LA-7713-MS
Informal Report

UC-51
Issued: March 1979

Nondestructive Assay Technology for Uranium Resource Evaluation

Infinite Medium Calculations

Final Report

Mahavir Jain
M. L. Evans
D. A. Close

CONTENTS

NONDESTRUCTIVE ASSAY TECHNOLOGY FOR URANIUM RESOURCE EVALUATION

INFINITE MEDIUM CALCULATIONS

FINAL REPORT

by

Mahavir Jain, M. L. Evans, and D. A. Close

ABSTRACT

A discrete ordinates transport code has been used to transport gamma rays from the decay of the naturally occurring radioactive isotopes of potassium, uranium, and thorium through an infinite homogeneous medium. Parametric studies varying the medium formation (i.e., shale and sandstone), porosity, and saturation were made to determine their effects on the calculated gamma-ray spectra. In addition, the effect on the gamma-ray spectra of trace quantities of heavy elements was studied by varying the uranium concentration in the formation from 0 to 6% by weight.

I. INTRODUCTION

Forecasts of uranium requirements show an increasing demand to meet the needs of the nuclear power industry for the forseeable future. It will be necessary to utilize state-of-the-art radiometric techniques and calculations to locate and quantify uranium deposits in new geographic areas. More importantly, it will be necessary to locate low-level and deep-lying deposits in previously explored areas and to extend the uranium resource evaluations to new rock compositions. Improvements in the handling of ore in the mining and milling phases, together with the rising costs of other power resources, will permit the use of low grades of ore that are presently uneconomical to develop.

Gamma-ray borehole logging and gamma-ray surface and airborne surveys are key elements of uranium exploration, yet too little quantitative attention has been given to the corrections necessary for variations in formation parameters (i.e., porosity, saturation, and elemental compositions). This has caused a general problem in the quantitative interpretation of gamma-ray spectral data.

These calculations will establish the dependence of natural gamma-ray spectra on pertinent formation and borehole parameters and will make it possible to establish, on a calculational level, the proper interpretation of the data.

The first series of calculations determines the effect of the infinite, homogeneous medium formation (i.e., shale and sandstone), porosity, and saturation on the gamma-ray spectra from the naturally occurring radioactive isotopes of potassium, uranium, and thorium. Later calculations will progress to spatially dependent calculations including the angle-dependent gamma-ray spectra for points above an air-formation interface and for points within a borehole introduced into an infinite homogeneous medium. These latter calculations will include a convolution of the calculated gamma-ray spectra with a NaI detector response function.

In this report, calculated spectra from potassium, uranium, and thorium (KUT) in an infinite homogeneous medium are presented. The calculations were performed for shale and sandstone with varying porosities and water saturations. The porosity and water saturation, expressed as volume fractions, were varied from 0.00 to 0.40 and from 0.0 to 1.0, respectively. A total of 18 spectral calculations was carried out for each sandstone and shale formation to study the dependence of the spectra on the medium formation, porosity, and saturation. The aim of these calculations was to provide a complete set of KUT spectra for representative media and to find simple correlations between different spectra. In addition, the effect on the gamma-ray spectra of trace quantities of heavy elements was studied by varying the uranium concentration in the formation from 0 to 6% by weight.

II. THEORY OF THE DISCRETE ORDINATES METHOD

The calculation of gamma-ray spectra is a problem of transport theory. There are two methods of solution. One is to use Monte Carlo techniques and the other is to solve the transport equation using discrete ordinates methods.

The Monte Carlo method is used to estimate the fraction of particles emanating from a source that can be expected to fall into specified categories after undergoing various processes in a material medium of known geometry. Typically, a large number of particles are followed throughout their life histories. The probabilities for various interactions are computed using random numbers and the appropriate cross sections (in the present case, the Compton, photoelectric, and pair production cross sections). The Los Alamos

Scientific Laboratory (LASL) Monte Carlo Code MCP[1] treats general three-dimensional geometric configurations of materials and includes standard variance-reduction techniques for optimizing the statistical accuracy of the results.

The discrete ordinates methods attempt to solve numerically the time-independent inhomogeneous transport equation over a specified geometrical region. Figure 1 shows the position and direction variables characterizing a gamma ray (photon) in a typical transport problem. For energy-dependent gamma-ray transport problems, one requires solutions of the equation

$$\vec{\nabla} \cdot (\vec{\Omega}\psi) + \sigma(\vec{r},E)\, \psi\, (\vec{r},E,\vec{\Omega}) = \int\int dE'\, d\vec{\Omega}'\, \sigma_s(\vec{r},E'\rightarrow E,\vec{\Omega}\cdot\vec{\Omega}')\psi(\vec{r},E',\vec{\Omega}') + Q(\vec{r},E,\vec{\Omega}) \tag{1}$$

where ψ is the gamma-ray flux (gamma-ray density times their speed) defined such that $\psi\, dE\, dV\, d\vec{\Omega}$ is the flux of gamma rays in the volume element dV about $\vec{r}$, in the element of solid angle $d\vec{\Omega}$ about $\vec{\Omega}$, and in the energy range dE about E. Similarly, $Q\, dV\, dE\, d\vec{\Omega}$ is the number of gamma rays in the same element of phase space emitted by sources independent of ψ. The total interaction cross section is denoted by σ and the scattering transfer cross section (i.e., scattering from energy E' to E through a scattering angle $\vec{\Omega} \cdot \vec{\Omega}'$) by σ_s. All of these quantities may be spatially dependent. The cross sections of interest in the gamma-ray transport problem include the photoelectric effect, Compton scattering, and pair production. The gamma-ray velocities are taken to be unity in the present calculations.

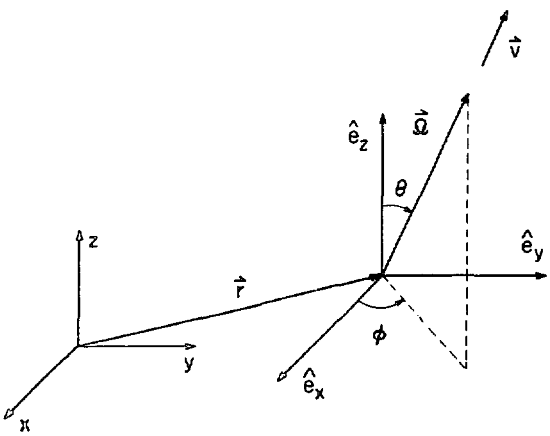

Fig. 1.
The position and direction variables characterizing a gamma ray. Unit vectors along the direction of velocity and coordinate axes are denoted by $\vec{\Omega}$, $\hat{e}_x$, $\hat{e}_y$, and $\hat{e}_z$, respectively. The variable μ is defined by:

$$\mu = \cos\theta = \hat{e}_z \cdot \vec{\Omega}.$$

In the following, a brief discussion of the LASL discrete ordinates code ONETRAN[2] is presented. The code solves the one-dimensional transport equation in plane, cylindrical, spherical, or two-angle plane geometries. This description of the code assumes the use of plane geometry as employed in the homogeneous infinite-medium calculations.

The energy, angular, and spatial variables of the gamma-ray transport equation are made to assume discrete values so that Eq. (1) reduces to a set of linear algebraic equations instead of a set of coupled integro-differential equations. That is, the scattering transfer cross section and inhomogeneous source terms (the first and second terms on the right-hand side of Eq. (1), respectively) are assumed to be represented by finite Legendre polynomial expansions of order ISCT;

$$\sigma_s(\vec{r},E'\rightarrow E,\vec{\Omega}\cdot\vec{\Omega}') = \sum_{n=0}^{ISCT} \frac{2n+1}{4\pi}\,\sigma_s^n\,(\vec{r},E'\rightarrow E)\,P_n(\vec{\Omega}\cdot\vec{\Omega}') \tag{2}$$

and

$$Q(\vec{r},E,\vec{\Omega}) = \sum_{n=0}^{ISCT} \frac{2n+1}{4\pi}\,Q^n(\vec{r},E)\,P_n(\vec{\Omega})\,. \tag{3}$$

For the infinite-medium calculations, the gamma-ray sources are assumed to be isotropic so that Eq. (3) reduces to

$$Q(\vec{r},E,\vec{\Omega}) = \frac{Q^o(\vec{r},E)}{4\pi}\ ,$$

where $Q^o(\vec{r},E)$ specifies the spatial and energy dependence of the gamma rays from potassium, uranium, and thorium.

In plane geometry the angular flux (angle-dependent) ψ is assumed independent of the azimuthal angle ϕ so that the angular flux depends only on the polar angle θ, or, more precisely, on $\mu = \cos\theta$ where $-1 \leqslant \mu \leqslant +1$. Also, the angular flux is assumed to be dependent on only one of the spatial coordinates, say z, and constant with respect to the remaining two coordinates (x and y), so that the spatial variable becomes z rather than $\vec{r}$. Therefore, if Eq. (2) is inserted into the first term on the right-hand side of Eq. (1) and the addition theorem is used to expand $P_n(\vec{\Omega}\cdot\vec{\Omega}')$, then the scattering term can be integrated over the azimuthal angle to obtain

$$\iint dE'\ d\vec{\Omega}'\ \sigma_s(z,E'\rightarrow E,\vec{\Omega}\cdot\vec{\Omega}')\psi(z,E',\vec{\Omega}') = \int_0^\infty dE' \sum_{n=0}^{ISCT} (2n+1)\sigma_s^n(z,E'\rightarrow E)P_n(\mu)\phi_n(z,E'),$$

where $\mu \equiv \cos\theta$, and where the moments of the angular flux are defined by

$$\phi_n(z,E') \equiv \int_{-1}^{+1} \frac{d\mu'}{2} P_n(\mu')\psi(z,E',\mu'),\ \text{and}\ \mu' \equiv \cos\theta'. \tag{4}$$

The zeroth-order moment of the angular flux, ϕ_o, is the total or isotropic flux, or the number of gamma rays per cm^2 of energy E at position z. The first moment of the angular flux, ϕ_1, is the gamma-ray current of energy E at position z and can be related to the source strength Q through Gauss' law. The physical interpretation of the higher-order moments is more difficult and will not be presented here.

The energy domain of interest is assumed to be partitioned into IGM intervals of constant width ΔE_g, g = 1,2,..., IGM. For the infinite medium calculations, IGM = 265 and ΔE_g = 10 keV, with the lower edge of the final group (group 265) at 10 keV. Integrating Eq. (1) over ΔE_g after substituting the expansions of Eqs. (2) and (3), one can write

$$\vec{\nabla}\cdot(\vec{\Omega}\psi_g) + \sigma_g(z)\psi_g(z,\vec{\Omega}) = \sum_{h=1}^{IGM}\sum_{n=0}^{ISCT}(2n+1)\sigma^n_{s,h\rightarrow g}(z)P_n(\mu)\phi_{nh}(z)$$

$$+ \sum_{n=0}^{ISCT}\frac{(2n+1)}{4\pi}P_n(\mu)Q_g^n(z), \tag{5}$$

for each group g = 1,2,..., IGM, where the integral over dE' has been replaced by a sum over the energy groups ΔE_h. Thus, the flux for group g,

$$\psi_g(z,\vec{\Omega}) = \int_{\Delta E_g} \psi(z,E,\vec{\Omega})dE,$$

no longer describes the number of gamma rays as a continuous function of energy, but rather as the number of gamma rays in the energy interval ΔE_g.

The *scattering transfer cross sections* of Eq. (5) are the flux-averaged group cross sections, that is,

$$\sigma^n_{s,h\to g} = \int_{\Delta E_h} \int_{\Delta E_g} \sigma^n_{s,h\to g} \psi dEdE' \Big/ \int_{\Delta E_h} \int_{\Delta E_g} \psi dEdE' .$$

However, ψ is not known beforehand and must be approximated. In the infinite medium calculations, the flux ψ (cross-section weighting factor) was taken as unity over the narrow group widths. This approximation was probably valid except, perhaps, for the few groups below about 50 keV where the flux can vary rapidly with energy.

The two terms on the right-hand side of Eq. (5) represent sources of gamma rays due to scattering and inhomogeneous sources, respectively. All coupling between the 265 multigroup equations is contained in these terms. In the following discussion, all sources will be denoted by S_g, which is treated as a known quantity. Of course, S_g depends on the unknown flux ψ_g, but S_g is generated iteratively using the latest values of ψ_g. Thus, omitting the group subscript, Eq. (5) can be written

$$\vec{\nabla} \cdot (\vec{\Omega}\psi) + \sigma(z)\psi(z,\vec{\Omega}) = S(z,\vec{\Omega}) \tag{6}$$

For plane geometry, the angular interval $-1 \leq \mu \leq +1$ is partitioned into a set of MM Gauss-Legendre quadrature points μ_m and associated quadrature weights w_m. The quadrature weights are normalized to unity

$$\sum_{m=1}^{MM} w_m = 1$$

and the angular flux is then assumed to be given by

$$\psi(z,\vec{\Omega}) \approx \psi(z,\mu_m) \equiv \psi_m(z) .$$

The angular flux moments of Eq. (4) are then approximated by

$$\phi_n(z) \approx \sum_{m=1}^{MM} w_m p_n(\mu_m)\psi_m(z) \quad ,$$

for each energy group, g = 1,2,...265. Thus, the discrete ordinates approximation of the multigroup transport Eq. (6) for plane geometry can be written

$$\mu_m \frac{\partial \psi_m}{\partial z} + \sigma(z)\psi_m(z) = S_m(z) \tag{7}$$

where $S_m(z) = S(z,\vec{\Omega})$ is the (known) source evaluated at the m^{th} angular quadrature point, μ_m.

The differential equation (7) for each energy group is solved by approximating it with a difference equation. In ONETRAN, a linear discontinuous finite element scheme is used to obtain stable and accurate solutions of Eq. (7). By imposing appropriate boundary and continuity conditions and using diamond difference relations, angular flux values are obtained over the space-angle mesh.

The code uses a two-level iteration scheme to obtain convergence of the set of difference equations. An inner iteration loop is executed within each energy group by performing a sweep in the space-angle mesh. An outer iteration is then performed to obtain convergence over all the energy groups. Convergence acceleration techniques are provided to help reduce the excessive number of iterations required for some classes of problems.

III. CALCULATIONS

A. Code Descriptions

For repetitive calculations, considerable savings in computer time could be achieved by using a discrete ordinates transport code, ONETRAN,[2] instead of a Monte Carlo gamma-ray code.[1] The ONETRAN code was modified to treat gamma rays and to meet the desired 10-keV energy resolution required for the calculations. The logical flow of the computer programs used in conjunction with ONETRAN to perform a spectral calculation is depicted in Fig. 2.

All computer codes are CDC 7600 FORTRAN compatible. These codes are presently under development by LASL Groups T-1 and T-2 and have not yet been documented.

1. GAMINR. The GAMINR code takes point cross-section values for Compton (incoherent and coherent) scattering, the photoelectric effect, and pair production, and generates group-averaged cross sections. The angular dependence of the cross sections is expressed in terms of a Legendre polynomial expansion of a specified order.

2. CCCC. The CCCC code takes the group-averaged cross sections of GAMINR and arranges the transition elements into an isotope-ordered format; i.e., for problems involving mixtures of several isotopes (or elements), CCCC orders the cross sections by isotope.

3. ONETRAN Preprocessor. Because the version of the ONETRAN code used for these calculations requires group-ordered cross sections as input, a preprocessor code is required to change the cross-section ordering from the isotope-ordered format of the CCCC output to the group-ordered format. The functions performed by the GAMINR, CCCC, and ONETRAN preprocessor codes could be combined in a single code that would yield cross-section files compatible with the current version of ONETRAN. Some apparent duplication in these different codes stems from the fact that we have adapted LASL codes that are used typically for reactor flux calculations. We felt that this approach was more expedient than generating our own codes.

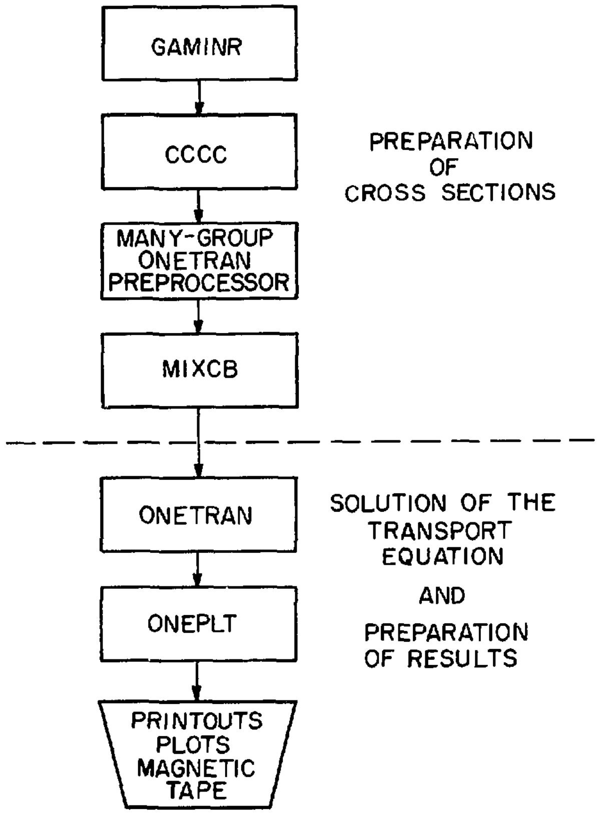

Fig. 2.
Flow diagram of computer codes used in the calculations.

4. MIXCB. The MIXCB code is used to create mixed cross-section files corresponding to various compositions of interest such as sandstone and shale. Input to the code includes the group-averaged, group-ordered, cross-section files (preprocessor output, see Fig. 2) for the elements comprising the formation and the elemental atomic densities appropriate for the formation. A

mixed cross-section file is then created by weighting each elemental cross section by its atomic density and summing the contributions for each element. Since all the gamma-ray calculations use the same set of compositions (e.g., the sandstone and shale mixtures of differing porosity and saturation), mixing the elemental cross sections external to the ONETRAN code avoids needless duplication of effort. Thus, each distinct composition is represented by a file containing the mixed cross section for that composition. Each ONETRAN run then involves reading a single, mixed cross-section file instead of reading a cross-section file for each element of the composition and then mixing them, a process that is expensive in terms of both computer time and core memory space.

5. ONETRAN. The ONETRAN code used for these calculations is a modification of LASL's standard ONETRAN code. The code is a discrete-ordinates finite-element program for the solution of the one-dimensional multigroup (up to 400 groups) transport equation.

6. ONEPLT. The ONEPLT code provides the capability of displaying ONETRAN results in a variety of formats. The ONETRAN code has been modified to produce output files of both the total and the angular flux values. These files serve as input to the ONEPLT code, which has the option of producing printed listings of the total and/or angular fluxes, of creating 35-mm film plots of spectra, and of writing the total and/or angular flux values on magnetic tape for further processing.

B. Comparison of Monte Carlo and ONETRAN Results

In order to gain confidence in using the ONETRAN discrete ordinates code, some ONETRAN calculations were performed for comparison with the results of an equivalent Monte Carlo calculation. A 352-keV gamma ray was transported through dry nonporous sandstone (ρ_B= 2.6263 g/cm^3). This gamma ray is the second most intense gamma ray in the ^{238}U decay series and the most intense gamma ray having an energy less than 500 keV. It allowed us to study the relative importance of the photoelectric cross section versus the Compton-scattering cross section for low-energy photons where we thought the ONETRAN results might be in error.

The ONETRAN-Monte Carlo comparison is shown in Fig. 3. Cylindrical geometry with reflecting boundary conditions was used. The results are tabulated in thirty-six 10-keV energy bins from 0.0 to 360.0 keV.

Both results are absolute and agree very well with each other within the statistical errors. It should be mentioned that the Monte Carlo code uses point cross sections while the ONETRAN code uses cross sections averaged over the energy-group width (10 keV in this example). Therefore, decreasing the energy-group width would minimize differences between the effective cross sections used in the two codes. Similarly, increasing the energy-group width would make the agreement between the calculations worse. This effect was verified by comparing a Monte Carlo calculation with a ONETRAN calculation that used 100-keV-wide groups.

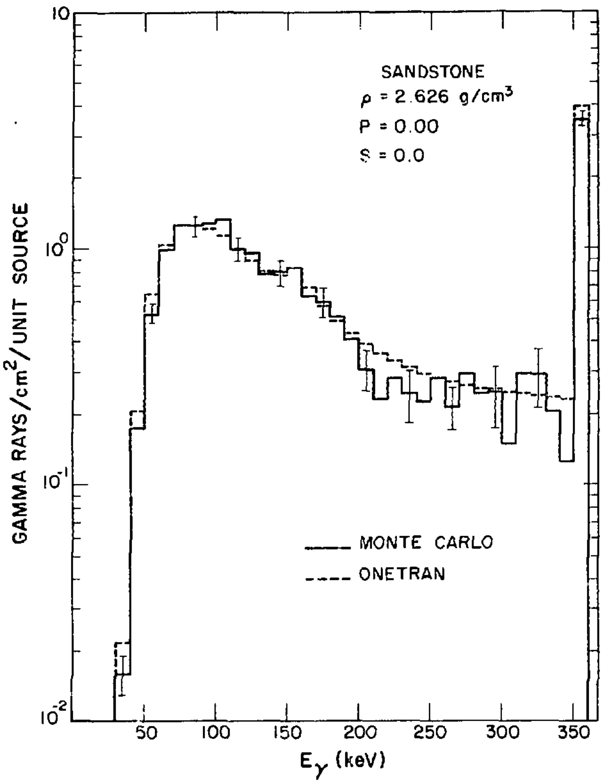

Fig. 3.
Comparison of ONETRAN and Monte Carlo gamma-ray spectral calculations for a 352-keV gamma ray. The formation was sandstone having a porosity of 0.00, a saturation of 0.0, and a bulk density of 2.6263 g/cm^2.

C. Description of Model Geometry and Parameters

The infinite medium calculations were performed for both sandstone and shale formations. The average elemental concentrations of dry, nonporous sandstone and shale are given in Table I. This composition contains the eight most abundant constituents of actual sandstone and accounts for 99.21% (2.6263 g/cm^3) of the actual density (2.6473 g/cm^3). Elements individually comprising more than 0.4% (weight per cent) of the actual sandstone density have been included. For shale the nine most abundant elements (> 1% by weight), accounting for 97.97% (2.6117 g/cm^3) of the actual density (2.6660 g/cm^3), were included. The less abundant elements were not included so that the computer time required to process the cross sections could be reduced while still retaining good simulation of the formation. It will become apparent later that the omission of trace elements from the formation is not significant. The oxygen component due to the three compounds K_2O, U_3O_8, and ThO_2 present in the formation has been included in the compositions of Table I.

The presence of fluid in the rock formation is quantified by both rock porosity and the extent to which the fluid saturates the pore spaces. When the effects of porosity and formation fluid are included, there results a bulk density, ρ_B, that is related to the dry, nonporous rock density, ρ_R, as follows:

$$\rho_B = \rho_R(1-P) + PS\rho_L ,$$

where

ρ_B = bulk density of the formation,

ρ_R = dry, nonporous rock density of the formation,

P = porosity, as a volume fraction,

ρ_L = formation fluid density (1.00 g/cm^3 for pure water),

and S = liquid saturation of the pore spaces, as a volume fraction.

The formation fluid was taken to be pure water. Also, the value of ρ_R used in the calculations did not include trace quantities of uranium and thorium present in the rock formation. The effects due to the presence of uranium in the formation will be discussed later.

The values of bulk density of sandstone and shale for porosities in the range of 0.00 to 0.40 and saturation values of 0.0, 0.5, and 1.0 are given in Table II. These six compositions for each formation were used in the calculations.

The calculations were performed separately for the gamma-ray spectra from the radioactive decay of ^{40}K in the compound K_2O, ^{238}U and ^{235}U in U_3O_8, and ^{232}Th in ThO_2. The gamma-ray energies and relative intensities for the uranium and thorium decay series and the decay of ^{40}K are listed in Table III and presented graphically in Fig. 4. The intensity values listed were computed assuming secular equilibrium of the uranium and thorium decay series. The uranium isotopes are assumed to be in the ratio $^{235}U/^{238}U = 0.00711$. The gamma-ray lines have been ordered according to decreasing energy.

TABLE I

AVERAGE ELEMENTAL CONCENTRATIONS

Element	Mass Density (g/cm^3)	Weight Fraction	Atom Fraction[a]
		SANDSTONE	
C	0.0366	0.01394	0.02336
O	1.3700	0.52165	0.65648
Mg	0.0188	0.00716	0.00593
Al	0.0670	0.02551	0.01904
Si	0.9740	0.37086	0.26587
K	0.0292	0.01112	0.00573
Ca	0.1045	0.03979	0.01999
Fe	0.0262	0.00998	0.00360
		SHALE	
H	0.0350	0.01340	0.21658
C	0.0405	0.01551	0.02103
O	1.3000	0.49776	0.50675
Mg	0.0392	0.01501	0.01006
Al	0.2165	0.08290	0.05004
Si	0.7250	0.27760	0.16099
K	0.0715	0.02738	0.01141
Ca	0.0590	0.02259	0.00918
Fe	0.1250	0.04786	0.01396

[a]Total atom density for sandstone = 0.07855×10^{24} atoms/cm^3; total atom density for shale = 0.09656×10^{24} atoms/cm^3.

Since the uranium series contains many gamma rays, the source spectrum has been limited to those lines comprising 90% of the total intensity. This results in 33 lines for the uranium spectrum--from the 63.3-keV ^{234}Th line to the 2448-keV ^{214}Bi line. The thorium source spectrum is limited to the 20 lines comprising 95% of the total intensity--from the 84.4-keV ^{228}Th line to the 2614-keV ^{208}Tl line. The relative intensities of both series have been renormalized to unity. Since the energy resolution of the calculations is 10 keV, several instances occur in which two gamma-ray lines lie in the same energy group and are indistinguishable from the point of view of the computer code. In these cases (indicated by brackets in Table III), the intensity of the energy group is taken to be the sum of the individual gamma-ray line intensities. The potassium spectrum consists almost entirely of the 1461-keV line from the electron capture of ^{40}K. The absolute intensity of the 511-keV radiation is twice the β^+ branching ratio because the emitted positron yields two annihilation quanta.

D. Model Parameter Studies

The ONETRAN spectral calculations were performed with an energy structure of 265 groups spanning the energy region from 10 keV to 2660 keV with a constant group width of 10 keV. The computer code simulated the infinite medium by employing the configuration shown schematically in Fig. 5. Since the ONETRAN discrete-ordinates code solves the one-dimensional photon transport equation, application of the code to three-dimensional problems requires that the gamma-ray flux be independent of the remaining two dimensions. The medium is homogeneous and infinite with respect to both the absorbing medium (formation) and the gamma-ray sources. As a result, the gamma-ray flux must be constant throughout the medium. Thus, the ONETRAN code can provide a viable method of solution if the problem configuration used in the code properly simulates an infinite medium along the one dimension for which a solution will

TABLE II

BULK PROPERTIES OF SANDSTONE AND SHALE

Porosity	Saturation	Bulk Density g/cm^3
	SANDSTONE	
0.00	0.0	2.6263
0.20	0.0	2.1010
0.10	0.5	2.4137
0.25	0.5	2.0947
0.10	1.0	2.4637
0.30	1.0	2.1384
	SHALE	
0.00	0.0	2.6117
0.30	0.0	1.8282
0.10	0.5	2.4005
0.30	0.5	1.9782
0.10	1.0	2.4505
0.40	1.0	1.9670

TABLE III

GAMMA-RAY SOURCE SPECTRA FOR POTASSIUM, URANIUM, AND THORIUM

Potassium

Energy (keV)	Relative Intensity	Parent Isotope
1461.0	0.9998	K 40
511.0	0.0002	K 40

Thorium Series

Energy (keV)[a]	Relative Intensity	Parent Isotope
2614.5	0.145	Tl 208
1587.9	0.015	Ac 228
968.9]	0.073	Ac 228
964.6]	0.023	Ac 228
911.1	0.121	Ac 228
860.5	0.017	Tl 208
794.8	0.020	Ac 228
727.3	0.027	Bi 212
583.1	0.125	Tl 208
510.7	0.033	Tl 208
463.0	0.019	Ac 228
338.4	0.050	Ac 228
328.0	0.014	Ac 228
300.1	0.014	Pb 212
270.3	0.016	Ac 228
241.0	0.015	Ra 224
238.6	0.179	Pb 212
209.4	0.019	Ac 228
129.1	0.012	Ac 228
84.4	0.064	Th 228

Uranium Series

Energy (keV)[a]	Relative Intensity	Parent Isotope
2448.0	0.008	Bi 214
2204.3	0.026	Bi 214
2118.7	0.006	Bi 214
1847.6	0.011	Bi 214
1764.6	0.081	Bi 214
1729.8	0.016	Bi 214
1661.4	0.006	Bi 214
1583.3	0.004	Bi 214
1509.3	0.011	Bi 214
1408.0]	0.013	Bi 214
1401.6]	0.007	Bi 214
1385.4	0.004	Bi 214
1377.7	0.021	Bi 214
1281.0	0.007	Bi 214
1238.2	0.030	Bi 214
1155.3	0.008	Bi 214
1120.4	0.073	Bi 214
1001.1	0.004	Pa 234m
934.0	0.015	Bi 214
806.2	0.005	Bi 214
786.0	0.004	Pb 214
768.4	0.023	Bi 214
665.6	0.007	Bi 214
609.4	0.208	Bi 214
352.0	0.177	Pb 214
295.2	0.092	Pb 214
258.8	0.004	Pb 214
241.9	0.037	Pb 214
186.0]	0.019	Ra 226
185.7]	0.012	U 235
92.8]	0.017	Th 234
92.3]	0.015	Th 234
63.3	0.028	Th 234

[a] Brackets indicate energies whose intensities were summed prior to input into ONETRAN.

