Southern Nuclear
Operating Company, Inc.
40 Inverness Center Parkway
Birmingham, Alabama 35242

SOUTHERN COMPANY
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JUL 1 2009

Docket Nos.: 52-025
52-026

ND-09-1040

U.S. Nuclear Regulatory Commission
Document Control Desk
Washington, DC 20555-0001

Southern Nuclear Operating Company
Vogtle Electric Generating Plant Units 3 and 4 Combined License Application
Response to Request for Additional Information Letter No. 036

Ladies and Gentlemen:

By letter dated March 28, 2008, Southern Nuclear Operating Company (SNC) submitted an application for combined licenses (COLs) for proposed Vogtle Electric Generating Plant (VEGP) Units 3 and 4 to the U.S. Nuclear Regulatory Commission (NRC) for two Westinghouse AP1000 reactor plants, in accordance with 10 CFR Part 52. During the NRC's detailed review of this application, the NRC identified a need for additional information, involving the three dimensional (3-D) soil structure interaction (SSI) analysis for the VEGP site, required to complete their review of the COL application's Final Safety Analysis Report (FSAR) Section 3.7, "Seismic Design." By letter dated June 1, 2009, the NRC provided SNC with Request for Additional Information (RAI) Letter No. 036 concerning this information need. This RAI letter contains one RAI question numbered 03.07.02-3. The enclosures to this letter provide the SNC response to this RAI.

If you have any questions regarding this letter, please contact Mr. Wes Sparkman at (205) 992-5061.

D092
NRO

Mr. C. R. Pierce states he is the Nuclear Development Licensing Manager for Southern Nuclear Operating Company, is authorized to execute this oath on behalf of Southern Nuclear Operating Company and to the best of his knowledge and belief, the facts set forth in this letter are true.

Respectfully submitted,

SOUTHERN NUCLEAR OPERATING COMPANY

Charles R. Pierce

Charles R. Pierce

Sworn to and subscribed before me this 1st *day of* July, *2009*

Notary Public: Dana Williams

My commission expires: 12/29/2010

CRP/BJS/dmw

Enclosure:
1. Response to NRC RAI Letter No. 036 on the VEGP Units 3 & 4 COL Application Involving The 3-D SSI Analysis for the VEGP Site
2. Vogtle NI15 Finite Element Model Verification Summary Report

cc: Southern Nuclear Operating Company
Mr. J. H. Miller, III, President and CEO (w/o enclosures)
Mr. J. A. (Buzz) Miller, Executive Vice President, Nuclear Development (w/o enclosures)
Mr. J. T. Gasser, Executive Vice President, Nuclear Operations (w/o enclosures)
Mr. D. H. Jones, Site Vice President, Vogtle 3 & 4 (w/o enclosures)
Mr. T. E. Tynan, Vice President - Vogtle (w/o enclosures)
Mr. D. M. Lloyd, Vogtle 3 & 4 Project Support Director
Mr. M. K. Smith, Technical Support Director
Mr. M. J. Ajluni, Nuclear Licensing Manager
Mr. W. A. Sparkman, COL Project Engineer
Document Services RTYPE: AR01.1053
File AR.01.02.06

Nuclear Regulatory Commission
Mr. L. A. Reyes, Region II Administrator (w/o enclosures)
Mr. F.M. Akstulewicz, Deputy Director Div. of Safety Systems & Risk Assess. (w/o enclosures)
Ms. S. M. Coffin, AP1000 Manager of New Reactors (w/o enclosures)
Mr. R. G. Joshi, Lead Project Manager of New Reactors
Mr. B. Hughes, Project Manager of New Reactors
Ms. T. E. Simms, Project Manager of New Reactors
Mr. B. C. Anderson, Project Manager of New Reactors
Mr. M. M. Comar, Project Manager of New Reactors
Mr. M. D. Notich, Environmental Project Manager
Mr. J. H. Fringer, III, Environmental Project Manager
Mr. L. M. Cain, Senior Resident Inspector of VEGP

Georgia Power Company
Mr. O. C. Harper, IV, Vice President, Resource Planning and Nuclear Development

Oglethorpe Power Corporation
Mr. M. W. Price, Executive Vice President and Chief Operating Officer

Municipal Electric Authority of Georgia
Mr. S. M. Jackson, Vice President, Power Supply

Dalton Utilities
Mr. D. Cope, President and Chief Executive Officer

Bechtel Power Corporation
Mr. J. S. Prebula, Project Engineer (w/o enclosures)
Mr. R. W. Prunty, Licensing Engineer

Tetra Tech NUS, Inc.
Ms. K. K. Patterson, Project Manager

Shaw Stone & Webster, Inc.
Mr. K. B. Allison, Project Manager (w/o enclosures)
Mr. J. M. Oddo, Licensing Manager
Mr. D. C. Shutt, Licensing Engineer

Westinghouse Electric Company, LLC
Mr. N. C. Boyter, Vice President, AP1000 Vogtle 3 & 4 Project (w/o enclosures)
Mr. R. B. Sisk, Manager, AP1000 Licensing and Customer Interface
Mr. S. A. Bradley, Vogtle Project Licensing Manager
Mr. J. L. Whiteman, Principal Engineer, Licensing & Customer Interface

NuStart Energy
Mr. R. J. Grumbir
Mr. P. S. Hastings
Mr. E. R. Grant
Mr. B. Hirmanpour
Mr. N. Haggerty
Ms. K. N. Slays

Southern Nuclear Operating Company

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Enclosure 1

Response to NRC RAI Letter No. 036

on the

VEGP Units 3 & 4 COL Application

Involving

The 3-D SSI Analysis for the VEGP Site

FSAR Section 3.7, Seismic Design

eRAI Tracking No. 2653

NRC RAI Number 03.07.02-3:

RAI 3.07.02-1 requested the applicant to justify the adequacy of the 2D SASSI analyses for predicting in-structure response spectra (ISRS).

In response, the applicant submitted a summary report entitled, "3-D SSI Analysis of AP1000 at Vogtle Site Using NI15 Model for VEGP Units 3 and 4", which provides a description of the Vogtle site-specific 3D SSI analysis. The details of the nuclear island structural modeling are described in Section 5, "Structural Model". Section 5 states that the AP1000 structural model used for Vogtle site-specific SSI analysis is a 3-D finite element model defined as NI15, developed by Westinghouse (WEC). This section also states that the NI15 was verified by WEC by assuring that the mass distribution, the modal behavior and floor response spectra results were consistent in ANSYS with WEC's most detailed model, NI10, used for hard rock.

The staff reviews the procedures used for analytical modeling under SRP Section 3.7.2. To perform this review, please provide (1) the details of the applicant's comparison of the NI15 and NI10 model results (referenced in Section 5 of the aforementioned report) and (2) the details of the applicant's comparison of the NI15 and NI20 SASSI model results. Additionally, the staff notes that the AP1000 DCD design basis for soil sites is the NI20 SASSI model. Please explain whether the applicant's use of the NI15 model constitutes a departure from the DCD.

SNC Response:

1. Details of the Applicant's Comparison of the NI15 and NI10 Model Results

The NI15 model has been verified by comparing the mass distribution, modal behavior, and the floor response spectra with the corresponding properties and responses of the NI20 and NI10 models. ANSYS fixed base analysis has been used for this comparison.

Enclosure 2 contains a report entitled "Vogtle NI15 Finite Element Model Verification Summary Report," dated June 11, 2009. The comparison results contained in the enclosed report conclude that the ANSYS NI15 model is consistent with both the ANSYS NI10 and NI20 models.

