



SEP 10 2013

10 CFR 50.54(f)

LR-N13-0205

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

Salem Nuclear Generating Station, Units 1 and 2  
Renewed Facility Operating License Nos. DPR-70 and DPR-75  
NRC Docket Nos. 50-272 and 50-311

Subject: Response to NRC Request for Information Pursuant to 10 CFR 50.54(f)  
Regarding the Seismic Aspects of Recommendation 2.1 of the Near-Term  
Task Force Review of Insights from the Fukushima Dai-ichi Accident -  
Base Case Velocity Profiles With Supporting Subsurface Materials and  
Properties

- References:
1. U.S. Nuclear Regulatory Commission (NRC) letter, "Request for Information Pursuant to Title 10 of the Code of Federal Regulations 50.54(f) Regarding Recommendations 2.1, 2.3, and 9.3, of the Near-Term Task Force Review of Insights from the Fukushima Dai-ichi Accident," dated March 12, 2012
  2. NRC Letter, "Endorsement of Electric Power Research Institute Final Draft Report 1025287, 'Seismic Evaluation Guidance,'" dated February 15, 2013
  3. Electric Power Research Institute (EPRI) Report 1025287, "Seismic Evaluation Guidance: Screening, Prioritization and Implementation Details (SPID) for the Resolution of Fukushima Near-Term Task Force Recommendation 2.1: Seismic," dated November 2012
  4. Nuclear Energy Institute (NEI) letter to NRC, "Proposed Path Forward for NTFF Recommendation 2.1: Seismic Reevaluations," dated April 9, 2013
  5. NRC Letter, "Electric Power Research Institute Final Draft Report XXXXXX, 'Seismic Evaluation Guidance: Augmented Approach for the Resolution of Near-Term Task Force Recommendation 2.1: Seismic,' as an Acceptable Alternative to the March 12, 2012, Information Request for Seismic Reevaluations," dated May 7, 2013

On March 12, 2012, the Nuclear Regulatory Commission (NRC) issued Reference 1 to all power reactor licensees and holders of construction permits in active or deferred status. Enclosure 1 of Reference 1 requested each addressee in the Central and Eastern United States (CEUS) to submit a written response consistent with the requested seismic hazard evaluation information (items 1 through 7) by September 12, 2013. On February 15, 2013, the NRC issued Reference 2, endorsing the Reference 3 industry guidance for responding to Reference 1. Section 4 of Reference 3 identifies the detailed information to be included in the seismic hazard evaluation submittals.

On April 9, 2013, the Nuclear Energy Institute (NEI) submitted Reference 4 to the NRC, requesting NRC agreement to delay submittal of some of the CEUS seismic hazard evaluation information so that an update to the Electric Power Research Institute (EPRI) ground motion attenuation model could be completed and used to develop that information. NEI proposed that descriptions of subsurface materials and properties and base case velocity profiles (items 3a and 3b in Section 4 of Reference 3) be submitted to the NRC by September 12, 2013, with the remaining seismic hazard and screening information submitted to the NRC by March 31, 2014. In Reference 5, the NRC agreed with this recommendation.

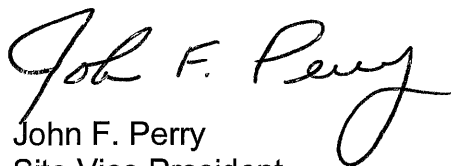
Enclosure 1 contains the requested descriptions of subsurface materials and properties and base case velocity profiles for the Salem Generating Station Units 1 and 2. The information provided in Enclosure 1 is an interim product of seismic hazard evaluation efforts being performed for the industry by EPRI. In accordance with Reference 5, PSEG will submit complete and final seismic hazard information for the Salem Generating Station Units 1 and 2, by March 31, 2014.

There are no regulatory commitments contained in this letter. If you have any questions or require additional information, please do not hesitate to contact Mrs. Emily Bauer at 856-339-1023.