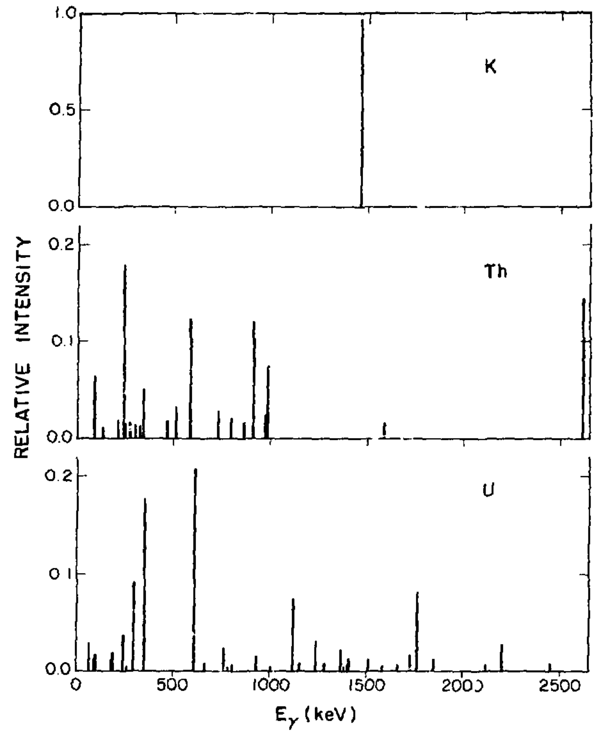

Fig. 4.
Relative intensities and energies of gamma rays from the decay of potassium, thorium, and uranium.

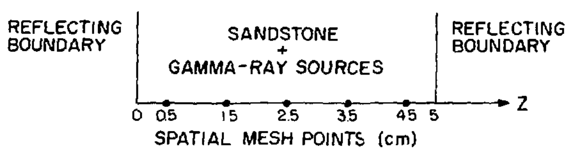

Fig. 5.
Geometry used in the homogeneous infinite-medium calculations.

be attempted. This is accomplished as shown in Fig. 5 for plane geometry. The z-axis is taken to be the active dimension, that is, the dimension for which a solution is obtained. The formation is made to look infinite in the z-direction by placing reflecting boundaries at z = 0 cm and z = 5 cm. A photon originating within the medium will be reflected back and forth between the boundaries, simulating an infinite medium. The code calculates gamma-ray fluxes as a function of energy at each of five mesh points (0.5, 1.5, 2.5, 3.5, and 4.5 cm) along the z-axis.

In principle, any of the three geometries (plane, cylindrical, or spherical) available with ONETRAN would have been adequate (and equivalent) for describing the homogeneous, infinite medium. Plane geometry was chosen because the discrete-ordinates method of ONETRAN generally converges faster for plane geometries than for either cylindrical or spherical geometries.

Prior to applying the discrete-ordinates method to the different formations and gamma-ray sources, studies were made to determine optimum values for the parameters of the method. Of particular importance are the parameters P_n and S_n. The P_n parameter is a measure of the anisotropy of the Compton, photoelectric, and pair-production cross sections that is included in the computation. The angular distributions of the three cross sections are expressed as a series expansion of Legendre polynomials, P_n. The more anisotropic the scattering, the larger the number of terms required to adequately describe the scattering. One might expect that for a homogeneous, infinite medium, the scattering order P_n might be very low, perhaps even isotropic, P_o. That the scattering could be accurately described by an expansion of order zero was, in fact, verified, but an order of one was chosen for the calculations so that problems inherent to the code for order zero could be circumvented.

The parameter S_n of the discrete-ordinates method describes the number of quadrature points (MM) at which angular flux values are computed. The larger the S_n value, the finer is the angular mesh and the smaller are the quadrature errors incurred when the angular flux values are integrated over angle to obtain total flux values. Since the medium for these calculations is both homogeneous and infinite, the angular flux should be constant for all values of angle and spatial position. The studies indicated that, indeed, the flux was isotropic and independent of position along the z-axis, resulting in a small number of quadrature points, S_4, being used in the calculations.

E. Absolute Normalization of ONETRAN Fluxes

Quantities of interest in transport problems include the total flux and current, defined as follows for an energy group E and spatial mesh point z:

$$\text{Total Flux} = \phi_o(z,E) = \sum_{m=1}^{MM} w_m \psi_m(z,E,\mu_m) \; ; \qquad (8)$$

$$\text{Current} = \phi_1(z,E) = \sum_{m=1}^{MM} w_m \mu_m \psi_m(z,E,\mu_m) . \qquad (9)$$

Both quantities have been integrated over the polar angle using a Gauss-Legendre quadrature with MM points. The total (scalar) flux is simply the number of photons, irrespective of their direction of motion, per cm^2 of energy E at point z. The current is the net photon flux of energy E at point z. In an infinite homogeneous medium, the current is zero, since the fluxes passing through a point from opposite directions are equal. The current (or the first moment of the angular flux) is perhaps the more fundamental of the quantities mentioned above, since it can be directly related to the number of source gamma rays in the formation using Gauss' Divergence Theorem. This relationship provides the proper normalization of all fluxes.

IV. RESULTS

A. Sandstone and Shale

A total of 18 infinite-medium gamma-ray spectral calculations was made for sandstone. Specifically, separate calculations for each of the three gamma-ray sources were required for each of the two porosities and each of the three saturation values given in Table II. The porosity and saturation parameters and the gamma-ray source for each of the 18 cases are listed in Table IVa. Shown in Figs. 6-11 are the gamma-ray spectra at the point z = 2.5 cm for a representative sample of the 18 cases of Table IVa. The sample demonstrates the changes in flux caused by relatively large variations in porosity and saturation.

A total of 18 infinite-medium gamma-ray spectral calculations was also made for shale. The porosity and saturation parameters and the gamma-ray source for each of the 18 cases are listed in Table IVb. The cases correspond to the potassium, thorium, and uranium source spectra listed in Table III.

TABLE IV

INDEX TO THE PARAMETERS OF THE INFINITE MEDIUM CALCULATIONS

Case	Figure	Porosity, P	Saturation, S	Gamma-Ray Source
a				
		Sandstone		
1	6	0.00	0.0	K
2	7	0.00	0.0	Th
3	8	0.00	0.0	U
4		0.20	0.0	K
5		0.20	0.0	Th
6		0.20	0.0	U
7		0.10	0.5	K
8		0.10	0.5	Th
9		0.10	0.5	U
10		0.25	0.5	K
11		0.25	0.5	Th
12		0.25	0.5	U
13		0.10	1.0	K
14		0.10	1.0	Th
15		0.10	1.0	U
16	9	0.30	1.0	K
17	10	0.30	1.0	Th
18	11	0.30	1.0	U
b				
		Shale		
1	12	0.00	0.0	K
2	13	0.00	0.0	Th
3	14	0.00	0.0	U
4		0.30	0.0	K
5		0.30	0.0	Th
6		0.30	0.0	U
7		0.10	0.5	K
8		0.10	0.5	Th
9		0.10	0.5	U
10		0.30	0.5	K
11		0.30	0.5	Th
12		0.30	0.5	U
13		0.10	1.0	K
14		0.10	1.0	Th
15		0.10	1.0	U
16	15	0.40	1.0	K
17	16	0.40	1.0	Th
18	17	0.40	1.0	U

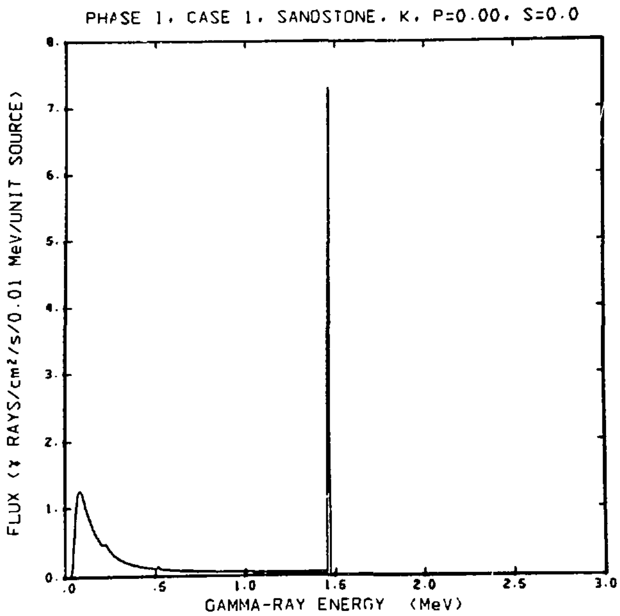

Fig. 6.
Gamma-ray total flux as a function of gamma-ray energy for the infinite-medium calculation of a potassium spectrum in sandstone having a porosity of 0.00 and a saturation of 0.0.

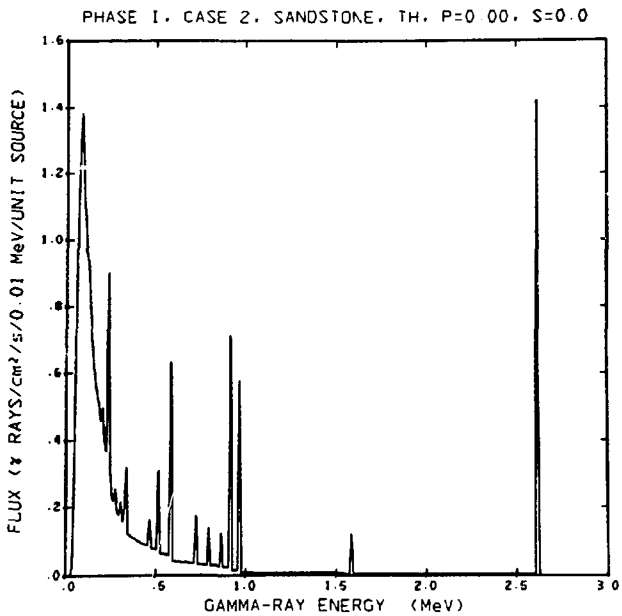

Fig. 7.
Gamma-ray total flux as a function of gamma-ray energy for the infinite-medium calculation of a thorium spectrum in sandstone having a porosity of 0.00 and a saturation of 0.0.

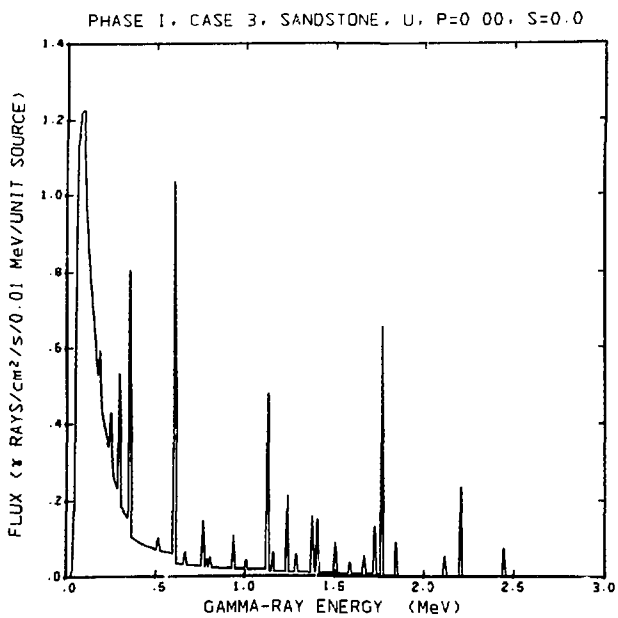

Fig. 8.
Gamma-ray total flux as a function of gamma-ray energy for the infinite-medium calculation of an uranium spectrum in sandstone having a porosity of 0.00 and a saturation of 0.0.

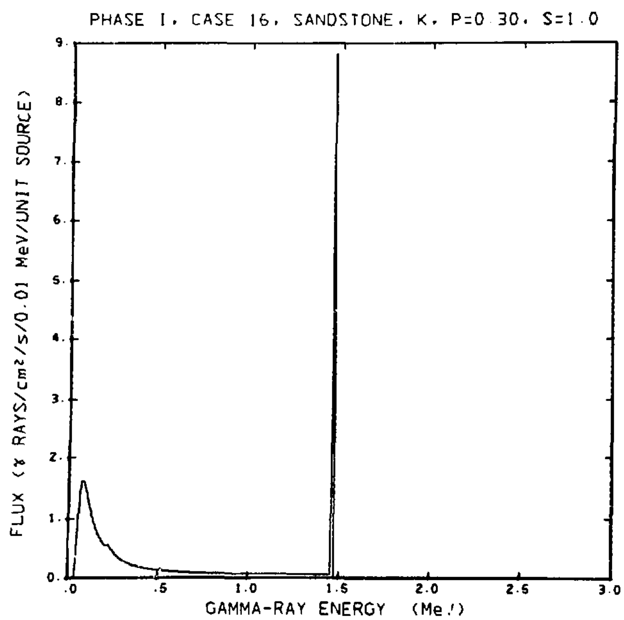

Fig. 9.
Gamma-ray total flux as a function of gamma-ray energy for the infinite-medium calculation of a potassium spectrum in sandstone having a porosity of 0.30 and a saturation of 1.0.

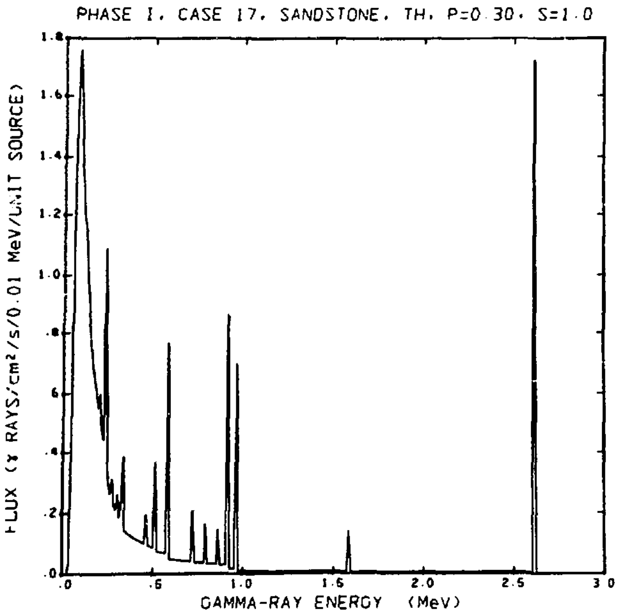

Fig. 10.
Gamma-ray total flux as a function of gamma-ray energy for the infinite-medium calculation of a thorium spectrum in sandstone having a porosity of 0.30 and a saturation of 1.0.

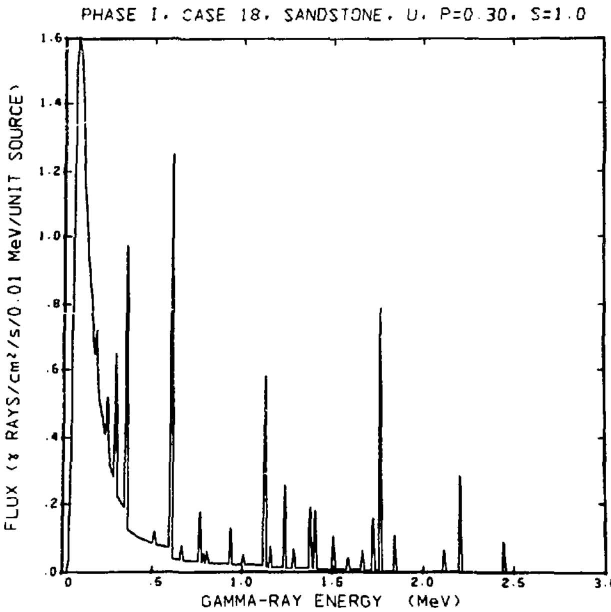

Fig. 11.
Gamma-ray total flux as a function of gamma-ray energy for the infinite-medium calculation of an uranium spectrum in sandstone having a porosity of 0.30 and a saturation of 1.0.

Shown in Figs. 12-17 are the gamma-ray spectra at the point z = 2.5 cm for a representative sample of the 18 shale cases of Table IVb.

All calculations for sandstone and shale assumed a 'UNIT SOURCE,' defined to be one gamma ray per second per cm^3 of the formation. This corresponds to 302.1, 0.2463, and 0.0813 milligrams per cm^3 of potassium, thorium, and uranium in the formation, respectively (see section IV.B.). The results for a given source concentration can be scaled from the spectral data contained in the Appendix.

B. Specific Activities

The recommended specific activity of the 1461-keV gamma ray from the decay of ^{40}K is [3]

$$2.81 * 10^4 \; \frac{\gamma\text{'s}}{s \cdot g(^{40}K)} = 3.31 \; \frac{\gamma\text{'s}}{s \cdot g(K)} \quad .$$

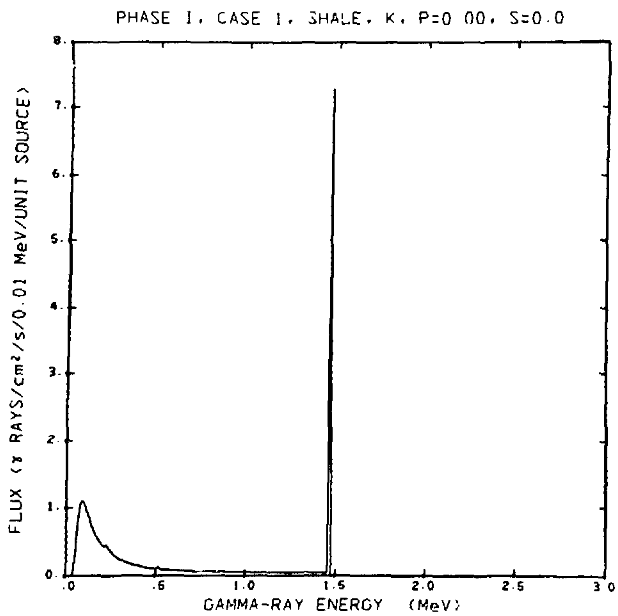

Fig. 12.
Gamma-ray total flux as a function of gamma-ray energy for the infinite-medium calculation of a potassium spectrum in shale having a porosity of 0.00 and a saturation of 0.0.

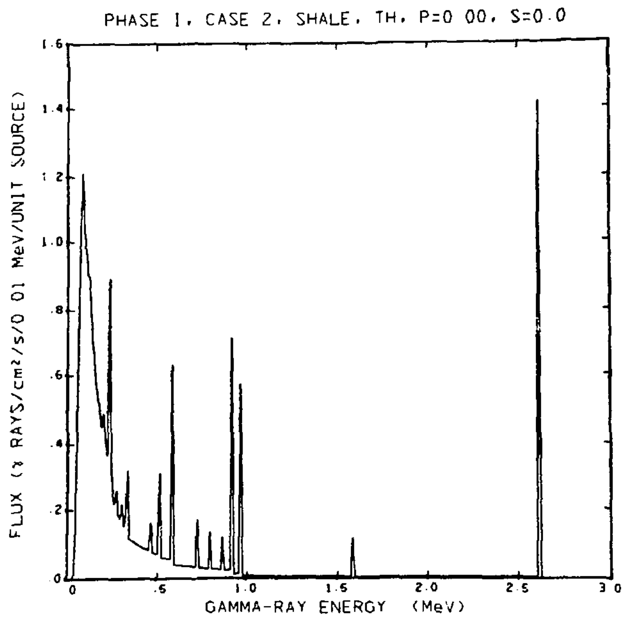

Fig. 13.
Gamma-ray total flux as a function of gamma-ray energy for the infinite-medium calculation of a thorium spectrum in shale having a porosity of 0.00 and a saturation of 0.0.

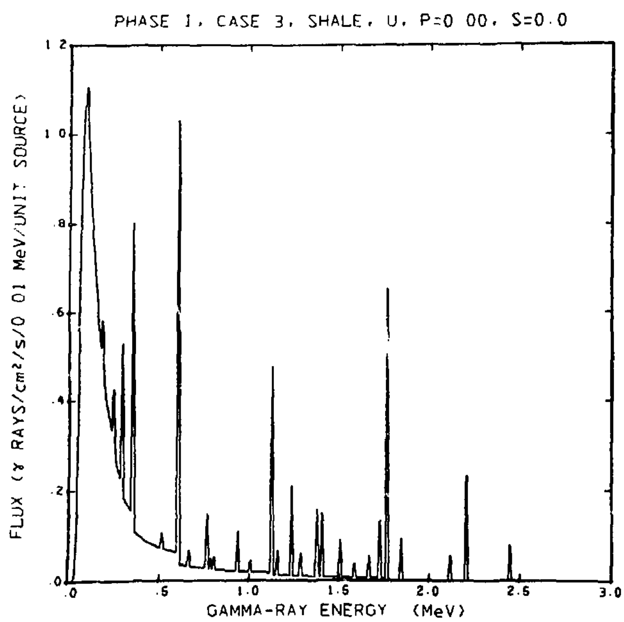

Fig. 14.
Gamma-ray total flux as a function of gamma-ray energy for the infinite-medium calculation of an uranium spectrum in shale having a porosity of 0.00 and a saturation of 0.0.

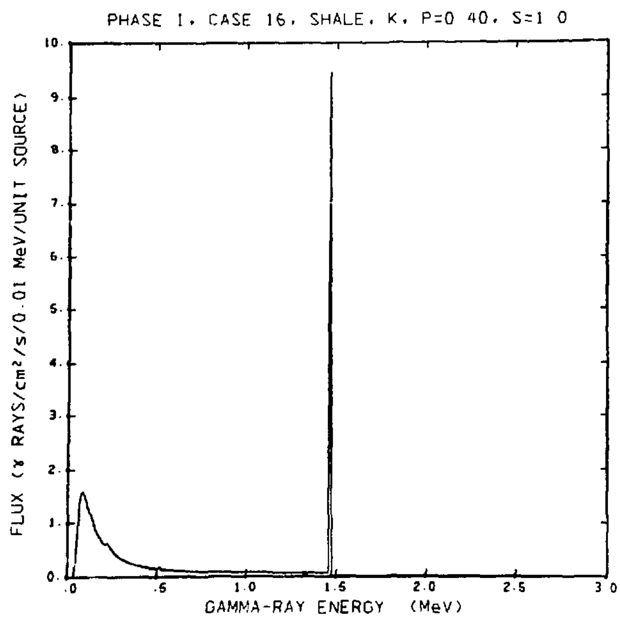

Fig. 15.
Gamma-ray total flux as a function of gamma-ray energy for the infinite-medium calculation of a potassium spectrum in shale having a porosity of 0.40 and a saturation of 1.0.

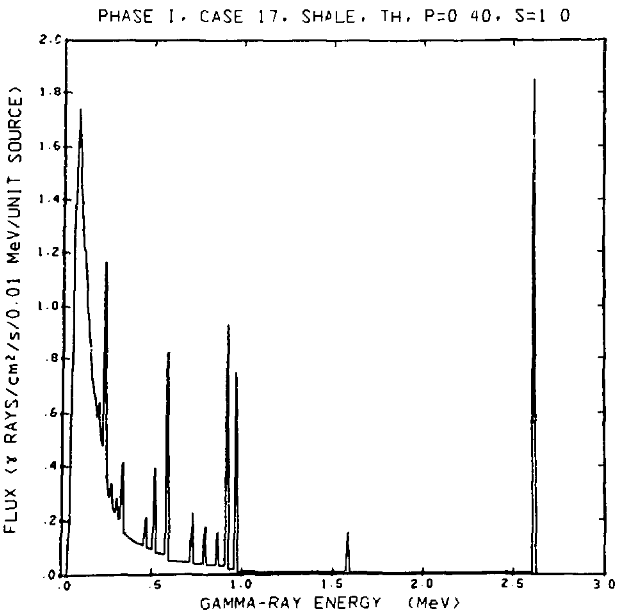

Fig. 16.
Gamma-ray total flux as a function of gamma-ray energy for the infinite-medium calculation of a thorium spectrum in shale having a porosity of 0.40 and a saturation of 1.0.

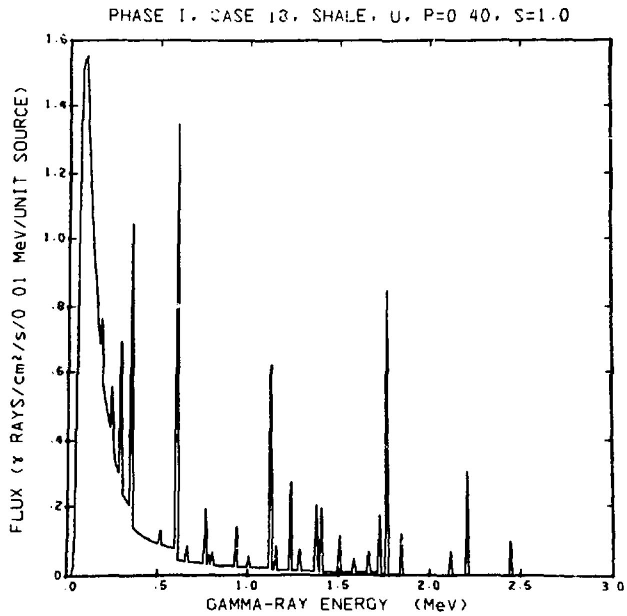

Fig. 17.
Gamma-ray total flux as a function of gamma-ray energy for the infinite-medium calculation of an uranium spectrum in shale having a porosity of 0.40 and a saturation of 1.0.

Based on the decay characteristics[4] of ^{232}Th, the calculated specific activity of ^{232}Th is 4.06×10^3 disintegrations per second per gram of ^{232}Th.

Similarly, based on the decay characteristics[5] of ^{238}U, the calculated specific activity of natural uranium is

$$1.23 * 10^4 \frac{\gamma' s}{s \cdot g(U)} .$$

V. DISCUSSION OF RESULTS

A. Effect of Porosity, Saturation, and Elemental Composition

Spectral calculations for KUT sources in sandstone and shale have been presented. In this section the dependence of the calculations on various formation parameters will be explored. Table V lists some important parameters for several representative formations.

TABLE V

PHYSICAL PARAMETERS OF THE FORMATION

Case	Formation Description	P	S	B (g/cm)	$\bar{Z}$ [a]	$\overline{(Z/A)}$ [b]	[c] (cm^{-1})	Compton Fraction [d]
2	Sandstone	0.00	0.0	2.6263	11.133	1.3089	0.1665	1.000
8	Sandstone	0.10	0.5	2.4137	11.052	1.2058	0.1534	1.000
14	Sandstone	0.10	1.0	2.4637	10.974	1.2335	0.1570	1.000
5	Sandstone	0.20	0.0	2.1011	11.133	1.0472	0.1332	1.000
11	Sandstone	0.25	0.5	2.0947	10.899	1.0511	0.1337	1.000
17	Sandstone	0.30	1.0	2.1384	10.583	1.0828	0.1378	1.000
2	Shale	0.00	0.0	2.6117	11.449	1.3124	0.1670	0.999

[a] Mass-fraction-weighted average Z.

[b] Mass-density-weighted average (Z/A).

[c] Total macroscopic cross section at 1.00 MeV.

[d] Fraction of total macroscopic cross section at 1.00 MeV due to Compton scattering.

The mass-fraction-weighted average value of Z for each formation was computed using the expression

$$\bar{Z} \equiv \sum_i f_i Z_i ,$$

where Z_i is the atomic number of the ith element in the formation and f_i is the mass fraction (weight fraction) for that element. The mass fraction is given by

$$f_i \equiv \rho_i / \sum_i \rho_i ,$$

where ρ_i is the mass density (in units of g/cm^3) of the ith element in the formation and $\sum_i \rho_i$ is the bulk density of the formation.

The mass-density-weighted average value of Z/A for each formation was calculated from the expression

$$\overline{(Z/A)} \equiv \sum_i \rho_i (Z_i/A_i) \ ,$$

where ρ_i and Z_i have the definitions given above, and A_i is the atomic mass of the ith element in the formation. The mass-fraction-weighted $\overline{Z}$ is a measure of the effective Z of the formation, and the mass-density-weighted $\overline{(Z/A)}$ is a measure of both the effective Z and the mass density of the formation. The two parameters are useful in explaining the variations in flux observed in the infinite medium calculations.

The total macroscopic cross section at 1.0 MeV was calculated using the photon cross section parameterizations of Biggs and Lighthill.[6] The fraction of the total cross section contributed by the incoherent Compton scattering cross section at 1.0 MeV was computed from the same cross section parameterizations.

Parameter studies will be discussed for only the thorium source spectrum, since that spectrum encompasses the energy range of both the potassium and uranium spectra. Table VI presents ratios of the parameters listed in Table V along with ratios of the ONETRAN flux values for the energy group 1.00-1.01 MeV. Figures 18-22 show the flux ratios as a function of gamma-ray energy. Typically, the flux ratios are virtually constant above about 200 keV. The shape of the curves can be understood by referring to Fig. 23, which shows the fraction of the total cross section contributed by the Compton, photoelectric, and pair production cross sections as a function of photon energy. The curves were computed for the sandstone formation of case 2. The Compton cross section accounts for more than 98% of the total cross section between about 200 keV and 2 MeV, giving rise to the flat region of the flux ratio curves. The photoelectric effect only plays a prominent role below about 200 keV, whereas the pair production cross section is zero below 1.022 MeV and only contributes about 5% to the total cross section at 3 MeV. In ONETRAN, the photoelectric effect is treated as an absorption channel that simply removes photon flux. Thus, the rise or fall of the flux ratio curves at low energies depends on the relative strength of the photoelectric effect for the formations of the two cases compared. If the photoelectric effect is stronger for the formation in the numerator of the flux ratio, relatively more photons will be absorbed for the case in the numerator, and the flux ratio will dip at low energies (as, for example, in Figs. 19, 20, and 22). Conversely, if more photoelectric absorption takes place for the formation in the denominator, the flux ratio will rise at low energies (as in Fig. 21).

