Progress Energy

Serial: NPD-NRC-2011-067
August 22, 2011

U.S. Nuclear Regulatory Commission
Attention: Document Control Desk
Washington, D.C. 20555-0001

LEVY NUCLEAR PLANT, UNITS 1 AND 2
DOCKET NOS. 52-029 AND 52-030
VOLUNTARY SUBMITTAL – PRELIMINARY EVALUATION OF IMPACT ON SSI ANALYSIS DUE TO TIME HISTORY INPUT ERROR

Reference: 1. Letter from John Elnitsky to the NRC, dated May 27, 2011, " Supplement 5 to Response to Request for Additional Information Letter No. 085 related to Seismic System Analysis," Serial: NPD-NRC-2011-047

Ladies and Gentlemen:

On August 4, 2011, Progress Energy – Florida (PEF) informed the NRC of an error identified in the input time histories used in the Levy Nuclear Plant (LNP) Soil Structure Interaction (SSI) documented in Reference 1. As a follow-up, PEF has completed a preliminary evaluation of the error and its impact on the LNP Floor Response Spectra (FRS) at the six key AP1000 locations for the Best Estimate (BE) and Upper Bound (UB) soil profiles. The preliminary results of the revised SSI analysis show that the FRS at the six key locations based on the corrected SSI input time histories are essentially the same as those submitted in response to NRC Letter 085 RAI 03.07.02-02 (Reference 1) for both the BE and the UB soil profiles. Attachment 1 provides details on the identified error, and Attachment 2 provides comparisons of the FRS at six key locations with the original and the corrected input time histories resulting from the revised SSI analysis for BE and UB soil profiles.

PEF has completed the formal revision of calculation LNG-0000-X7C-044 to develop the corrected SSI input time histories and will revise the Westinghouse SSI report LNG-1000-S2R-804 to develop the FRS at the six key locations using the corrected time histories. A revised response to NRC letter 085 RAI 03.07.02-02 with the corrected time histories and SSI analysis results is scheduled to be submitted in early October, 2011. Based on the preliminary SSI analysis results (Attachment 2), PEF believes the revised FRS at the six AP1000 key locations will be shown to be essentially the same as those submitted via letter NPD-NRC-2011-047.

If you have any further questions, or need additional information, please contact Bob Kitchen at (919) 546-6992, or me at (727) 820-4481.

Progress Energy Florida, Inc.
P.O. Box 14042
St. Petersburg, FL 33733

D094
NRO

I declare under penalty of perjury that the foregoing is true and correct.

Executed on August 22, 2011.

Sincerely,

John Elnitsky
Vice President
New Generation Programs & Projects

Attachments:

1. Memorandum from Bob Youngs of AMEC "Documentation of Error in SSI Time History Generation in Calculation LNG-0000-X7C-044", dated August 15, 2011
2. Westinghouse Report "Preliminary Evaluation of Revised Time History Input for the Best Estimate and Upper Bound Soil Cases – Levy Nuclear Island and RCC Bridging Mat", dated August 18, 2011

cc : U.S. NRC Region II, Regional Administrator
Mr. Brian C. Anderson, U.S. NRC Project Manager
Ms. Terri Spicher, U.S. NRC Project Manager

Attachment 1
Memorandum from Bob Youngs of AMEC "Documentation of Error in SSI Time History Generation in Calculation LNG-0000-X7C-044", dated August 15, 2011, 5 pages

Memo

To: Lorin Young
CH2M Hill
151 North Ridge, Suite 150
Idaho Falls, ID 83402

Project: 11151.003

From: Bob Youngs

cc:

Tel: (510) 663-4231

Fax: (510) 663-4141

Date: August 15, 2011

Subject: Documentation of Error in SSI Time History Generation in Calculation LNG-0000-X7C-044

This memorandum documents an error discovered in the input acceleration time histories created for Soil Structure Interaction (SSI) analyses of the Levy Site. The error occurred in the last step of the process used to generate the input time histories. The process used to develop the time histories consisted of the following steps as presented in calculation LNG-0000-X7C-044.

1. Generate randomize soil profiles to finished grade (elevation 51 ft.) including the fill properties.
2. Compute amplification functions representing amplification of hard rock motions to the surface of the fill.
3. Use the results of Step 2 to perform cumulative absolute velocity (CAV) calculations to generate the performance-based surface response spectra (PBSRS).
4. Use the results of Step 2 to develop lower bound (LB), best estimate (BE), and upper bound (UB) SSI profiles; an additional lower lower bound (LLB) SSI profile was also developed.
5. Extract from Step 2 the amplification from the hard rock base motion to the base of excavation (BE) elevation at -24 ft.
6. Use the results of Step 5 to develop a soil column outcrop response (SCOR) foundation input response spectrum (FIRS) for elevation -24 ft.
7. Match recorded acceleration time histories to the SCOR FIRS for elevation -24 ft.
8. Input the time histories developed in Step 7 as outcrop motions at elevation -24 ft into the SSI profiles developed in Step 4. Using the program SHAKE, extract in-column motions at elevation -24 ft for use in SSI analyses.

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The error occurred in Step 8. The time histories matched to the SCOR FIRS were incorrectly assigned as outcropping motions to one layer too shallow in the SSI profile models. The differences in elevation were 1.6, 1.6, 1.2, and 4.6 ft for the LLB, LB, BE, and UB profiles, respectively.

Figures 1, 2, and 3 show the effect of the error on the in-column time histories. Plotted on each figure is the percent difference in spectral acceleration (5% damping) between the incorrect and correct time histories. These calculations were performed for 301 frequencies between 0.1 and 100 hertz (Hz). The percent error is shown as incorrect minus correct such that a negative error indicates ground motions that were too low and a positive error indicates ground motions that were too high. For the LB, BE, and UB profiles the differences in the in-column motions are less than ±1% for frequencies of 10 Hz and less. The small -0.6% offset for the UB time histories reflects the fact that a slight difference in scaling was needed to maintain a geometric mean peak ground acceleration (pga) of 0.1g at the reactor foundation elevation for the UB case. For the LLB case, the difference is about -2% for spectral accelerations in the frequency range of 3 to 10 Hz. At frequencies above 10 Hz the differences for the LB, BE, and UB cases are generally less than ±2% with a few isolated peak differences as large as ±5% in the frequency range of 20 to 30 Hz. The differences for the LLB case oscillate between -3% and + 1% for frequencies above 10 Hz. In general, the differences are smaller for the vertical component of motion.

We have corrected the error and issued a new Revision 3 of the calculation. As part of the update we performed an independent check of the entire calculation.

Sincerely yours,
AMEC Geomatrix, Inc.

Bob Youngs
Principal Engineer
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E-mail: bob.youngs@amec.com

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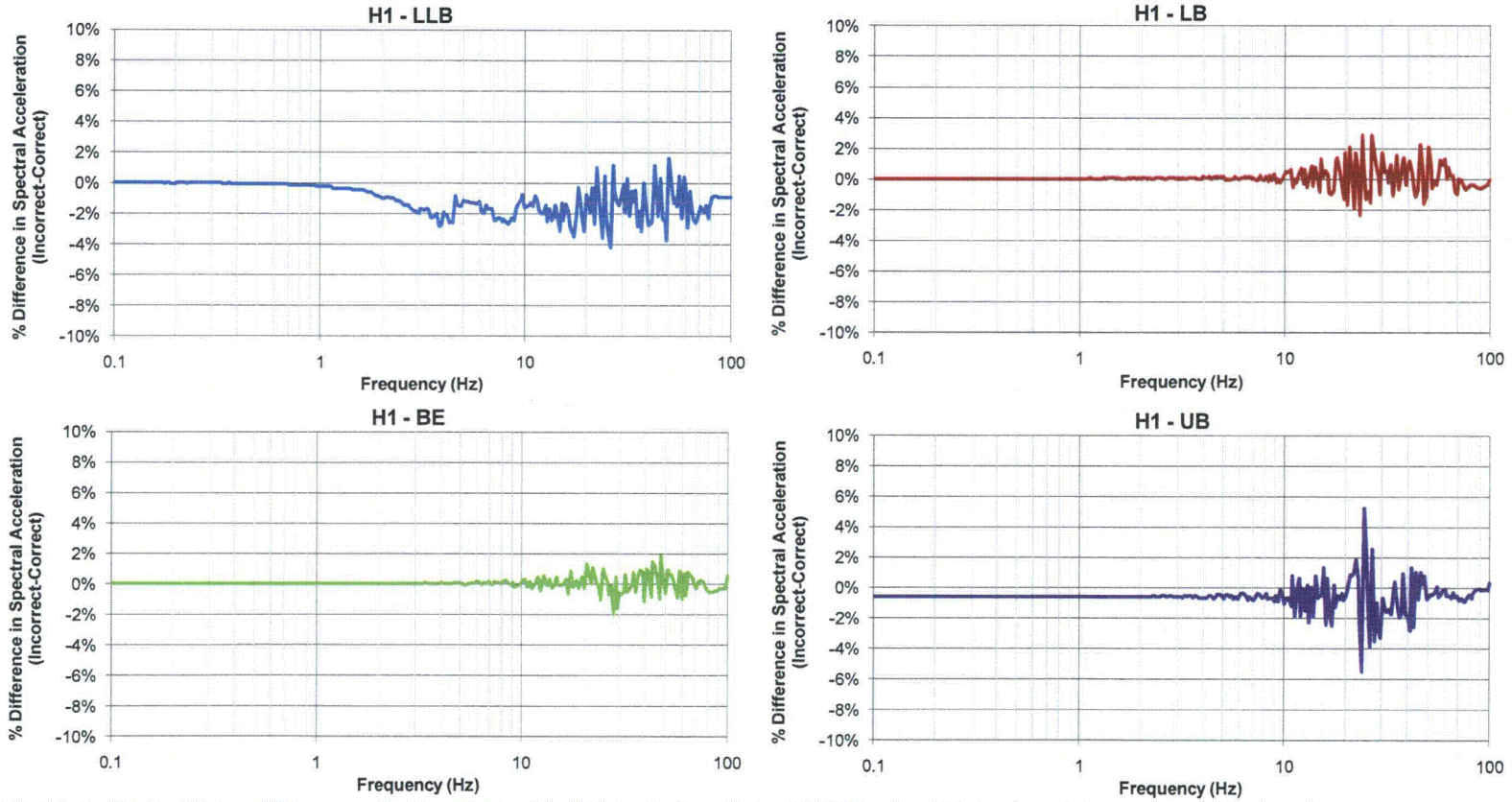

Figure 1: Percentage difference in in-column motions at elevation -24 ft for the H1 horizontal component of motion.

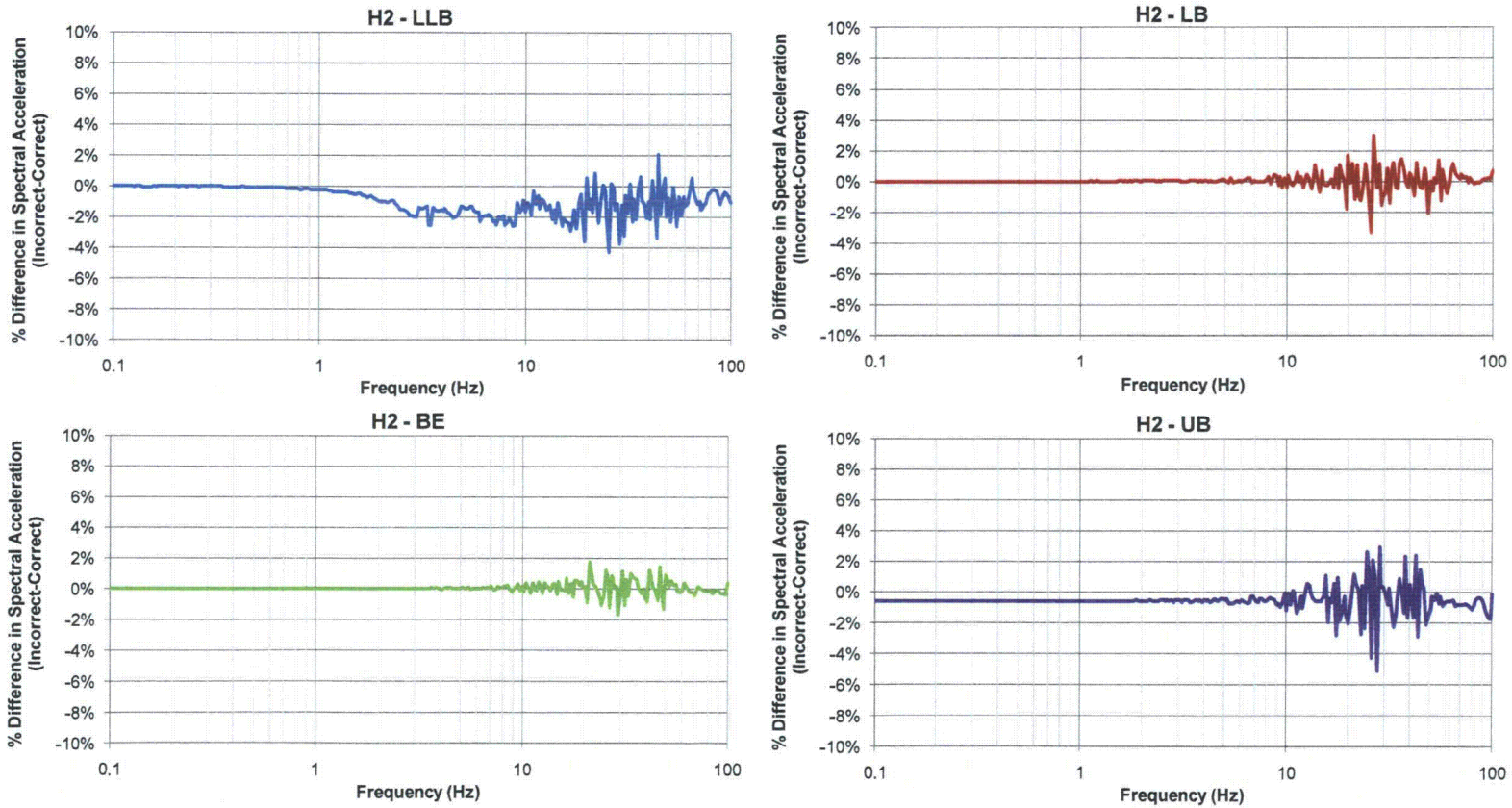

Figure 2: Percentage difference in in-column motions at elevation -24 ft for the H2 horizontal component of motion.