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

Executed on 9/10/13  
(Date)

Sincerely,



John F. Perry  
Site Vice President  
Salem Generating Station

Enclosure 1 – Base Case Velocity Profiles With Supporting Subsurface Materials and Properties for the Salem Generating Station Units 1 and 2

cc: Mr. W. Dean, Administrator, Region I, NRC  
Mr. J. Hughey, Project Manager, NRC  
NRC Senior Resident Inspector, Salem  
Mr. P. Mulligan, Manager IV, NJBNE  
Salem Commitment Tracking Coordinator  
PSEG Commitment Coordinator – Corporate

## **Base Case Velocity Profiles With Supporting Subsurface Materials and Properties for the Salem Generating Station Units 1 and 2**

### Salem Site Description

The basic information used to create the site geologic profile at the Salem Generating Station (SGS) Units 1 and 2 is shown in Table 1. The Safe Shutdown Earthquake (SSE) Control Point is the top of the Vincentown formation at a depth of 71 feet from the surface.

For dynamic properties of rock layers, modulus and damping curves were represented with two models. The first model used rock curves taken from Reference 1, and the second model assumed linear behavior. These dynamic property models were weighted equally.

For dynamic properties of fill, sand, silt, and clay layers, modulus and damping curves were also represented with two models. The first model used soil curves taken from Reference 1, and the second model used soil curves taken from Reference 2 and Reference 3. These dynamic property models were weighted equally.

To model the site geologic profile, rock modulus and damping curves from Reference 1 were paired with soil modulus and damping curves from Reference 1, and linear rock modulus and damping curves were paired with soil modulus and damping curves from Reference 2 and Reference 3.

The three base case shear-wave velocity ( $V_s$ ) profiles used to model amplification at the site are shown in Figure 1. In accordance with Reference 4 Table B-1, Profile 1 (the mean base case), Profile 2 (lower-range), and Profile 3 (upper-range) are weighted 0.4, 0.3, and 0.3, respectively. Thicknesses, depths, and shear-wave velocities corresponding to each profile are shown in Table 2.

### References

1. EPRI (1993). "Guidelines for Determining Design Basis Ground Motions," Electric Power Research Institute, Palo Alto, CA, Report TR-102293, Vol. 1-5.
2. Silva, W.J., N. A. Abrahamson, G.R. Toro, and C. Costantino (1996). "Description and Validation of the Stochastic Ground Motion Model," Report submitted to Brookhaven National Laboratory. Assoc. Universities Inc., Upton NY 11973, Contract No. 770573.
3. Walling, M.A., W.J. Silva and N.A. Abrahamson (2008). "Nonlinear Site Amplification Factors for Constraining the NGA Models," *Earthquake Spectra*, 24 (1) 243-255.
4. EPRI (2012). "Seismic Evaluation Guidance: Screening, Prioritization and Implementation Details (SPID) for the Resolution of Fukushima Near-Term Task Force Recommendation 2.1: Seismic," Electric Power Research Institute, Palo Alto, CA, Report 1025287

