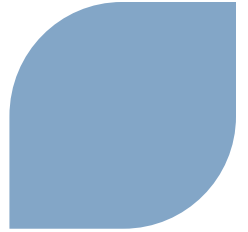


Public Meeting to Discuss U.S. EPR Design Certification Civil/Structural Path Forward for Closure of Open Items

Nawar Alchaar
Rockville, Maryland
August 21, 2012



Purpose and Background



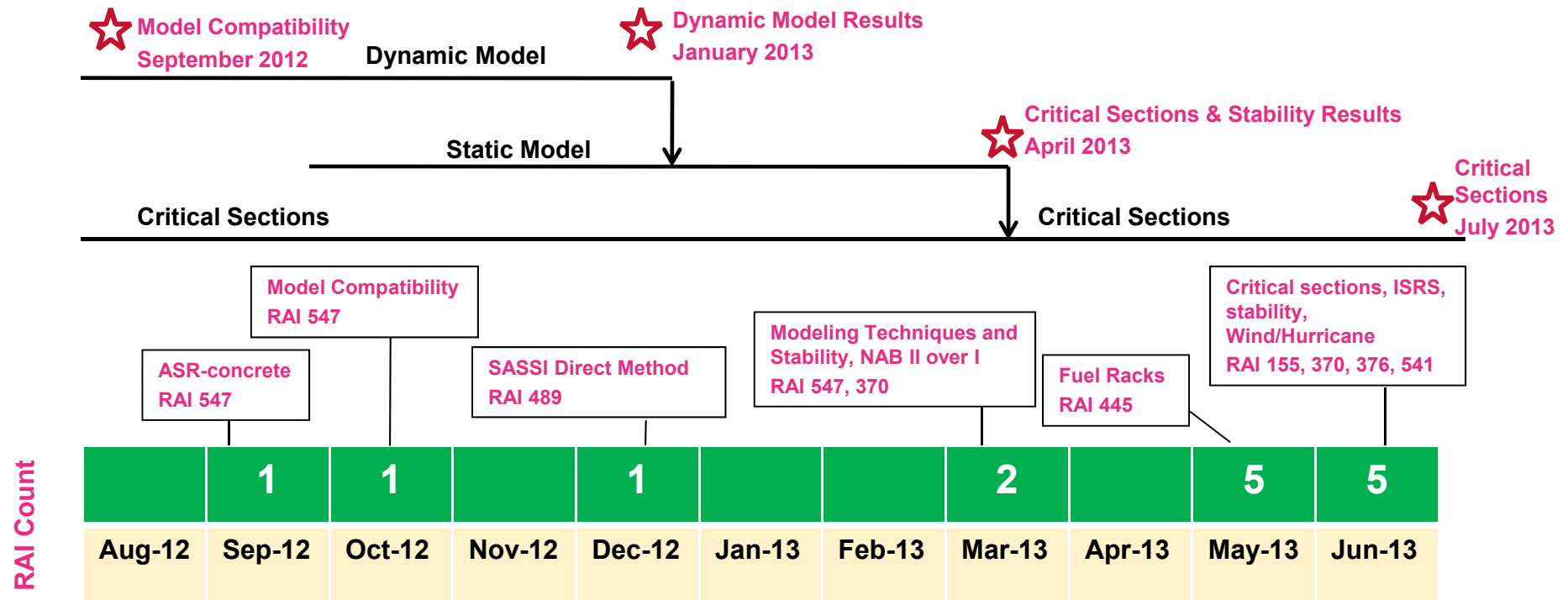
► Purpose

- ◆ Present schedule for U.S. EPR FSAR Civil/Structural open items
- ◆ Confirm agreement with the NRC on the Civil/Structural path to closure technical approach for U.S. EPR Design Certification
- ◆ Identify future NRC/AREVA interaction opportunities

► Background

- ◆ May 2012 Schedule Letter
 - Complete all outstanding Open Items by Commitment Dates
- ◆ Key Technical Change
 - US EPR Dynamic Analyses will be rerun using the SASSI Direct Method

