



## Duquesne Light

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8-7-85

United States Nuclear Regulatory Commission  
Washington, DC 20555

ATTENTION: Mr. George W. Knighton, Chief  
Licensing Branch 3  
Office of Nuclear Reactor Regulation

SUBJECT: Beaver Valley Power Station - Unit No. 2  
Docket No. 50-412  
Soil-Structure Interaction -- Additional Information

REFERENCES: (a) DLC Letter 2NRC-5-016, dated February 1, 1985  
(b) DLC Letter 2NRC-5-049, dated March 25, 1985

Gentlemen:

In Reference (a), Duquesne Light Company (DLC) submitted a supplemental response to the NRC Structural and Geotechnical Engineering Branch's (SGEB) Draft SER open item on Soil-Structure Interaction (SSI) which included DLC's position on this issue. That supplemental response was provided to address the discussion that occurred on the SSI issue at our November 30, 1984, meeting with the SGEB.

To obtain an additional review of our position, DLC assembled a panel of six consultants to evaluate the SSI analyses that had been docketed for BVPS-2. Each panel member provided a written evaluation which further substantiated our position, and these evaluations were submitted to the NRC in Reference (b).

In the Final Draft SER (FDSER) issued to DLC in an NRC letter dated June 6, 1985, the NRC upgraded the SSI issue to confirmatory status. The NRC stated in the FDSER that they would perform an audit of the BVPS-2 SSI analyses and utilize the results of the audit in establishing their final position on this issue. This SSI audit occurred on June 19 and 20, 1985, at the Stone and Webster Engineering Corporation offices in Boston, MA.

At the conclusion of the audit, the NRC staff requested that DLC docket certain information that had been discussed during the audit. This information, which is attached, includes (1) two plots (Figures I and II) which compare various response spectra at 5% damping; (2) a written definition of each response spectrum curve shown on the two comparison plots; and (3) the digitized data used to generate the response spectra curves.

Based on the discussion that occurred at the conclusion of the audit, it is expected that this submittal will result in the closing of the SSI

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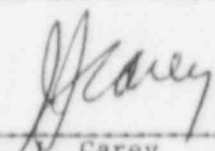
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issue for BVPS-2. It is understood that closure of this issue is dependent upon the NRC's final review and approval of both the site-specific response spectra issue and the attached information.

DLC would appreciate being informed as soon as possible of the NRC's final position on this issue.

