

May 21, 2014

MEMORANDUM TO: David Skeen, Director  
Japan Lessons Learned Project Directorate  
Office of Nuclear Reactor Regulation

FROM: Scott C. Flanders, Director */RA/*  
Division of Site Safety and Environmental Analysis  
Office of New Reactors

SUBJECT: SUPPORT DOCUMENT FOR SCREENING AND  
PRIORITIZATION RESULTS REGARDING SEISMIC  
HAZARD RE-EVALUATIONS FOR OPERATING  
REACTORS IN THE CENTRAL AND EASTERN  
UNITED STATES

By letter dated May 9, 2014<sup>1</sup>, from Eric J. Leeds, Director of the Office of Nuclear Reactor Regulation (NRR), the Nuclear Regulatory Commission (NRC) staff notified licensees for operating nuclear power reactors in the central and eastern United States (CEUS) of the results of screening and prioritization evaluations and the interim evaluations performed by the NRC staff related to the re-evaluation of seismic hazards. The seismic hazard re-evaluations were performed by the licensees in response to a request for information dated March 12, 2012, which was issued pursuant to Section 50.54(f) of Title 10 of the *Code of Federal Regulations* (10 CFR 50.54(f)). This memorandum provides the preliminary graphs used by the NRC staff during the 30-day time period to identify and prioritize the plants that would perform a risk evaluation. The staff used these preliminary graphs and other information to make the determination. The information in this memorandum should be used in conjunction with the information in the May 9, 2014, letter.

For some plants, the re-evaluated seismic hazard is larger than the current design basis. It is important to note that the re-evaluated seismic hazard, as represented by the ground motion response spectra (GMRS), only represents the hazard (ground shaking) and not the plant's capacity to withstand the shaking. The risk posed to the public from a nuclear power plant due to a seismic event is a function of not only the ground motion estimates but also the plant's design and construction. For plants where the GMRS is higher than the design basis, the licensee performed an interim evaluation, based on available plant capacity information and the re-evaluated seismic hazard, to demonstrate that the seismic risk is acceptably low to allow for continued operation while the Expedited Approach<sup>2</sup> and full plant risk evaluations are in progress. As stated in the May 9, 2014, letter the staff concluded that operation of nuclear plants could continue while additional plant evaluations are being conducted.

For performing its independent evaluation, the NRC staff used information from the final safety analysis reports, previous submittals from licensees, as well as outside sources of information

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<sup>1</sup> The May 9, 2014, NRC letter is found in ADAMS under Accession No. ML14111A147.

<sup>2</sup> The NRC-endorsed industry Expedited Approach guidance document is found in ADAMS under Accession No. ML13102A142.

from state geologic surveys and published literature, and its own technical judgment to develop the staff's estimated GMRS curve for each plant site. As expected, the NRC staff GMRS curves sometimes differ from those calculated by licensees and in some cases led to different preliminary conclusions as to whether the re-evaluated seismic hazard exceeds a plant's design basis values. These are the cases described in the May 9, 2014, letter as plants that are "conditionally screened in" for further evaluation.

As described in the letter dated May 9, 2014, the licensees' responses to the request for information were also used to prioritize a licensee's future submittal of a plant risk evaluation. For the prioritization, the staff considered certain key parameters such as (1) the maximum ratio of the re-evaluated hazard (GMRS) to the safe shutdown earthquake (SSE) in the 1-10 Hertz (Hz) range; (2) the maximum ground motion in the 1-10 Hz range; and (3) insights from previous risk evaluations. The frequency range from 1-10 Hz is the focus for this portion of the risk evaluation, as this range has the greatest potential effect on the performance of equipment and structures important to safety. Group 1 plants are generally those that have the highest re-evaluated hazard relative to the original plant seismic design basis (GMRS to SSE) as well as ground motions in the 1-10Hz range that are generally higher in absolute magnitude. Group 1 plants are expected to conduct a seismic risk evaluation and submit it by June 30, 2017. Group 2 plants are also expected to conduct a seismic risk evaluation, which should be submitted by December 31, 2019. Group 3 plants have GMRS to SSE ratios that are greater than 1, but the amount of exceedance in the 1-10 Hz range is relatively small, and the maximum ground motion in the 1-10Hz range is also not high. Given the limited level of exceedance of the Group 3 plants, staff is evaluating the need for licensees to conduct a seismic risk evaluation in order for the staff to complete its regulatory decision making. However, the staff has had insufficient review time with the recently submitted seismic hazard submittals to reach a conclusion. For those cases where the re-evaluated seismic hazard is bounded by the safe shutdown earthquake for a specific plant, no additional analyses need be performed.

For plants where the re-evaluated hazard is greater than the SSE, licensees will use the NRC-approved industry guidance to perform an evaluation called the "Expedited Approach," as described in the April 2013 letter from the Nuclear Energy Institute (NEI). The Expedited Approach is a near-term licensee evaluation to be completed by December 31, 2014, to look at certain equipment needed to ensure that a safe shutdown pathway can withstand a higher seismic ground motion under conditions of a station blackout (i.e., no alternating current power is available) and loss of ultimate heat sink.

Following the issuance of the May 9, 2014, letter various internal and external stakeholders have requested further explanation of the NRC staff's seismic hazard evaluation. This is especially true for those cases where the NRC staff's evaluation resulted in a plant being "conditionally screened in." The easiest way to explain the screening results, including differences between a licensee's analysis and the preliminary NRC staff assessment, is by discussing the enclosed preliminary graphical representations of the various estimates of seismic hazards for each site in public interactions with licensees and other stakeholders. Each graph includes the licensee's GMRS or seismic hazard curve that was provided in their response to the request for information. In addition, the licensees' submittals included the SSE or in some cases a plant seismic capacity demonstrated from the licensee's response to the Individual Plant Examination of External Events (IPEEE) evaluations. In accordance with the Industry's Screening, Prioritization and Implementation Details (SPID) document<sup>3</sup>, licensees

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<sup>3</sup> The SPID document is found in ADAMS ML12333A170. The staff endorsement letter is ADAMS ML12319A074.

could demonstrate that their plant capacity results from the IPEEE were adequate for the screening evaluation rather than the plant SSE. These seismic plant capacity curves are included as the "IHS" (IPEEE HCLPF (High Confidence Low Probability of Failure) spectra) for those licensees that attempted to apply their IPEEE results for screening purposes.

A review of the preliminary graphs, with particular focus on the 1-10 Hz region, for the different plants makes it easier to understand the groupings described in the May 9, 2014 letter. In addition, the differences shown in the graphs between some licensee and NRC staff estimated GMRS curves make clearer the discussions of those plants that conditionally screen in. Now that the screening and preliminary prioritization is complete, the staff is scheduling public meetings with licensees to discuss and understand the differences. For these public meetings, which are being scheduled for June 2014 (to the extent practical), the staff is giving priority to licensees with plants that are conditionally screened in or that were screened differently by the staff than the licensee.

The screening and prioritization that resulted in the May 9, 2014, letter to industry was a substantial accomplishment but was only the first step in the overall process. The next steps for the staff include:

- Continue the review of the March 2014 seismic hazard submittals, and issue staff assessments over the next 12 to 18 months;
- Engage licensees by the end of June 2014 whose sites were conditionally screened in or screened differently based on the NRC staff's estimated GMRS;
- Engage licensees performing further evaluations (including the Expedited Approach) whose GMRS differ substantially from the staff's results; and
- Engage industry to discuss the scope and level of detail for the Expedited Approach submittals due to the NRC in December 2014.

The graphs included as an enclosure to this memorandum are intended to provide a visual representation of the estimated seismic hazards in order to assist in further dialogue with public and industry stakeholders.

Enclosure:

Preliminary ground motion response spectra (GMRS) comparison plots

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Preliminary ground motion response spectra (GMRS) comparison plots

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**ADAMS Accession No.: ML14136A126, Pkg. No.ML14141A516**

**NRO-002**

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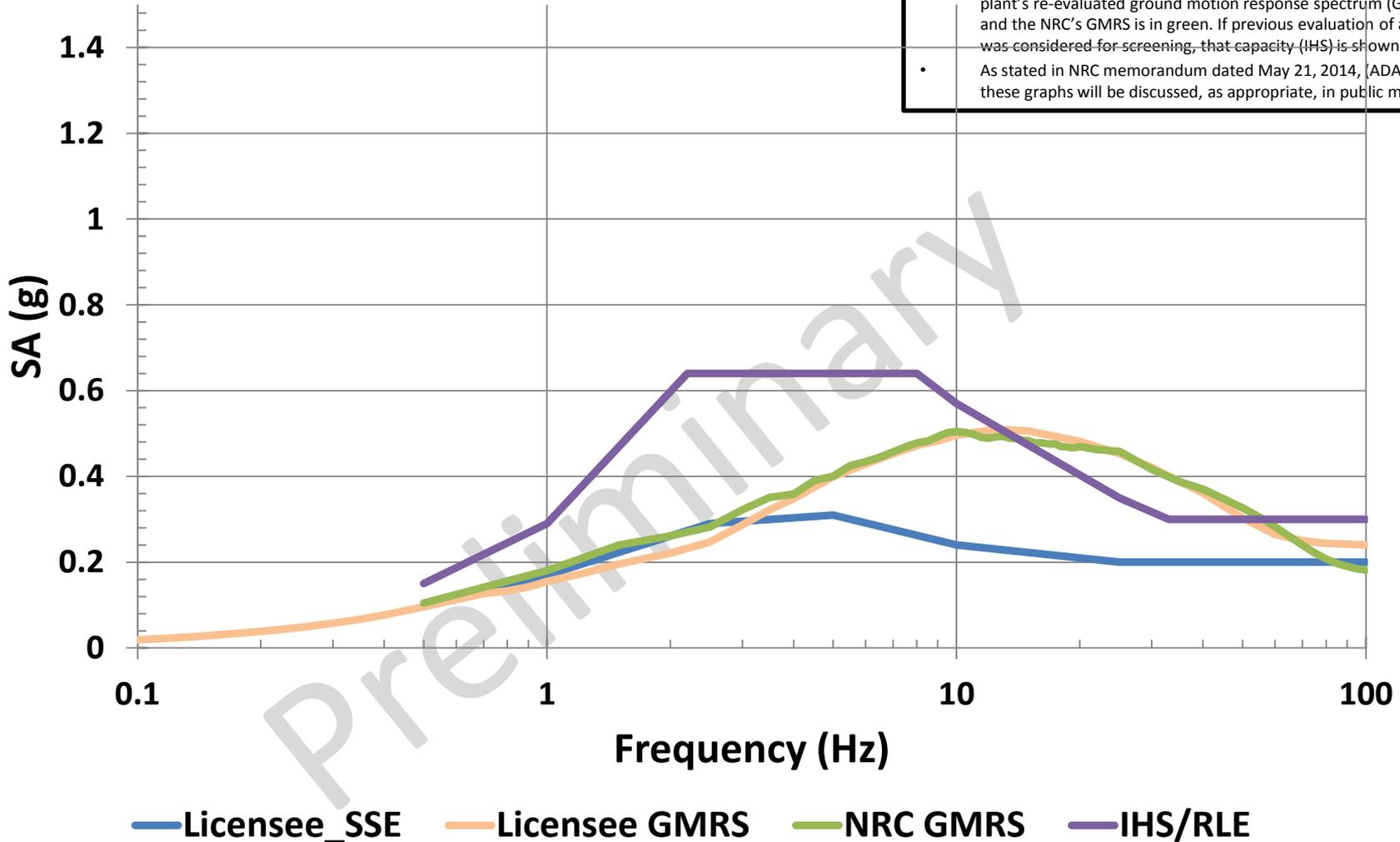
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# R2.1 Preliminary GMRS Comparisons

5/07/2014

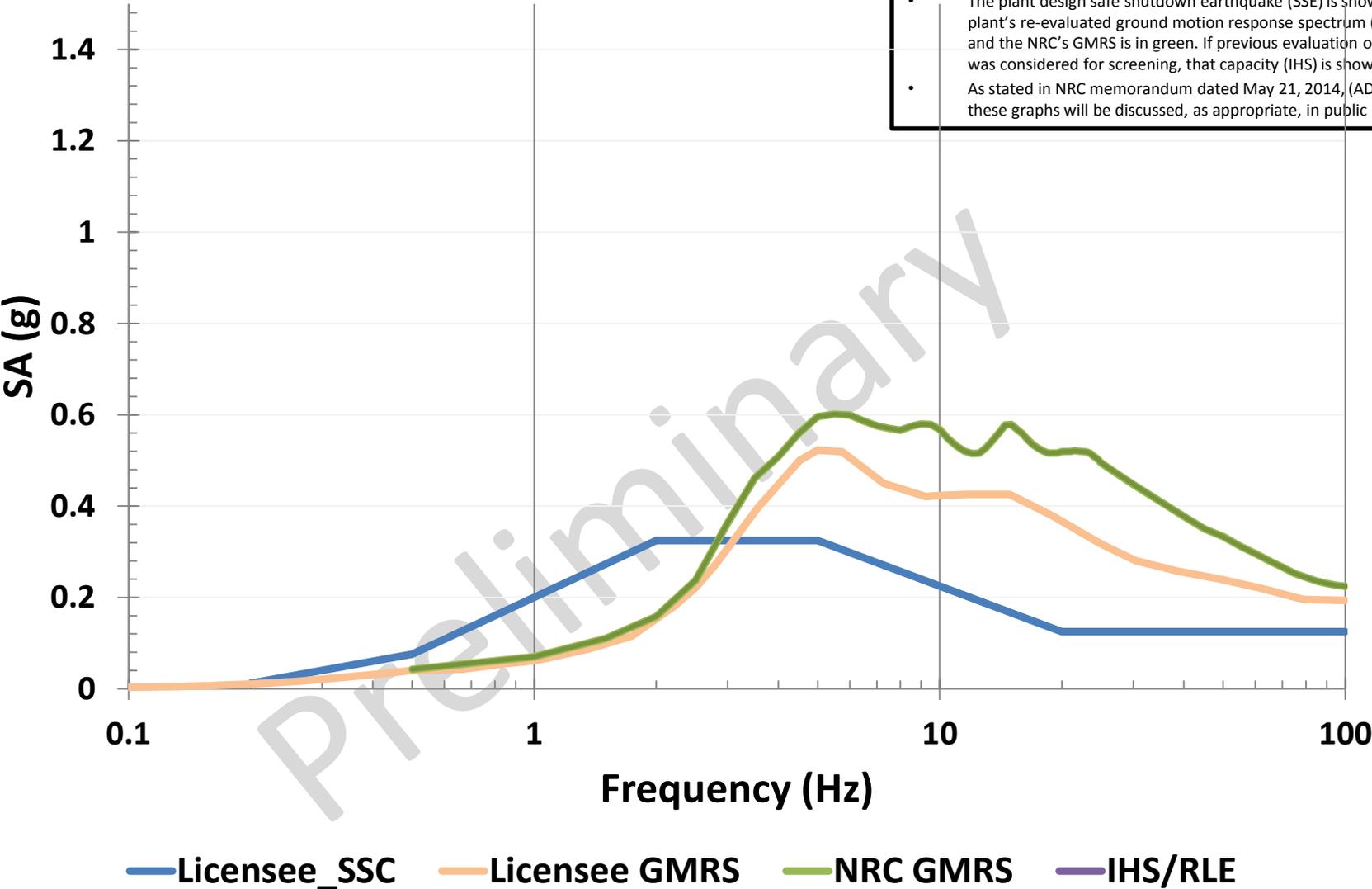
# Arkansas

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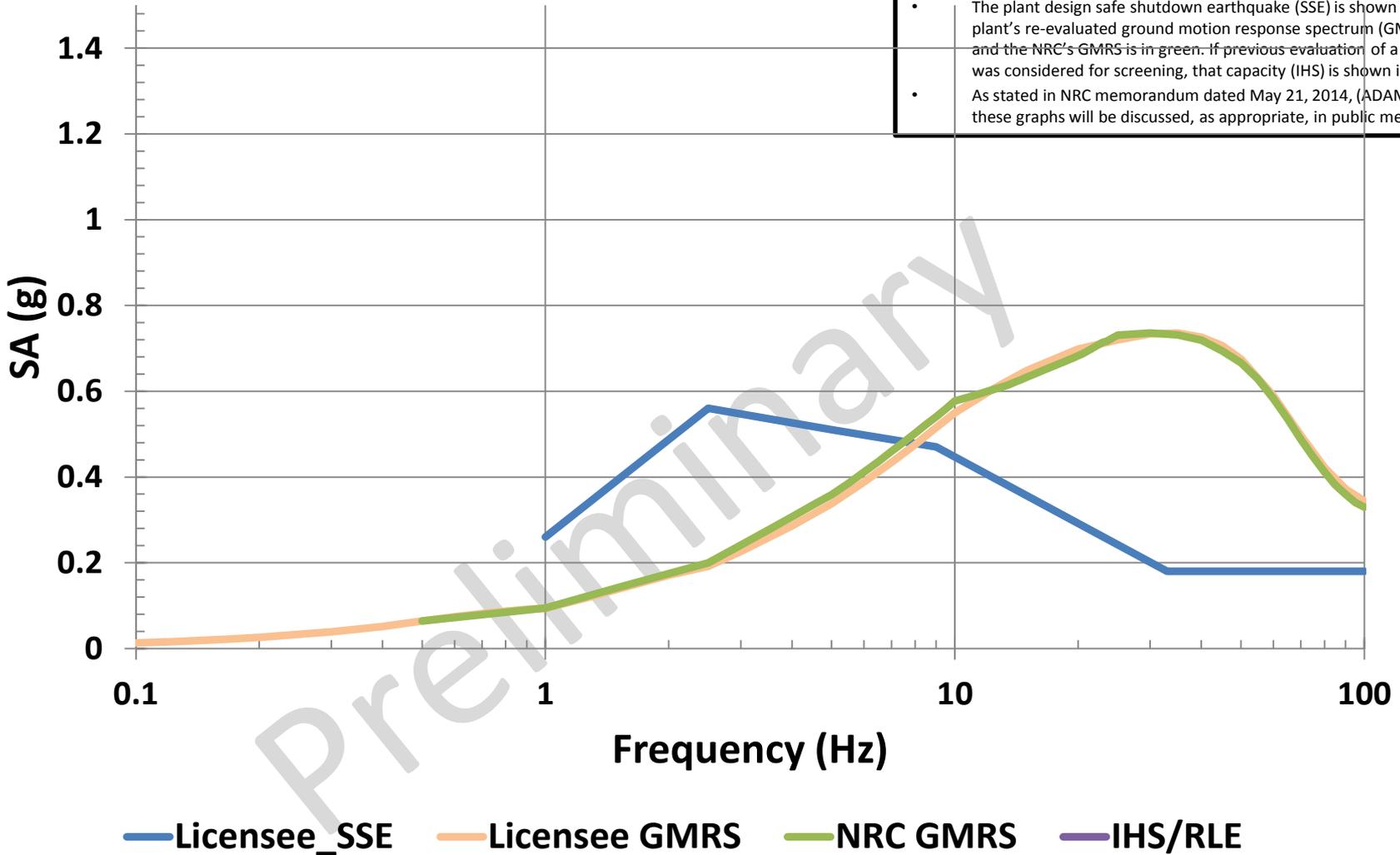
# Beaver Valley

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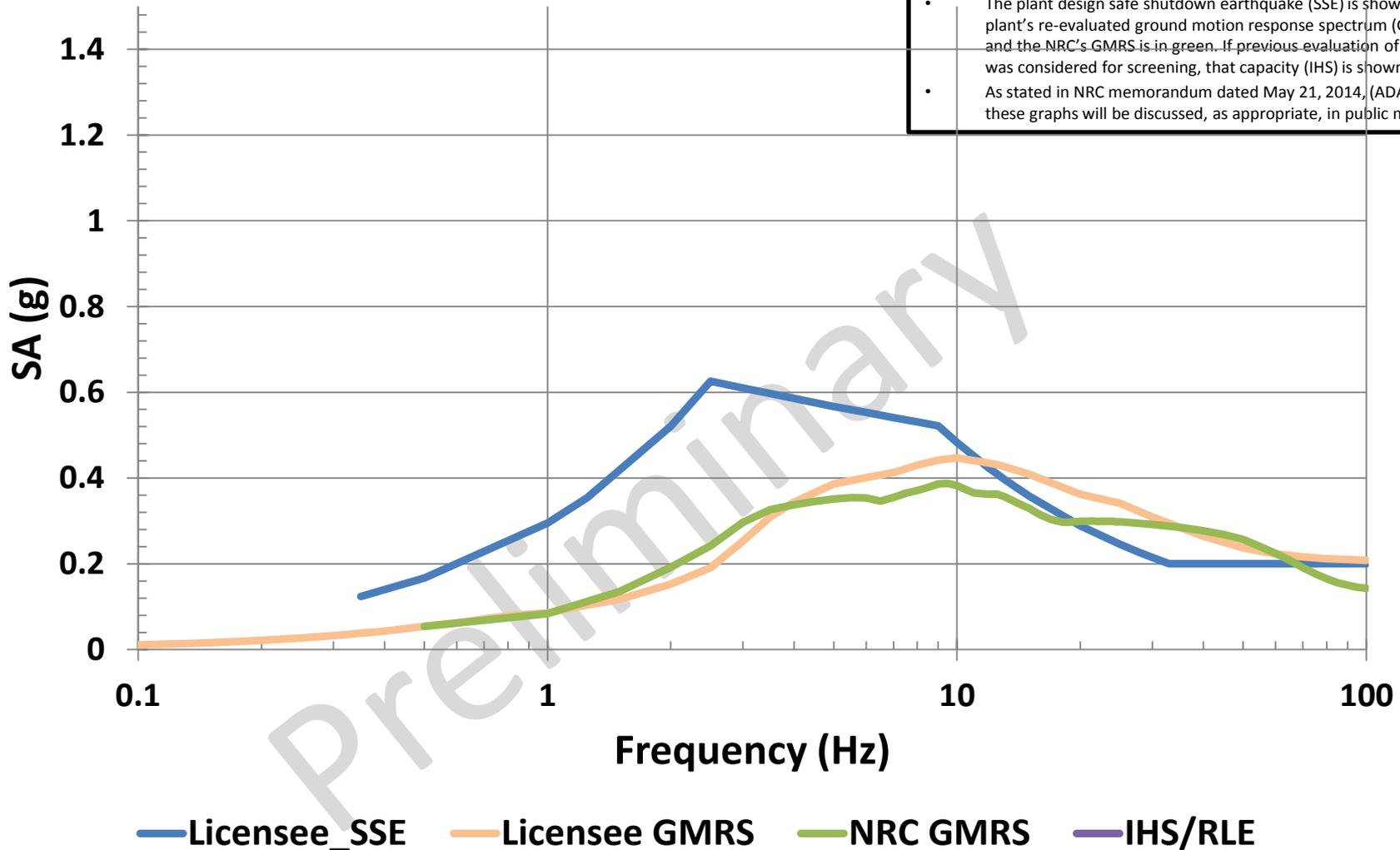
# Bellefonte

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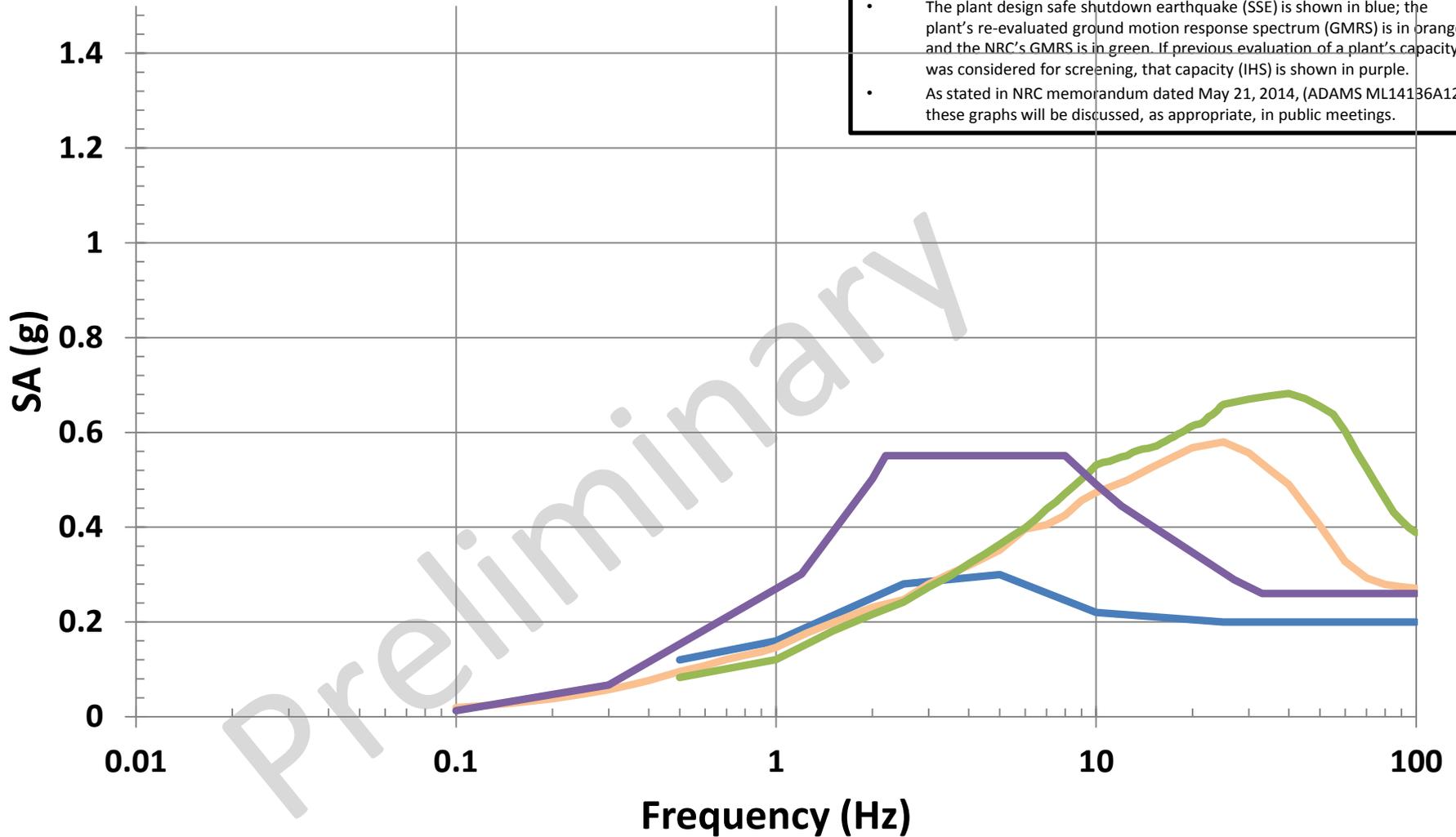
# Braidwood

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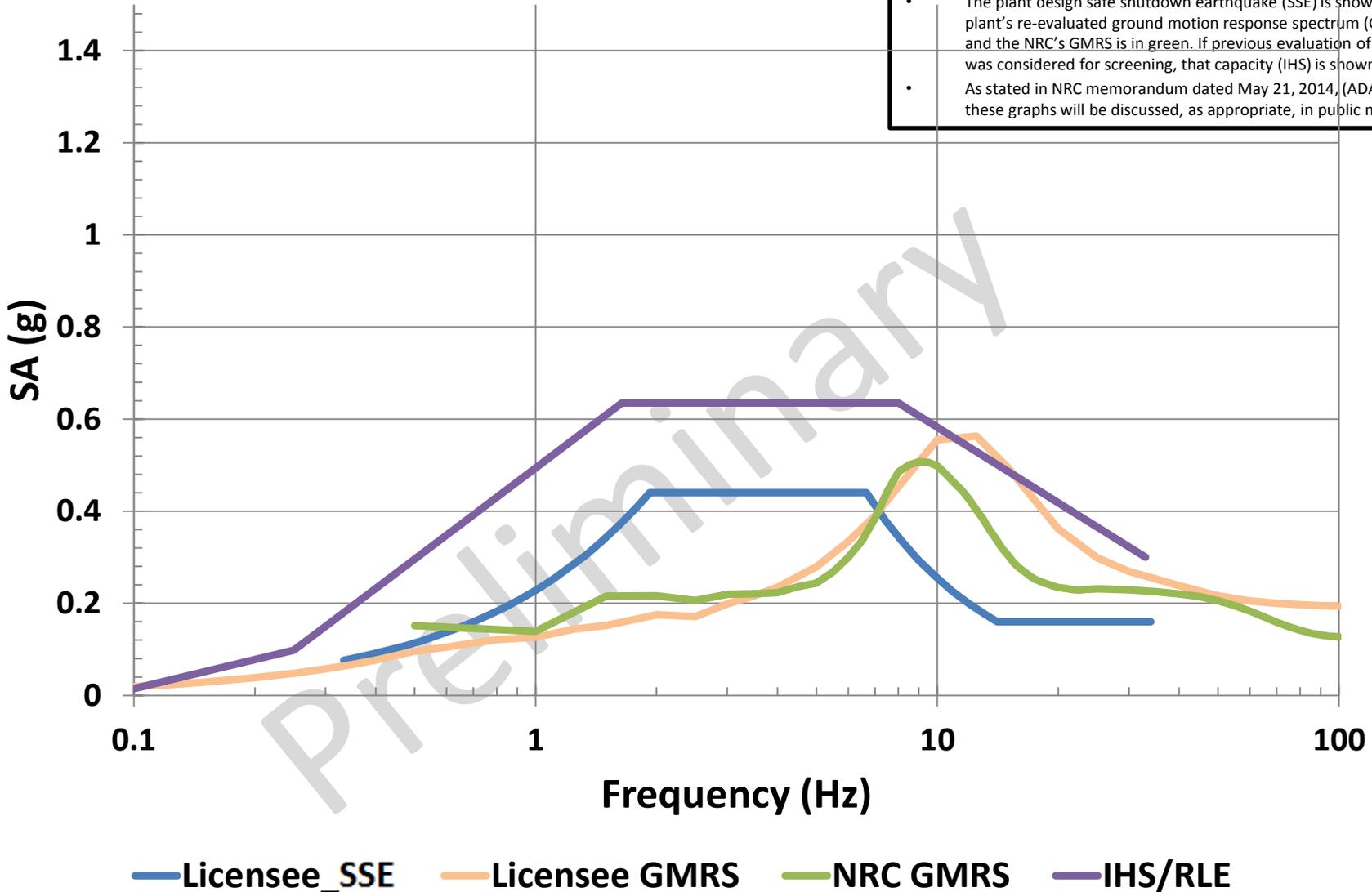
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Licensee\_SSE Licensee GMRS NRC GMRS IHS/RLE