2. Details of the Applicant's comparison of the NI15 and NI20 SASSI Results

A Vogtle site-specific comparison of the NI15 and NI20 SASSI model results was not performed. The NI15 model was developed specifically for the Vogtle site to incorporate additional refinement in order to 1) capture the Vogtle high frequency exceedance of the CSDRS and 2) to account for the softer soil profile that is significantly different than the AP1000 generic soil profiles used for the standard design. Therefore, the Vogtle site-specific NI15 SASSI model was developed to adequately capture the site-specific seismic responses of the AP1000 NI that would not be possible using the NI20. Thus, a comparison of the NI15 to NI20 Vogtle SASSI model results would not be meaningful.

Instead, the adequacy of the NI15 model, as compared to the NI20 model, is confirmed by comparing the fixed base mass properties and modal characteristics, as well as the ISRS (in-structure response spectra), at the six key locations in the NI. Use of fixed base analysis for

qualification of the model is consistent with the ASCE 4-98, Section 3.3.1.8(b) recommendation. In this section, it is recommended that for a model intended to generate ISRS, a comparison of ISRS results under fixed base conditions should be made with the reference model to confirm the adequacy of the model before it is used for SSI analysis. The basis for using fixed base models for comparison, in lieu of SSI models, is due to the fact that the fixed base results clearly reveal the effects of the modes in the structure as compared to the SSI results which tend to reduce and/or mask the effects of high frequency responses.

3. Explanation of Whether the Applicant's use of the NI15 Model Constitutes a Departure from the DCD

A departure is a plant-specific deviation from design information in a standard design certification rule (for VEGP Units 3 and 4, Appendix D to 10 CFR Part 52, "Design Certification Rule for the AP1000 Design"). Subsection 3G.2.2.2 of DCD Revision 17 states that the NI20 model is used in the soil-structure interaction (SSI) analyses of the nuclear island using the program SASSI. Initial NI20 development work for the VEGP Units 3 and 4 site showed that this model lacked the refinement to accurately account for differences between the local soil profile at VEGP and the AP1000 generic soil profiles described in the DCD. Accordingly, a more refined model identified as NI15 was developed and utilized for the VEGP site-specific SSI analysis, as allowed in DCD Tier 1, Table 5.0-1, Site Parameters. The SSE site parameter specifically states: "If the site-specific spectra exceed the response spectra in Figures 5.0-1 and 5.0-2 at any frequency, or if soil conditions are outside the range evaluated for AP1000 design certification, a site-specific evaluation can be performed." Thus, Tier 1 contains provisions to allow for site-specific evaluations to demonstrate acceptability of the Ground Motion Response Spectra with the Certified Seismic Design Response Spectra. The adequacy of the NI15 model is confirmed by comparing its dynamic characteristics with the NI20 model. NI15 provides the refinement needed for SSI analysis using the VEGP Units 3 and 4 soil profile and design motion. Due to dependency of the structural model refinement on site-specific soil profile and site-specific design motion, use of the NI15 model does not represent a deviation from the DCD as provided in Tier 1, and, accordingly, is not a departure.

Associated VEGP COL Application Revisions:
None

Southern Nuclear Operating Company

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Enclosure 2

Vogtle NI15 Finite Element Model Verification Summary Report

NOTE: The enclosed document is 15 pages.

Vogtle NI15 Finite Element Model Verification Summary Report

June 11, 2009

This letter report is a summary of Vogtle Specific NI15 Finite Element Model Verification. The AP1000 Nuclear Island consists of the Auxiliary and Shield building (ASB), Containment Internal Structure (CIS), Reactor Coolant Loop (RCL), and Steel Containment Vessel (SCV). The average element size of ANSYS NI15 Model is 15' by 15' for solid and shell elements in the ASB. ANSYS NI15 model is shown in Figure 1. The SCV, CIS, and RCL are shown in Figure 2. The embedded portion of the NI is modeled using 5 layers of elements from bottom of basemat to grade, elevation 60.5 to 100 ft. The structure model has over 6300 nodes and 7500 elements as shown in Table 1. The NI20 model averaged element size is 20' by 20' as shown in Figure 3.

The NI15 model is verified by checking the mass distribution, modal behavior, and the floor response spectra. The mass properties and modal characteristic of the NI15 ANSYS model are compared to the ANSYS NI10 and NI20 fixed base models to verify the accuracy of the NI15 model. Figure 4 to 6 show the summation of effective masses in the X, Y, and Z-direction from 1 to 55 Hz.

The time history fixed base analysis performed on the NI10, NI15 and NI20 models uses the CSDRS input time histories. The input motion is applied in three directions simultaneously. The models are free-standing fixed at the basemat level. The floor acceleration response spectra between the three models are compared for the six key nodes listed in Table 2. The response spectra are computed at 5% damping. The results are shown in Figure 7 through 24.

The comparison results show that the ANSYS NI15 model is consistent with both the ANSYS NI10 and NI20 finite element models.

Table 1: Nuclear Island Model Components

	Ni15	Ni20n
Number of nodes	6,341	2,314
Number of elements	7,504	3,649
Approximate Element Size	15'	20'

Table 2: Nuclear Island 6 Key Node Coordinates and Descriptions

Node #			Coordinates			
NI10	NI15	NI20n	X	Y	Z	Locations
4724	10115	2078	1116.5	948.5	116.5	ASB - **North-East Corner at Control Room Floor**
5754	11111	2675	929	1000	179.19	ASB - **Corner of Fuel Building Roof at Shield Building**
8573	12052	3329	956.5	1000	327.41	ASB - **Shield Building Roof Area**
105772	10471	2199	1008	1014	134.25	CIS - **Operating Deck**
130401	9007	1761	1000	1000	100	CIS - **Reactor Vessel Support Elevation**
130412	11224	2788	1000	1000	224	SCV - **Polar Crane**