DUQUESNE LIGHT COMPANY

By

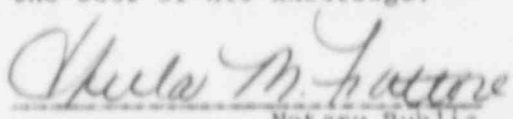
  
J. J. Carey  
Vice President

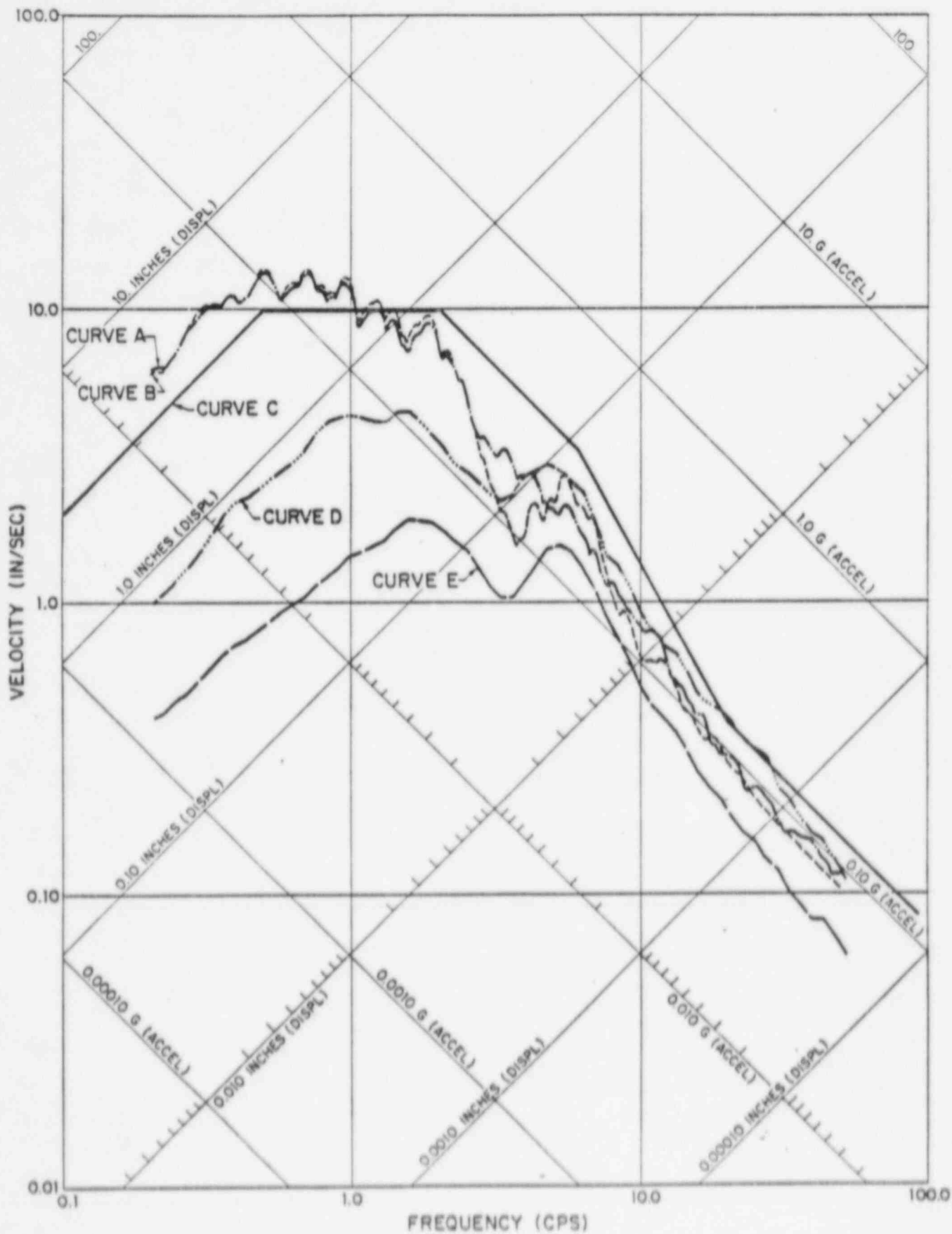
JDO/wjs  
Attachments

cc: Mr. N. Chokshi, NRC SGEB (w/a)  
Mr. L. Heller, NRC SGEB Section Leader (w/a)  
Dr. W. Kerr, ACRS (w/a)  
Mr. J. Knight, Director NRC Division of Engineering (w/a)  
Mr. G. Lear, NRC SGEB Chief (w/a)  
Dr. D. Okrent, ACRS (w/a)  
Mr. L. Reiter, NRC GB Section Leader (w/a)  
Dr. C. Siess, ACRS (w/a)  
Mr. B. K. Singh, Project Manager (w/a)  
Mr. H. Thompson, Jr., Director NRC Division of Licensing (w/a)  
Mr. G. Walton, NRC Resident Inspector (w/a)

COMMONWEALTH OF PENNSYLVANIA )  
 ) SS:  
COUNTY OF BEAVER )

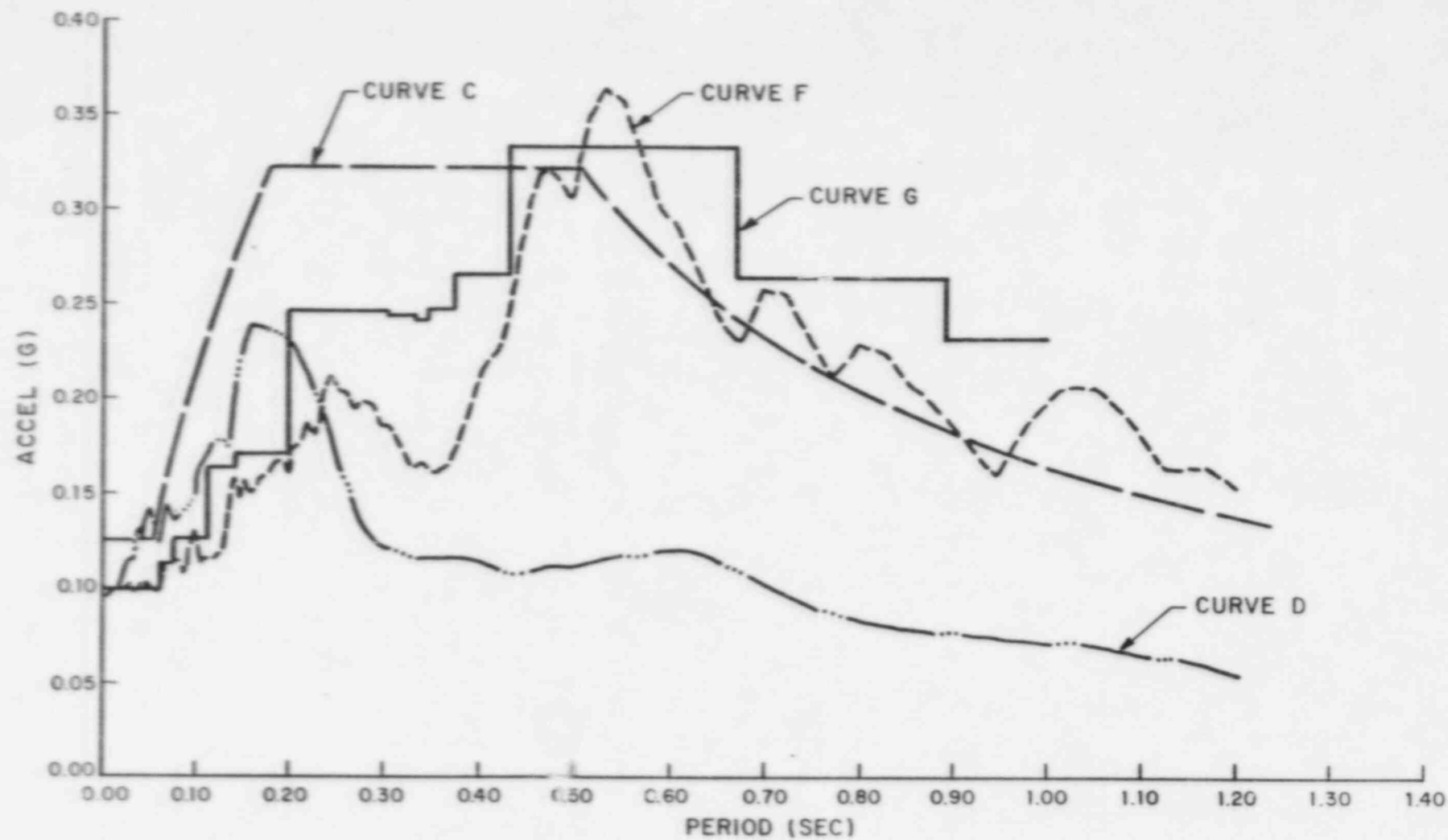
On this 7th day of August, 1985, before me, a Notary Public in and for said Commonwealth and County, personally appeared J. J. Carey, who being duly sworn, deposed and said that (1) he is Vice President of Duquesne Light, (2) he is duly authorized to execute and file the foregoing Submittal on behalf of said Company, and (3) the statements set forth in the Submittal are true and correct to the best of his knowledge.

  
Notary Public  
SHEILA M. FATTORÉ, NOTARY PUBLIC  
SHIPPINGPORT BORO, BEAVER COUNTY  
MY COMMISSION EXPIRES SEPT. 16, 1985  
Member, Pennsylvania Association of Notaries



- CURVE A KINACT OUTPUT
- - - CURVE B FLUSH OUTPUT
- CURVE C BVPS-2 G.R.S.
- ..... CURVE D 84th PERCENTILE SOIL RESPONSE
- CURVE E 50th PERCENTILE SOIL RESPONSE

FIGURE 1  
RESPONSE SPECTRA COMPARISON  
5% DAMPING



- CURVE C BVPS-2 G.R.S.
- CURVE D 84th PERCENTILE SOIL RESPONSE
- - - CURVE F 3-STEP METHOD
- CURVE G PLAXLY ENVELOPED PEAK SPREAD A.R.S.