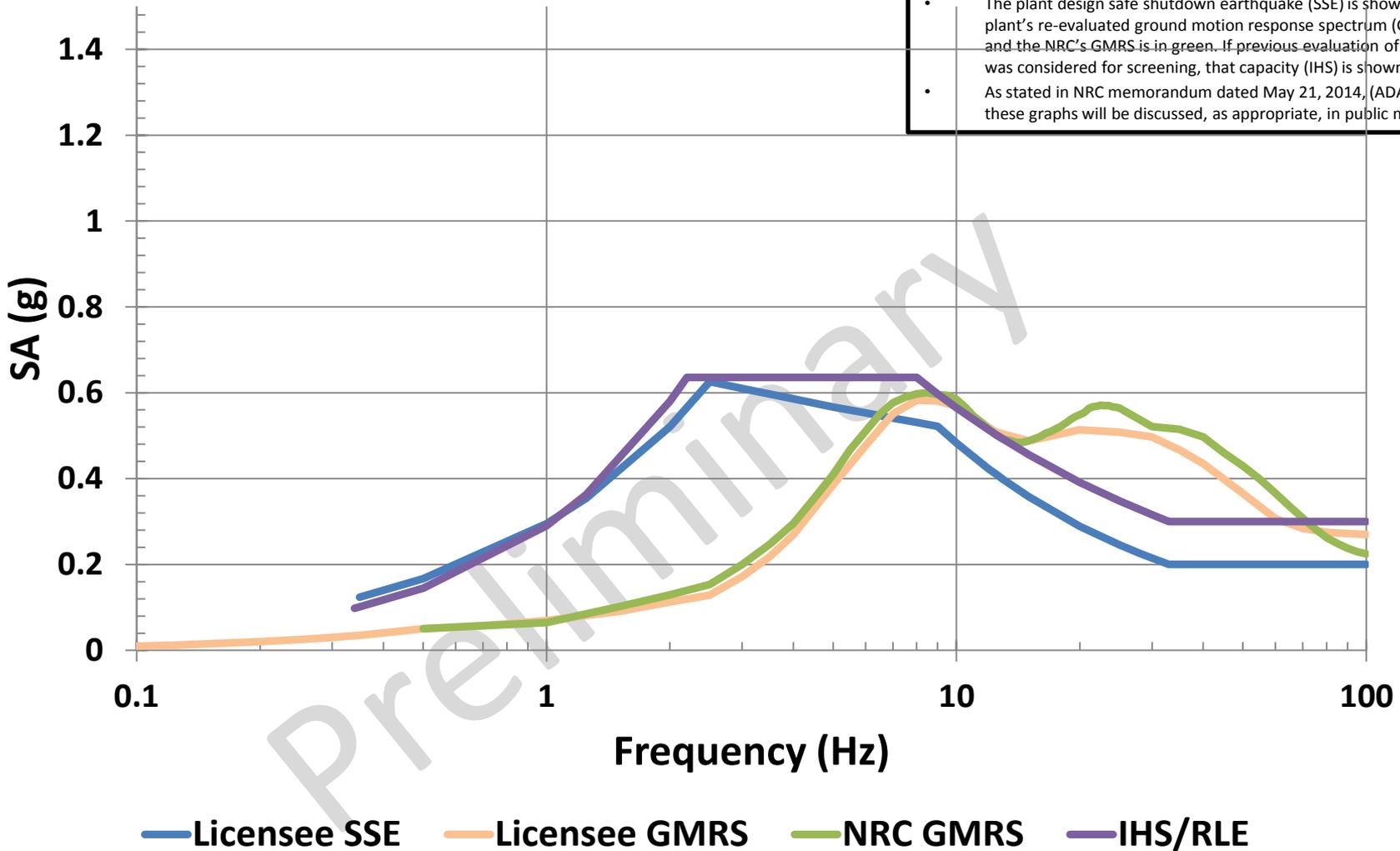
# Brunswick

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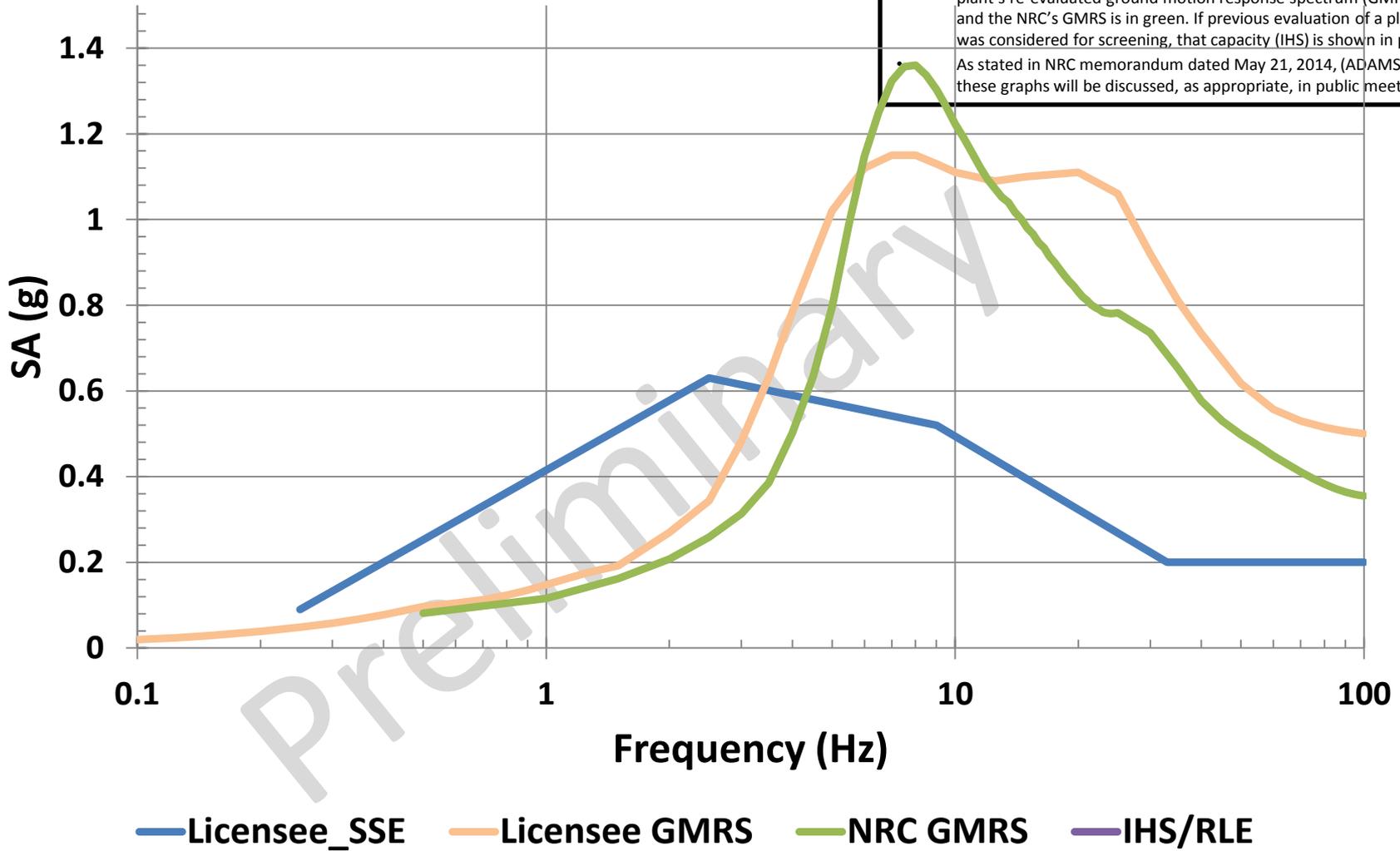
# Byron

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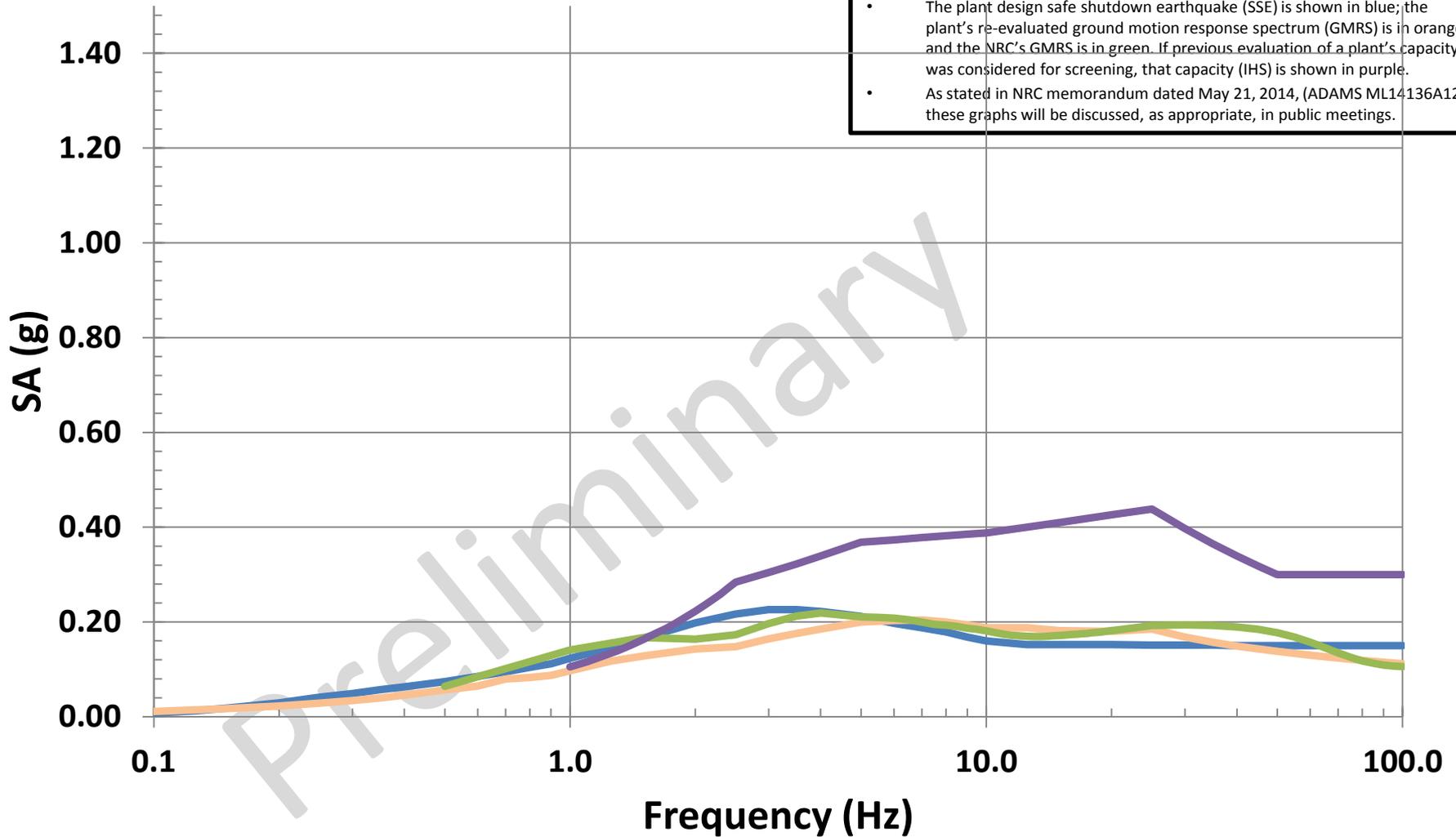
# Callaway

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# Calvert Cliffs

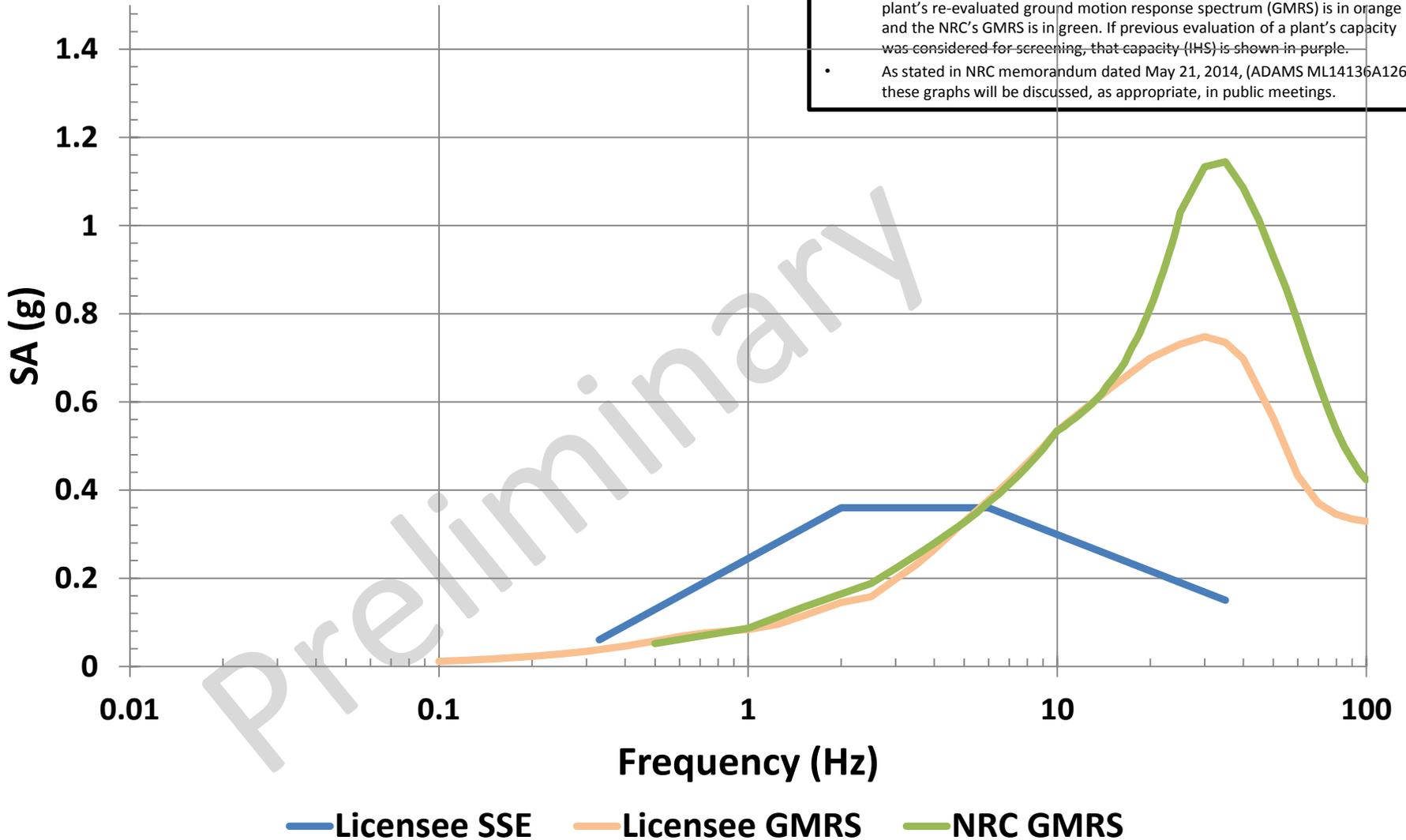
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— Licensee\_SSE — Licensee GMRS — NRC GMRS — IHS/RLE

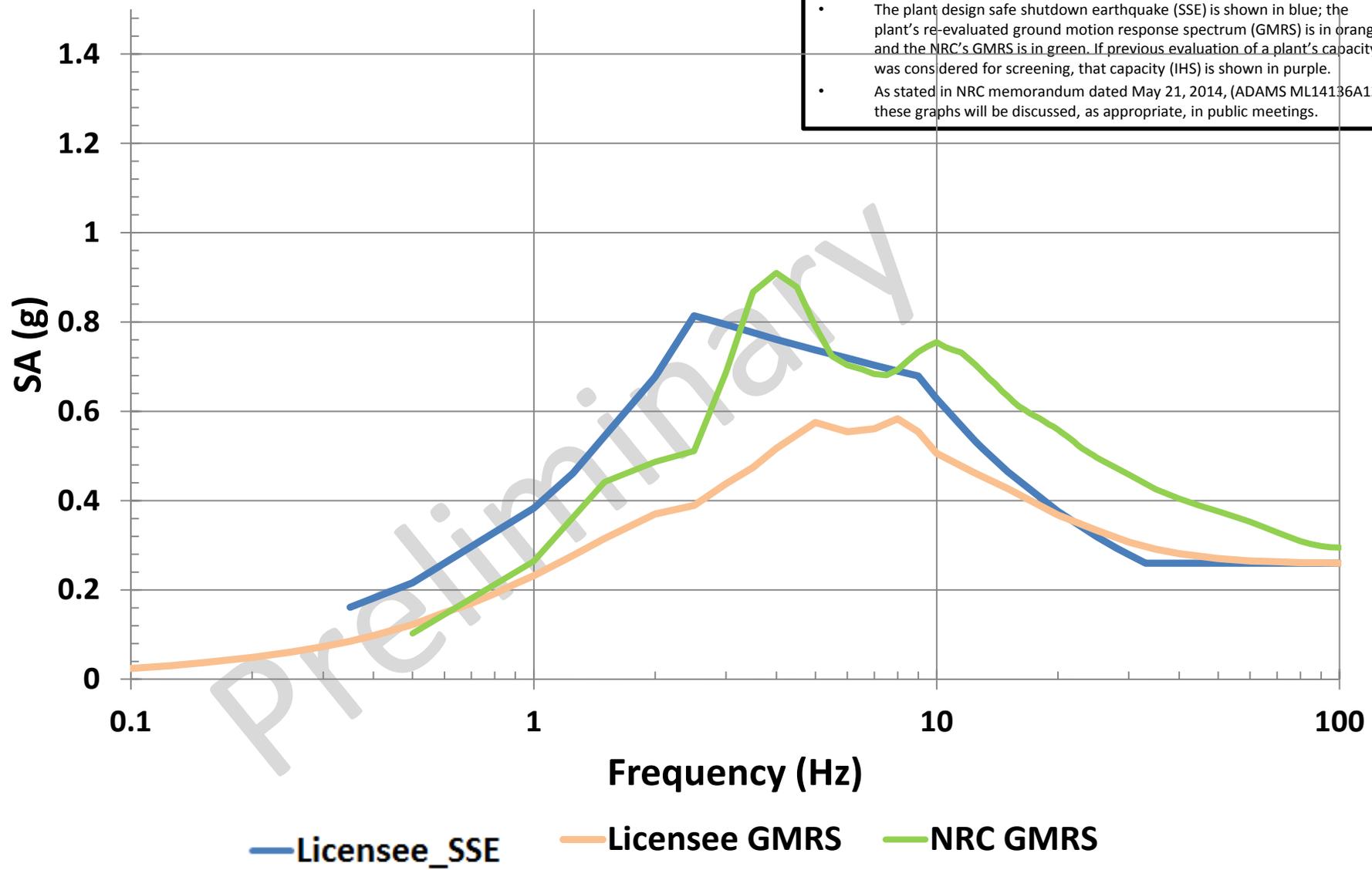
# Catawba Units 1 & 2

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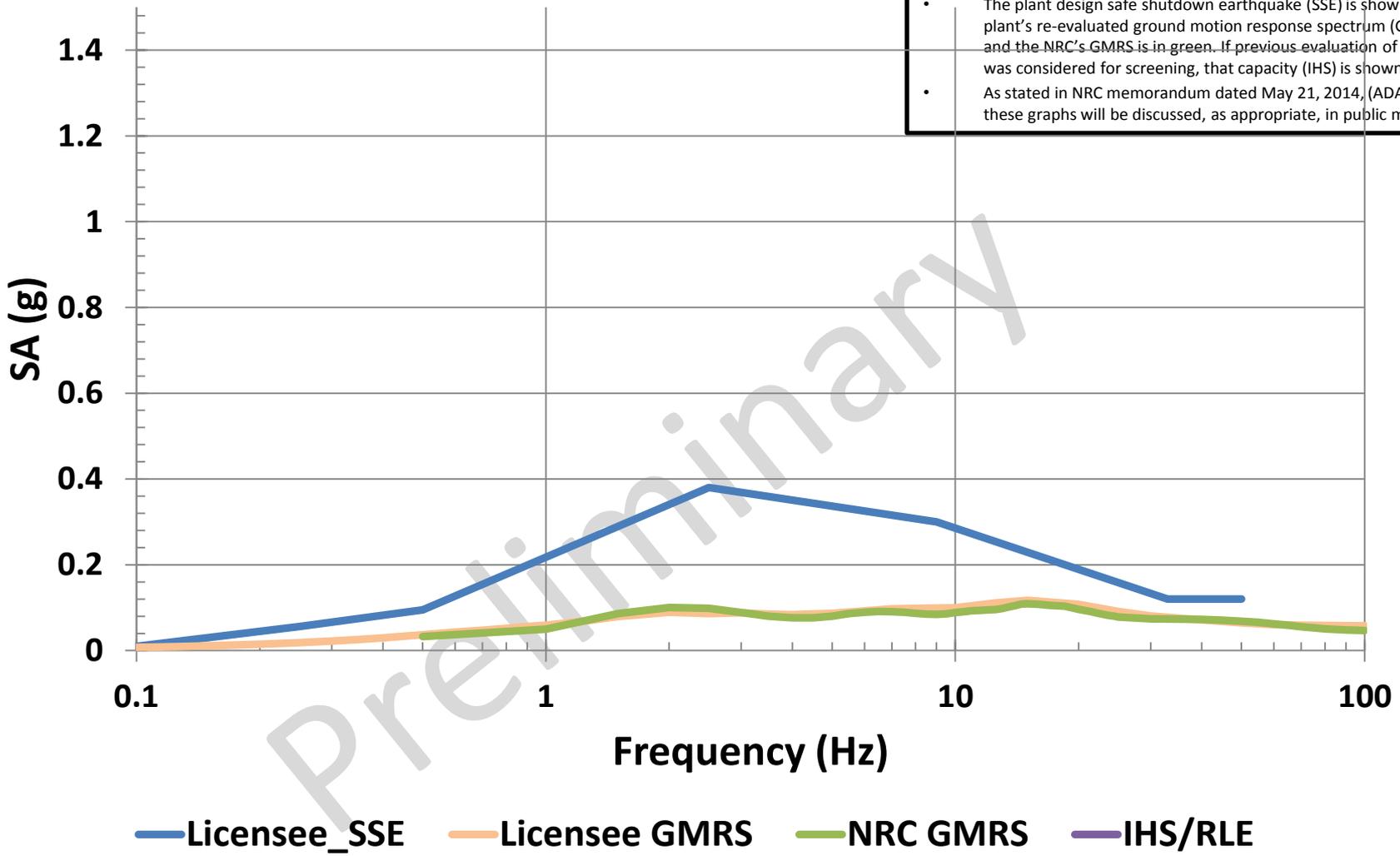
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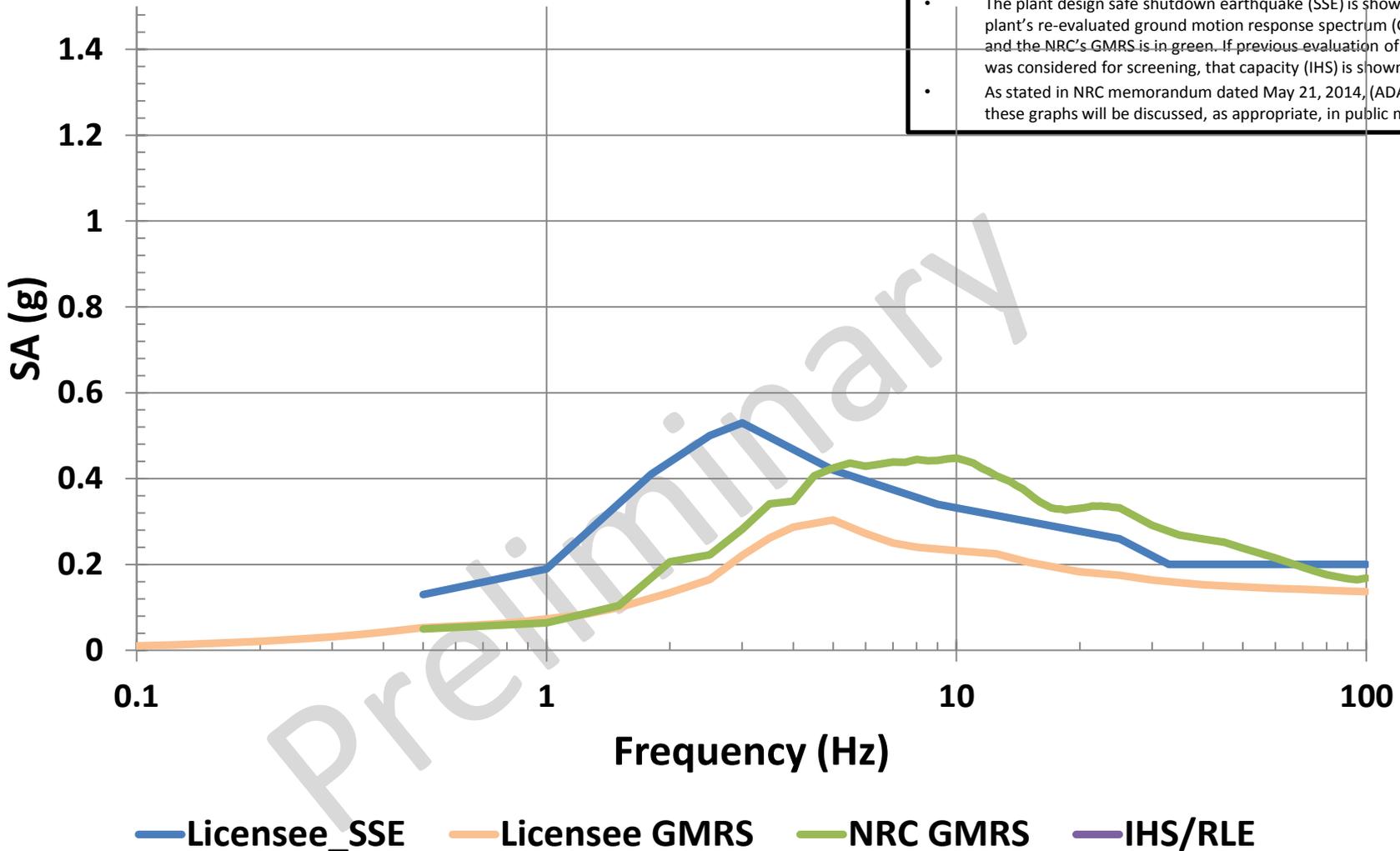
# Comanche Peak

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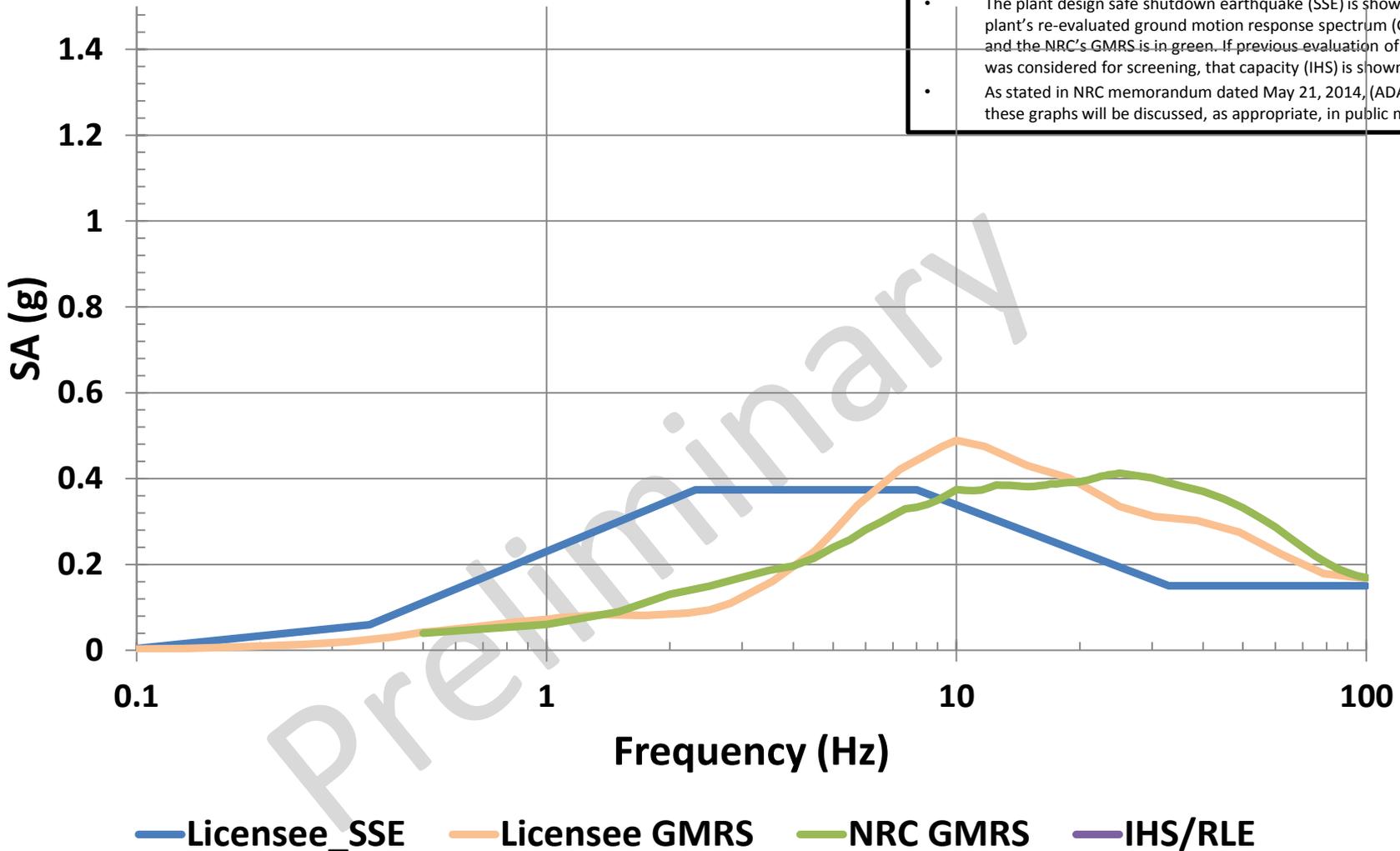
# Cooper

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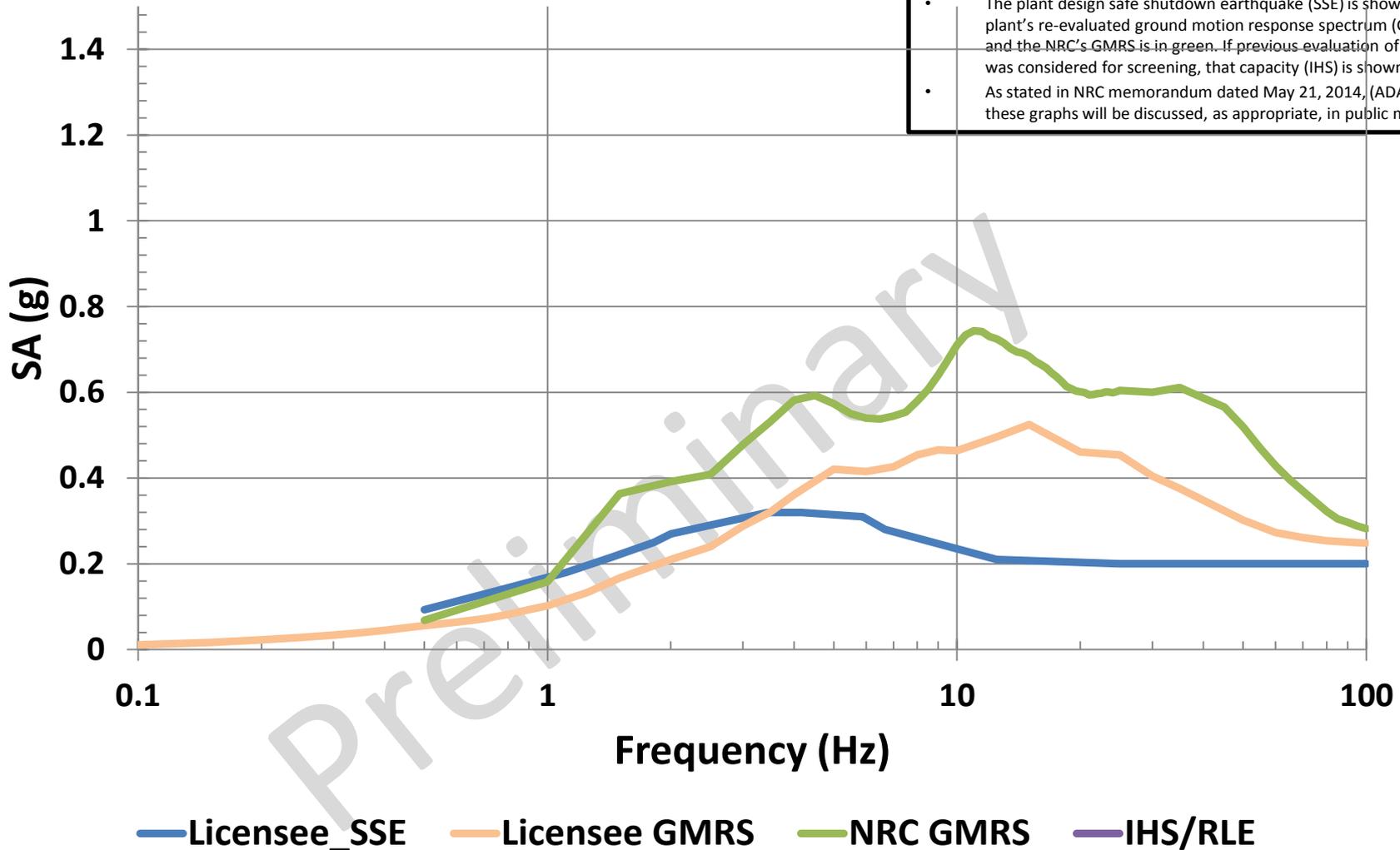
# Davis Besse