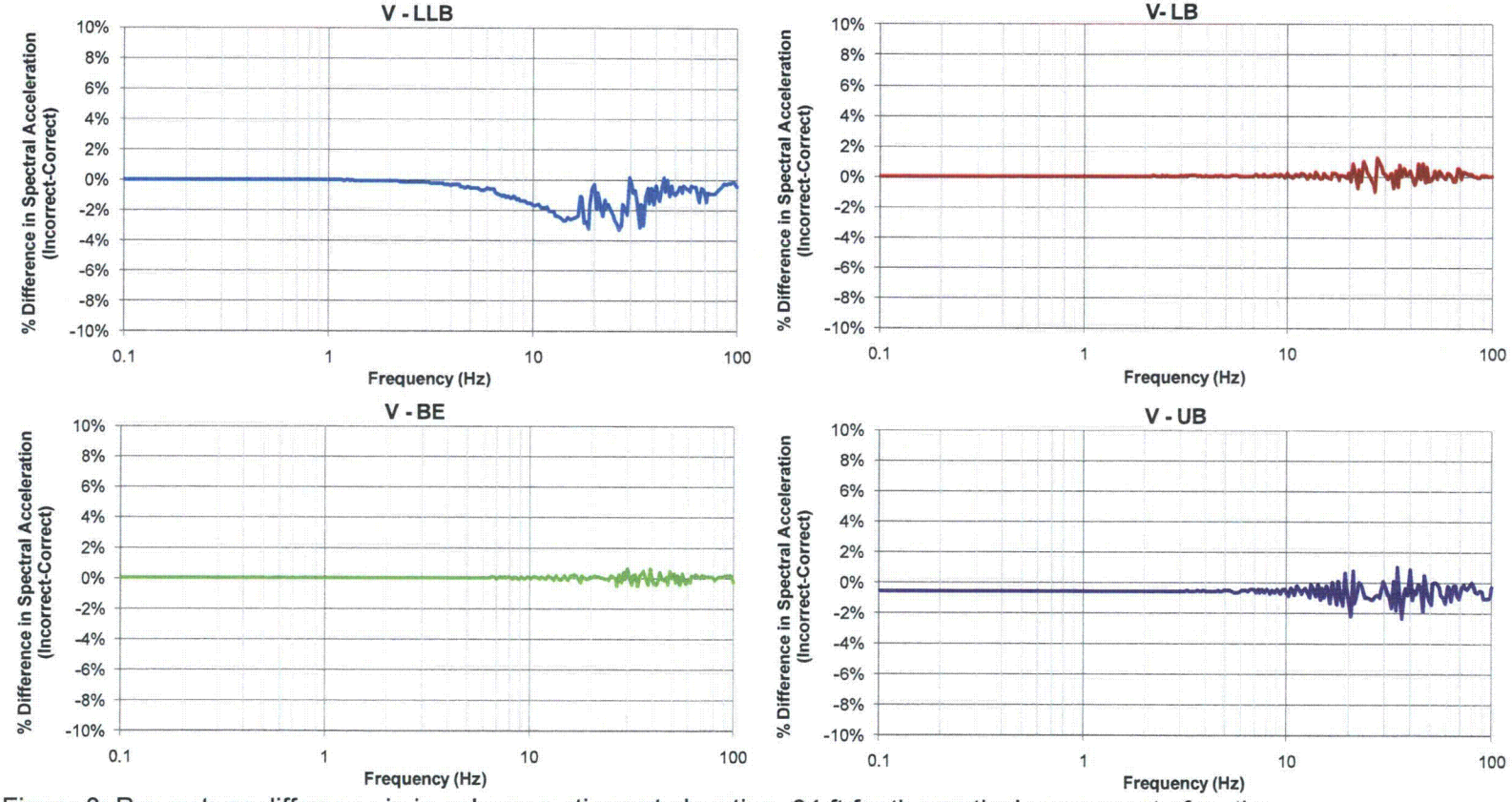

Figure 3: Percentage difference in in-column motions at elevation -24 ft for the vertical component of motion.

Attachment 2

Westinghouse Report "Preliminary Evaluation of Revised Time History Input for the Best Estimate and Upper Bound Soil Cases – Levy Nuclear Island and RCC Bridging Mat", dated August 2011, 21 pages

August 2011

AP1000

Preliminary Evaluation of Revised Time History Input for the Best Estimate and Upper Bound Soil Cases –

Levy Nuclear Island and RCC Bridging Mat (Reference LNG-1000-S2R-804, Rev. 4)

Westinghouse Electric Company LLC
Nuclear Power Plants
1000 Westinghouse Drive
Cranberry Township, PA 16066

1.0 Purpose

Westinghouse Electric Company (WEC) has completed a preliminary supplemental evaluation of the site specific Soil-Structure Interaction (SSI) analysis of the Levy Nuclear Plant (LNP) Nuclear Island (NI) and Roller Compacted Concrete (RCC) bridging mat.

This preliminary evaluation was performed at the request of NRC to initially assess the in-structure Floor Response Spectra (FRS) at six (6) key **AP1000** NI locations as a result of changes in the LNP input time histories. The Best Estimate (BE) and Upper Bound (UB) soil profile cases were evaluated. For both the BE and UB soil cases, a preliminary comparison of the LNP FRS is presented at six (6) key **AP1000** NI locations based on SSI analysis utilizing the previous (old) time history and the preliminary revised (new) time history. WEC understands the new time history received via email on July 29, 2011 from Bob Youngs of AMEC Geomatrix, and used in this preliminary evaluation, is not verified. The revised input time histories are used as seismic input in three orthogonal directions at the base of the LNP excavation (El. -24') in the LNP SSI analyses.

Note that the methodologies used for this preliminary evaluation, as well as for any subsequent final SSI analyses are exactly the same as the methods adopted in the LNP SSI Report, LNG-1000-S2R-804, Rev.4, and as agreed upon by WEC, Progress Energy and the NRC during the March 2011 audit of the LNP SSI analyses.

2.0 LNP 3D BE Design-Basis SSI Analysis and Results

The LNP 3D 5-Layer model was developed for the LNP BE soil case, and is the design-basis model/analysis. The LNP 3D Design-Basis BE FRS are determined using the SASSI Direct method.

The preliminary SSI analyses were carried out using both the old and new LNP BE seismic input time histories and BE soil profile, and the resulting FRS was compared to the 3D **AP1000** generic FRS envelopes at the six (6) key NI locations. The BE soil profile presented in Table 3.2-1, and the SITE profile presented in Table 4.2-1 of LNP SSI Report, LNG-1000-S2R-804, Rev.4 were utilized in this evaluation. Material properties for the CLSM and RCC for the BE soil cases presented in Tables 3.3-1 and 3.3-2 of the LNP SSI Report, LNG-1000-S2R-804, Rev.4 were also utilized. The BE FRS for 5% damping at the six (6) key NI locations produced by both the old and new time histories are compared against each other and presented below in Figures 2-1 through 2-18. This preliminary comparison of results does not include the frequency-dependent Bump Factor; however, the FRS produced in the final analysis will include these factors.

As shown in Figures 2-1 through 2-18, the preliminary LNP BE site specific FRS produced by both the old and new time histories are practically the same, and are enveloped by the **AP1000** generic FRS envelopes at each of the six key NI locations with sufficient margin. The LNP SSI report will be revised to include finalized updates, where applicable to the input, analyses and results based on the exact methods used in LNG-1000-S2R-804, Rev.4, and agreed upon by WEC, Progress Energy and the NRC.

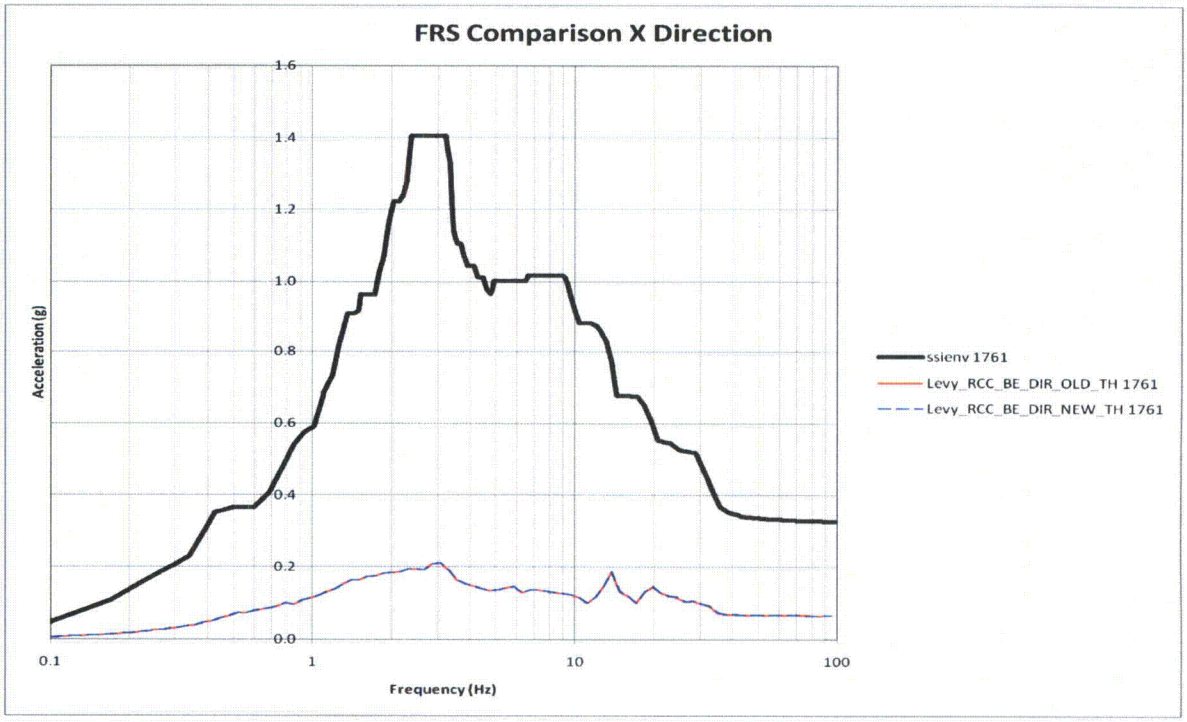

Figure 2-1: LNP BE Old TH and New TH FRS and AP1000 FRS Envelope in X-Direction – Node 1761

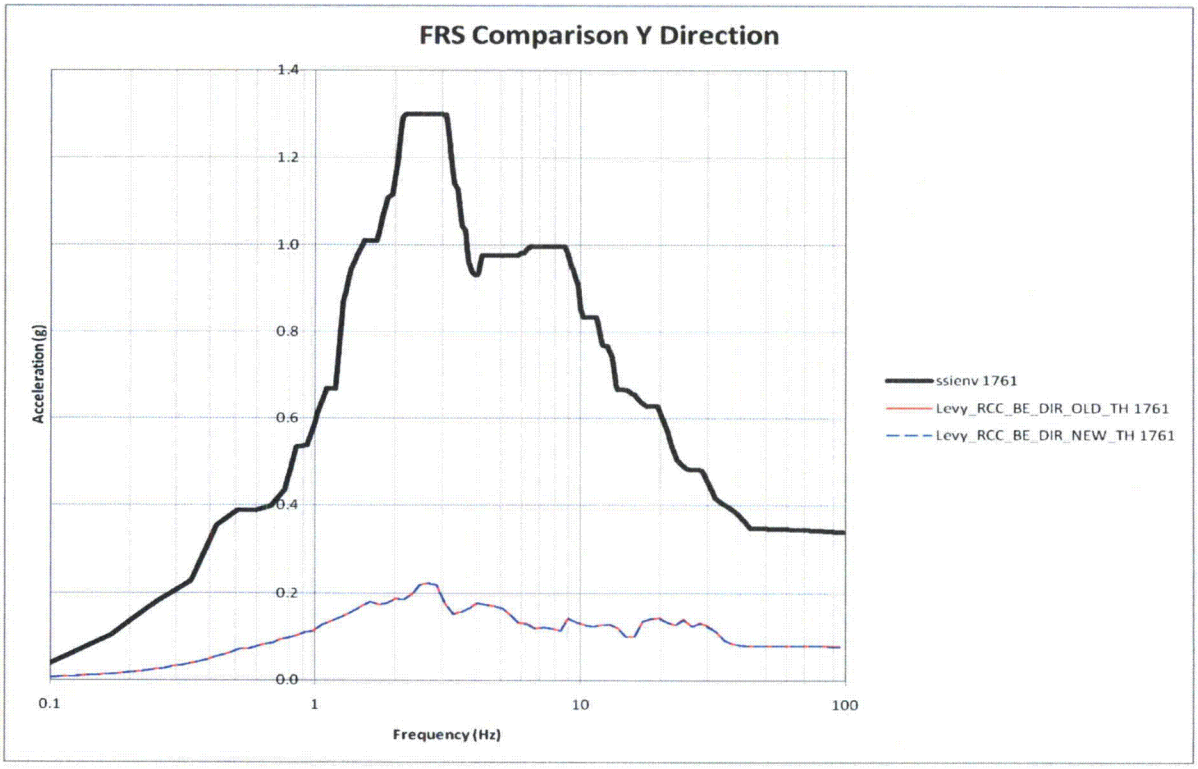

Figure 2-2: LNP BE Old TH and New TH FRS and AP1000 FRS Envelope in Y-Direction – Node 1761

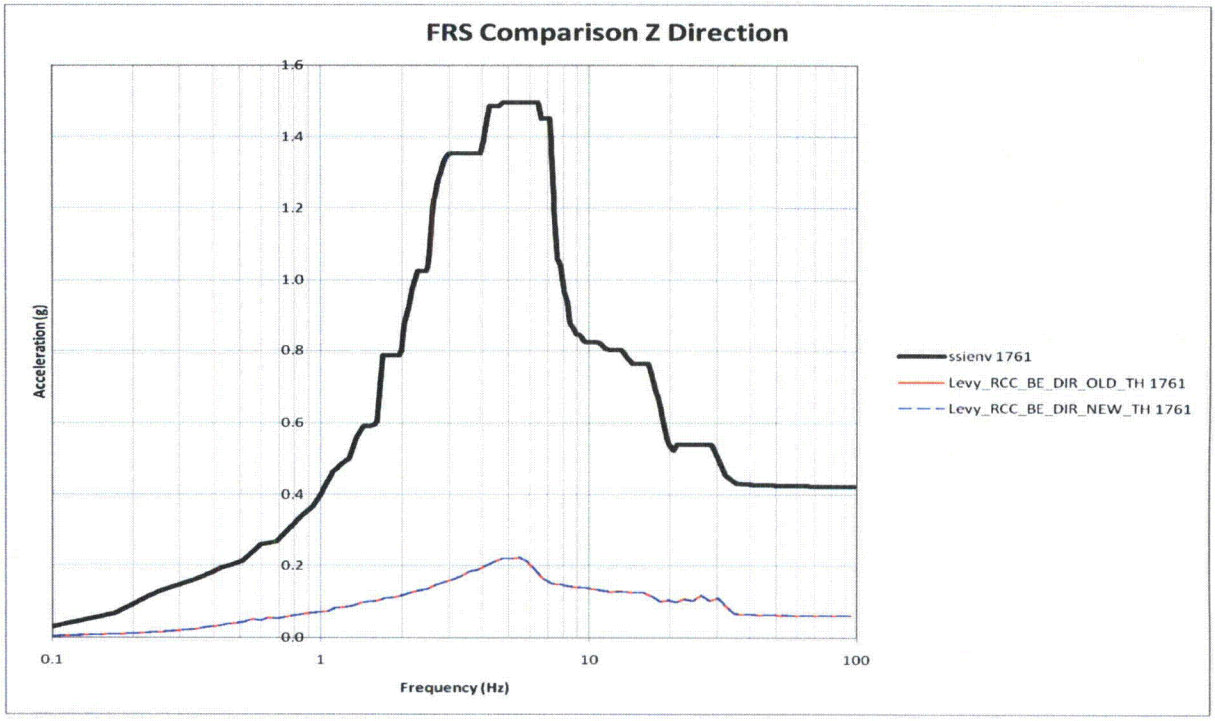

Figure 2-3: LNP BE Old TH and New TH FRS and AP1000 FRS Envelope in Z-Direction – Node 1761

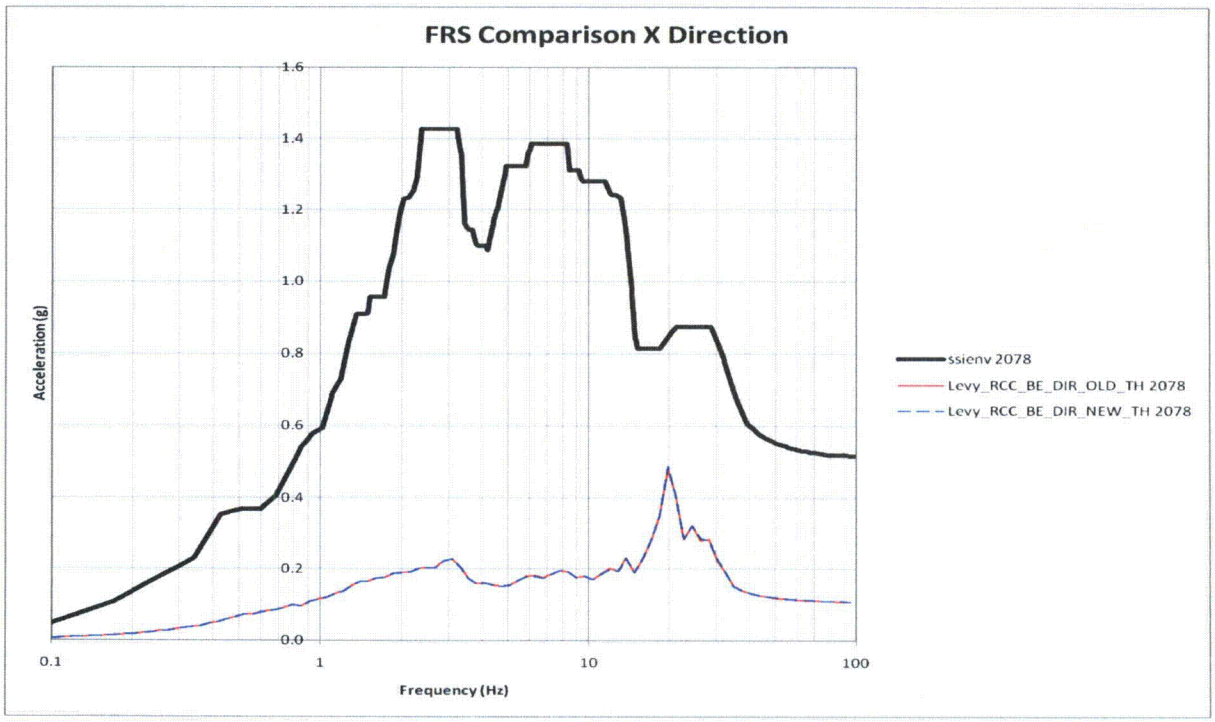

Figure 2-4: LNP BE Old TH and New TH FRS and AP1000 FRS Envelope in X-Direction – Node 2078

