



**NRC Public Meeting  
Fukushima Near-Term Task Force Recommendation 2.1  
Seismic Re-evaluation and Screening Results**

**Surry Power Station - Units 1 and 2  
Millstone Unit 2**

**Dominion  
June 25, 2014**

# Agenda

- **Surry GMRS Differences**
  - Introduction
  - NRC and EPRI GMRS and Surry SSE Comparison
  - Velocity Profiles
  - Basis for Kappa
  - Basis for Depth to Hard Rock
  - Summary
  - Conclusion
- **Millstone Unit 2 - Draft RAIs**

# Introduction

- Dominion followed the NRC-endorsed industry guidance (EPRI 1025287 – SPID) to develop the Surry ground motion response spectrum (GMRS) in response to the NRC 10CFR 50.54(f) request for information letter
- Dominion submitted the GMRS/hazard curves and screening results for Surry Power Station Units 1 and 2 on March 31, 2014
- The objective of this meeting is to discuss the identified differences between the Surry submittal and NRC confirmatory results, i.e., shear wave velocity profiles, total effective kappa and depth to hard rock
- Dominion will present the basis for the information provided in the submittal related to these differences



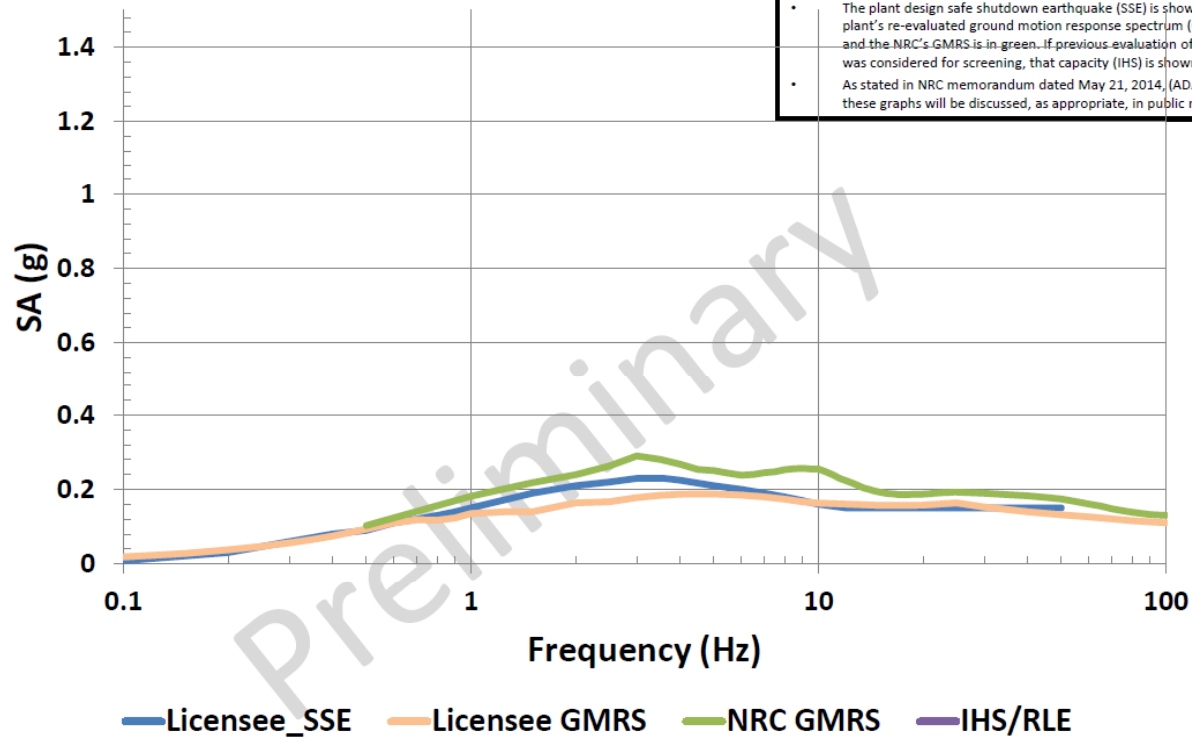
# Surry GMRS and SSE Comparison



- Surry is a low seismic hazard site (SSE spectral peak  $< 0.23g$  at 5% damping)
- GMRS (Dominion) enveloped by SSE
- GMRS (NRC)  $< 0.29g$  (est.) spectral peak
- NRC GMRS confirmatory analysis differences
  - Shear Wave Velocity ( $V_s$ ) Profiles
  - Total Kappa Value (0.027s [NRC] vs. 0.034s [Dominion])