If plotted on an expanded scale, the flux ratio curves exhibit similar though much less dramatic behavior at energies above about 2 MeV. At high energies, the pair production cross section removes photon flux in much the same way as the photoelectric effect absorbs flux at low energies. The two

TABLE VI

RATIOS OF FORMATION PARAMETERS

Cases Compared	P	S	Inverse ρ_B	Inverse[a] $\overline{Z}$	Inverse[b] $\overline{(Z/A)}$	Inverse[c] Σ	Compton[d] Fraction	ONETRAN[e] Flux
Sandstone-2 / Sandstone-5	0.00 / 0.20	0.0 / 0.0	0.8000	1.0000	0.8001	0.8000	1.000	0.8004
Sandstone-8 / Sandstone-11	0.10 / 0.25	0.5 / 0.5	0.8678	0.9862	0.8717	0.8717	1.000	0.8713
Sandstone-14 / Sandstone-17	0.10 / 0.30	1.0 / 1.0	0.8680	0.9644	0.8778	0.8778	1.000	0.8766
Sandstone-14 / Sandstone-8	0.10 / 0.10	1.0 / 0.5	0.9797	1.0071	0.9775	0.9771	1.000	0.9779
Shale-2 / Sandstone-2	0.00 / 0.00	0.0 / 0.0	1.0056	0.9724	0.9973	0.9770	0.9965	0.999

a Inverse ratio of mass-fraction-weighted average Z.

b Inverse ratio of mass-density-weighted average (Z/A).

c Inverse ratio of total macroscopic cross section at 1.0 MeV.

d Ratio of fraction of total macroscopic cross section at 1.00 MeV due to Compton scattering.

e Ratio of ONETRAN flux values for the group 1.00-1.01 MeV; that is, the flux saturation values.

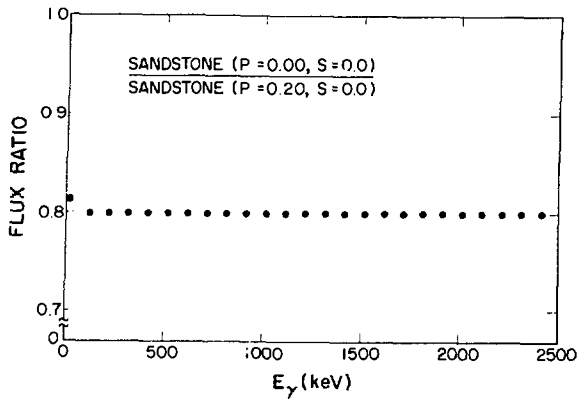

Fig. 18.
Flux ratio versus gamma-ray energy for sandstone having P = 0.00 and S = 0.0, to sandstone having P = 0.20 and S = 0.0 for the thorium-source spectrum.

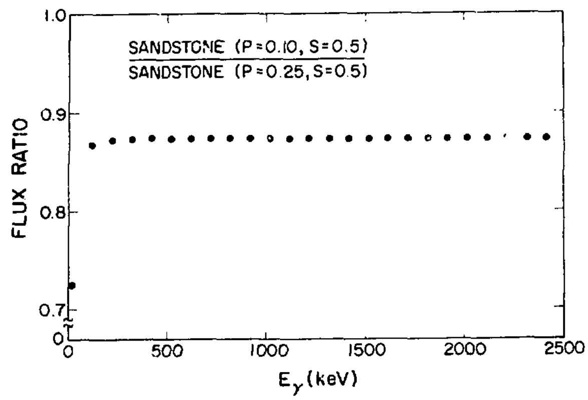

Fig. 19.
Flux ratio versus gamma-ray energy for sandstone having P = 0.10 and S = 0.5, to sandstone having P = 0.25 and S = 0.5 for the thorium-source spectrum.

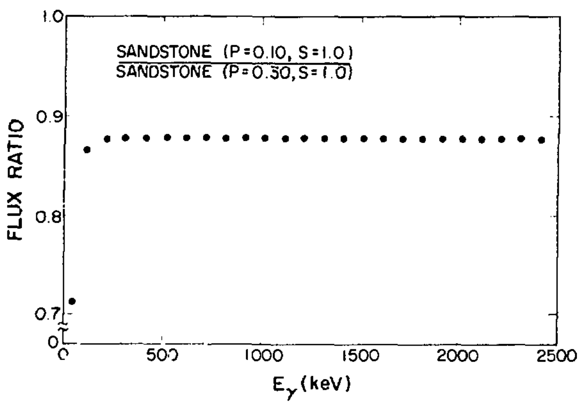

Fig. 20.
Flux ratio versus gamma-ray energy for sandstone having P = 0.10 and S = 1.0, to sandstone having P = 0.30 and S = 1.0 for the thorium-source spectrum.

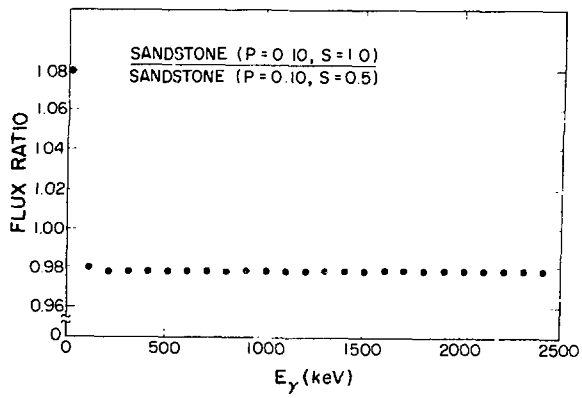

Fig. 21.
Flux ratio versus gamma-ray energy for sandstone having P = 0.10 and S = 1.0, to sandstone having P = 0.10 and S = 0.5 for the thorium-source spectrum.

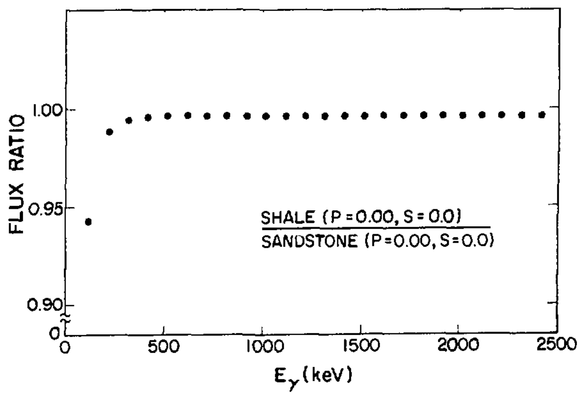

Fig. 22.
Flux ratio versus gamma-ray energy for shale having P = 0.00, S = 0.0, and ρ_B = 2.6117 g/cm^3 to sandstone having P = 0.00, S = 0.0, and ρ_B = 2.6263 g/cm^3 for the thorium source spectrum.

processes are different only in that pair production transfers some flux to the annihilation peak and that the magnitude of the pair production absorption over the range of energies of interest (that is, 10 keV-2.65 MeV) is small compared with the photoelectric effect over the same region (refer to Fig. 23). The rise or fall of the flux ratios at high energies depends on the relative strength of the pair production cross sections for the formations compared. The changes in formation Z between the cases compared are small, resulting in small changes in the pair production cross section (Z^2 dependence) and the flux ratios at high energies, and large changes in the photoelectric cross section (Z^5 dependence) and the flux ratios at low energies.

The ratios of formation parameters given in Table VI provide a semiquantitative understanding of the difference in flux caused by changing formation porosity, saturation, and elemental composition. A quantitative description of the flux ratio curves as a function of energy requires the use of detailed photon transport calculations such as those performed using ONETRAN. However, a qualitative understanding of the flat or "saturation" region of the curves is much more amenable to simple calculation. Table VI lists several ratios as aids to understanding the ratio of total flux values for the energy group 1.00-1.01 MeV (which are the saturation values) for the cases of Table V. The mass-density-weighted value of $(\overline{Z/A})$ predicts the ONETRAN-calculated saturation values to better than 0.15%. This agreement is excellent considering that the ONETRAN fluxes were calculated to a precision of 0.10%.

The success of the mass-density-weighted value of $(\overline{Z/A})$ in explaining the observed flux ratios is not surprising if one considers the factors that influence the quantity of flux present in any energy group of the spectra. The flux in the 1.00-1.01 MeV energy group is the difference in the amount of flux scattered down in energy from the higher energy groups and the amount of flux removed from the group. (In general, the flux would also include the contribution due to gamma-ray lines in that particular energy group.) That is, the Compton and (possibly) pair production cross sections transfer flux into any given group from the higher energy groups, while the Compton, photoelectric, and (possibly) pair production interactions remove flux from any given group. For the 1.00-1.01 MeV group, Compton scattering is solely responsible for the scattering of flux into the group, while the Compton and photoelectric processes are responsible for removing the flux. The amount of flux scattered from higher-energy groups into the 1.00-1.01 MeV group is

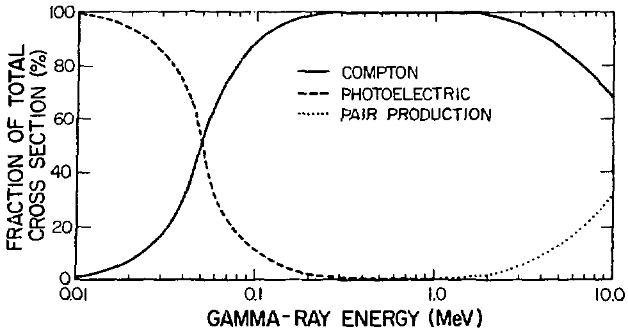

Fig. 23.
Fraction of the total macroscopic cross section contributed by the Compton, photoelectric, and pair production cross sections as a function of photon energy. The formation is sandstone (Case 2) having $P = 0.00$, $S = 0.0$, and $\rho_B = 2.6263\ g/cm^3$.

essentially constant for the cases of Table VI. This is attributable to the homogeneous, infinite medium and the fact that the Compton fraction of the total cross section is virtually constant for those cases. Thus, any differences in flux values for the 1.00-1.01 MeV group are due to different absorption cross sections for the cases compared. That is, the ratio of saturation flux values for two cases is related to the inverse ratio of the total cross sections. For the formations of Table VI, the total cross section at 1.0 MeV is due essentially entirely to the Compton interaction. Thus, any formation parameter that accurately predicts the relative magnitude of the Compton cross section will be successful in estimating the saturation flux ratios.

The Compton cross section is proportional to both the atom density and Z number of each of the constituent elements of the formation:

$$\sigma_{Compton} \propto \sum_i \rho_i' \; Z_i \quad ,$$

where $\sigma_{Compton}$ is the cross section of the formation and Z_i is the atomic number of the ith element of the formation. The atom density ρ_i' of the ith element can be written as

$$\rho_i' \equiv \rho_i \quad A_V/A_i$$

where A_V is Avogadro's number, ρ_i is the mass density of the ith element, and A_i is the atomic mass of the ith element. Thus the Compton cross section is proportional to

$$\sigma_{Compton} \propto \sum_i \rho_i (Z_i/A_i) \equiv \overline{(Z/A)} ,$$

where the summation is simply the mass-density-weighted average value of (Z/A) for the formation.

The inverse bulk density ratio accounts only for changes in formation density, while the inverse ratio of mass-fraction-weighted $\overline{Z}$ accounts only for changes in effective Z of the formation. On the other hand, the inverse ratio of mass-density weighted $\overline{(Z/A)}$ accounts for changes in both formation density and effective Z (elemental composition) and thus accurately predicts the saturation flux ratio for the cases of Table VI. If the Compton fraction of flux scattered from higher energy groups into the 1.00-1.01 MeV group were different for the cases being compared, the ratio of mass-density-weighted $\overline{(Z/A)}$ would not be sufficient in predicting the ratio of saturation flux values. An estimate of the relative fraction of flux downscattered into the 1.00-1.01 MeV group would be required to accurately predict the flux ratio. That is, the ratio of $\overline{(Z/A)}$ yields an estimate only of the flux removed from the 1.00-1.01 MeV group, not an estimate of both the downscattered incoming flux and the removed flux. Later in this report a study of the effect of including substantial amounts of uranium in the formation will demonstrate cases in which the relative fraction of downscattered flux changes between formations.

Certain cases arise in which a parameter other than the mass-density-weighted $\overline{(Z/A)}$ is adequate in predicting the ratio of saturation fluxes. For example, consider the flux ratio for sandstone formations having zero saturation and different porosities (0.00 and 0.20). Figure 18 shows the flux ratio as a function of gamma-ray energy. For this case all elemental atomic fractions and hence, the effective Z (as indicated by the mass-fraction-weighted $\overline{Z}$) of the two formations are the same; no additional elements have been introduced into either of the formations. The formations differ only in bulk density. The ONETRAN saturation value of 0.8004 is found to be the same as the reciprocal of the bulk density ratio, even at low energies. This is not surprising, since the ratios of the photon cross sections for the two formations are the same. The net effect is simply one of increased absorption due to the denser sandstone. The slight rise in the flux ratio at energies below about 100 keV is an anomaly related to the accuracy of the ONETRAN convergence process for very small flux values (i.e., the flux values in this region are about a million times smaller than those near 1 MeV).

The flux ratio curves shown in Figs. 19-21 demonstrate the changes in flux caused by varying the porosity and saturation of the formation. As indicated by the data in Table VI, changes in the ONETRAN saturation flux values due to changes in formation porosity and saturation for sandstone can be accurately predicted by the mass-density-weighted $(\overline{Z/A})$. This is not surprising, since the effective $(\overline{Z/A})$ (that is, mass-density-weighted $(\overline{Z/A})$) is nearly the same for both the formation and formation fluid (water). Hence, removing formation material (by changing the porosity) and inserting formation water (by changing the saturation) does not significantly change the effective $(\overline{Z/A})$ of the formation.

The mass-density-weighted $(\overline{Z/A})$ ratio also accurately predicts the ONETRAN saturation flux ratio for a shale formation and a sandstone formation having the same porosity (P = 0.00) and saturation (S = 0.0) but different elemental compositions. Again, this is attributable to the nearly equal values of $(\overline{Z/A})$ for the two formations. Hence, performing separate calculations for both shale and sandstone for the remaining studies of this project is probably not worthwhile.

B. Effect of Uranium Concentration

In all spectral calculations , trace quantities of uranium and thorium present in the formation were not included in the compositions for sandstone and shale (see Table I). However, since the atomic numbers of uranium and thorium are high (92 and 90, respectively), even small quantities of the elements could affect the gamma-ray spectra. As a result, additional calculations were performed to determine the effect on the gamma-ray spectra of quantities of uranium (or thorium, since the atomic numbers are nearly identical) in the formation.

This analysis was performed for sandstone having a porosity of 0.00, a saturation of 0.0, and a bulk density of 2.6263 g/cm^3. Density was eliminated as a variable in this study by keeping the density of the formation constant while adding different amounts of uranium. This was done by changing all elemental densities (see Table I) by a fraction $(1 - x/2.6263)$, where x is the density (g/cm^3) of uranium added to the sandstone. Table VII summarizes the uranium concentrations for which spectra were calculated. For these calculations, a thorium gamma-ray spectrum was uniformly distributed throughout the sandstone. The effect of adding uranium to shale should be similar to adding similar amounts of uranium to sandstone.

The ratio of the gamma-ray flux for a specified uranium concentration to the gamma-ray flux for zero uranium concentration as a function of the gamma-ray energy is shown in Figs. 24-25. Fig. 24 shows the flux ratios for 0.2% and 2.0% uranium, while Fig. 25 shows the ratios for 0.06%, 0.6%, and 6.0% uranium. In all cases the flux ratios tend to flatten out at the higher energies. This shape can be understood (as in the cases discussed previously) from the dominance of Compton scattering over other processes in this energy range. The falloff in the flux ratios at lower energies as a function of higher uranium concentration can be similarly understood in terms of the dominance of the photoelectric effect (i,e., the absorption of gamma rays at low energies).

TABLE VII

FORMATION PARAMETERS FOR VARIOUS URANIUM CONCENTRATIONS IN SANDSTONE[a]

Case	Uranium Concentration (wt. %)	ρ_B (g/cm^3)	$\bar{Z}$[b]	$\overline{(Z/A)}$[c]	Σ[d] (cm^{-1})	Compton Fraction[e]
2	0.00	2.6263	11.133	1.3089	0.1665	1.000
35	0.06	2.6263	11.181	1.3087	0.1666	0.999
38	0.20	2.6263	11.295	1.3083	0.1666	0.999
29	0.60	2.6263	11.618	1.3072	0.1667	0.997
32	2.00	2.6263	12.750	1.3030	0.1672	0.991
26	6.00	2.6263	15.985	1.2913	0.1684	0.975

a The formation porosity, saturation, and bulk density are the same for all cases: P = 0.00, S = 0.0, and $\rho_B = 2.6263$ g/cm^3.

b Mass-fraction-weighted average Z.

c Mass-density-weighted average (Z/A).

d Total macroscopic cross section at 1.00 MeV.

e Fraction of total macroscopic cross section at 1.00 MeV due to Compton scattering.

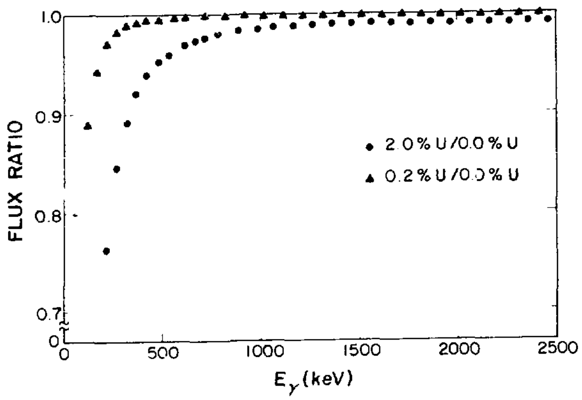

Fig. 24.
Gamma-ray flux ratios (as a function of gamma-ray energy) of 0.2% and 2.0% uranium concentrations to 0% uranium concentration. The formation was sandstone of porosity 0.00 and saturation 0.0. A thorium-source spectrum was used.

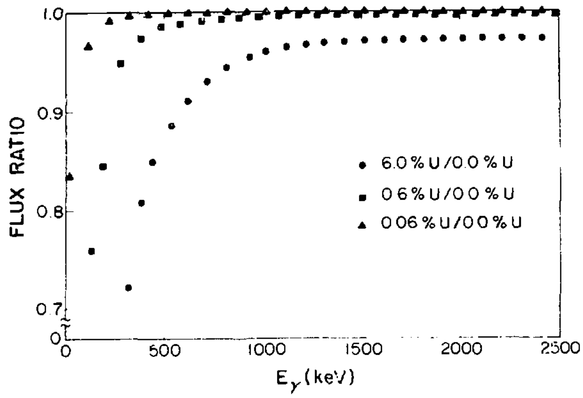

Fig. 25.
Gamma-ray flux ratios (as a function of gamma-ray energy) of 0.06%, 0.6%, and 6% uranium concentration to 0% uranium concentration. The formation was, sandstone or porosity 0.00 and saturation 0.0. A thorium-source spectrum was used.

The ratios of formation parameters presented in Table VIII provide a quantitative understanding of the change in saturation flux values caused by increasing the uranium concentration in the formation. The ratio of inverse mass-density-weighted ($\overline{Z/A}$) no longer accurately predicts the ONETRAN saturation flux ratio, especially for high uranium concentrations. In fact, the trend of the ratio of inverse mass-density-weighted ($\overline{Z/A}$) with increasing uranium concentration is counter to that of the flux ratio. The cause for this discrepancy is evident from Table VIII. The relative amount of downscattered flux (as indicated by the ratio of the Compton fraction of the total cross section) is no longer constant as it was for the previous cases (see Table VI). Thus, as the uranium concentration increases, the relative amount of flux downscattered into the 1.00-1.01 MeV group from higher energy groups changes as does the amount of flux that is absorbed from the group (as indicated by the ratio of inverse total cross section). A rough estimate of the flux ratio can be obtained by multiplying the ratio of the Compton fraction of the total cross section times the ratio of the inverse total cross section. This procedure crudely accounts for the differences in downscatter and absorbed flux for the 1.00-1.01 MeV group for each uranium concentration.

The ratio of inverse mass-density-weighted $\overline{(Z/A)}$ is accurate to better than 0.6% in predicting the ONETRAN saturation flux ratio for uranium concentrations less than 0.6% by weight. However, for these low-grade ores, the saturation value of the flux is constant with uranium concentration to better than 0.5%. For ore grades containing more than 0.6% uranium, the saturation flux should be corrected only by performing the appropriate ONETRAN flux calculations, not by using the mass-density-weighted $\overline{(Z/A)}$ ratio.

TABLE VIII

RATIOS OF FORMATION PARAMETERS FOR VARIOUS URANIUM CONCENTRATIONS IN SANDSTONE[a]

Case	Uranium Concentration (wt. %)	Inverse[a] ρ_B	Inverse[b] $\overline{Z}$	Inverse[c] $\overline{(Z/A)}$	Inverse[d] Σ	Compton[e] Fraction	ONETRAN[f] Flux
35	0.06	1.0000	0.9957	1.0002	0.9994	0.999	0.9996
38	0.20	1.0000	0.9857	1.0005	0.9996	0.999	0.9985
29	0.60	1.0000	0.9583	1.0013	0.9988	0.997	0.9954
32	2.00	1.0000	0.8732	1.0045	0.9958	0.991	0.9846
26	6.00	1.0000	0.6965	1.0136	0.9887	0.975	0.9545

a The formation porosity, saturation, and bulk density are the same for all cases: P = 0.00, S = 0.0, and ρ_B = 2.6263 g/cm^3. All ratios correspond to: uranium concentration listed/0% uranium concentration.

b Inverse ratio of mass-fraction-weighted average Z.

c Inverse ratio of mass-density-weighted average (Z/A).

d Inverse ratio of total macroscopic cross section at 1.00 MeV.

e Ratio of fraction of total macroscopic cross section at 1.00 MeV due to Compton scattering.

f Ratio of ONETRAN flux values for the group 1.00-1.01 MeV; that is, the flux saturation values.

VI. CONCLUSIONS AND RECOMMENDATIONS

The infinite medium studies lead to the following conclusions regarding the effects of formation porosity, saturation, and elemental composition on the transport of KUT spectra in an infinite medium.

1. Corrections to the flux in formations containing less than 0.6% uranium by weight are unnecessary above 1 MeV in photon energy if imprecisions in the flux values of up to 0.5% can be tolerated;
2. Corrections to the flux in formations differing only in porosity and saturation can be made to better than 0.2 % for photon energies above 200 keV by using the ratio of inverse mass-density-weighted $\overline{(Z/A)}$ for the formations being compared;
3. Corrections to the flux in formations differing in effective Z by less than 5% (such as sandstone and shale ores) can be made to about 0.2 % for photon energies above 500 keV by using the ratio of inverse mass-density-weighted $\overline{(Z/A)}$ for the formations being compared; and
4. Corrections to the flux for energies outside the bounds given in 1, 2, and 3 above or for uranium concentrations greater than 0.6% by weight should be made only by performing ONETRAN calculations for the formations being compared.

REFERENCES

1. E. D. Cashwell, J. R. Neergaard, C. J. Everett, R. G. Schrandt, W. M. Taylor, and G. D. Turner, "Monte Carlo Photon Codes: MCG and MCP," Los Alamos Scientific Laboratory report LA-5157-MS (March 1973).

2. T. R. Hill, "ONETRAN: A Discrete Ordinate Finite Element Code for the Solution of the One-Dimensional Multigroup Transport Equation," Los Alamos Scientific Laboratory report LA-5990-MS (June 1975).

3. P. M. Endt and C. Van der Leum, Nucl. Phys. A142, 1 (1973).

4. M. R. Shmorak, Nucl. Data Sheets. 20, 165 (1977).

5. Y. A. Ellis, Nucl. Data Sheets. B4, 635 (1970).

6. F. Biggs and R. Lighthill, "Analytical Approximations for Total Pair-Production Cross Sections," SC-RR-68-619, Sandia Laboratories, Albuquerque, New Mexico, 1967, unpublished; and F. Biggs and R. Lighthill, "Analytical Approximations for X-Ray Cross Sections II," SC-RR-71-0507, Sandia Laboratories, Albuquerque, New Mexico, 1971, unpublished.

APPENDIX

A. MAGNETIC TAPES

The results (flux values) of the infinite medium calculations have been forwarded to the Bendix Field Engineering Corporation office in Grand Junction. The data have been written on tapes in binary coded decimal (BCD) format at 800 bits per inch (BPI) and even parity. The data for the potassium source spectrum for the six shale compositions and the six sandstone compositions have been written on a single tape. Similar tapes were written for the thorium and uranium source spectra. Thus, for potassium, the data consist of 12 files corresponding in sequence to cases 1, 4, 7, 10, 13, and 16 for shale and cases 1, 4, 7, 10, 13, and 16 for sandstone (refer to Table IV). The same procedure was followed for the thorium and uranium spectra.

A format has been adopted for the storage and retrieval of data from all phases of this project. Each file on a data tape will contain a title, the various ONETRAN parameters of interest, the numerical quadrature points and weights, and values of the angular flux. For each energy group, data are written for all fine-mesh boundaries. For each fine-mesh boundary, the values of angular fluxes at the quadrature points (μ_m) are written. A computer program to read the data and to compute various moments of the flux with options for plotting and printing the flux values has been sent to Grand Junction.

B. SPECTRAL PRINTOUTS

Included below are computer printouts of the total flux values for each of the spectra of the 18 sandstone and 18 shale cases. The data for each spectrum are printed on a single page with descriptive information including case number, formation type (sandstone or shale), source spectrum (K, U, or Th), porosity, and saturation. The values of energy listed are the centers of the 10-keV-wide bins used in the ONETRAN calculations. The units for the printouts are identical to those of the spectral plots of Figs. 6-17: that is, MeV for the energy values and gamma rays/cm^2/s/0.01 MeV/unit source for the flux values. Interpolation between the flux values presented herein should yield accurate correction factors for almost any sandstone or shale formation encountered in practice.

TOTAL FLUX ENERGY SPECTRUM FOR THE PHASE 1 INFINITE MEDIUM

PHASE 1, CASE 1, SANDSTONE, K, P=0.00, S=0.0

ENERGY	FLUX	ENERGY	FLUX	ENERGY	FLUX	ENERGY	FLUX	ENERGY	FLUX	ENERGY	FLUX
.015	6.979E-07	.515	1.400E-01	1.015	5.647E-02	1.515	0.	2.015	0.	2.515	0.
.025	4.480E-04	.525	1.049E-01	1.025	5.617E-02	1.525	0.	2.025	0.	2.525	0.
.035	2.187E-02	.535	1.024E-01	1.035	5.587E-02	1.535	0.	2.035	0.	2.535	0.
.045	2.095E-01	.545	1.001E-01	1.045	5.558E-02	1.545	0.	2.045	0.	2.545	0.
.055	6.597E-01	.555	9.785E-02	1.055	5.531E-02	1.555	0.	2.055	0.	2.555	0.
.065	1.058E+00	.565	9.571E-02	1.065	5.505E-02	1.565	0.	2.065	0.	2.565	0.
.075	1.246E+00	.575	9.370E-02	1.075	5.480E-02	1.575	0.	2.075	0.	2.575	0.
.085	1.270E+00	.585	9.179E-02	1.085	5.456E-02	1.585	0.	2.085	0.	2.585	0.
.095	1.210E+00	.595	8.999E-02	1.095	5.434E-02	1.595	0.	2.095	0.	2.595	0.
.105	1.113E+00	.605	8.827E-02	1.105	5.411E-02	1.605	0.	2.105	0.	2.605	0.
.115	1.017E+00	.615	8.665E-02	1.115	5.388E-02	1.615	0.	2.115	0.	2.615	0.
.125	9.366E-01	.625	8.511E-02	1.125	5.366E-02	1.625	0.	2.125	0.	2.625	0.
.135	8.487E-01	.635	8.365E-02	1.135	5.345E-02	1.635	0.	2.135	0.	2.635	0.
.145	7.631E-01	.645	8.227E-02	1.145	5.325E-02	1.645	0.	2.145	0.	2.645	0.
.155	6.889E-01	.655	8.092E-02	1.155	5.306E-02	1.655	0.	2.155	0.	2.655	0.
.165	6.270E-01	.665	7.963E-02	1.165	5.289E-02	1.665	0.	2.165	0.	2.665	0.
.175	5.758E-01	.675	7.842E-02	1.175	5.271E-02	1.675	0.	2.175	0.	2.675	0.
.185	5.318E-01	.685	7.726E-02	1.185	5.254E-02	1.685	0.	2.185	0.	2.685	0.
.195	4.949E-01	.695	7.615E-02	1.195	5.238E-02	1.695	0.	2.195	0.	2.695	0.
.205	4.650E-01	.705	7.506E-02	1.205	5.223E-02	1.705	0.	2.205	0.	2.705	0.
.215	4.577E-01	.715	7.403E-02	1.215	5.209E-02	1.715	0.	2.215	0.	2.715	0.
.225	4.728E-01	.725	7.304E-02	1.225	5.194E-02	1.725	0.	2.225	0.	2.725	0.
.235	4.280E-01	.735	7.211E-02	1.235	5.179E-02	1.735	0.	2.235	0.	2.735	0.
.245	3.901E-01	.745	7.121E-02	1.245	5.166E-02	1.745	0.	2.245	0.	2.745	0.
.255	3.577E-01	.755	7.033E-02	1.255	5.153E-02	1.755	0.	2.255	0.	2.755	0.
.265	3.298E-01	.765	6.948E-02	1.265	5.141E-02	1.765	0.	2.265	0.	2.765	0.
.275	3.055E-01	.775	6.867E-02	1.275	5.128E-02	1.775	0.	2.275	0.	2.775	0.
.285	2.843E-01	.785	6.790E-02	1.285	5.117E-02	1.785	0.	2.285	0.	2.785	0.
.295	2.656E-01	.795	6.717E-02	1.295	5.106E-02	1.795	0.	2.295	0.	2.795	0.
.305	2.492E-01	.805	6.647E-02	1.305	5.095E-02	1.805	0.	2.305	0.	2.805	0.
.315	2.347E-01	.815	6.578E-02	1.315	5.084E-02	1.815	0.	2.315	0.	2.815	0.
.325	2.218E-01	.825	6.513E-02	1.325	5.074E-02	1.825	0.	2.325	0.	2.825	0.
.335	2.101E-01	.835	6.450E-02	1.335	5.064E-02	1.835	0.	2.335	0.	2.835	0.
.345	1.996E-01	.845	6.391E-02	1.345	5.055E-02	1.845	0.	2.345	0.	2.845	0.
.355	1.900E-01	.855	6.333E-02	1.355	5.046E-02	1.855	0.	2.355	0.	2.855	0.
.365	1.813E-01	.865	6.277E-02	1.365	5.038E-02	1.865	0.	2.365	0.	2.865	0.
.375	1.734E-01	.875	6.225E-02	1.375	5.029E-02	1.875	0.	2.375	0.	2.875	0.
.385	1.660E-01	.885	6.174E-02	1.385	5.021E-02	1.885	0.	2.385	0.	2.885	0.
.395	1.593E-01	.895	6.125E-02	1.395	5.014E-02	1.895	0.	2.395	0.	2.895	0.
.405	1.532E-01	.905	6.076E-02	1.405	5.006E-02	1.905	0.	2.405	0.	2.905	0.
.415	1.476E-01	.915	6.028E-02	1.415	4.999E-02	1.915	0.	2.415	0.	2.915	0.
.425	1.424E-01	.925	5.982E-02	1.425	4.992E-02	1.925	0.	2.425	0.	2.925	0.
.435	1.375E-01	.935	5.939E-02	1.435	4.983E-02	1.935	0.	2.435	0.	2.935	0.
.445	1.330E-01	.945	5.897E-02	1.445	4.971E-02	1.945	0.	2.445	0.	2.945	0.
.455	1.288E-01	.955	5.857E-02	1.455	4.914E-02	1.955	0.	2.455	0.	2.955	0.
.465	1.249E-01	.965	5.818E-02	1.465	7.306E+00	1.965	0.	2.465	0.	2.965	0.
.475	1.212E-01	.975	5.780E-02	1.475	0.	1.975	0.	2.475	0.	2.975	0.
.485	1.178E-01	.985	5.745E-02	1.485	0.	1.985	0.	2.485	0.	2.985	0.
.495	1.145E-01	.995	5.711E-02	1.495	0.	1.995	0.	2.495	0.	2.995	0.
.505	1.115E-01	1.005	5.679E-02	1.505	0.	2.005	0.	2.505	0.	3.005	0.