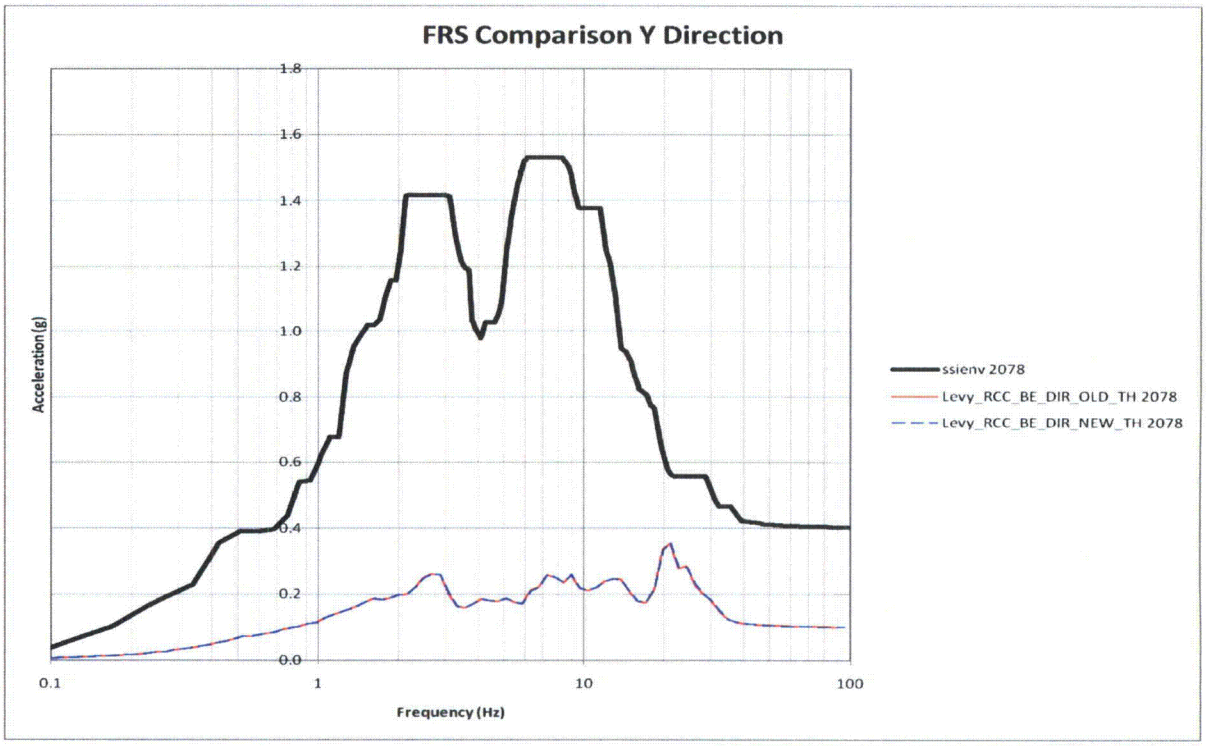

Figure 2-5: LNP BE Old TH and New TH FRS and AP1000 FRS Envelope in Y-Direction – Node 2078

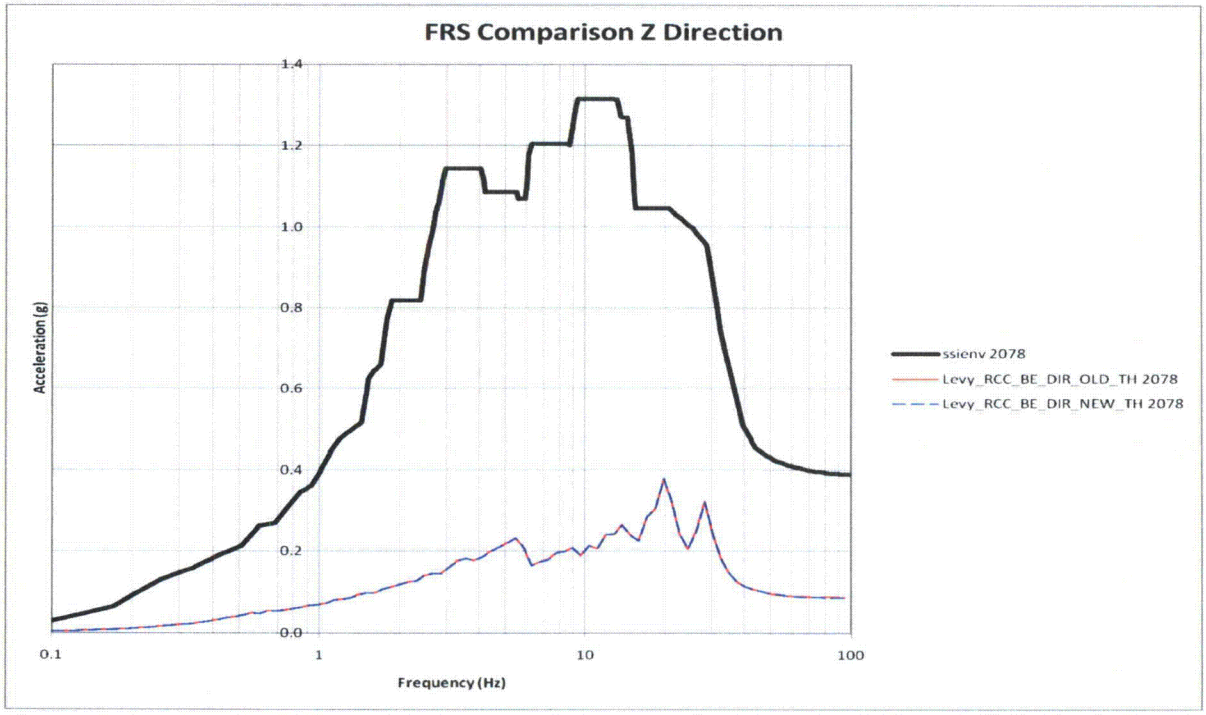

Figure 2-6: LNP BE Old TH and New TH FRS and AP1000 FRS Envelope in Z-Direction – Node 2078

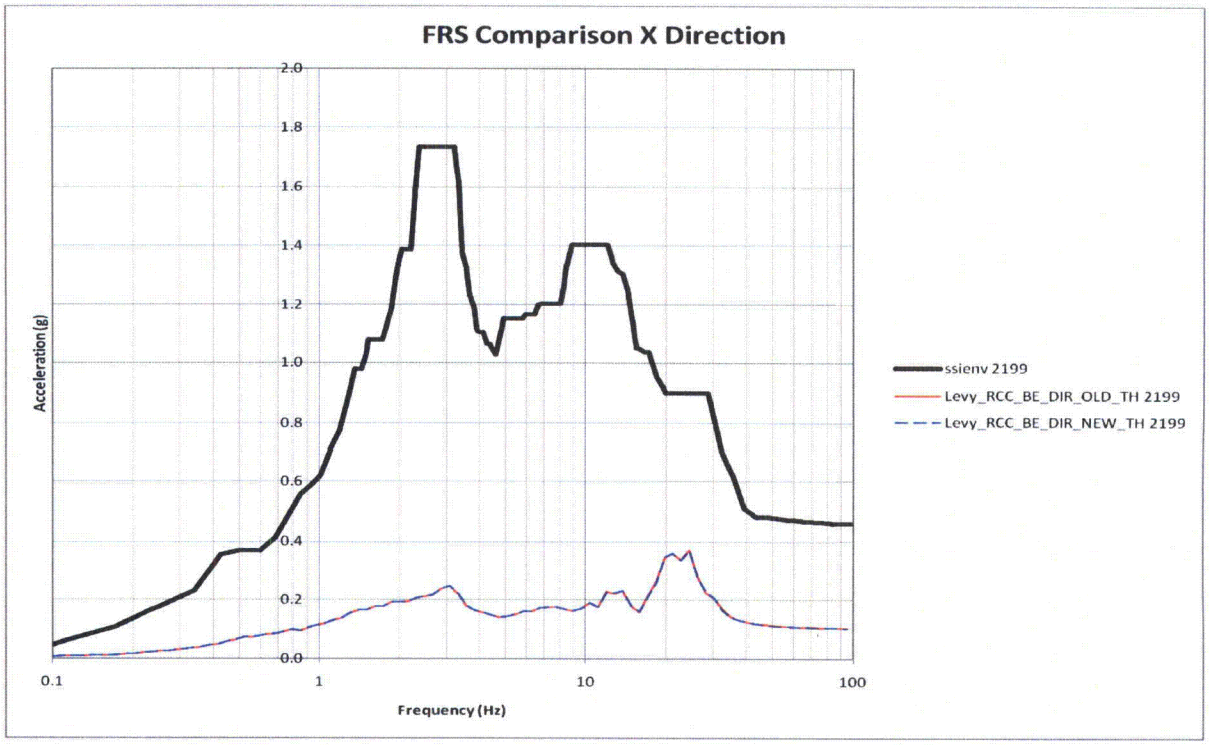

Figure 2-7: LNP BE Old TH and New TH FRS and AP1000 FRS Envelope in X-Direction – Node 2199

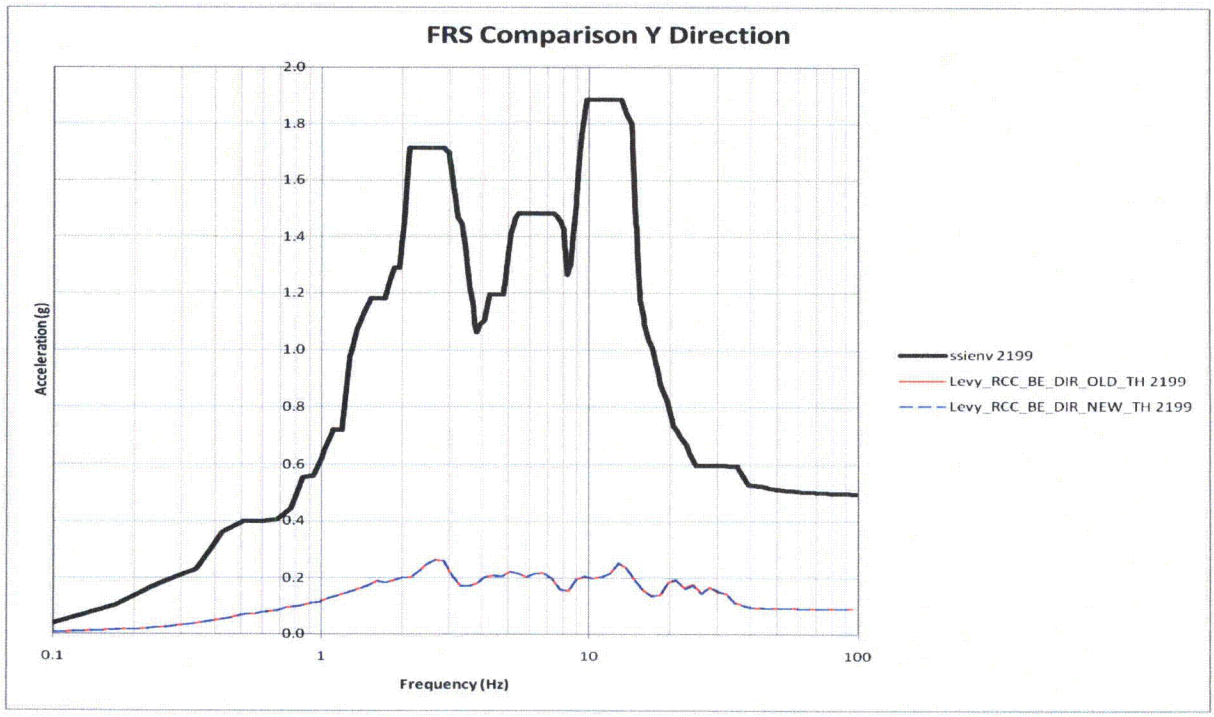

Figure 2-8: LNP BE Old TH and New TH FRS and AP1000 FRS Envelope in Y-Direction – Node 2199

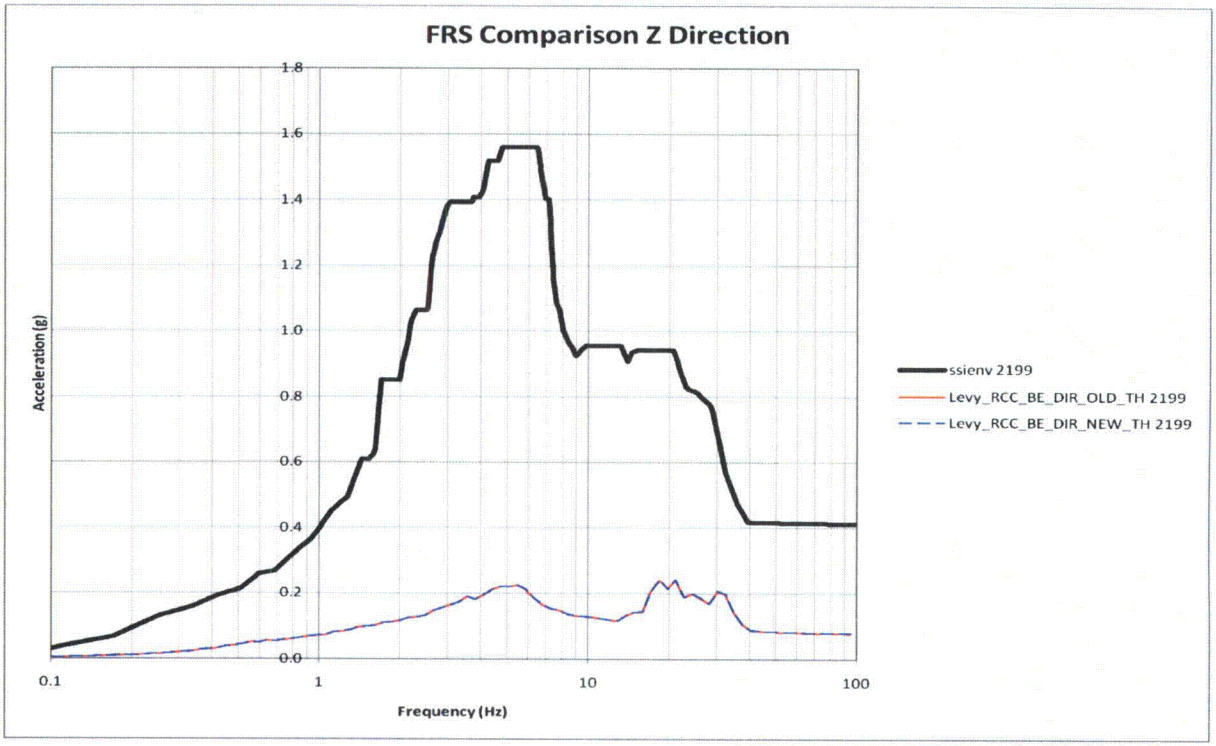

Figure 2-9: LNP BE Old TH and New TH FRS and AP1000 FRS Envelope in Z-Direction – Node 2199