  - Depth to Hard Rock (1460' [NRC] vs. 1700' [Dominion])

# GMRS and SSE Comparison

Surry



- As discussed in the May 9, 2014, letter (ADAMS ML14111A147), the NRC considered the re-evaluated hazard and previous estimates of plant capacity to conclude that this plant is safe to continue operating while additional evaluations are conducted.
- NRC staff used this preliminary graph, focusing on the 1-10 Hertz range, and other information to determine whether this plant requires a risk evaluation over the next few years.
- The plant design safe shutdown earthquake (SSE) is shown in blue; the plant's re-evaluated ground motion response spectrum (GMRS) is in black and the NRC's GMRS is in green. If previous evaluation of a plant's capacity was considered for screening, that capacity (IHS) is shown in purple.
- As stated in NRC memorandum dated May 21, 2014, (ADAMS ML14136A126) these graphs will be discussed, as appropriate, in public meetings.

# Vs Profiles

- Basis for Shear Wave Velocity (Vs) Profiles
  - Site-specific geotechnical profile data from Report Table 2.3.2-1
  - SSE control point at surface (26'6 El.)
  - Vs values
    - Compacted fill – 16' – 1000 fps
    - Upper 140' – based on sampler penetration tests (hammer blows)
    - Uncertainty factor of 1.57 applied based on limited data
  - Profiles reflect site-specific estimated Vs values
  - No gradient applied since soft soil site (consistent with SPID)

# Vs Profiles

TABLE 2.3.2-1 (Reference 7.9, 7.11):  
Surry Power Station Site Geotechnical Profile Data