FIGURE II  
RESPONSE SPECTRA COMPARISON  
5% DAMPING

# DEFINITION OF CURVES IN FIGURES I AND II

(Note: All curves are for 5% damping)

- CURVE A: Response Spectrum for the translational component of the input motion for the 3-Step Method analysis performed for the reactor containment structure. (Note: This is for the translational component only; the total input includes an additional rotational component of motion.)
- CURVE B: Response Spectrum for the translational motion calculated, by the FLUSH computer code, for a point in the "free-field" soil profile at the elevation of the reactor containment's foundation.
- CURVE C: BVPS-2 Ground Design Response Spectrum defined at the ground surface in the "free-field".
- CURVE D: 84th percentile free field soil response analysis response spectrum at elevation of reactor containment foundation. (See February 1985 Site Dependent Response Spectrum Report for procedure.)
- CURVE E: 50th percentile free field soil response analysis response spectrum at elevation of reactor containment foundation.
- CURVE F: Amplified response spectrum for the foundation of the reactor containment structure resulting from the 3-Step Method analysis (FRIDAY Output).
- CURVE G: BVPS-2 Enveloped Peak Spread Amplified Response Spectrum for the foundation of the reactor containment structure (PLAXLY output).

# DIGITIZED DATA FOR CURVE A

## SPECTRUM FROM KINACT HORIZONTAL OUTPUT

### PERIOD (SEC)

|        |        |        |        |        |        |        |        |        |        |
|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|
| 0.0200 | 0.0204 | 0.0209 | 0.0214 | 0.0219 | 0.0223 | 0.0228 | 0.0234 | 0.0239 | 0.0244 |
| 0.0250 | 0.0255 | 0.0261 | 0.0267 | 0.0273 | 0.0279 | 0.0285 | 0.0292 | 0.0298 | 0.0305 |
| 0.0312 | 0.0319 | 0.0326 | 0.0333 | 0.0341 | 0.0348 | 0.0356 | 0.0364 | 0.0372 | 0.0380 |
| 0.0389 | 0.0398 | 0.0407 | 0.0416 | 0.0425 | 0.0435 | 0.0444 | 0.0454 | 0.0464 | 0.0475 |
| 0.0486 | 0.0496 | 0.0508 | 0.0519 | 0.0531 | 0.0542 | 0.0555 | 0.0567 | 0.0580 | 0.0593 |
| 0.0606 | 0.0620 | 0.0634 | 0.0648 | 0.0662 | 0.0677 | 0.0692 | 0.0708 | 0.0724 | 0.0740 |
| 0.0757 | 0.0774 | 0.0791 | 0.0809 | 0.0827 | 0.0845 | 0.0864 | 0.0884 | 0.0903 | 0.0924 |
| 0.0944 | 0.0966 | 0.0987 | 0.1009 | 0.1032 | 0.1055 | 0.1079 | 0.1103 | 0.1128 | 0.1153 |
| 0.1179 | 0.1205 | 0.1232 | 0.1260 | 0.1288 | 0.1317 | 0.1347 | 0.1377 | 0.1408 | 0.1439 |
| 0.1471 | 0.1504 | 0.1538 | 0.1573 | 0.1608 | 0.1644 | 0.1681 | 0.1719 | 0.1757 | 0.1796 |
| 0.1837 | 0.1878 | 0.1920 | 0.1963 | 0.2007 | 0.2052 | 0.2098 | 0.2145 | 0.2193 | 0.2242 |
| 0.2293 | 0.2344 | 0.2397 | 0.2450 | 0.2505 | 0.2562 | 0.2619 | 0.2678 | 0.2738 | 0.2799 |
| 0.2862 | 0.2926 | 0.2992 | 0.3059 | 0.3127 | 0.3198 | 0.3269 | 0.3343 | 0.3417 | 0.3494 |
| 0.3572 | 0.3653 | 0.3734 | 0.3818 | 0.3904 | 0.3991 | 0.4081 | 0.4172 | 0.4266 | 0.4362 |
| 0.4459 | 0.4559 | 0.4662 | 0.4766 | 0.4873 | 0.4982 | 0.5094 | 0.5208 | 0.5325 | 0.5444 |
| 0.5564 | 0.5691 | 0.5819 | 0.5949 | 0.6083 | 0.6219 | 0.6358 | 0.6501 | 0.6647 | 0.6796 |
| 0.6948 | 0.7104 | 0.7263 | 0.7426 | 0.7592 | 0.7763 | 0.7937 | 0.8115 | 0.8297 | 0.8483 |
| 0.8673 | 0.8868 | 0.9066 | 0.9270 | 0.9478 | 0.9690 | 0.9907 | 1.0129 | 1.0357 | 1.0589 |
| 1.0826 | 1.1069 | 1.1317 | 1.1571 | 1.1830 | 1.2096 | 1.2367 | 1.2644 | 1.2928 | 1.3218 |
| 1.3514 | 1.3817 | 1.4127 | 1.4444 | 1.4767 | 1.5098 | 1.5437 | 1.5783 | 1.6137 | 1.6499 |
| 1.6869 | 1.7247 | 1.7634 | 1.8029 | 1.8433 | 1.8847 | 1.9269 | 1.9701 | 2.0143 | 2.0595 |
| 2.1057 | 2.1529 | 2.2011 | 2.2505 | 2.3010 | 2.3525 | 2.4053 | 2.4592 | 2.5144 | 2.5708 |
| 2.6284 | 2.6873 | 2.7474 | 2.8092 | 2.8722 | 2.9366 | 3.0024 | 3.0697 | 3.1386 | 3.2089 |
| 3.2809 | 3.3548 | 3.4297 | 3.5064 | 3.5852 | 3.6654 | 3.7478 | 3.8318 | 3.9177 | 4.0056 |
| 4.0954 | 4.1872 | 4.2811 | 4.3771 | 4.4752 | 4.5754 | 4.6782 | 4.7831 | 4.8903 | 5.0000 |