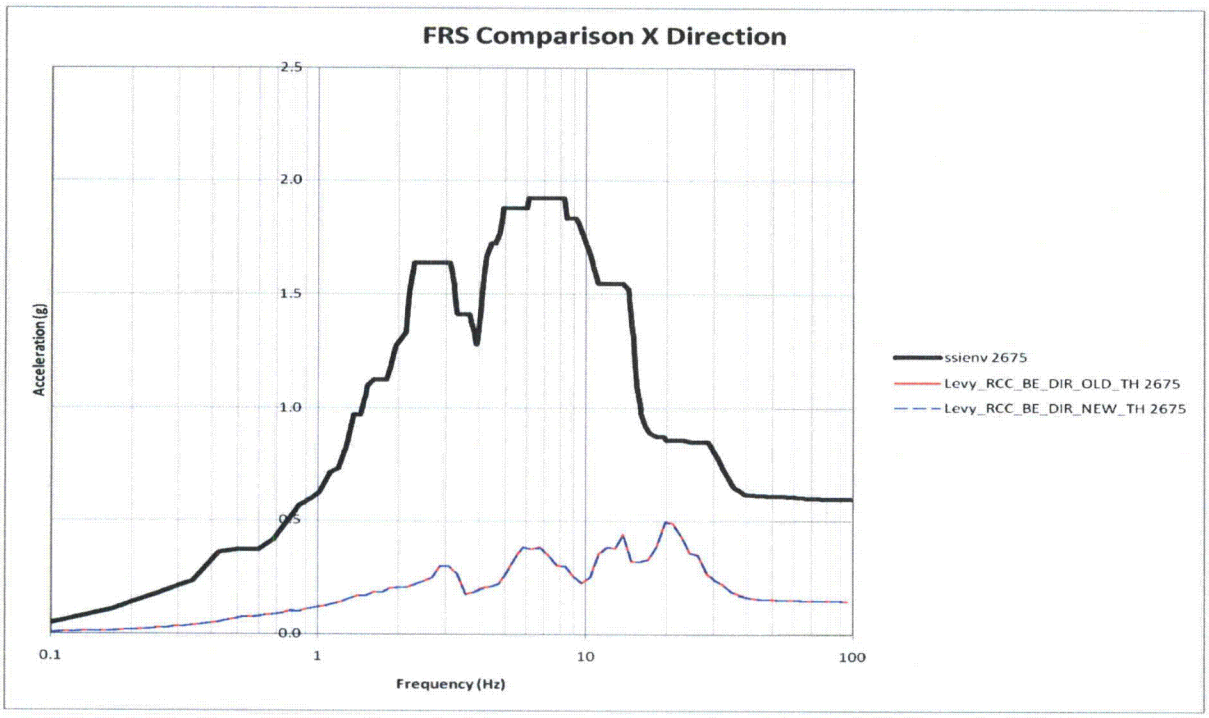

Figure 2-10: LNP BE Old TH and New TH FRS and AP1000 FRS Envelope in X-Direction – Node 2675

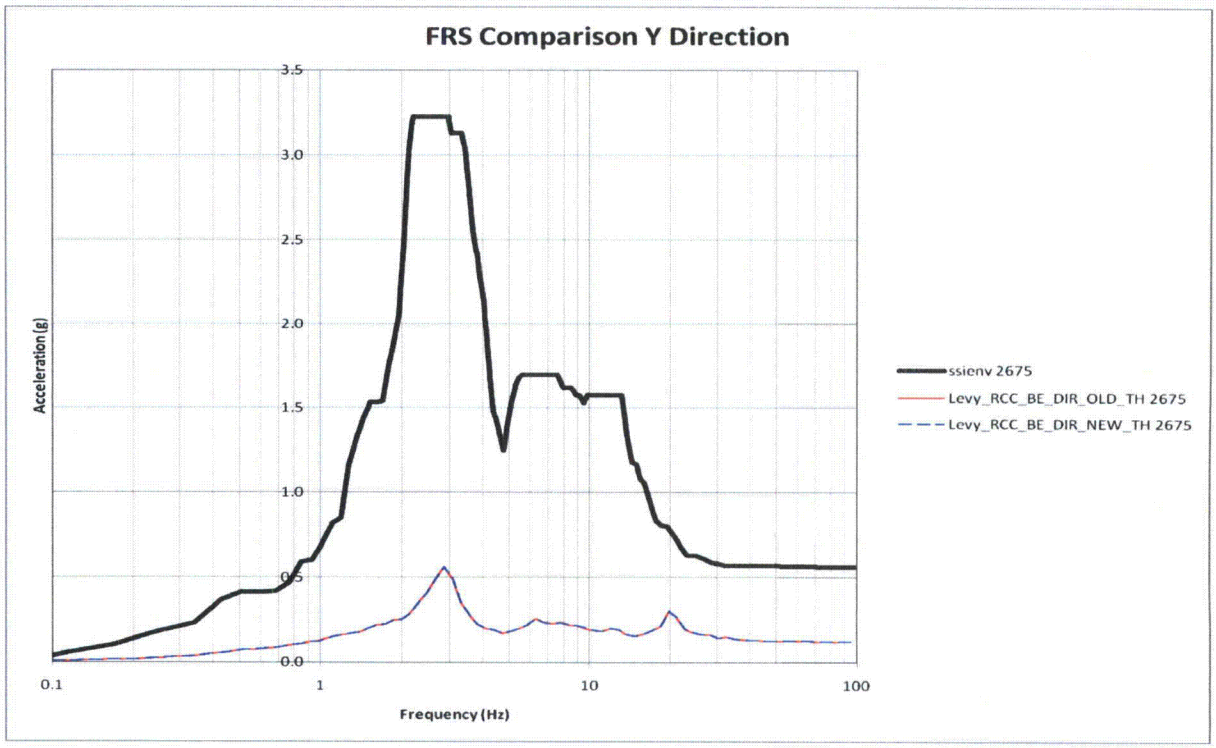

Figure 2-11: LNP BE Old TH and New TH FRS and AP1000 FRS Envelope in Y-Direction – Node 2675

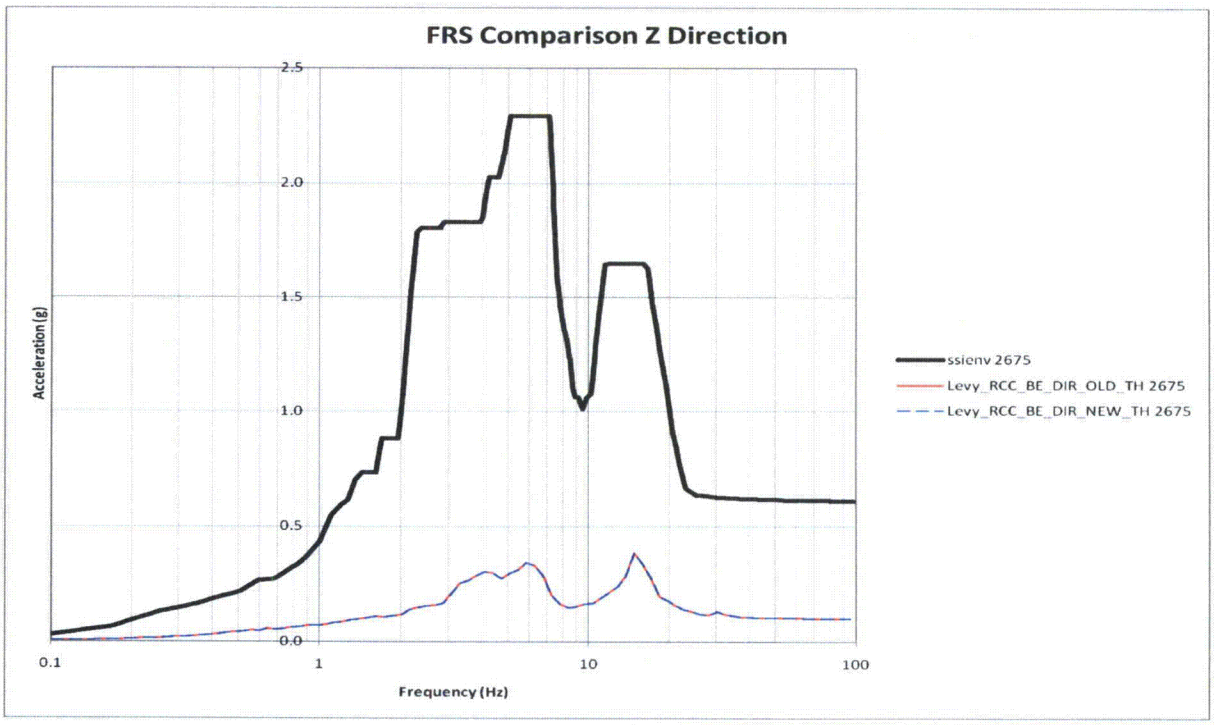

Figure 2-12: LNP BE Old TH and New TH FRS and AP1000 FRS Envelope in Z-Direction – Node 2675

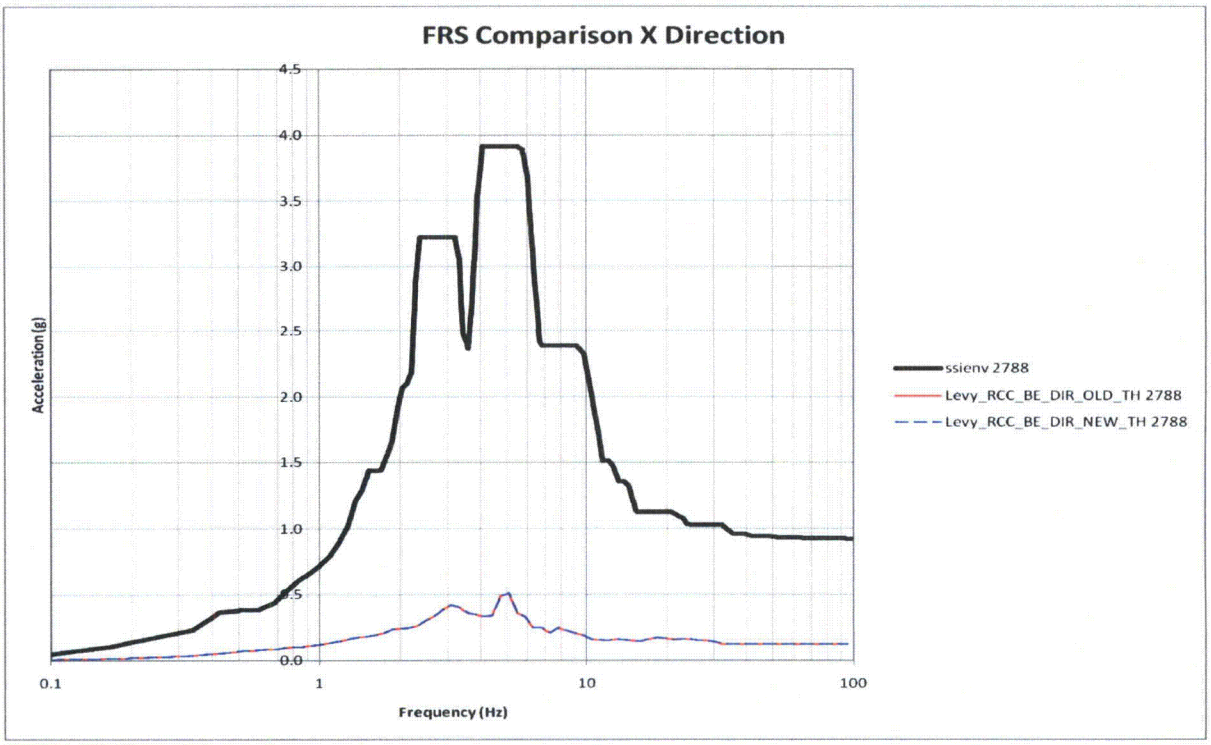

Figure 2-13: LNP BE Old TH and New TH FRS and AP1000 FRS Envelope in X-Direction – Node 2788

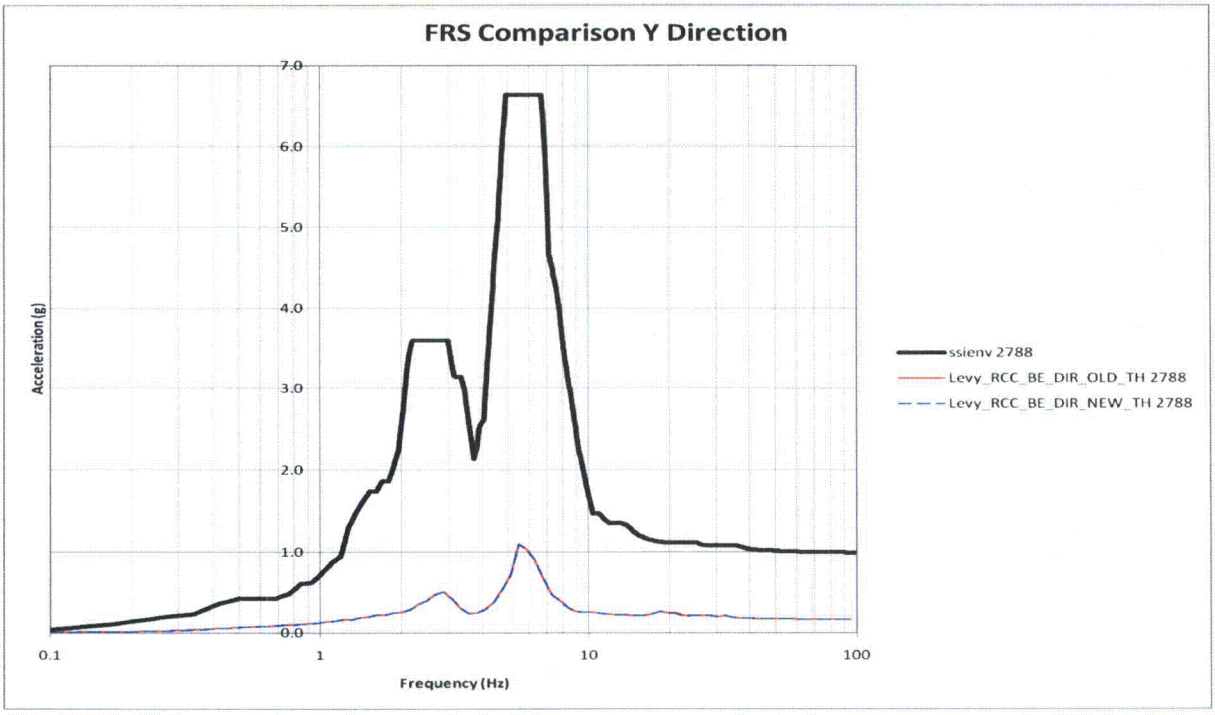

Figure 2-14: LNP BE Old TH and New TH FRS and AP1000 FRS Envelope in Y-Direction – Node 2788

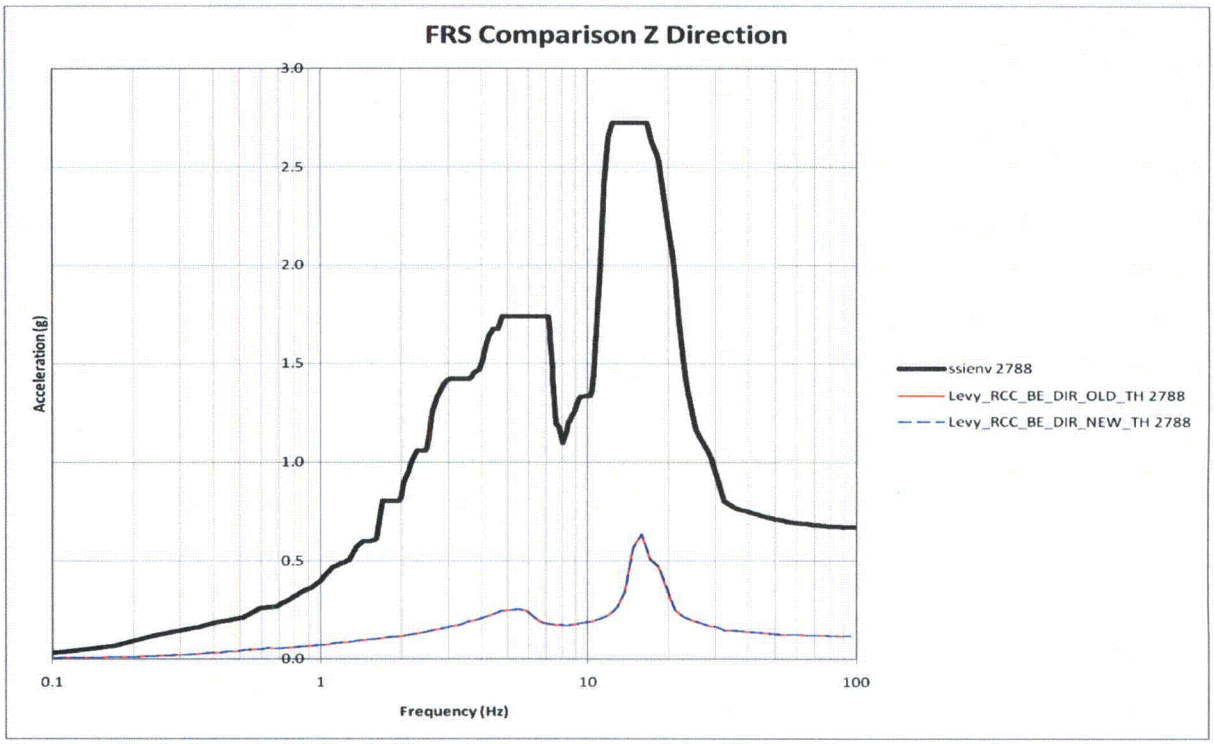

Figure 2-15: LNP BE Old TH and New TH FRS and AP1000 FRS Envelope in Z-Direction – Node 2788