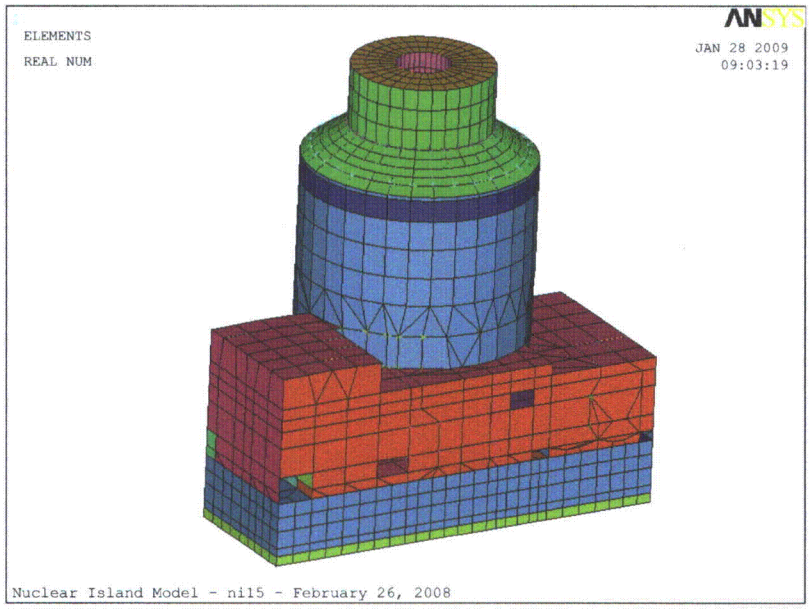

Figure 1: Refined NI15 Model

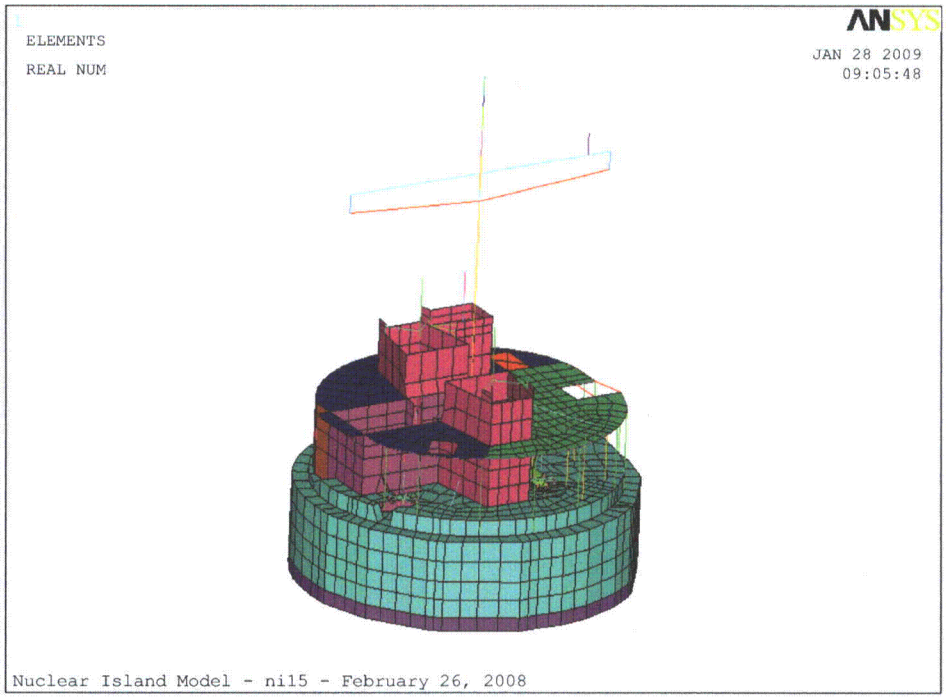

Figure 2: NI15 CIS, RCL, and SVC Elements

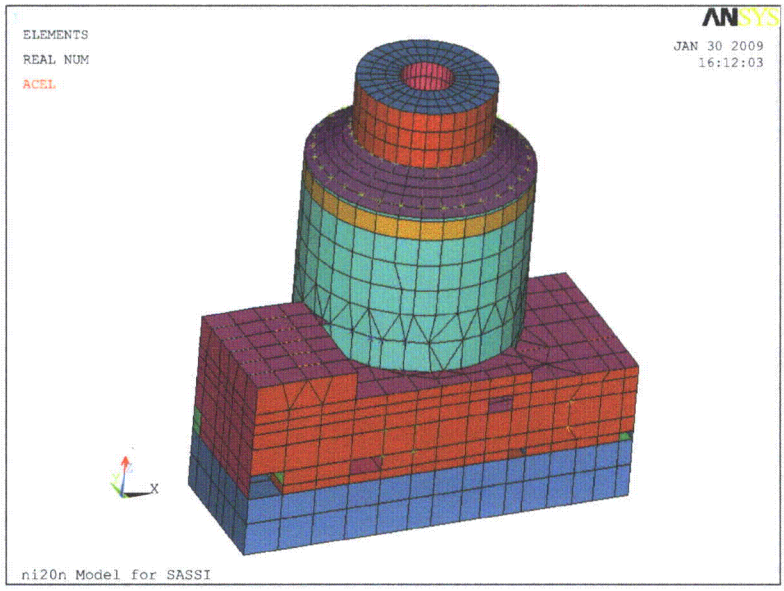

Figure 3: NI20 Model

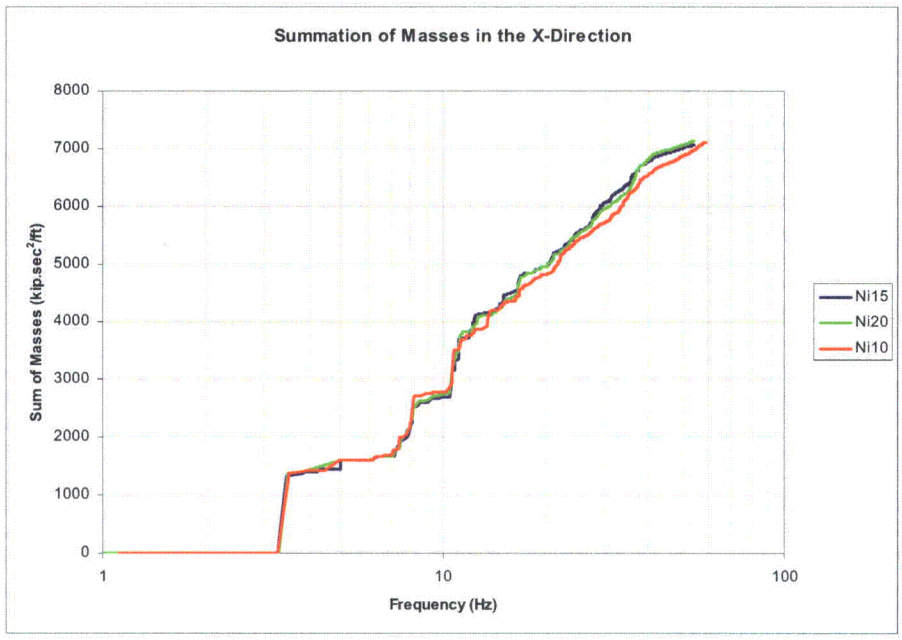

Figure 4: X-Direction Modal Analysis

