

February 17, 2012

MEMORANDUM TO: Michael Waters, Acting Deputy Director  
Division of Spent Fuel Storage and Transportation, NMSS

Anne T. Boland, Director  
Division of Nuclear Material Safety, Region III

FROM: Norma Garcia Santos, Project Manager **/RA/**  
Rules, Inspections, and Operations Branch  
Division of Spent Fuel Storage and Transportation, NMSS

SUBJECT: SUMMARY OF JANUARY 10, 2012, PUBLIC MEETING WITH EXELON,  
LLC TO DISCUSS APPROACH TO UNRESTRAINED STACK-UP  
OPERATIONS AT THE UPCOMING LOADING CAMPAIGN AT BYRON  
NUCLEAR STATION [BYRON]

### Background

A public meeting was held on January 10, 2012, in Rockville, Maryland, at the request of the Exelon Generating Company, LLC (Exelon) to discuss Exelon's plans to support unrestrained stack-up operations for the upcoming dry fuel storage campaign at Byron.

The meeting was noticed on December 21, 2011(ML113550591). The meeting was open to the public. Exelon provided presentation slides on January 9, 2012 (ML120090302). The meeting attendance list is provided as Enclosure 1. The meeting agenda and meeting logistics are provided as Enclosure 2. Exelon's presentation slides are provided as Enclosure 3. Additional handouts provided by Exelon at the public meeting are provided as Enclosure 4. A summary of additional comments discussed at the meeting are provided as Enclosure 5.

### Discussion

The discussion generally followed the agenda (Enclosure 2). The primary reason for the meeting was to discuss Exelon's assumptions and calculations to support unrestrained stack-up operations for the upcoming dry fuel storage campaign at Byron. No regulatory decisions were made at this meeting. Exelon was seeking feedback on its planned analysis and at the same time to understand the United States Nuclear Regulatory Commission's (NRC's) position regarding unrestrained stack-up operations during loading campaigns. Currently, NRC staff from the Division of Spent Fuel Storage and Transportation (SFST) as well as regional inspectors had asked questions about unrestrained stack-up operations during loading of spent fuel into dry storage cask systems due to seismic concerns (i.e., tip over, rocking, etc.). During inspections, NRC staff has asked licensees to provide justification for why restraints are not needed to prevent tip over or rocking of a cask system, if an earthquake occurs during spent fuel loading operations. Staff from the Office of Nuclear Reactor Regulation (NRR) as well as Office of New Reactors (NRO) attended the meeting as well as representatives from the nuclear industry and the press.

Exelon explained that no analytical evaluations or tests had yet been performed to validate the analyses or simulations performed using the ANSYS and LS-DYNA computer codes. The NRC staff also noted that the assumptions of the analysis should be clearly supported. The staff noted that when using analytical methods, it is important to properly benchmark the model in order for staff to have confidence in the modeling techniques.

### Technical Discussion

The licensee mentioned that the LS-DYNA stack-up model incorporated nonlinear material properties and friction sliding contact at the base, and that the model's free rocking response was the basis for determining the coefficient of restitution (COR). The calculated COR was then converted to equivalent viscous damping, which was assigned to the contact elements at the base of the ANSYS stack-up model. Friction sliding contact was also included in the ANSYS model. The staff commented that this meant that frictional energy dissipation (damping) had been "double counted" by friction having been included in determining the COR from the LS-DYNA model, from which the damping for the ANSYS contact elements was calculated, and also having been included again in the ANSYS model.

The staff noted that the sliding and rocking of a stack-up exhibit many elements of chaotic behavior, and as such, the final results may be significantly altered by small changes in initial conditions. The staff mentioned that recent tests on the free rocking of concrete blocks on different surfaces conducted at the University of Auckland in New Zealand, in which the blocks had been restrained from sliding, had confirmed Housner's original equation for calculating the rocking COR. The staff commented that, in the absence of physical evidence to the contrary, a COR computed from an LS-DYNA model, which is restrained from sliding should be no less than Housner's value. The staff also mentioned that the equivalent viscous damping of 9% that had been calculated from the LS-DYNA COR result and used in the ANSYS model appeared to be too high.

The licensee commented that the average of the five real earthquake time history spectra used in the ANSYS analysis enveloped the 2 percent (%) damped floor response spectra. The staff commented that the average of the time history spectra should envelope the "undamped" floor spectra. The staff noted that on slide 12 of the licensee's presentation, seismic loads are input to ANSYS in the form of velocity time histories (and not the acceleration time histories). The licensee would need to verify if the velocity and acceleration time histories will provide the same response.

The staff noted that the gap between the interior of the transfer cask and the canister was 3/16-inch, which was less than the gap of 1/2-inch mentioned by the staff at the Technical Exchange. SFST staff explained that the 1/2-inch gap was based solely on engineering judgment. NRO staff mentioned that the licensee needed to verify that the 3/16-inch gap would not have a significant influence on the sliding or rocking of the stack-up.