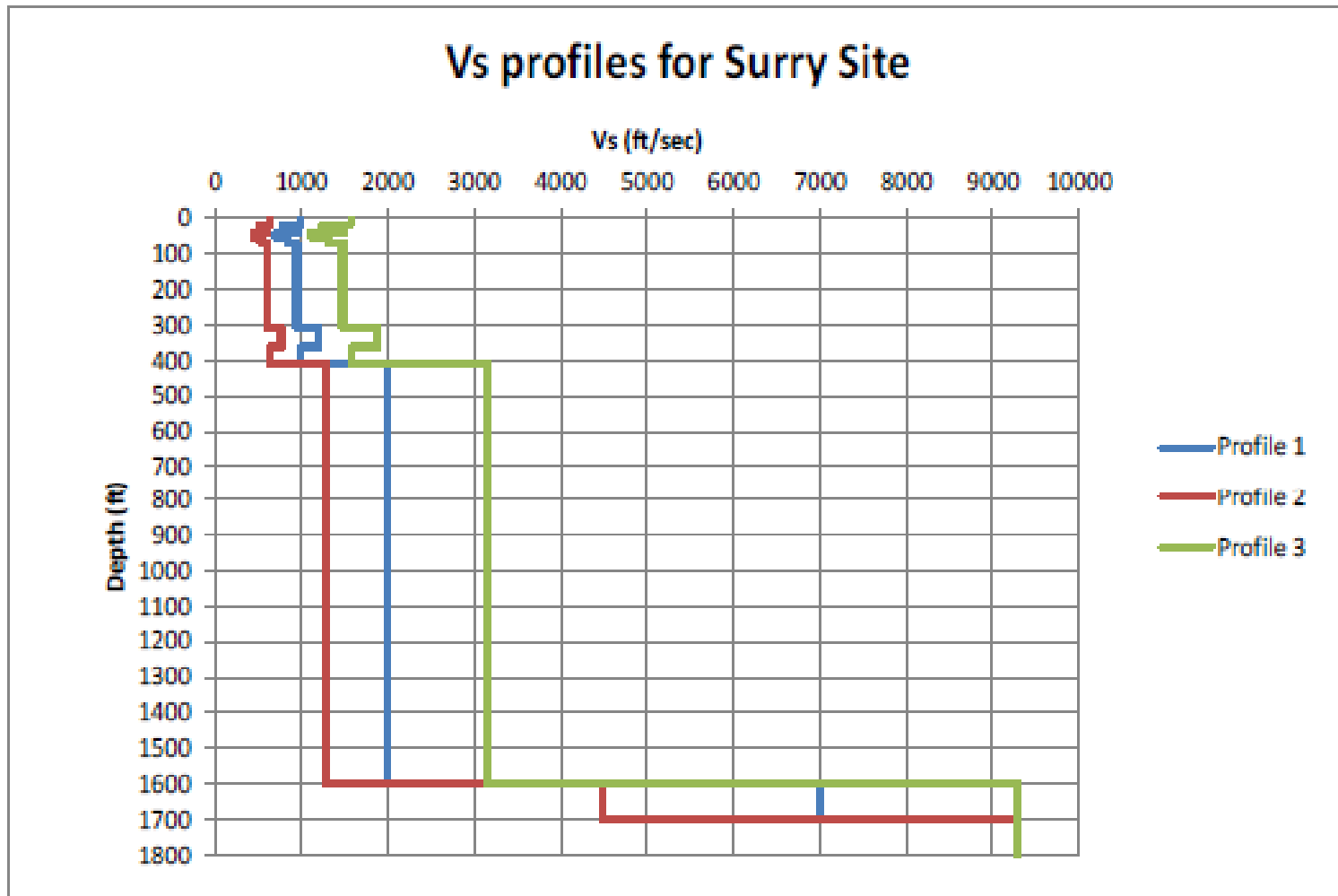
Depth Range (feet)	Soil Description	Density (pcf)	Shear Wave Velocity, Vs (fps)
0 (El. 26.5)	<b>Emergency Condensate Storage Tank</b>	---	---
0 (El. 26.5)	<b>SSE Control Point Elevation</b>	---	---
0-16	Compacted Granular Fill to 95% Modified (ASTM D1557)	130 <sup>(1)</sup>	1000 <sup>(1)</sup>
16-27	Pleistocene Upper Clay	94	790
27-40	Pleistocene Sand A	99	950
40-52	Pleistocene Lower Medium Clay	84	710
52-67	Pleistocene Sand B	102	830
67 (El. -41)	<b>Containment Foundation</b>	---	---
67-96	Miocene Chesapeake dark blue to gray Clay, shell Marl	87	940
96 (El. -70)	<b>Pile tips below Spent Fuel Pool, Main Steam Valve House, and Refueling Water Storage Tank</b>	---	---
67-307	Miocene Chesapeake dark blue to gray Clay, shell Marl	87	940
307-362	Eocene gray Marl, Glauconitic and Quart Sand, Pyritic Marl, Limestone beds	120 <sup>(2)</sup>	1200 <sup>(2)</sup>
362-407	Paleocene Mattaponi mottled Clay, Glauconitic Sand and Marl, Quartz Sand	130 <sup>(2)</sup>	1000 <sup>(2)</sup>
407-1600	Cretaceous Potomac Group Sand and Clay beds	140 <sup>(2)</sup>	2000 <sup>(2)</sup>
1600 - 1700	Crystalline Igneous and Metamorphic Rock	160 <sup>(2)</sup>	7000 <sup>(2)</sup>
1700+ <sup>(2)</sup>	"Hard Rock" - Crystalline Igneous and Metamorphic Rock	170 <sup>(2)</sup>	9200 <sup>(2) (3)</sup>

<sup>(1)</sup> Estimated; considered typical for compacted granular fill material.