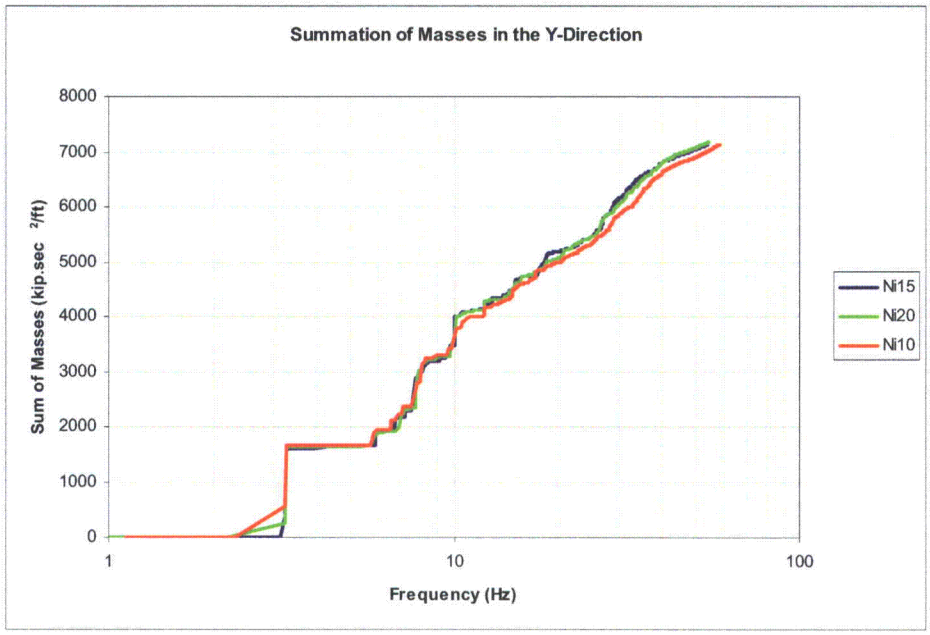

Figure 5: Y-Direction Modal Analysis

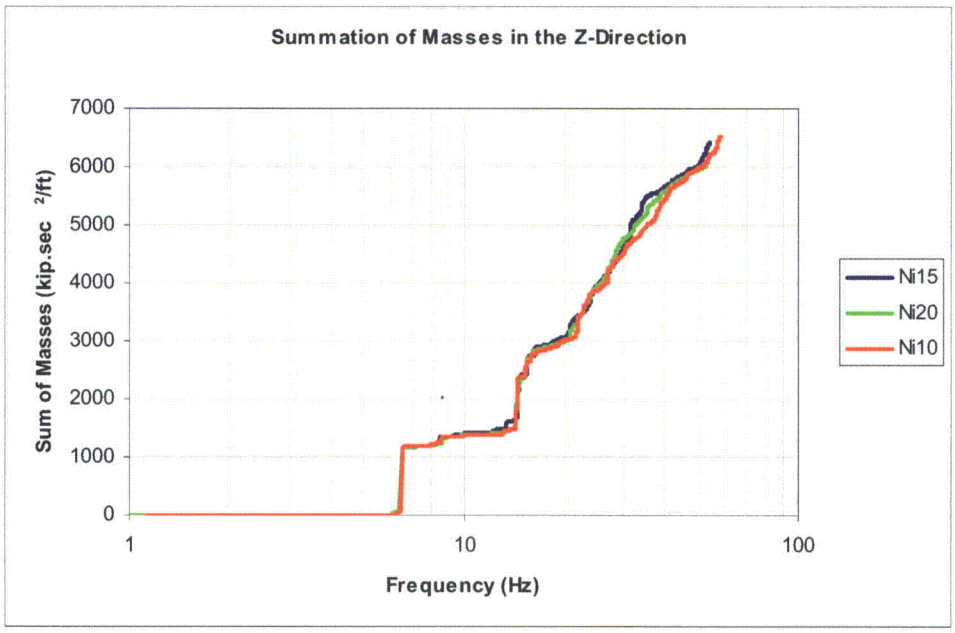

Figure 6: Z-Direction Modal Analysis

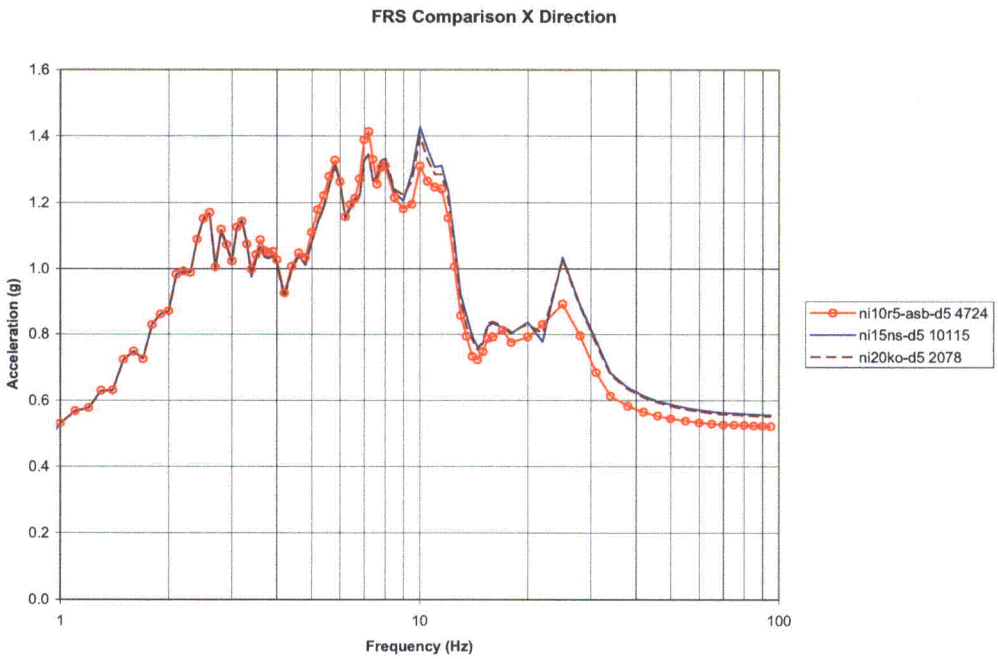

Figure 7: X-Direction at Node 10115

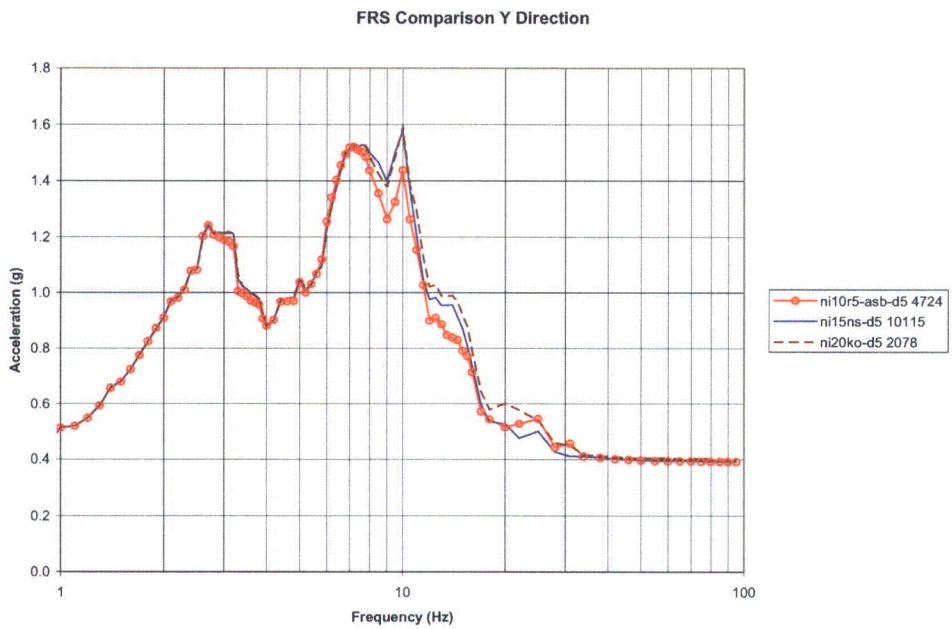

Figure 8: Y-Direction at Node 10115