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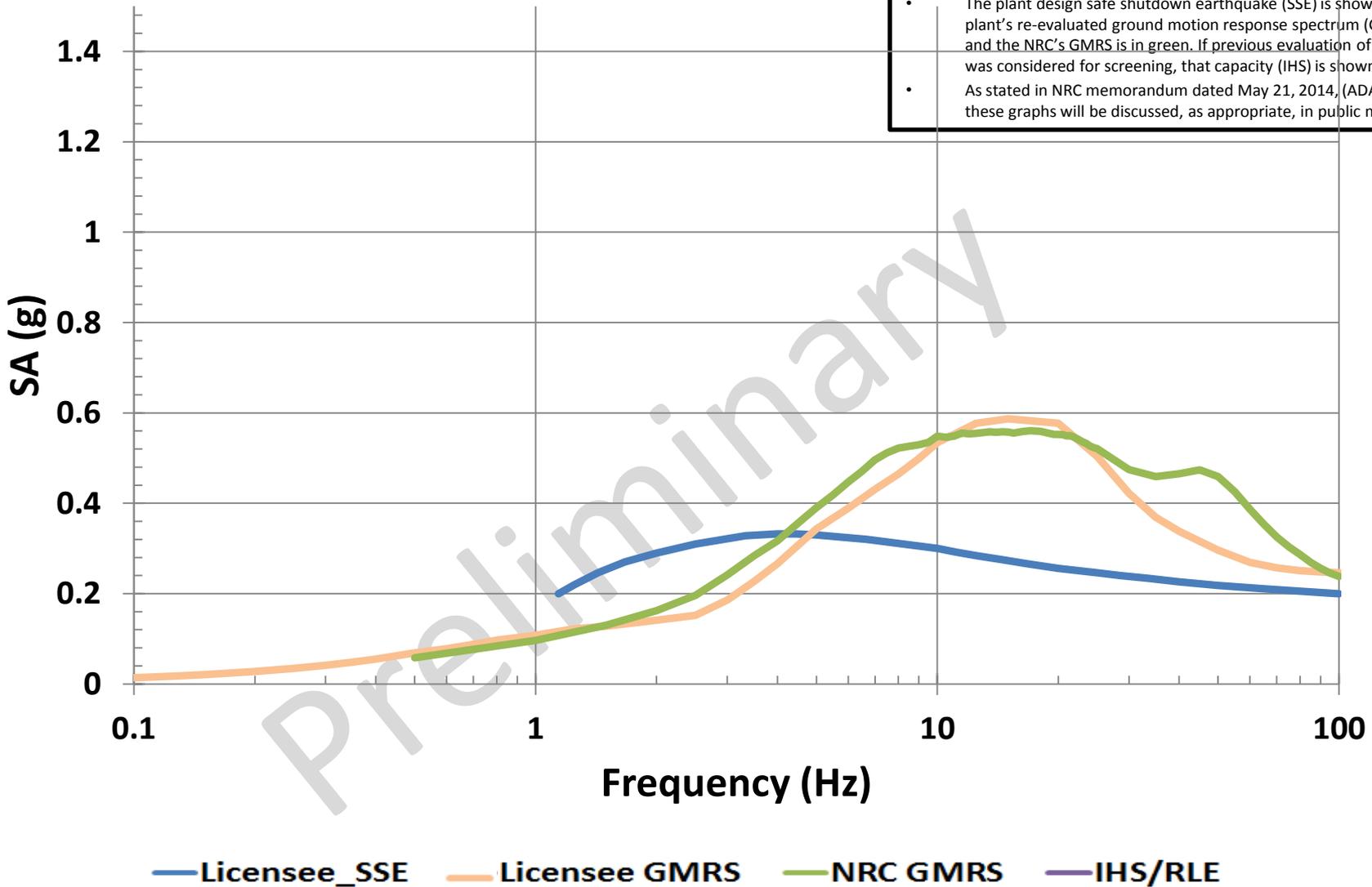
# DC Cook

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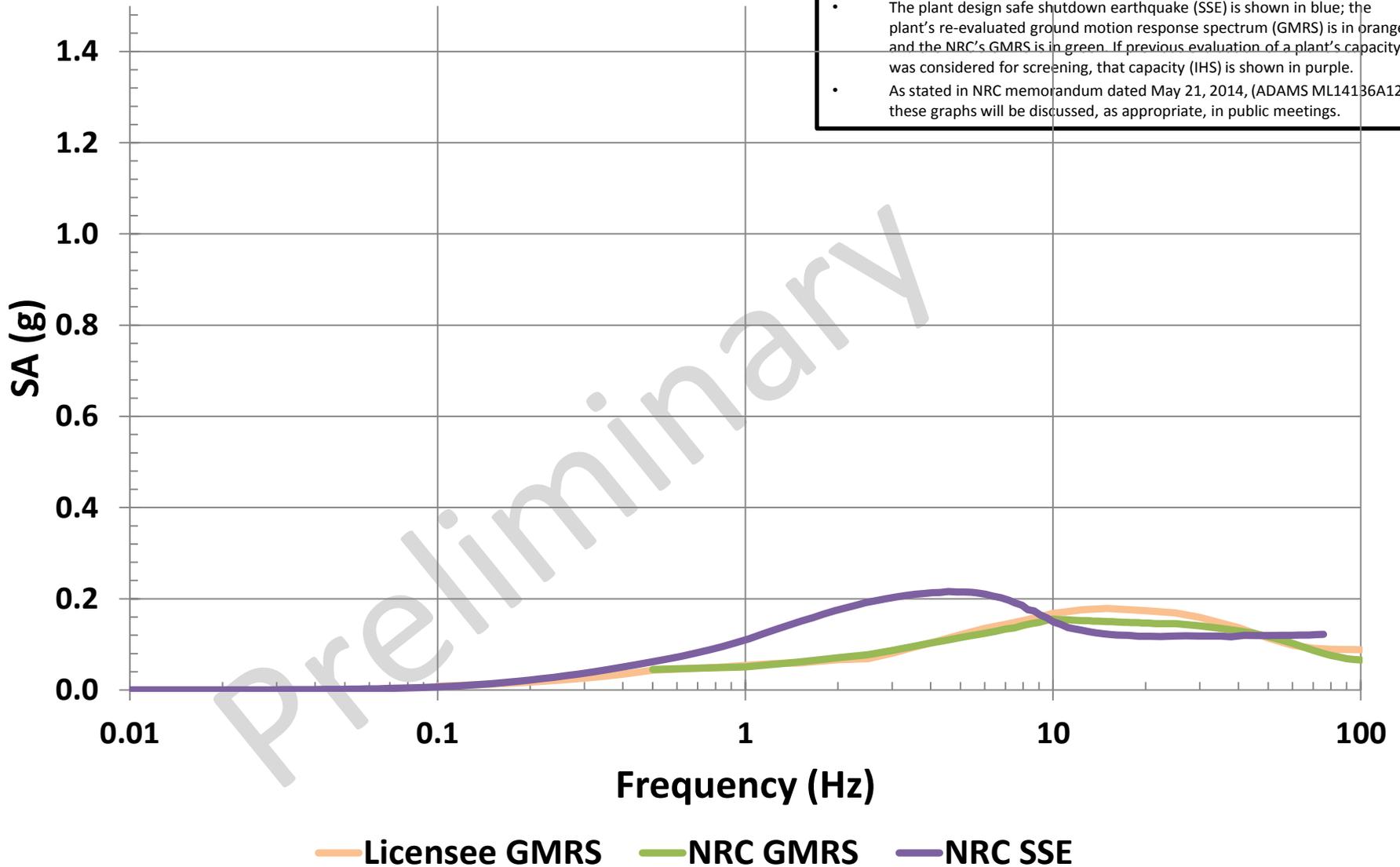
# Dresden

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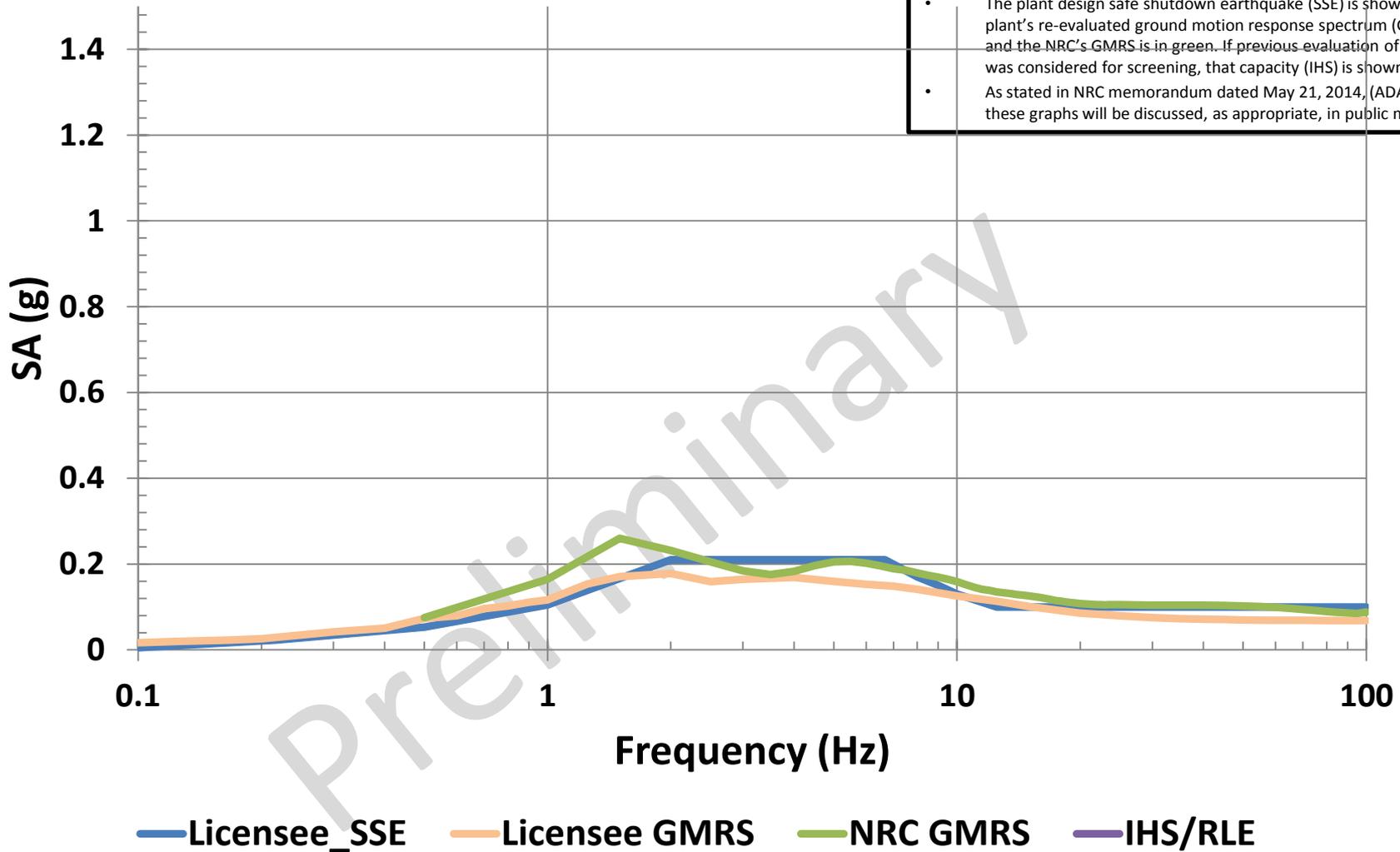
# Duane Arnold

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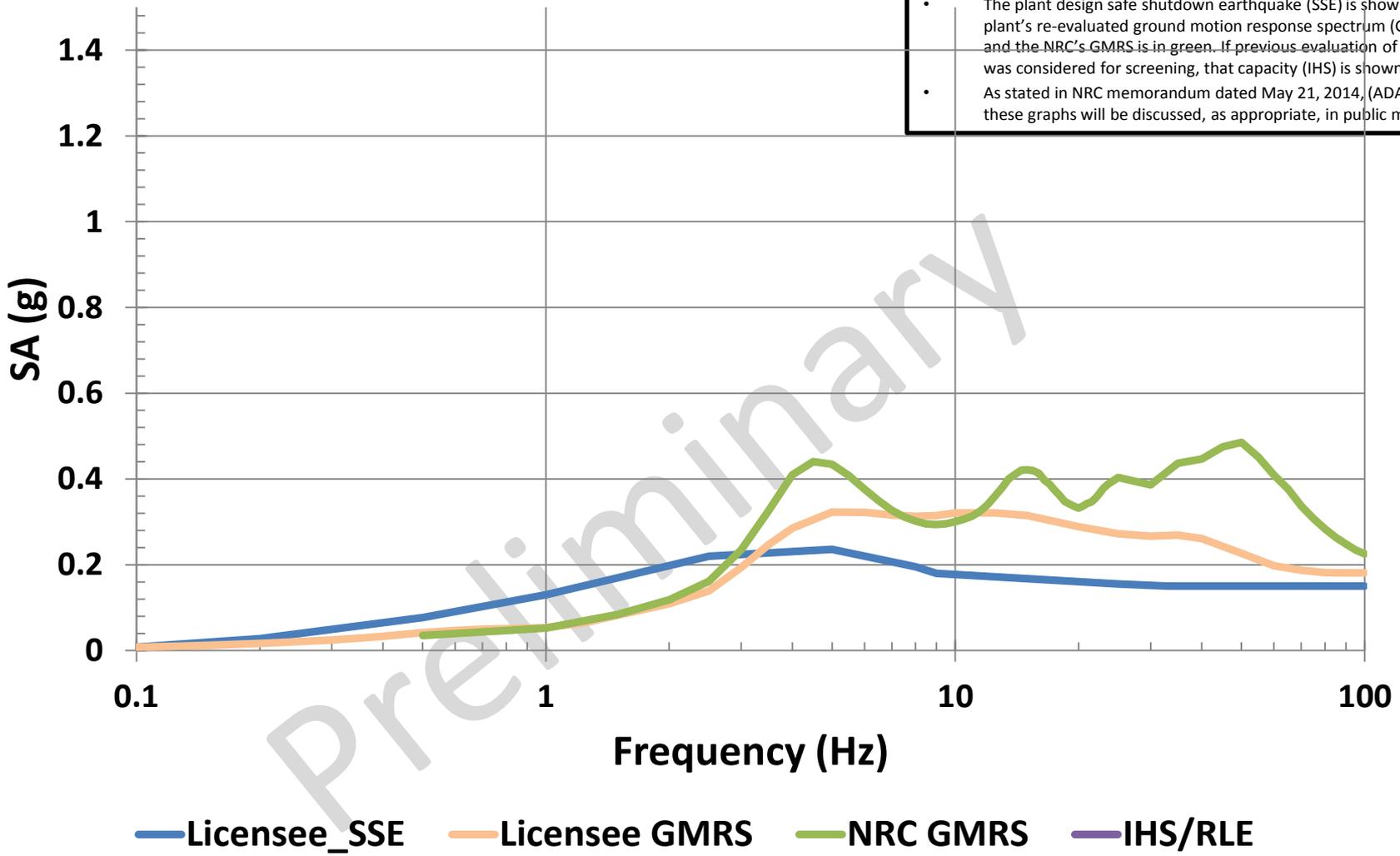
# Farley

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- As stated in NRC memorandum dated May 21, 2014, (ADAMS ML14136A126) these graphs will be discussed, as appropriate, in public meetings.



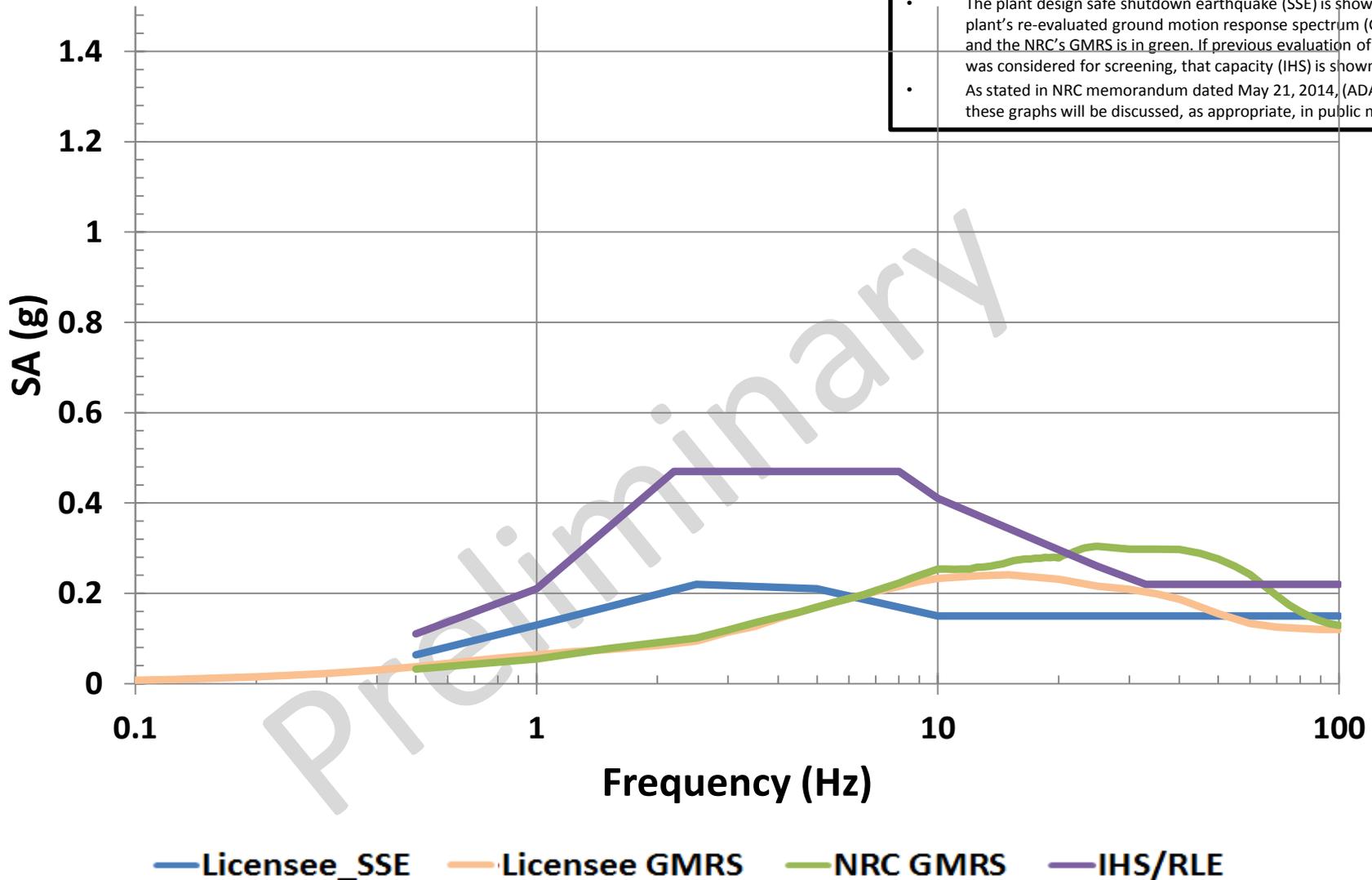
# Fermi Unit 2

- 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.
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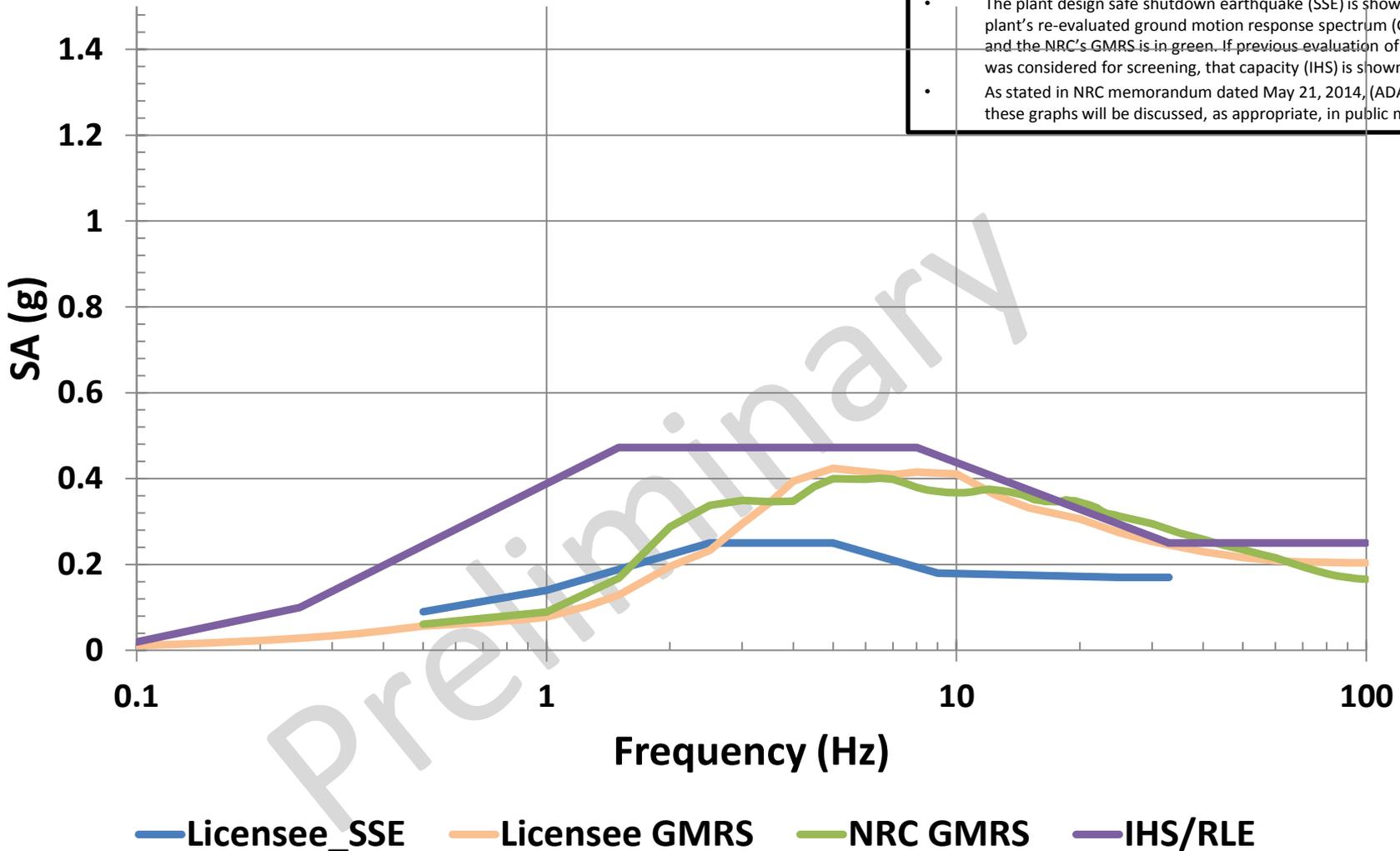
# FitzPatrick

- 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.
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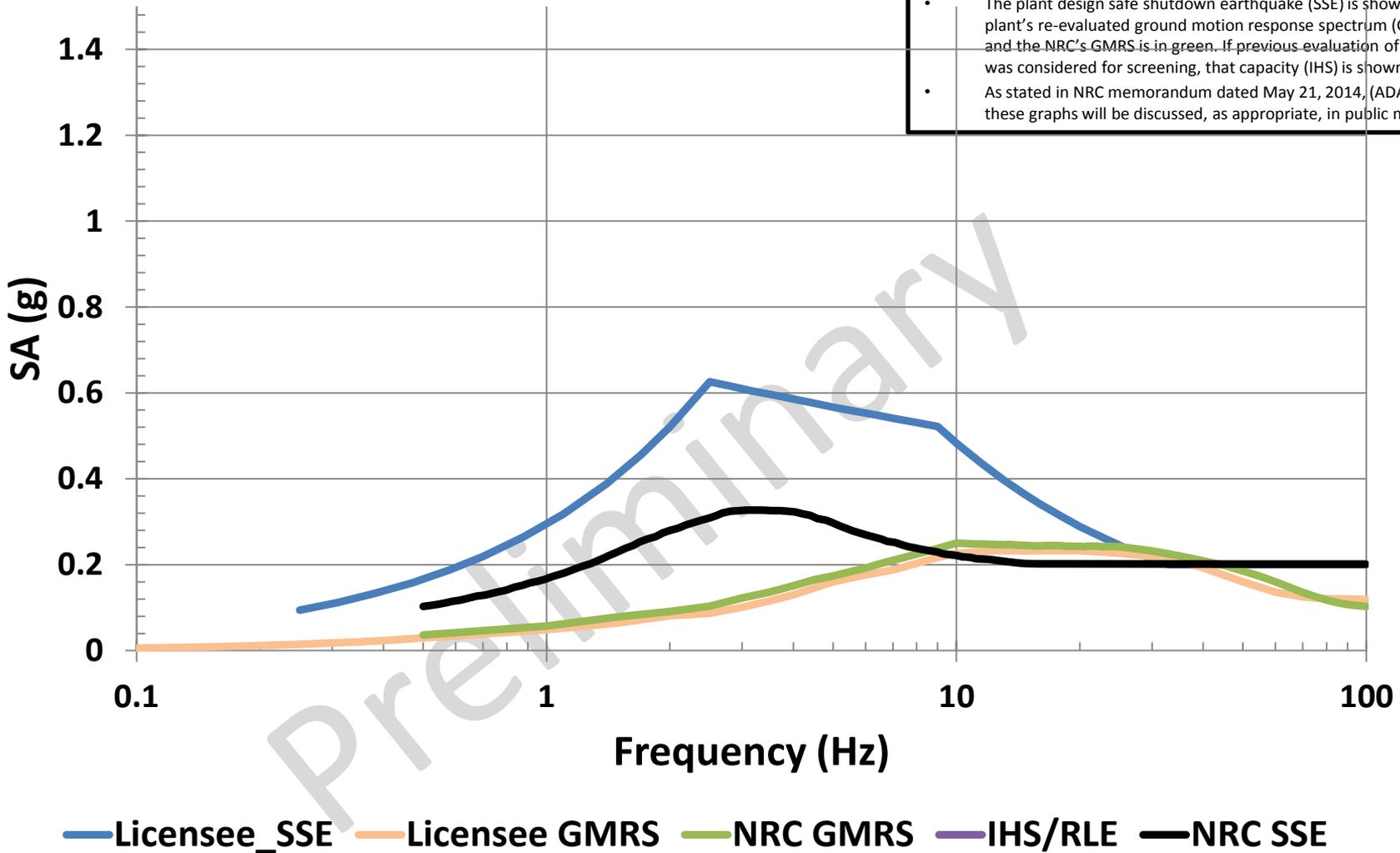
# Fort Calhoun

- 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.
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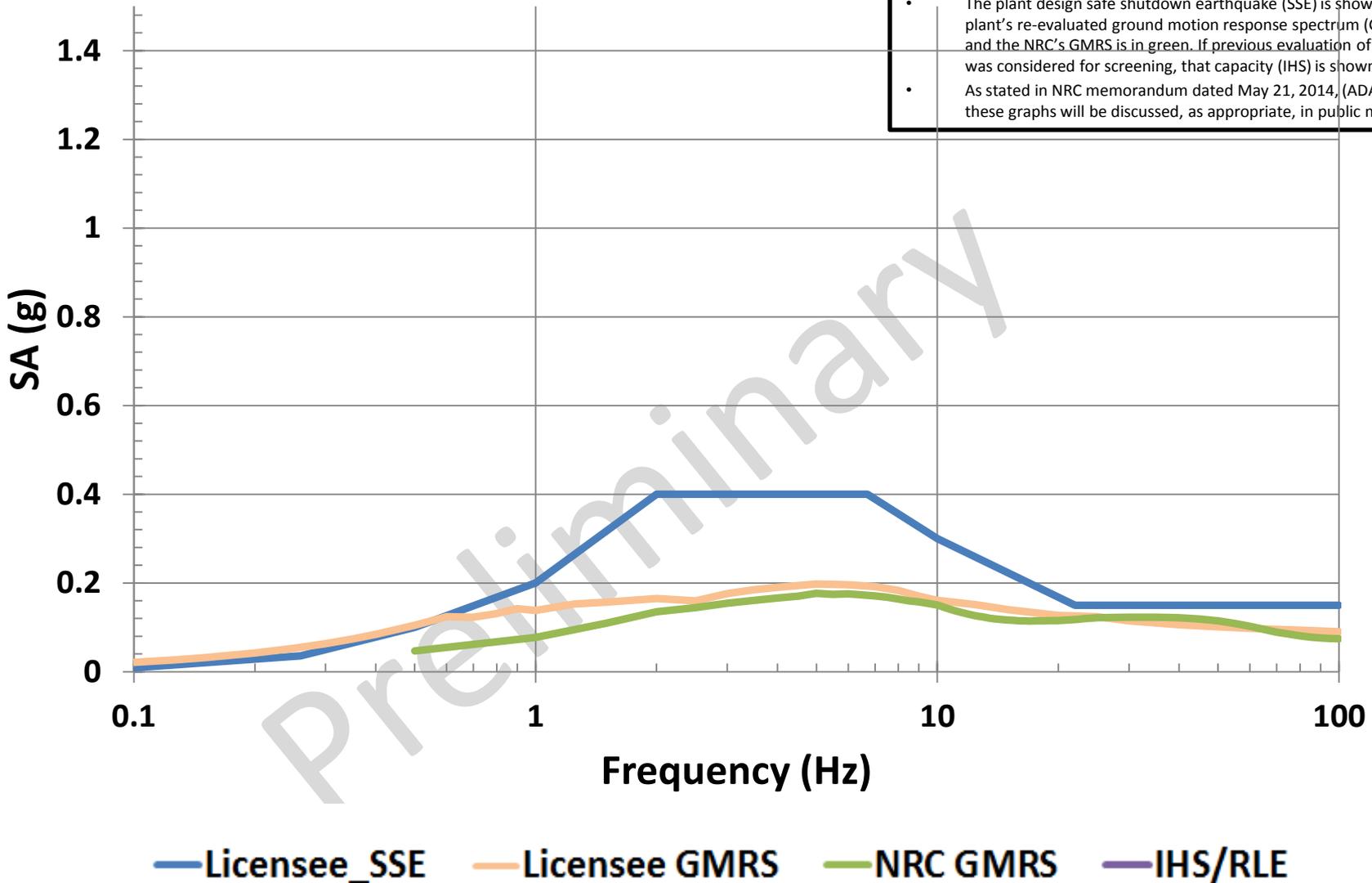
# Ginna

