeal
 - Innovative vs. structured
- No lack of market opportunities for those companies interested and willing
 - Opportunities to excel
 - Opportunities to ???

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