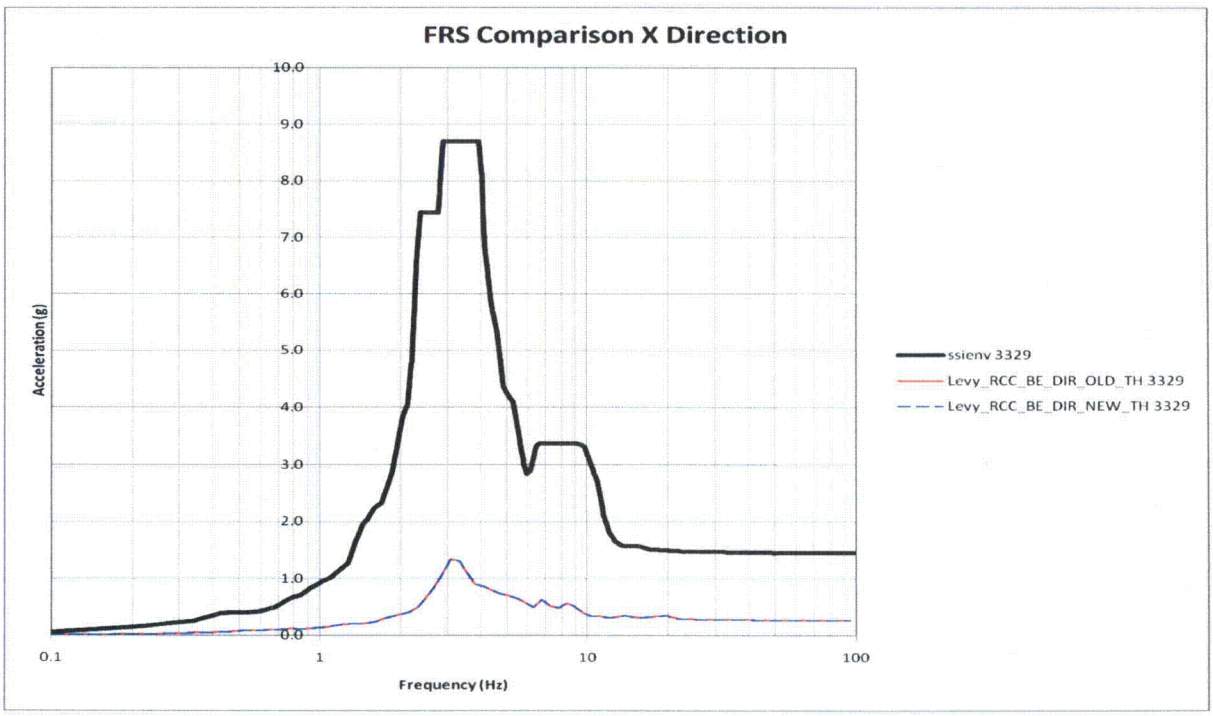

Figure 2-16: LNP BE Old TH and New TH FRS and AP1000 FRS Envelope in X-Direction – Node 3329

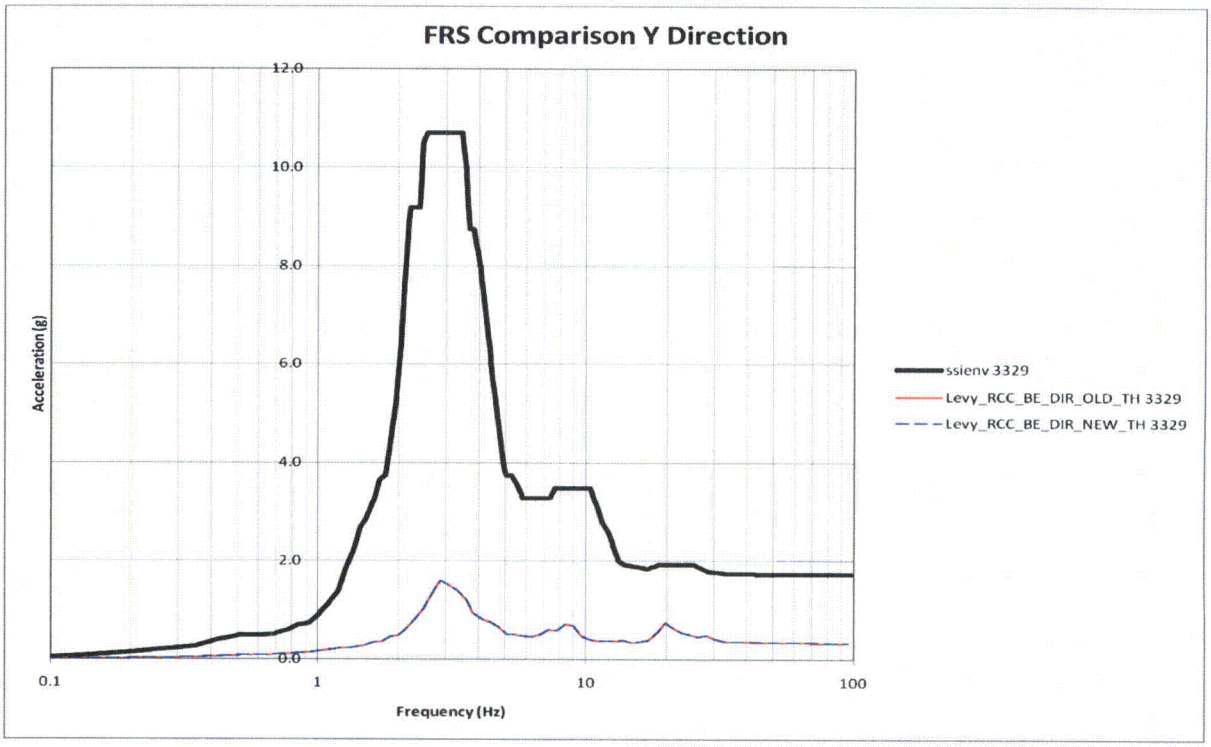

Figure 2-17: LNP BE Old TH and New TH FRS and AP1000 FRS Envelope Y-Direction – Node 3329

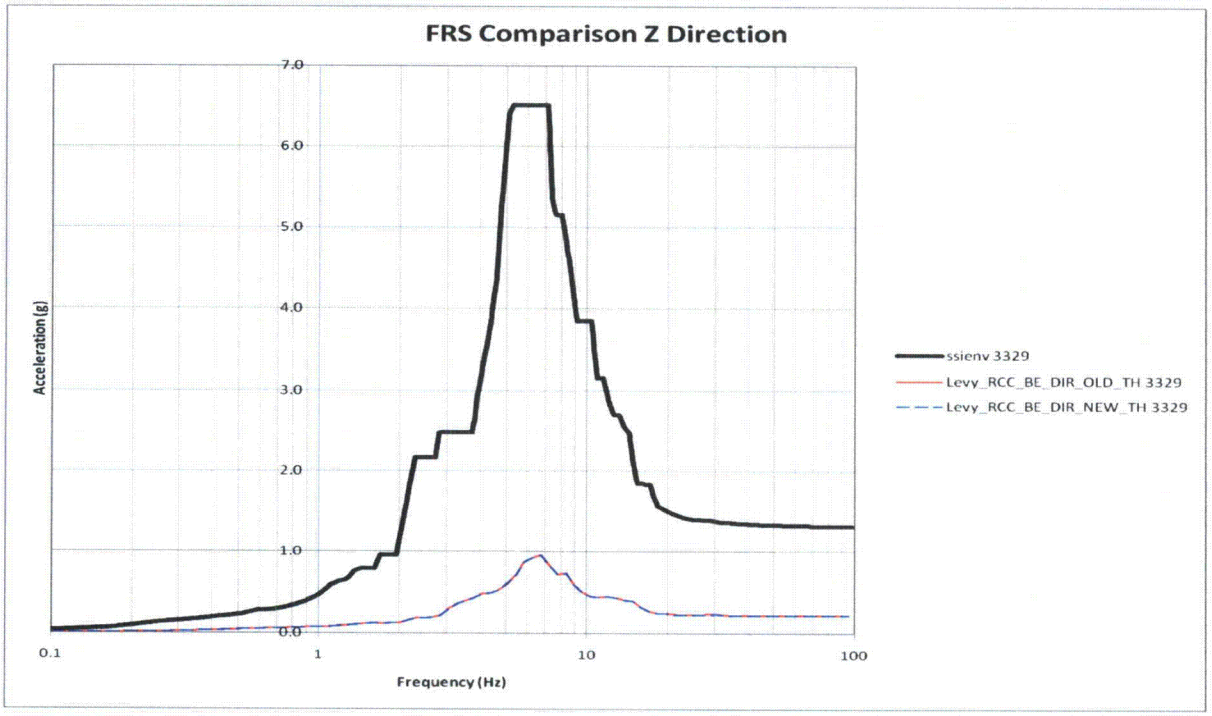

Figure 2-18: LNP BE Old TH and New TH FRS and AP1000 FRS Envelope in Z-Direction – Node 3329

3.0 Preliminary Comparison of Previous and Revised LNP 3D UB SSI Sensitivity FRS Results

The 8-Layer, 75-foot embedded LNP 3D model was developed to evaluate the FRS for the LNP UB soil cases utilizing the SASSI Subtraction method.

Preliminary time history SSI analyses with the LNP 8-Layer Embedded Model were carried out using the previous (old) and preliminary revised (new) LNP UB soil case specific time histories and corresponding UB soil profile. The LNP UB soil profile and SITE profiles are presented in Tables 3.2-2 and Table 4.4-2, respectively, of the LNP SSI Report, LNG-1000-S2R-804, Rev. 4. The UB FRS for 5% damping at the six (6) key NI locations produced by both the old and new time histories are compared against each other and presented below in Figures 3-1 through 3-18.

As shown in Figures 3-1 through 3-18, the preliminary LNP UB site specific FRS produced by both the old and new time histories are practically the same, and are enveloped by the **AP1000** generic FRS envelopes at each of the six key NI locations with sufficient margin. The LNP SSI Report, LNG-1000-S2R-804, Rev. 4 will be revised to include finalized updates, where applicable to the input, analyses and results based on the exact methods used in LNG-1000-S2R-804, Rev.4, and agreed upon by WEC, Progress Energy and the NRC.

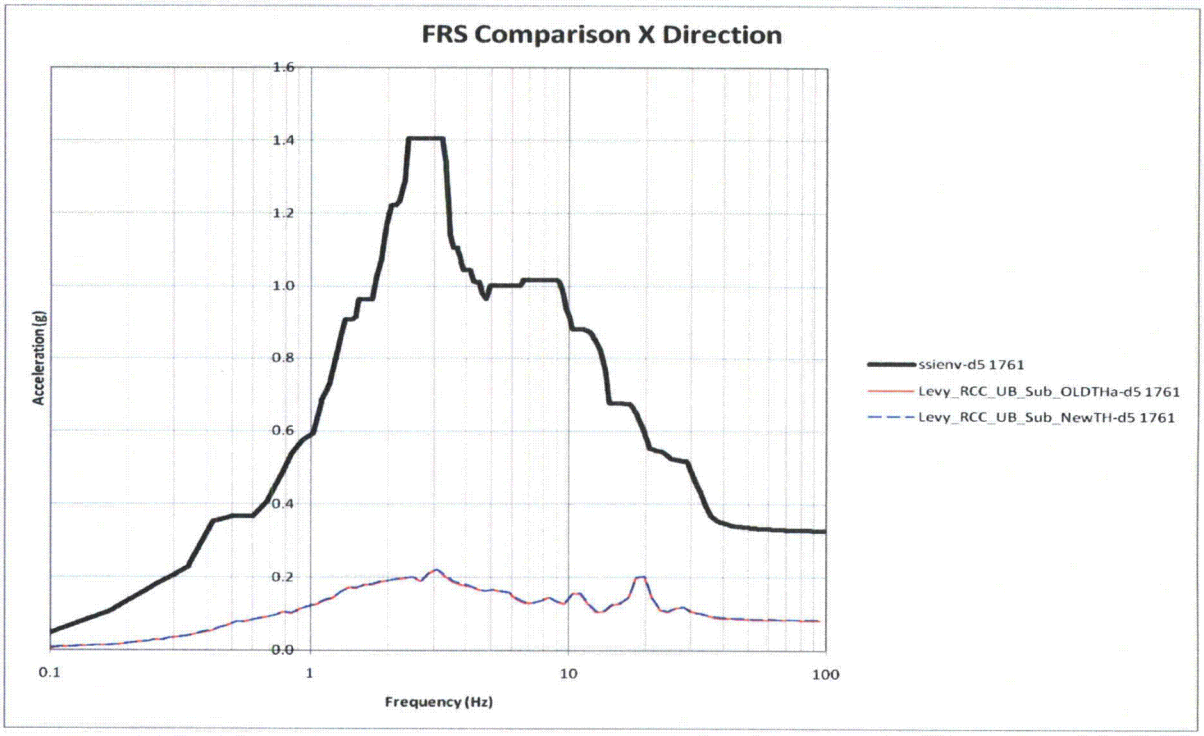

Figure 3-1: LNP UB Old TH and New TH FRS and AP1000 FRS Envelope in X-Direction – Node 1761

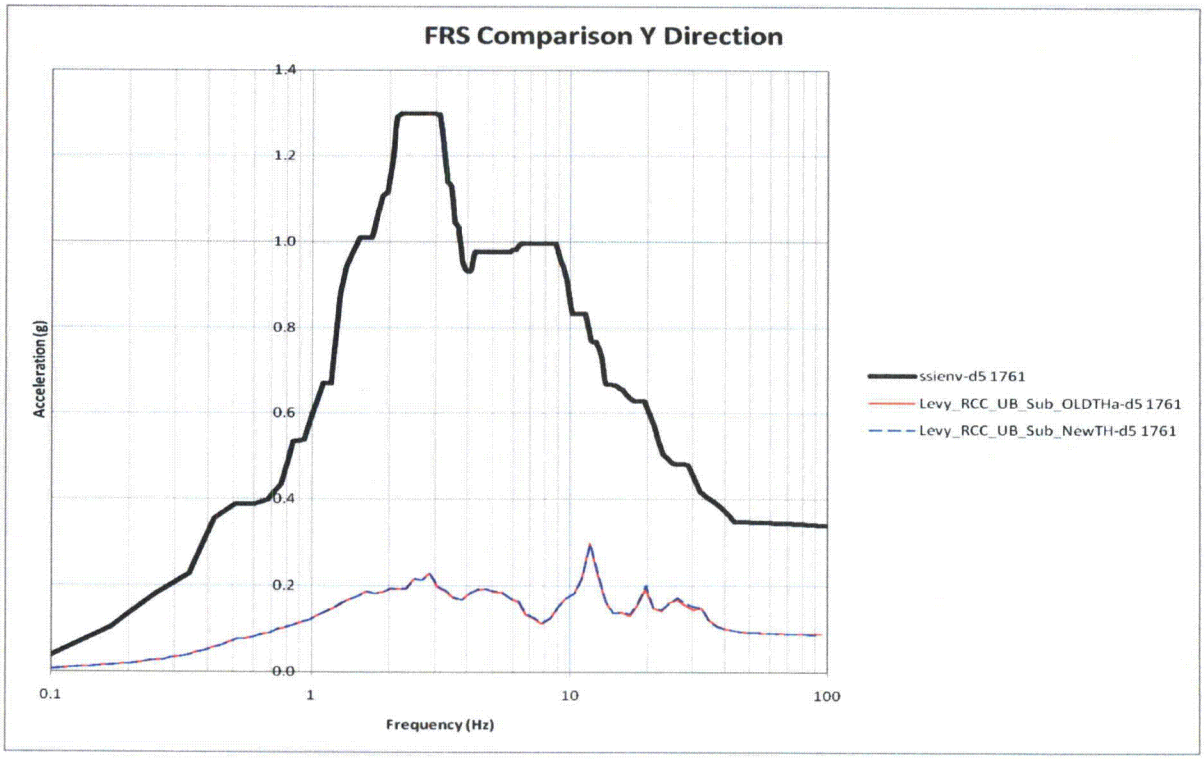

Figure 3-2: LNP UB Old TH and New TH FRS and AP1000 FRS Envelope in Y-Direction – Node 1761