- 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.
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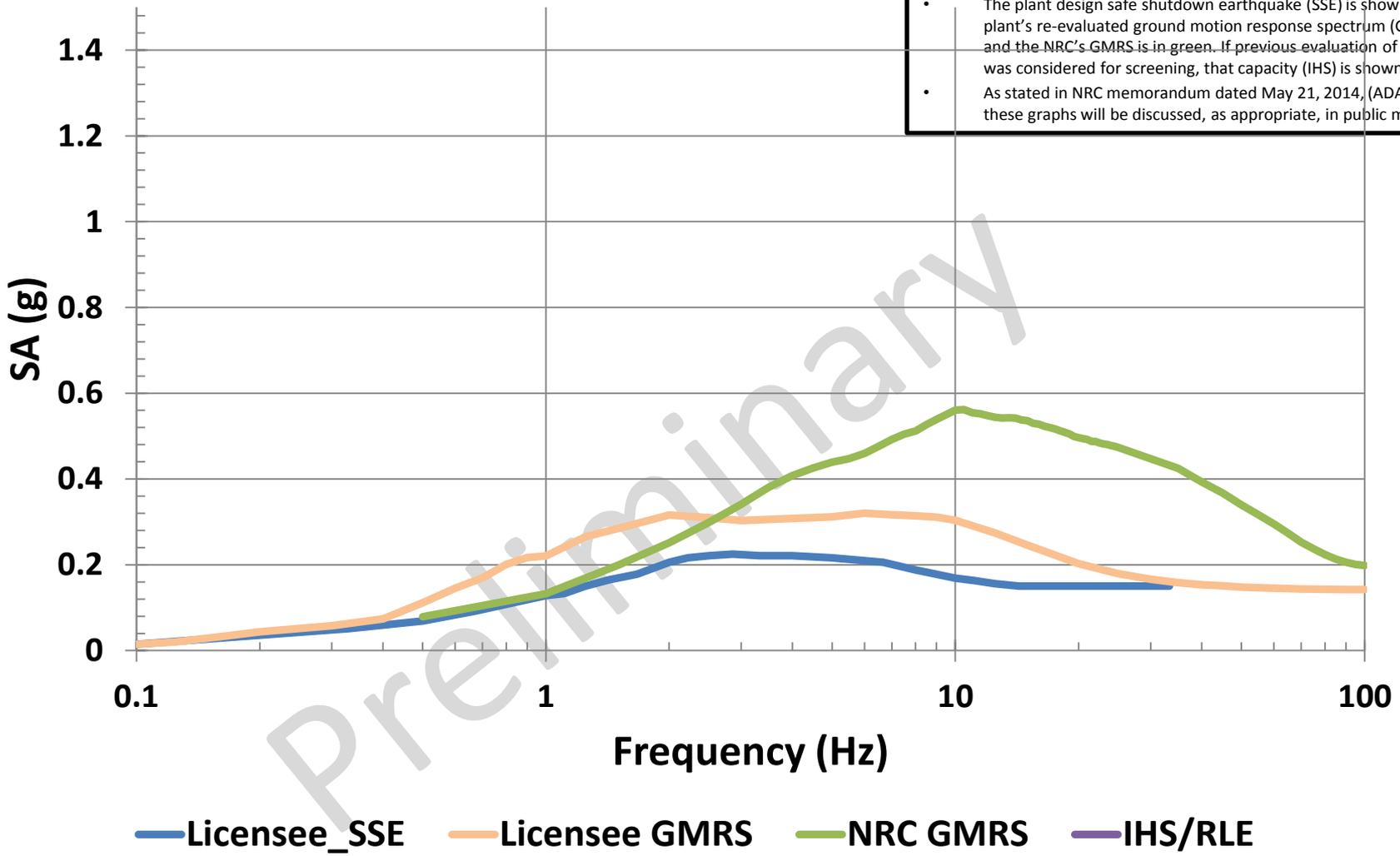
# Grand Gulf

- 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.
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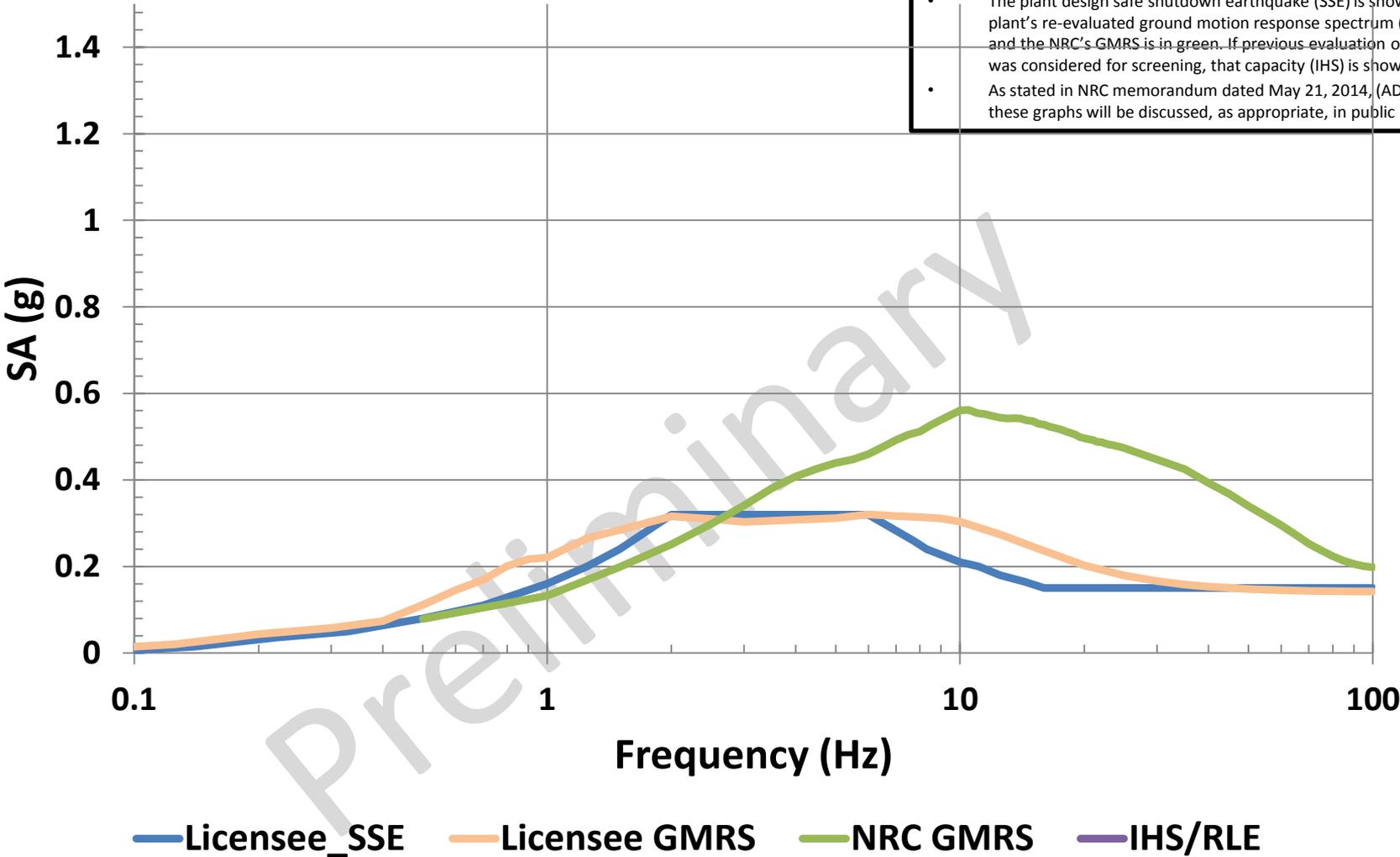
# Hatch Unit 1

- 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.
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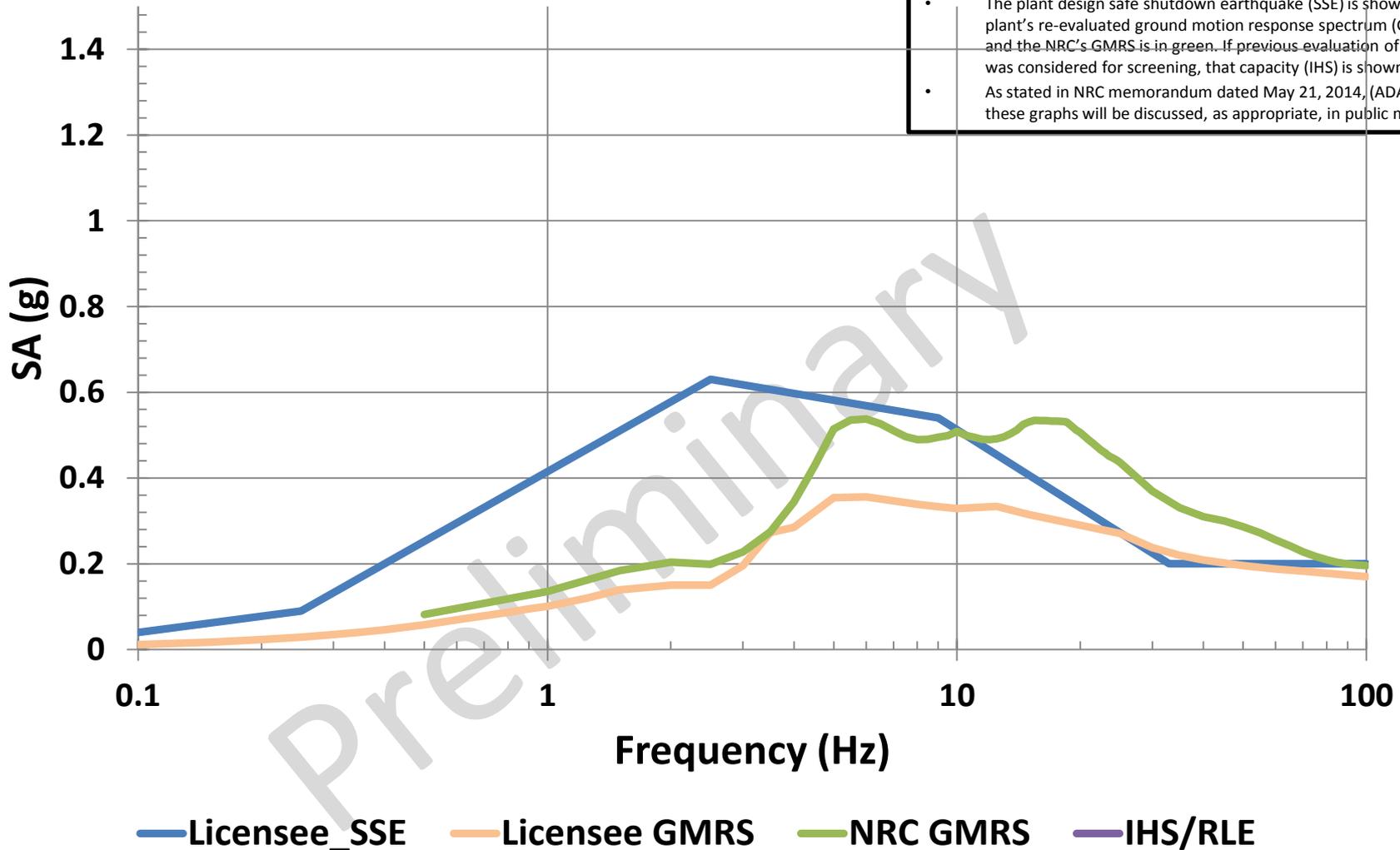
# Hatch Unit 2

- 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 orange 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.
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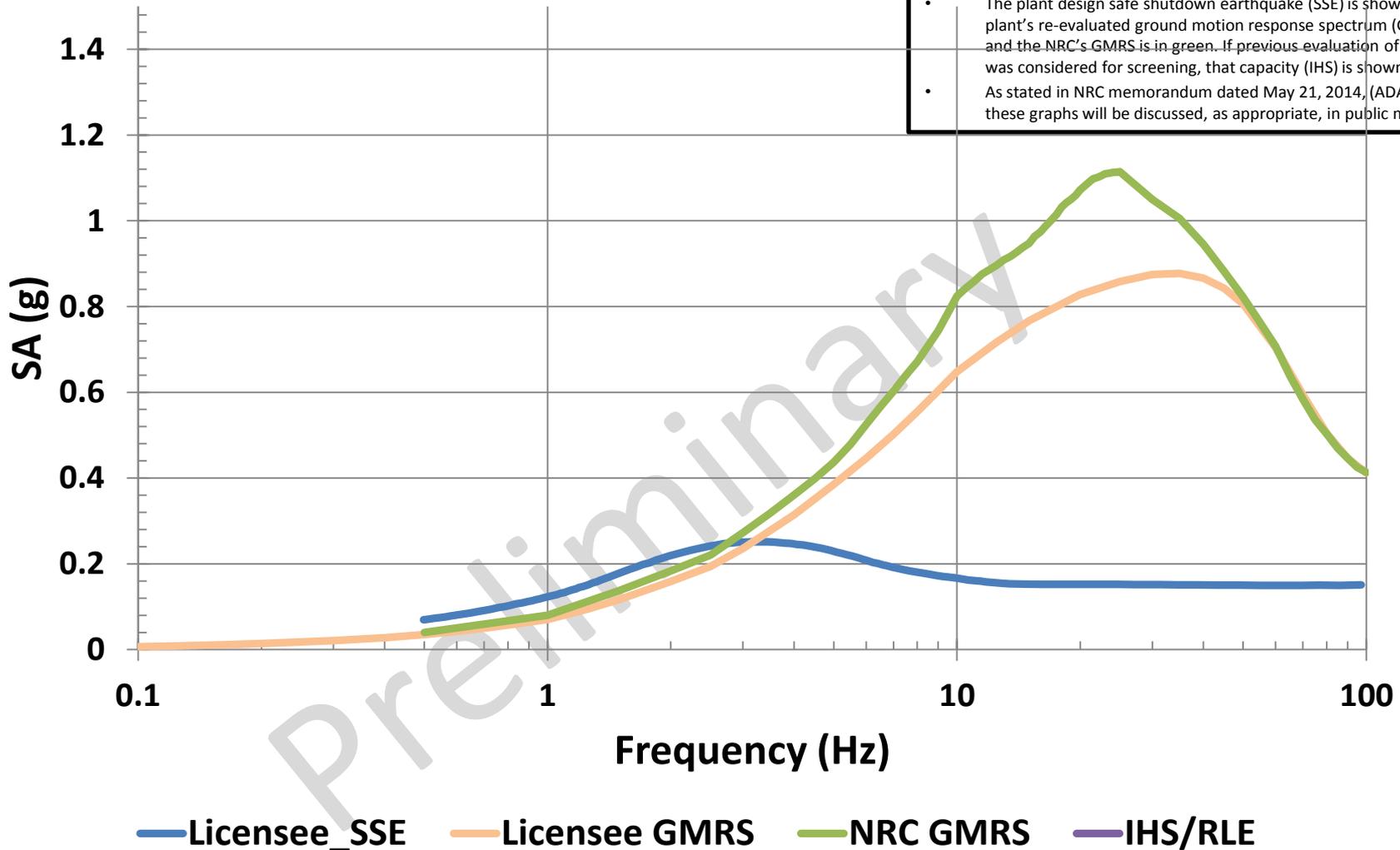
# Hope Creek

- 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.
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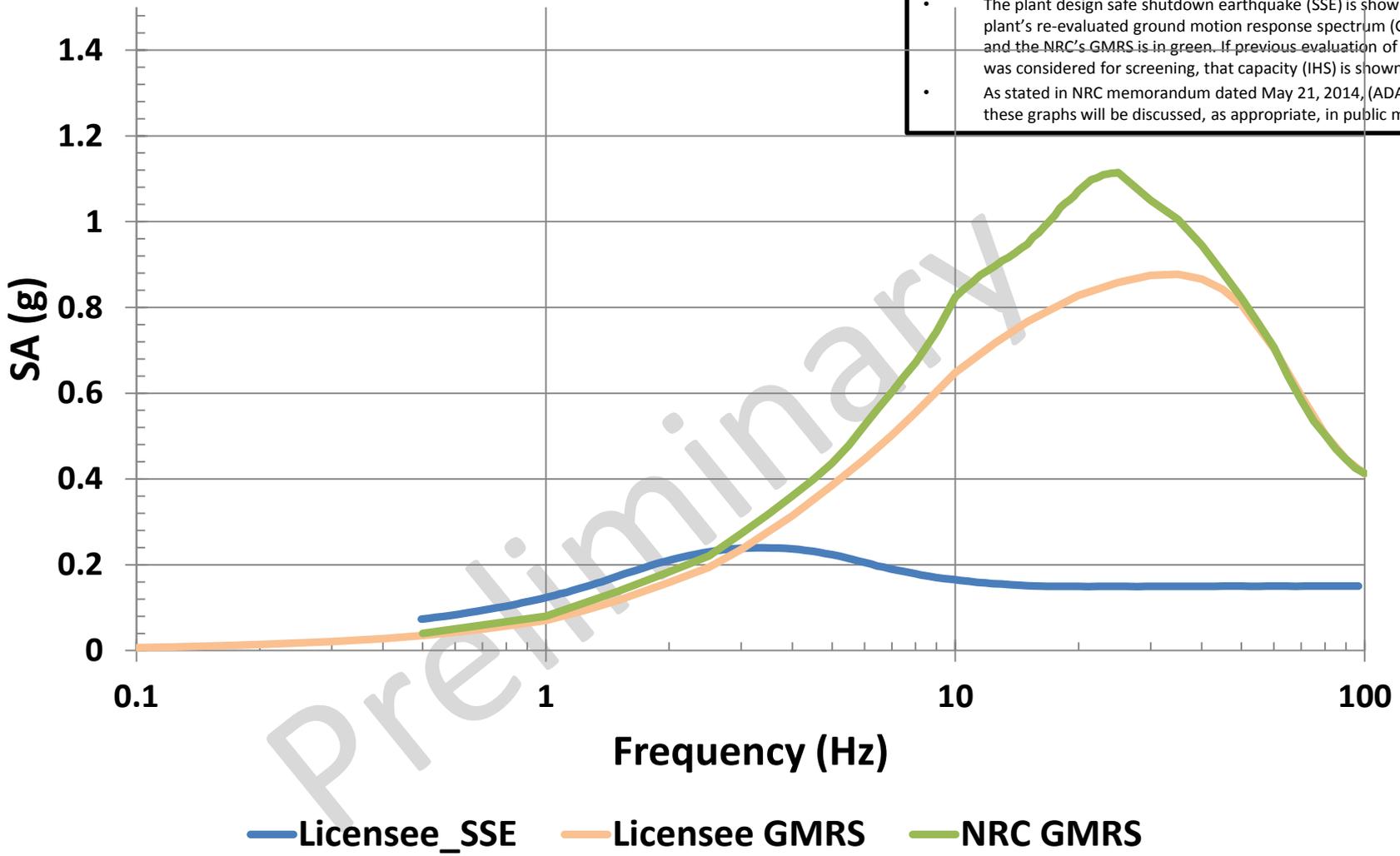
# Indian Point Unit 2

- 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.
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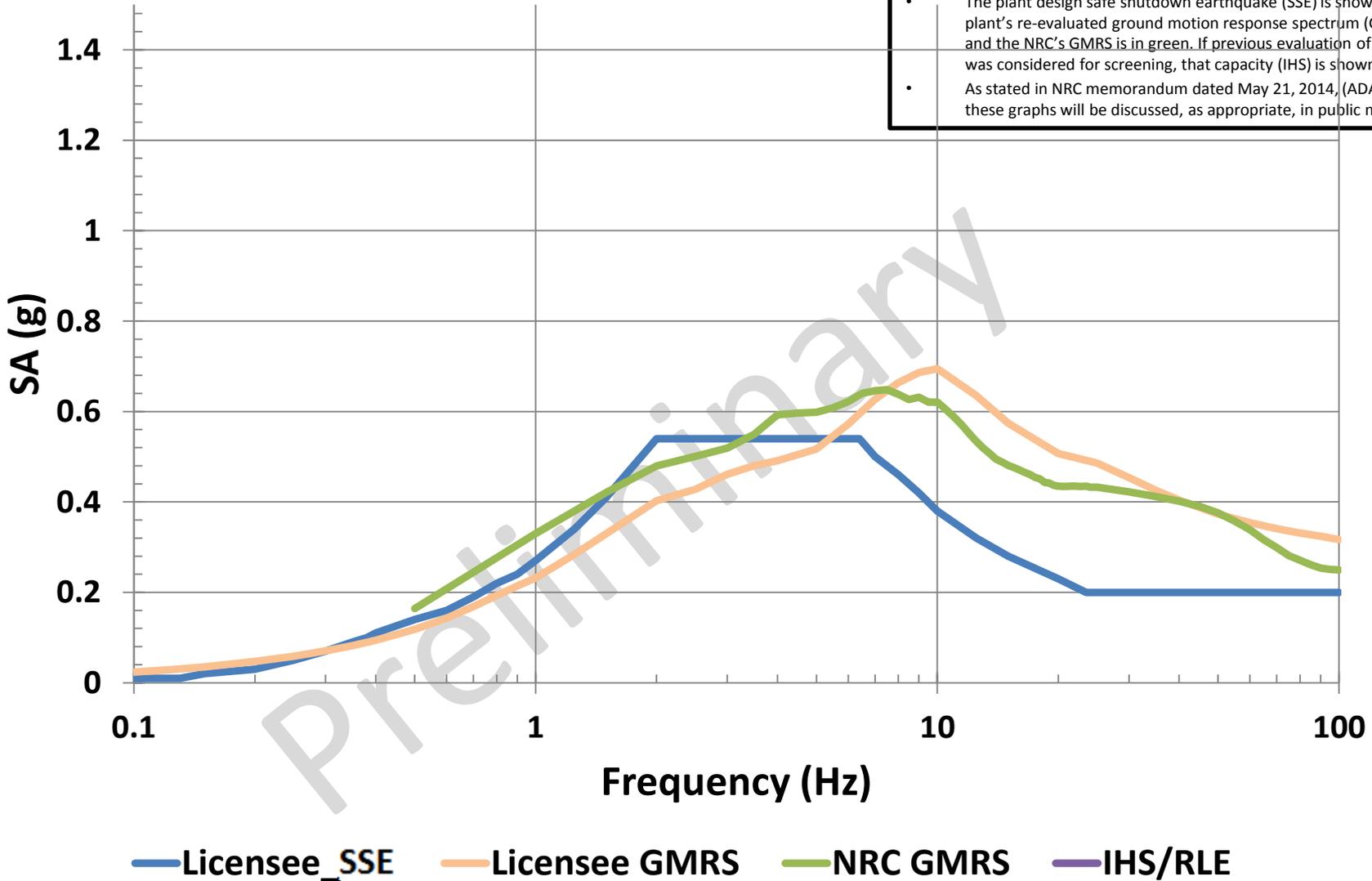
# Indian Point Unit 3

- 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.
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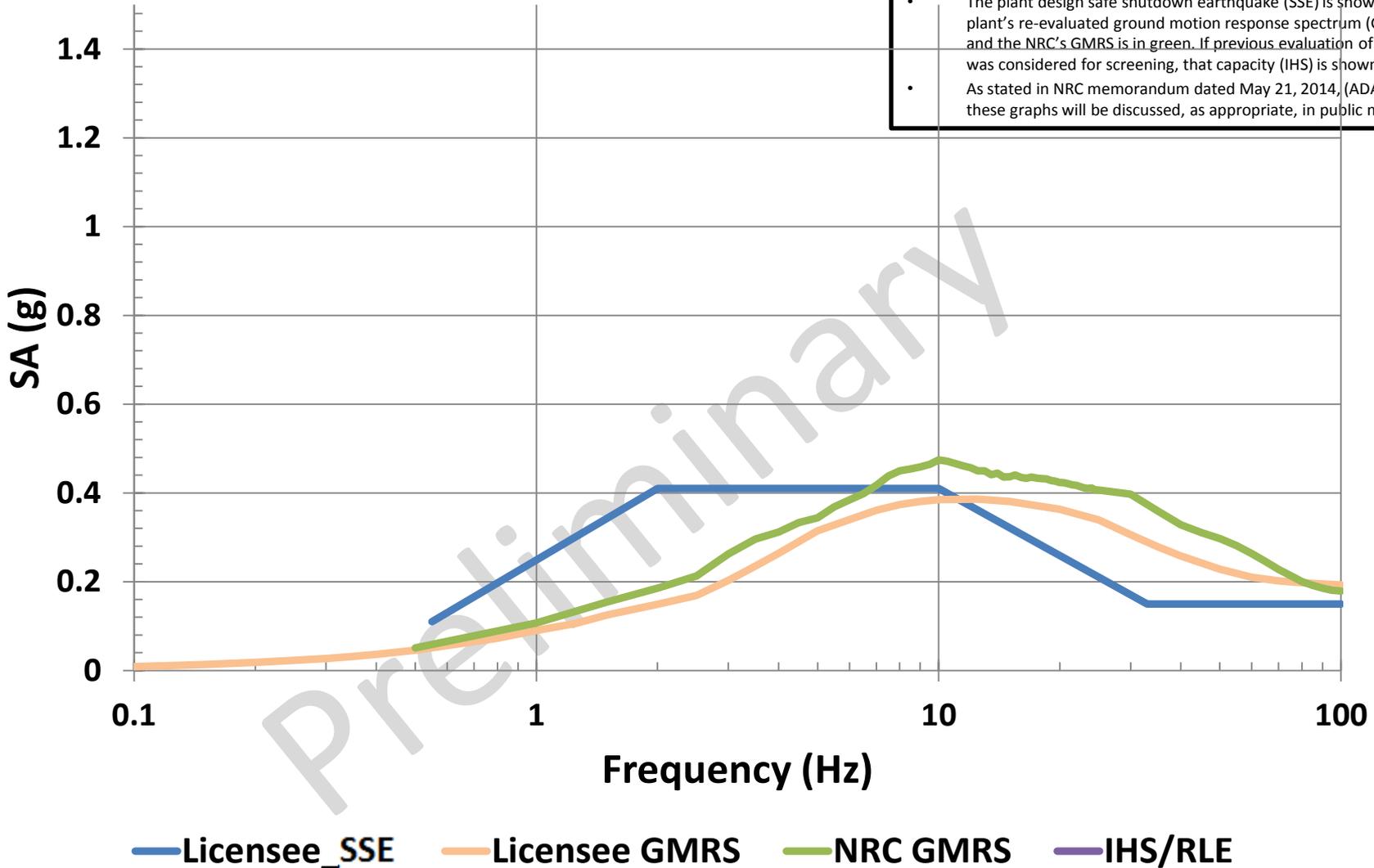
# LaSalle

- 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.
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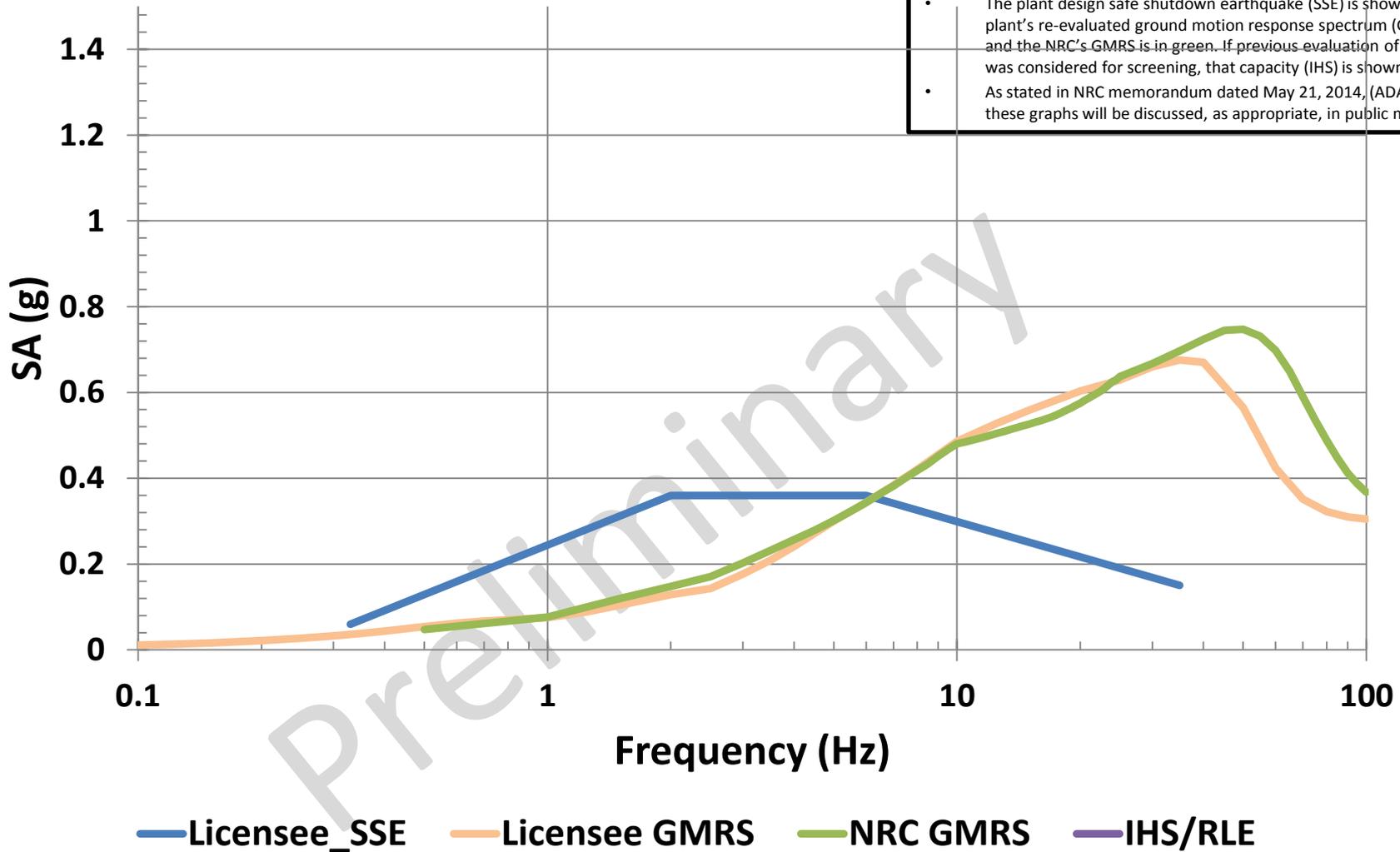
# Limerick