### VELOCITY (IN/SEC)

|         |         |         |         |         |         |         |         |         |         |
|---------|---------|---------|---------|---------|---------|---------|---------|---------|---------|
| 0.1143  | 0.1169  | 0.1162  | 0.1145  | 0.1196  | 0.1254  | 0.1298  | 0.1331  | 0.1374  | 0.1435  |
| 0.1490  | 0.1522  | 0.1530  | 0.1533  | 0.1554  | 0.1579  | 0.1600  | 0.1615  | 0.1625  | 0.1618  |
| 0.1603  | 0.1637  | 0.1719  | 0.1797  | 0.1883  | 0.1982  | 0.2067  | 0.2122  | 0.2161  | 0.2214  |
| 0.2283  | 0.2329  | 0.2323  | 0.2283  | 0.2244  | 0.2264  | 0.2417  | 0.2607  | 0.2760  | 0.2862  |
| 0.2909  | 0.2933  | 0.2967  | 0.2999  | 0.2993  | 0.3140  | 0.3215  | 0.3214  | 0.3495  | 0.3807  |
| 0.4048  | 0.4113  | 0.4072  | 0.4084  | 0.4381  | 0.4519  | 0.4625  | 0.4946  | 0.5115  | 0.5174  |
| 0.5367  | 0.5424  | 0.5549  | 0.6122  | 0.6798  | 0.7315  | 0.7586  | 0.7687  | 0.7888  | 0.8048  |
| 0.7973  | 0.7790  | 0.7996  | 0.8325  | 0.8514  | 0.8771  | 0.9141  | 0.9488  | 0.9629  | 1.0144  |
| 1.0252  | 1.0833  | 1.1430  | 1.1652  | 1.1303  | 1.1212  | 1.1968  | 1.2358  | 1.3895  | 1.4783  |
| 1.5044  | 1.4363  | 1.5576  | 1.6340  | 1.7089  | 1.7507  | 1.8259  | 1.9754  | 2.0941  | 2.1325  |
| 2.1573  | 2.0956  | 1.9381  | 1.9806  | 2.0373  | 2.0766  | 2.0779  | 2.1804  | 2.1757  | 2.4124  |
| 2.5849  | 2.6797  | 2.7512  | 2.7220  | 2.6645  | 2.6836  | 2.6799  | 2.5994  | 2.7824  | 2.9531  |
| 3.1719  | 3.3206  | 3.3180  | 3.2126  | 3.1021  | 3.1227  | 3.2685  | 3.3592  | 3.5492  | 3.6877  |
| 3.5909  | 3.6720  | 3.8105  | 4.0527  | 4.5280  | 5.0574  | 5.5054  | 5.7094  | 5.5985  | 5.9824  |
| 6.3591  | 6.7056  | 6.9766  | 6.9454  | 6.6977  | 7.0810  | 7.9335  | 8.5204  | 8.8790  | 8.9871  |
| 8.7890  | 8.4498  | 8.1706  | 8.0707  | 7.9612  | 7.5273  | 6.9797  | 7.3973  | 7.3594  | 7.7447  |
| 8.7542  | 9.1405  | 9.1742  | 8.9158  | 8.3215  | 9.1887  | 9.7804  | 9.9892  | 9.7642  | 9.8133  |
| 9.6899  | 9.3900  | 9.0218  | 8.6265  | 8.5204  | 9.7440  | 10.8334 | 11.6615 | 12.1647 | 12.2694 |
| 11.9361 | 11.2514 | 10.7396 | 11.0116 | 10.7931 | 10.5304 | 11.2105 | 11.5629 | 11.3800 | 11.5459 |
| 12.4170 | 12.9810 | 13.1723 | 13.0020 | 12.5674 | 11.8984 | 11.8475 | 11.8240 | 11.6963 | 11.4971 |
| 11.1651 | 10.7080 | 10.5224 | 11.1066 | 11.9053 | 12.6081 | 13.1100 | 13.3564 | 13.3354 | 13.0796 |
| 12.6327 | 12.1415 | 11.5336 | 11.1316 | 10.8656 | 10.7037 | 10.4146 | 10.3780 | 10.8903 | 11.1064 |
| 11.1218 | 10.9418 | 10.6287 | 10.1895 | 10.1756 | 10.2493 | 10.2683 | 10.2295 | 10.1251 | 9.9829  |
| 9.7253  | 9.4822  | 9.2144  | 8.9234  | 8.6529  | 8.4363  | 8.1929  | 7.9020  | 7.5402  | 7.1473  |
| 6.8401  | 6.6976  | 6.4915  | 6.2332  | 6.2391  | 6.2993  | 6.3120  | 6.2720  | 6.2245  | 6.1149  |