**Table 1 - Summary of Geotechnical Profile Data for Salem Generating Station<sup>(a)</sup>**

| Layer ID number and Formation                | Depth Range (feet) <sup>(b)</sup> | Soil/Rock Description                                                                                                                                                                                                           | Unit Weight (pcf) | Shear Wave Velocity (Vs), <sup>(c)</sup><br>(fps) | Compressional Wave Velocity (fps) <sup>(d)</sup> | Poisson's ratio <sup>(d)</sup> |
|----------------------------------------------|-----------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------|---------------------------------------------------|--------------------------------------------------|--------------------------------|
| 0                                            | 0-71                              | Hydraulic fill, alluvium and Tertiary sands (this layer is included for completeness only; it is not present below safety-related structures). Lean concrete fill is placed above 71' to the base of containment building mats. | 100-137           | 500                                               | -                                                | -                              |
| -                                            | 71                                | Bearing surface at 71' depth                                                                                                                                                                                                    | -                 | -                                                 | -                                                | -                              |
| 1 Vincentown<br>Hornerstown<br>Navesink      | 71-163                            | Tertiary dense sands and Cretaceous dense silty and clayey sands                                                                                                                                                                | 121               | 2250                                              | -                                                | -                              |
| 2<br>Mt Laurel                               | 163-181                           | Cretaceous dense sand                                                                                                                                                                                                           | 131               | 3920                                              | -                                                | -                              |
| 3<br>Mt Laurel                               | 181-203                           | Cretaceous dense sand                                                                                                                                                                                                           | 131               | 2490                                              | -                                                | -                              |
| 4<br>Mt Laurel                               | 203-237                           | Cretaceous dense sand                                                                                                                                                                                                           | 131               | 3020                                              | -                                                | -                              |
| 5<br>Mt Laurel<br>Wenonah<br>Marshalltown    | 237-299                           | Cretaceous sandy clay and silty sand, very stiff to hard/dense                                                                                                                                                                  | 128               | 2490                                              | -                                                | -                              |
| 6<br>Marshalltown<br>Englishtown<br>Woodbury | 299-383                           | Cretaceous sandy clay and clayey sand, very stiff to hard                                                                                                                                                                       | 125               | 1710                                              | -                                                | -                              |
| 7<br>Woodbury<br>Merchantville               | 383-409                           | Cretaceous silt and clay, hard                                                                                                                                                                                                  | 130               | 2290                                              | -                                                | -                              |
| 8<br>Merchantville<br>Magothy                | 409-434                           | Cretaceous clay and silt, hard                                                                                                                                                                                                  | 130               | 1780                                              | -                                                | -                              |
| 9<br>Magothy<br>Potomac                      | 434-516                           | Cretaceous sand with clay and silt, dense                                                                                                                                                                                       | 130               | 2490                                              | -                                                | -                              |
| 10<br>Potomac                                | 516-881                           | Cretaceous Potomac Formation, Upper Zone                                                                                                                                                                                        | 135               | 2200                                              | 6200                                             | 0.42                           |
| 11<br>Potomac                                | 881-1311                          | Cretaceous Potomac Formation, Middle Zone                                                                                                                                                                                       | 135               | 2630                                              | 6200                                             | 0.42                           |
| 12<br>Potomac                                | 1311-1761                         | Cretaceous Potomac Formation, Lower Zone                                                                                                                                                                                        | 135               | 3060                                              | 6200                                             | 0.42                           |

| Layer ID number and Formation | Depth Range (feet) <sup>(b)</sup> | Soil/Rock Description                   | Unit Weight (pcf) | Shear Wave Velocity (Vs), (fps) <sup>(c)</sup> | Compressional Wave Velocity (fps) <sup>(d)</sup> | Poisson's ratio <sup>(d)</sup> |
|-------------------------------|-----------------------------------|-----------------------------------------|-------------------|------------------------------------------------|--------------------------------------------------|--------------------------------|
| 13<br>Potomac                 | 1761                              | Seismic Basement,<br>Crystalline Schist | 150               | 11,000                                         | 20,450                                           | 0.30                           |

Table Notes:

- (a) Information in this table is generally from PSEG Early Site Permit Application (ESPA) Site Safety Analysis Report (SSAR) Table 2.5.2-17, Figure 2.5.4.7-8(a), and Figure 2.5.4.7-8(b). This table is not a safety-related document.
- (b) Depths are from ground surface (approximate elevation 11 ft, North American Vertical Datum (NAVD), 1988 datum).
- (c) Values are from PSEG ESPA SSAR information. Values for layers 0 through 9 are from PSEG suspension logging (depth of logging).
- (d) Values for layers 0 through 9 are not presented here because the shear wave velocities are based on direct measurements. Values for layers 10 through 13 are based on PSEG ESPA SSAR information.