<sup>(2)</sup> Rough estimates / Approximation for analysis purposes; no data readily available.

<sup>(3)</sup> Definition of Hard Rock Position C, Section 4 in Reference 7.8.

# Vs Profiles





# Calculation of Kappa

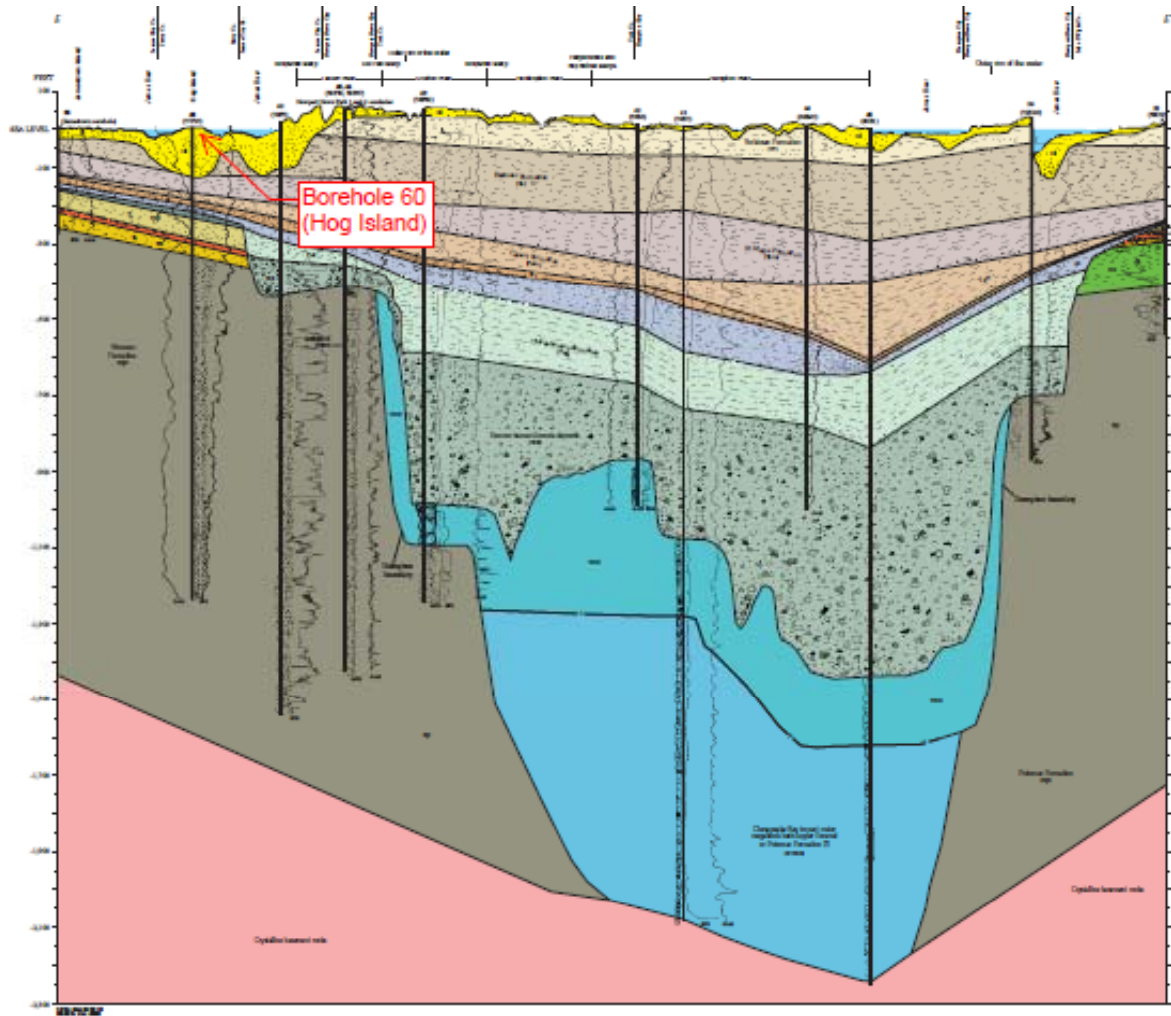
- Basis For Estimate of Total Effective Kappa
  - $Kappa = 0.034s$  based on SPID Appendix B.5.1.3.1 guidance for soil site with  $<3,000$  ft depth to hard rock
  - Contributions from soil ( $\approx 1,600$  ft) plus underlying hard rock
  - Soil contribution from empirical relation based on soil depth
  - Hard rock contribution  $0.006s$