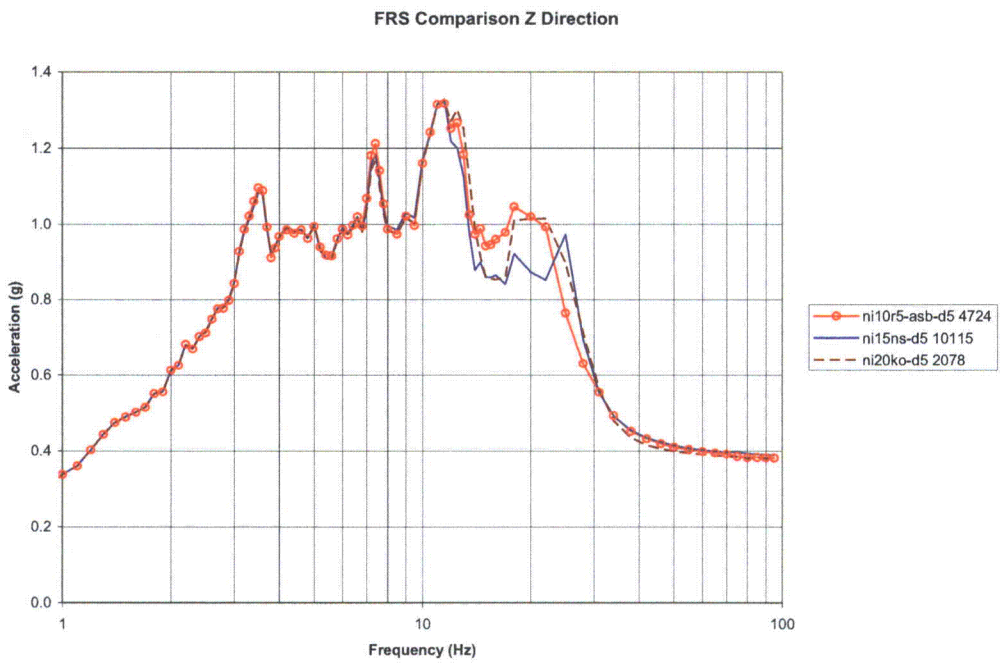

Figure 9: Z-Direction at Node 10115

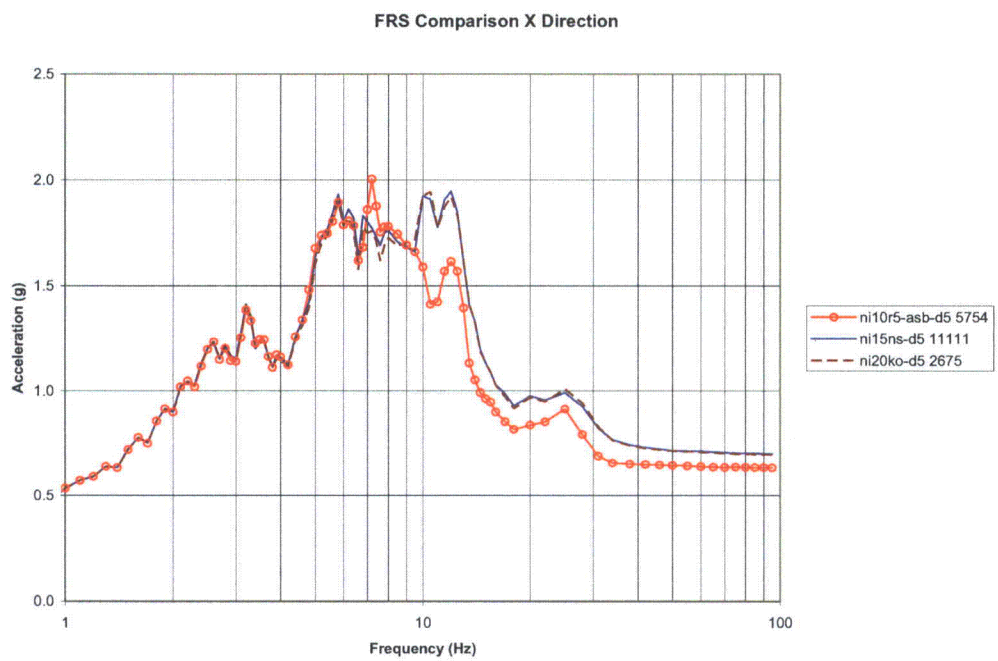

Figure 10: X-Direction at Node 11111

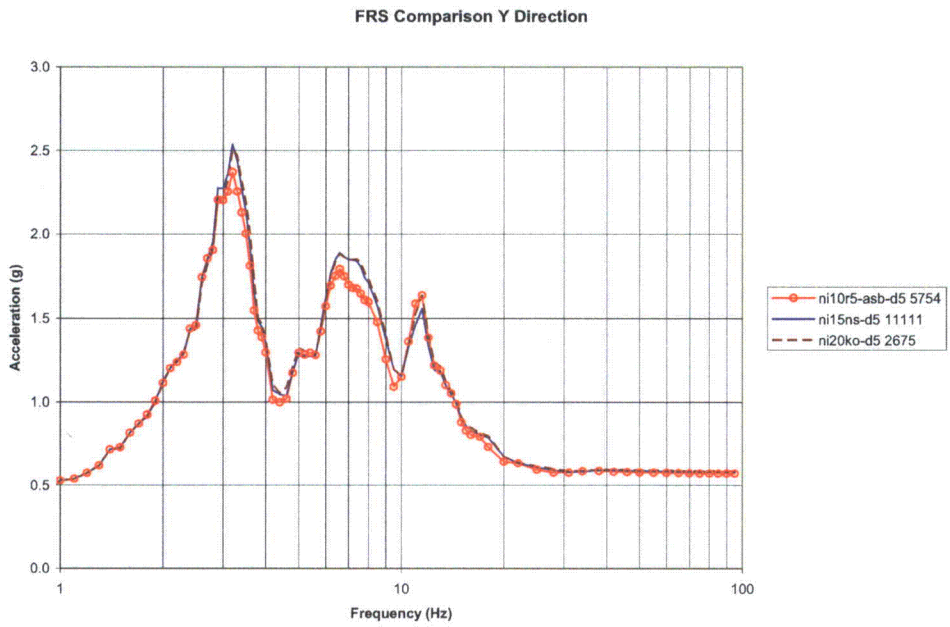

Figure 11: Y-Direction at Node 11111

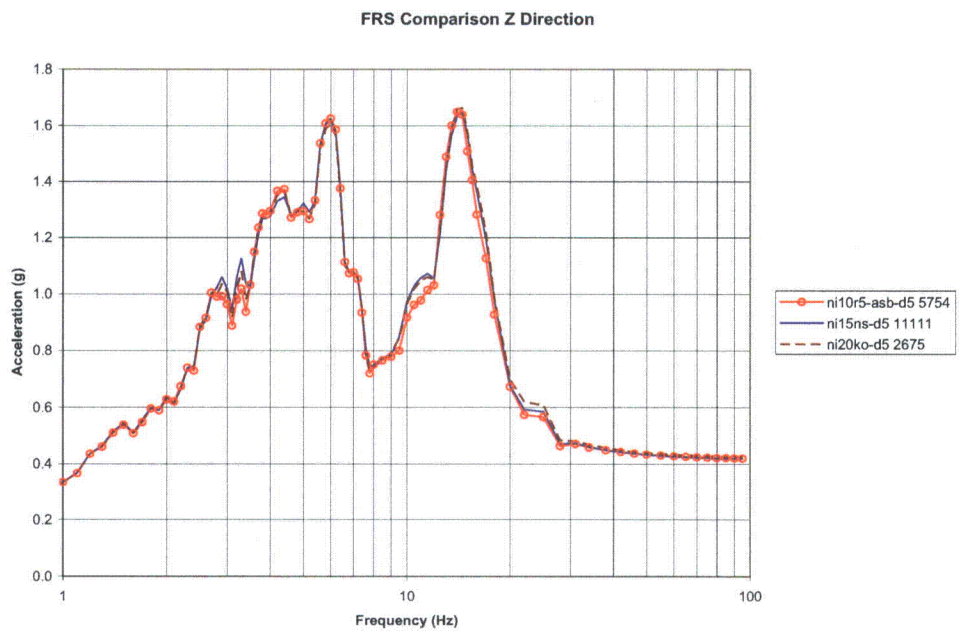

Figure 12: Z-Direction at Node 11111