**Table 2 - Layer Thicknesses, Depths, and Vs for the Three Velocity Profiles, Salem**

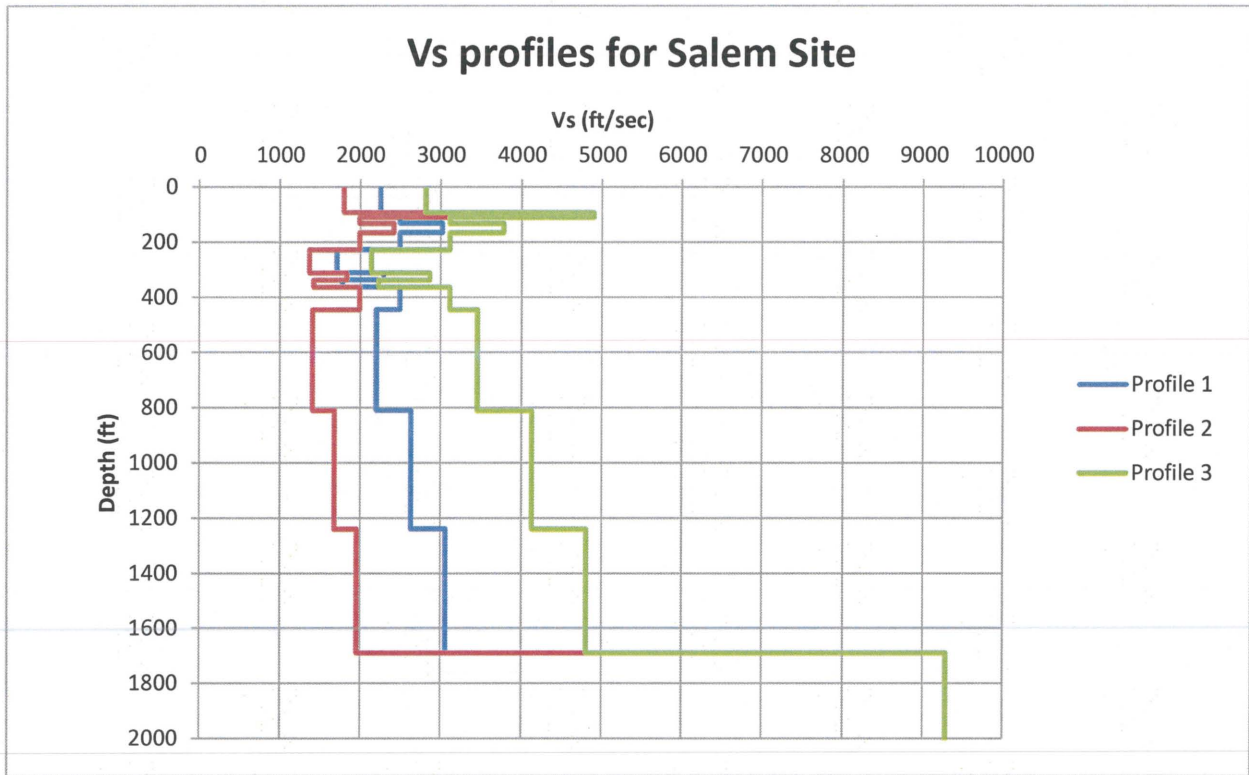
| Profile 1     |                        |          | Profile 2     |                        |          | Profile 3     |                        |          |
|---------------|------------------------|----------|---------------|------------------------|----------|---------------|------------------------|----------|
| thickness(ft) | depth (ft)<br>(Note a) | Vs(ft/s) | thickness(ft) | depth (ft)<br>(Note a) | Vs(ft/s) | thickness(ft) | depth (ft)<br>(Note a) | Vs(ft/s) |
|               | 0                      | 2250     |               | 0                      | 1800     |               | 0                      | 2812     |
| 10.0          | 10.0                   | 2250     | 10.0          | 10.0                   | 1800     | 10.0          | 10.0                   | 2812     |
| 10.0          | 20.0                   | 2250     | 10.0          | 20.0                   | 1800     | 10.0          | 20.0                   | 2812     |
| 10.0          | 30.0                   | 2250     | 10.0          | 30.0                   | 1800     | 10.0          | 30.0                   | 2812     |
| 10.0          | 40.0                   | 2250     | 10.0          | 40.0                   | 1800     | 10.0          | 40.0                   | 2812     |
| 10.0          | 50.0                   | 2250     | 10.0          | 50.0                   | 1800     | 10.0          | 50.0                   | 2812     |
| 10.0          | 60.0                   | 2250     | 10.0          | 60.0                   | 1800     | 10.0          | 60.0                   | 2812     |
| 10.0          | 70.0                   | 2250     | 10.0          | 70.0                   | 1800     | 10.0          | 70.0                   | 2812     |
| 10.0          | 80.0                   | 2250     | 10.0          | 80.0                   | 1800     | 10.0          | 80.0                   | 2812     |
| 12.0          | 92.0                   | 2250     | 12.0          | 92.0                   | 1800     | 12.0          | 92.0                   | 2812     |
| 9.0           | 101.0                  | 3920     | 9.0           | 101.0                  | 3136     | 9.0           | 101.0                  | 4900     |
| 9.0           | 110.0                  | 3920     | 9.0           | 110.0                  | 3136     | 9.0           | 110.0                  | 4900     |
| 10.0          | 120.0                  | 2490     | 10.0          | 120.0                  | 1992     | 10.0          | 120.0                  | 3112     |
| 10.0          | 130.0                  | 2490     | 10.0          | 130.0                  | 1992     | 10.0          | 130.0                  | 3112     |
| 2.0           | 132.0                  | 2490     | 2.0           | 132.0                  | 1992     | 2.0           | 132.0                  | 3112     |
| 11.3          | 143.3                  | 3020     | 11.3          | 143.3                  | 2416     | 11.3          | 143.3                  | 3775     |
| 11.3          | 154.7                  | 3020     | 11.3          | 154.7                  | 2416     | 11.3          | 154.7                  | 3775     |