# Depth to Hard Rock

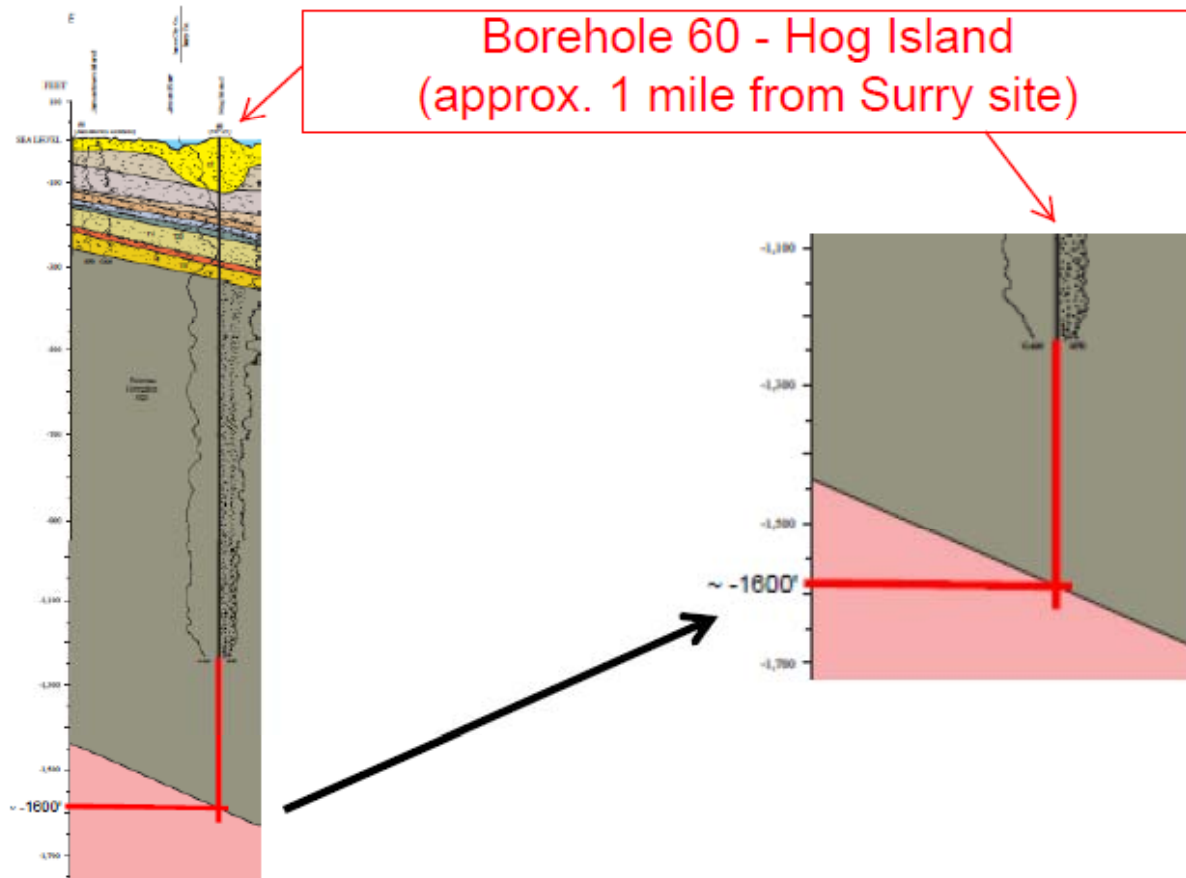
- Surry Screening Report: ‘Hard rock’ (i.e., shear wave velocity,  $V_s$ , >9200 ft/sec) elevation reported as -1700’
- Based on review of USGS Professional Paper No. 1612 (Feb 22, 2000)<sup>1</sup>
- Extrapolation of borehole 60 (Hog Island) [Plate 4] – indicates ‘crystalline basement rocks’ reached at approximately -1600’
- Additional 100’ depth to  $V_s=9200$  ft/sec was assumed in order to account for likely weathering effects during the period the Potomac formation was being deposited