Slide 24 of the licensee's presentation showed the allowable sliding distance of the stack-up to be 29.75 inches. Based on the geometry of the shims and LPT shown on slide 8, the staff commented that the allowable distance was too large, because it would allow the stack-up to extend over the edge of the LPT and shims by almost 2.5 feet, which would not only change the COR but also increase the possibility for greater rocking response of the stack-up.

The licensee was asked if testing had been performed to demonstrate that the cask system would not rock or slide in the longitudinal direction during a seismic event. The licensee mentioned that they had performed some tests for Dresden Station, but no specific tests were conducted at Dresden for longitudinal motion (i.e., rolling) of the LPT. However, HOLTEC commented that they had, in the past, performed numerical simulations for other licensees, using VisualNastran, to quantify the amount of LPT rolling in the longitudinal direction.

The staff asked if the calibrated low friction material (CLFM) would be reused. The licensee replied that it would be reused. The staff suggested that the CLFM be tested before each use to ensure that the coefficient of friction (COF) had not increased with time or wear, because an increase in COF could lead to increased rocking.

While discussing the structural methodology, Exelon mentioned that if resolution was reached between Exelon and NRC on concerns raised during this meeting, it would develop a 10 CFR 50.59 evaluation, finalize the analysis, and provide it to Region III ISFSI staff for inspection during Byron's upcoming loading campaign. At the end of the meeting, Exelon mentioned that this timeline may be delayed given the feedback provided by NRC staff during this public meeting.

Finally, the staff discussed the possibility for HOLTEC, Exelon's cask system vendor, to submit a topical report for NRC's review, because of the generic applicability of this issue. This approach would provide a higher level of closure than an inspection report, even though it would not be the end state. Moreover, the staff mentioned that the general license process has advantages, but it requires the vendor to demonstrate that the cask system would not tip over with a high degree of certainty.

The loading campaign at Byron is scheduled for February 2012.

Docket Nos. 50-454, 50-455, 72-68  
TAC No. L24611

Enclosures:

1. Meeting Attendees
2. Agenda and Meeting Logistics
3. Presentation Slides (Public Meeting)
4. Supporting Material (Provided by Exelon at the Public Meeting)

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Distribution:

NRC Attendees

[G:\SFST\Garcia\Public Meetings NGS\Meetings-ngs\SFST-Stackup\Exelon Approach-Byron\Exelon Mtg-Concurrence Pkg](#)

**ML120481631**

OFC	NMSS\SFST		NMSS\SFST	NRR		NRO	
NAME	NGarcia-Santos		GBjörkman	KManoly		BJain	
DATE	1/25/2012		1/27/2012	1/27/2012		1/26/2012	

OFC	NMSS\SFST		NMSS\SFST		Region III		NMSS\SFST	
NAME	WWheatley		CAraguas		CLipa		MWaters	
DATE	1/31/2012		2/16/2012		2/17/2012			

"C" = Copy without attachment/enclosure "E" = Copy with attachment/enclosure "N" = No copy

OFFICIAL RECORD COPY

**January 10, 2012, Public Meeting  
Between Exelon, LLC and the Nuclear Regulatory Commission**

**MEETING ATTENDANCE LIST**

<b>Name</b>	<b>Organization</b>
Doug Weaver	NRC
Gordon Björkman	NRC
Anne T. Boland	NRC
Christine A. Lipa	NRC
Blair Spitzberg	NRC
Vincent Everett	NRC
John Bozga	NRC
Vijay Meghani	NRC
Jim Neurauder	NRC
Robert Carrion	NRC
Marc Ferdas	NRC
John Nicholson	NRC
Eric Benner	NRC
BP Jain	NRC
D. Ibana	NRC
John Goshen	NRC
Rhex Edwards	NRC
David Tarantino	NRC
David Tang	NRC
Bob Tripathi	NRC
Jon Woodfield	NRC
Bob Martin	NRC
Breda Mozafari	NRC
Ray Wharton	NRC
David Pstrak	NRC
Natreon Jordan	NRC
Alexis Sotomayor	NRC
Jimmy Chang	NRC
Kamal Manoly	NRR
Norma Garcia Santos	NRC
Lucieann Vechioli	NRC
Terry Sides	Southern Nuclear
John Schrage	Exelon
David Gullot	Exelon