Updated Timeline U.S. EPR FSAR Civil/Structural Sections



★ = NRC Interaction

Schedule of Civil/Structural Open Items

RAI	Question No.	Topic/Subject	Draft to NRC	Final to NRC
155	03.08.01-24	Critical Sections	6/30/2013	8/30/2013
155	03.08.04-06	Critical Sections	6/30/2013	8/30/2013
370	03.07.01-27	OBE/SSE Damping	6/30/2013	8/30/2013
370	03.07.02-64	NAB II/I	3/21/2013	11/14/2012 5/21/2013
376	03.08.05-31	Stability	6/30/2013	8/30/2013
445	03.08.04-15	Fuel Racks	5/28/2013	6/28/2013
445	03.08.04-19	Fuel Racks	5/28/2013	6/28/2013
445	03.08.04-20	Fuel Racks	5/28/2013	6/28/2013
445	03.08.04-21	Fuel Racks	5/28/2013	6/28/2013
445	03.08.04-27	Fuel Racks	5/28/2013	6/28/2013
489	03.07.02-75	SASSI Method	12/14/2012	10/29/2012 1/31/2013
541	02-3	Wind/Hurricane	6/13/2013	7/16/2013
547	03.07.02-76	Dynamic/Static Model Compatibility	10/9/2012	11/29/2012
547	03.07.02-77	ASR induced concrete degradation	9/14/2012	11/14/2012
547	03.07.02-78	Modeling techniques, stability	3/7/2013	4/30/2013

Path to Closure

► RAI 155, Questions 03.08.01-24 and 03.08.04-06 – Critical Sections

- ◆ Critical sections are identified using the selection methodology described in FSAR
- ◆ Perform reinforced concrete design using ZPAs from SASSI subtraction method results
- ◆ Perform design using ANSYS / CivilFEM design modules
- ◆ Report results in accordance with Appendix 3E template
- ◆ Confirm design results are bounding the direct method ZPAs
- ◆ Audit opportunities in 2013 for results (~April 2013 and July 2013)

► RAI 370, Question 03.07.01-27– OBE/SSE Damping

- ◆ Use OBE damping for high frequency motion
- ◆ Confirm demand to capacity ratio is above 50% justifying the use of SSE damping

Path to Closure

► RAI 370, Question 03.07.02-64 – NAB II/I

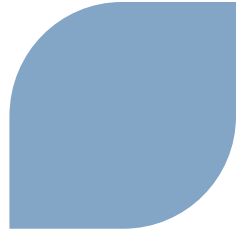
- ◆ Address hysteretic response of side soil springs by performing a study of a case with hysteric response based on passive earth pressure coefficients to limit movement away from the NI
- ◆ Methodology for calculating the NAB static and dynamic bearing pressure will be reevaluated and third party geotechnical assistance will be obtained to address bearing pressure at corners and edges

Path to Closure

► RAI 376, Question 03.08.05-31 – Stability (Bearing Pressure)

- ◆ Reevaluate the methodology for determining static and dynamic bearing pressures; third party geotechnical assistance will be obtained
- ◆ Update bearing pressure results and acceptance criteria, if needed

Path to Closure



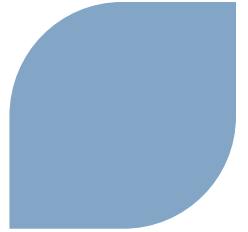
► RAI 445, Questions 03.08.04-15 – Fuel Rack Design

- ◆ Sketches of the new fuel rack design showing the lateral supports will be provided
- ◆ The basis for eliminating seismic amplification will be included
- ◆ The gap dimensions will be added to the FSAR
- ◆ The effect of the varying gaps between rack modules due to erection tolerances will be investigated

► RAI 445, Questions 03.08.04-19 – Fuel Rack Design

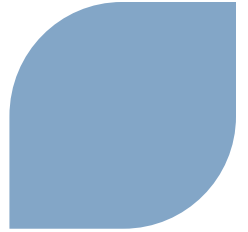
- ◆ The whole pool model will be modified to incorporate a simplified representation of the fuel assembly inside all the tube cells
- ◆ The analysis will be performed using the bounding time history set 1
- ◆ The whole pool model run results will be evaluated and compared with the same run case where the fuel assemblies were modeled as added density to the tubes
- ◆ The rack legs design evaluation for the seismic load combination will be summarized