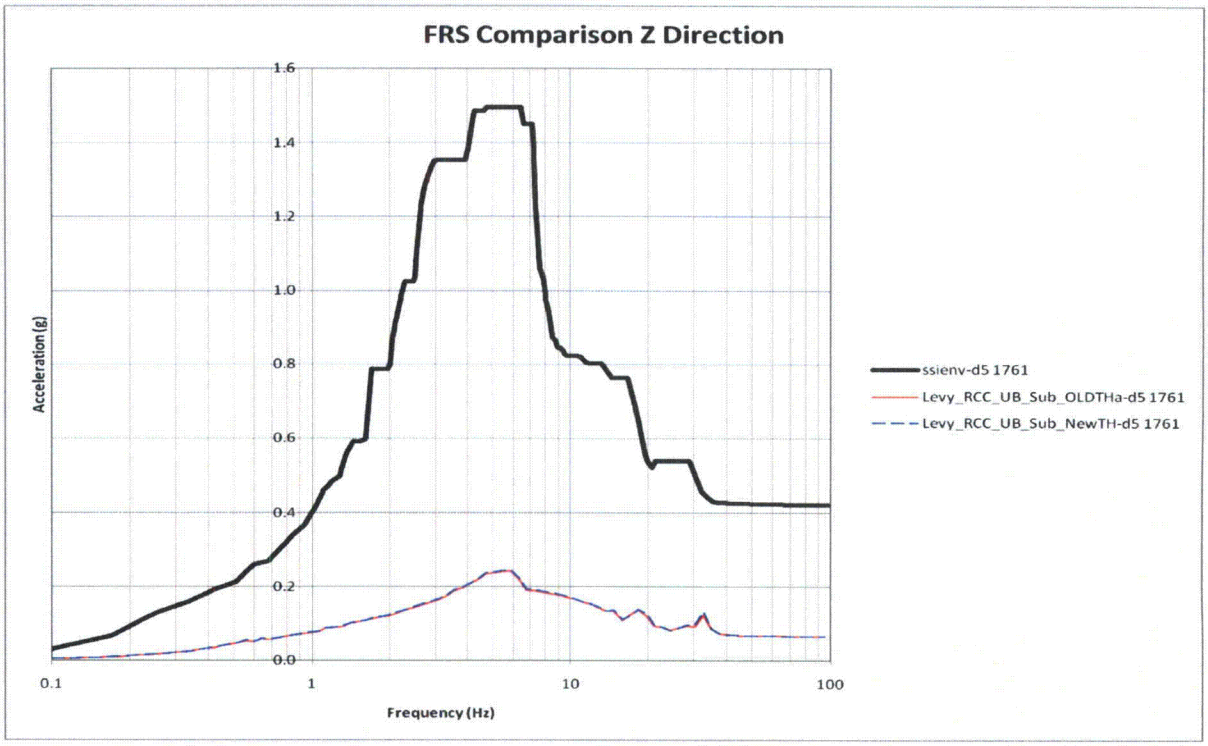

Figure 3-3: LNP UB Old TH and New TH FRS and AP1000 FRS Envelope in Z-Direction – Node 1761

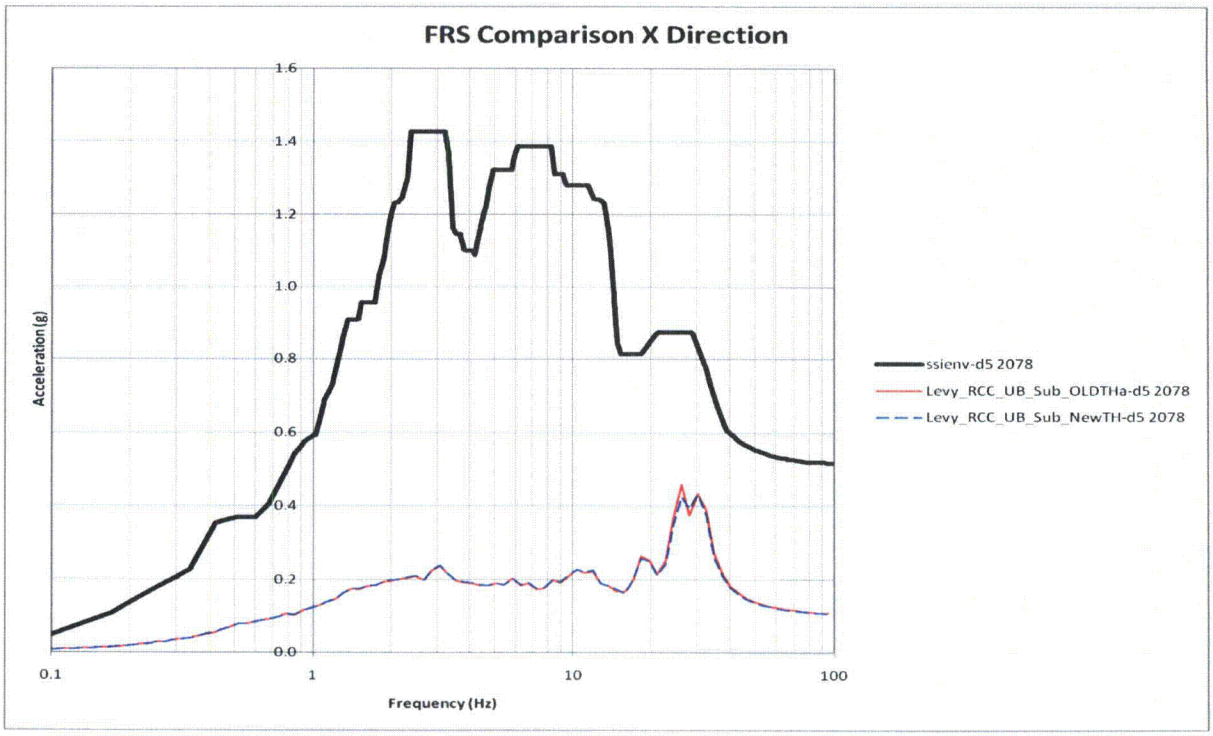

Figure 3-4: LNP UB Old TH and New TH FRS and AP1000 FRS Envelope in X-Direction – Node 2078

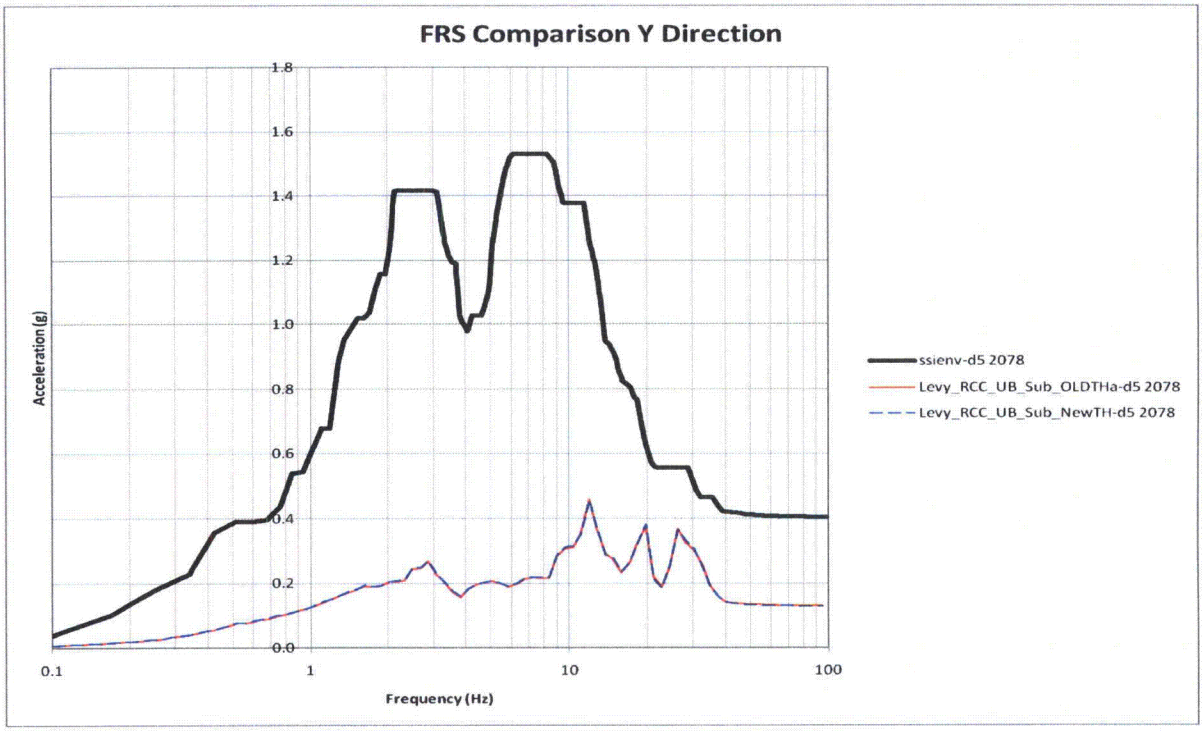

Figure 3-5: LNP UB Old TH and New TH FRS and AP1000 FRS Envelope in Y-Direction – Node 2078

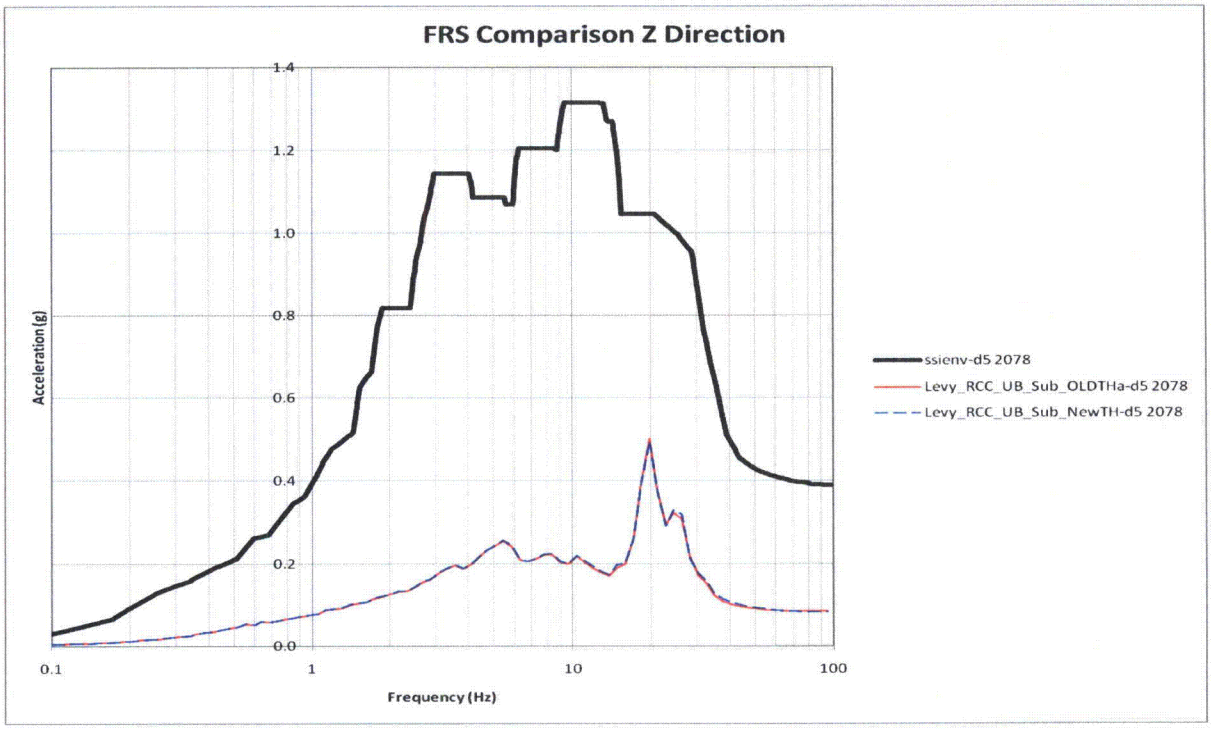

Figure 3-6: LNP UB Old TH and New TH FRS and AP1000 FRS Envelope in Z-Direction – Node 2078

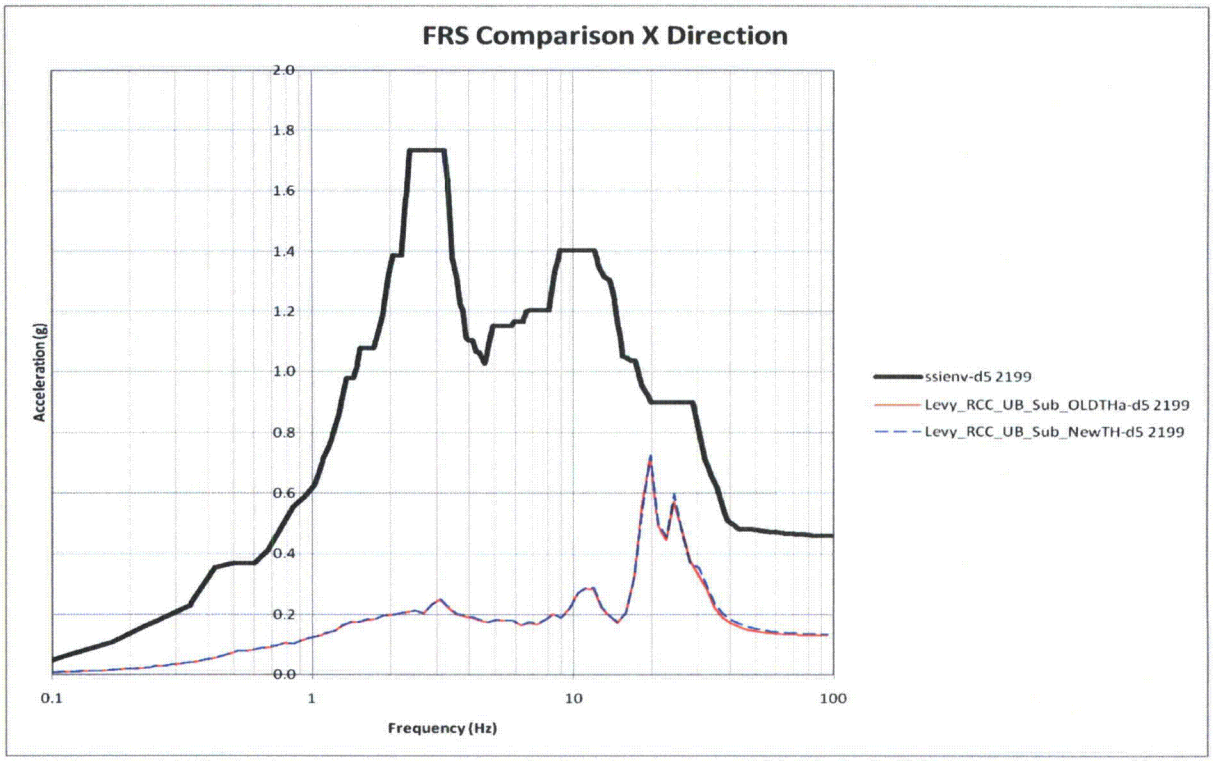

Figure 3-7: LNP UB Old TH and New TH FRS and AP1000 FRS Envelope in X-Direction – Node 2199