- 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.
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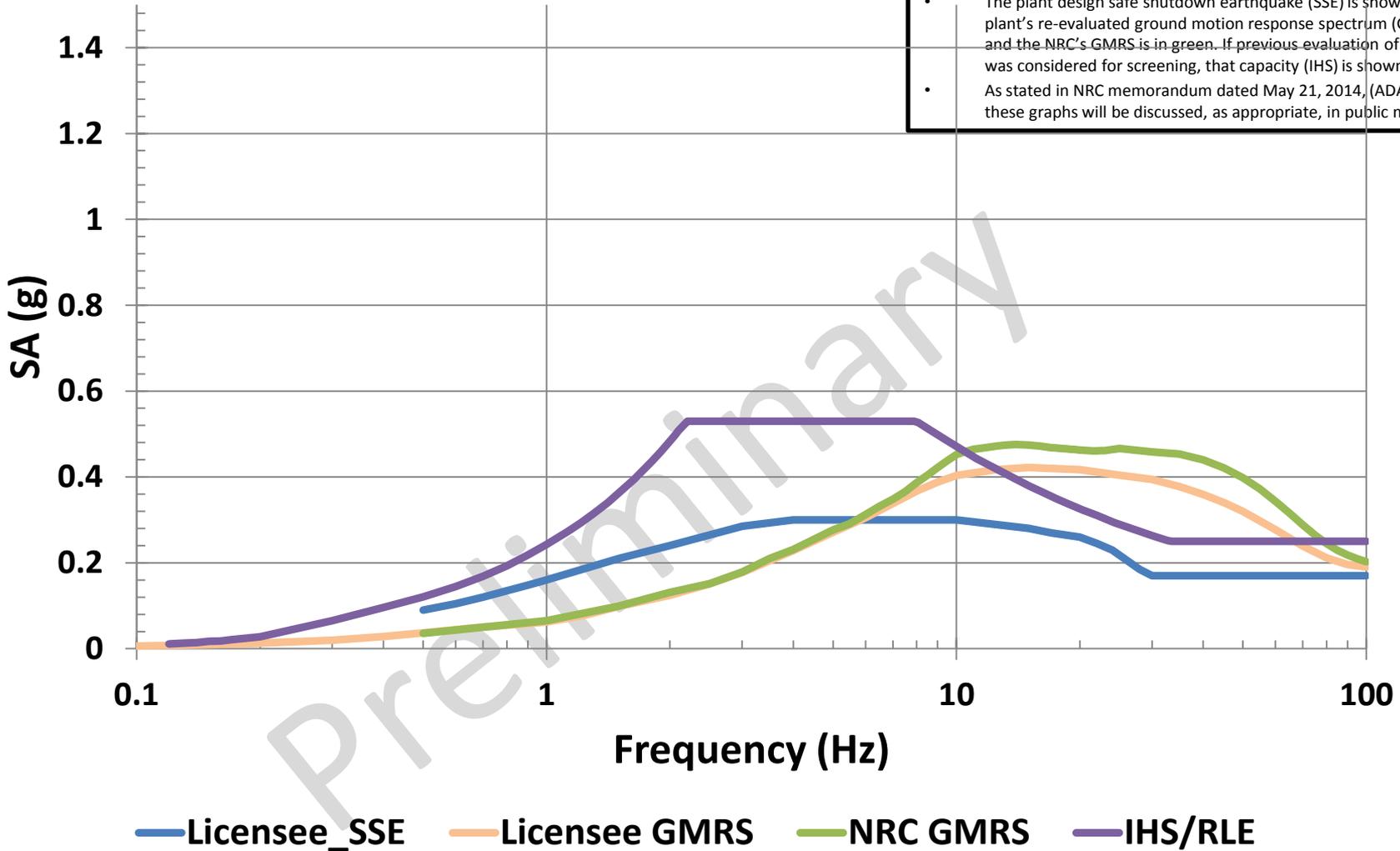
# McGuire

- 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.
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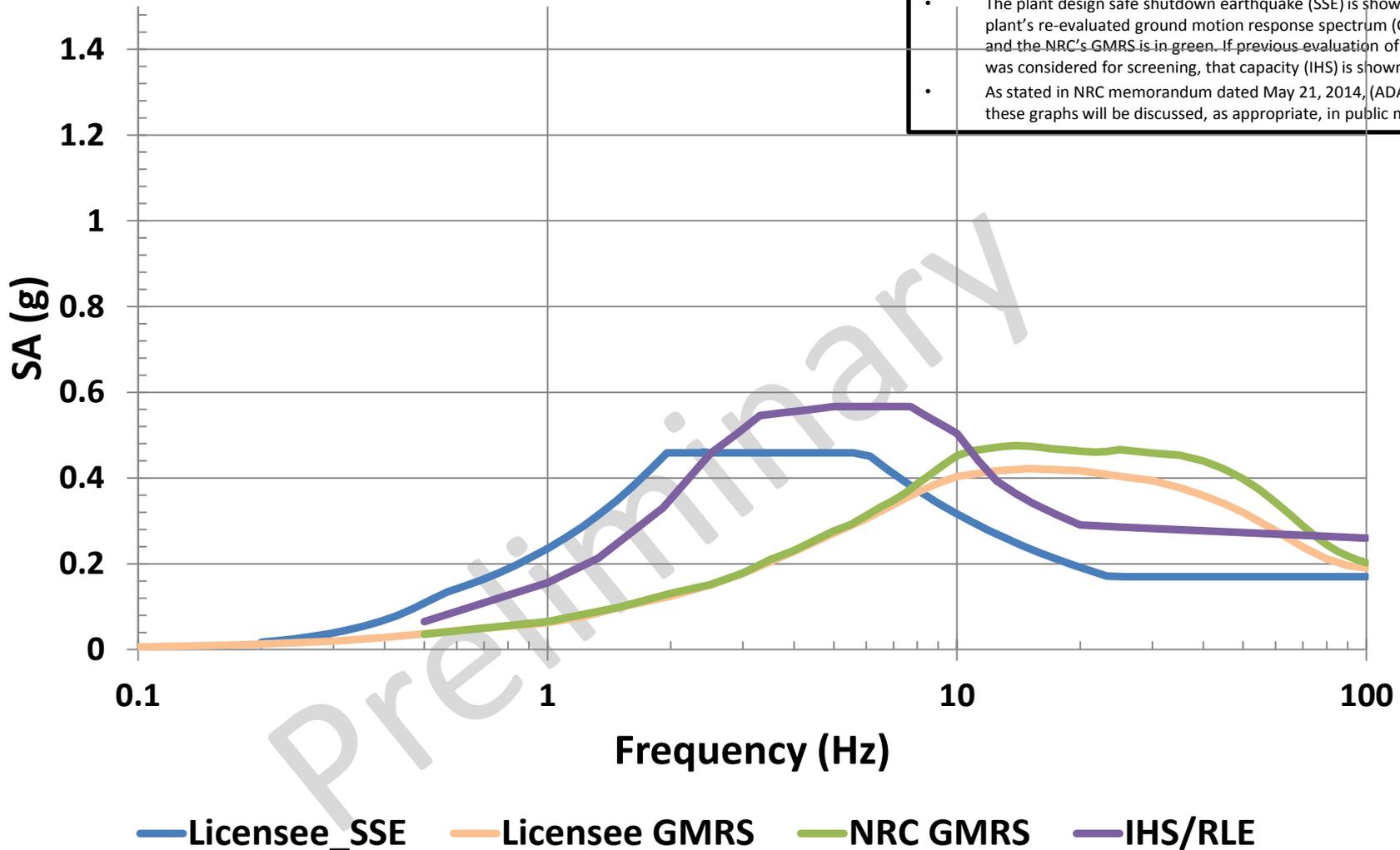
# Millstone Unit 2

- 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.
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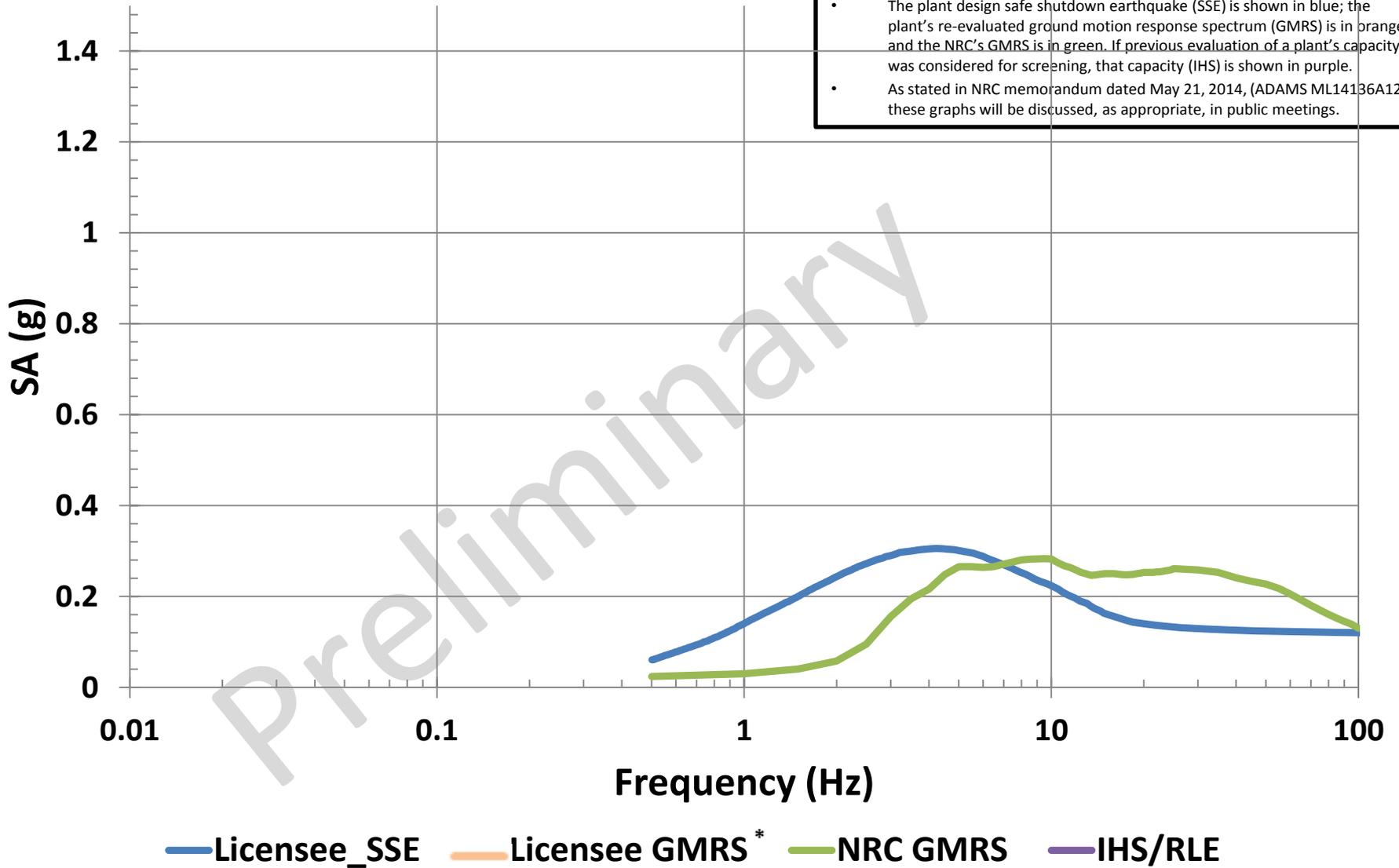
# Millstone Unit 3

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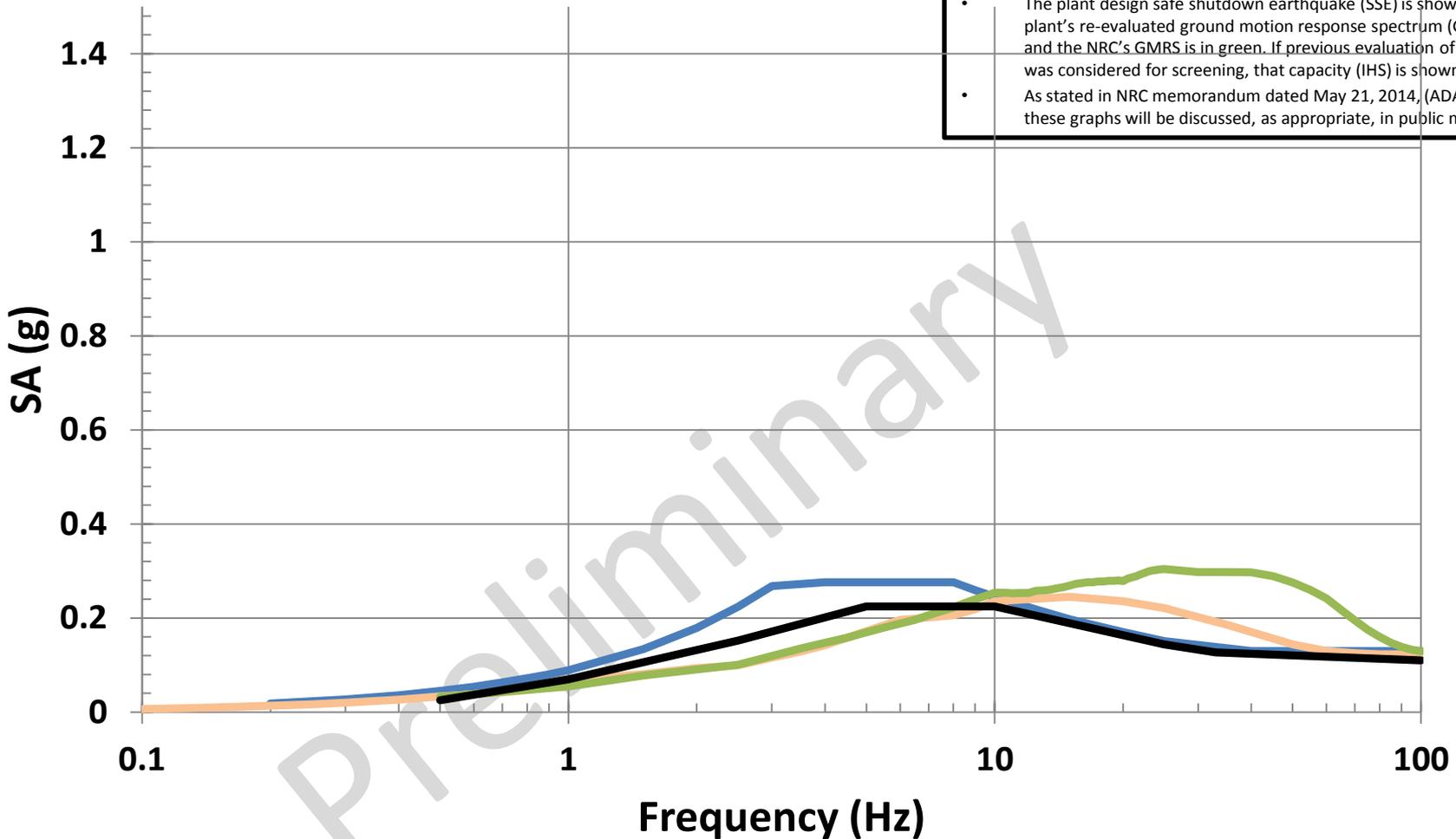
# Monticello (prelim)

- 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.
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# Nine Mile Point Unit 1

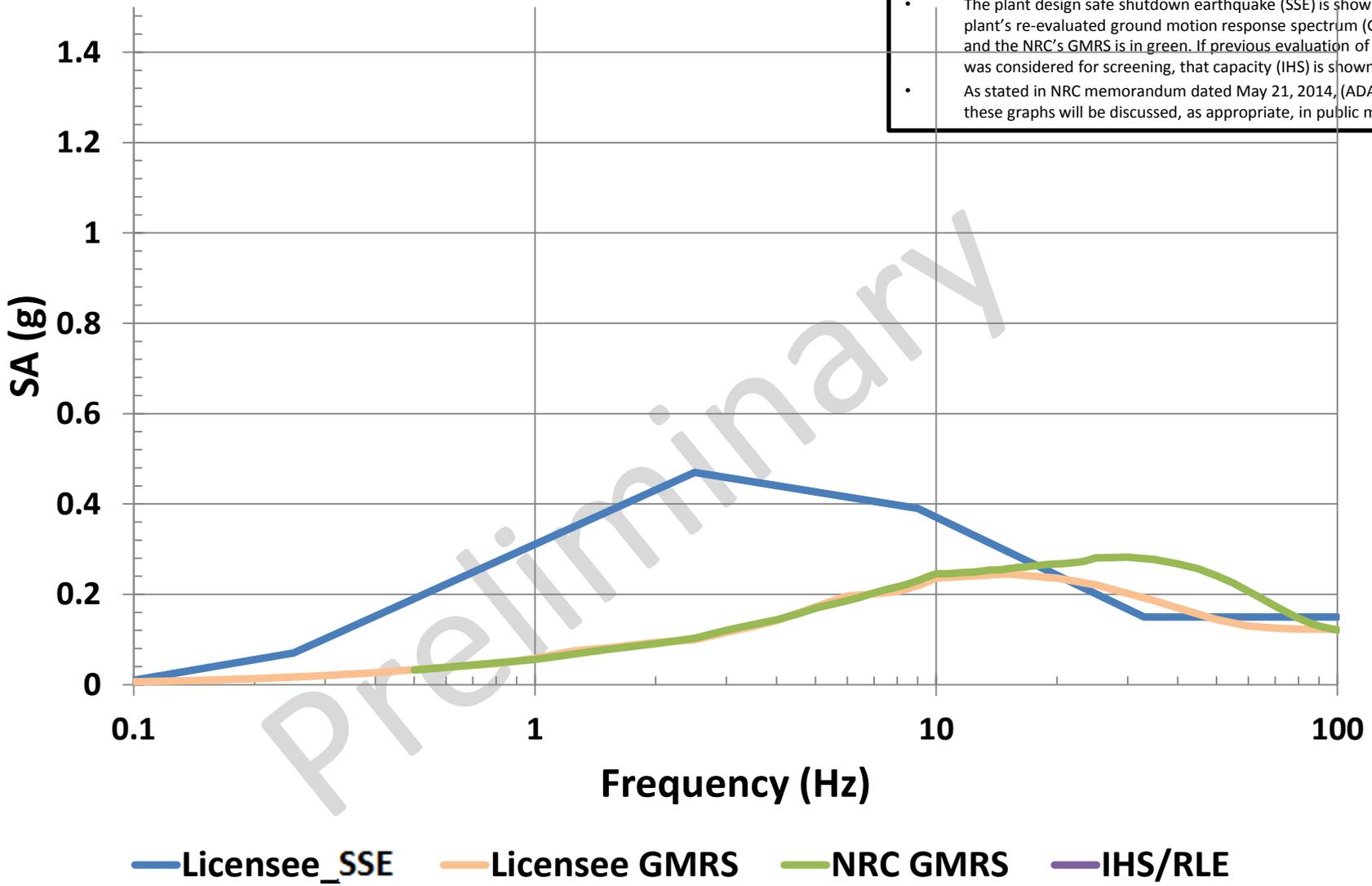
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— Licensee\_SSE — Licensee GMRS — NRC GMRS — IHS/RLE — NRC\_SSE

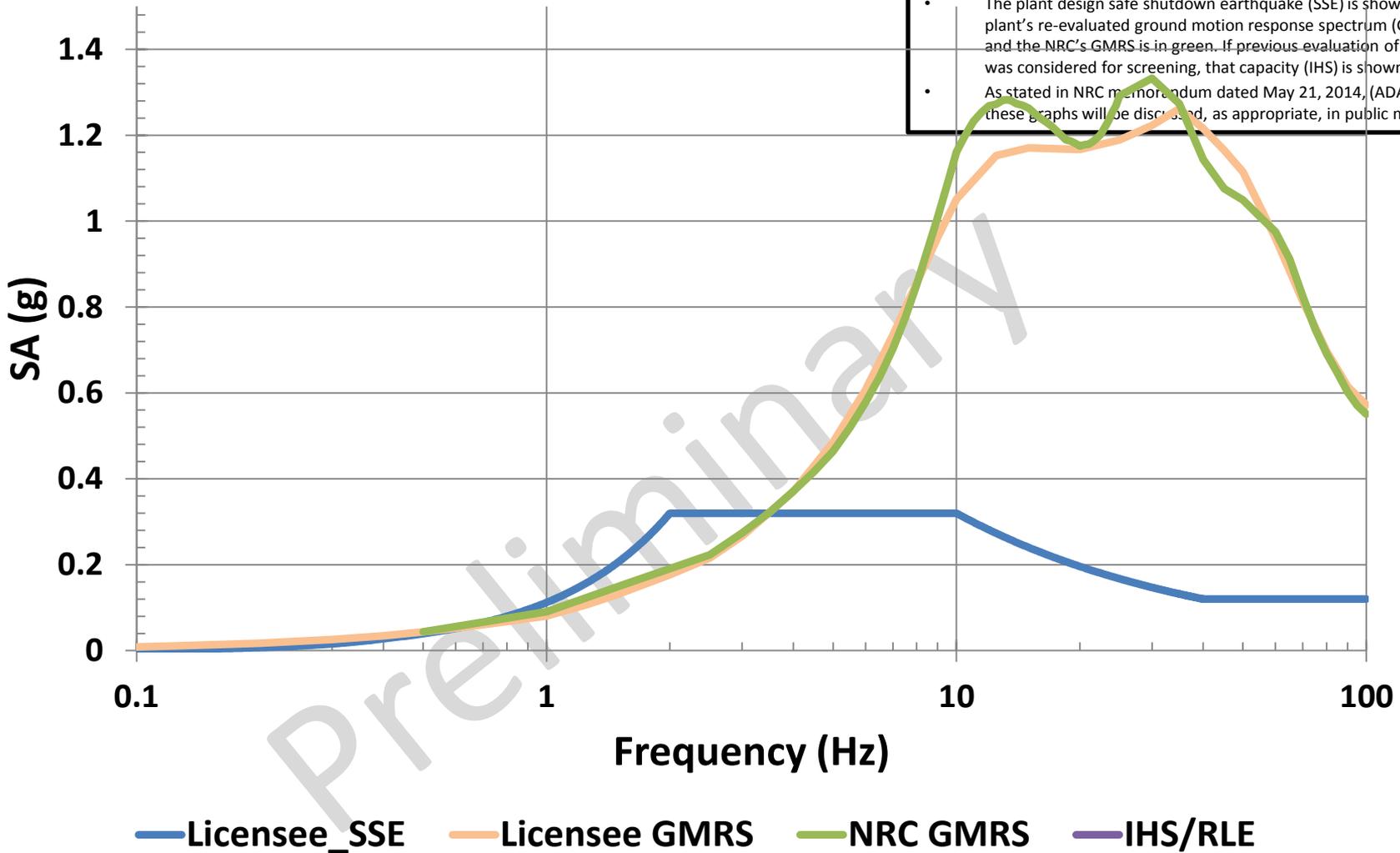
# Nine Mile Point Unit 2

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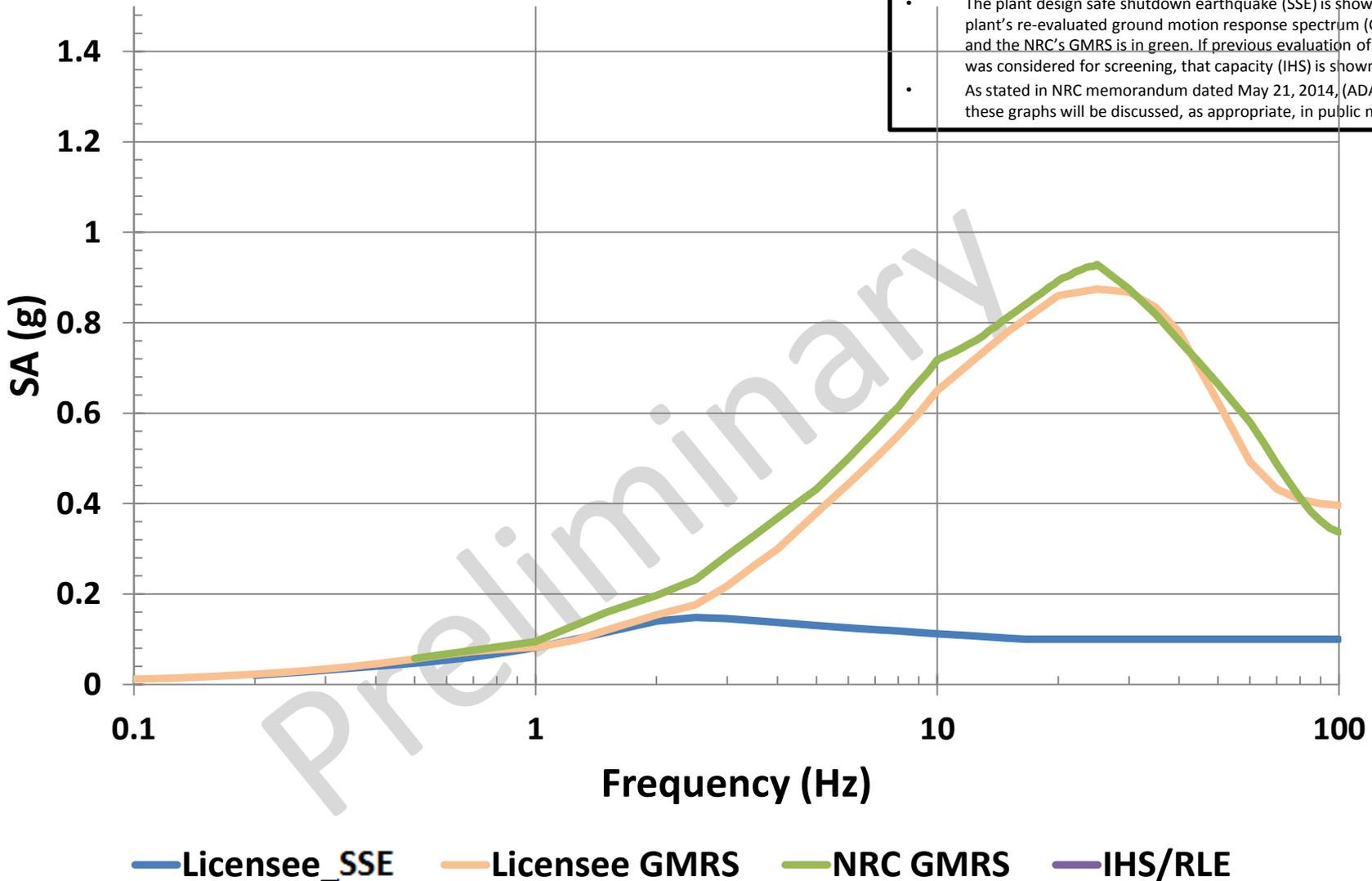
# North Anna

- 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.
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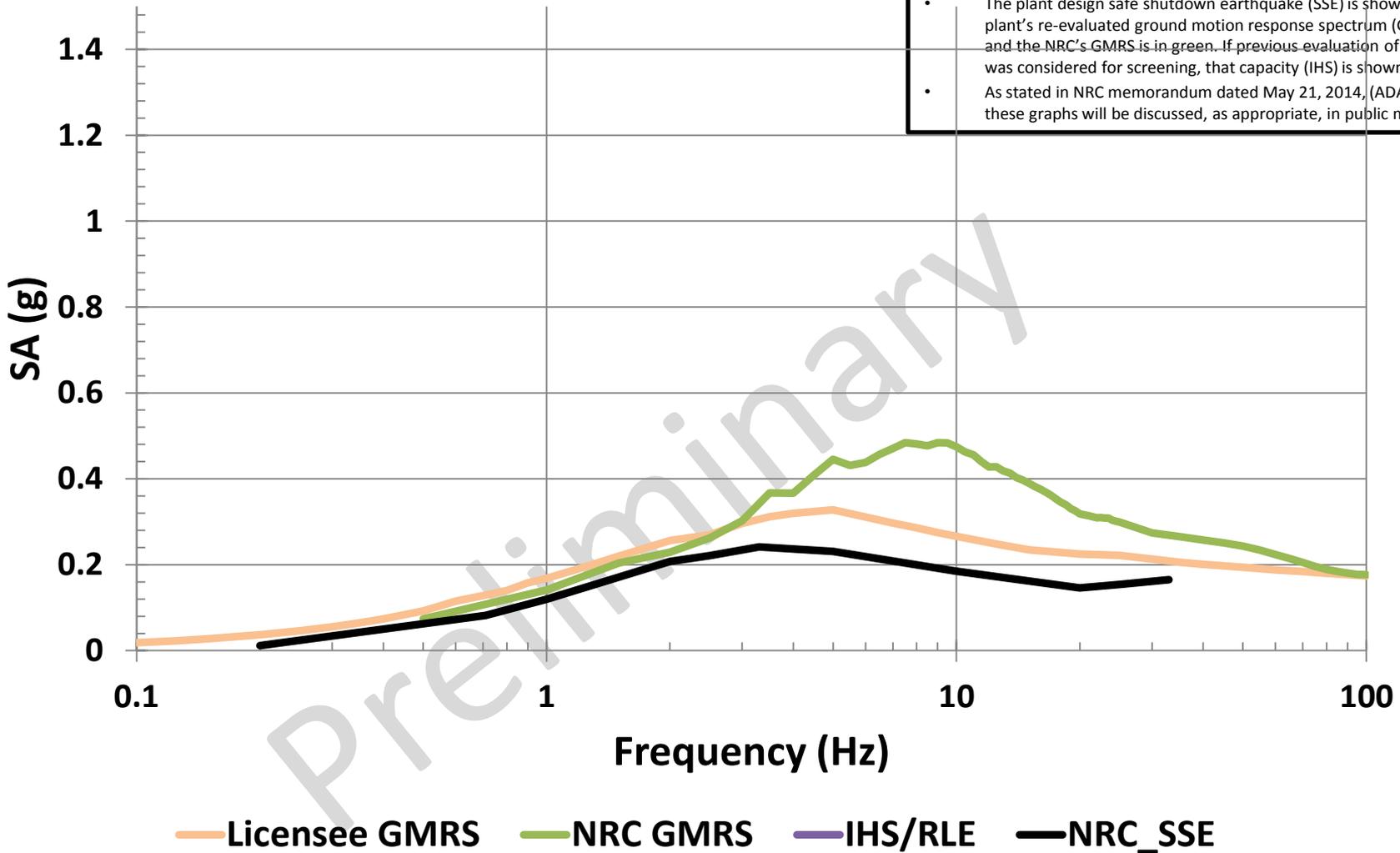
# Oconee