Path to Closure



- ▶ **RAI 445, Questions 03.08.04-20 – Fuel Rack Design**
 - ◆ Seismic analysis of the fuel racks based on the latest seismic inputs will be performed
 - ◆ Rack(s) with the maximum stresses from among all 17 racks of each of the 15 whole pool analyses cases based on examination of the maximum stress in the simplified racks in the multi-rack whole pool analysis models will be identified and analyzed in detail
- ▶ **RAI 445, Questions 03.08.04-21 – Fuel Rack Design**
 - ◆ Results of stress analysis of fuel rack elements will be provided
 - ◆ Detailed finite element model for the NFS racks with constraints at bumper locations will be built
 - ◆ Either equivalent static or response spectra (per RG 1.92) analysis will be performed
- ▶ **RAI 445, Questions 03.08.04-27 – Fuel Rack Design**
 - ◆ Thermo-mechanical analysis of fuel rack elements will be performed

Path to Closure



► RAI 489, Question 03.07.02-75 – SASSI Method

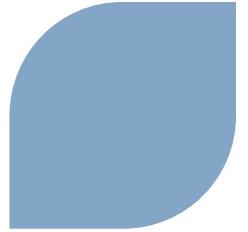
- ◆ Use SASSI direct method for dynamic analysis (NI, EPGB and ESWB)
- ◆ Compare SASSI direct method results with subtraction method results to determine downstream effects on RCS and Fuel qualification
- ◆ If subtraction method results bound the direct method results, use subtraction method results in all downstream work
- ◆ If not, justification will be provided or reanalysis will be performed

Path to Closure

► RAI 541, Question 02-3 – Wind/Hurricane

- ◆ Add hurricane wind speed of 230 mph (Same as tornado wind speed)
- ◆ Update missile calculation per new wind speeds
- ◆ Include hurricane wind speed and hurricane missile criteria in the FSAR

Path to Closure



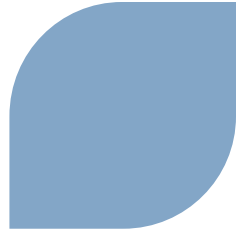
► RAI 547, Question 03.07.02-76 – Model Compatibility

- ◆ Compare geometries for Static and Dynamic Models and identify key differences
- ◆ Modify the Dynamic and/or Static models, as appropriate
- ◆ Generate and compare ISRS for each model to demonstrate compatibility
- ◆ Provide summary of analysis results and conclusions – NRC interaction (September 20, 2012)

Path to Closure

- ▶ **RAI 547, Question 03.07.02-77 – ASR-induced concrete degradation**
 - ◆ Include ASTM C1260 and C1293 references in the FSAR

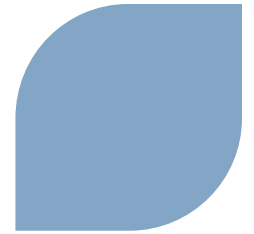
Path to Closure



► RAI 547, Question 03.07.02-78 – Modeling Techniques and Stability

- ◆ Clarify description of basemat analysis methodology and results by adding figures and enhancing the text
- ◆ Perform basemat reanalysis or supplementary analyses to address the effect of different passive pressure curves
- ◆ Clarify tendon gallery modeling and bearing pressures considering “delta pressures” developed due to postulated sliding
- ◆ Clarify description of bearing pressure profiles on the sidewalls and provide additional figures as requested
- ◆ Clarify sidewall design forces and determination of critical sections
- ◆ Provide comparison of design loads based on SASSI versus sliding bearing pressure for a set of critical walls
- ◆ Reevaluate the methodology for determining static and dynamic bearing pressures, third party assistance will be obtained
- ◆ Update FSAR write-ups

Interaction Opportunities



► NRC/AREVA Interaction Opportunities

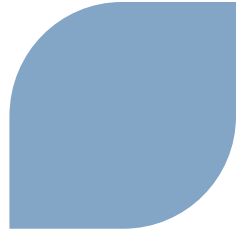
◆ Telecons

- Bi-Weekly Civil/Structural Management Meetings [Starting Week of September 10th, 2012]
 - Status work progress
 - Discuss emerging issues
- Weekly Technical Meetings [Starting Week of September 20th, 2012]
 - Discuss NRC feedback on RAI responses

◆ Audits and Public Meetings

- Scheduled during the Civil/Structural Management Meetings
 - NRC review of in-progress and completed technical work that form the basis of the RAI responses
 - Review methodologies used

Next Step



- ▶ **Execute the plan by submitting RAI responses as shown on timeline**
- ▶ **Interface regularly on progress and technical items**

>> Goal is to clearly specify what NRC will get and when, to support a predictable and timely review.