# DIGITIZED DATA FOR CURVE B

## FLUSH FREE FIELD SPECTRUM

### PERIOD (SEC)

|        |        |        |        |        |        |        |        |        |        |
|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|
| 0.0200 | 0.0204 | 0.0209 | 0.0214 | 0.0219 | 0.0223 | 0.0228 | 0.0234 | 0.0239 | 0.0244 |
| 0.0250 | 0.0255 | 0.0261 | 0.0267 | 0.0273 | 0.0279 | 0.0285 | 0.0292 | 0.0298 | 0.0305 |
| 0.0312 | 0.0319 | 0.0326 | 0.0333 | 0.0341 | 0.0348 | 0.0356 | 0.0364 | 0.0372 | 0.0380 |
| 0.0389 | 0.0398 | 0.0407 | 0.0416 | 0.0425 | 0.0435 | 0.0444 | 0.0454 | 0.0464 | 0.0475 |
| 0.0486 | 0.0496 | 0.0508 | 0.0519 | 0.0531 | 0.0542 | 0.0555 | 0.0567 | 0.0580 | 0.0593 |
| 0.0606 | 0.0620 | 0.0634 | 0.0648 | 0.0662 | 0.0677 | 0.0692 | 0.0708 | 0.0724 | 0.0740 |
| 0.0757 | 0.0774 | 0.0791 | 0.0809 | 0.0827 | 0.0845 | 0.0864 | 0.0884 | 0.0903 | 0.0924 |
| 0.0944 | 0.0966 | 0.0987 | 0.1009 | 0.1032 | 0.1055 | 0.1079 | 0.1103 | 0.1128 | 0.1153 |
| 0.1179 | 0.1205 | 0.1232 | 0.1260 | 0.1288 | 0.1317 | 0.1347 | 0.1377 | 0.1408 | 0.1439 |
| 0.1471 | 0.1504 | 0.1538 | 0.1573 | 0.1608 | 0.1644 | 0.1681 | 0.1719 | 0.1757 | 0.1796 |
| 0.1837 | 0.1878 | 0.1920 | 0.1963 | 0.2007 | 0.2052 | 0.2098 | 0.2145 | 0.2193 | 0.2242 |
| 0.2293 | 0.2344 | 0.2397 | 0.2450 | 0.2505 | 0.2562 | 0.2619 | 0.2678 | 0.2738 | 0.2799 |
| 0.2862 | 0.2926 | 0.2992 | 0.3059 | 0.3127 | 0.3198 | 0.3269 | 0.3343 | 0.3417 | 0.3494 |
| 0.3572 | 0.3653 | 0.3734 | 0.3818 | 0.3904 | 0.3991 | 0.4081 | 0.4172 | 0.4266 | 0.4362 |
| 0.4459 | 0.4559 | 0.4662 | 0.4766 | 0.4873 | 0.4982 | 0.5094 | 0.5208 | 0.5325 | 0.5444 |
| 0.5544 | 0.5691 | 0.5819 | 0.5949 | 0.6083 | 0.6219 | 0.6358 | 0.6501 | 0.6647 | 0.6796 |
| 0.6948 | 0.7104 | 0.7263 | 0.7426 | 0.7593 | 0.7763 | 0.7937 | 0.8115 | 0.8297 | 0.8483 |
| 0.8673 | 0.8868 | 0.9066 | 0.9270 | 0.9478 | 0.9690 | 0.9907 | 1.0129 | 1.0357 | 1.0589 |
| 1.0826 | 1.1069 | 1.1317 | 1.1571 | 1.1830 | 1.2096 | 1.2367 | 1.2644 | 1.2928 | 1.3218 |
| 1.3514 | 1.3817 | 1.4127 | 1.4444 | 1.4767 | 1.5098 | 1.5437 | 1.5783 | 1.6137 | 1.6499 |
| 1.6869 | 1.7247 | 1.7634 | 1.8029 | 1.8433 | 1.8847 | 1.9269 | 1.9701 | 2.0143 | 2.0595 |
| 2.1057 | 2.1529 | 2.2011 | 2.2505 | 2.3010 | 2.3525 | 2.4053 | 2.4592 | 2.5144 | 2.5708 |
| 2.6284 | 2.6873 | 2.7476 | 2.8092 | 2.8722 | 2.9366 | 3.0024 | 3.0697 | 3.1386 | 3.2089 |
| 3.2809 | 3.3545 | 3.4297 | 3.5064 | 3.5852 | 3.6654 | 3.7478 | 3.8318 | 3.9177 | 4.0056 |
| 4.0954 | 4.1872 | 4.2811 | 4.3771 | 4.4752 | 4.5756 | 4.6782 | 4.7831 | 4.8903 | 5.0000 |

### VELOCITY (IN/SEC)

|         |         |         |         |         |         |         |         |         |         |
|---------|---------|---------|---------|---------|---------|---------|---------|---------|---------|
| 0.1036  | 0.1060  | 0.1084  | 0.1108  | 0.1133  | 0.1159  | 0.1185  | 0.1212  | 0.1239  | 0.1267  |
| 0.1296  | 0.1325  | 0.1355  | 0.1386  | 0.1417  | 0.1450  | 0.1483  | 0.1516  | 0.1551  | 0.1586  |
| 0.1623  | 0.1660  | 0.1699  | 0.1738  | 0.1779  | 0.1821  | 0.1864  | 0.1909  | 0.1957  | 0.2009  |
| 0.2064  | 0.2122  | 0.2176  | 0.2232  | 0.2317  | 0.2417  | 0.2512  | 0.2573  | 0.2593  | 0.2637  |
| 0.2727  | 0.2817  | 0.2889  | 0.3001  | 0.3204  | 0.3365  | 0.3440  | 0.3453  | 0.3424  | 0.3377  |
| 0.3401  | 0.3542  | 0.3707  | 0.3882  | 0.4041  | 0.4115  | 0.4178  | 0.4319  | 0.4555  | 0.4853  |
| 0.5116  | 0.5498  | 0.5799  | 0.6035  | 0.6225  | 0.6354  | 0.6312  | 0.6140  | 0.6208  | 0.6310  |
| 0.6282  | 0.6294  | 0.6372  | 0.6496  | 0.7243  | 0.7834  | 0.8380  | 0.8913  | 0.9376  | 0.9396  |
| 0.8966  | 0.9442  | 1.0009  | 1.0643  | 1.1896  | 1.2875  | 1.4157  | 1.5129  | 1.6970  | 1.8639  |
| 1.9518  | 1.8974  | 2.0028  | 2.0588  | 2.1141  | 2.1245  | 2.2460  | 2.3778  | 2.5094  | 2.6785  |
| 2.7127  | 2.6620  | 2.4831  | 2.1601  | 2.2301  | 2.2443  | 2.1105  | 1.8673  | 1.8863  | 2.0189  |
| 2.1165  | 2.1932  | 2.1148  | 1.9188  | 1.6990  | 1.6555  | 1.6320  | 1.5401  | 1.6290  | 1.7500  |
| 1.8772  | 1.9827  | 2.0339  | 2.0478  | 2.2074  | 2.3376  | 2.4197  | 2.6027  | 2.8542  | 3.0704  |
| 3.1335  | 3.4947  | 3.8348  | 4.1943  | 4.6573  | 5.1732  | 5.8793  | 5.7651  | 5.6056  | 5.9034  |
| 6.5431  | 7.0205  | 7.2339  | 7.1949  | 6.9321  | 7.6087  | 8.4901  | 9.0940  | 9.4466  | 9.5402  |
| 9.3253  | 8.9524  | 8.7442  | 8.8425  | 8.5758  | 8.2203  | 7.6140  | 8.0219  | 7.9579  | 8.7798  |
| 9.4655  | 9.9988  | 9.8928  | 9.5030  | 8.9705  | 9.8802  | 10.4770 | 10.6622 | 10.4052 | 10.4431 |
| 10.2771 | 9.9393  | 9.5649  | 9.1711  | 9.0119  | 10.3190 | 11.4521 | 12.2762 | 12.7284 | 12.7629 |
| 12.3843 | 11.6664 | 11.1326 | 11.4322 | 11.2405 | 10.9820 | 11.6918 | 12.0558 | 11.8485 | 11.9120 |
| 12.8241 | 13.4116 | 13.6029 | 13.4154 | 12.9598 | 12.2660 | 12.1472 | 12.1161 | 12.2156 | 11.9795 |
| 11.5693 | 11.0522 | 10.6147 | 11.2895 | 12.1069 | 12.8328 | 13.3475 | 13.5962 | 13.6041 | 13.3536 |
| 12.8562 | 12.8945 | 11.7638 | 11.3038 | 10.9409 | 10.7722 | 10.4814 | 10.3504 | 10.9290 | 11.1973 |
| 11.2185 | 11.0303 | 10.6949 | 10.2353 | 10.3207 | 10.3857 | 10.4126 | 10.4039 | 10.3354 | 10.2039 |
| 10.8161 | 9.7872  | 9.5222  | 9.2212  | 8.8935  | 8.5483  | 8.1941  | 7.8911  | 7.5757  | 7.2563  |
| 6.9590  | 6.7599  | 6.5375  | 6.2903  | 6.0218  | 6.0624  | 6.0796  | 6.0858  | 6.0397  | 5.9368  |