| 11.3          | 166.0                  | 3020     | 11.3          | 166.0                  | 2416     | 11.3          | 166.0                  | 3775     |
| 10.3          | 176.3                  | 2490     | 10.3          | 176.3                  | 1992     | 10.3          | 176.3                  | 3112     |
| 10.3          | 186.7                  | 2490     | 10.3          | 186.7                  | 1992     | 10.3          | 186.7                  | 3112     |
| 10.3          | 197.0                  | 2490     | 10.3          | 197.0                  | 1992     | 10.3          | 197.0                  | 3112     |
| 10.3          | 207.3                  | 2490     | 10.3          | 207.3                  | 1992     | 10.3          | 207.3                  | 3112     |
| 10.3          | 217.7                  | 2490     | 10.3          | 217.7                  | 1992     | 10.3          | 217.7                  | 3112     |
| 10.3          | 228.0                  | 2490     | 10.3          | 228.0                  | 1992     | 10.3          | 228.0                  | 3112     |
| 7.3           | 235.3                  | 1710     | 7.3           | 235.3                  | 1368     | 7.3           | 235.3                  | 2137     |
| 7.3           | 242.6                  | 1710     | 7.3           | 242.6                  | 1368     | 7.3           | 242.6                  | 2137     |
| 7.3           | 250.0                  | 1710     | 7.3           | 250.0                  | 1368     | 7.3           | 250.0                  | 2137     |
| 7.7           | 257.7                  | 1710     | 7.7           | 257.7                  | 1368     | 7.7           | 257.7                  | 2137     |
| 7.7           | 265.5                  | 1710     | 7.7           | 265.5                  | 1368     | 7.7           | 265.5                  | 2137     |
| 7.7           | 273.2                  | 1710     | 7.7           | 273.2                  | 1368     | 7.7           | 273.2                  | 2137     |
| 7.7           | 281.0                  | 1710     | 7.7           | 281.0                  | 1368     | 7.7           | 281.0                  | 2137     |
| 7.7           | 288.7                  | 1710     | 7.7           | 288.7                  | 1368     | 7.7           | 288.7                  | 2137     |
| 7.7           | 296.5                  | 1710     | 7.7           | 296.5                  | 1368     | 7.7           | 296.5                  | 2137     |
| 7.7           | 304.2                  | 1710     | 7.7           | 304.2                  | 1368     | 7.7           | 304.2                  | 2137     |
| 7.7           | 312.0                  | 1710     | 7.7           | 312.0                  | 1368     | 7.7           | 312.0                  | 2137     |
| 8.7           | 320.6                  | 2290     | 8.7           | 320.6                  | 1832     | 8.7           | 320.6                  | 2862     |
| 8.7           | 329.3                  | 2290     | 8.7           | 329.3                  | 1832     | 8.7           | 329.3                  | 2862     |
| 8.7           | 338.0                  | 2290     | 8.7           | 338.0                  | 1832     | 8.7           | 338.0                  | 2862     |