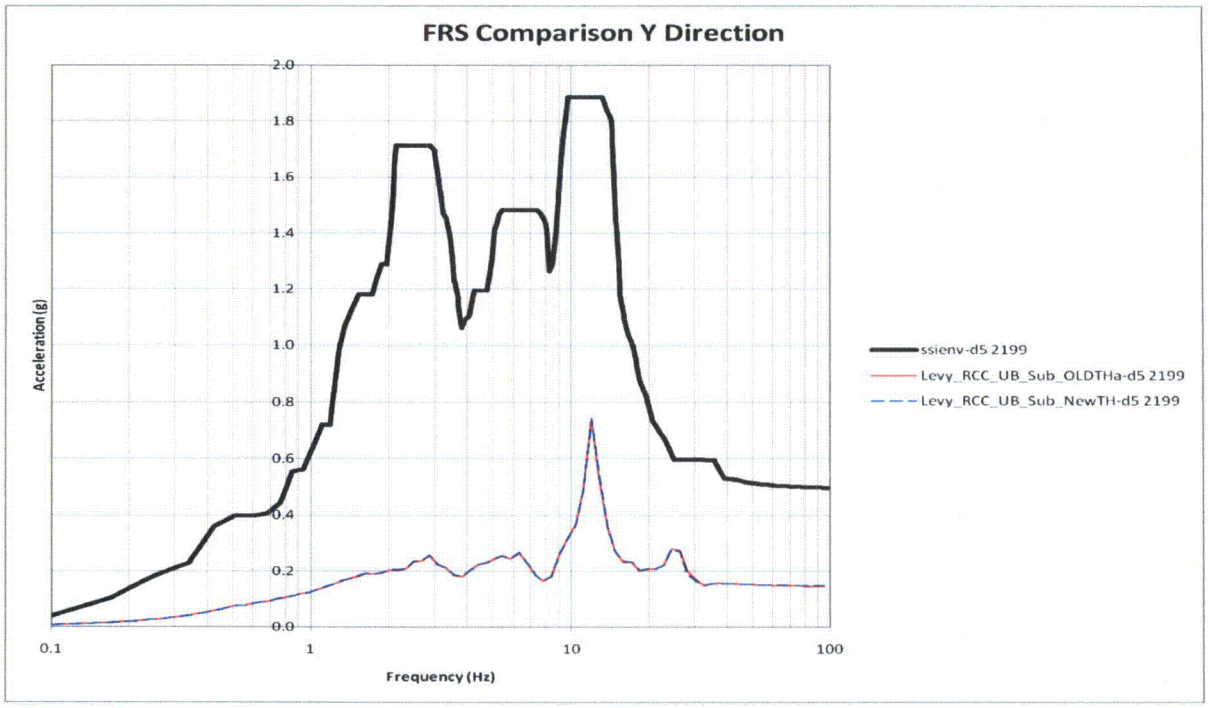

Figure 3-8: LNP UB Old TH and New TH FRS and AP1000 FRS Envelope in Y-Direction – Node 2199

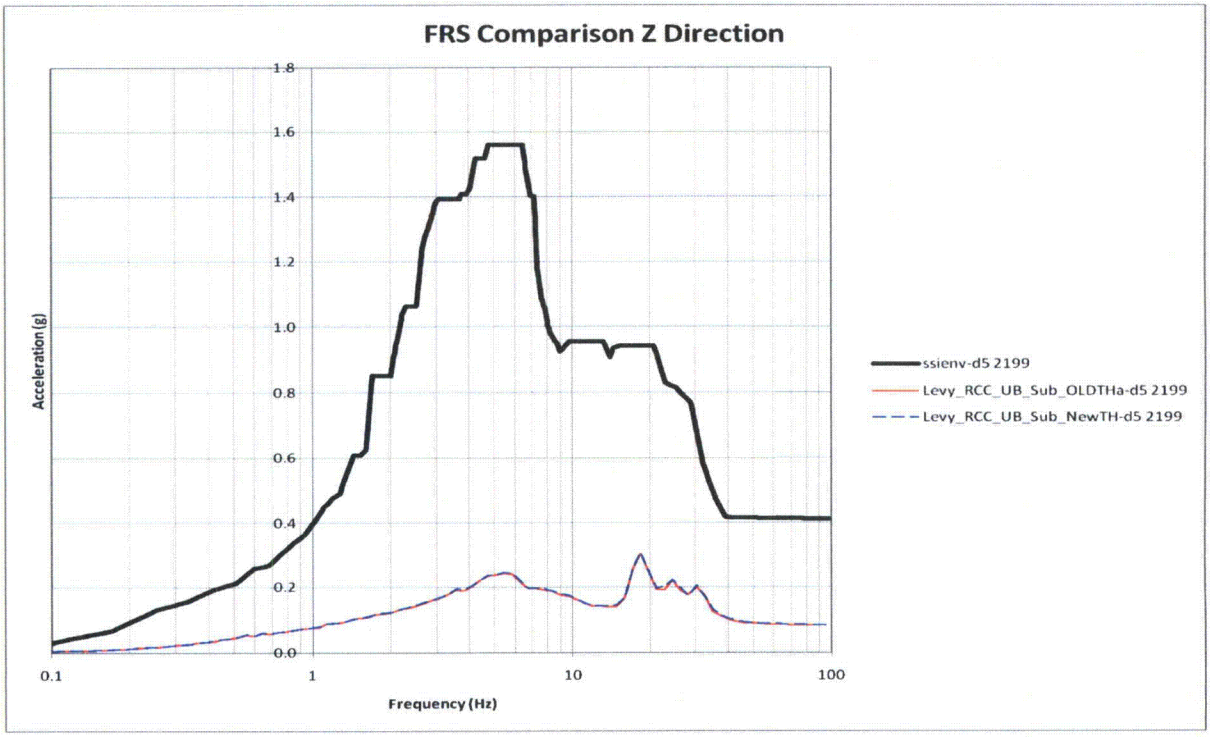

Figure 3-9: LNP UB Old TH and New TH FRS and AP1000 FRS Envelope in Z-Direction – Node 2199

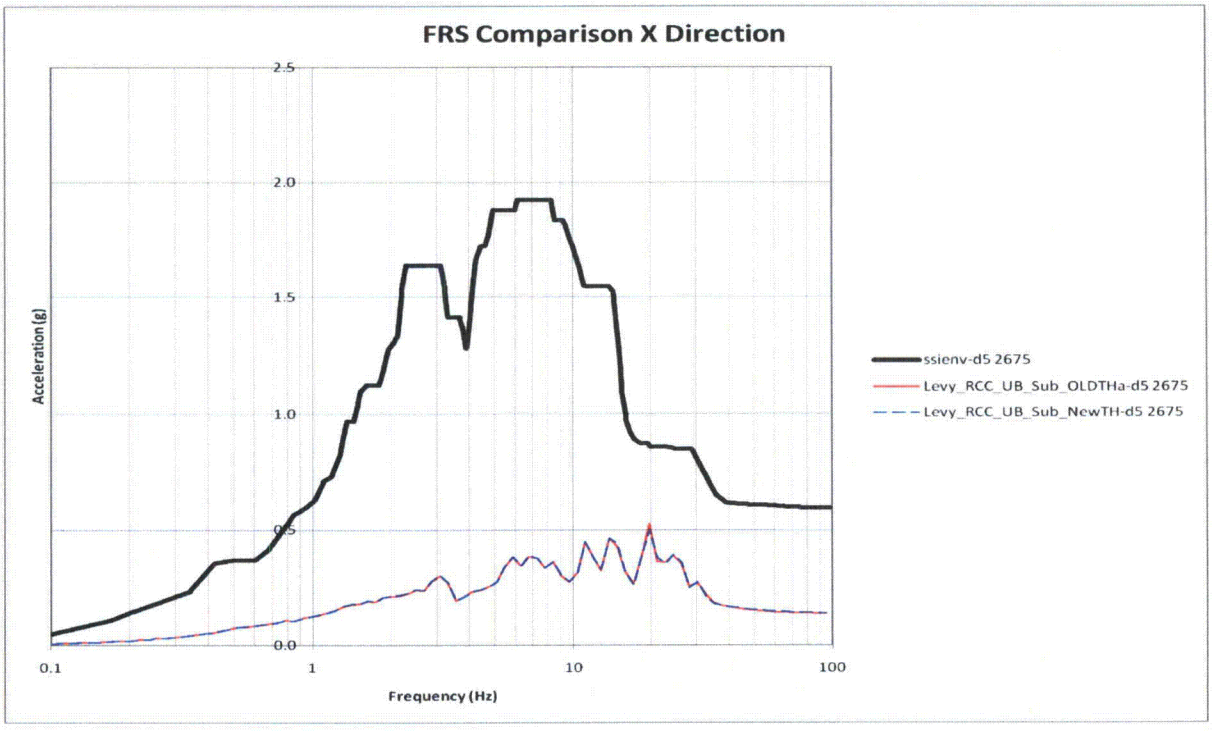

Figure 3-10: LNP UB Old TH and New TH FRS and AP1000 FRS Envelope in X-Direction – Node 2675

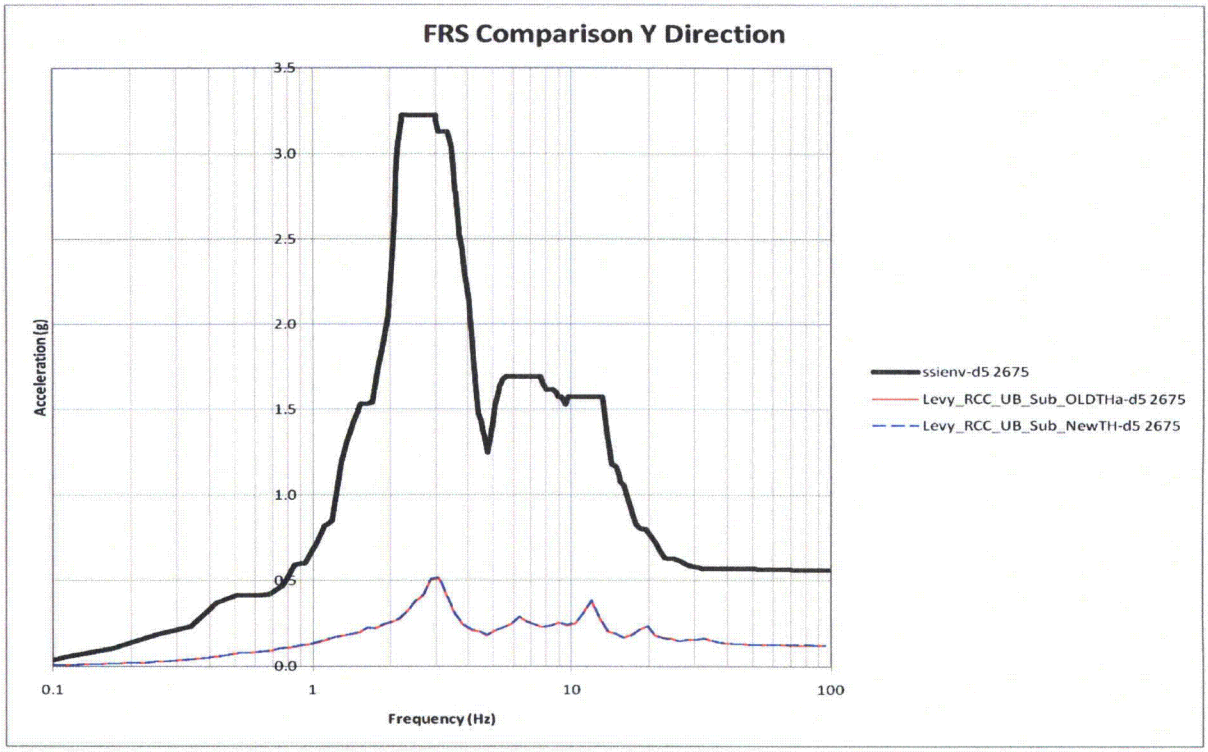

Figure 3-11: LNP UB Old TH and New TH FRS and AP1000 FRS Envelope in Y-Direction – Node 2675

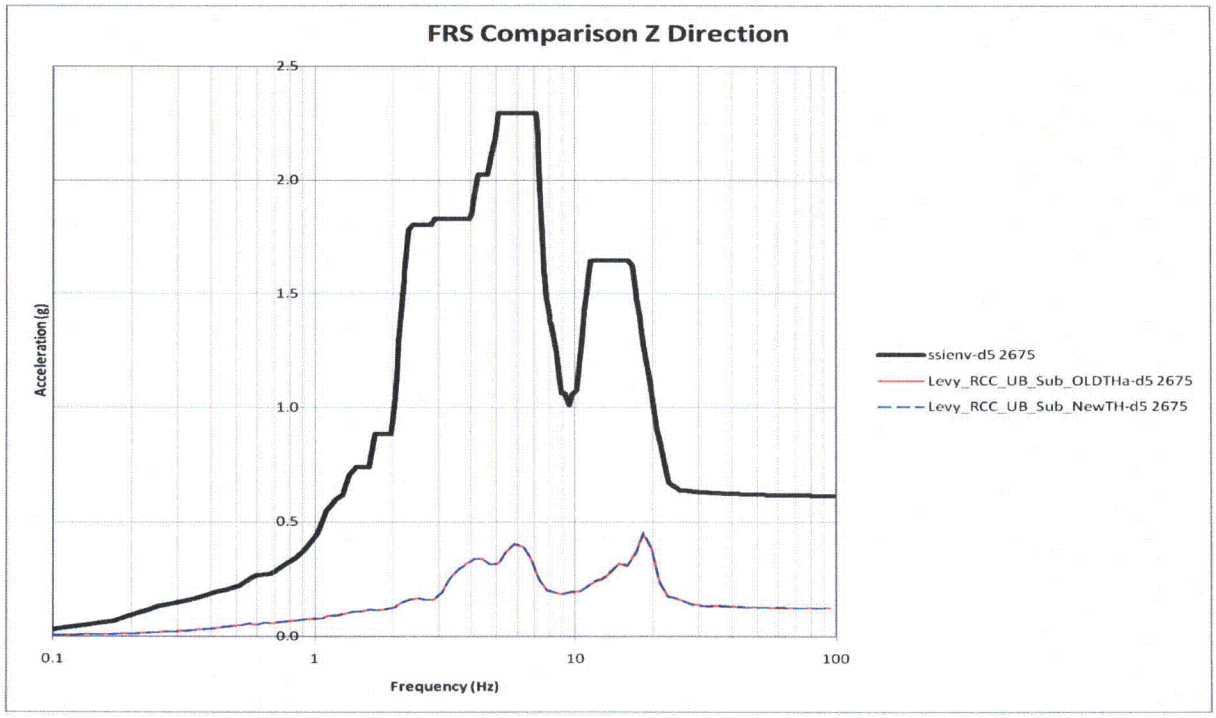

Figure 3-12: LNP UB Old TH and New TH FRS and AP1000 FRS Envelope in Z-Direction – Node 2675

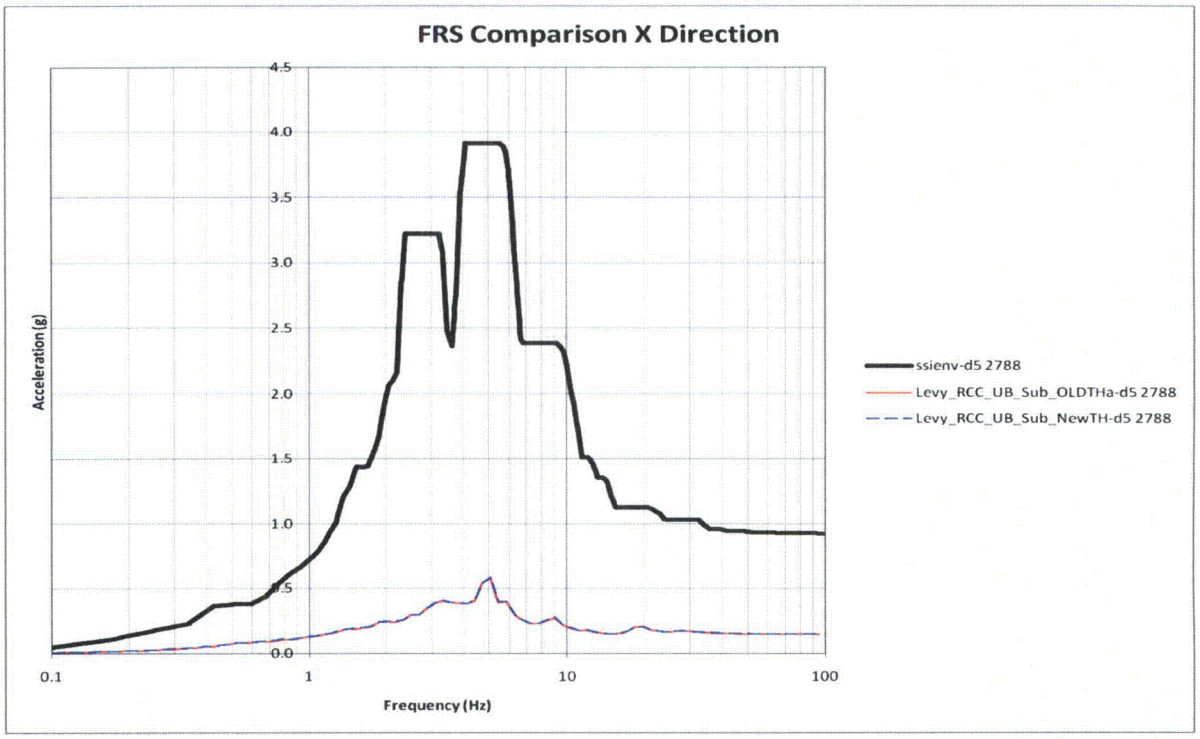

Figure 3-13: LNP UB Old TH and New TH FRS and AP1000 FRS Envelope in X-Direction – Node 2788