DIGITIZED DATA FOR CURVE C OF FIGURE I

BVPS-2 G.R.S. 5% DAMPING

| FREQUENCY<br>(CPS) | VELOCITY<br>(IN/SEC) |
|--------------------|----------------------|
| 0.100              | 1.980                |
| 0.108              | 2.138                |
| 0.463              | 9.171                |
| 0.500              | 9.901                |
| 0.523              | 9.901                |
| 1.913              | 9.901                |
| 2.000              | 9.901                |
| 2.210              | 8.960                |
| 5.430              | 3.647                |
| 6.000              | 3.300                |
| 6.238              | 3.079                |
| 19.238             | 0.412                |
| 20.000             | 0.384                |
| 43.089             | 0.178                |
| 92.831             | 0.083                |



DIGITIZED DATA FOR CURVE C OF FIGURE II

BVPS-2 G.R.S. 5% DAMPING

| PERIOD<br>(SEC) | ACCELERATION<br>(G) |
|-----------------|---------------------|
| 0.0             | 0.125               |
| 0.05            | 0.125               |
| 0.054           | 0.133               |
| 0.058           | 0.141               |
| 0.063           | 0.150               |
| 0.068           | 0.160               |
| 0.074           | 0.170               |
| 0.080           | 0.180               |
| 0.086           | 0.192               |
| 0.093           | 0.204               |
| 0.101           | 0.217               |
| 0.109           | 0.230               |
| 0.118           | 0.245               |
| 0.127           | 0.260               |
| 0.137           | 0.276               |
| 0.148           | 0.294               |
| 0.167           | 0.322               |
| 0.500           | 0.322               |
| 0.523           | 0.308               |
| 0.572           | 0.282               |
| 0.625           | 0.257               |
| 0.684           | 0.235               |
| 0.748           | 0.215               |
| 0.818           | 0.197               |
| 0.894           | 0.180               |
| 0.978           | 0.165               |
| 1.069           | 0.151               |
| 1.169           | 0.138               |
| 1.279           | 0.126               |

# DIGITIZED DATA FOR CURVES D AND E

15:06 THURSDAY, DECEMBER 20, 1984

HORIZONTAL RESPONSE SPECTRA FOR 5 PERCENT DAMPING  
SOIL RESPONSE ANALYSIS OUTPUT SCALED AT 55 FT.