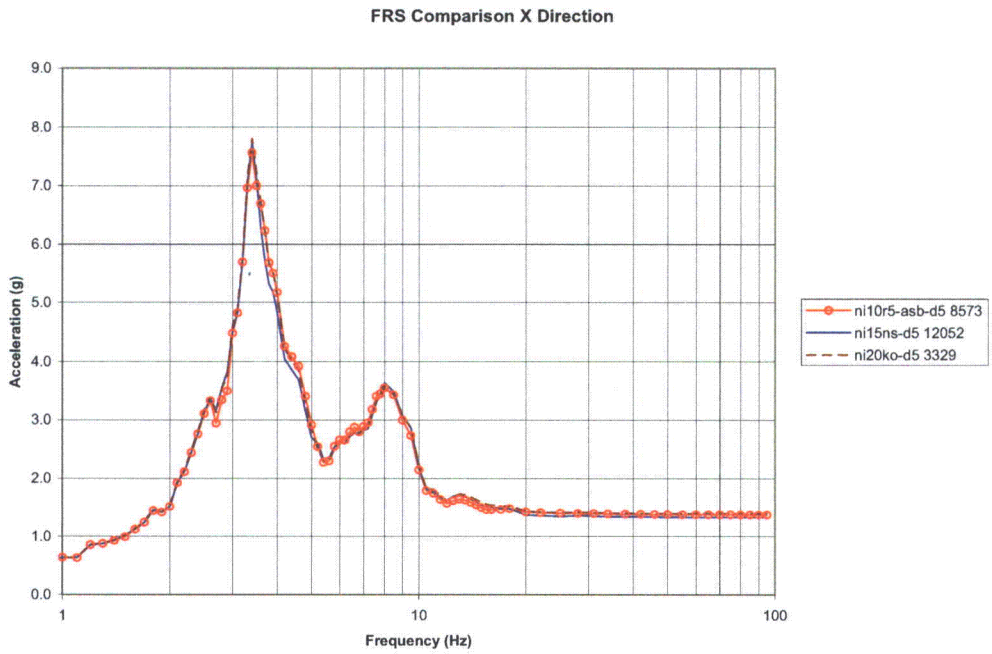

Figure 13: X-Direction at Node 12052

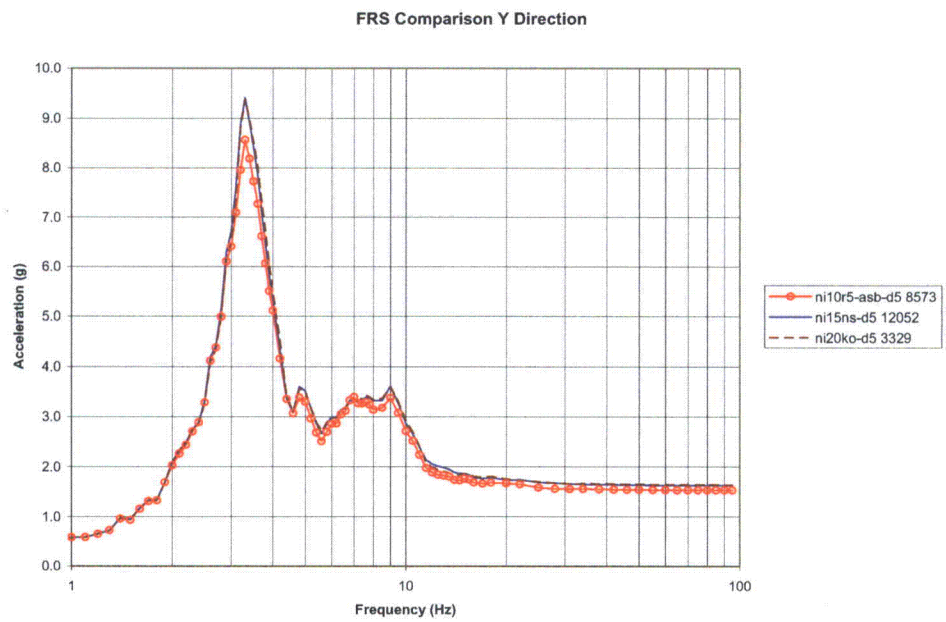

Figure 14: Y-Direction at Node 12052

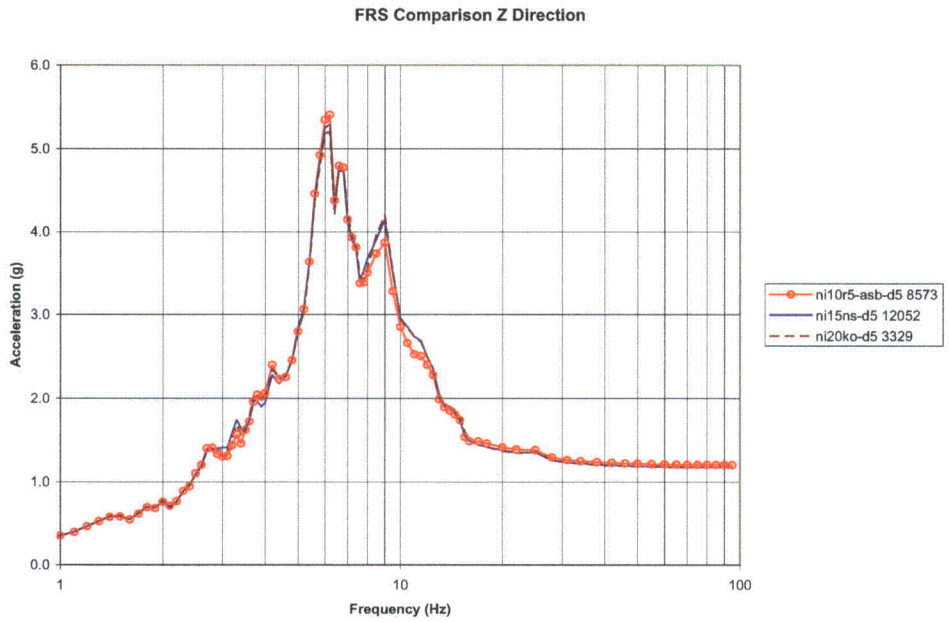

Figure 15: Z-Direction at Node 12052

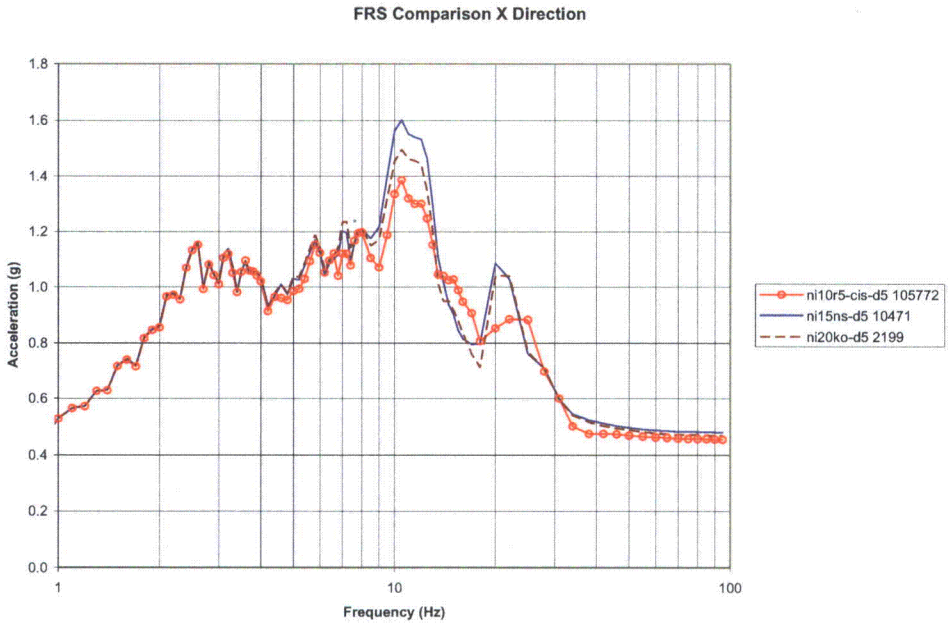

Figure 16: X-Direction at Node 10471