- 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.
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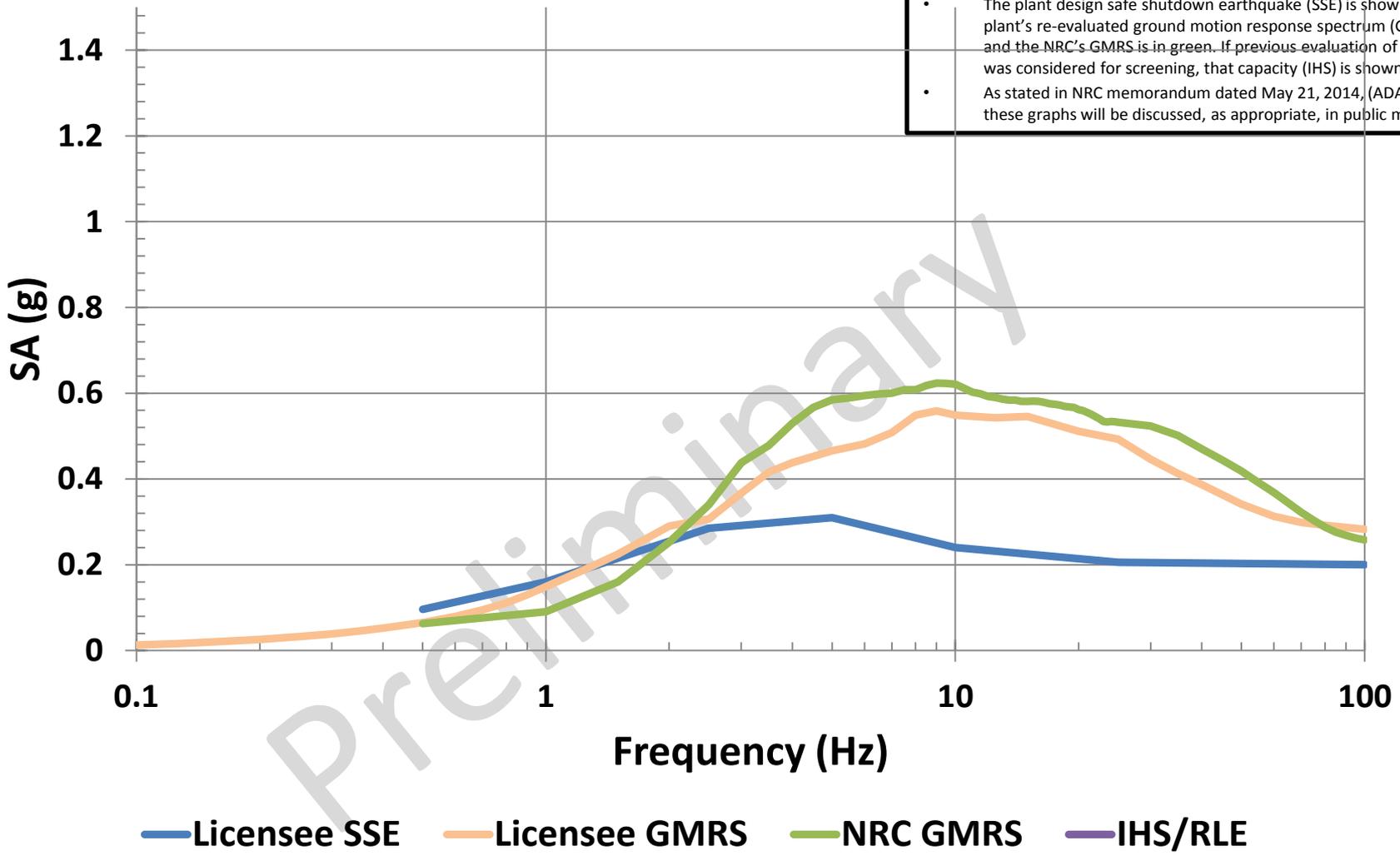
# Oyster Creek

- 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.
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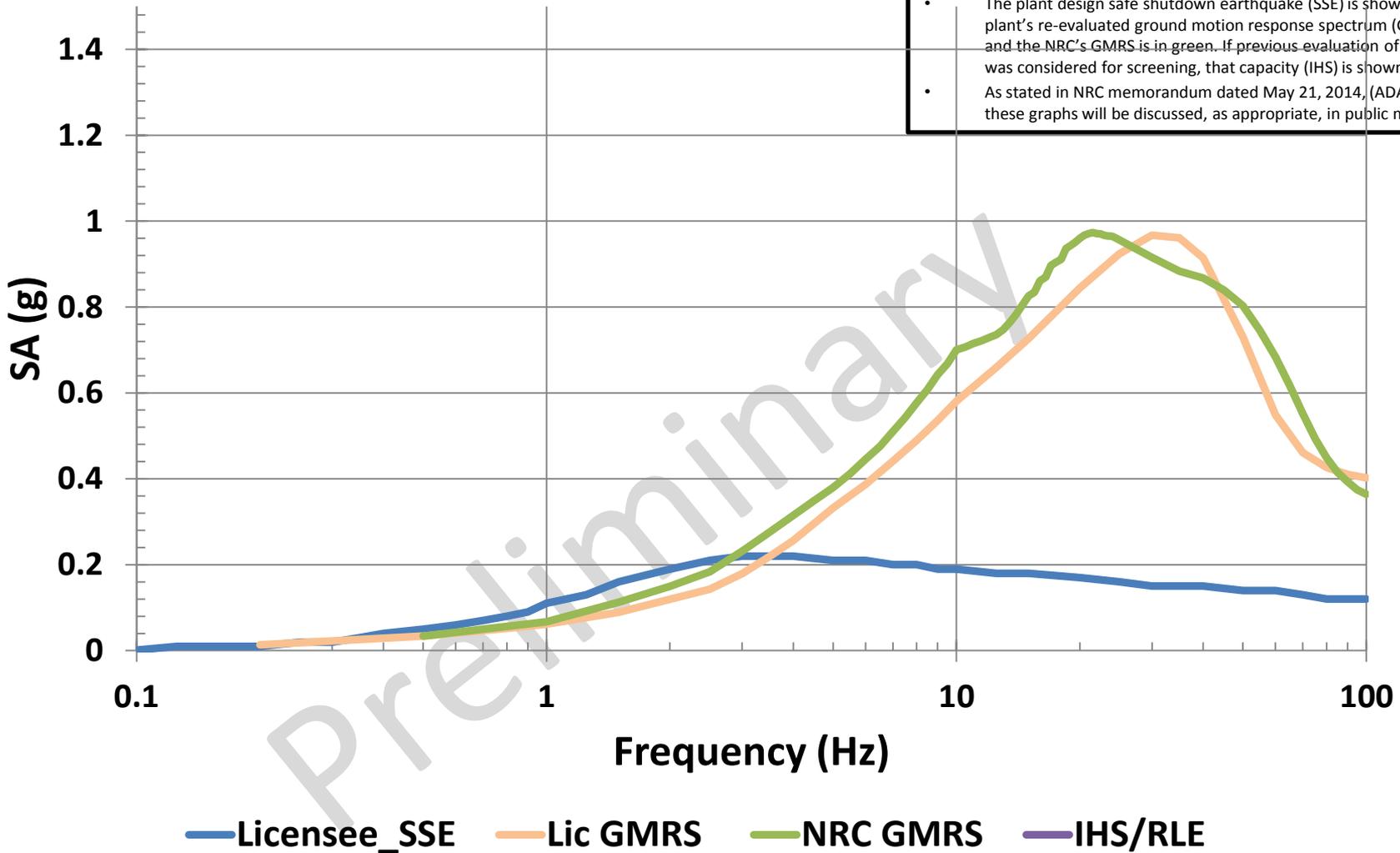
# Palisades

- 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.
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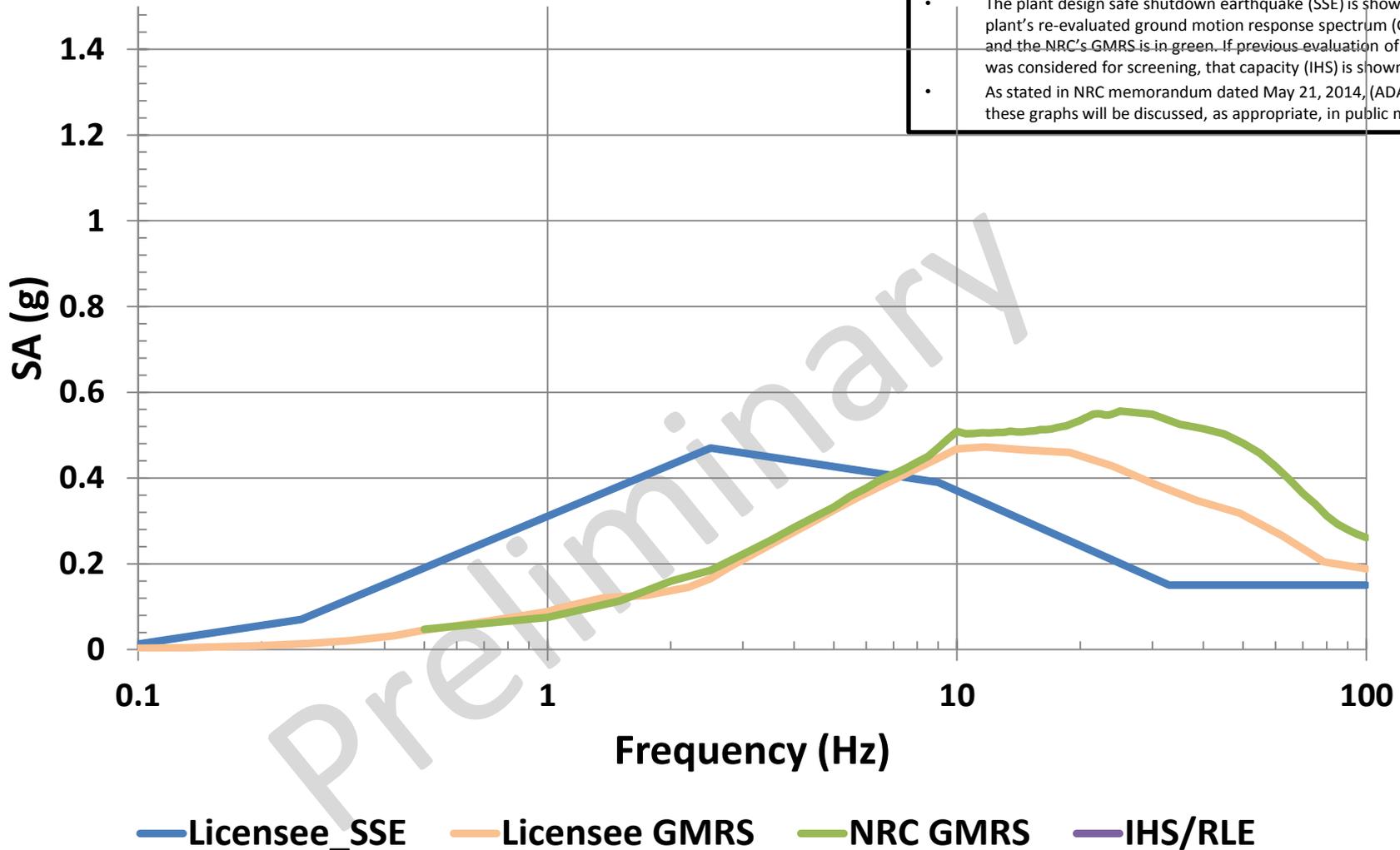
# Peach Bottom Units 2 & 3

- 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.
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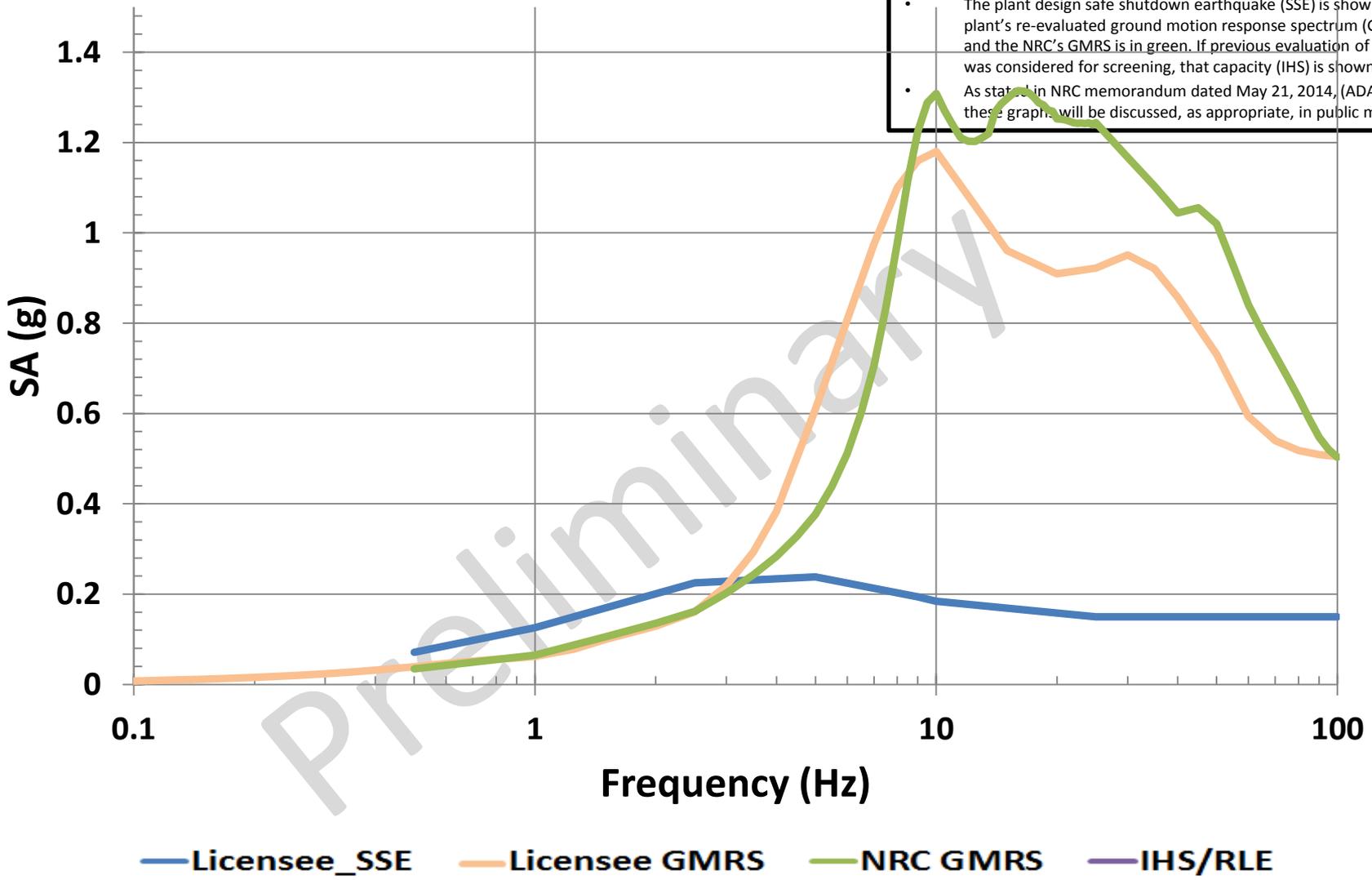
# Perry

- 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.
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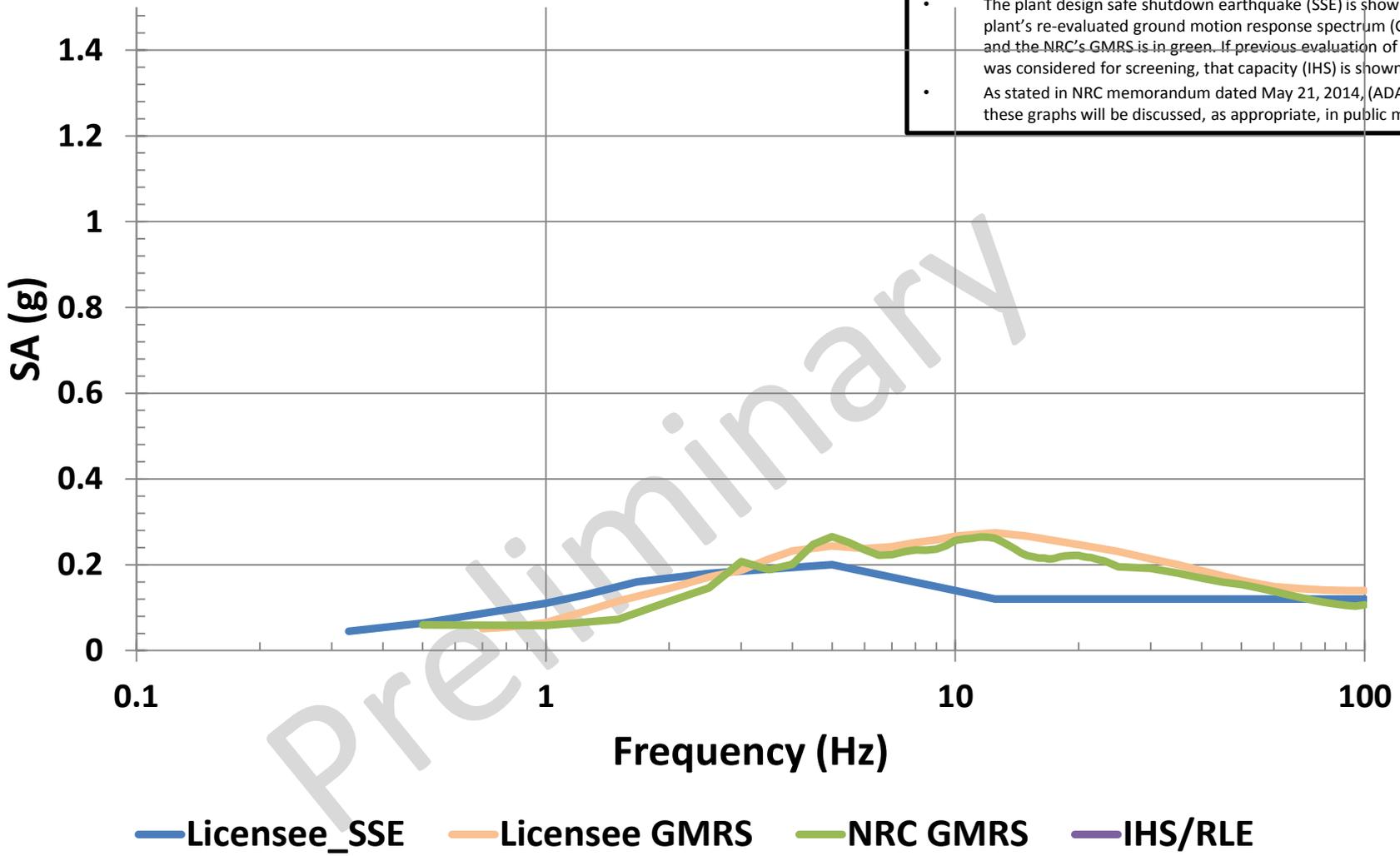
# Pilgrim

- 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.
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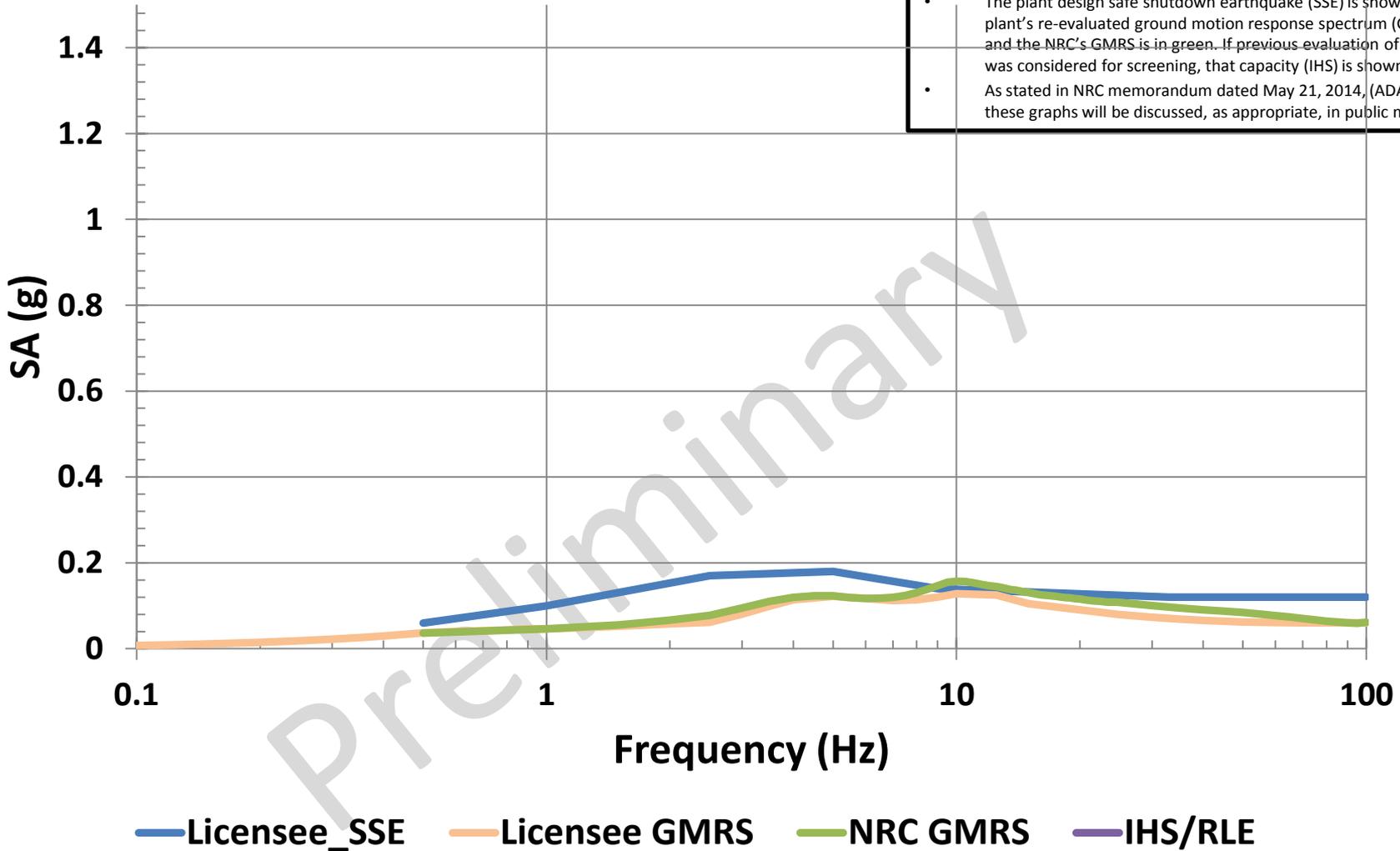
# Point Beach

- 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.
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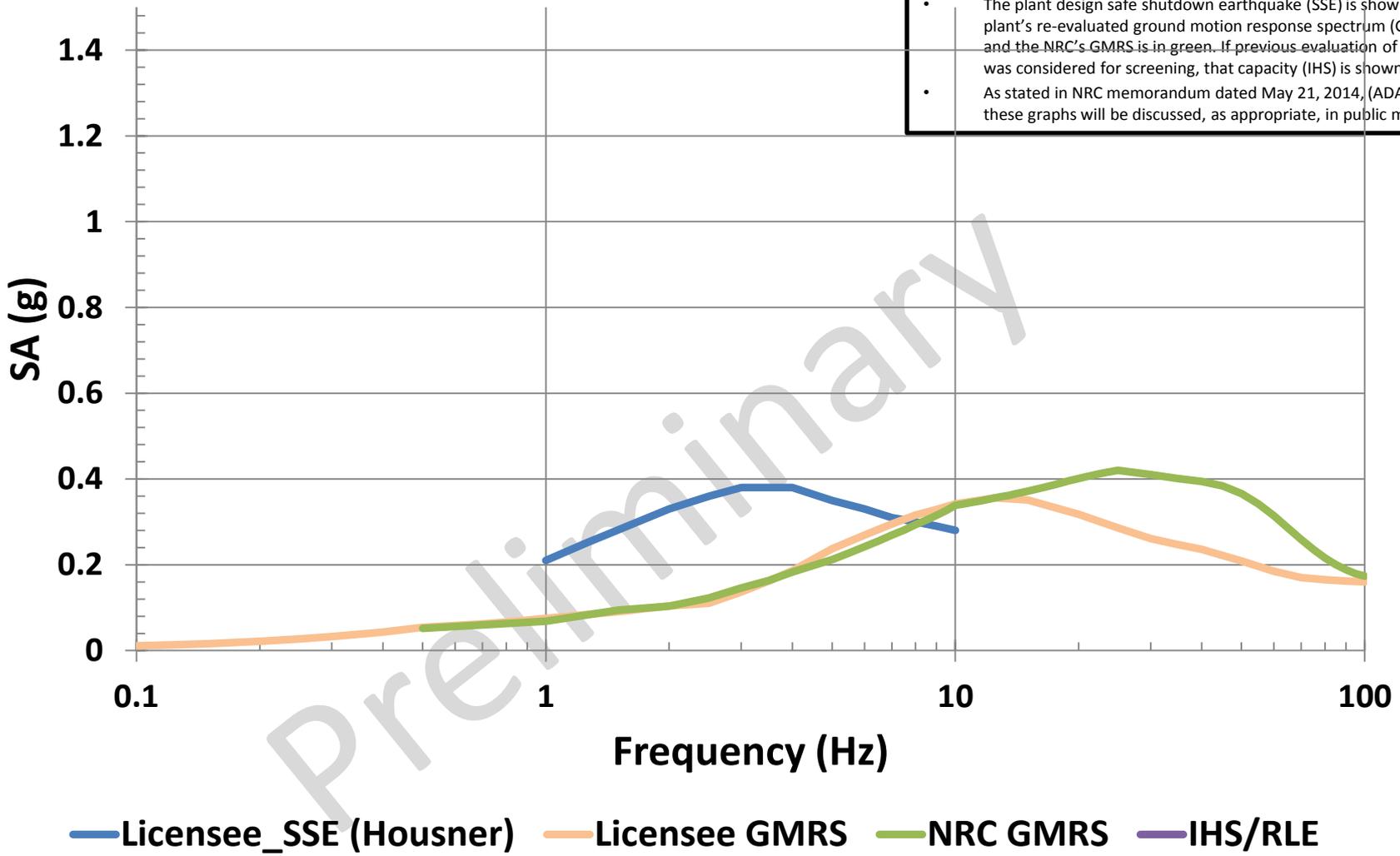
# Prairie Island

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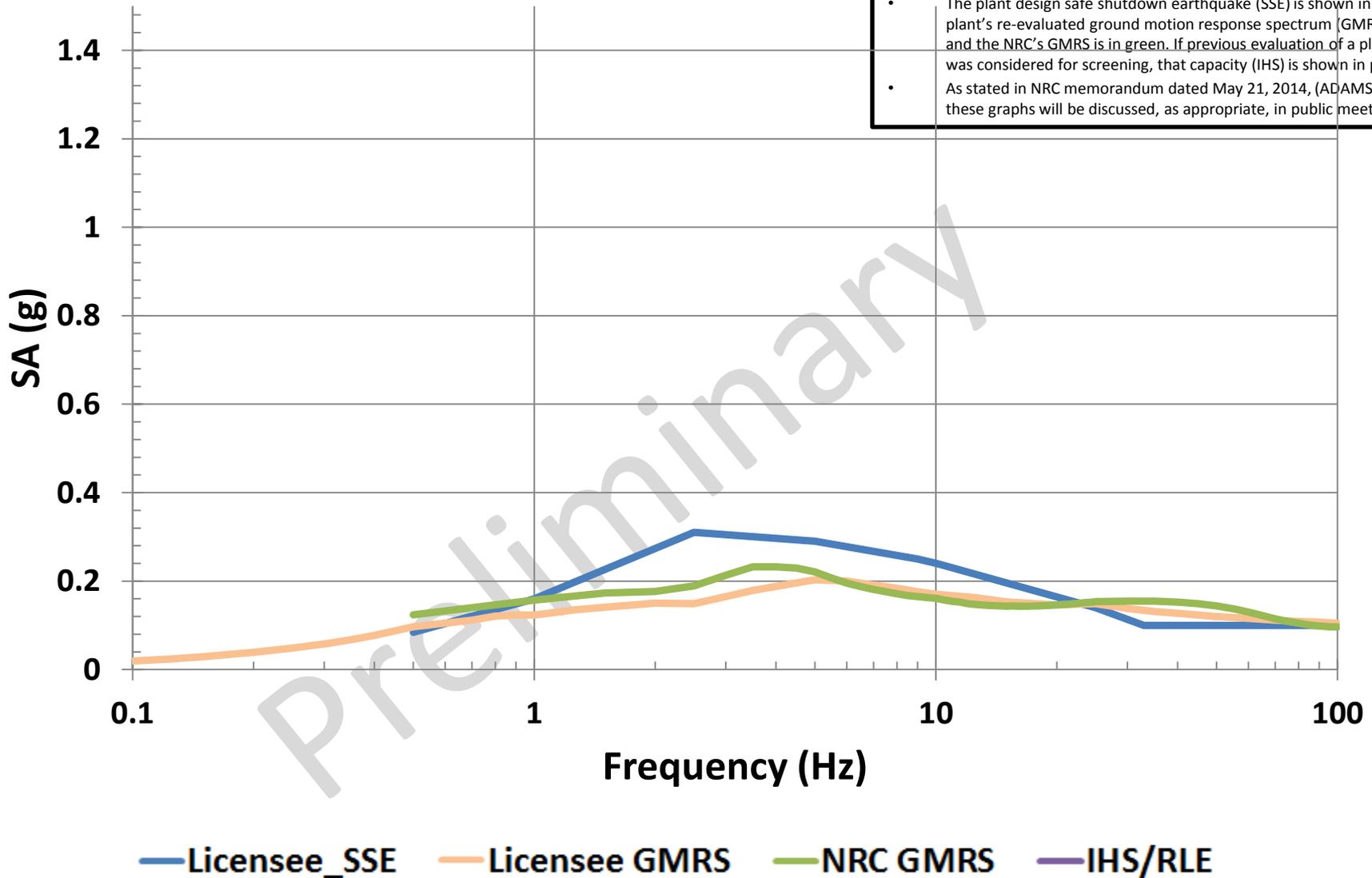
# Quad Cities

- 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.
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- As stated in NRC memorandum dated May 21, 2014, (ADAMS ML14136A126) these graphs will be discussed, as appropriate, in public meetings.