| OBS | PERIOD<br>SECONDS | 50th<br>IN/SEC | 84th<br>IN/SEC |
|-----|-------------------|----------------|----------------|
| 1   | 0.01905           | 0.06           | 0.11           |
| 2   | 0.02089           | 0.07           | 0.13           |
| 3   | 0.02291           | 0.08           | 0.15           |
| 4   | 0.02512           | 0.08           | 0.16           |
| 5   | 0.02755           | 0.09           | 0.18           |
| 6   | 0.03020           | 0.10           | 0.21           |
| 7   | 0.03312           | 0.12           | 0.23           |
| 8   | 0.03631           | 0.13           | 0.29           |
| 9   | 0.03982           | 0.15           | 0.31           |
| 10  | 0.04366           | 0.16           | 0.33           |
| 11  | 0.04787           | 0.18           | 0.38           |
| 12  | 0.05249           | 0.21           | 0.42           |
| 13  | 0.05755           | 0.23           | 0.44           |
| 14  | 0.06310           | 0.26           | 0.48           |
| 15  | 0.06919           | 0.31           | 0.57           |
| 16  | 0.07587           | 0.36           | 0.67           |
| 17  | 0.08319           | 0.40           | 0.70           |
| 18  | 0.09121           | 0.44           | 0.79           |
| 19  | 0.10001           | 0.51           | 0.91           |
| 20  | 0.10966           | 0.63           | 1.13           |
| 21  | 0.12024           | 0.75           | 1.32           |
| 22  | 0.13184           | 0.89           | 1.43           |
| 23  | 0.14456           | 1.11           | 1.87           |
| 24  | 0.15851           | 1.31           | 2.32           |
| 25  | 0.17380           | 1.48           | 2.53           |
| 26  | 0.19057           | 1.55           | 2.76           |
| 27  | 0.20895           | 1.51           | 2.93           |
| 28  | 0.22911           | 1.32           | 2.80           |
| 29  | 0.25122           | 1.16           | 2.66           |
| 30  | 0.27546           | 1.03           | 2.32           |
| 31  | 0.30203           | 1.02           | 2.20           |
| 32  | 0.33117           | 1.12           | 2.29           |
| 33  | 0.36312           | 1.28           | 2.54           |
| 34  | 0.39816           | 1.49           | 2.74           |
| 35  | 0.43657           | 1.59           | 2.92           |
| 36  | 0.47869           | 1.73           | 3.31           |
| 37  | 0.52487           | 1.85           | 3.68           |
| 38  | 0.57551           | 1.88           | 4.06           |
| 39  | 0.63103           | 1.90           | 4.44           |
| 40  | 0.69191           | 1.77           | 4.38           |
| 41  | 0.75867           | 1.61           | 4.08           |
| 42  | 0.83186           | 1.54           | 4.06           |
| 43  | 0.91212           | 1.47           | 4.19           |
| 44  | 1.00012           | 1.42           | 4.30           |
| 45  | 1.09661           | 1.29           | 4.20           |
| 46  | 1.20241           | 1.20           | 4.04           |
| 47  | 1.31842           | 1.12           | 3.69           |
| 48  | 1.44561           | 1.02           | 3.20           |
| 49  | 1.58508           | 0.97           | 2.94           |
| 50  | 1.73801           | 0.92           | 2.76           |
| 51  | 1.90569           | 0.85           | 2.56           |
| 52  | 2.08955           | 0.79           | 2.39           |
| 53  | 2.29114           | 0.74           | 2.23           |
| 54  | 2.51219           | 0.71           | 2.14           |
| 55  | 2.75456           | 0.66           | 1.95           |
| 56  | 3.02032           | 0.60           | 1.68           |
| 57  | 3.31171           | 0.54           | 1.47           |
| 58  | 3.63122           | 0.49           | 1.31           |
| 59  | 3.98155           | 0.46           | 1.18           |
| 60  | 4.36568           | 0.42           | 1.07           |
| 61  | 4.78688           | 0.40           | 0.99           |

Computed using earthquake records  
listed in Table 4-4 of the February  
1985 report entitled "Site Dependent  
Response Spectra, Beaver Valley  
Power Station - Unit 2"

DIGITIZED DATA FOR CURVE D OF FIGURE II

84TH PERCENTILE SOIL RESPONSE

| PERIOD<br>(SEC) | ACCELERATION<br>(G) |
|-----------------|---------------------|
| 0.01905         | 0.09389             |
| 0.02089         | 0.10119             |
| 0.02291         | 0.10647             |
| 0.02512         | 0.10357             |
| 0.02755         | 0.10624             |
| 0.03020         | 0.11307             |
| 0.03312         | 0.11292             |
| 0.03631         | 0.12987             |
| 0.03982         | 0.12659             |
| 0.04366         | 0.12291             |
| 0.04787         | 0.12908             |
| 0.05249         | 0.13011             |
| 0.05755         | 0.12432             |
| 0.06310         | 0.12370             |
| 0.06919         | 0.13396             |
| 0.07587         | 0.14360             |
| 0.08319         | 0.13683             |
| 0.09121         | 0.14084             |
| 0.10001         | 0.14796             |
| 0.10965         | 0.16756             |
| 0.12024         | 0.17851             |
| 0.13184         | 0.17637             |
| 0.14456         | 0.21035             |
| 0.15851         | 0.23800             |
| 0.17380         | 0.23671             |
| 0.19057         | 0.23550             |
| 0.20895         | 0.22802             |
| 0.22911         | 0.19873             |
| 0.25122         | 0.17218             |
| 0.27546         | 0.13695             |
| 0.30203         | 0.11844             |
| 0.33117         | 0.11244             |
| 0.36312         | 0.11374             |
| 0.39816         | 0.11190             |
| 0.43657         | 0.10876             |
| 0.47869         | 0.11244             |
| 0.52487         | 0.11401             |
| 0.57551         | 0.11471             |
| 0.63103         | 0.11441             |
| 0.69191         | 0.10294             |
| 0.75867         | 0.08745             |
| 0.83186         | 0.07936             |
| 0.91212         | 0.07470             |
| 1.00012         | 0.06991             |
| 1.09661         | 0.06228             |
| 1.20291         | 0.05464             |