TOTAL FLUX ENERGY SPECTRUM FOR THE PHASE 1 INFINITE MEDIUM

PHASE I, CASE 2, SANDSTONE, TH, P=0.00, S=0.0

ENERGY	FLUX	ENERGY	FLUX	ENERGY	FLUX	ENERGY	FLUX	ENERGY	FLUX	ENERGY	FLUX
.015	7.162E-07	.515	3.119E-01	1.015	7.621E-03	1.515	5.646E-03	2.015	4.313E-03	2.515	4.119E-03
.025	4.598E-04	.525	6.431E-02	1.025	7.554E-03	1.525	5.626E-03	2.025	4.306E-03	2.525	4.117E-03
.035	2.244E-02	.535	6.322E-02	1.035	7.487E-03	1.535	5.606E-03	2.035	4.300E-03	2.535	4.115E-03
.045	2.150E-01	.545	6.220E-02	1.045	7.423E-03	1.545	5.587E-03	2.045	4.294E-03	2.545	4.113E-03
.055	6.768E-01	.555	6.121E-02	1.055	7.361E-03	1.555	5.568E-03	2.055	4.287E-03	2.555	4.111E-03
.065	1.092E+00	.565	6.027E-02	1.065	7.300E-03	1.565	5.549E-03	2.065	4.281E-03	2.565	4.110E-03
.075	1.253E+00	.575	5.925E-02	1.075	7.242E-03	1.575	5.523E-03	2.075	4.274E-03	2.575	4.108E-03
.085	1.384E+00	.585	6.361E-01	1.085	7.186E-03	1.585	1.189E-01	2.085	4.268E-03	2.585	4.105E-03
.095	1.146E+00	.595	4.103E-02	1.095	7.132E-03	1.595	4.807E-03	2.095	4.262E-03	2.595	4.099E-03
.105	1.047E+00	.605	4.118E-02	1.105	7.078E-03	1.605	4.790E-03	2.105	4.256E-03	2.605	4.057E-03
.115	9.620E-01	.615	4.057E-02	1.115	7.023E-03	1.615	4.774E-03	2.115	4.251E-03	2.615	1.425E+00
.125	9.373E-01	.625	3.999E-02	1.125	6.971E-03	1.625	4.758E-03	2.125	4.246E-03	2.625	0.
.135	7.959E-01	.635	3.945E-02	1.135	6.919E-03	1.635	4.742E-03	2.135	4.240E-03	2.635	0.
.145	7.041E-01	.645	3.894E-02	1.145	6.870E-03	1.645	4.726E-03	2.145	4.236E-03	2.645	0.
.155	6.262E-01	.655	3.843E-02	1.155	6.822E-03	1.655	4.711E-03	2.155	4.231E-03	2.655	0.
.165	5.643E-01	.665	3.796E-02	1.165	6.776E-03	1.665	4.697E-03	2.165	4.226E-03	2.665	0.
.175	5.266E-01	.675	3.751E-02	1.175	6.730E-03	1.675	4.682E-03	2.175	4.222E-03	2.675	0.
.185	4.938E-01	.685	3.709E-02	1.185	6.686E-03	1.685	4.667E-03	2.185	4.218E-03	2.685	0.
.195	4.574E-01	.695	3.668E-02	1.195	6.643E-03	1.695	4.653E-03	2.195	4.214E-03	2.695	0.
.205	4.954E-01	.705	3.628E-02	1.205	6.601E-03	1.705	4.639E-03	2.205	4.210E-03	2.705	0.
.215	3.981E-01	.715	3.588E-02	1.215	6.560E-03	1.715	4.626E-03	2.215	4.206E-03	2.715	0.
.225	3.692E-01	.725	1.734E-01	1.225	6.520E-03	1.725	4.613E-03	2.225	4.202E-03	2.725	0.
.235	9.014E-01	.735	3.2[illegible]9E-02	1.235	6.480E-03	1.735	4.599E-03	2.235	4.198E-03	2.735	0.
.245	3.078E-01	.745	3.210E-02	1.[illegible]5	6.441E-03	1.745	4.586E-03	2.245	4.194E-03	2.745	0.
.255	2.361E-01	.755	3.187E-02	1.255	6.403E-03	1.755	4.573E-03	2.255	4.189E-03	2.755	0.
.265	2.197E-01	.765	3.158E-02	1.265	6.367E-03	1.765	4.561E-03	2.265	4.185E-03	2.765	0.
.275	2.586E-01	.775	3.130E-02	1.275	6.330E-03	1.775	4.549E-03	2.275	4.182E-03	2.775	0.
.285	1.885E-01	.785	3.102E-02	1.285	6.295E-03	1.785	4.537E-03	2.285	4.178E-03	2.785	0.
.295	1.779E-01	.795	1.374E-01	1.295	6.260E-03	1.795	4.525E-03	2.295	4.174E-03	2.795	0.
.305	2.172E-01	.805	2.872E-02	1.305	6.226E-03	1.805	4.514E-03	2.305	4.171E-03	2.805	0.
.315	1.569E-01	.815	2.849E-02	1.315	6.193E-03	1.815	4.502E-03	2.315	4.168E-03	2.815	0.
.325	1.996E-01	.825	2.820E-02	1.325	6.160E-03	1.825	4.491E-03	2.325	4.164E-03	2.825	0.
.335	3.203E-01	.835	2.807E-02	1.335	6.128E-03	1.835	4.480E-03	2.335	4.161E-03	2.835	0.
.345	1.221E-01	.845	2.788E-02	1.345	6.097E-03	1.845	4.469E-03	2.345	4.158E-03	2.845	0.
.355	1.171E-01	.855	2.768E-02	1.355	6.066E-03	1.855	4.459E-03	2.355	4.156E-03	2.855	0.
.365	1.126E-01	.865	1.219E-01	1.365	6.036E-03	1.865	4.448E-03	2.365	4.153E-03	2.865	0.
.375	1.085E-01	.875	2.592E-02	1.375	6.007E-03	1.875	4.438E-03	2.375	4.151E-03	2.875	0.
.385	1.047E-01	.885	2.577E-02	1.385	5.978E-03	1.885	4.427E-03	2.385	4.149E-03	2.885	0.
.395	1.014E-01	.895	2.561E-02	1.395	5.950E-03	1.895	4.417E-03	2.395	4.146E-03	2.895	0.
.405	9.829E-02	.905	2.535E-02	1.405	5.922E-03	1.905	4.408E-03	2.405	4.145E-03	2.905	0.
.415	9.549E-02	.915	7.160E-01	1.415	5.894E-03	1.915	4.398E-03	2.415	4.143E-03	2.915	0.
.425	9.292E-02	.925	1.561E-02	1.425	5.868E-03	1.925	4.389E-03	2.425	4.141E-03	2.925	0.
.435	9.053E-02	.935	1.549E-02	1.435	5.841E-03	1.935	4.380E-03	2.435	4.139E-03	2.935	0.
.445	8.834E-02	.945	1.538E-02	1.445	5.815E-03	1.945	4.370E-03	2.445	4.136E-03	2.945	0.
.455	8.626E-02	.955	1.521E-02	1.455	5.789E-03	1.955	4.361E-03	2.455	4.133E-03	2.955	0.
.465	1.636E-01	.965	5.775E-01	1.465	5.764E-03	1.965	4.352E-03	2.465	4.131E-03	2.965	0.
.475	7.948E-02	.975	7.909E-03	1.475	5.739E-03	1.975	4.344E-03	2.475	4.128E-03	2.975	0.
.485	7.784E-02	.985	7.833E-03	1.485	5.714E-03	1.985	4.335E-03	2.485	4.125E-03	2.985	0.
.495	7.632E-02	.995	7.760E-03	1.495	5.690E-03	1.995	4.327E-03	2.495	4.123E-03	2.995	0.
.505	7.484E-02	1.005	7.689E-03	1.505	5.667E-03	2.005	4.320E-03	2.505	4.121E-03	3.005	0.

TOTAL FLUX ENERGY SPECTRUM FOR THE PHASE I INFINITE MEDIUM

PHASE I, CASE 3, SANDSTONE, U, P=0.00, S=0.0

ENERGY	FLUX	ENERGY	FLUX	ENERGY	FLUX	ENERGY	FLUX	ENERGY	FLUX	ENERGY	FLUX
.015	7.142E-07	.515	1.034E-01	1.015	1.897E-02	1.515	6.535E-03	2.015	1.337E-03	2.515	0.
.025	4.585E-04	.525	6.876E-02	1.025	1.887E-02	1.525	6.522E-03	2.025	1.336E-03	2.525	0.
.035	2.238E-02	.535	6.760E-02	1.035	1.878E-02	1.535	6.509E-03	2.035	1.335E-03	2.535	0.
.045	2.144E-01	.545	6.653E-02	1.045	1.868E-02	1.545	6.497E-03	2.045	1.334E-03	2.545	0.
.055	6.746E-01	.555	6.549E-02	1.055	1.859E-02	1.555	6.486E-03	2.055	1.333E-03	2.555	0.
.065	1.097E+00	.565	6.452E-02	1.065	1.851E-02	1.565	6.474E-03	2.065	1.331E-03	2.565	0.
.075	1.218E+00	.575	6.360E-02	1.075	1.843E-02	1.575	6.461E-03	2.075	1.330E-03	2.575	0.
.085	1.226E+00	.585	6.271E-02	1.085	1.835E-02	1.585	3.668E-02	2.085	1.329E-03	2.585	0.
.095	1.227E+00	.595	6.166E-02	1.095	1.827E-02	1.595	6.258E-03	2.095	1.328E-03	2.595	0.
.105	1.051E+00	.605	1.037E+00	1.105	1.820E-02	1.605	6.248E-03	2.105	1.325E-03	2.605	0.
.115	9.590E-01	.615	3.480E-02	1.115	1.807E-02	1.615	6.238E-03	2.115	5.397E-02	2.615	0.
.125	8.677E-01	.625	3.424E-02	1.125	4.807E-01	1.625	6.229E-03	2.125	1.118E-03	2.625	0.
.135	7.887E-01	.635	3.371E-02	1.135	1.330E-02	1.635	6.219E-03	2.135	1.117E-03	2.635	0.
.145	7.210E-01	.645	3.320E-02	1.145	1.323E-02	1.645	6.210E-03	2.145	1.117E-03	2.645	0.
.155	6.662E-01	.655	3.270E-02	1.155	6.457E-02	1.655	6.199E-03	2.155	1.116E-03	2.655	0.
.165	5.892E-01	.665	6.658E-02	1.165	1.263E-02	1.665	5.275E-02	2.165	1.116E-03	2.665	0.
.175	5.328E-01	.675	3.103E-02	1.175	1.258E-02	1.675	5.923E-03	2.175	1.115E-03	2.675	0.
.185	5.935E-01	.685	3.062E-02	1.185	1.253E-02	1.685	5.915E-03	2.185	1.113E-03	2.685	0.
.195	4.466E-01	.695	3.022E-02	1.195	1.248E-02	1.695	5.908E-03	2.195	1.104E-03	2.695	0.
.205	4.105E-01	.705	2.983E-02	1.205	1.244E-02	1.705	5.900E-03	2.205	2.345E-01	2.705	0.
.215	3.866E-01	.715	2.946E-02	1.215	1.239E-02	1.715	5.886E-03	2.215	2.449E-04	2.715	0.
.225	3.642E-01	.725	2.911E-02	1.225	1.233E-02	1.725	1.324E-01	2.225	2.447E-04	2.725	0.
.235	3.394E-01	.735	2.877E-02	1.235	2.119E-01	1.735	5.202E-03	2.235	2.445E-04	2.735	0.
.245	4.309E-01	.745	2.845E-02	1.245	1.051E-02	1.745	5.192E-03	2.245	2.444E-04	2.745	0.
.255	2.933E-01	.755	2.811E-02	1.255	1.047E-02	1.755	5.152E-03	2.255	2.442E-04	2.755	0.
.265	2.615E-01	.765	1.403E-01	1.265	1.043E-02	1.765	6.530E-01	2.265	2.440E-04	2.765	0.
.275	2.464E-01	.775	2.535E-02	1.275	1.039E-02	1.775	1.823E-03	2.275	2.439E-04	2.775	0.
.285	2.331E-01	.785	4.629E-02	1.285	5.791E-02	1.785	1.821E-03	2.285	2.437E-04	2.785	0.
.295	5.355E-01	.795	2.446E-02	1.295	9.935E-03	1.795	1.818E-03	2.295	2.436E-04	2.795	0.
.305	1.858E-01	.805	5.105E-02	1.305	9.903E-03	1.805	1.815E-03	2.305	2.435E-04	2.805	0.
.315	1.775E-01	.815	2.354E-02	1.315	9.872E-03	1.815	1.812E-03	2.315	2.433E-04	2.815	0.
.325	1.701E-01	.825	2.332E-02	1.325	9.841E-03	1.825	1.809E-03	2.325	2.432E-04	2.825	0.
.335	1.634E-01	.835	2.311E-02	1.335	9.812E-03	1.835	1.802E-03	2.335	2.431E-04	2.835	0.
.345	1.572E-01	.845	2.291E-02	1.345	9.783E-03	1.845	9.181E-02	2.345	2.430E-04	2.845	0.
.355	8.071E-01	.855	2.271E-02	1.355	9.754E-03	1.855	1.365E-03	2.355	2.429E-04	2.855	0.
.365	1.068E-01	.865	2.252E-02	1.365	9.715E-03	1.865	1.363E-03	2.365	2.428E-04	2.865	0.
.375	1.028E-01	.875	2.234E-02	1.375	1.574E-01	1.875	1.361E-03	2.375	2.427E-04	2.875	0.
.385	9.909E-02	.885	2.217E-02	1.385	3.680E-02	1.885	1.359E-03	2.385	2.427E-04	2.885	0.
.395	9.573E-02	.895	2.201E-02	1.395	8.321E-03	1.895	1.357E-03	2.395	2.426E-04	2.895	0.
.405	9.268E-02	.905	2.184E-02	1.405	1.505E-01	1.905	1.355E-03	2.405	2.425E-04	2.905	0.
.415	8.988E-02	.915	2.168E-02	1.415	7.253E-03	1.915	1.353E-03	2.415	2.424E-04	2.915	0.
.425	8.732E-02	.925	2.151E-02	1.425	7.232E-03	1.925	1.351E-03	2.425	2.421E-04	2.925	0.
.435	8.494E-02	.935	1.079E-01	1.435	7.212E-03	1.935	1.349E-03	2.435	2.396E-04	2.935	0.
.445	8.275E-02	.945	2.008E-02	1.445	7.192E-03	1.945	1.347E-03	2.445	7.008E-02	2.945	0.
.455	8.070E-02	.955	1.995E-02	1.455	7.172E-03	1.955	1.346E-03	2.455	0.	2.955	0.
.465	7.880E-02	.965	1.982E-02	1.465	7.153E-03	1.965	1.344E-03	2.465	0.	2.965	0.
.475	7.704E-02	.975	1.970E-02	1.475	7.134E-03	1.975	1.342E-03	2.475	0.	2.975	0.
.485	7.539E-02	.985	1.958E-02	1.485	7.115E-03	1.985	1.341E-03	2.485	0.	2.985	0.
.495	7.385E-02	.995	1.946E-02	1.495	7.091E-03	1.995	1.339E-03	2.495	0.	2.995	0.
.505	7.242E-02	1.005	4.328E-02	1.505	8.794E-02	2.005	1.338E-03	2.505	0.	3.005	0.

TOTAL FLUX ENERGY SPECTRUM FOR THE PHASE 1 INFINITE MEDIUM

PHASE I, CASE 4, SANDSTONE, K, P=0.20, S=0.0

ENERGY	FLUX	ENERGY	FLUX	ENERGY	FLUX	ENERGY	FLUX	ENERGY	FLUX	ENERGY	FLUX
.015	8.581E-07	.515	1.749E-01	1.015	7.055E-02	1.515	0.	2.015	0.	2.515	0.
.025	5.522E-04	.525	1.311E-01	1.025	7.017E-02	1.525	0.	2.025	0.	2.525	0.
.035	2.704E-02	.535	1.280E-01	1.035	6.979E-02	1.535	0.	2.035	0.	2.535	0.
.045	2.598E-01	.545	1.250E-01	1.045	6.943E-02	1.545	0.	2.045	0.	2.545	0.
.055	8.200E-01	.555	1.222E-01	1.055	6.909E-02	1.555	0.	2.055	0.	2.555	0.
.065	1.318E+00	.565	1.196E-01	1.065	6.877E-02	1.565	0.	2.065	0.	2.565	0.
.075	1.553E+00	.575	1.170E-01	1.075	6.845E-02	1.575	0.	2.075	0.	2.575	0.
.085	1.584E+00	.585	1.146E-01	1.085	6.816E-02	1.585	0.	2.085	0.	2.585	0.
.095	1.510E+00	.595	1.124E-01	1.095	6.788E-02	1.595	0.	2.095	0.	2.595	0.
.105	1.390E+00	.605	1.103E-01	1.105	6.760E-02	1.605	0.	2.105	0.	2.605	0.
.115	1.270E+00	.615	1.082E-01	1.115	6.731E-02	1.615	0.	2.115	0.	2.615	0.
.125	1.169E+00	.625	1.063E-01	1.125	6.704E-02	1.625	0.	2.125	0.	2.625	0.
.135	1.060E+00	.635	1.045E-01	1.135	6.677E-02	1.635	0.	2.135	0.	2.635	0.
.145	9.530E-01	.645	1.028E-01	1.145	6.652E-02	1.645	0.	2.145	0.	2.645	0.
.155	8.603E-01	.655	1.011E-01	1.155	6.629E-02	1.655	0.	2.155	0.	2.655	0.
.165	7.831E-01	.665	9.947E-02	1.165	6.606E-02	1.665	0.	2.165	0.	2.665	0.
.175	7.191E-01	.675	9.795E-02	1.175	6.584E-02	1.675	0.	2.175	0.	2.675	0.
.185	6.642E-01	.685	9.651E-02	1.185	6.563E-02	1.685	0.	2.185	0.	2.685	0.
.195	6.181E-01	.695	9.511E-02	1.195	6.543E-02	1.695	0.	2.195	0.	2.695	0.
.205	5.808E-01	.705	9.375E-02	1.205	6.524E-02	1.705	0.	2.205	0.	2.705	0.
.215	5.717E-01	.715	9.246E-02	1.215	6.506E-02	1.715	0.	2.215	0.	2.715	0.
.225	5.906E-01	.725	9.124E-02	1.225	6.488E-02	1.725	0.	2.225	0.	2.725	0.
.235	5.346E-01	.735	9.007E-02	1.235	6.470E-02	1.735	0.	2.235	0.	2.735	0.
.245	4.872E-01	.745	8.895E-02	1.245	6.453E-02	1.745	0.	2.245	0.	2.745	0.
.255	4.468E-01	.755	8.784E-02	1.255	6.437E-02	1.755	0.	2.255	0.	2.755	0.
.265	4.119E-01	.765	8.678E-02	1.265	6.421E-02	1.765	0.	2.265	0.	2.765	0.
.275	3.816E-01	.775	8.578E-02	1.275	6.405E-02	1.775	0.	2.275	0.	2.775	0.
.285	3.552E-01	.785	8.482E-02	1.285	6.391E-02	1.785	0.	2.285	0.	2.785	0.
.295	3.318E-01	.795	8.391E-02	1.295	6.377E-02	1.795	0.	2.295	0.	2.795	0.
.305	3.113E-01	.805	8.303E-02	1.305	6.363E-02	1.805	0.	2.305	0.	2.805	0.
.315	2.932E-01	.815	8.217E-02	1.315	6.350E-02	1.815	0.	2.315	0.	2.815	0.
.325	2.771E-01	.825	8.136E-02	1.325	6.338E-02	1.825	0.	2.325	0.	2.825	0.
.335	2.625E-01	.835	8.058E-02	1.335	6.325E-02	1.835	0.	2.335	0.	2.835	0.
.345	2.494E-01	.845	7.983E-02	1.345	6.314E-02	1.845	0.	2.345	0.	2.845	0.
.355	2.373E-01	.855	7.911E-02	1.355	6.303E-02	1.855	0.	2.355	0.	2.855	0.
.365	2.265E-01	.865	7.842E-02	1.365	6.292E-02	1.865	0.	2.365	0.	2.865	0.
.375	2.165E-01	.875	7.776E-02	1.375	6.282E-02	1.875	0.	2.375	0.	2.875	0.
.385	2.074E-01	.885	7.713E-02	1.385	6.272E-02	1.885	0.	2.385	0.	2.885	0.
.395	1.990E-01	.895	7.652E-02	1.395	6.262E-02	1.895	0.	2.395	0.	2.895	0.
.405	1.914E-01	.905	7.590E-02	1.405	6.253E-02	1.905	0.	2.405	0.	2.905	0.
.415	1.843E-01	.915	7.530E-02	1.415	6.244E-02	1.915	0.	2.415	0.	2.915	0.
.425	1.778E-01	.925	7.473E-02	1.425	6.234E-02	1.925	0.	2.425	0.	2.925	0.
.435	1.718E-01	.935	7.419E-02	1.435	6.224E-02	1.935	0.	2.435	0.	2.935	0.
.445	1.662E-01	.945	7.367E-02	1.445	6.208E-02	1.945	0.	2.445	0.	2.945	0.
.455	1.609E-01	.955	7.316E-02	1.455	6.138E-02	1.955	0.	2.455	0.	2.955	0.
.465	1.560E-01	.965	7.267E-02	1.465	9.127E+00	1.965	0.	2.465	0.	2.965	0.
.475	1.514E-01	.975	7.221E-02	1.475	0.	1.975	0.	2.475	0.	2.975	0.
.485	1.471E-01	.985	7.176E-02	1.485	0.	1.985	0.	2.485	0.	2.985	0.
.495	1.431E-01	.995	7.134E-02	1.495	0.	1.995	0.	2.495	0.	2.995	0.
.505	1.393E-01	1.005	7.094E-02	1.505	0.	2.005	0.	2.505	0.	3.005	0.

TOTAL FLUX ENERGY SPECTRUM FOR THE PHASE 1 INFINITE MEDIUM

PHASE 1, CASE 5, SANDSTONE, TH, P=0.20, S=0.0

ENERGY	FLUX	ENERGY	FLUX	ENERGY	FLUX	ENERGY	FLUX	ENERGY	FLUX	ENERGY	FLUX
.015	8.809E-07	.515	3.897E-01	1.015	9.521E-03	1.515	7.054E-03	2.015	5.388E-03	2.515	5.145E-03
.025	5.070E-04	.525	8.035E-02	1.025	9.437E-03	1.525	7.028E-03	2.025	5.380E-03	2.525	5.143E-03
.035	2.776E-02	.535	7.898E-02	1.035	9.354E-03	1.535	7.004E-03	2.035	5.372E-03	2.535	5.141E-03
.045	2.667E-01	.545	7.771E-02	1.045	9.273E-03	1.545	6.980E-03	2.045	5.364E-03	2.545	5.138E-03
.055	8.415E-01	.555	7.648E-02	1.055	9.196E-03	1.555	6.956E-03	2.055	5.356E-03	2.555	5.136E-03
.065	1.361E+00	.565	7.530E-02	1.065	9.121E-03	1.565	6.932E-03	2.065	5.348E-03	2.565	5.134E-03
.075	1.563E+00	.575	7.402E-02	1.075	9.048E-03	1.575	6.900E-03	2.075	5.340E-03	2.575	5.132E-03
.085	1.727E+00	.585	7.948E-01	1.085	8.978E-03	1.585	1.485E-01	2.085	5.332E-03	2.585	5.129E-03
.095	1.431E+00	.595	5.226E-02	1.095	8.910E-03	1.595	6.005E-03	2.095	5.324E-03	2.595	5.121E-03
.105	1.307E+00	.605	5.145E-02	1.105	8.843E-03	1.605	5.984E-03	2.105	5.317E-03	2.605	5.068E-03
.115	1.201E+00	.615	5.069E-02	1.115	8.775E-03	1.615	5.964E-03	2.115	5.310E-03	2.615	1.780E+00
.125	1.171E+00	.625	4.997E-02	1.125	8.709E-03	1.625	5.944E-03	2.125	5.304E-03	2.625	0.
.135	9.941E-01	.635	4.929E-02	1.135	8.645E-03	1.635	5.924E-03	2.135	5.297E-03	2.635	0.
.145	8.795E-01	.645	4.865E-02	1.145	8.583E-03	1.645	5.905E-03	2.145	5.291E-03	2.645	0.
.155	7.823E-01	.655	4.802E-02	1.155	8.523E-03	1.655	5.886E-03	2.155	5.285E-03	2.655	0.
.165	7.050E-01	.665	4.743E-02	1.165	8.465E-03	1.665	5.867E-03	2.165	5.280E-03	2.665	0.
.175	6.578E-01	.675	4.687E-02	1.175	8.408E-03	1.675	5.849E-03	2.175	5.274E-03	2.675	0.
.185	6.169E-01	.685	4.634E-02	1.185	8.353E-03	1.685	5.831E-03	2.185	5.269E-03	2.685	0.
.195	5.714E-01	.695	4.503E-02	1.195	8.299E-03	1.695	5.813E-03	2.195	5.264E-03	2.695	0.
.205	6.190E-01	.705	4.533E-02	1.205	8.247E-03	1.705	5.796E-03	2.205	5.259E-03	2.705	0.
.215	4.973E-01	.715	4.483E-02	1.215	8.196E-03	1.715	5.779E-03	2.215	5.254E-03	2.715	0.
.225	4.613E-01	.725	2.167E-01	1.225	8.145E-03	1.725	5.763E-03	2.225	5.249E-03	2.725	0.
.235	1.126E+00	.735	4.059E-02	1.235	8.095E-03	1.735	5.746E-03	2.235	5.244E-03	2.735	0.
.245	3.846E-01	.745	4.020E-02	1.245	8.046E-03	1.745	5.729E-03	2.245	5.239E-03	2.745	0.
.255	2.949E-01	.755	3.982E-02	1.255	7.999E-03	1.755	5.713E-03	2.255	5.233E-03	2.755	0.
.265	2.745E-01	.765	3.945E-02	1.265	7.953E-03	1.765	5.698E-03	2.265	5.228E-03	2.765	0.
.275	3.231E-01	.775	3.910E-02	1.275	7.907E-03	1.775	5.683E-03	2.275	5.223E-03	2.775	0.
.285	2.356E-01	.785	3.875E-02	1.285	7.863E-03	1.785	5.668E-03	2.285	5.218E-03	2.785	0.
.295	2.223E-01	.795	1.717E-01	1.295	7.820E-03	1.795	5.654E-03	2.295	5.214E-03	2.795	0.
.305	2.714E-01	.805	3.588E-02	1.305	7.777E-03	1.805	5.639E-03	2.305	5.209E-03	2.805	0.
.315	1.960E-01	.815	3.560E-02	1.315	7.735E-03	1.815	5.624E-03	2.315	5.205E-03	2.815	0.
.325	2.494E-01	.825	3.533E-02	1.325	7.695E-03	1.825	5.610E-03	2.325	5.201E-03	2.825	0.
.335	4.002E-01	.835	3.508E-02	1.335	7.655E-03	1.835	5.596E-03	2.335	5.199E-03	2.835	0.
.345	1.525E-01	.845	3.484E-02	1.345	7.616E-03	1.845	5.583E-03	2.345	5.195E-03	2.845	0.
.355	1.463E-01	.855	3.459E-02	1.355	7.577E-03	1.855	5.570E-03	2.355	5.192E-03	2.855	0.
.365	1.406E-01	.865	1.524E-01	1.365	7.540E-03	1.865	5.557E-03	2.365	5.189E-03	2.865	0.
.375	1.356E-01	.875	3.239E-02	1.375	7.503E-03	1.875	5.544E-03	2.375	5.186E-03	2.875	0.
.385	1.309E-01	.885	3.220E-02	1.385	7.467E-03	1.885	5.531E-03	2.385	5.183E-03	2.885	0.
.395	1.267E-01	.895	3.199E-02	1.395	7.432E-03	1.895	5.519E-03	2.395	5.180E-03	2.895	0.
.405	1.228E-01	.905	3.168E-02	1.405	7.397E-03	1.905	5.506E-03	2.405	5.178E-03	2.905	0.
.415	1.193E-01	.915	8.947E-01	1.415	7.363E-03	1.915	5.495E-03	2.415	5.176E-03	2.915	0.
.425	1.161E-01	.925	1.950E-02	1.425	7.329E-03	1.925	5.483E-03	2.425	5.173E-03	2.925	0.
.435	1.131E-01	.935	1.936E-02	1.435	7.296E-03	1.935	5.472E-03	2.435	5.171E-03	2.935	0.
.445	1.104E-01	.945	1.922E-02	1.445	7.263E-03	1.945	5.460E-03	2.445	5.167E-03	2.945	0.
.455	1.078E-01	.955	1.900E-02	1.455	7.231E-03	1.955	5.448E-03	2.455	5.164E-03	2.955	0.
.465	2.044E-01	.965	7.216E-01	1.465	7.200E-03	1.965	5.437E-03	2.465	5.160E-03	2.965	0.
.475	9.930E-02	.975	9.881E-03	1.475	7.170E-03	1.975	5.426E-03	2.475	5.157E-03	2.975	0.
.485	9.726E-02	.985	9.786E-03	1.485	7.139E-03	1.985	5.416E-03	2.485	5.154E-03	2.985	0.
.495	9.536E-02	.995	9.695E-03	1.495	7.108E-03	1.995	5.406E-03	2.495	5.151E-03	2.995	0.
.505	9.351E-02	1.005	9.606E-03	1.505	7.080E-03	2.005	5.397E-03	2.505	5.148E-03	3.005	0.