| Profile 1     |                        |          | Profile 2     |                        |          | Profile 3     |                        |          |
|---------------|------------------------|----------|---------------|------------------------|----------|---------------|------------------------|----------|
| thickness(ft) | depth (ft)<br>(Note a) | Vs(ft/s) | thickness(ft) | depth (ft)<br>(Note a) | Vs(ft/s) | thickness(ft) | depth (ft)<br>(Note a) | Vs(ft/s) |
| 8.3           | 346.3                  | 1780     | 8.3           | 346.3                  | 1424     | 8.3           | 346.3                  | 2225     |
| 8.3           | 354.6                  | 1780     | 8.3           | 354.6                  | 1424     | 8.3           | 354.6                  | 2225     |
| 8.3           | 363.0                  | 1780     | 8.3           | 363.0                  | 1424     | 8.3           | 363.0                  | 2225     |
| 11.7          | 374.7                  | 2490     | 11.7          | 374.7                  | 1992     | 11.7          | 374.7                  | 3112     |
| 11.7          | 386.4                  | 2490     | 11.7          | 386.4                  | 1992     | 11.7          | 386.4                  | 3112     |
| 11.7          | 398.1                  | 2490     | 11.7          | 398.1                  | 1992     | 11.7          | 398.1                  | 3112     |
| 11.7          | 409.8                  | 2490     | 11.7          | 409.8                  | 1992     | 11.7          | 409.8                  | 3112     |
| 11.7          | 421.5                  | 2490     | 11.7          | 421.5                  | 1992     | 11.7          | 421.5                  | 3112     |
| 11.7          | 433.2                  | 2490     | 11.7          | 433.2                  | 1992     | 11.7          | 433.2                  | 3112     |
| 11.7          | 445.0                  | 2490     | 11.7          | 445.0                  | 1992     | 11.7          | 445.0                  | 3112     |
| 11.0          | 456.0                  | 2200     | 11.0          | 456.0                  | 1408     | 11.0          | 456.0                  | 3454     |
| 11.0          | 467.0                  | 2200     | 11.0          | 467.0                  | 1408     | 11.0          | 467.0                  | 3454     |
| 11.0          | 478.0                  | 2200     | 11.0          | 478.0                  | 1408     | 11.0          | 478.0                  | 3454     |
| 11.0          | 489.0                  | 2200     | 11.0          | 489.0                  | 1408     | 11.0          | 489.0                  | 3454     |
| 11.0          | 500.0                  | 2200     | 11.0          | 500.0                  | 1408     | 11.0          | 500.0                  | 3454     |
| 31.0          | 531.0                  | 2200     | 31.0          | 531.0                  | 1408     | 31.0          | 531.0                  | 3454     |
| 31.0          | 562.0                  | 2200     | 31.0          | 562.0                  | 1408     | 31.0          | 562.0                  | 3454     |
| 31.0          | 593.0                  | 2200     | 31.0          | 593.0                  | 1408     | 31.0          | 593.0                  | 3454     |
| 31.0          | 623.9                  | 2200     | 31.0          | 623.9                  | 1408     | 31.0          | 623.9                  | 3454     |
| 31.0          | 654.9                  | 2200     | 31.0          | 654.9                  | 1408     | 31.0          | 654.9                  | 3454     |
| 31.0          | 685.9                  | 2200     | 31.0          | 685.9                  | 1408     | 31.0          | 685.9                  | 3454     |
| 31.0          | 716.9                  | 2200     | 31.0          | 716.9                  | 1408     | 31.0          | 716.9                  | 3454     |
| 31.0          | 747.9                  | 2200     | 31.0          | 747.9                  | 1408     | 31.0          | 747.9                  | 3454     |
| 31.0          | 778.9                  | 2200     | 31.0          | 778.9                  | 1408     | 31.0          | 778.9                  | 3454     |
| 31.0          | 809.9                  | 2200     | 31.0          | 809.9                  | 1408     | 31.0          | 809.9                  | 3454     |
| 43.0          | 852.9                  | 2630     | 43.0          | 852.9                  | 1683     | 43.0          | 852.9                  | 4129     |
| 43.0          | 895.9                  | 2630     | 43.0          | 895.9                  | 1683     | 43.0          | 895.9                  | 4129     |
| 43.0          | 938.9                  | 2630     | 43.0          | 938.9                  | 1683     | 43.0          | 938.9                  | 4129     |
| 43.0          | 981.9                  | 2630     | 43.0          | 981.9                  | 1683     | 43.0          | 981.9                  | 4129     |
| 43.0          | 1024.9                 | 2630     | 43.0          | 1024.9                 | 1683     | 43.0          | 1024.9                 | 4129     |
| 43.0          | 1067.9                 | 2630     | 43.0          | 1067.9                 | 1683     | 43.0          | 1067.9                 | 4129     |
| 43.0          | 1110.9                 | 2630     | 43.0          | 1110.9                 | 1683     | 43.0          | 1110.9                 | 4129     |
| 43.0          | 1153.9                 | 2630     | 43.0          | 1153.9                 | 1683     | 43.0          | 1153.9                 | 4129     |
| 43.0          | 1196.9                 | 2630     | 43.0          | 1196.9                 | 1683     | 43.0          | 1196.9                 | 4129     |
| 43.0          | 1239.9                 | 2630     | 43.0          | 1239.9                 | 1683     | 43.0          | 1239.9                 | 4129     |
| 45.0          | 1284.9                 | 3060     | 45.0          | 1284.9                 | 1958     | 45.0          | 1284.9                 | 4804     |
| 45.0          | 1329.9                 | 3060     | 45.0          | 1329.9                 | 1958     | 45.0          | 1329.9                 | 4804     |
| 45.0          | 1374.9                 | 3060     | 45.0          | 1374.9                 | 1958     | 45.0          | 1374.9                 | 4804     |
| 45.0          | 1419.9                 | 3060     | 45.0          | 1419.9                 | 1958     | 45.0          | 1419.9                 | 4804     |
| 45.0          | 1464.9                 | 3060     | 45.0          | 1464.9                 | 1958     | 45.0          | 1464.9                 | 4804     |