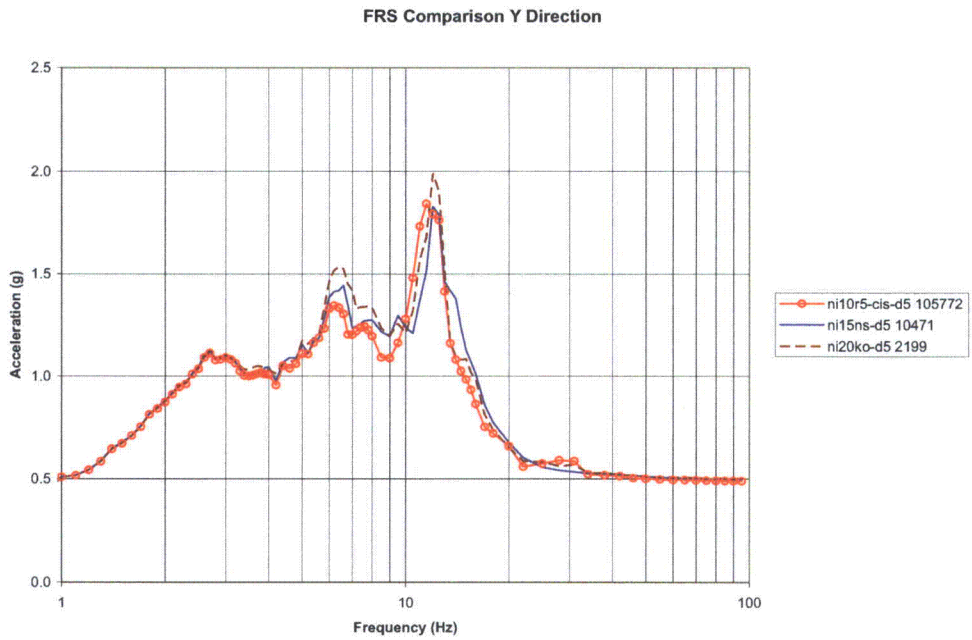

Figure 17: Y-Direction at Node 10471

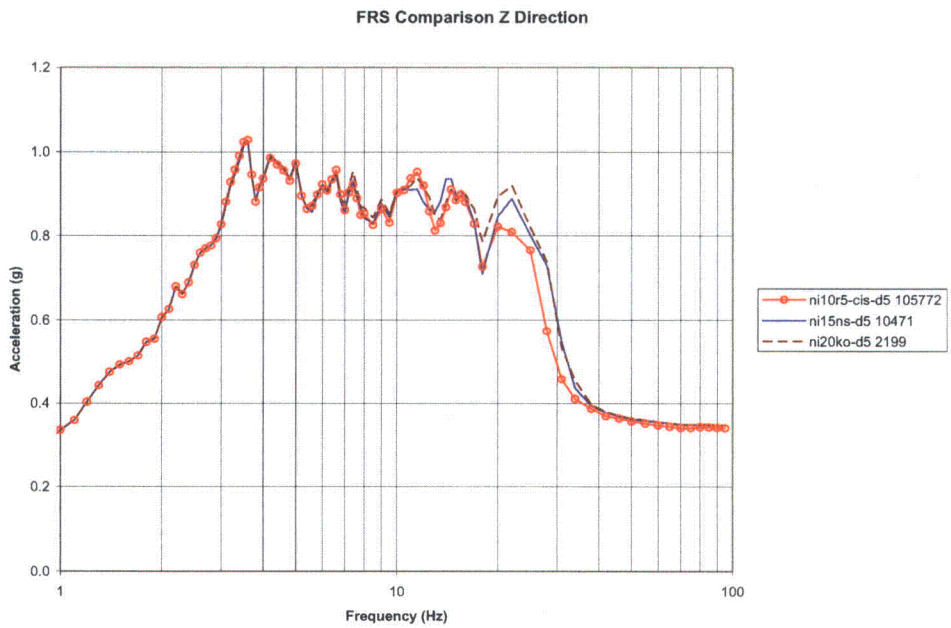

Figure 18: Z-Direction at Node 10471

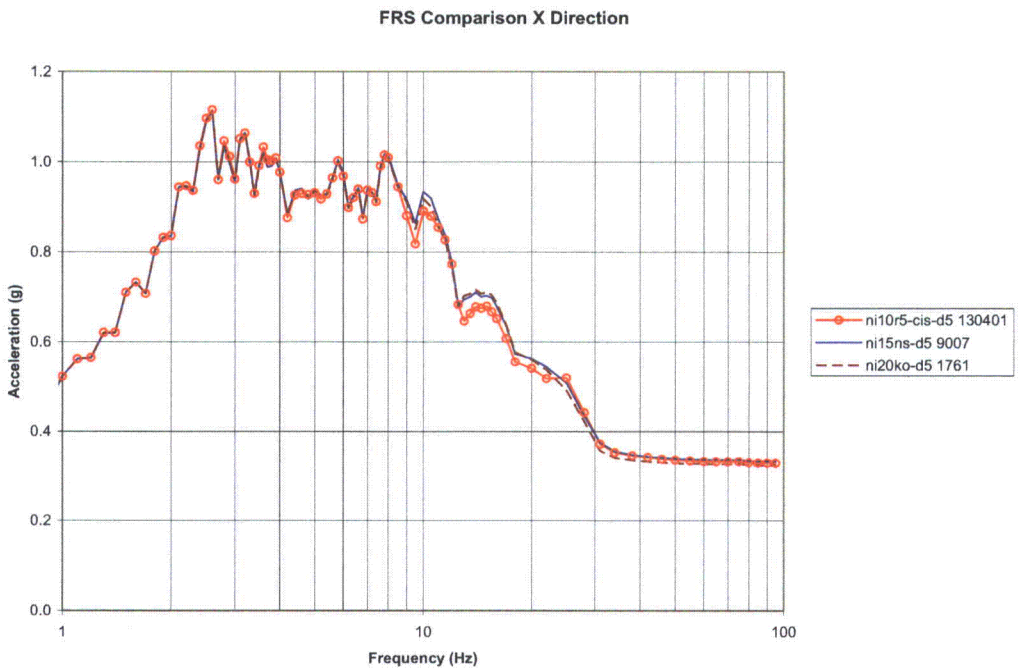

Figure 19: X-Direction at Node 9007

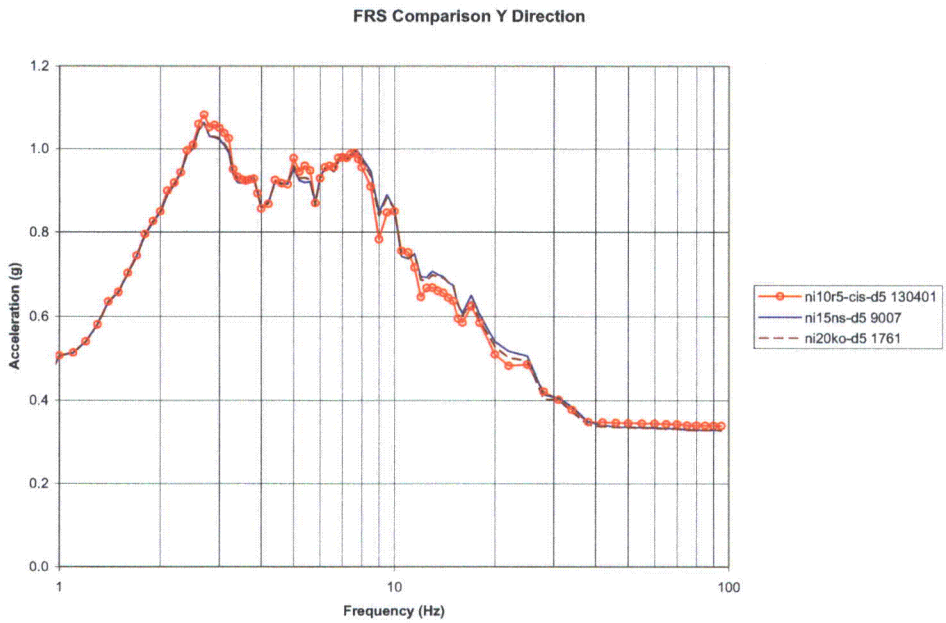

Figure 20: Y-Direction at Node 9007