TOTAL FLUX ENERGY SPECTRUM FOR THE PHASE 1 INFINITE MEDIUM

PHASE I, CASE 6, SANDSTONE, U, P=0.20, S=0.0

ENERGY	FLUX	ENERGY	FLUX	ENERGY	FLUX	ENERGY	FLUX	ENERGY	FLUX	ENERGY	FLUX
.015	8.785E-07	.515	1.292E-01	1.015	2.371E-02	1.515	8.165E-03	2.015	1.670E-03	2.515	0.
.025	5.654E-04	.525	8.590E-02	1.025	2.358E-02	1.525	8.149E-03	2.025	1.669E-03	2.525	0.
.035	2.768E-02	.535	8.446E-02	1.035	2.346E-02	1.535	8.133E-03	2.035	1.667E-03	2.535	0.
.045	2.660E-01	.545	8.312E-02	1.045	2.334E-02	1.545	8.118E-03	2.045	1.666E-03	2.545	0.
.055	8.388E-01	.555	8.183E-02	1.055	2.323E-02	1.555	8.104E-03	2.055	1.665E-03	2.555	0.
.065	1.366E+00	.565	8.061E-02	1.065	2.312E-02	1.565	8.089E-03	2.065	1.663E-03	2.565	0.
.075	1.519E+00	.575	7.946E-02	1.075	2.302E-02	1.575	8.072E-03	2.075	1.662E-03	2.575	0.
.085	1.530E+00	.585	7.835E-02	1.085	2.293E-02	1.585	4.584E-02	2.085	1.661E-03	2.585	0.
.095	1.532E+00	.595	7.703E-02	1.095	2.283E-02	1.595	7.819E-03	2.095	1.659E-03	2.595	0.
.105	1.312E+00	.605	1.296E+00	1.105	2.274E-02	1.605	7.807E-03	2.105	1.656E-03	2.605	0.
.115	1.198E+00	.615	4.347E-02	1.115	2.258E-02	1.615	7.795E-03	2.115	6.743E-02	2.615	0.
.125	1.084E+00	.625	4.277E-02	1.125	6.006E-01	1.625	7.782E-03	2.125	1.596E-03	2.625	0.
.135	9.851E-01	.635	4.211E-02	1.135	1.661E-02	1.635	7.771E-03	2.135	1.596E-03	2.635	0.
.145	9.006E-01	.645	4.148E-02	1.145	1.654E-02	1.645	7.759E-03	2.145	1.395E-03	2.645	0.
.155	8.323E-01	.655	4.086E-02	1.155	8.069E-02	1.655	7.746E-03	2.155	1.394E-03	2.655	0.
.165	7.361E-01	.665	8.319E-02	1.165	1.578E-02	1.665	6.591E-02	2.165	1.394E-03	2.665	0.
.175	6.656E-01	.675	3.877E-02	1.175	1.572E-02	1.675	7.401E-03	2.175	1.393E-03	2.675	0.
.185	7.415E-01	.685	3.825E-02	1.185	1.566E-02	1.685	7.391E-03	2.185	1.391E-03	2.685	0.
.195	5.579E-01	.695	3.775E-02	1.195	1.560E-02	1.695	7.381E-03	2.195	1.380E-03	2.695	0.
.205	5.129E-01	.705	3.726E-02	1.205	1.554E-02	1.705	7.372E-03	2.205	2.930E-01	2.705	0.
.215	4.831E-01	.715	3.680E-02	1.215	1.548E-02	1.715	7.355E-03	2.215	3.059E-04	2.715	0.
.225	4.550E-01	.725	3.636E-02	1.225	1.541E-02	1.725	1.654E-01	2.225	3.057E-04	2.725	0.
.235	4.241E-01	.735	3.595E-02	1.235	2.648E-01	1.735	6.499E-03	2.235	3.055E-04	2.735	0.
.245	5.384E-01	.745	3.555E-02	1.245	1.313E-02	1.745	6.487E-03	2.245	3.053E-04	2.745	0.
.255	3.664E-01	.755	3.512E-02	1.255	1.308E-02	1.755	6.437E-03	2.255	3.050E-04	2.755	0.
.265	3.267E-01	.765	1.852E-01	1.265	1.303E-02	1.765	8.160E-01	2.265	3.048E-04	2.765	0.
.275	3.078E-01	.775	3.167E-02	1.275	1.298E-02	1.775	2.278E-03	2.275	3.046E-04	2.775	0.
.285	2.913E-01	.785	5.783E-02	1.285	7.235E-02	1.785	2.275E-03	2.285	3.044E-04	2.785	0.
.295	6.691E-01	.795	3.057E-02	1.295	1.241E-02	1.795	2.271E-03	2.295	3.042E-04	2.795	0.
.305	2.321E-01	.805	6.378E-02	1.305	1.237E-02	1.805	2.267E-03	2.305	3.041E-04	2.805	0.
.315	2.217E-01	.815	2.941E-02	1.315	1.233E-02	1.815	2.264E-03	2.315	3.039E-04	2.815	0.
.325	2.125E-01	.825	2.914E-02	1.325	1.229E-02	1.825	2.260E-03	2.325	3.038E-04	2.825	0.
.335	2.042E-01	.835	2.887E-02	1.335	1.226E-02	1.835	2.251E-03	2.335	3.037E-04	2.835	0.
.345	1.964E-01	.845	2.862E-02	1.345	1.222E-02	1.845	1.147E-01	2.345	3.036E-04	2.845	0.
.355	1.009E+00	.855	2.838E-02	1.355	1.218E-02	1.855	1.706E-03	2.355	3.035E-04	2.855	0.
.365	1.335E-01	.865	2.814E-02	1.365	1.214E-02	1.865	1.703E-03	2.365	3.034E-04	2.865	0.
.375	1.284E-01	.875	2.792E-02	1.375	1.966E-01	1.875	1.700E-03	2.375	3.033E-04	2.875	0.
.385	1.238E-01	.885	2.771E-02	1.385	4.597E-02	1.885	1.697E-03	2.385	3.032E-04	2.885	0.
.395	1.196E-01	.895	2.750E-02	1.395	1.039E-02	1.895	1.695E-03	2.395	3.031E-04	2.895	0.
.405	1.158E-01	.905	2.729E-02	1.405	1.880E-01	1.905	1.692E-03	2.405	3.030E-04	2.905	0.
.415	1.123E-01	.915	2.709E-02	1.415	9.060E-03	1.915	1.690E-03	2.415	3.029E-04	2.915	0.
.425	1.091E-01	.925	2.688E-02	1.425	9.034E-03	1.925	1.688E-03	2.425	3.025E-04	2.925	0.
.435	1.061E-01	.935	1.340E-01	1.435	9.009E-03	1.935	1.686E-03	2.435	2.993E-04	2.935	0.
.445	1.034E-01	.945	2.509E-02	1.445	8.984E-03	1.945	1.683E-03	2.445	9.506E-02	2.945	0.
.455	1.008E-01	.955	2.492E-02	1.455	8.960E-03	1.955	1.681E-03	2.455	0.	2.955	0.
.465	9.846E-02	.965	2.476E-02	1.465	8.935E-03	1.965	1.679E-03	2.465	0.	2.965	0.
.475	9.626E-02	.975	2.461E-02	1.475	8.914E-03	1.975	1.677E-03	2.475	0.	2.975	0.
.485	9.419E-02	.985	2.446E-02	1.485	8.889E-03	1.985	1.675E-03	2.485	0.	2.985	0.
.495	9.227E-02	.995	2.432E-02	1.495	8.859E-03	1.995	1.673E-03	2.495	0.	2.995	0.
.505	9.048E-02	1.005	5.408E-02	1.505	1.099E-01	2.005	1.671E-03	2.505	0.	3.005	0.

TOTAL FLUX ENERGY SPECTRUM FOR THE PHASE 1 INFINITE MEDIUM

PHASE I, CASE 7, SANDSTONE, K, P=0.10, S=0.5

ENERGY	FLUX	ENERGY	FLUX	ENERGY	FLUX	ENERGY	FLUX	ENERGY	FLUX	ENERGY	FLUX
.015	8.461E-07	.515	1.517E-01	1.015	6.132E-02	1.515	0.	2.015	0.	2.515	0.
.025	5.316E-04	.525	1.140E-01	1.025	6.099E-02	1.525	0.	2.025	0.	2.525	0.
.035	2.540E-02	.535	1.112E-01	1.035	6.066E-02	1.535	0.	2.035	0.	2.535	0.
.045	2.385E-01	.545	1.087E-01	1.045	6.035E-02	1.545	0.	2.045	0.	2.545	0.
.055	7.386E-01	.555	1.062E-01	1.055	6.005E-02	1.555	0.	2.055	0.	2.555	0.
.065	1.172E+00	.565	1.039E-01	1.065	5.977E-02	1.565	0.	2.065	0.	2.565	0.
.075	1.371E+00	.575	1.017E-01	1.075	5.951E-02	1.575	0.	2.075	0.	2.575	0.
.085	1.392E+00	.585	9.966E-02	1.085	5.925E-02	1.585	0.	2.085	0.	2.585	0.
.095	1.322E+00	.595	9.771E-02	1.095	5.900E-02	1.595	0.	2.095	0.	2.595	0.
.105	1.214E+00	.605	9.585E-02	1.105	5.876E-02	1.605	0.	2.105	0.	2.605	0.
.115	1.108E+00	.615	9.408E-02	1.115	5.851E-02	1.615	0.	2.115	0.	2.615	0.
.125	1.020E+00	.625	9.241E-02	1.125	5.827E-02	1.625	0.	2.125	0.	2.625	0.
.135	9.233E-01	.635	9.083E-02	1.135	5.804E-02	1.635	0.	2.135	0.	2.635	0.
.145	8.299E-01	.645	8.933E-02	1.145	5.783E-02	1.645	0.	2.145	0.	2.645	0.
.155	7.490E-01	.655	8.786E-02	1.155	5.762E-02	1.655	0.	2.155	0.	2.655	0.
.165	6.815E-01	.665	8.646E-02	1.165	5.743E-02	1.665	0.	2.165	0.	2.665	0.
.175	6.258E-01	.675	8.514E-02	1.175	5.724E-02	1.675	0.	2.175	0.	2.675	0.
.185	5.778E-01	.685	8.389E-02	1.185	5.705E-02	1.685	0.	2.185	0.	2.685	0.
.195	5.377E-01	.695	8.268E-02	1.195	5.688E-02	1.695	0.	2.195	0.	2.695	0.
.205	5.052E-01	.705	8.150E-02	1.205	5.672E-02	1.705	0.	2.205	0.	2.705	0.
.215	4.972E-01	.715	8.038E-02	1.215	5.656E-02	1.715	0.	2.215	0.	2.715	0.
.225	5.136E-01	.725	7.931E-02	1.225	5.640E-02	1.725	0.	2.225	0.	2.725	0.
.235	4.648E-01	.735	7.830E-02	1.235	5.624E-02	1.735	0.	2.235	0.	2.735	0.
.245	4.236E-01	.745	7.732E-02	1.245	5.609E-02	1.745	0.	2.245	0.	2.745	0.
.255	3.884E-01	.755	7.636E-02	1.255	5.595E-02	1.755	0.	2.255	0.	2.755	0.
.265	3.581E-01	.765	7.544E-02	1.265	5.582E-02	1.765	0.	2.265	0.	2.765	0.
.275	3.318E-01	.775	7.456E-02	1.275	5.568E-02	1.775	0.	2.275	0.	2.775	0.
.285	3.088E-01	.785	7.373E-02	1.285	5.555E-02	1.785	0.	2.285	0.	2.785	0.
.295	2.885E-01	.795	7.293E-02	1.295	5.543E-02	1.795	0.	2.295	0.	2.795	0.
.305	2.706E-01	.805	7.217E-02	1.305	5.531E-02	1.805	0.	2.305	0.	2.805	0.
.315	2.549E-01	.815	7.142E-02	1.315	5.520E-02	1.815	0.	2.315	0.	2.815	0.
.325	2.409E-01	.825	7.071E-02	1.325	5.509E-02	1.825	0.	2.325	0.	2.825	0.
.335	2.282E-01	.835	7.003E-02	1.335	5.499E-02	1.835	0.	2.335	0.	2.835	0.
.345	2.168E-01	.845	6.939E-02	1.345	5.489E-02	1.845	0.	2.345	0.	2.845	0.
.355	2.063E-01	.855	6.876E-02	1.355	5.479E-02	1.855	0.	2.355	0.	2.855	0.
.365	1.969E-01	.865	6.816E-02	1.365	5.470E-02	1.865	0.	2.365	0.	2.865	0.
.375	1.802E-01	.875	6.758E-02	1.375	5.461E-02	1.875	0.	2.375	0.	2.875	0.
.385	1.803E-01	.885	6.704E-02	1.385	5.452E-02	1.885	0.	2.385	0.	2.885	0.
.395	1.730E-01	.895	6.650E-02	1.395	5.444E-02	1.895	0.	2.395	0.	2.895	0.
.405	1.664E-01	.905	6.596E-02	1.405	5.436E-02	1.905	0.	2.405	0.	2.905	0.
.415	1.602E-01	.915	6.545E-02	1.415	5.428E-02	1.915	0.	2.415	0.	2.915	0.
.425	1.546E-01	.925	6.495E-02	1.425	5.420E-02	1.925	0.	2.425	0.	2.925	0.
.435	1.493E-01	.935	6.448E-02	1.435	5.411E-02	1.935	0.	2.435	0.	2.935	0.
.445	1.444E-01	.945	6.403E-02	1.445	5.397E-02	1.945	0.	2.445	0.	2.945	0.
.455	1.399E-01	.955	6.359E-02	1.455	5.337E-02	1.955	0.	2.455	0.	2.955	0.
.465	1.356E-01	.965	6.316E-02	1.465	7.932E+00	1.965	0.	2.465	0.	2.965	0.
.475	1.316E-01	.975	6.276E-02	1.475	0.	1.975	0.	2.475	0.	2.975	0.
.485	1.279E-01	.985	6.237E-02	1.485	0.	1.985	0.	2.485	0.	2.985	0.
.495	1.244E-01	.995	6.201E-02	1.495	0.	1.995	0.	2.495	0.	2.995	0.
.505	1.211E-01	1.005	6.165E-02	1.505	0.	2.005	0.	2.505	0.	3.005	0.

TOTAL FLUX ENERGY SPECTRUM FOR THE PHASE I INFINITE MEDIUM

PHASE I, CASE 8, SANDSTONE, TH, P=0.10, S=0.5

ENERGY	FLUX	ENERGY	FLUX	ENERGY	FLUX	ENERGY	FLUX	ENERGY	FLUX	ENERGY	FLUX
.015	8.680E-07	.515	3.376E-01	1.015	8.276E-03	1.515	6.131E-03	2.015	4.685E-03	2.515	4.474E-03
.025	5.454E-04	.525	6.984E-02	1.025	8.203E-03	1.525	6.109E-03	2.025	4.678E-03	2.525	4.471E-03
.035	2.006E-02	.535	6.865E-02	1.035	8.131E-03	1.535	6.088E-03	2.035	4.671E-03	2.535	4.469E-03
.045	2.447E-01	.545	6.754E-02	1.045	8.061E-03	1.545	6.067E-03	2.045	4.665E-03	2.545	4.468E-03
.055	7.575E-01	.555	6.647E-02	1.055	7.993E-03	1.555	6.047E-03	2.055	4.657E-03	2.555	4.466E-03
.065	1.209E+00	.565	6.544E-02	1.065	7.928E-03	1.565	6.026E-03	2.065	4.650E-03	2.565	4.464E-03
.075	1.379E+00	.575	6.434E-02	1.075	7.866E-03	1.575	5.998E-03	2.075	4.643E-03	2.575	4.462E-03
.085	1.515E+00	.585	6.907E-01	1.085	7.805E-03	1.585	1.291E-01	2.085	4.637E-03	2.585	4.459E-03
.095	1.252E+00	.595	4.542E-02	1.095	7.746E-03	1.595	5.220E-03	2.095	4.630E-03	2.595	4.453E-03
.105	1.142E+00	.605	4.472E-02	1.105	7.687E-03	1.605	5.202E-03	2.105	4.624E-03	2.605	4.407E-03
.115	1.048E+00	.615	4.405E-02	1.115	7.628E-03	1.615	5.185E-03	2.115	4.618E-03	2.615	1.547E+00
.125	1.020E+00	.625	4.343E-02	1.125	7.571E-03	1.625	5.167E-03	2.125	4.612E-03	2.625	0.
.135	8.658E-01	.635	4.284E-02	1.135	7.515E-03	1.635	5.150E-03	2.135	4.607E-03	2.635	0.
.145	7.656E-01	.645	4.228E-02	1.145	7.461E-03	1.645	5.133E-03	2.145	4.601E-03	2.645	0.
.155	6.808E-01	.655	4.174E-02	1.155	7.409E-03	1.655	5.116E-03	2.155	4.596E-03	2.655	0.
.165	6.134E-01	.665	4.122E-02	1.165	7.359E-03	1.665	5.100E-03	2.165	4.591E-03	2.665	0.
.175	5.722E-01	.675	4.073E-02	1.175	7.310E-03	1.675	5.085E-03	2.175	4.587E-03	2.675	0.
.185	5.365E-01	.685	4.028E-02	1.185	7.261E-03	1.685	5.069E-03	2.185	4.582E-03	2.685	0.
.195	4.969E-01	.695	3.983E-02	1.195	7.215E-03	1.695	5.053E-03	2.195	4.578E-03	2.695	0.
.205	5.382E-01	.705	3.940E-02	1.205	7.169E-03	1.705	5.038E-03	2.205	4.574E-03	2.705	0.
.215	4.324E-01	.715	3.896E-02	1.215	7.125E-03	1.715	5.024E-03	2.215	4.569E-03	2.715	0.
.225	4.010E-01	.725	1.883E-01	1.225	7.081E-03	1.725	5.009E-03	2.225	4.565E-03	2.725	0.
.235	9.790E-01	.735	3.528E-02	1.235	7.038E-03	1.735	4.995E-03	2.235	4.561E-03	2.735	0.
.245	3.343E-01	.745	3.494E-02	1.245	6.995E-03	1.745	4.981E-03	2.245	4.556E-03	2.745	0.
.255	2.563E-01	.755	3.460E-02	1.255	6.954E-03	1.755	4.967E-03	2.255	4.551E-03	2.755	0.
.265	2.386E-01	.765	3.429E-02	1.265	6.914E-03	1.765	4.953E-03	2.265	4.547E-03	2.765	0.
.275	2.808E-01	.775	3.398E-02	1.275	6.874E-03	1.775	4.940E-03	2.275	4.542E-03	2.775	0.
.285	2.047E-01	.785	3.368E-02	1.285	6.836E-03	1.785	4.927E-03	2.285	4.538E-03	2.785	0.
.295	1.932E-01	.795	1.492E-01	1.295	6.798E-03	1.795	4.915E-03	2.295	4.534E-03	2.795	0.
.305	2.358E-01	.805	3.118E-02	1.305	6.761E-03	1.805	4.902E-03	2.305	4.530E-03	2.805	0.
.315	1.703E-01	.815	3.094E-02	1.315	6.725E-03	1.815	4.889E-03	2.315	4.527E-03	2.815	0.
.325	2.167E-01	.825	3.070E-02	1.325	6.690E-03	1.825	4.877E-03	2.325	4.523E-03	2.825	0.
.335	3.478E-01	.835	3.048E-02	1.335	6.655E-03	1.835	4.865E-03	2.335	4.520E-03	2.835	0.
.345	1.325E-01	.845	3.027E-02	1.345	6.621E-03	1.845	4.853E-03	2.345	4.517E-03	2.845	0.
.355	1.271E-01	.855	3.005E-02	1.355	6.588E-03	1.855	4.842E-03	2.355	4.514E-03	2.855	0.
.365	1.222E-01	.865	1.324E-01	1.365	6.555E-03	1.865	4.831E-03	2.365	4.511E-03	2.865	0.
.375	1.170E-01	.875	2.815E-02	1.375	6.523E-03	1.875	4.819E-03	2.375	4.508E-03	2.875	0.
.385	1.137E-01	.885	2.798E-02	1.385	6.492E-03	1.885	4.808E-03	2.385	4.506E-03	2.885	0.
.395	1.100E-01	.895	2.780E-02	1.395	6.461E-03	1.895	4.797E-03	2.395	4.504E-03	2.895	0.
.405	1.067E-01	.905	2.753E-02	1.405	6.431E-03	1.905	4.787E-03	2.405	4.502E-03	2.905	0.
.415	1.037E-01	.915	7.774E-01	1.415	6.401E-03	1.915	4.777E-03	2.415	4.500E-03	2.915	0.
.425	1.009E-01	.925	1.695E-02	1.425	6.372E-03	1.925	4.767E-03	2.425	4.498E-03	2.925	0.
.435	9.827E-02	.935	1.682E-02	1.435	6.343E-03	1.935	4.757E-03	2.435	4.496E-03	2.935	0.
.445	9.589E-02	.945	1.670E-02	1.445	6.315E-03	1.945	4.748E-03	2.445	4.493E-03	2.945	0.
.455	9.363E-02	.955	1.651E-02	1.455	6.287E-03	1.955	4.738E-03	2.455	4.490E-03	2.955	0.
.465	1.776E-01	.965	6.270E-01	1.465	6.260E-03	1.965	4.728E-03	2.465	4.487E-03	2.965	0.
.475	8.627E-02	.975	8.589E-03	1.475	6.233E-03	1.975	4.719E-03	2.475	4.484E-03	2.975	0.
.485	8.449E-02	.985	8.507E-03	1.485	6.206E-03	1.985	4.709E-03	2.485	4.481E-03	2.985	0.
.495	8.285E-02	.995	8.427E-03	1.495	6.179E-03	1.995	4.701E-03	2.495	4.478E-03	2.995	0.
.505	8.124E-02	1.005	8.350E-03	1.505	6.154E-03	2.005	4.693E-03	2.505	4.476E-03	3.005	0.

TOTAL FLUX ENERGY SPECTRUM FOR THE PHASE I INFINITE MEDIUM

PHASE I, CASE 9, SANDSTONE, U, P=0.10, S=0.5

ENERGY	FLUX	ENERGY	FLUX	ENERGY	FLUX	ENERGY	FLUX	ENERGY	FLUX	ENERGY	FLUX
.015	8.654E-07	.515	1.120E-01	1.015	2.060E-02	1.515	7.096E-03	2.015	1.452E-03	2.515	0.
.025	5.438E-04	.525	7.466E-02	1.025	2.049E-02	1.525	7.082E-03	2.025	1.451E-03	2.525	0.
.035	2.598E-02	.535	7.341E-02	1.035	2.039E-02	1.535	7.068E-03	2.035	1.450E-03	2.535	0.
.045	2.440E-01	.545	7.224E-02	1.045	2.029E-02	1.545	7.055E-03	2.045	1.449E-03	2.545	0.
.055	7.550E-01	.555	7.112E-02	1.055	2.019E-02	1.555	7.043E-03	2.055	1.448E-03	2.555	0.
.065	1.214E+00	.565	7.006E-02	1.065	2.010E-02	1.565	7.030E-03	2.065	1.447E-03	2.565	0.
.075	1.340E+00	.575	6.906E-02	1.075	2.001E-02	1.575	7.015E-03	2.075	1.445E-03	2.575	0.
.085	1.343E+00	.585	6.810E-02	1.085	1.993E-02	1.585	3.983E-02	2.085	1.444E-03	2.585	0.
.095	1.341E+00	.595	6.696E-02	1.095	1.985E-02	1.595	6.795E-03	2.095	1.443E-03	2.595	0.
.105	1.146E+00	.605	1.126E+00	1.105	1.976E-02	1.605	6.784E-03	2.105	1.440E-03	2.605	0.
.115	1.045E+00	.615	3.778E-02	1.115	1.963E-02	1.615	6.774E-03	2.115	5.862E-02	2.615	0.
.125	9.446E-01	.625	3.718E-02	1.125	5.220E-01	1.625	6.763E-03	2.125	1.214E-03	2.625	0.
.135	8.581E-01	.635	3.660E-02	1.135	1.444E-02	1.635	6.753E-03	2.135	1.214E-03	2.635	0.
.145	7.842E-01	.645	3.605E-02	1.145	1.437E-02	1.645	6.743E-03	2.145	1.213E-03	2.645	0.
.155	7.244E-01	.655	3.551E-02	1.155	7.012E-02	1.655	6.731E-03	2.155	1.213E-03	2.655	0.
.165	6.405E-01	.665	7.229E-02	1.165	1.372E-02	1.665	5.727E-02	2.165	1.212E-03	2.665	0.
.175	5.790E-01	.675	3.369E-02	1.175	1.366E-02	1.675	6.432E-03	2.175	1.211E-03	2.675	0.
.185	6.449E-01	.685	3.325E-02	1.185	1.361E-02	1.685	6.423E-03	2.185	1.210E-03	2.685	0.
.195	4.852E-01	.695	3.281E-02	1.195	1.356E-02	1.695	6.415E-03	2.195	1.200E-03	2.695	0.
.205	4.460E-01	.705	3.239E-02	1.205	1.351E-02	1.705	6.407E-03	2.205	2.547E-01	2.705	0.
.215	4.200E-01	.715	3.199E-02	1.215	1.346E-02	1.715	6.392E-03	2.215	2.600E-04	2.715	0.
.225	3.956E-01	.725	3.161E-02	1.225	1.339E-02	1.725	1.437E-01	2.225	2.658E-04	2.725	0.
.235	3.687E-01	.735	3.125E-02	1.235	2.301E-01	1.735	5.649E-03	2.235	2.657E-04	2.735	0.
.245	4.680E-01	.745	3.090E-02	1.245	1.141E-02	1.745	5.638E-03	2.245	2.655E-04	2.745	0.
.255	3.185E-01	.755	3.053E-02	1.255	1.137E-02	1.755	5.595E-03	2.255	2.653E-04	2.755	0.
.265	2.840E-01	.765	1.610E-01	1.265	1.133E-02	1.765	7.090E-01	2.265	2.651E-04	2.765	0.
.275	2.676E-01	.775	2.753E-02	1.275	1.129E-02	1.775	1.980E-03	2.275	2.649E-04	2.775	0.
.285	2.532E-01	.785	5.026E-02	1.285	6.288E-02	1.785	1.977E-03	2.285	2.647E-04	2.785	0.
.295	5.815E-01	.795	2.656E-02	1.295	1.079E-02	1.795	1.974E-03	2.295	2.646E-04	2.795	0.
.305	2.017E-01	.805	5.543E-02	1.305	1.075E-02	1.805	1.971E-03	2.305	2.644E-04	2.805	0.
.315	1.927E-01	.815	2.556E-02	1.315	1.072E-02	1.815	1.968E-03	2.315	2.643E-04	2.815	0.
.325	1.847E-01	.825	2.532E-02	1.325	1.069E-02	1.825	1.964E-03	2.325	2.642E-04	2.825	0.
.335	1.775E-01	.835	2.509E-02	1.335	1.065E-02	1.835	1.957E-03	2.335	2.640E-04	2.835	0.
.345	1.707E-01	.845	2.487E-02	1.345	1.062E-02	1.845	9.960E-02	2.345	2.639E-04	2.845	0.
.355	8.764E-01	.855	2.466E-02	1.355	1.059E-02	1.855	1.483E-03	2.355	2.638E-04	2.855	0.
.365	1.160E-01	.865	2.446E-02	1.365	1.055E-02	1.865	1.480E-03	2.365	2.637E-04	2.865	0.
.375	1.116E-01	.875	2.426E-02	1.375	1.709E-01	1.875	1.478E-03	2.375	2.637E-04	2.875	0.
.385	1.076E-01	.885	2.408E-02	1.385	3.996E-02	1.885	1.476E-03	2.385	2.636E-04	2.885	0.
.395	1.040E-01	.895	2.390E-02	1.395	9.035E-03	1.895	1.474E-03	2.395	2.635E-04	2.895	0.
.405	1.006E-01	.905	2.372E-02	1.405	1.634E-01	1.905	1.471E-03	2.405	2.634E-04	2.905	0.
.415	9.759E-02	.915	2.354E-02	1.415	7.875E-03	1.915	1.469E-03	2.415	2.633E-04	2.915	0.
.425	9.481E-02	.925	2.336E-02	1.425	7.853E-03	1.925	1.467E-03	2.425	2.630E-04	2.925	0.
.435	9.222E-02	.935	1.172E-01	1.435	7.831E-03	1.935	1.465E-03	2.435	2.603E-04	2.935	0.
.445	8.984E-02	.945	2.180E-02	1.445	7.809E-03	1.945	1.464E-03	2.445	8.263E-02	2.945	0.
.455	8.762E-02	.955	2.166E-02	1.455	7.788E-03	1.955	1.462E-03	2.455	0.	2.955	0.
.465	8.556E-02	.965	2.152E-02	1.465	7.767E-03	1.965	1.460E-03	2.465	0.	2.965	0.
.475	8.365E-02	.975	2.139E-02	1.475	7.746E-03	1.975	1.458E-03	2.475	0.	2.975	0.
.485	8.185E-02	.985	2.126E-02	1.485	7.725E-03	1.985	1.456E-03	2.485	0.	2.985	0.
.495	8.019E-02	.995	2.114E-02	1.495	7.699E-03	1.995	1.455E-03	2.495	0.	2.995	0.
.505	7.862E-02	1.005	4.699E-02	1.505	9.548E-02	2.005	1.453E-03	2.505	0.	3.005	0.