<sup>1</sup> USGS Professional Paper No. 1612, [The Effects of the Chesapeake Bay Impact Crater on the Geological Framework and Correlation of Hydrogeologic Units of the Lower York-James Peninsula, Virginia.](#)

# Depth to Hard Rock



# Depth to Hard Rock



# Summary

- Surry GMRS and screening results developed based on the NRC-endorsed EPRI SPID Guidance
- Surry Vs profiles are based on site-specific data and developed consistent with SPID
- Surry site kappa value consistent with SPID Appendix B methodology
- Surry site depth to hard rock is based on a reasonable interpretation of available data

# Conclusion

- Surry GMRS and screening results are consistent with industry guidance
- Surry screens out from performance of further seismic risk assessment, high frequency confirmation, and spent fuel pool evaluation
- Expedited Seismic Evaluation Process (ESEP) is not required per the Augmented Approach guidance (EPRI 3002000704)

## Millstone Unit 2

- The Millstone Unit 2 GMRS and screening submittal provided the screening results based on comparison of the GMRS to the IPEEE HCLPF spectrum (IHS) per the SPID guidance
- NRC has drafted two requests for additional information related to the Millstone Unit 2 submittal
- Dominion has reviewed these requests and is providing information for discussion

## Millstone Unit 2

- Request 1
  - In the IPEEE adequacy review supporting IHS screening, HCLPF capacity calculations could not be located for resolution of two items: (1) Battery Racks DB1 and DB2, and (2) Chilled Water Surge Tank. The submittal indicates that calculations were subsequently reconstituted for these components with acceptable results.
  - Provide a detailed description of the methods and inputs for the evaluation of the battery racks and chilled water surge tank performed for the submittal
  - Provide a detailed description of any modifications to these components performed to support the reconstitution of the calculations



# Millstone Unit 2

- Request 1 Discussion
  - The calculations were reconstituted for these components to resolve comments from the IPEEE adequacy review.
  - The methods used in these two recent calculations are consistent with the Seismic Margin Assessment (SMA) methodology in EPRI NP-6041 SL, Rev. 1 and were independently reviewed. The capacities of both items are >0.25g, therefore plant HCLPF remains unchanged.
  - There were no new modifications to improve the HCLPF of the battery racks or the chilled water surge tank components after the IPEEE submittal and closure of IPEEE open issues.

## Millstone Unit 2

- Request 2
  - The Millstone Unit 2 IPEEE submittal included “Opportunities for Safety Enhancements” and identified valve 2-CHW-11 as an item to be resolved. This air operated valve has a heavy yoke that is independently braced.
  - Provide a detailed description of how this item was resolved and its safety significance related to the plant HCLPF of 0.25g

## Millstone Unit 2

- Request 2 Discussion
  - The vital chilled water system (CHW) provides chilled water for the DC Switchgear Room HVAC system, which is a support system. Valve 2-CHW-11 provides isolation from the non-seismic portion of the system.
  - The CHW system is a two-train system and failure of 2-CHW-11 only affects one train. The room cooling support function is maintained by the redundant train. Therefore, valve 2-CHW-11 has low safety significance.
  - Valve 2-CHW-11 is top-braced at the valve actuator. The top bracing, and pipe supports in the vicinity of the valve, are anchored to the same structure and stresses due to differential displacement are minimal.
  - The valve was analyzed in this configuration and confirmed to meet the design basis requirements as part of the USI A-46 program.