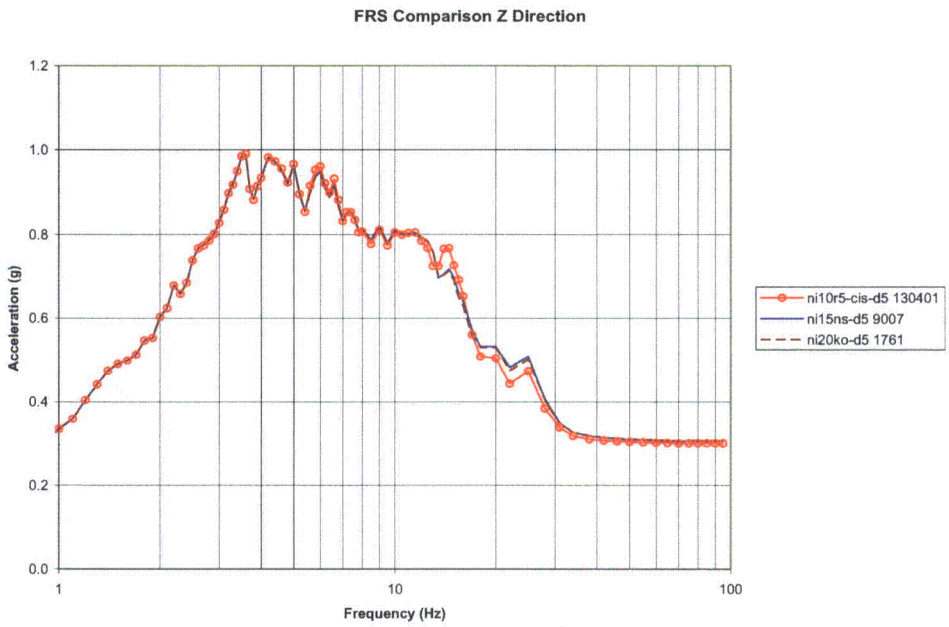

Figure 21: Z-Direction at Node 9007

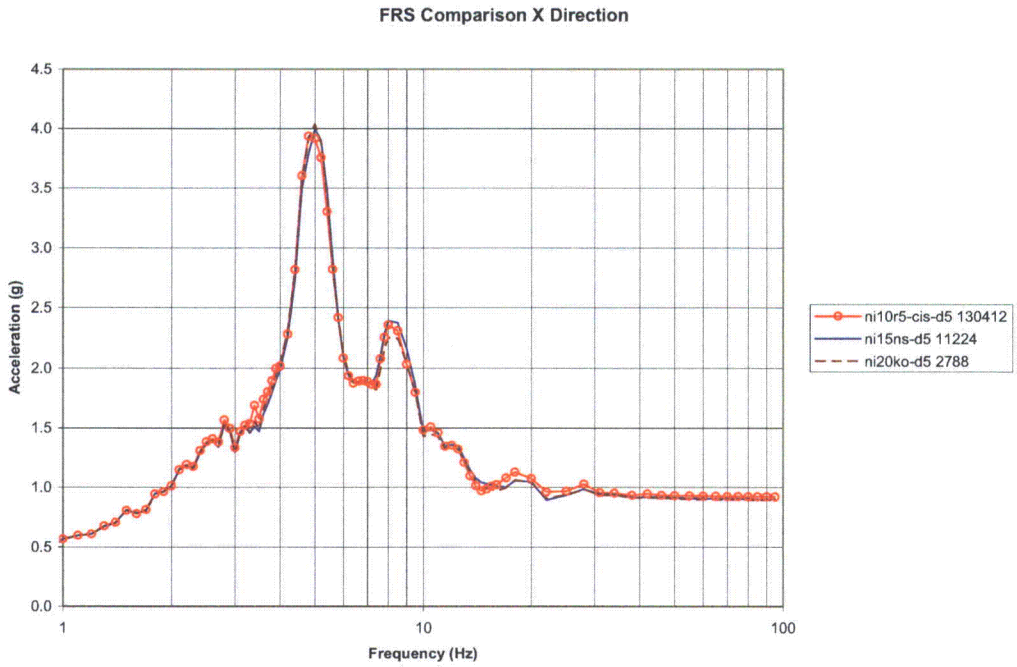

Figure 22: X-Direction at Node 11224

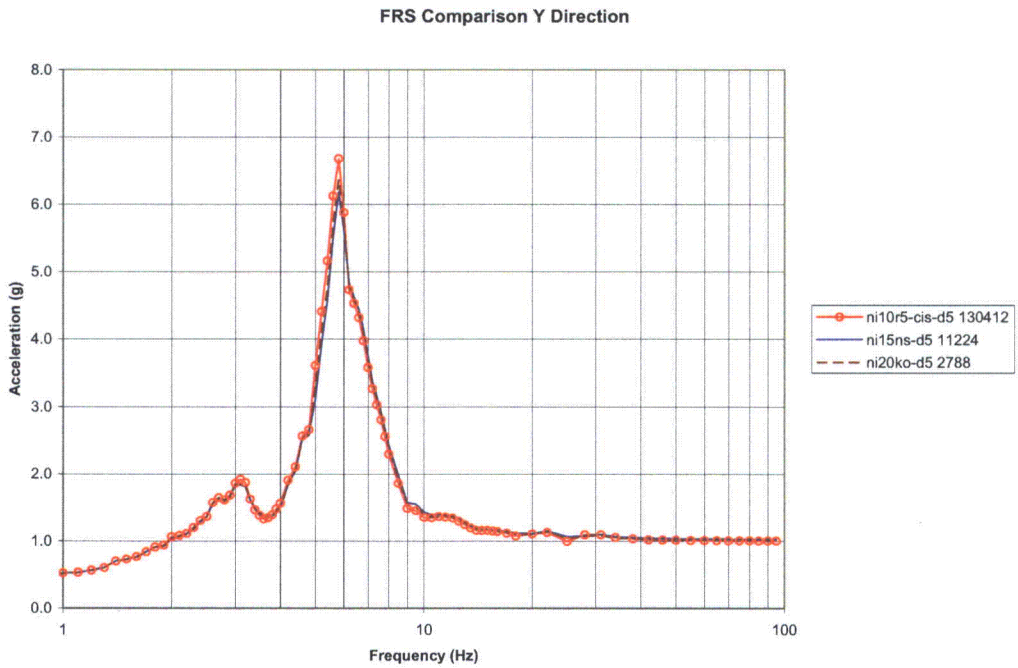

Figure 23: Y-Direction at Node 11224

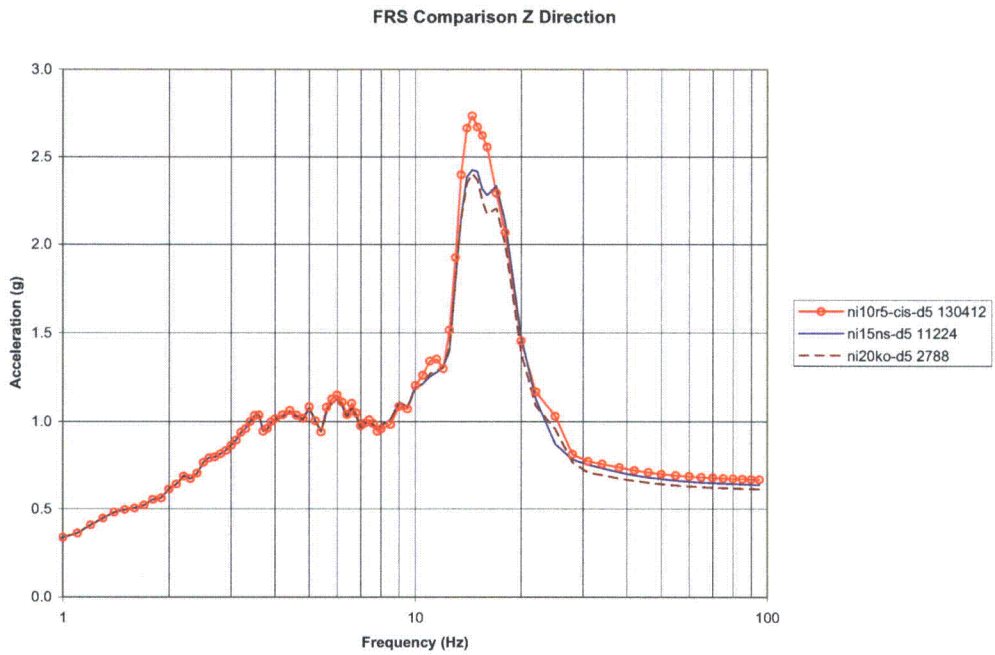

Figure 24: Z-Direction at Node 11224