TOTAL FLUX ENERGY SPECTRUM FOR THE PHASE 1 INFINITE MEDIUM

PHASE I, CASE 10, SANDSTONE, K, P=0.25, S=0.5

ENERGY	FLUX	ENERGY	FLUX	ENERGY	FLUX	ENERGY	FLUX	ENERGY	FLUX	ENERGY	FLUX
.015	1.171E-06	.515	1.734E-01	1.015	7.032E-02	1.515	0.	2.015	0.	2.515	0.
.025	7.089E-04	.525	1.307E-01	1.025	6.994E-02	1.525	0.	2.025	0.	2.525	0.
.035	3.265E-02	.535	1.276E-01	1.035	6.957E-02	1.535	0.	2.035	0.	2.535	0.
.045	2.962E-01	.545	1.246E-01	1.045	6.921E-02	1.545	0.	2.045	0.	2.545	0.
.055	8.917E-01	.555	1.218E-01	1.055	6.887E-02	1.555	0.	2.055	0.	2.555	0.
.065	1.390E+00	.565	1.192E-01	1.065	6.854E-02	1.565	0.	2.065	0.	2.565	0.
.075	1.607E+00	.575	1.167E-01	1.075	6.823E-02	1.575	0.	2.075	0.	2.575	0.
.085	1.619E+00	.585	1.143E-01	1.085	6.794E-02	1.585	0.	2.085	0.	2.585	0.
.095	1.532E+00	.595	1.120E-01	1.095	6.766E-02	1.595	0.	2.095	0.	2.595	0.
.105	1.403E+00	.605	1.099E-01	1.105	6.738E-02	1.605	0.	2.105	0.	2.605	0.
.115	1.278E+00	.615	1.079E-01	1.115	6.709E-02	1.615	0.	2.115	0.	2.615	0.
.125	1.174E+00	.625	1.060E-01	1.125	6.681E-02	1.625	0.	2.125	0.	2.625	0.
.135	1.062E+00	.635	1.042E-01	1.135	6.655E-02	1.635	0.	2.135	0.	2.635	0.
.145	9.542E-01	.645	1.024E-01	1.145	6.630E-02	1.645	0.	2.145	0.	2.645	0.
.155	8.607E-01	.655	1.007E-01	1.155	6.607E-02	1.655	0.	2.155	0.	2.655	0.
.165	7.829E-01	.665	9.915E-02	1.165	6.584E-02	1.665	0.	2.165	0.	2.665	0.
.175	7.186E-01	.675	9.763E-02	1.175	6.563E-02	1.675	0.	2.175	0.	2.675	0.
.185	6.634E-01	.685	9.620E-02	1.185	6.542E-02	1.685	0.	2.185	0.	2.685	0.
.195	6.172E-01	.695	9.481E-02	1.195	6.522E-02	1.695	0.	2.195	0.	2.695	0.
.205	5.798E-01	.705	9.345E-02	1.205	6.503E-02	1.705	0.	2.205	0.	2.705	0.
.215	5.705E-01	.715	9.216E-02	1.215	6.485E-02	1.715	0.	2.215	0.	2.715	0.
.225	5.893E-01	.725	9.094E-02	1.225	6.467E-02	1.725	0.	2.225	0.	2.725	0.
.235	5.333E-01	.735	8.978E-02	1.235	6.449E-02	1.735	0.	2.235	0.	2.735	0.
.245	4.860E-01	.745	8.866E-02	1.245	6.432E-02	1.745	0.	2.245	0.	2.745	0.
.255	4.456E-01	.755	8.755E-02	1.255	6.416E-02	1.755	0.	2.255	0.	2.755	0.
.265	4.108E-01	.765	8.650E-02	1.265	6.400E-02	1.765	0.	2.265	0.	2.765	0.
.275	3.806E-01	.775	8.550E-02	1.275	6.384E-02	1.775	0.	2.275	0.	2.775	0.
.285	3.541E-01	.785	8.454E-02	1.285	6.370E-02	1.785	0.	2.285	0.	2.785	0.
.295	3.308E-01	.795	8.364E-02	1.295	6.356E-02	1.795	0.	2.295	0.	2.795	0.
.305	3.104E-01	.805	8.276E-02	1.305	6.342E-02	1.805	0.	2.305	0.	2.805	0.
.315	2.924E-01	.815	8.190E-02	1.315	6.329E-02	1.815	0.	2.315	0.	2.815	0.
.325	2.762E-01	.825	8.109E-02	1.325	6.317E-02	1.825	0.	2.325	0.	2.825	0.
.335	2.617E-01	.835	8.031E-02	1.335	6.304E-02	1.835	0.	2.335	0.	2.835	0.
.345	2.486E-01	.845	7.957E-02	1.345	6.293E-02	1.845	0.	2.345	0.	2.845	0.
.355	2.366E-01	.855	7.885E-02	1.355	6.282E-02	1.855	0.	2.355	0.	2.855	0.
.365	2.258E-01	.865	7.816E-02	1.365	6.271E-02	1.865	0.	2.365	0.	2.865	0.
.375	2.159E-01	.875	7.750E-02	1.375	6.261E-02	1.875	0.	2.375	0.	2.875	0.
.385	2.067E-01	.885	7.687E-02	1.385	6.251E-02	1.885	0.	2.385	0.	2.885	0.
.395	1.984E-01	.895	7.626E-02	1.395	6.241E-02	1.895	0.	2.395	0.	2.895	0.
.405	1.908E-01	.905	7.564E-02	1.405	6.232E-02	1.905	0.	2.405	0.	2.905	0.
.415	1.837E-01	.915	7.505E-02	1.415	6.223E-02	1.915	0.	2.415	0.	2.915	0.
.425	1.773E-01	.925	7.448E-02	1.425	6.214E-02	1.925	0.	2.425	0.	2.925	0.
.435	1.712E-01	.935	7.394E-02	1.435	6.204E-02	1.935	0.	2.435	0.	2.935	0.
.445	1.656E-01	.945	7.342E-02	1.445	6.189E-02	1.945	0.	2.445	0.	2.945	0.
.455	1.604E-01	.955	7.292E-02	1.455	6.121E-02	1.955	0.	2.455	0.	2.955	0.
.465	1.555E-01	.965	7.243E-02	1.465	9.097E+00	1.965	0.	2.465	0.	2.965	0.
.475	1.509E-01	.975	7.197E-02	1.475	0.	1.975	0.	2.475	0.	2.975	0.
.485	1.466E-01	.985	7.153E-02	1.485	0.	1.985	0.	2.485	0.	2.985	0.
.495	1.426E-01	.995	7.111E-02	1.495	0.	1.995	0.	2.495	0.	2.995	0.
.505	1.388E-01	1.005	7.071E-02	1.505	0.	2.005	0.	2.505	0.	3.005	0.

TOTAL FLUX ENERGY SPECTRUM FOR THE PHASE I INFINITE MEDIUM

PHASE I, CASE 11, SANDSTONE, TH, P=0.25, S=0.5

ENERGY	FLUX	ENERGY	FLUX	ENERGY	FLUX	ENERGY	FLUX	ENERGY	FLUX	ENERGY	FLUX
.015	1.201E-06	.515	3.853E-01	1.015	9.498E-03	1.515	7.037E-03	2.015	5.377E-03	2.515	5.137E-03
.025	7.270E-04	.525	8.011E-02	1.025	9.414E-03	1.525	7.012E-03	2.025	5.369E-03	2.525	5.134E-03
.035	3.349E-02	.535	7.875E-02	1.035	9.331E-03	1.535	6.987E-03	2.035	5.362E-03	2.535	5.132E-03
.045	3.037E-01	.545	7.748E-02	1.045	9.251E-03	1.545	6.964E-03	2.045	5.354E-03	2.545	5.130E-03
.055	9.141E-01	.555	7.625E-02	1.055	9.174E-03	1.555	6.940E-03	2.055	5.345E-03	2.555	5.128E-03
.065	1.433E+00	.565	7.507E-02	1.065	9.099E-03	1.565	6.916E-03	2.065	5.337E-03	2.565	5.126E-03
.075	1.615E+00	.575	7.381E-02	1.075	9.026E-03	1.575	6.885E-03	2.075	5.329E-03	2.575	5.123E-03
.085	1.762E+00	.585	7.922E-01	1.085	8.956E-03	1.585	1.481E-01	2.085	5.321E-03	2.585	5.120E-03
.095	1.451E+00	.595	5.211E-02	1.095	8.888E-03	1.595	5.992E-03	2.095	5.314E-03	2.595	5.113E-03
.105	1.319E+00	.605	5.130E-02	1.105	8.821E-03	1.605	5.971E-03	2.105	5.307E-03	2.605	5.062E-03
.115	1.209E+00	.615	5.054E-02	1.115	8.753E-03	1.615	5.951E-03	2.115	5.300E-03	2.615	1.775E+00
.125	1.175E+00	.625	4.982E-02	1.125	8.687E-03	1.625	5.931E-03	2.125	5.293E-03	2.625	0.
.135	9.962E-01	.635	4.915E-02	1.135	8.624E-03	1.635	5.911E-03	2.135	5.287E-03	2.635	0.
.145	8.803E-01	.645	4.850E-02	1.145	8.562E-03	1.645	5.892E-03	2.145	5.281E-03	2.645	0.
.155	7.824E-01	.655	4.788E-02	1.155	8.502E-03	1.655	5.873E-03	2.155	5.275E-03	2.655	0.
.165	7.046E-01	.665	4.729E-02	1.165	8.444E-03	1.665	5.855E-03	2.165	5.269E-03	2.665	0.
.175	6.570E-01	.675	4.673E-02	1.175	8.388E-03	1.675	5.836E-03	2.175	5.264E-03	2.675	0.
.185	6.159E-01	.685	4.620E-02	1.185	8.332E-03	1.685	5.818E-03	2.185	5.259E-03	2.685	0.
.195	5.703E-01	.695	4.569E-02	1.195	8.279E-03	1.695	5.800E-03	2.195	5.254E-03	2.695	0.
.205	6.176E-01	.705	4.520E-02	1.205	8.227E-03	1.705	5.783E-03	2.205	5.249E-03	2.705	0.
.215	4.962E-01	.715	4.470E-02	1.215	8.176E-03	1.715	5.767E-03	2.215	5.244E-03	2.715	0.
.225	4.602E-01	.725	2.160E-01	1.225	8.125E-03	1.725	5.750E-03	2.225	5.239E-03	2.725	0.
.235	1.123E+00	.735	4.047E-02	1.235	8.076E-03	1.735	5.734E-03	2.235	5.234E-03	2.735	0.
.245	3.835E-01	.745	4.008E-02	1.245	8.027E-03	1.745	5.717E-03	2.245	5.229E-03	2.745	0.
.255	2.941E-01	.755	3.970E-02	1.255	7.980E-03	1.755	5.701E-03	2.255	5.224E-03	2.755	0.
.265	2.737E-01	.765	3.933E-02	1.265	7.934E-03	1.765	5.686E-03	2.265	5.218E-03	2.765	0.
.275	3.221E-01	.775	3.898E-02	1.275	7.888E-03	1.775	5.671E-03	2.275	5.213E-03	2.775	0.
.285	2.348E-01	.785	3.864E-02	1.285	7.844E-03	1.785	5.656E-03	2.285	5.209E-03	2.785	0.
.295	2.216E-01	.795	1.712E-01	1.295	7.801E-03	1.795	5.642E-03	2.295	5.204E-03	2.795	0.
.305	2.705E-01	.805	3.577E-02	1.305	7.758E-03	1.805	5.627E-03	2.305	5.200E-03	2.805	0.
.315	1.954E-01	.815	3.549E-02	1.315	7.716E-03	1.815	5.612E-03	2.315	5.195E-03	2.815	0.
.325	2.485E-01	.825	3.523E-02	1.325	7.676E-03	1.825	5.598E-03	2.325	5.191E-03	2.825	0.
.335	3.989E-01	.835	3.497E-02	1.335	7.636E-03	1.835	5.585E-03	2.335	5.188E-03	2.835	0.
.345	1.520E-01	.845	3.473E-02	1.345	7.597E-03	1.845	5.571E-03	2.345	5.186E-03	2.845	0.
.355	1.457E-01	.855	3.448E-02	1.355	7.559E-03	1.855	5.558E-03	2.355	5.182E-03	2.855	0.
.365	1.401E-01	.865	1.519E-01	1.365	7.521E-03	1.865	5.545E-03	2.365	5.179E-03	2.865	0.
.375	1.351E-01	.875	3.229E-02	1.375	7.485E-03	1.875	5.532E-03	2.375	5.176E-03	2.875	0.
.385	1.304E-01	.885	3.210E-02	1.385	7.449E-03	1.885	5.520E-03	2.385	5.174E-03	2.885	0.
.395	1.262E-01	.895	3.190E-02	1.395	7.413E-03	1.895	5.507E-03	2.395	5.171E-03	2.895	0.
.405	1.223E-01	.905	3.159E-02	1.405	7.379E-03	1.905	5.495E-03	2.405	5.169E-03	2.905	0.
.415	1.189E-01	.915	8.917E-01	1.415	7.345E-03	1.915	5.483E-03	2.415	5.166E-03	2.915	0.
.425	1.156E-01	.925	1.944E-02	1.425	7.311E-03	1.925	5.472E-03	2.425	5.164E-03	2.925	0.
.435	1.127E-01	.935	1.930E-02	1.435	7.278E-03	1.935	5.460E-03	2.435	5.162E-03	2.935	0.
.445	1.099E-01	.945	1.916E-02	1.445	7.246E-03	1.945	5.449E-03	2.445	5.158E-03	2.945	0.
.455	1.073E-01	.955	1.895E-02	1.455	7.214E-03	1.955	5.437E-03	2.455	5.155E-03	2.955	0.
.465	2.037E-01	.965	7.192E-01	1.465	7.183E-03	1.965	5.426E-03	2.465	5.151E-03	2.965	0.
.475	9.890E-02	.975	9.857E-03	1.475	7.151E-03	1.975	5.416E-03	2.475	5.148E-03	2.975	0.
.485	9.686E-02	.985	9.763E-03	1.485	7.122E-03	1.985	5.405E-03	2.485	5.145E-03	2.985	0.
.495	9.497E-02	.995	9.672E-03	1.495	7.092E-03	1.995	5.395E-03	2.495	5.142E-03	2.995	0.
.505	9.313E-02	1.005	9.584E-03	1.505	7.063E-03	2.005	5.386E-03	2.505	5.139E-03	3.005	0.

TOTAL FLUX ENERGY SPECTRUM FOR THE PHASE I INFINITE MEDIUM

PHASE I, CASE 12, SANDSTONE, U, P=0.25, S=0.5

ENERGY	FLUX	ENERGY	FLUX	ENERGY	FLUX	ENERGY	FLUX	ENERGY	FLUX	ENERGY	FLUX
.015	1.197E-06	.515	1.277E-01	1.015	2.363E-02	1.515	8.141E-03	2.015	1.666E-03	2.515	0.
.025	7.246E-04	.525	8.564E-02	1.025	2.351E-02	1.525	8.125E-03	2.025	1.665E-03	2.525	0.
.035	3.338E-02	.535	8.420E-02	1.035	2.339E-02	1.535	8.109E-03	2.035	1.663E-03	2.535	0.
.045	3.027E-01	.545	8.286E-02	1.045	2.327E-02	1.545	8.094E-03	2.045	1.662E-03	2.545	0.
.055	9.108E-01	.555	8.157E-02	1.055	2.316E-02	1.555	8.080E-03	2.055	1.661E-03	2.555	0.
.065	1.438E+00	.565	8.035E-02	1.065	2.305E-02	1.565	8.065E-03	2.065	1.659E-03	2.565	0.
.075	1.571E+00	.575	7.921E-02	1.075	2.295E-02	1.575	8.049E-03	2.075	1.658E-03	2.575	0.
.085	1.563E+00	.585	7.811E-02	1.085	2.285E-02	1.585	4.569E-02	2.085	1.657E-03	2.585	0.
.095	1.553E+00	.595	7.681E-02	1.095	2.276E-02	1.595	7.796E-03	2.095	1.655E-03	2.595	0.
.105	1.325E+00	.605	1.292E+00	1.105	2.266E-02	1.605	7.784E-03	2.105	1.652E-03	2.605	0.
.115	1.205E+00	.615	4.334E-02	1.115	2.251E-02	1.615	7.772E-03	2.115	6.723E-02	2.615	0.
.125	1.088E+00	.625	4.264E-02	1.125	5.986E-01	1.625	7.760E-03	2.125	1.393E-03	2.625	0.
.135	9.875E-01	.635	4.198E-02	1.135	1.656E-02	1.635	7.748E-03	2.135	1.392E-03	2.635	0.
.145	9.017E-01	.645	4.135E-02	1.145	1.648E-02	1.645	7.737E-03	2.145	1.392E-03	2.645	0.
.155	8.325E-01	.655	4.073E-02	1.155	8.042E-02	1.655	7.723E-03	2.155	1.391E-03	2.655	0.
.165	7.358E-01	.665	8.292E-02	1.165	1.573E-02	1.665	6.570E-02	2.165	1.390E-03	2.665	0.
.175	6.651E-01	.675	3.864E-02	1.175	1.567E-02	1.675	7.380E-03	2.175	1.390E-03	2.675	0.
.185	7.405E-01	.685	3.813E-02	1.185	1.561E-02	1.685	7.370E-03	2.185	1.388E-03	2.685	0.
.195	5.570E-01	.695	3.763E-02	1.195	1.555E-02	1.695	7.360E-03	2.195	1.377E-03	2.695	0.
.205	5.120E-01	.705	3.715E-02	1.205	1.549E-02	1.705	7.351E-03	2.205	2.922E-01	2.705	0.
.215	4.821E-01	.715	3.669E-02	1.215	1.543E-02	1.715	7.334E-03	2.215	3.052E-04	2.715	0.
.225	4.540E-01	.725	3.625E-02	1.225	1.536E-02	1.725	1.649E-01	2.225	3.050E-04	2.725	0.
.235	4.231E-01	.735	3.584E-02	1.235	2.639E-01	1.735	6.481E-03	2.235	3.049E-04	2.735	0.
.245	5.370E-01	.745	3.543E-02	1.245	1.309E-02	1.745	6.469E-03	2.245	3.046E-04	2.745	0.
.255	3.655E-01	.755	3.501E-02	1.255	1.304E-02	1.755	6.421E-03	2.255	3.044E-04	2.755	0.
.265	3.258E-01	.765	1.846E-01	1.265	1.299E-02	1.765	8.134E-01	2.265	3.042E-04	2.765	0.
.275	3.070E-01	.775	3.157E-02	1.275	1.294E-02	1.775	2.272E-03	2.275	3.040E-04	2.775	0.
.285	2.905E-01	.785	5.765E-02	1.285	7.211E-02	1.785	2.269E-03	2.285	3.038E-04	2.785	0.
.295	6.671E-01	.795	3.047E-02	1.295	1.237E-02	1.795	2.265E-03	2.295	3.036E-04	2.795	0.
.305	2.314E-01	.805	6.358E-02	1.305	1.233E-02	1.805	2.261E-03	2.305	3.034E-04	2.805	0.
.315	2.211E-01	.815	2.932E-02	1.315	1.229E-02	1.815	2.258E-03	2.315	3.033E-04	2.815	0.
.325	2.119E-01	.825	2.904E-02	1.325	1.226E-02	1.825	2.254E-03	2.325	3.031E-04	2.825	0.
.335	2.036E-01	.835	2.878E-02	1.335	1.222E-02	1.835	2.245E-03	2.335	3.030E-04	2.835	0.
.345	1.958E-01	.845	2.853E-02	1.345	1.218E-02	1.845	1.144E-01	2.345	3.030E-04	2.845	0.
.355	1.005E+00	.855	2.828E-02	1.355	1.215E-02	1.855	1.701E-03	2.355	3.029E-04	2.855	0.
.365	1.331E-01	.865	2.805E-02	1.365	1.210E-02	1.865	1.699E-03	2.365	3.028E-04	2.865	0.
.375	1.280E-01	.875	2.783E-02	1.375	1.960E-01	1.875	1.696E-03	2.375	3.027E-04	2.875	0.
.385	1.234E-01	.885	2.762E-02	1.385	4.582E-02	1.885	1.693E-03	2.385	3.026E-04	2.885	0.
.395	1.192E-01	.895	2.741E-02	1.395	1.036E-02	1.895	1.691E-03	2.395	3.025E-04	2.895	0.
.405	1.154E-01	.905	2.720E-02	1.405	1.874E-01	1.905	1.688E-03	2.405	3.024E-04	2.905	0.
.415	1.119E-01	.915	2.700E-02	1.415	9.033E-03	1.915	1.686E-03	2.415	3.023E-04	2.915	0.
.425	1.087E-01	.925	2.680E-02	1.425	9.007E-03	1.925	1.684E-03	2.425	3.019E-04	2.925	0.
.435	1.058E-01	.935	1.344E-01	1.435	8.982E-03	1.935	1.682E-03	2.435	2.989E-04	2.935	0.
.445	1.030E-01	.945	2.501E-02	1.445	8.957E-03	1.945	1.679E-03	2.445	9.481E-02	2.945	0.
.455	1.005E-01	.955	2.484E-02	1.455	8.933E-03	1.955	1.677E-03	2.455	0.	2.955	0.
.465	9.812E-02	.965	2.468E-02	1.465	8.909E-03	1.965	1.675E-03	2.465	0.	2.965	0.
.475	9.592E-02	.975	2.453E-02	1.475	8.885E-03	1.975	1.673E-03	2.475	0.	2.975	0.
.485	9.386E-02	.985	2.439E-02	1.485	8.863E-03	1.985	1.671E-03	2.485	0.	2.985	0.
.495	9.195E-02	.995	2.424E-02	1.495	8.833E-03	1.995	1.669E-03	2.495	0.	2.995	0.
.505	9.016E-02	1.005	5.390E-02	1.505	1.095E-01	2.005	1.667E-03	2.505	0.	3.005	0.

TOTAL FLUX ENERGY SPECTRUM FOR THE PHASE I INFINITE MEDIUM

PHASE I, CASE 13, SANDSTONE, K, P=0.10, S=1.0

ENERGY	FLUX	ENERGY	FLUX	ENERGY	FLUX	ENERGY	FLUX	ENERGY	FLUX	ENERGY	FLUX
.015	9.144E-07	.515	1.481E-01	1.015	5.994E-02	1.515	0.	2.015	0.	2.515	0.
.025	5.633E-04	.525	1.114E-01	1.025	5.962E-02	1.525	0.	2.025	0.	2.525	0.
.035	2.640E-02	.535	1.087E-01	1.035	5.930E-02	1.535	0.	2.035	0.	2.535	0.
.045	2.434E-01	.545	1.063E-01	1.045	5.900E-02	1.545	0.	2.045	0.	2.545	0.
.055	7.423E-01	.555	1.039E-01	1.055	5.871E-02	1.555	0.	2.055	0.	2.555	0.
.065	1.167E+00	.565	1.016E-01	1.065	5.843E-02	1.565	0.	2.065	0.	2.565	0.
.075	1.356E+00	.575	9.946E-02	1.075	5.816E-02	1.575	0.	2.075	0.	2.575	0.
.085	1.371E+00	.585	9.743E-02	1.085	5.791E-02	1.585	0.	2.085	0.	2.585	0.
.095	1.300E+00	.595	9.552E-02	1.095	5.767E-02	1.595	0.	2.095	0.	2.595	0.
.105	1.192E+00	.605	9.370E-02	1.105	5.744E-02	1.605	0.	2.105	0.	2.605	0.
.115	1.087E+00	.615	9.197E-02	1.115	5.719E-02	1.615	0.	2.115	0.	2.615	0.
.125	9.990E-01	.625	9.034E-02	1.125	5.696E-02	1.625	0.	2.125	0.	2.625	0.
.135	9.042E-01	.635	8.880E-02	1.135	5.674E-02	1.635	0.	2.135	0.	2.635	0.
.145	8.125E-01	.645	8.732E-02	1.145	5.653E-02	1.645	0.	2.145	0.	2.645	0.
.155	7.330E-01	.655	8.589E-02	1.155	5.633E-02	1.655	0.	2.155	0.	2.655	0.
.165	6.669E-01	.665	8.453E-02	1.165	5.614E-02	1.665	0.	2.165	0.	2.665	0.
.175	6.122E-01	.675	8.323E-02	1.175	5.595E-02	1.675	0.	2.175	0.	2.675	0.
.185	5.652E-01	.685	8.201E-02	1.185	5.577E-02	1.685	0.	2.185	0.	2.685	0.
.195	5.259E-01	.695	6.083E-02	1.195	5.560E-02	1.695	0.	2.195	0.	2.695	0.
.205	4.941E-01	.705	7.967E-02	1.205	5.544E-02	1.705	0.	2.205	0.	2.705	0.
.215	4.862E-01	.715	7.857E-02	1.215	5.529E-02	1.715	0.	2.215	0.	2.715	0.
.225	5.022E-01	.725	7.753E-02	1.225	5.513E-02	1.725	0.	2.225	0.	2.725	0.
.235	4.545E-01	.735	7.654E-02	1.235	5.498E-02	1.735	0.	2.235	0.	2.735	0.
.245	4.142E-01	.745	7.559E-02	1.245	5.484E-02	1.745	0.	2.245	0.	2.745	0.
.255	3.798E-01	.755	7.465E-02	1.255	5.470E-02	1.755	0.	2.255	0.	2.755	0.
.265	3.502E-01	.765	7.375E-02	1.265	5.456E-02	1.765	0.	2.265	0.	2.765	0.
.275	3.244E-01	.775	7.289E-02	1.275	5.443E-02	1.775	0.	2.275	0.	2.775	0.
.285	3.019E-01	.785	7.208E-02	1.285	5.431E-02	1.785	0.	2.285	0.	2.785	0.
.295	2.820E-01	.795	7.130E-02	1.295	5.419E-02	1.795	0.	2.295	0.	2.795	0.
.305	2.646E-01	.805	7.055E-02	1.305	5.407E-02	1.805	0.	2.305	0.	2.805	0.
.315	2.492E-01	.815	6.982E-02	1.315	5.396E-02	1.815	0.	2.315	0.	2.815	0.
.325	2.355E-01	.825	6.913E-02	1.325	5.386E-02	1.825	0.	2.325	0.	2.825	0.
.335	2.231E-01	.835	6.846E-02	1.335	5.375E-02	1.835	0.	2.335	0.	2.835	0.
.345	2.119E-01	.845	6.783E-02	1.345	5.366E-02	1.845	0.	2.345	0.	2.845	0.
.355	2.017E-01	.855	6.721E-02	1.355	5.356E-02	1.855	0.	2.355	0.	2.855	0.
.365	1.925E-01	.865	6.663E-02	1.365	5.347E-02	1.865	0.	2.365	0.	2.865	0.
.375	1.840E-01	.875	6.607E-02	1.375	5.338E-02	1.875	0.	2.375	0.	2.875	0.
.385	1.762E-01	.885	6.553E-02	1.385	5.330E-02	1.885	0.	2.385	0.	2.885	0.
.395	1.691E-01	.895	6.501E-02	1.395	5.322E-02	1.895	0.	2.395	0.	2.895	0.
.405	1.626E-01	.905	6.448E-02	1.405	5.314E-02	1.905	0.	2.405	0.	2.905	0.
.415	1.566E-01	.915	6.398E-02	1.415	5.306E-02	1.915	0.	2.415	0.	2.915	0.
.425	1.511E-01	.925	6.350E-02	1.425	5.298E-02	1.925	0.	2.425	0.	2.925	0.
.435	1.460E-01	.935	6.303E-02	1.435	5.290E-02	1.935	0.	2.435	0.	2.935	0.
.445	1.412E-01	.945	6.259E-02	1.445	5.277E-02	1.945	0.	2.445	0.	2.945	0.
.455	1.367E-01	.955	6.216E-02	1.455	5.218E-02	1.955	0.	2.455	0.	2.955	0.
.465	1.325E-01	.965	6.175E-02	1.465	7.754E+00	1.965	0.	2.465	0.	2.965	0.
.475	1.287E-01	.975	6.135E-02	1.475	0.	1.975	0.	2.475	0.	2.975	0.
.485	1.250E-01	.985	6.098E-02	1.485	0.	1.985	0.	2.485	0.	2.985	0.
.495	1.216E-01	.995	6.062E-02	1.495	0.	1.995	0.	2.495	0.	2.995	0.
.505	1.183E-01	1.005	6.027E-02	1.505	0.	2.005	0.	2.505	0.	3.005	0.