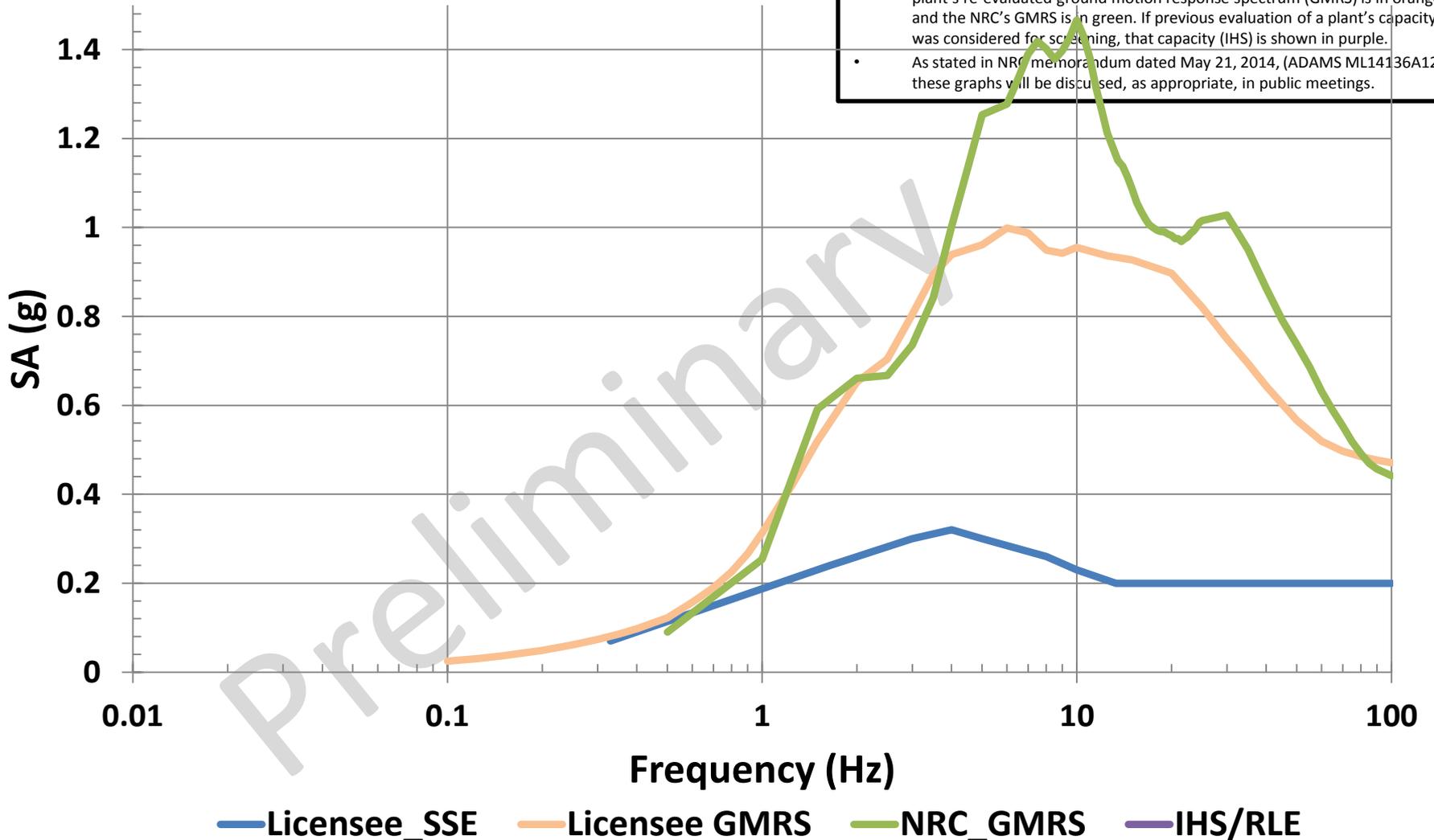
# River Bend

- 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.
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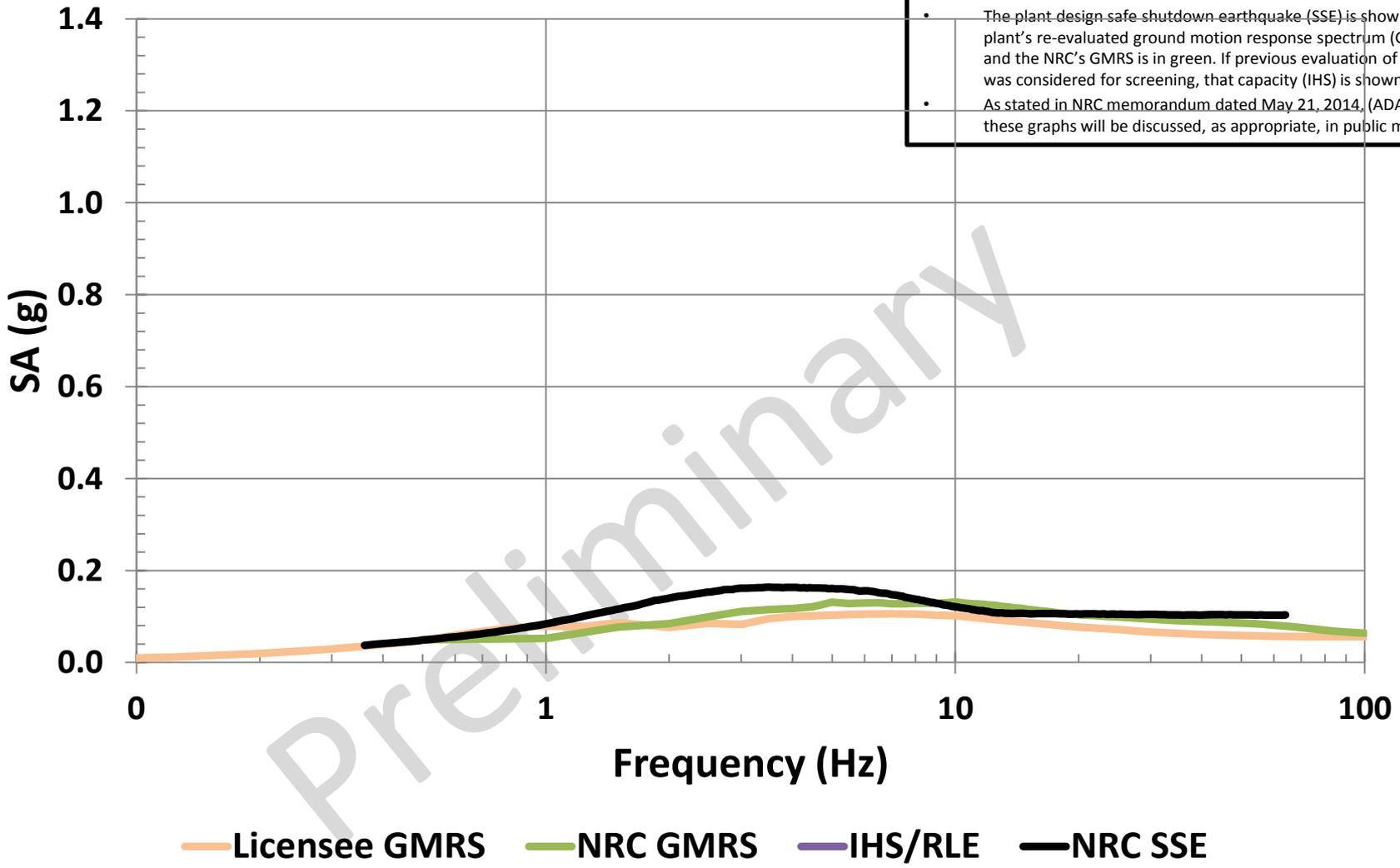
# HB Robinson

- 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.
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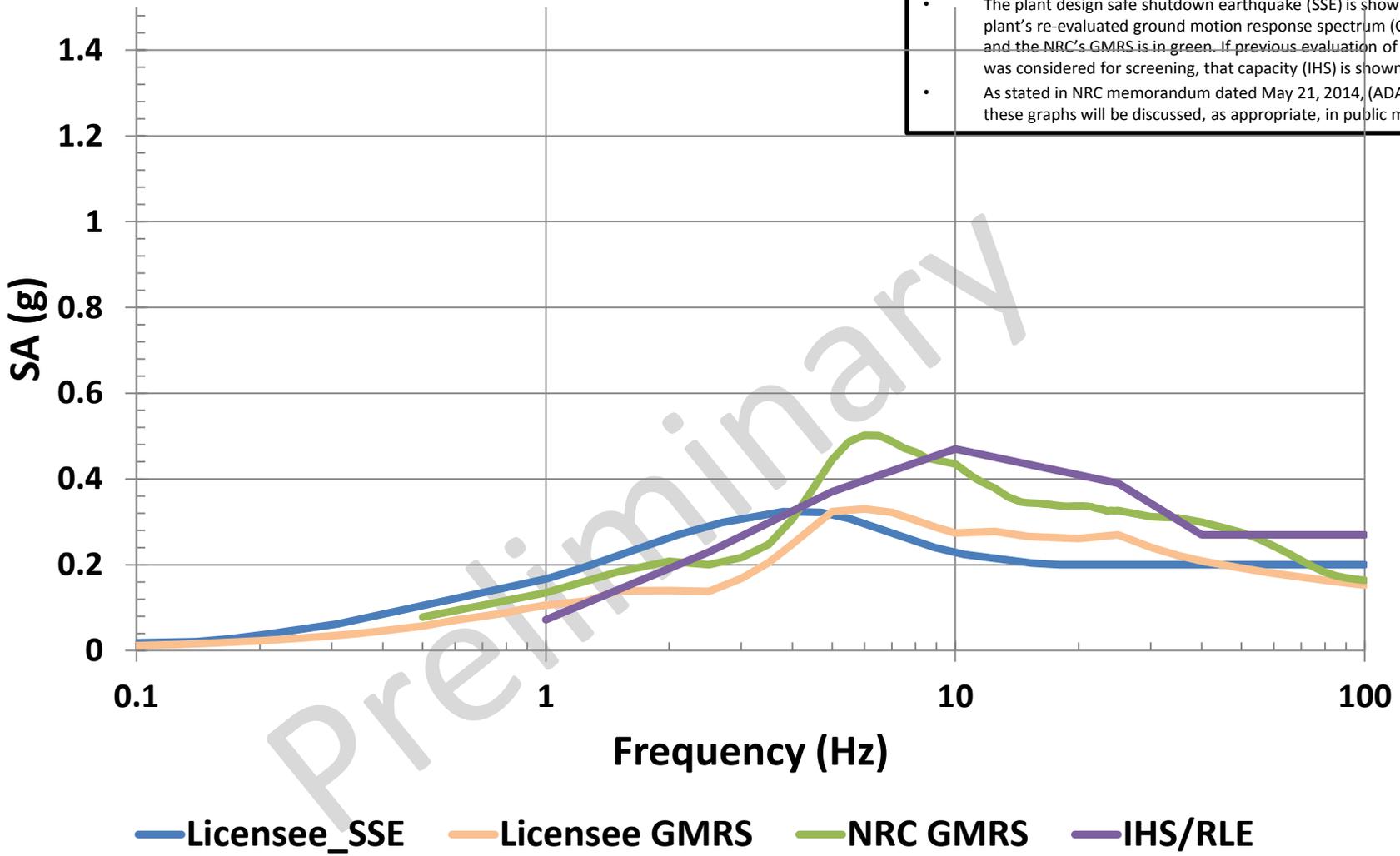
# St. Lucie

- 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.
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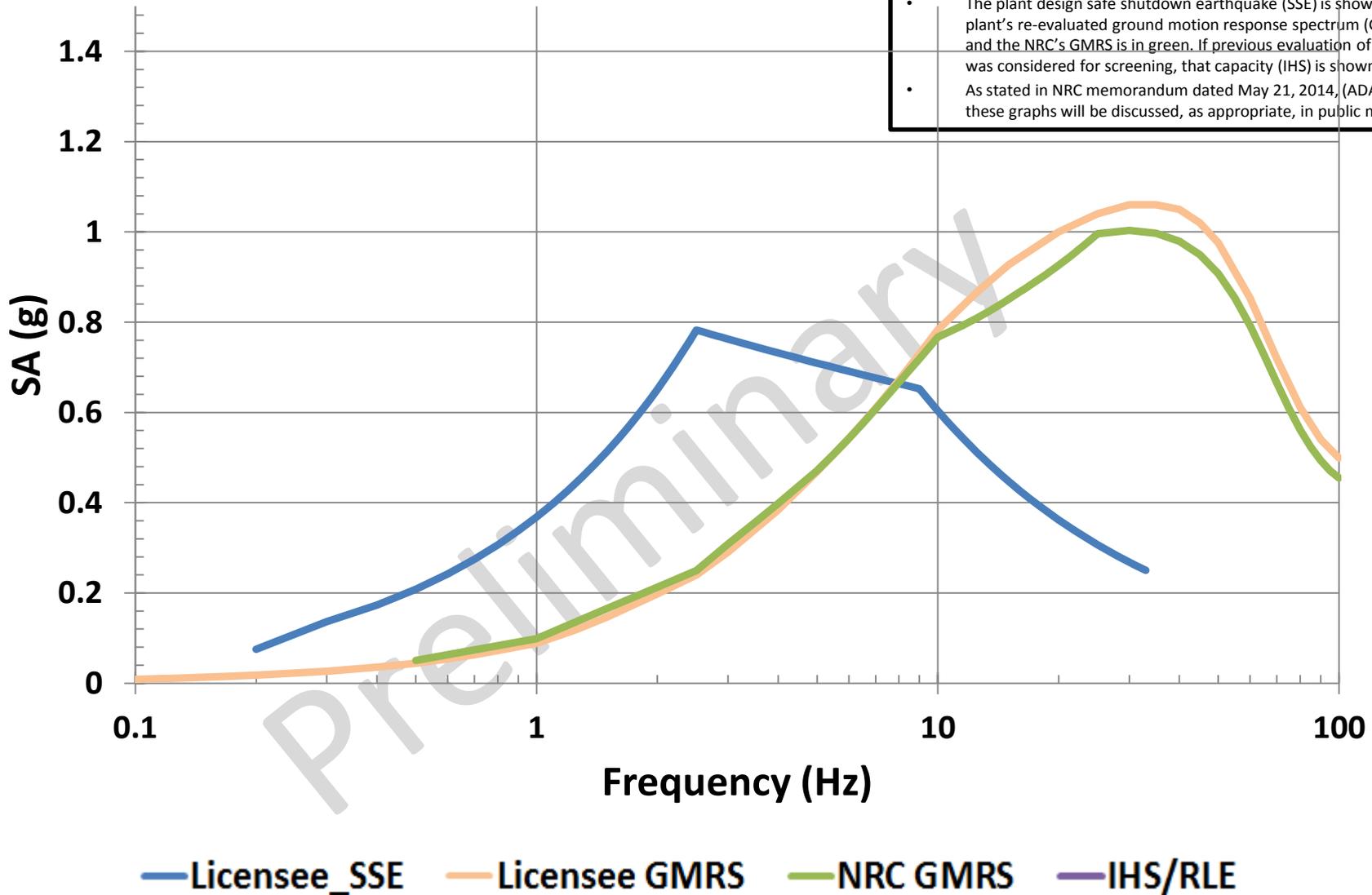
# Salem

- 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.
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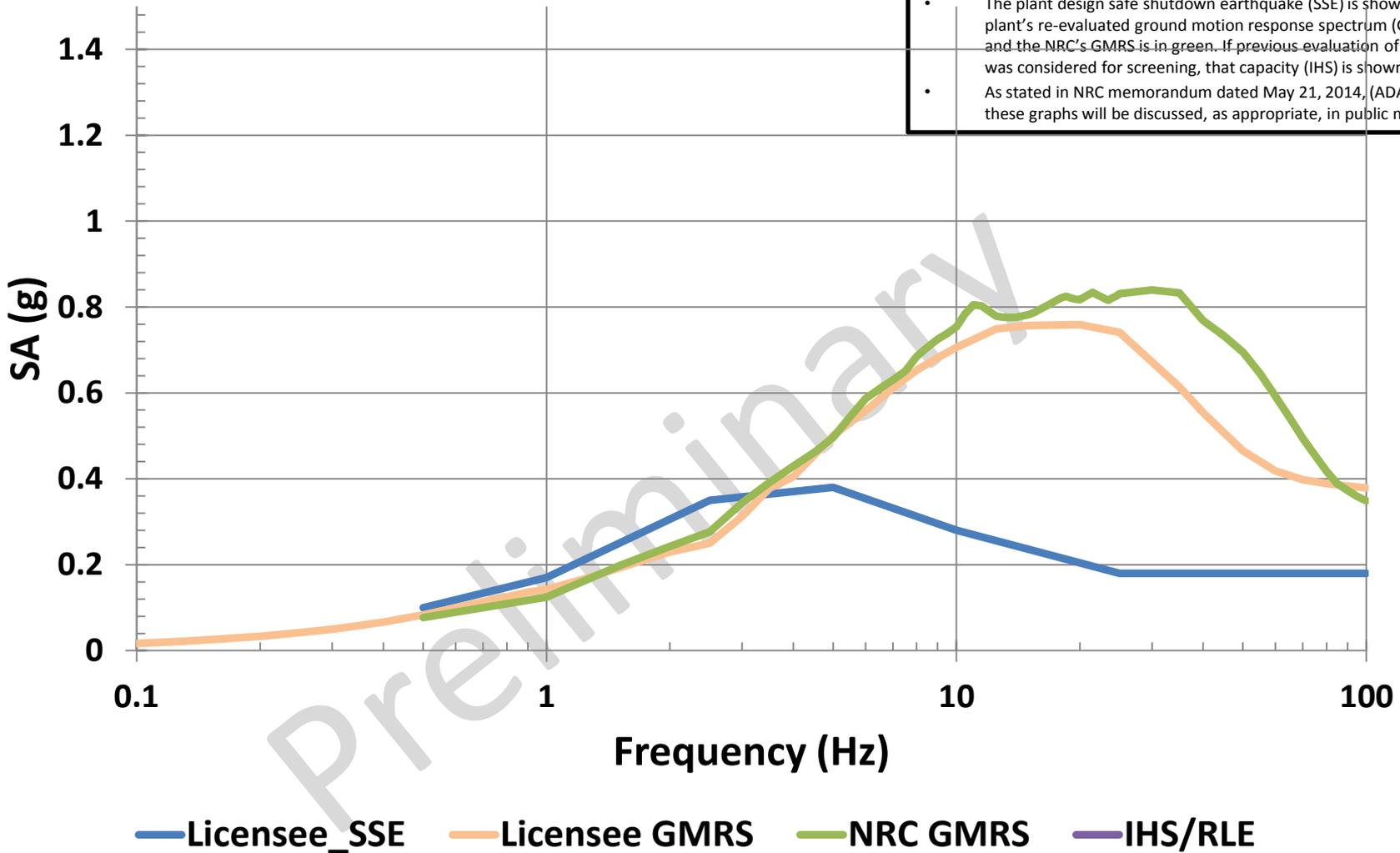
# Seabrook

- 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.
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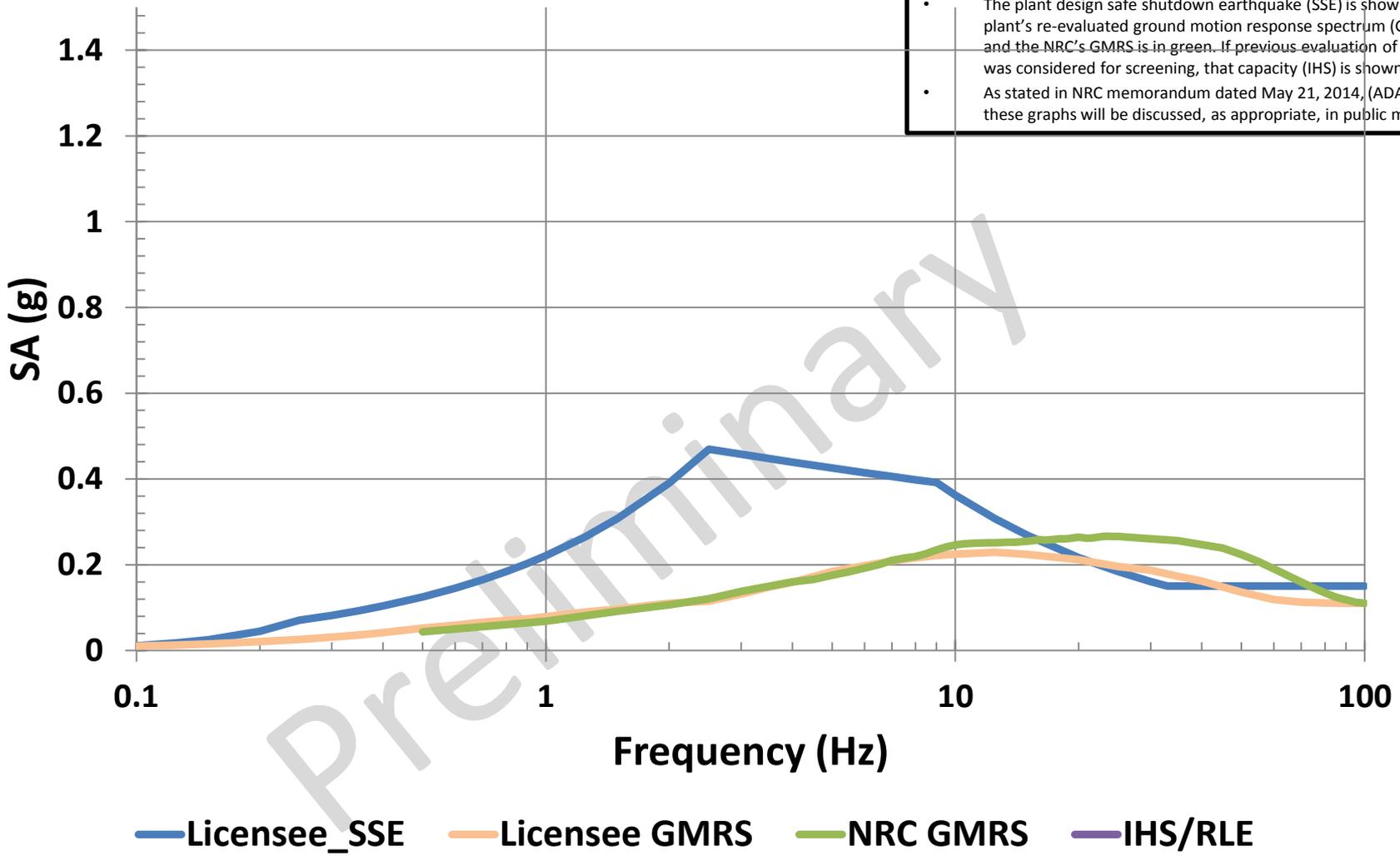
# Sequoyah

- 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.
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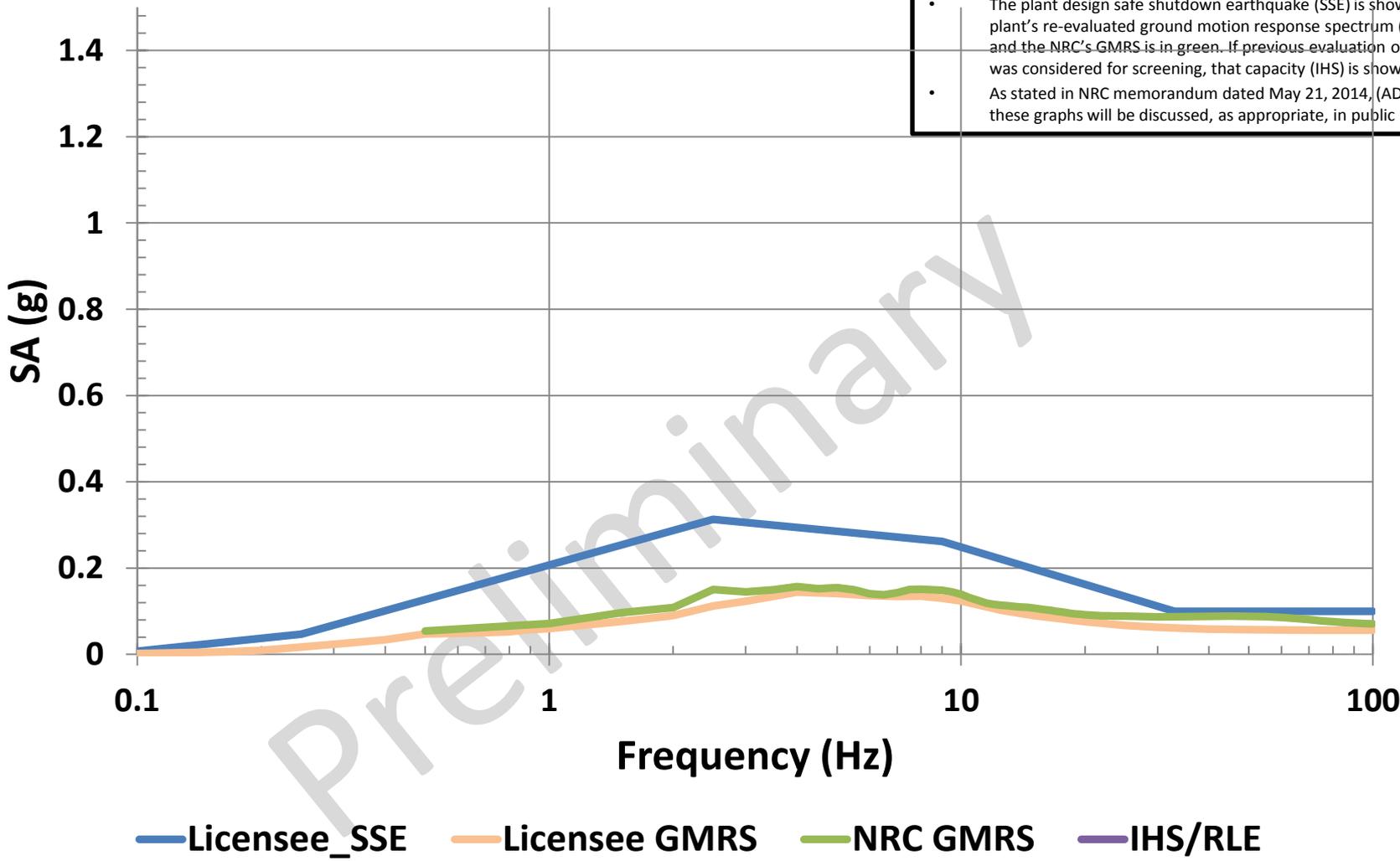
# Shearon Harris

- 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.
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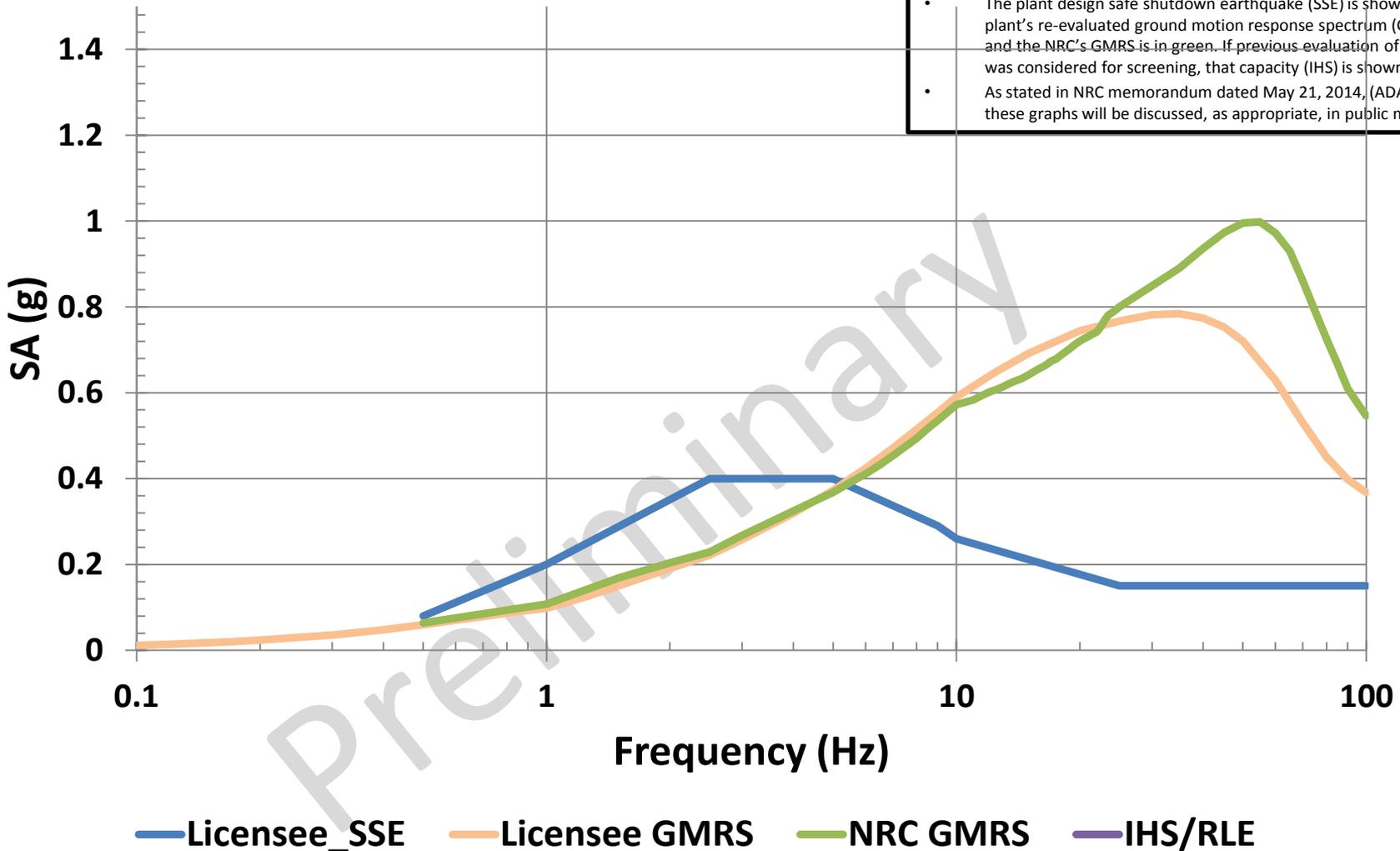
# South Texas Project

- 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.
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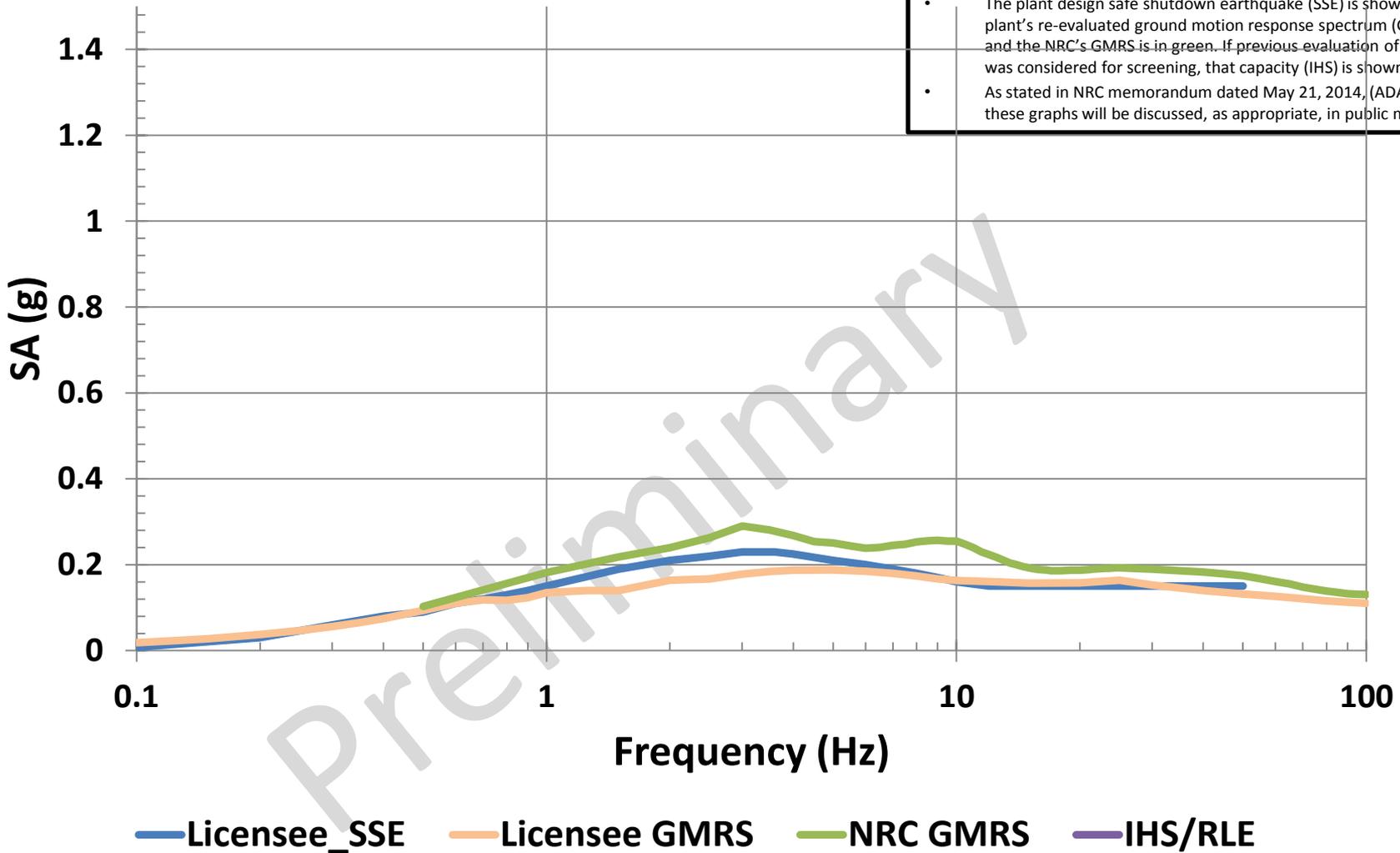
# V. C. Summer