**January 10, 2012, Public Meeting  
Between Exelon, LLC and the Nuclear Regulatory Commission**

**MEETING ATTENDANCE LIST**

<b>Name</b>	<b>Organization</b>
Kevin Donovan	Exelon
Ed Blodin	Exelon
Gary Voss	Exelon
Tom Bortolini	Exelon
Ken Hunter	Exelon
M Kassar	Exelon
Adam Levin	Exelon
Stefan Anton	HOLTEC
Tammy Morin	HOLTEC
Chuck Bullard	HOLTEC
Venkat Prabhala	HOLTEC
Zhihua Yue	HOLTEC
Anveshan Bommarreddi	HOLTEC
Pierre Oneid	HOLTEC
Marc Nichol	NEI
George Abadallah	DTE, Fermi
Bruce F. Henley, PE & PMP	Luminant Power
Ken Spates	TVA/RRC
Stephenie Pyle	Entergy - Arkansas Nuclear One
Robert Clark	Entergy - Arkansas Nuclear One
Jay G. Wellwood;	Nuclear Services Westinghouse
Glenn Schwartz, P.E.	PSEG Nuclear Fuels
Sam Hassoun	Fermi 2 Nuclear Power Plant
Zita Martin	Tennessee Valley Authority
John Pfabe	D.C. Cook Nuclear Plant
Ben Spiesman	FirstEnergy Nuclear Operating Company
Jeff Fox	FENOC
Jim Veglia	FENOC
Donna Haviland	FENOC
Paul Wilson	FENOC
Lloyd Zerr	FENOC
Ted Hilston	FENOC
Kevin Koski	FENOC
Maureen Conley	Platts/McGraw Hill Nuclear Publications
Carlyn Greene	Ux Consulting



# Public Meeting with Exelon, LLC

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January 10, 2012

## *Agenda*

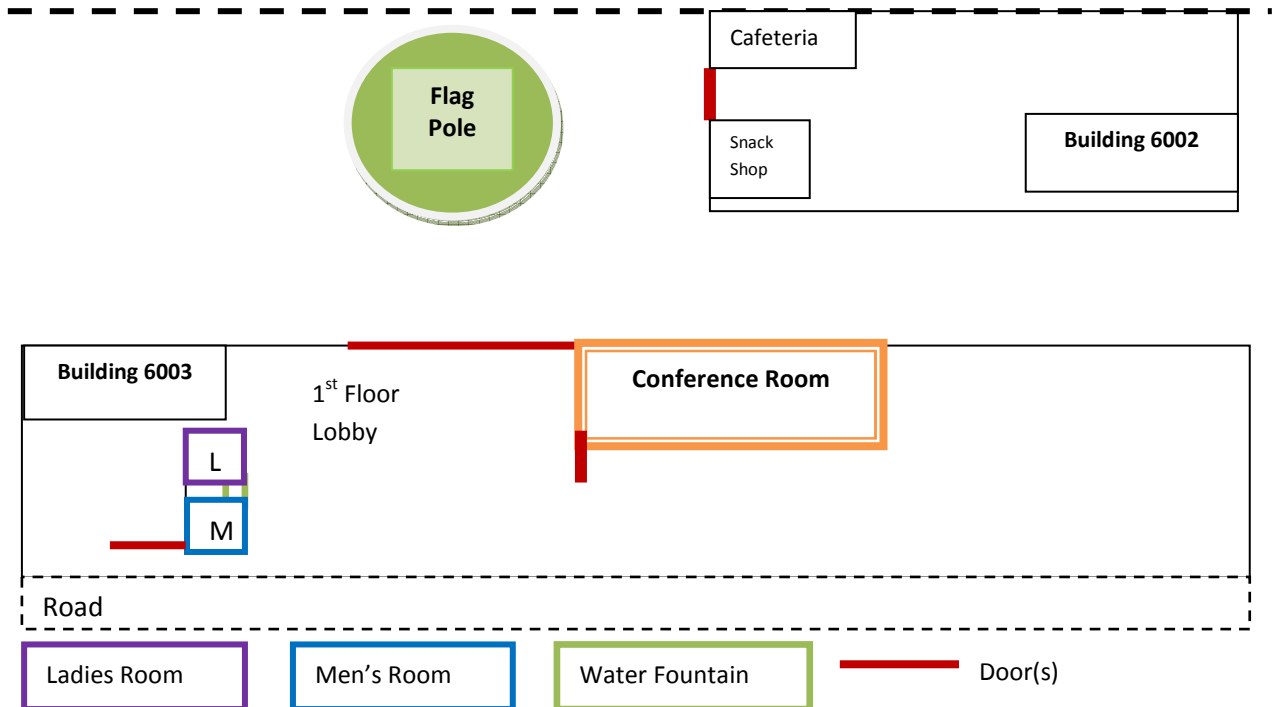
Opening remarks	Norma Garcia Santos Anne Boland Doug Weaver
Introductions	All
Exelon's Approach	Exelon
Break	All
Open Discussion Parking Lot	All
Parking Lot Summary	Norma Garcia Santos
Opportunity for Public Comment	Public
Closing Remarks	Anne Boland Doug Weaver

# Public Meeting with Exelon, LLC

January 10, 2012

## Logistics

### Executive Boulevard Building (EEB) Complex



## Reminders

- You will need an escort at all times while in EBB 6003.
- You will need an identification to access EBB 6002 and 6003.
- Building evacuation – Meet at the flag pole.
- Return your provisional badge when you leave this building.
- Please fill out the "Public Meeting Feedback Form" at the end of the meeting or send it by mail (NO Postage necessary).