TOTAL FLUX ENERGY SPECTRUM FOR THE PHASE I INFINITE MEDIUM

PHASE I, CASE 14, SANDSTONE, TH, P=0.10, S=1.0

ENERGY	FLUX	ENERGY	FLUX	ENERGY	FLUX	ENERGY	FLUX	ENERGY	FLUX	ENERGY	FLUX
.015	9.377E-07	.515	3.292E-01	1.015	8.093E-03	1.515	5.996E-03	2.015	4.581E-03	2.515	4.376E-03
.025	5.777E-04	.525	6.828E-02	1.025	8.022E-03	1.525	5.974E-03	2.025	4.574E-03	2.525	4.374E-03
.035	2.707E-02	.535	6.711E-02	1.035	7.951E-03	1.535	5.954E-03	2.035	4.569E-03	2.535	4.372E-03
.045	2.496E-01	.545	6.603E-02	1.045	7.883E-03	1.545	5.933E-03	2.045	4.562E-03	2.545	4.370E-03
.055	7.610E-01	.555	6.498E-02	1.055	7.817E-03	1.555	5.913E-03	2.055	4.555E-03	2.555	4.368E-03
.065	1.203E+00	.565	6.398E-02	1.065	7.753E-03	1.565	5.893E-03	2.065	4.548E-03	2.565	4.366E-03
.075	1.363E+00	.575	6.290E-02	1.075	7.691E-03	1.575	5.066E-03	2.075	4.541E-03	2.575	4.365E-03
.085	1.492E+00	.585	6.752E-01	1.085	7.631E-03	1.585	1.262E-01	2.085	4.535E-03	2.585	4.362E-03
.095	1.231E+00	.595	4.441E-02	1.095	7.574E-03	1.595	5.105E-03	2.095	4.528E-03	2.595	4.356E-03
.105	1.121E+00	.605	4.372E-02	1.105	7.516E-03	1.605	5.088E-03	2.105	4.522E-03	2.605	4.312E-03
.115	1.027E+00	.615	4.307E-02	1.115	7.458E-03	1.615	5.070E-03	2.115	4.516E-03	2.615	1.513E+00
.125	9.995E-01	.625	4.246E-02	1.125	7.403E-03	1.625	5.053E-03	2.125	4.511E-03	2.625	0.
.135	8.478E-01	.635	4.180E-02	1.135	7.349E-03	1.635	5.036E-03	2.135	4.505E-03	2.635	0.
.145	7.494E-01	.645	4.134E-02	1.145	7.296E-03	1.645	5.020E-03	2.145	4.500E-03	2.645	0.
.155	6.662E-01	.655	4.080E-02	1.155	7.246E-03	1.655	5.004E-03	2.155	4.495E-03	2.655	0.
.165	6.001E-01	.665	4.030E-02	1.165	7.196E-03	1.665	4.988E-03	2.165	4.491E-03	2.665	0.
.175	5.597E-01	.675	3.982E-02	1.175	7.148E-03	1.675	4.973E-03	2.175	4.486E-03	2.675	0.
.185	5.247E-01	.685	3.938E-02	1.185	7.101E-03	1.685	4.957E-03	2.185	4.482E-03	2.685	0.
.195	4.859E-01	.695	3.894E-02	1.195	7.055E-03	1.695	4.942E-03	2.195	4.478E-03	2.695	0.
.205	5.263E-01	.705	3.852E-02	1.205	7.011E-03	1.705	4.927E-03	2.205	4.473E-03	2.705	0.
.215	4.228E-01	.715	3.809E-02	1.215	6.968E-03	1.715	4.913E-03	2.215	4.469E-03	2.715	0.
.225	3.921E-01	.725	1.841E-01	1.225	6.925E-03	1.725	4.899E-03	2.225	4.465E-03	2.725	0.
.235	9.572E-01	.735	3.449E-02	1.235	6.882E-03	1.735	4.885E-03	2.235	4.460E-03	2.735	0.
.245	3.268E-01	.745	3.416E-02	1.245	6.841E-03	1.745	4.871E-03	2.245	4.456E-03	2.745	0.
.255	2.506E-01	.755	3.383E-02	1.255	6.801E-03	1.755	4.857E-03	2.255	4.451E-03	2.755	0.
.265	2.332E-01	.765	3.352E-02	1.265	6.761E-03	1.765	4.844E-03	2.265	4.447E-03	2.765	0.
.275	2.745E-01	.775	3.322E-02	1.275	6.722E-03	1.775	4.831E-03	2.275	4.443E-03	2.775	0.
.285	2.001E-01	.785	3.293E-02	1.285	6.685E-03	1.785	4.819E-03	2.285	4.439E-03	2.785	0.
.295	1.889E-01	.795	1.459E-01	1.295	6.648E-03	1.795	4.807E-03	2.295	4.435E-03	2.795	0.
.305	2.305E-01	.805	3.049E-02	1.305	6.611E-03	1.805	4.794E-03	2.305	4.431E-03	2.805	0.
.315	1.665E-01	.815	3.025E-02	1.315	6.576E-03	1.815	4.782E-03	2.315	4.427E-03	2.815	0.
.325	2.118E-01	.825	3.002E-02	1.325	6.542E-03	1.825	4.770E-03	2.325	4.424E-03	2.825	0.
.335	3.400E-01	.835	2.980E-02	1.335	6.508E-03	1.835	4.758E-03	2.335	4.421E-03	2.835	0.
.345	1.295E-01	.845	2.960E-02	1.345	6.474E-03	1.845	4.747E-03	2.345	4.418E-03	2.845	0.
.355	1.242E-01	.855	2.938E-02	1.355	6.442E-03	1.855	4.736E-03	2.355	4.415E-03	2.855	0.
.365	1.194E-01	.865	1.294E-01	1.365	6.410E-03	1.865	4.725E-03	2.365	4.412E-03	2.865	0.
.375	1.151E-01	.875	2.752E-02	1.375	6.379E-03	1.875	4.713E-03	2.375	4.410E-03	2.875	0.
.385	1.111E-01	.885	2.735E-02	1.385	6.348E-03	1.885	4.703E-03	2.385	4.407E-03	2.885	0.
.395	1.076E-01	.895	2.718E-02	1.395	6.318E-03	1.895	4.692E-03	2.395	4.405E-03	2.895	0.
.405	1.043E-01	.905	2.692E-02	1.405	6.288E-03	1.905	4.682E-03	2.405	4.403E-03	2.905	0.
.415	1.013E-01	.915	7.600E-01	1.415	6.260E-03	1.915	4.672E-03	2.415	4.401E-03	2.915	0.
.425	9.859E-02	.925	1.657E-02	1.425	6.231E-03	1.925	4.662E-03	2.425	4.400E-03	2.925	0.
.435	9.605E-02	.935	1.645E-02	1.435	6.203E-03	1.935	4.652E-03	2.435	4.398E-03	2.935	0.
.445	9.372E-02	.945	1.633E-02	1.445	6.175E-03	1.945	4.642E-03	2.445	4.394E-03	2.945	0.
.455	9.151E-02	.955	1.615E-02	1.455	6.148E-03	1.955	4.632E-03	2.455	4.391E-03	2.955	0.
.465	1.736E-01	.965	6.129E-01	1.465	6.121E-03	1.965	4.623E-03	2.465	4.388E-03	2.965	0.
.475	8.431E-02	.975	8.399E-03	1.475	6.095E-03	1.975	4.614E-03	2.475	4.386E-03	2.975	0.
.485	8.258E-02	.985	8.319E-03	1.485	6.069E-03	1.985	4.605E-03	2.485	4.383E-03	2.985	0.
.495	8.097E-02	.995	8.241E-03	1.495	6.043E-03	1.995	4.596E-03	2.495	4.380E-03	2.995	0.
.505	7.940E-02	1.005	8.166E-03	1.505	6.018E-03	2.005	4.588E-03	2.505	4.378E-03	3.005	0.

TOTAL FLUX ENERGY SPECTRUM FOR THE PHASE I INFINITE MEDIUM

PHASE I, CASE 15, SANDSTONE, U, P=0,10, S=1,0

ENERGY	FLUX	ENERGY	FLUX	ENERGY	FLUX	ENERGY	FLUX	ENERGY	FLUX	ENERGY	FLUX
.015	9.348E-07	.515	1.091E-01	1.015	2.014E-02	1.515	6.930E-03	2.015	1.420E-03	2.515	0.
.025	5.759E-04	.525	7.299E-02	1.025	2.004E-02	1.525	6.924E-03	2.025	1.419E-03	2.525	0.
.035	2.699E-02	.535	7.176E-02	1.035	1.993E-02	1.535	6.910E-03	2.035	1.418E-03	2.535	0.
.045	2.488E-01	.545	7.062E-02	1.045	1.983E-02	1.545	6.898E-03	2.045	1.417E-03	2.545	0.
.055	7.583E-01	.555	6.952E-02	1.055	1.974E-02	1.555	6.886E-03	2.055	1.416E-03	2.555	0.
.065	1.208E+00	.565	6.849E-02	1.065	1.965E-02	1.565	6.873E-03	2.065	1.415E-03	2.565	0.
.075	1.326E+00	.575	6.751E-02	1.075	1.956E-02	1.575	6.859E-03	2.075	1.413E-03	2.575	0.
.085	1.324E+00	.585	6.657E-02	1.085	1.948E-02	1.585	3.894E-02	2.085	1.412E-03	2.585	0.
.095	1.318E+00	.595	6.546E-02	1.095	1.940E-02	1.595	6.643E-03	2.095	1.411E-03	2.595	0.
.105	1.125E+00	.605	1.101E+00	1.105	1.932E-02	1.605	6.633E-03	2.105	1.408E-03	2.605	0.
.115	1.025E+00	.615	3.694E-02	1.115	1.919E-02	1.615	6.623E-03	2.115	5.731E-02	2.615	0.
.125	9.256E-01	.625	3.634E-02	1.125	5.102E-01	1.625	6.613E-03	2.125	1.108E-03	2.625	0.
.135	8.404E-01	.635	3.578E-02	1.135	1.412E-02	1.635	6.603E-03	2.135	1.187E-03	2.635	0.
.145	7.677E-01	.645	3.525E-02	1.145	1.405E-02	1.645	6.593E-03	2.145	1.186E-03	2.645	0.
.155	7.089E-01	.655	3.472E-02	1.155	6.854E-02	1.655	6.582E-03	2.155	1.186E-03	2.655	0.
.165	6.267E-01	.665	7.067E-02	1.165	1.341E-02	1.665	5.599E-02	2.165	1.185E-03	2.665	0.
.175	5.665E-01	.675	3.294E-02	1.175	1.336E-02	1.675	6.289E-03	2.175	1.185E-03	2.675	0.
.185	6.308E-01	.685	3.250E-02	1.185	1.330E-02	1.685	6.280E-03	2.185	1.103E-03	2.685	0.
.195	4.746E-01	.695	3.208E-02	1.195	1.325E-02	1.695	6.272E-03	2.195	1.174E-03	2.695	0.
.205	4.362E-01	.705	3.166E-02	1.205	1.320E-02	1.705	6.264E-03	2.205	2.490E-01	2.705	0.
.215	4.108E-01	.715	3.127E-02	1.215	1.316E-02	1.715	6.250E-03	2.215	2.601E-04	2.715	0.
.225	3.868E-01	.725	3.090E-02	1.225	1.309E-02	1.725	1.405E-01	2.225	2.600E-04	2.725	0.
.235	3.605E-01	.735	3.055E-02	1.235	2.250E-01	1.735	5.523E-03	2.235	2.598E-04	2.735	0.
.245	4.576E-01	.745	3.020E-02	1.245	1.115E-02	1.745	5.512E-03	2.245	2.596E-04	2.745	0.
.255	3.114E-01	.755	2.985E-02	1.255	1.111E-02	1.755	5.471E-03	2.255	2.594E-04	2.755	0.
.265	2.777E-01	.765	1.570E-01	1.265	1.108E-02	1.765	6.932E-01	2.265	2.592E-04	2.765	0.
.275	2.616E-01	.775	[illegible]	1.275	1.103E-02	1.775	1.936E-03	2.275	2.591E-04	2.775	0.
.285	2.476E-01	.785	4.914E-02	1.285	6.147E-02	1.785	1.933E-03	2.285	2.589E-04	2.785	0.
.295	5.685E-01	.795	2.597E-02	1.295	1.055E-02	1.795	1.930E-03	2.295	2.587E-04	2.795	0.
.305	1.972E-01	.805	5.418E-02	1.305	1.051E-02	1.805	1.927E-03	2.305	2.586E-04	2.805	0.
.315	1.884E-01	.815	2.479E-02	1.315	1.048E-02	1.815	1.924E-03	2.315	2.585E-04	2.815	0.
.325	1.806E-01	.825	2.475E-02	1.325	1.045E-02	1.825	1.921E-03	2.325	2.583E-04	2.825	0.
.335	1.735E-01	.835	2.453E-02	1.335	1.042E-02	1.835	1.913E-03	2.335	2.582E-04	2.835	0.
.345	1.669E-01	.845	2.431E-02	1.345	1.038E-02	1.845	9.745E-02	2.345	2.581E-04	2.845	0.
.355	8.568E-01	.855	2.411E-02	1.355	1.035E-02	1.855	1.450E-03	2.355	2.580E-04	2.855	0.
.365	1.134E-01	.865	2.391E-02	1.365	1.031E-02	1.865	1.448E-03	2.365	2.579E-04	2.865	0.
.375	1.091E-01	.875	2.372E-02	1.375	1.670E-01	1.875	1.445E-03	2.375	2.579E-04	2.875	0.
.385	1.052E-01	.885	2.354E-02	1.385	3.906E-02	1.885	1.443E-03	2.385	2.578E-04	2.885	0.
.395	1.016E-01	.895	2.336E-02	1.395	8.833E-03	1.895	1.441E-03	2.395	2.577E-04	2.895	0.
.405	9.837E-02	.905	2.318E-02	1.405	1.597E-01	1.905	1.439E-03	2.405	2.576E-04	2.905	0.
.415	9.540E-02	.915	2.301E-02	1.415	7.699E-03	1.915	1.437E-03	2.415	2.575E-04	2.915	0.
.425	9.266E-02	.925	2.284E-02	1.425	7.677E-03	1.925	1.435E-03	2.425	2.572E-04	2.925	0.
.435	9.015E-02	.935	1.145E-01	1.435	7.656E-03	1.935	1.433E-03	2.435	2.546E-04	2.935	0.
.445	8.782E-02	.945	2.132E-02	1.445	7.635E-03	1.945	1.431E-03	2.445	8.079E-02	2.945	0.
.455	8.565E-02	.955	2.117E-02	1.455	7.614E-03	1.955	1.429E-03	2.455	0.	2.955	0.
.465	8.364E-02	.965	2.104E-02	1.465	7.594E-03	1.965	1.427E-03	2.465	0.	2.965	0.
.475	8.177E-02	.975	2.091E-02	1.475	7.573E-03	1.975	1.426E-03	2.475	0.	2.975	0.
.485	8.001E-02	.985	2.078E-02	1.485	7.553E-03	1.985	1.424E-03	2.485	0.	2.985	0.
.495	7.838E-02	.995	2.066E-02	1.495	7.528E-03	1.995	1.422E-03	2.495	0.	2.995	0.
.505	7.686E-02	1.005	4.594E-02	1.505	9.334E-02	2.005	1.421E-03	2.505	0.	3.005	0.

TOTAL FLUX ENERGY SPECTRUM FOR THE PHASE I INFINITE MEDIUM

PHASE I, CASE 16, SANDSTONE, K, P=0.30, S=1.0

ENERGY	FLUX	ENERGY	FLUX	ENERGY	FLUX	ENERGY	FLUX	ENERGY	FLUX	ENERGY	FLUX
.015	1.727E-06	.515	1.671E-01	1.015	6.827E-02	1.515	0.	2.015	0.	2.515	0.
.025	9.620E-04	.525	1.269E-01	1.025	6.791E-02	1.525	0.	2.025	0.	2.525	0.
.035	4.080E-02	.535	1.239E-01	1.035	6.754E-02	1.535	0.	2.035	0.	2.535	0.
.045	3.425E-01	.545	1.210E-01	1.045	6.719E-02	1.545	0.	2.045	0.	2.545	0.
.055	9.685E-01	.555	1.183E-01	1.055	6.686E-02	1.555	0.	2.055	0.	2.555	0.
.065	1.450E+00	.565	1.157E-01	1.065	6.654E-02	1.565	0.	2.065	0.	2.565	0.
.075	1.635E+00	.575	1.133E-01	1.075	6.624E-02	1.575	0.	2.075	0.	2.575	0.
.085	1.623E+00	.585	1.110E-01	1.085	6.596E-02	1.585	0.	2.085	0.	2.585	0.
.095	1.521E+00	.595	1.088E-01	1.095	6.568E-02	1.595	0.	2.095	0.	2.595	0.
.105	1.385E+00	.605	1.067E-01	1.105	6.541E-02	1.605	0.	2.105	0.	2.605	0.
.115	1.256E+00	.615	1.047E-01	1.115	6.513E-02	1.615	0.	2.115	0.	2.615	0.
.125	1.150E+00	.625	1.029E-01	1.125	6.487E-02	1.625	0.	2.125	0.	2.625	0.
.135	1.039E+00	.635	1.011E-01	1.135	6.461E-02	1.635	0.	2.135	0.	2.635	0.
.145	9.317E-01	.645	9.945E-02	1.145	6.437E-02	1.645	0.	2.145	0.	2.645	0.
.155	8.395E-01	.655	9.782E-02	1.155	6.414E-02	1.655	0.	2.155	0.	2.655	0.
.165	7.630E-01	.665	9.627E-02	1.165	6.393E-02	1.665	0.	2.165	0.	2.665	0.
.175	6.998E-01	.675	9.479E-02	1.175	6.371E-02	1.675	0.	2.175	0.	2.675	0.
.185	6.457E-01	.685	9.340E-02	1.185	6.351E-02	1.685	0.	2.185	0.	2.685	0.
.195	6.005E-01	.695	9.205E-02	1.195	6.332E-02	1.695	0.	2.195	0.	2.695	0.
.205	5.639E-01	.705	9.074E-02	1.205	6.314E-02	1.705	0.	2.205	0.	2.705	0.
.215	5.548E-01	.715	8.949E-02	1.215	6.297E-02	1.715	0.	2.215	0.	2.715	0.
.225	5.728E-01	.725	8.830E-02	1.225	6.278E-02	1.725	0.	2.225	0.	2.725	0.
.235	5.183E-01	.735	8.717E-02	1.235	6.261E-02	1.735	0.	2.235	0.	2.735	0.
.245	4.723E-01	.745	8.608E-02	1.245	6.244E-02	1.745	0.	2.245	0.	2.745	0.
.255	4.330E-01	.755	8.501E-02	1.255	6.229E-02	1.755	0.	2.255	0.	2.755	0.
.265	3.991E-01	.765	8.399E-02	1.265	6.213E-02	1.765	0.	2.265	0.	2.765	0.
.275	3.697E-01	.775	8.301E-02	1.275	6.198E-02	1.775	0.	2.275	0.	2.775	0.
.285	3.440E-01	.785	8.208E-02	1.285	6.184E-02	1.785	0.	2.285	0.	2.785	0.
.295	3.214E-01	.795	8.120E-02	1.295	6.170E-02	1.795	0.	2.295	0.	2.795	0.
.305	3.015E-01	.805	8.034E-02	1.305	6.157E-02	1.805	0.	2.305	0.	2.805	0.
.315	2.840E-01	.815	7.951E-02	1.315	6.145E-02	1.815	0.	2.315	0.	2.815	0.
.325	2.683E-01	.825	7.872E-02	1.325	6.132E-02	1.825	0.	2.325	0.	2.825	0.
.335	2.541E-01	.835	7.796E-02	1.335	6.121E-02	1.835	0.	2.335	0.	2.835	0.
.345	2.414E-01	.845	7.724E-02	1.345	6.109E-02	1.845	0.	2.345	0.	2.845	0.
.355	2.298E-01	.855	7.655E-02	1.355	6.099E-02	1.855	0.	2.355	0.	2.855	0.
.365	2.192E-01	.865	7.588E-02	1.365	6.088E-02	1.865	0.	2.365	0.	2.865	0.
.375	2.096E-01	.875	7.524E-02	1.375	6.078E-02	1.875	0.	2.375	0.	2.875	0.
.385	2.007E-01	.885	7.463E-02	1.385	6.069E-02	1.885	0.	2.385	0.	2.885	0.
.395	1.926E-01	.895	7.404E-02	1.395	6.060E-02	1.895	0.	2.395	0.	2.895	0.
.405	1.852E-01	.905	7.344E-02	1.405	6.051E-02	1.905	0.	2.405	0.	2.905	0.
.415	1.784E-01	.915	7.286E-02	1.415	6.042E-02	1.915	0.	2.415	0.	2.915	0.
.425	1.721E-01	.925	7.231E-02	1.425	6.033E-02	1.925	0.	2.425	0.	2.925	0.
.435	1.662E-01	.935	7.179E-02	1.435	6.024E-02	1.935	0.	2.435	0.	2.935	0.
.445	1.608E-01	.945	7.128E-02	1.445	6.010E-02	1.945	0.	2.445	0.	2.945	0.
.455	1.557E-01	.955	7.079E-02	1.455	5.948E-02	1.955	0.	2.455	0.	2.955	0.
.465	1.509E-01	.965	7.032E-02	1.465	8.831E+00	1.965	0.	2.465	0.	2.965	0.
.475	1.465E-01	.975	6.987E-02	1.475	0.	1.975	0.	2.475	0.	2.975	0.
.485	1.423E-01	.985	6.945E-02	1.485	0.	1.985	0.	2.485	0.	2.985	0.
.495	1.384E-01	.995	6.904E-02	1.495	0.	1.995	0.	2.495	0.	2.995	0.
.505	1.347E-01	1.005	6.865E-02	1.505	0.	2.005	0.	2.505	0.	3.005	0.

TOTAL FLUX ENERGY SPECTRUM FOR THE PHASE 1 INFINITE MEDIUM

PHASE I, CASE 17, SANDSTONE, TH, P=0.30, S=1.0

ENERGY	FLUX	ENERGY	FLUX	ENERGY	FLUX	ENERGY	FLUX	ENERGY	FLUX	ENERGY	FLUX
.015	1.768E-06	.515	3.700E-01	1.015	9.232E-03	1.515	6.839E-03	2.015	5.230E-03	2.515	4.997E-03
.025	9.850E-04	.525	7.781E-02	1.025	9.151E-03	1.525	6.815E-03	2.025	5.222E-03	2.525	4.995E-03
.035	4.178E-02	.535	7.648E-02	1.035	9.070E-03	1.535	6.791E-03	2.035	5.215E-03	2.535	4.993E-03
.045	3.507E-01	.545	7.524E-02	1.045	8.992E-03	1.545	6.768E-03	2.045	5.207E-03	2.545	4.991E-03
.055	9.913E-01	.555	7.405E-02	1.055	8.917E-03	1.555	6.745E-03	2.055	5.199E-03	2.555	4.989E-03
.065	1.492E+00	.565	7.291E-02	1.065	8.844E-03	1.565	6.721E-03	2.065	5.191E-03	2.565	4.987E-03
.075	1.642E+00	.575	7.169E-02	1.075	8.773E-03	1.575	6.693E-03	2.075	5.183E-03	2.575	4.985E-03
.085	1.761E+00	.585	7.691E-01	1.085	8.705E-03	1.585	1.438E-01	2.085	5.176E-03	2.585	4.982E-03
.095	1.440E+00	.595	5.061E-02	1.095	8.639E-03	1.595	5.825E-03	2.095	5.168E-03	2.595	4.976E-03
.105	1.301E+00	.605	4.983E-02	1.105	8.574E-03	1.605	5.805E-03	2.105	5.161E-03	2.605	4.929E-03
.115	1.187E+00	.615	4.908E-02	1.115	8.508E-03	1.615	5.786E-03	2.115	5.155E-03	2.615	1.725E+00
.125	1.150E+00	.625	4.839E-02	1.125	8.444E-03	1.625	5.766E-03	2.125	5.148E-03	2.625	0.
.135	9.735E-01	.635	4.773E-02	1.135	8.382E-03	1.635	5.747E-03	2.135	5.142E-03	2.635	0.
.145	8.591E-01	.645	4.711E-02	1.145	8.322E-03	1.645	5.728E-03	2.145	5.136E-03	2.645	0.
.155	7.627E-01	.655	4.650E-02	1.155	8.264E-03	1.655	5.710E-03	2.155	5.131E-03	2.655	0.
.165	6.864E-01	.665	4.592E-02	1.165	8.207E-03	1.665	5.692E-03	2.165	5.125E-03	2.665	0.
.175	6.395E-01	.675	4.530E-02	1.175	8.152E-03	1.675	5.675E-03	2.175	5.120E-03	2.675	0.
.185	5.991E-01	.685	4.487E-02	1.185	8.099E-03	1.685	5.657E-03	2.185	5.115E-03	2.685	0.
.195	5.547E-01	.695	4.438E-02	1.195	8.047E-03	1.695	5.640E-03	2.195	5.110E-03	2.695	0.
.205	6.004E-01	.705	4.389E-02	1.205	7.996E-03	1.705	5.623E-03	2.205	5.106E-03	2.705	0.
.215	4.823E-01	.715	4.341E-02	1.215	7.947E-03	1.715	5.607E-03	2.215	5.101E-03	2.715	0.
.225	4.473E-01	.725	2.097E-01	1.225	7.898E-03	1.725	5.591E-03	2.225	5.096E-03	2.725	0.
.235	1.091E+00	.735	3.930E-02	1.235	7.849E-03	1.735	5.575E-03	2.235	5.091E-03	2.735	0.
.245	3.725E-01	.745	3.893E-02	1.245	7.802E-03	1.745	5.559E-03	2.245	5.086E-03	2.745	0.
.255	2.856E-01	.755	3.855E-02	1.255	7.756E-03	1.755	5.543E-03	2.255	5.081E-03	2.755	0.
.265	2.657E-01	.765	3.820E-02	1.265	7.711E-03	1.765	5.528E-03	2.265	5.076E-03	2.765	0.
.275	3.128E-01	.775	3.786E-02	1.275	7.667E-03	1.775	5.514E-03	2.275	5.071E-03	2.775	0.
.285	2.280E-01	.785	3.752E-02	1.285	7.624E-03	1.785	5.499E-03	2.285	5.066E-03	2.785	0.
.295	2.151E-01	.795	1.662E-01	1.295	7.582E-03	1.795	5.485E-03	2.295	5.062E-03	2.795	0.
.305	2.626E-01	.805	3.474E-02	1.305	7.540E-03	1.805	5.471E-03	2.305	5.058E-03	2.805	0.
.315	1.896E-01	.815	3.447E-02	1.315	7.500E-03	1.815	5.457E-03	2.315	5.054E-03	2.815	0.
.325	2.413E-01	.825	3.421E-02	1.325	7.460E-03	1.825	5.443E-03	2.325	5.050E-03	2.825	0.
.335	3.872E-01	.835	3.396E-02	1.335	7.421E-03	1.835	5.430E-03	2.335	5.046E-03	2.835	0.
.345	1.475E-01	.845	3.372E-02	1.345	7.384E-03	1.845	5.417E-03	2.345	5.043E-03	2.845	0.
.355	1.414E-01	.855	3.349E-02	1.355	7.347E-03	1.855	5.405E-03	2.355	5.040E-03	2.855	0.
.365	1.360E-01	.865	1.474E-01	1.365	7.310E-03	1.865	5.392E-03	2.365	5.037E-03	2.865	0.
.375	1.310E-01	.875	3.136E-02	1.375	7.275E-03	1.875	5.380E-03	2.375	5.034E-03	2.875	0.
.385	1.265E-01	.885	3.117E-02	1.385	7.240E-03	1.885	5.367E-03	2.385	5.031E-03	2.885	0.
.395	1.224E-01	.895	3.098E-02	1.395	7.205E-03	1.895	5.355E-03	2.395	5.029E-03	2.895	0.
.405	1.187E-01	.905	3.069E-02	1.405	7.172E-03	1.905	5.343E-03	2.405	5.026E-03	2.905	0.
.415	1.153E-01	.915	8.655E-01	1.415	7.139E-03	1.915	5.332E-03	2.415	5.024E-03	2.915	0.
.425	1.122E-01	.925	1.889E-02	1.425	7.106E-03	1.925	5.321E-03	2.425	5.022E-03	2.925	0.
.435	1.093E-01	.935	1.875E-02	1.435	7.074E-03	1.935	5.310E-03	2.435	5.020E-03	2.935	0.
.445	1.066E-01	.945	1.862E-02	1.445	7.043E-03	1.945	5.299E-03	2.445	5.017E-03	2.945	0.
.455	1.041E-01	.955	1.841E-02	1.455	7.012E-03	1.955	5.288E-03	2.455	5.013E-03	2.955	0.
.465	1.976E-01	.965	6.981E-01	1.465	6.982E-03	1.965	5.277E-03	2.465	5.010E-03	2.965	0.
.475	9.591E-02	.975	9.581E-03	1.475	6.952E-03	1.975	5.267E-03	2.475	5.008E-03	2.975	0.
.485	9.394E-02	.985	9.489E-03	1.485	6.922E-03	1.985	5.257E-03	2.485	5.005E-03	2.985	0.
.495	9.211E-02	.995	9.401E-03	1.495	6.892E-03	1.995	5.247E-03	2.495	5.003E-03	2.995	0.
.505	9.032E-02	1.005	9.315E-03	1.505	6.865E-03	2.005	5.230E-03	2.505	5.000E-03	3.005	0.