- 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.
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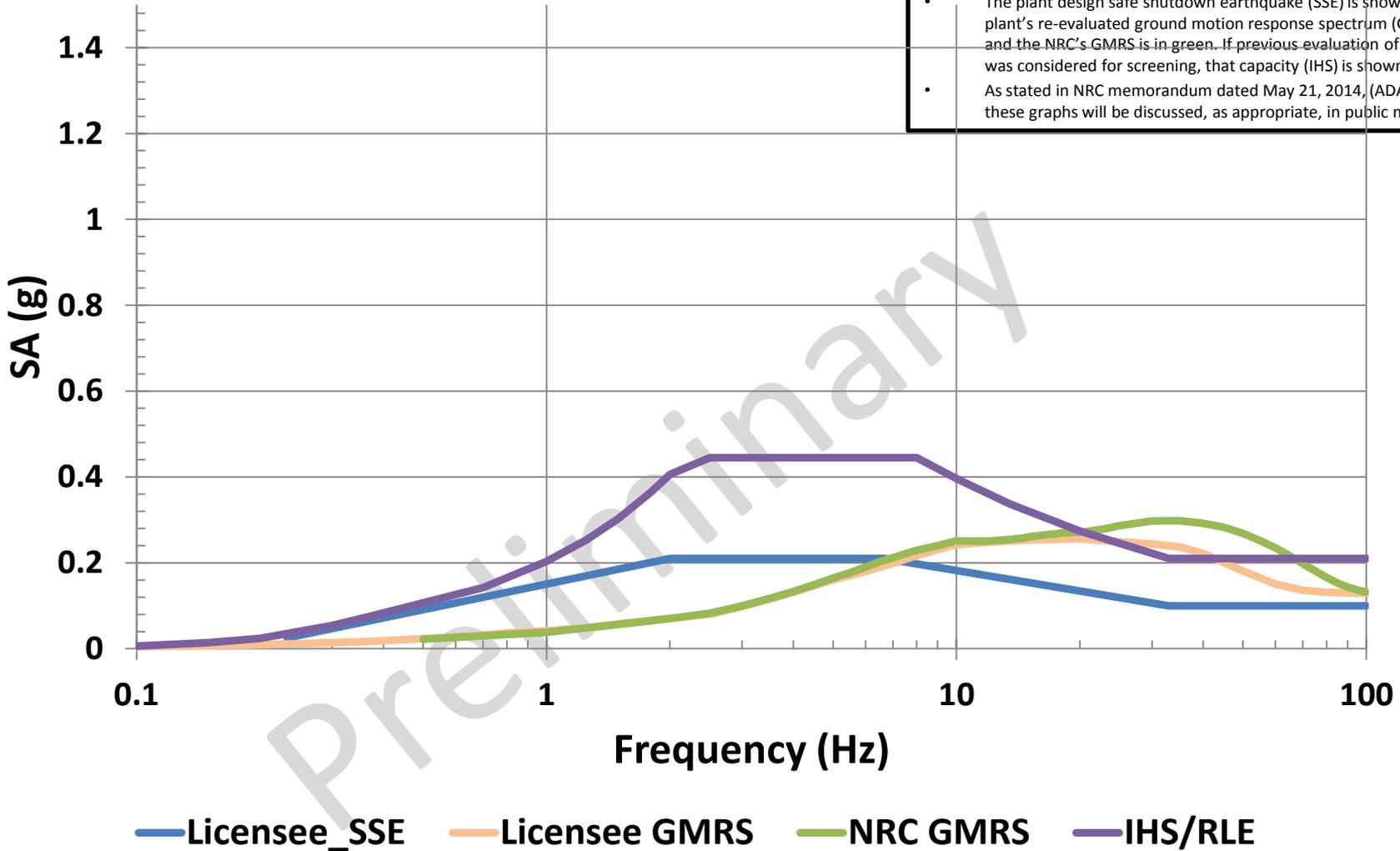
# Surry

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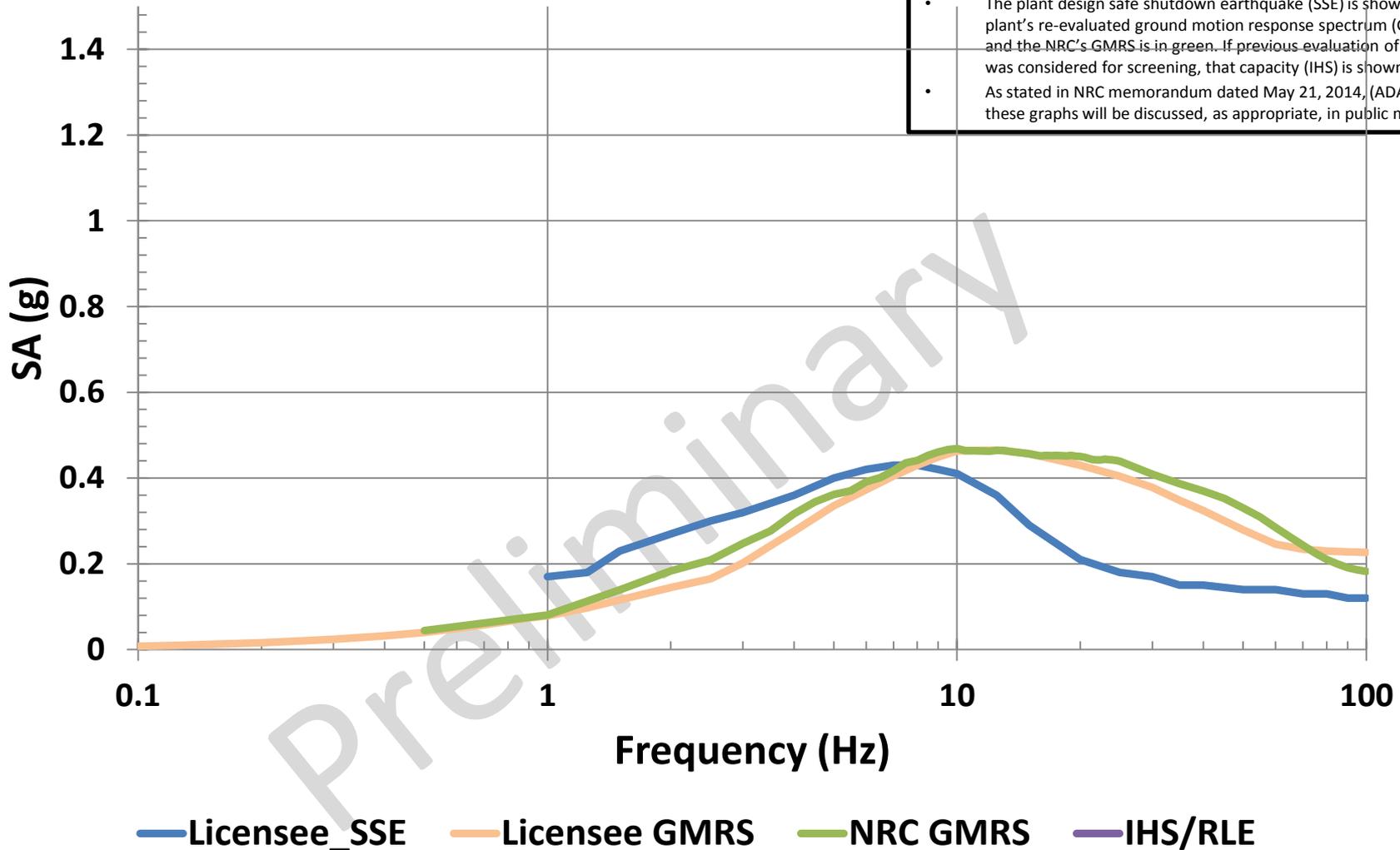
# Susquehanna

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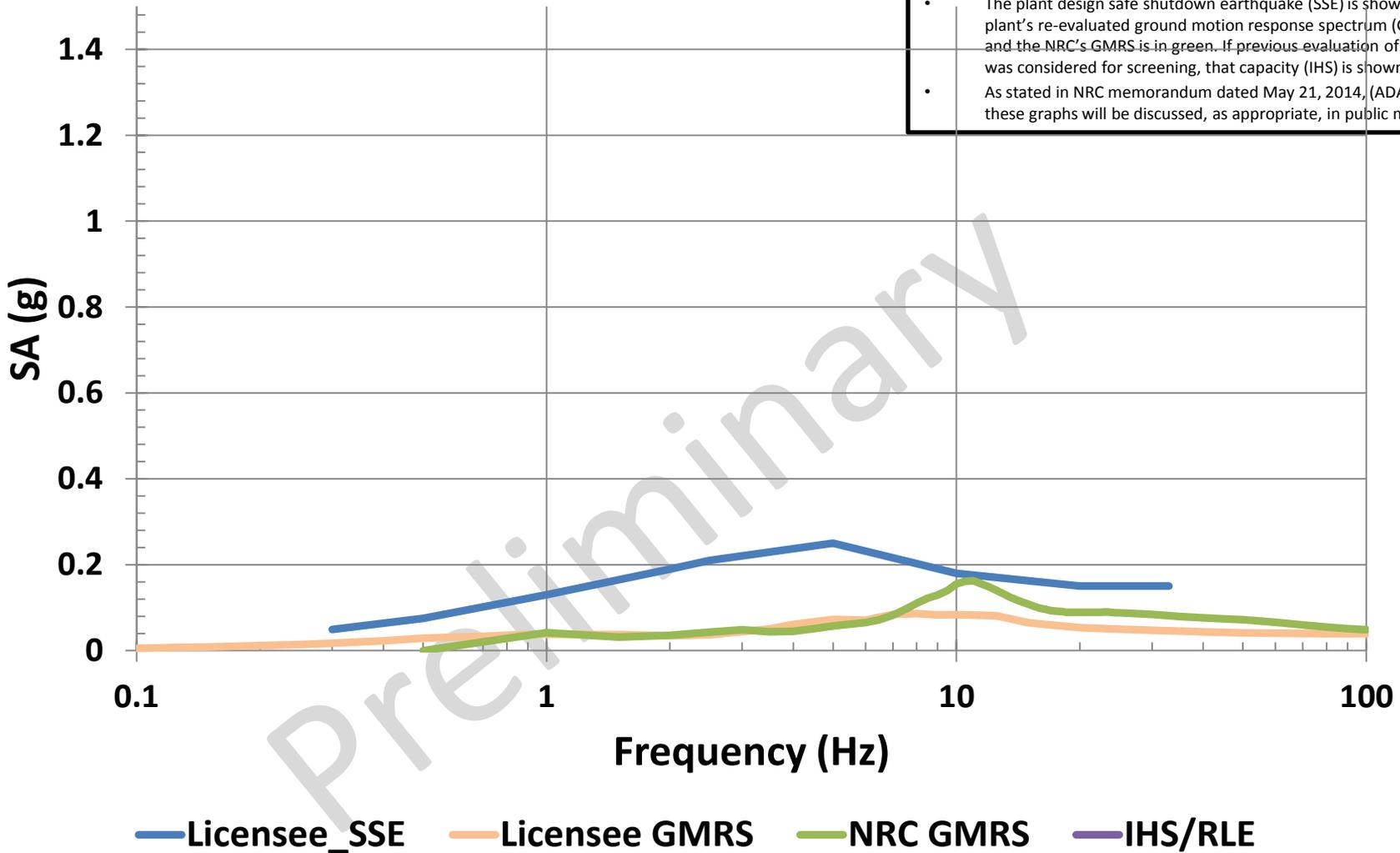
# Three Mile Island

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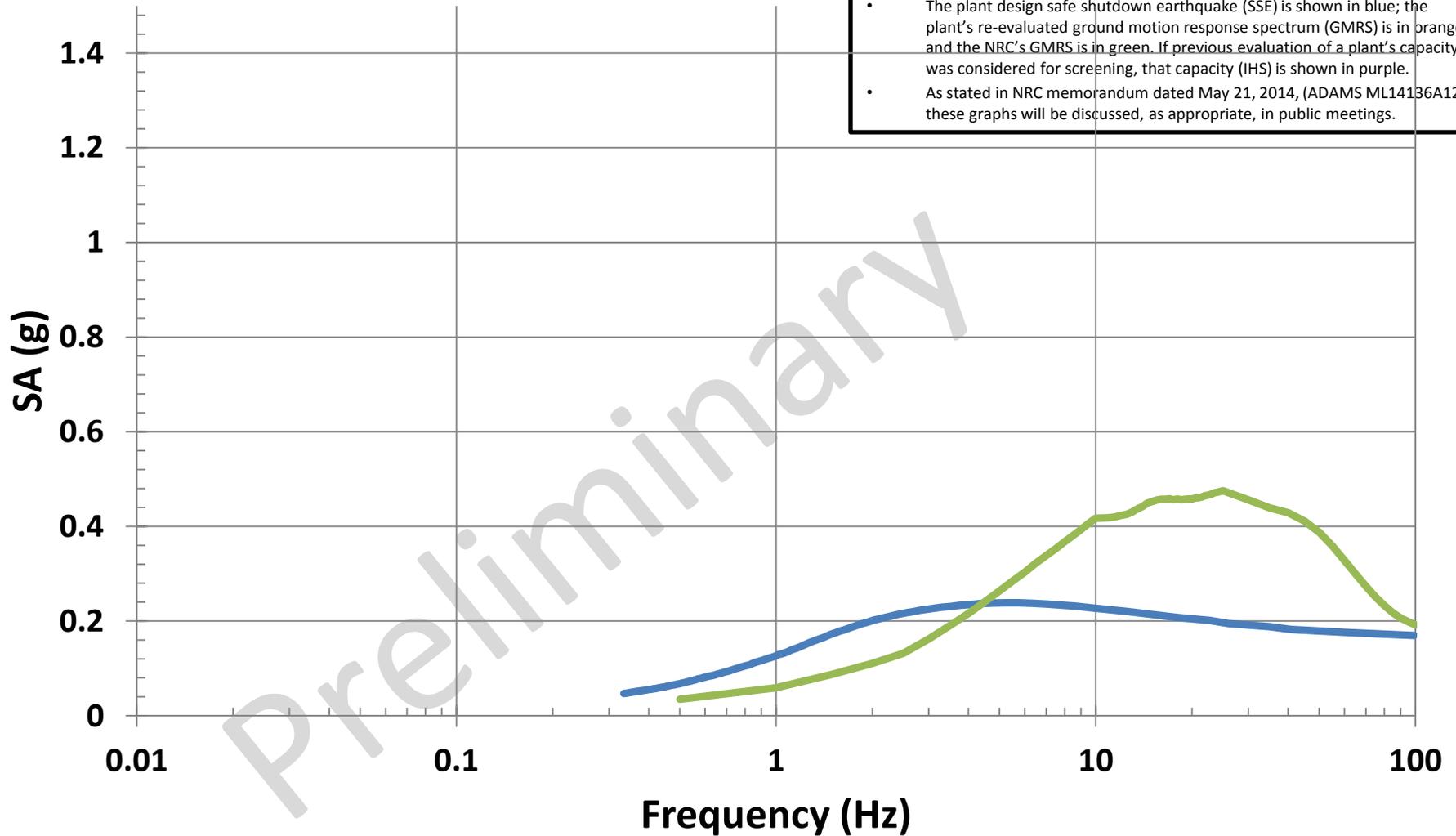
# Turkey Point

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# Vermont Yankee

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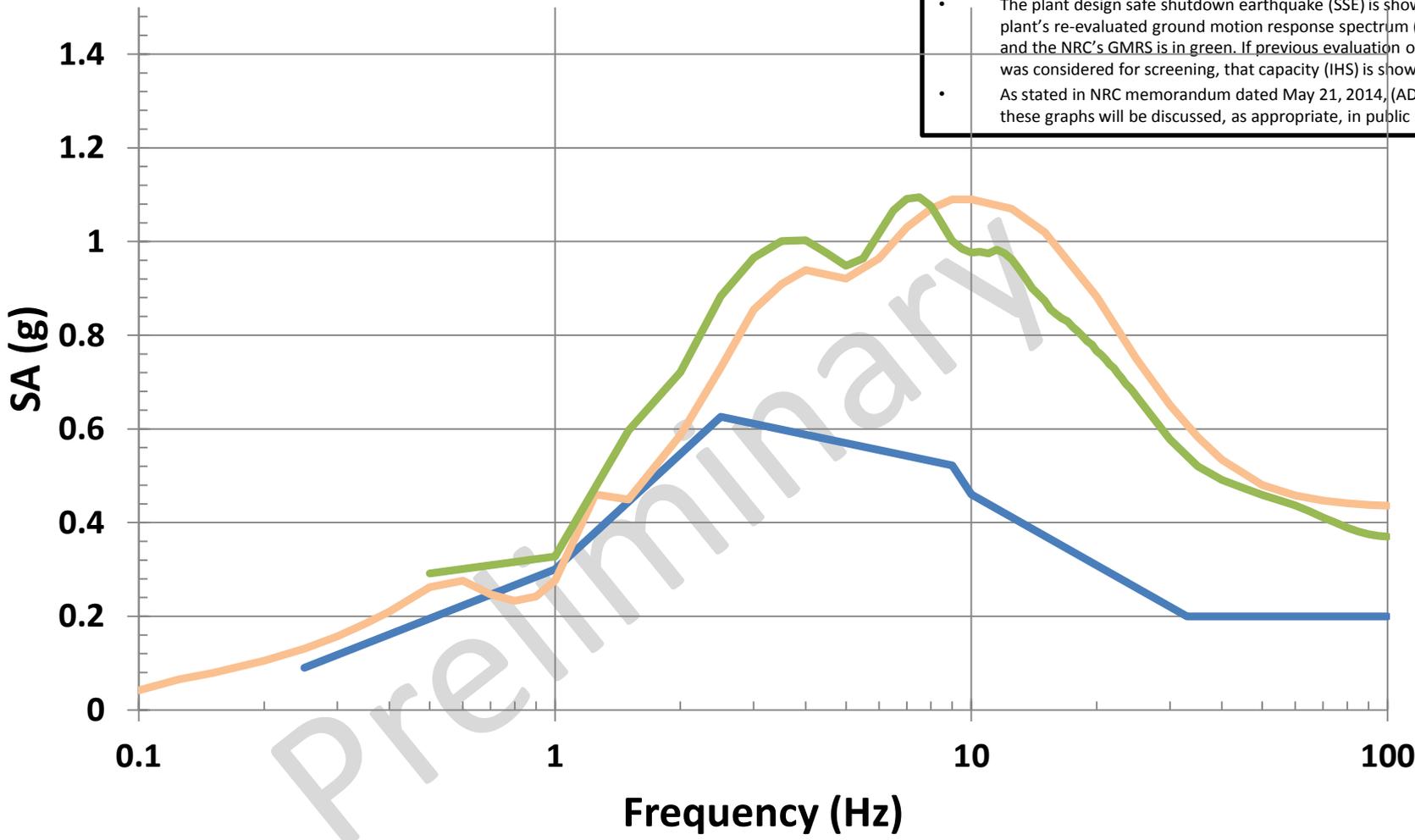
— Licensee\_SSE

— Licensee GMRS \*

— NRC GMRS

# Vogtle

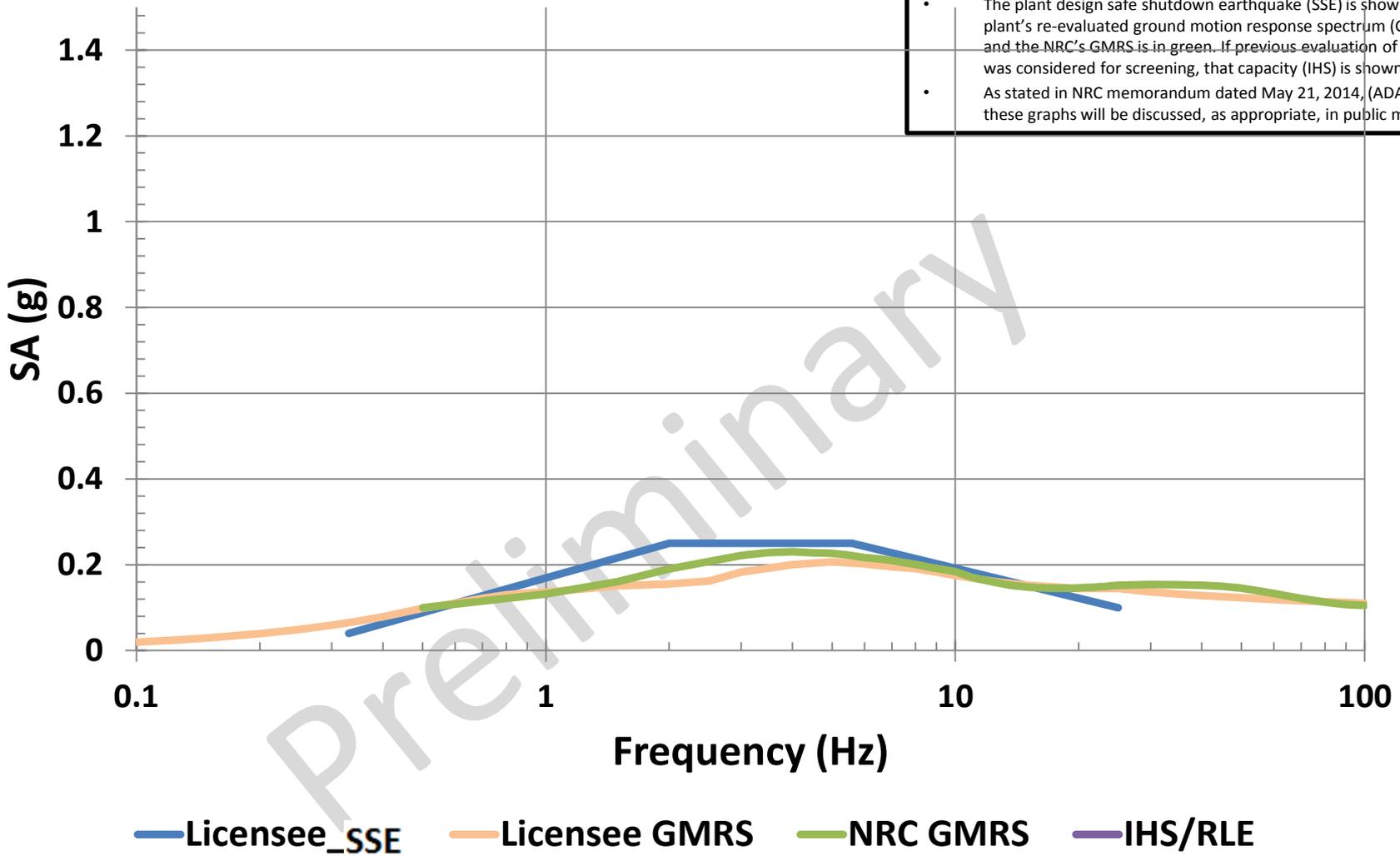
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— Licensee\_SSE    — Licensee GMRS    — NRC GMRS    — IHS/RLE

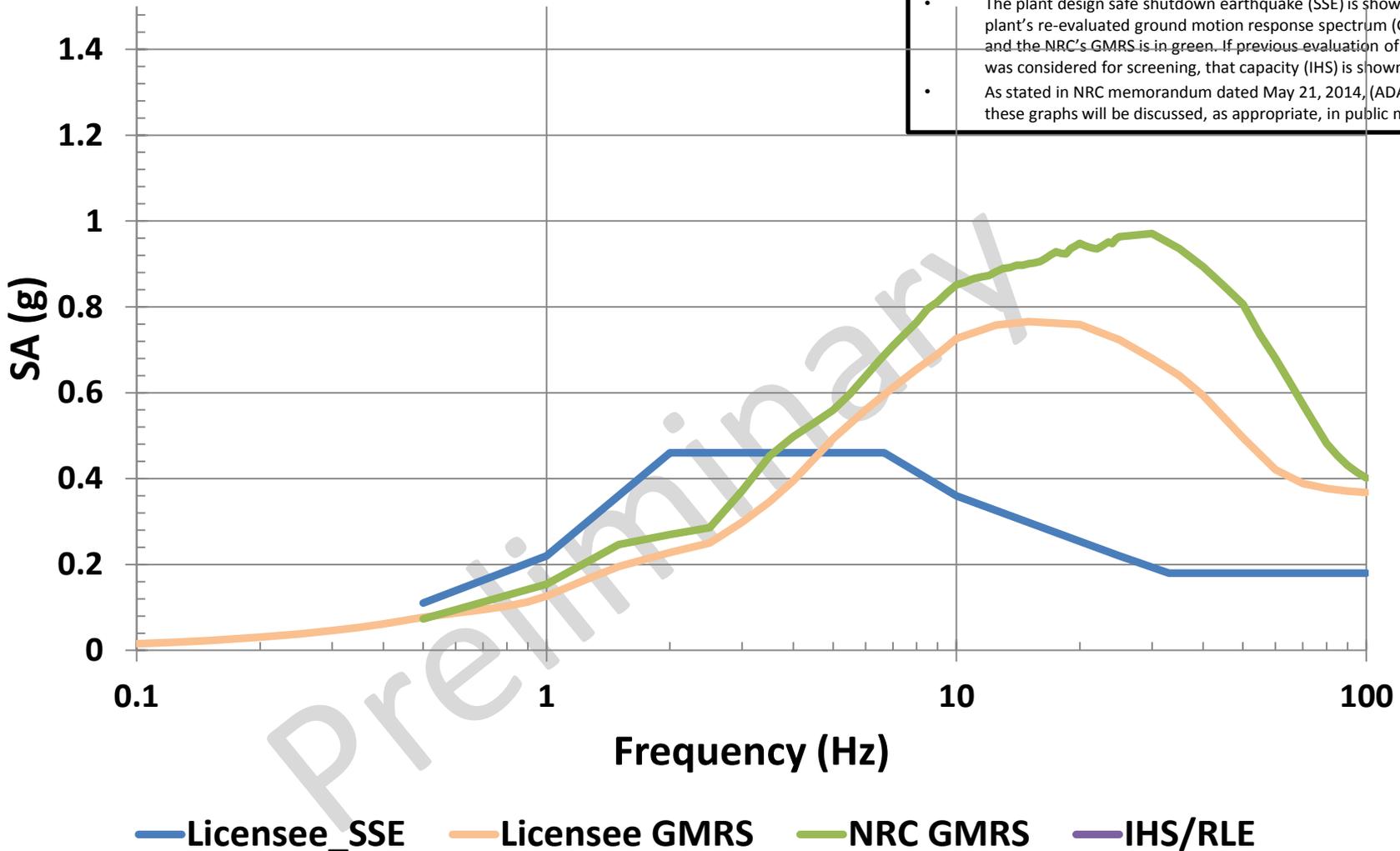
# Waterford

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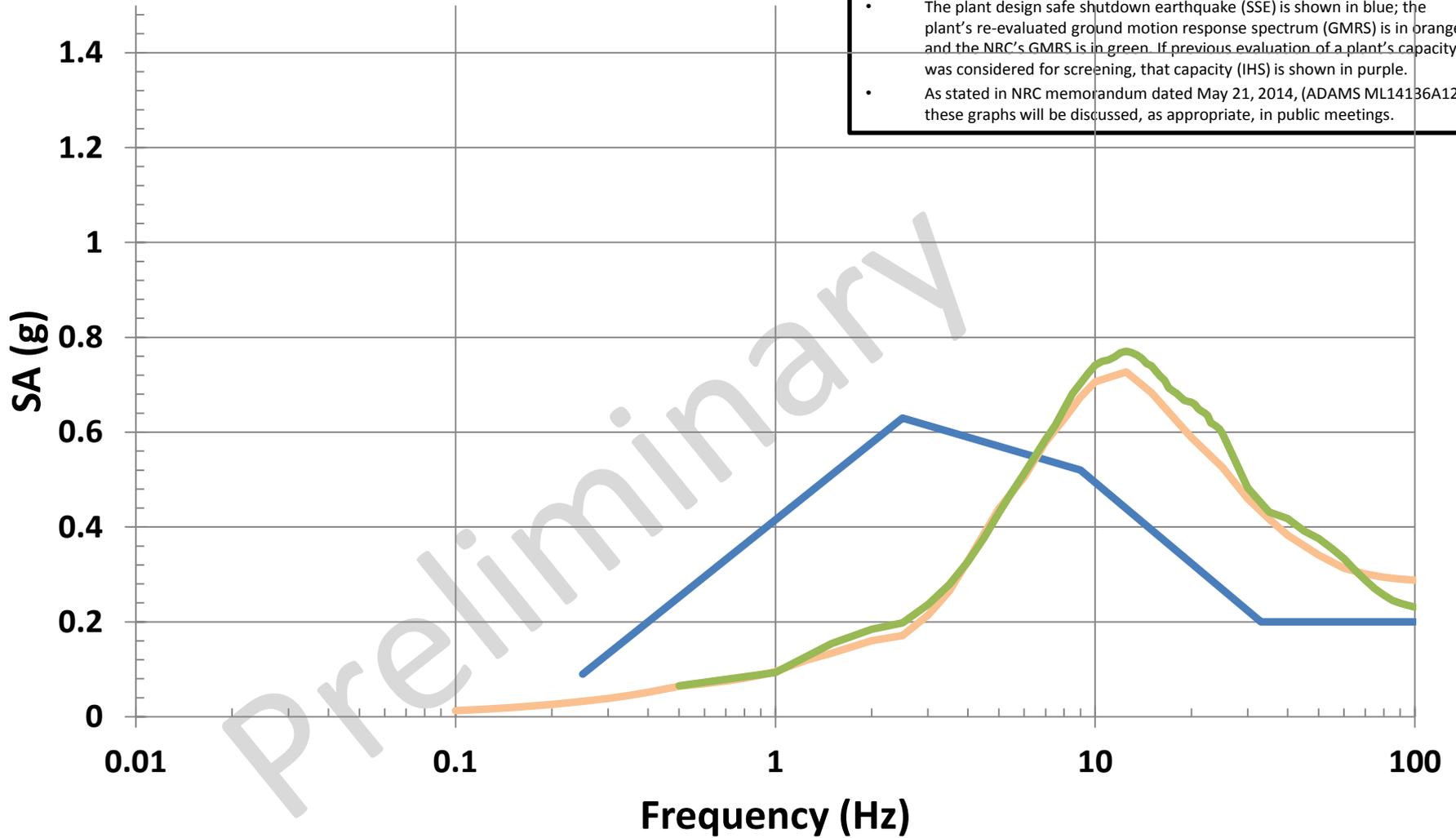
# Watts Bar

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# Wolf Creek

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— Licensee\_SSE    — Licensee GMRS    — NRC GMRS    — RLE(IPEEE)