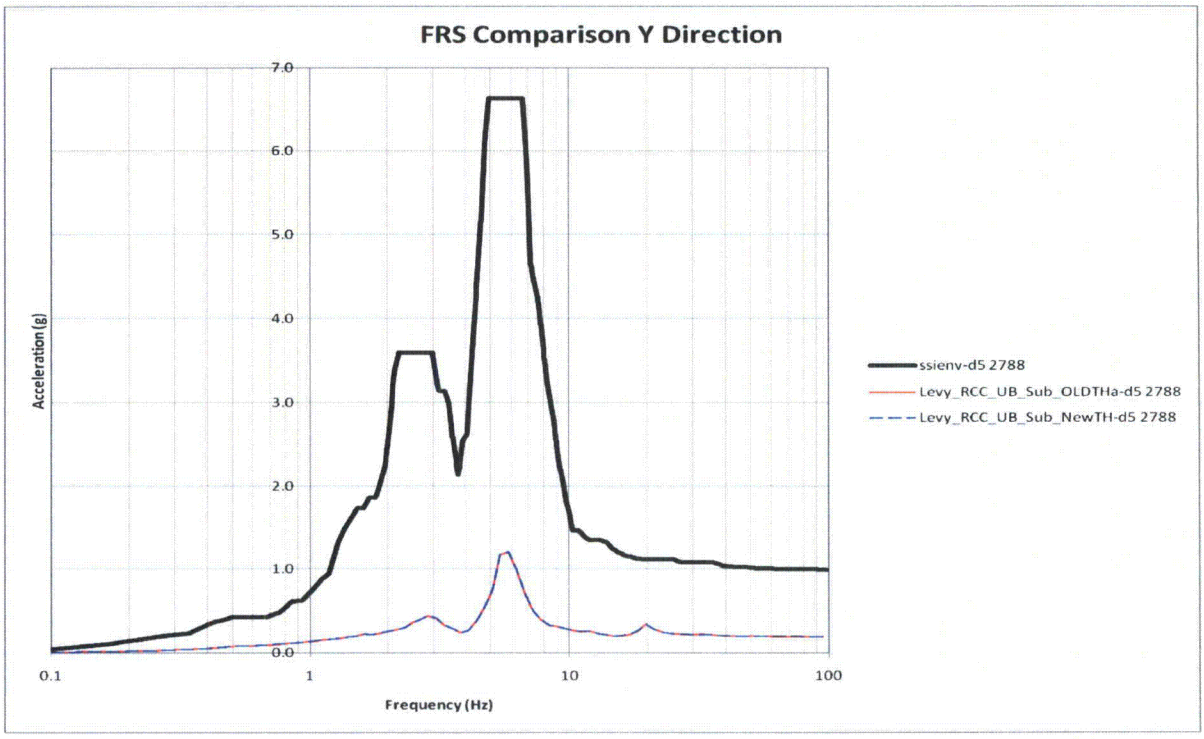

Figure 3-14: LNP UB Old TH and New TH FRS and AP1000 FRS Envelope in Y-Direction – Node 2788

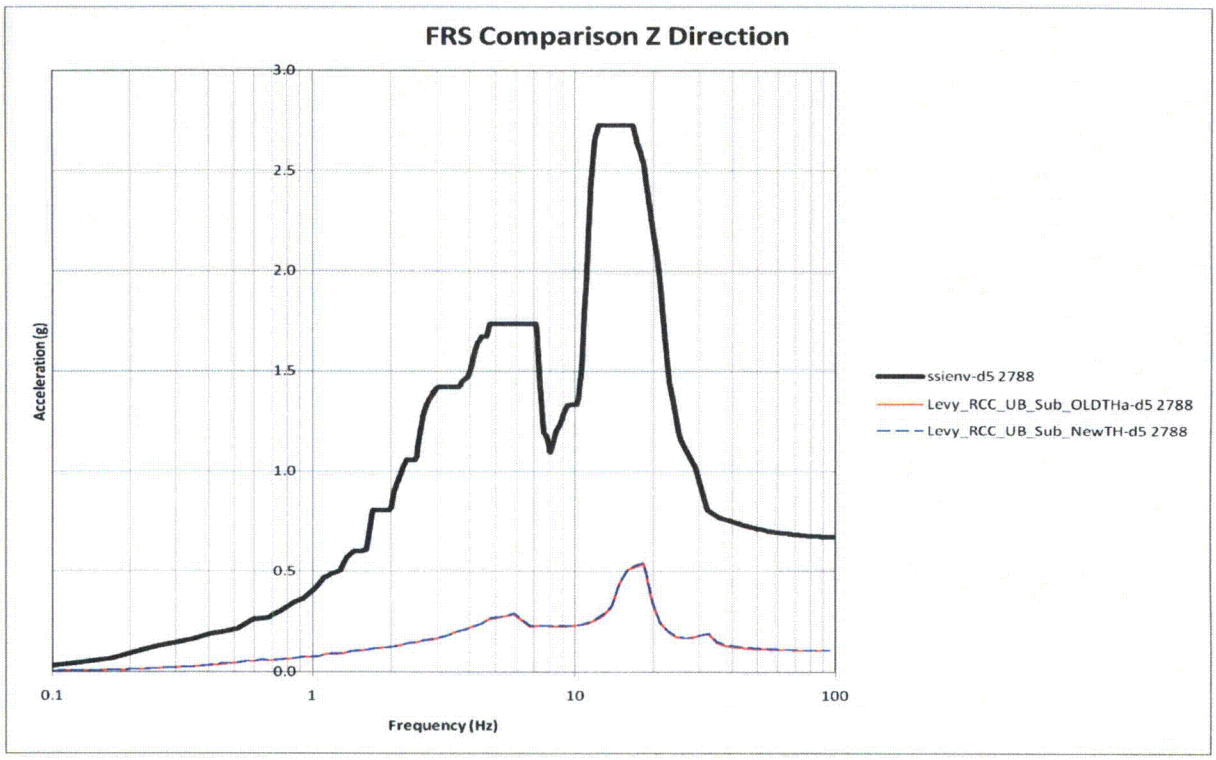

Figure 3-15: LNP UB Old TH and New TH FRS and AP1000 FRS Envelope in Z-Direction – Node 2788

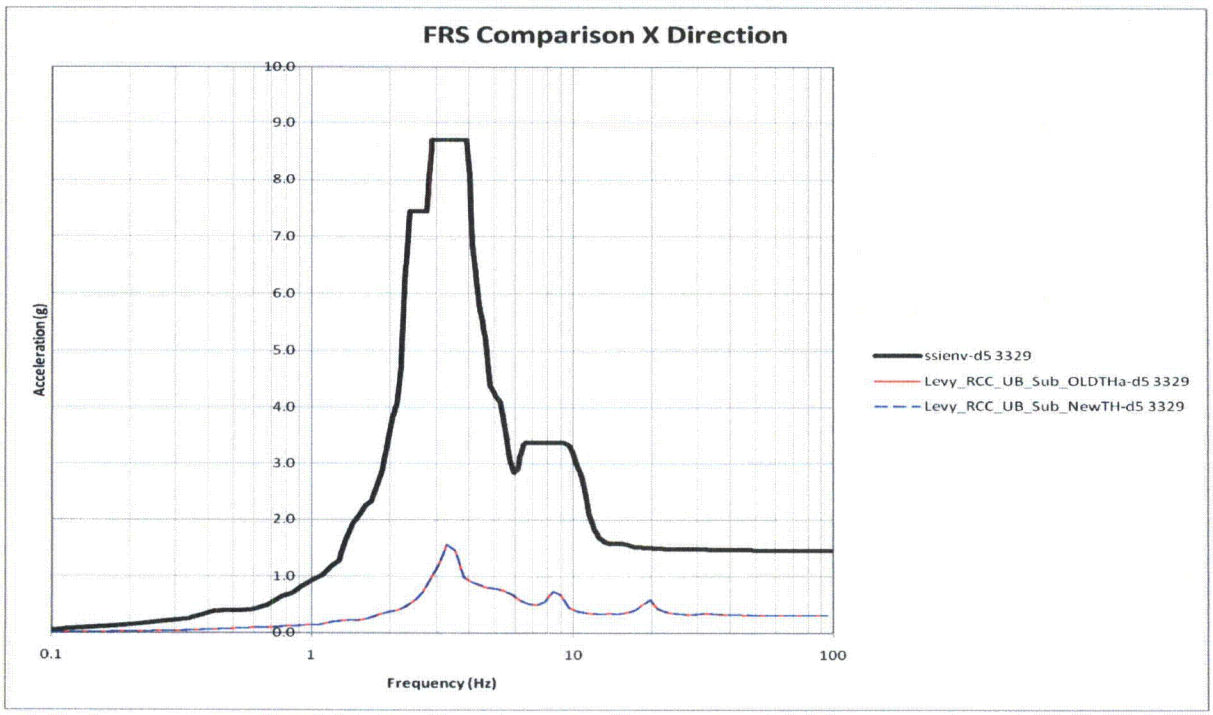

Figure 3-16: LNP UB Old TH and New TH FRS and AP1000 FRS Envelope in X-Direction – Node 3329

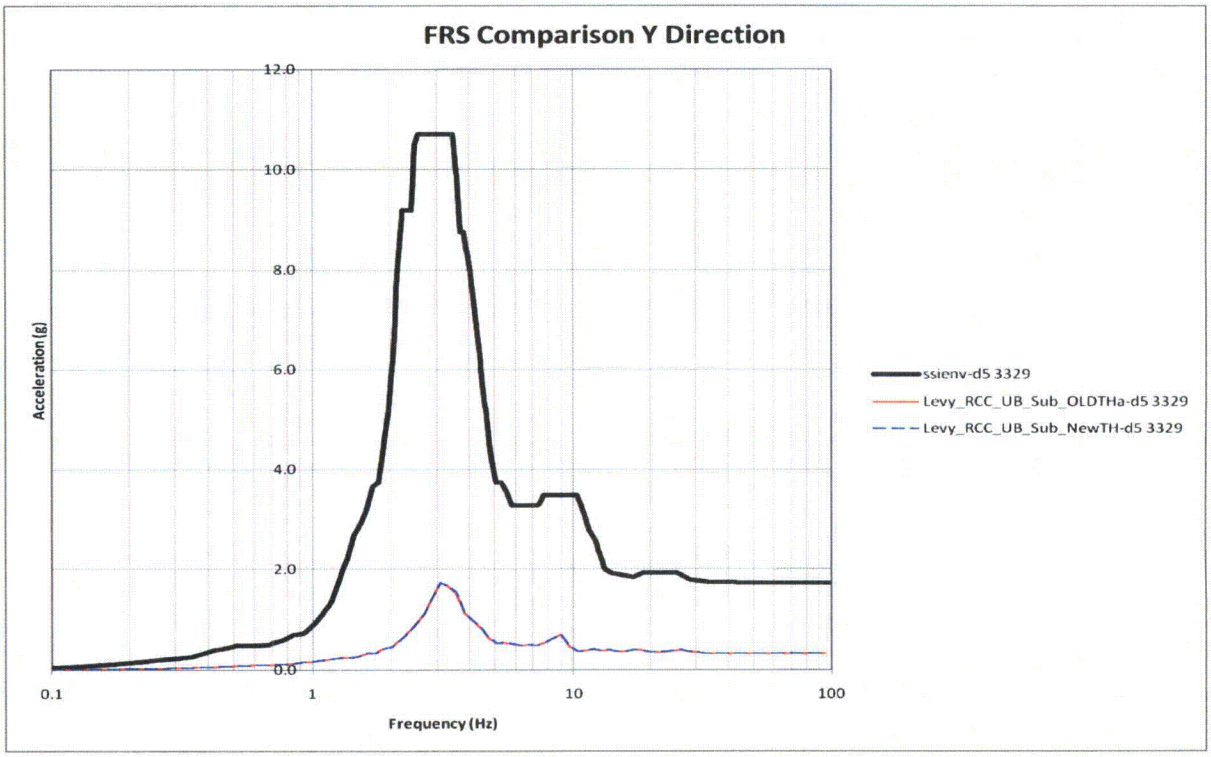

Figure 3-17: LNP UB Old TH and New TH FRS and AP1000 FRS Envelope Y-Direction – Node 3329

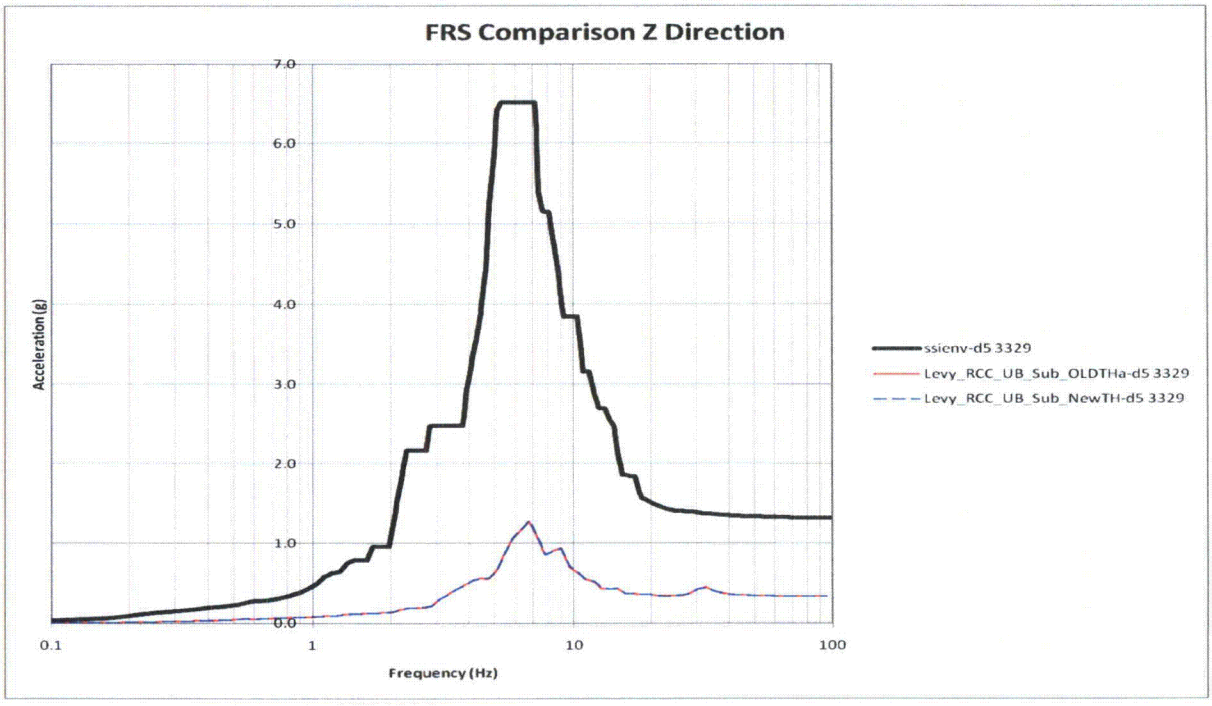

Figure 3-18: LNP UB Old TH and New TH FRS and AP1000 FRS Envelope in Z-Direction – Node 3329