| Profile 1     |                        |          | Profile 2     |                        |          | Profile 3     |                        |          |
|---------------|------------------------|----------|---------------|------------------------|----------|---------------|------------------------|----------|
| thickness(ft) | depth (ft)<br>(Note a) | Vs(ft/s) | thickness(ft) | depth (ft)<br>(Note a) | Vs(ft/s) | thickness(ft) | depth (ft)<br>(Note a) | Vs(ft/s) |
| 45.0          | 1509.9                 | 3060     | 45.0          | 1509.9                 | 1958     | 45.0          | 1509.9                 | 4804     |
| 45.0          | 1554.9                 | 3060     | 45.0          | 1554.9                 | 1958     | 45.0          | 1554.9                 | 4804     |
| 45.0          | 1599.9                 | 3060     | 45.0          | 1599.9                 | 1958     | 45.0          | 1599.9                 | 4804     |
| 45.0          | 1644.9                 | 3060     | 45.0          | 1644.9                 | 1958     | 45.0          | 1644.9                 | 4804     |
| 45.0          | 1689.9                 | 3060     | 45.0          | 1689.9                 | 1958     | 45.0          | 1689.9                 | 4804     |
| 3280.8        | 4970.7                 | 9285     | 3280.8        | 4970.7                 | 9285     | 3280.8        | 4970.7                 | 9285     |

Table Note:

(a) Depth in this table is measured from the control point, which is at the top of the Vincentown formation.



**Figure 1 - Vs Profiles for Salem Site**