DIGITIZED DATA FOR CURVE F

A.R.S. FROM 3-STEP METHOD

| PERIOD<br>(SEC) | ACCEL.<br>(G) | PERIOD<br>(SEC) | ACCEL.<br>(G) | PERIOD<br>(SEC) | ACCEL.<br>(G) |
|-----------------|---------------|-----------------|---------------|-----------------|---------------|
| 0.02000         | 9.05253E-02   | 0.10077         | 1.11994E-01   | 0.50771         | 3.44004E-01   |
| 0.02070         | 9.87558E-02   | 0.10430         | 1.13911E-01   | 0.52549         | 3.61837E-01   |
| 0.02142         | 9.89426E-02   | 0.10795         | 1.14425E-01   | 0.54388         | 3.57773E-01   |
| 0.02217         | 9.97190E-02   | 0.11173         | 1.14669E-01   | 0.56292         | 3.29644E-01   |
| 0.02295         | 9.92811E-02   | 0.11564         | 1.13521E-01   | 0.58262         | 2.99411E-01   |
| 0.02375         | 9.91482E-02   | 0.11968         | 1.14567E-01   | 0.60302         | 2.87399E-01   |
| 0.02459         | 9.98112E-02   | 0.12387         | 1.19984E-01   | 0.62413         | 2.64745E-01   |
| 0.02545         | 9.97160E-02   | 0.12821         | 1.41382E-01   | 0.64597         | 2.39604E-01   |
| 0.02634         | 9.81449E-02   | 0.13270         | 1.55923E-01   | 0.66859         | 2.26887E-01   |
| 0.02726         | 9.75519E-02   | 0.13734         | 1.56740E-01   | 0.69199         | 2.56788E-01   |
| 0.02821         | 9.79167E-02   | 0.14215         | 1.44657E-01   | 0.71621         | 2.55379E-01   |
| 0.02920         | 1.00363E-01   | 0.14713         | 1.55868E-01   | 0.74128         | 2.31315E-01   |
| 0.03022         | 1.01216E-01   | 0.15228         | 1.48934E-01   | 0.76723         | 2.09736E-01   |
| 0.03128         | 1.00504E-01   | 0.15741         | 1.50138E-01   | 0.79409         | 2.27930E-01   |
| 0.03238         | 9.87689E-02   | 0.16312         | 1.56499E-01   | 0.82189         | 2.24636E-01   |
| 0.03351         | 9.56627E-02   | 0.16883         | 1.57472E-01   | 0.85066         | 2.04516E-01   |
| 0.03468         | 9.54589E-02   | 0.17474         | 1.61942E-01   | 0.88044         | 1.92845E-01   |
| 0.03590         | 9.82048E-02   | 0.18086         | 1.46398E-01   | 0.91125         | 1.76217E-01   |
| 0.03715         | 1.00533E-01   | 0.18719         | 1.65521E-01   | 0.94315         | 1.58188E-01   |
| 0.03845         | 1.01775E-01   | 0.19375         | 1.58621E-01   | 0.97617         | 1.86627E-01   |
| 0.03980         | 9.99724E-02   | 0.20053         | 1.72724E-01   | 1.01034         | 2.04162E-01   |
| 0.04119         | 9.79085E-02   | 0.20755         | 1.75055E-01   | 1.04570         | 2.04973E-01   |
| 0.04263         | 9.82043E-02   | 0.21481         | 1.85368E-01   | 1.08231         | 1.89231E-01   |
| 0.04413         | 9.89004E-02   | 0.22233         | 1.78749E-01   | 1.12020         | 1.62020E-01   |
| 0.04567         | 1.01296E-01   | 0.23011         | 2.03575E-01   | 1.15941         | 1.63519E-01   |
| 0.04727         | 1.00794E-01   | 0.23817         | 2.10542E-01   | 1.20000         | 1.51849E-01   |
| 0.04893         | 1.00342E-01   | 0.24651         | 2.02285E-01   |                 |               |
| 0.05064         | 9.92441E-02   | 0.25513         | 2.01007E-01   |                 |               |
| 0.05241         | 1.00246E-01   | 0.26407         | 1.92510E-01   |                 |               |
| 0.05425         | 1.00499E-01   | 0.27331         | 1.97349E-01   |                 |               |
| 0.05614         | 9.72803E-02   | 0.28288         | 1.96063E-01   |                 |               |
| 0.05811         | 9.66129E-02   | 0.29270         | 1.83487E-01   |                 |               |
| 0.06014         | 9.95361E-02   | 0.30303         | 1.81496E-01   |                 |               |
| 0.06225         | 1.03072E-01   | 0.31363         | 1.70830E-01   |                 |               |
| 0.06443         | 1.08000E-01   | 0.32461         | 1.62379E-01   |                 |               |
| 0.06668         | 1.12996E-01   | 0.33598         | 1.64080E-01   |                 |               |
| 0.06902         | 1.13480E-01   | 0.34774         | 1.58889E-01   |                 |               |
| 0.07143         | 1.11997E-01   | 0.35991         | 1.61464E-01   |                 |               |
| 0.07393         | 1.13530E-01   | 0.37251         | 1.77565E-01   |                 |               |
| 0.07652         | 1.13556E-01   | 0.38555         | 1.94604E-01   |                 |               |
| 0.07920         | 1.11888E-01   | 0.39904         | 2.17538E-01   |                 |               |
| 0.08197         | 1.07502E-01   | 0.41301         | 2.22659E-01   |                 |               |
| 0.08484         | 1.04918E-01   | 0.42747         | 2.46859E-01   |                 |               |
| 0.08781         | 1.14734E-01   | 0.44243         | 2.91757E-01   |                 |               |
| 0.09089         | 1.24961E-01   | 0.45792         | 3.19556E-01   |                 |               |
| 0.09407         | 1.29499E-01   | 0.47395         | 3.16720E-01   |                 |               |
| 0.09736         | 1.25313E-01   | 0.49054         | 3.03765E-01   |                 |               |

DIGITIZED DATA FOR CURVE G

Containment Mat Horizontal SSE ARS Enveloped  
Cracked and Uncracked Externals

Five Percent Equipment Damping

| <u>Period</u><br>(Sec) | <u>Acceleration</u><br>(G) |
|------------------------|----------------------------|
| 0.0                    | 0.098                      |
| 0.021                  | 0.098                      |
| 0.022                  | 0.099                      |
| 0.041                  | 0.099                      |
| 0.042                  | 0.100                      |
| 0.053                  | 0.100                      |
| 0.054                  | 0.101                      |
| 0.060                  | 0.101                      |
| 0.061                  | 0.112                      |
| 0.076                  | 0.112                      |
| 0.077                  | 0.127                      |
| 0.107                  | 0.127                      |
| 0.108                  | 0.162                      |
| 0.139                  | 0.162                      |
| 0.140                  | 0.169                      |
| 0.191                  | 0.169                      |
| 0.192                  | 0.247                      |
| 0.300                  | 0.247                      |
| 0.301                  | 0.244                      |
| 0.328                  | 0.244                      |
| 0.329                  | 0.241                      |
| 0.340                  | 0.241                      |
| 0.341                  | 0.248                      |
| 0.371                  | 0.248                      |
| 0.372                  | 0.265                      |
| 0.424                  | 0.265                      |
| 0.425                  | 0.330                      |
| 0.665                  | 0.330                      |
| 0.666                  | 0.264                      |
| 0.888                  | 0.264                      |
| 0.889                  | 0.231                      |
| 1.000                  | 0.231                      |