TOTAL FLUX ENERGY SPECTRUM FOR THE PHASE I INFINITE MEDIUM

PHASE I, CASE 18, SANDSTONE, U, P=0.30, S=1.0

ENERGY	FLUX	ENERGY	FLUX	ENERGY	FLUX	ENERGY	FLUX	ENERGY	FLUX	ENERGY	FLUX
.015	1.762E-06	.515	1.226E-01	1.015	2.294E-02	1.515	7.906E-03	2.015	1.619E-03	2.515	0.
.025	9.813E-04	.525	8.315E-02	1.025	2.283E-02	1.525	7.890E-03	2.025	1.618E-03	2.525	0.
.035	4.162E-02	.535	8.175E-02	1.035	2.271E-02	1.535	7.874E-03	2.035	1.617E-03	2.535	0.
.045	3.493E-01	.545	8.045E-02	1.045	2.259E-02	1.545	7.860E-03	2.045	1.616E-03	2.545	0.
.055	9.873E-01	.555	7.920E-02	1.055	2.248E-02	1.555	7.846E-03	2.055	1.614E-03	2.555	0.
.065	1.496E+00	.565	7.802E-02	1.065	2.238E-02	1.565	7.832E-03	2.065	1.613E-03	2.565	0.
.075	1.598E+00	.575	7.691E-02	1.075	2.228E-02	1.575	7.817E-03	2.075	1.612E-03	2.575	0.
.085	1.567E+00	.585	7.584E-02	1.085	2.219E-02	1.585	4.436E-02	2.085	1.611E-03	2.585	0.
.095	1.541E+00	.595	7.460E-02	1.095	2.210E-02	1.595	7.572E-03	2.095	1.609E-03	2.595	0.
.105	1.307E+00	.605	1.254E+00	1.105	2.201E-02	1.605	7.560E-03	2.105	1.606E-03	2.605	0.
.115	1.184E+00	.615	4.208E-02	1.115	2.186E-02	1.615	7.549E-03	2.115	6.531E-02	2.615	0.
.125	1.066E+00	.625	4.140E-02	1.125	5.811E-01	1.625	7.537E-03	2.125	1.354E-03	2.625	0.
.135	9.655E-01	.635	4.076E-02	1.135	1.608E-02	1.635	7.526E-03	2.135	1.354E-03	2.635	0.
.145	8.804E-01	.645	4.015E-02	1.145	1.601E-02	1.645	7.515E-03	2.145	1.353E-03	2.645	0.
.155	8.119E-01	.655	3.955E-02	1.155	7.806E-02	1.655	7.502E-03	2.155	1.352E-03	2.655	0.
.165	7.170E-01	.665	8.050E-02	1.165	1.528E-02	1.665	6.379E-02	2.165	1.352E-03	2.665	0.
.175	6.476E-01	.675	3.752E-02	1.175	1.521E-02	1.675	7.160E-03	2.175	1.351E-03	2.675	0.
.185	7.205E-01	.685	3.703E-02	1.185	1.515E-02	1.685	7.159E-03	2.185	1.349E-03	2.685	0.
.195	5.419E-01	.695	3.654E-02	1.195	1.510E-02	1.695	7.150E-03	2.195	1.339E-03	2.695	0.
.205	4.979E-01	.705	3.607E-02	1.205	1.504E-02	1.705	7.140E-03	2.205	2.038E-01	2.705	0.
.215	4.687E-01	.715	3.562E-02	1.215	1.499E-02	1.715	7.125E-03	2.215	2.967E-04	2.715	0.
.225	4.413E-01	.725	3.520E-02	1.225	1.492E-02	1.725	1.601E-01	2.225	2.965E-04	2.725	0.
.235	4.112E-01	.735	3.480E-02	1.235	2.562E-01	1.735	6.296E-03	2.235	2.963E-04	2.735	0.
.245	5.218E-01	.745	3.441E-02	1.245	1.271E-02	1.745	6.285E-03	2.245	2.961E-04	2.745	0.
.255	3.551E-01	.755	3.400E-02	1.255	1.266E-02	1.755	6.241E-03	2.255	2.959E-04	2.755	0.
.265	3.165E-01	.765	1.792E-01	1.265	1.262E-02	1.765	7.398E-01	2.265	2.957E-04	2.765	0.
.275	2.982E-01	.775	3.066E-02	1.275	1.257E-02	1.775	2.208E-03	2.275	2.955E-04	2.775	0.
.285	2.822E-01	.785	5.597E-02	1.285	7.000E-02	1.785	2.204E-03	2.285	2.953E-04	2.785	0.
.295	6.478E-01	.795	2.958E-02	1.295	1.201E-02	1.795	2.201E-03	2.295	2.952E-04	2.795	0.
.305	2.248E-01	.805	6.172E-02	1.305	1.197E-02	1.805	2.197E-03	2.305	2.950E-04	2.805	0.
.315	2.147E-01	.815	2.847E-02	1.315	1.194E-02	1.815	2.194E-03	2.315	2.948E-04	2.815	0.
.325	2.058E-01	.825	2.820E-02	1.325	1.190E-02	1.825	2.190E-03	2.325	2.947E-04	2.825	0.
.335	1.977E-01	.835	2.794E-02	1.335	1.186E-02	1.835	2.182E-03	2.335	2.946E-04	2.835	0.
.345	1.902E-01	.845	2.769E-02	1.345	1.183E-02	1.845	1.110E-01	2.345	2.945E-04	2.845	0.
.355	9.761E-01	.855	2.746E-02	1.355	1.179E-02	1.855	1.653E-03	2.355	2.943E-04	2.855	0.
.365	1.292E-01	.865	2.723E-02	1.365	1.175E-02	1.865	1.651E-03	2.365	2.942E-04	2.865	0.
.375	1.243E-01	.875	2.702E-02	1.375	1.902E-01	1.875	1.640E-03	2.375	2.942E-04	2.875	0.
.385	1.198E-01	.885	2.681E-02	1.385	4.448E-02	1.885	1.646E-03	2.385	2.941E-04	2.885	0.
.395	1.157E-01	.895	2.661E-02	1.395	1.006E-02	1.895	1.643E-03	2.395	2.940E-04	2.895	0.
.405	1.120E-01	.905	2.641E-02	1.405	1.819E-01	1.905	1.641E-03	2.405	2.939E-04	2.905	0.
.415	1.086E-01	.915	2.621E-02	1.415	8.772E-03	1.915	1.639E-03	2.415	2.938E-04	2.915	0.
.425	1.055E-01	.925	2.602E-02	1.425	8.747E-03	1.925	1.636E-03	2.425	2.935E-04	2.925	0.
.435	1.026E-01	.935	1.304E-01	1.435	8.722E-03	1.935	1.634E-03	2.435	2.907E-04	2.935	0.
.445	1.000E-01	.945	2.428E-02	1.445	8.698E-03	1.945	1.632E-03	2.445	9.209E-02	2.945	0.
.455	9.752E-02	.955	2.412E-02	1.455	8.675E-03	1.955	1.630E-03	2.455	0.	2.955	0.
.465	9.523E-02	.965	2.397E-02	1.465	8.652E-03	1.965	1.628E-03	2.465	0.	2.965	0.
.475	9.310E-02	.975	2.382E-02	1.475	8.629E-03	1.975	1.626E-03	2.475	0.	2.975	0.
.485	9.109E-02	.985	2.368E-02	1.485	8.606E-03	1.985	1.624E-03	2.485	0.	2.985	0.
.495	8.924E-02	.995	2.354E-02	1.495	8.578E-03	1.995	1.622E-03	2.495	0.	2.995	0.
.505	8.750E-02	1.005	5.233E-02	1.505	1.063E-01	2.005	1.621E-03	2.505	0.	3.005	0.

TOTAL FLUX ENERGY SPECTRUM FOR THE PHASE I INFINITE MEDIUM

PHASE I, CASE 1, SHALE, K, P=0.00, S=0.0

ENERGY	FLUX	ENERGY	FLUX	ENERGY	FLUX	ENERGY	FLUX	ENERGY	FLUX	ENERGY	FLUX
.015	1.838E-07	.515	1.399E-01	1.015	5.630E-02	1.515	0.	2.015	0.	2.515	0.
.025	1.438E-04	.525	1.046E-01	1.025	5.600E-02	1.525	0.	2.025	0.	2.525	0.
.035	8.883E-03	.535	1.021E-01	1.035	5.570E-02	1.535	0.	2.035	0.	2.535	0.
.045	1.005E-01	.545	9.973E-02	1.045	5.541E-02	1.545	0.	2.045	0.	2.545	0.
.055	4.218E-01	.555	9.749E-02	1.055	5.514E-02	1.555	0.	2.055	0.	2.555	0.
.065	7.832E-01	.565	9.537E-02	1.065	5.488E-02	1.565	0.	2.065	0.	2.565	0.
.075	1.015E+00	.575	9.336E-02	1.075	5.463E-02	1.575	0.	2.075	0.	2.575	0.
.085	1.100E+00	.585	9.146E-02	1.085	5.439E-02	1.585	0.	2.085	0.	2.585	0.
.095	1.090E+00	.595	8.967E-02	1.095	5.417E-02	1.595	0.	2.095	0.	2.595	0.
.105	1.030E+00	.605	8.797E-02	1.105	5.395E-02	1.605	0.	2.105	0.	2.605	0.
.115	9.582E-01	.615	8.635E-02	1.115	5.372E-02	1.615	0.	2.115	0.	2.615	0.
.125	8.939E-01	.625	8.481E-02	1.125	5.350E-02	1.625	0.	2.125	0.	2.625	0.
.135	8.175E-01	.635	8.337E-02	1.135	5.329E-02	1.635	0.	2.135	0.	2.635	0.
.145	7.400E-01	.645	8.199E-02	1.145	5.309E-02	1.645	0.	2.145	0.	2.645	0.
.155	6.714E-01	.655	8.064E-02	1.155	5.290E-02	1.655	0.	2.155	0.	2.655	0.
.165	6.134E-01	.665	7.936E-02	1.165	5.272E-02	1.665	0.	2.165	0.	2.665	0.
.175	5.650E-01	.675	7.815E-02	1.175	5.255E-02	1.675	0.	2.175	0.	2.675	0.
.185	5.231E-01	.685	7.701E-02	1.185	5.238E-02	1.685	0.	2.185	0.	2.685	0.
.195	4.877E-01	.695	7.589E-02	1.195	5.222E-02	1.695	0.	2.195	0.	2.695	0.
.205	4.590E-01	.705	7.481E-02	1.205	5.207E-02	1.705	0.	2.205	0.	2.705	0.
.215	4.525E-01	.715	7.378E-02	1.215	5.193E-02	1.715	0.	2.215	0.	2.715	0.
.225	4.601E-01	.725	7.280E-02	1.225	5.178E-02	1.725	0.	2.225	0.	2.725	0.
.235	4.240E-01	.735	7.187E-02	1.235	5.164E-02	1.735	0.	2.235	0.	2.735	0.
.245	3.867E-01	.745	7.098E-02	1.245	5.150E-02	1.745	0.	2.245	0.	2.745	0.
.255	3.548E-01	.755	7.010E-02	1.255	5.137E-02	1.755	0.	2.255	0.	2.755	0.
.265	3.273E-01	.765	6.925E-02	1.265	5.124E-02	1.765	0.	2.265	0.	2.765	0.
.275	3.034E-01	.775	6.845E-02	1.275	5.113E-02	1.775	0.	2.275	0.	2.775	0.
.285	2.824E-01	.785	6.769E-02	1.285	5.101E-02	1.785	0.	2.285	0.	2.785	0.
.295	2.639E-01	.795	6.696E-02	1.295	5.090E-02	1.795	0.	2.295	0.	2.795	0.
.305	2.477E-01	.805	6.625E-02	1.305	5.079E-02	1.805	0.	2.305	0.	2.805	0.
.315	2.334E-01	.815	6.557E-02	1.315	5.069E-02	1.815	0.	2.315	0.	2.815	0.
.325	2.206E-01	.825	6.492E-02	1.325	5.059E-02	1.825	0.	2.325	0.	2.825	0.
.335	2.090E-01	.835	6.430E-02	1.335	5.049E-02	1.835	0.	2.335	0.	2.835	0.
.345	1.986E-01	.845	6.370E-02	1.345	5.040E-02	1.845	0.	2.345	0.	2.845	0.
.355	1.891E-01	.855	6.312E-02	1.355	5.031E-02	1.855	0.	2.355	0.	2.855	0.
.365	1.804E-01	.865	6.257E-02	1.365	5.022E-02	1.865	0.	2.365	0.	2.865	0.
.375	1.725E-01	.875	6.205E-02	1.375	5.014E-02	1.875	0.	2.375	0.	2.875	0.
.385	1.653E-01	.885	6.154E-02	1.385	5.006E-02	1.885	0.	2.385	0.	2.885	0.
.395	1.586E-01	.895	6.105E-02	1.395	4.998E-02	1.895	0.	2.395	0.	2.895	0.
.405	1.525E-01	.905	6.056E-02	1.405	4.991E-02	1.905	0.	2.405	0.	2.905	0.
.415	1.469E-01	.915	6.009E-02	1.415	4.983E-02	1.915	0.	2.415	0.	2.915	0.
.425	1.418E-01	.925	5.963E-02	1.425	4.976E-02	1.925	0.	2.425	0.	2.925	0.
.435	1.369E-01	.935	5.920E-02	1.435	4.967E-02	1.935	0.	2.435	0.	2.935	0.
.445	1.325E-01	.945	5.879E-02	1.445	4.954E-02	1.945	0.	2.445	0.	2.945	0.
.455	1.283E-01	.955	5.838E-02	1.455	4.896E-02	1.955	0.	2.455	0.	2.955	0.
.465	1.244E-01	.965	5.799E-02	1.465	7.285E+00	1.965	0.	2.465	0.	2.965	0.
.475	1.207E-01	.975	5.762E-02	1.475	0.	1.975	0.	2.475	0.	2.975	0.
.485	1.173E-01	.985	5.727E-02	1.485	0.	1.985	0.	2.485	0.	2.985	0.
.495	1.141E-01	.995	5.693E-02	1.495	0.	1.995	0.	2.495	0.	2.995	0.
.505	1.111E-01	1.005	5.661E-02	1.505	0.	2.005	0.	2.505	0.	3.005	0.

TOTAL FLUX ENERGY SPECTRUM FOR THE PHASE 1 INFINITE MEDIUM

PHASE I, CASE 2, SHALE, TH, P=0.00, S=0.0

ENERGY	FLUX	ENERGY	FLUX	ENERGY	FLUX	ENERGY	FLUX	ENERGY	FLUX	ENERGY	FLUX
.015	1.896E-07	.515	3.121E-01	1.015	7.594E-03	1.515	5.627E-03	2.015	4.298E-03	2.515	4.104E-03
.025	1.404E-04	.525	6.406E-02	1.025	7.527E-03	1.525	5.606E-03	2.025	4.291E-03	2.525	4.101E-03
.035	9.164E-03	.535	6.297E-02	1.035	7.461E-03	1.535	5.587E-03	2.035	4.285E-03	2.535	4.100E-03
.045	1.119E-01	.545	6.195E-02	1.045	7.397E-03	1.545	5.567E-03	2.045	4.279E-03	2.545	4.098E-03
.055	4.350E-01	.555	6.097E-02	1.055	7.335E-03	1.555	5.549E-03	2.055	4.272E-03	2.555	4.096E-03
.065	8.136E-01	.565	6.003E-02	1.065	7.275E-03	1.565	5.529E-03	2.065	4.265E-03	2.565	4.094E-03
.075	1.024E+00	.575	5.902E-02	1.075	7.217E-03	1.575	5.503E-03	2.075	4.259E-03	2.575	4.092E-03
.085	1.211E+00	.585	6.341E-01	1.085	7.161E-03	1.585	1.185E-01	2.085	4.253E-03	2.585	4.089E-03
.095	1.034E+00	.595	4.168E-02	1.095	7.107E-03	1.595	4.790E-03	2.095	4.247E-03	2.595	4.082E-03
.105	9.609E-01	.605	4.103E-02	1.105	7.053E-03	1.605	4.773E-03	2.105	4.241E-03	2.605	4.039E-03
.115	9.066E-01	.615	4.042E-02	1.115	6.999E-03	1.615	4.757E-03	2.115	4.235E-03	2.615	1.420E+00
.125	8.961E-01	.625	3.985E-02	1.125	6.946E-03	1.625	4.741E-03	2.125	4.230E-03	2.625	0.
.135	7.670E-01	.635	3.931E-02	1.135	6.895E-03	1.635	4.725E-03	2.135	4.225E-03	2.635	0.
.145	6.829E-01	.645	3.881E-02	1.145	6.846E-03	1.645	4.709E-03	2.145	4.220E-03	2.645	0.
.155	6.104E-01	.655	3.830E-02	1.155	6.798E-03	1.655	4.695E-03	2.155	4.215E-03	2.655	0.
.165	5.521E-01	.665	3.783E-02	1.165	6.752E-03	1.665	4.680E-03	2.165	4.211E-03	2.665	0.
.175	5.168E-01	.675	3.738E-02	1.175	6.707E-03	1.675	4.665E-03	2.175	4.207E-03	2.675	0.
.185	4.858E-01	.685	3.696E-02	1.185	6.663E-03	1.685	4.651E-03	2.185	4.203E-03	2.685	0.
.195	4.508E-01	.695	3.656E-02	1.195	6.620E-03	1.695	4.637E-03	2.195	4.199E-03	2.695	0.
.205	4.894E-01	.705	3.616E-02	1.205	6.578E-03	1.705	4.623E-03	2.205	4.195E-03	2.705	0.
.215	3.935E-01	.715	3.576E-02	1.215	6.538E-03	1.715	4.610E-03	2.215	4.190E-03	2.715	0.
.225	3.653E-01	.725	1.729E-01	1.225	6.497E-03	1.725	4.597E-03	2.225	4.186E-03	2.725	0.
.235	8.946E-01	.735	3.238E-02	1.235	6.457E-03	1.735	4.583E-03	2.235	4.182E-03	2.735	0.
.245	3.053E-01	.745	3.207E-02	1.245	6.418E-03	1.745	4.570E-03	2.245	4.178E-03	2.745	0.
.255	2.342E-01	.755	3.176E-02	1.255	6.381E-03	1.755	4.557E-03	2.255	4.174E-03	2.755	0.
.265	2.180E-01	.765	3.147E-02	1.265	6.344E-03	1.765	4.545E-03	2.265	4.170E-03	2.765	0.
.275	2.569E-01	.775	3.119E-02	1.275	6.308E-03	1.775	4.533E-03	2.275	4.166E-03	2.775	0.
.285	1.873E-01	.785	3.091E-02	1.285	6.273E-03	1.785	4.521E-03	2.285	4.162E-03	2.785	0.
.295	1.768E-01	.795	1.370E-01	1.295	6.238E-03	1.795	4.509E-03	2.295	4.159E-03	2.795	0.
.305	2.159E-01	.805	2.862E-02	1.305	6.204E-03	1.805	4.498E-03	2.305	4.156E-03	2.805	0.
.315	1.560E-01	.815	2.840E-02	1.315	6.171E-03	1.815	4.486E-03	2.315	4.152E-03	2.815	0.
.325	1.985E-01	.825	2.818E-02	1.325	6.138E-03	1.825	4.475E-03	2.325	4.149E-03	2.825	0.
.335	3.188E-01	.835	2.798E-02	1.335	6.107E-03	1.835	4.464E-03	2.335	4.146E-03	2.835	0.
.345	1.214E-01	.845	2.779E-02	1.345	6.075E-03	1.845	4.453E-03	2.345	4.143E-03	2.845	0.
.355	1.165E-01	.855	2.758E-02	1.355	6.045E-03	1.855	4.443E-03	2.355	4.140E-03	2.855	0.
.365	1.120E-01	.865	1.215E-01	1.365	6.015E-03	1.865	4.432E-03	2.365	4.138E-03	2.865	0.
.375	1.080E-01	.875	2.584E-02	1.375	5.986E-03	1.875	4.422E-03	2.375	4.136E-03	2.875	0.
.385	1.043E-01	.885	2.568E-02	1.385	5.957E-03	1.885	4.412E-03	2.385	4.133E-03	2.885	0.
.395	1.009E-01	.895	2.551E-02	1.395	5.929E-03	1.895	4.402E-03	2.395	4.131E-03	2.895	0.
.405	9.788E-02	.905	2.526E-02	1.405	5.901E-03	1.905	4.392E-03	2.405	4.129E-03	2.905	0.
.415	9.510E-02	.915	7.139E-01	1.415	5.874E-03	1.915	4.382E-03	2.415	4.128E-03	2.915	0.
.425	9.255E-02	.925	1.555E-02	1.425	5.847E-03	1.925	4.373E-03	2.425	4.126E-03	2.925	0.
.435	9.017E-02	.935	1.544E-02	1.435	5.821E-03	1.935	4.364E-03	2.435	4.124E-03	2.935	0.
.445	8.797E-02	.945	1.533E-02	1.445	5.795E-03	1.945	4.355E-03	2.445	4.121E-03	2.945	0.
.455	8.593E-02	.955	1.515E-02	1.455	5.769E-03	1.955	4.346E-03	2.455	4.118E-03	2.955	0.
.465	1.630E-01	.965	5.758E-01	1.465	5.744E-03	1.965	4.337E-03	2.465	4.115E-03	2.965	0.
.475	7.919E-02	.975	7.881E-03	1.475	5.719E-03	1.975	4.320E-03	2.475	4.113E-03	2.975	0.
.485	7.756E-02	.985	7.806E-03	1.485	5.695E-03	1.985	4.320E-03	2.485	4.110E-03	2.985	0.
.495	7.606E-02	.995	7.733E-03	1.495	5.670E-03	1.995	4.312E-03	2.495	4.108E-03	2.995	0.
.505	7.458E-02	1.005	7.662E-03	1.505	5.647E-03	2.005	4.304E-03	2.505	4.106E-03	3.005	0.

TOTAL FLUX ENERGY SPECTRUM FOR THE PHASE 1 INFINITE MEDIUM

PHASE 1, CASE 3, SHALE, U, P=0.00, S=0.0

ENERGY	FLUX	ENERGY	FLUX	ENERGY	FLUX	ENERGY	FLUX	ENERGY	FLUX	ENERGY	FLUX
.015	1.699E-07	.515	1.036E-01	1.015	1.891E-02	1.515	6.515E-03	2.015	1.332E-03	2.515	0.
.025	1.486E-04	.525	6.849E-02	1.025	1.882E-02	1.525	6.501E-03	2.025	1.331E-03	2.525	0.
.035	9.176E-03	.535	6.734E-02	1.035	1.872E-02	1.535	6.489E-03	2.035	1.330E-03	2.535	0.
.045	1.121E-01	.545	6.628E-02	1.045	1.862E-02	1.545	6.477E-03	2.045	1.329E-03	2.545	0.
.055	4.353E-01	.555	6.525E-02	1.055	1.853E-02	1.555	6.465E-03	2.055	1.328E-03	2.555	0.
.065	6.221E-01	.565	6.428E-02	1.065	1.845E-02	1.565	6.453E-03	2.065	1.327E-03	2.565	0.
.075	9.944E-01	.575	6.336E-02	1.075	1.837E-02	1.575	6.440E-03	2.075	1.326E-03	2.575	0.
.085	1.063E+00	.585	6.247E-02	1.085	1.829E-02	1.585	3.657E-02	2.085	1.325E-03	2.585	0.
.095	1.111E+00	.595	6.142E-02	1.095	1.822E-02	1.595	6.238E-03	2.095	1.324E-03	2.595	0.
.105	9.726E-01	.605	1.034E+00	1.105	1.814E-02	1.605	6.228E-03	2.105	1.321E-03	2.605	0.
.115	9.037E-01	.615	3.467E-02	1.115	1.801E-02	1.615	6.218E-03	2.115	5.380E-02	2.615	0.
.125	8.281E-01	.625	3.412E-02	1.125	4.793E-01	1.625	6.209E-03	2.125	1.114E-03	2.625	0.
.135	7.597E-01	.635	3.359E-02	1.135	1.326E-02	1.635	6.199E-03	2.135	1.113E-03	2.635	0.
.145	6.993E-01	.645	3.309E-02	1.145	1.319E-02	1.645	6.190E-03	2.145	1.113E-03	2.645	0.
.155	6.495E-01	.655	3.259E-02	1.155	6.438E-02	1.655	6.179E-03	2.155	1.112E-03	2.655	0.
.165	5.765E-01	.665	6.636E-02	1.165	1.259E-02	1.665	5.257E-02	2.165	1.112E-03	2.665	0.
.175	5.228E-01	.675	3.092E-02	1.175	1.254E-02	1.675	5.904E-03	2.175	1.111E-03	2.675	0.
.185	5.845E-01	.685	3.051E-02	1.185	1.249E-02	1.685	5.896E-03	2.185	1.109E-03	2.685	0.
.195	4.402E-01	.695	3.012E-02	1.195	1.244E-02	1.695	5.889E-03	2.195	1.100E-03	2.695	0.
.205	4.053E-01	.705	2.973E-02	1.205	1.240E-02	1.705	5.881E-03	2.205	2.338E-01	2.705	0.
.215	3.822E-01	.715	2.936E-02	1.215	1.235E-02	1.715	5.867E-03	2.215	2.440E-04	2.715	0.
.225	3.603E-01	.725	2.901E-02	1.225	1.229E-02	1.725	1.320E-01	2.225	2.438E-04	2.725	0.
.235	3.361E-01	.735	2.868E-02	1.235	2.113E-01	1.735	5.185E-03	2.235	2.437E-04	2.735	0.
.245	4.274E-01	.745	2.836E-02	1.245	1.047E-02	1.745	5.174E-03	2.245	2.435E-04	2.745	0.
.255	2.908E-01	.755	2.802E-02	1.255	1.044E-02	1.755	5.133E-03	2.255	2.433E-04	2.755	0.
.265	2.594E-01	.765	1.478E-01	1.265	1.040E-02	1.765	6.511E-01	2.265	2.431E-04	2.765	0.
.275	2.446E-01	.775	2.527E-02	1.275	1.036E-02	1.775	1.817E-03	2.275	2.430E-04	2.775	0.
.285	2.315E-01	.785	4.614E-02	1.285	5.774E-02	1.785	1.814E-03	2.285	2.428E-04	2.785	0.
.295	5.325E-01	.795	2.438E-02	1.295	9.904E-03	1.795	1.812E-03	2.295	2.427E-04	2.795	0.
.305	1.846E-01	.805	5.089E-02	1.305	9.871E-03	1.805	1.809E-03	2.305	2.426E-04	2.805	0.
.315	1.764E-01	.815	2.346E-02	1.315	9.840E-03	1.815	1.806E-03	2.315	2.425E-04	2.815	0.
.325	1.691E-01	.825	2.324E-02	1.325	9.810E-03	1.825	1.802E-03	2.325	2.423E-04	2.825	0.
.335	1.625E-01	.835	2.303E-02	1.335	9.780E-03	1.835	1.795E-03	2.335	2.422E-04	2.835	0.
.345	1.563E-01	.845	2.283E-02	1.345	9.752E-03	1.845	9.153E-02	2.345	2.421E-04	2.845	0.
.355	8.037E-01	.855	2.264E-02	1.355	9.722E-03	1.855	1.361E-03	2.355	2.420E-04	2.855	0.
.365	1.063E-01	.865	2.245E-02	1.365	9.683E-03	1.865	1.358E-03	2.365	2.419E-04	2.865	0.
.375	1.023E-01	.875	2.227E-02	1.375	1.569E-01	1.875	1.356E-03	2.375	2.419E-04	2.875	0.
.385	9.864E-02	.885	2.210E-02	1.385	3.669E-02	1.885	1.351E-03	2.385	2.418E-04	2.885	0.
.395	9.531E-02	.895	2.194E-02	1.395	8.294E-03	1.895	1.352E-03	2.395	2.417E-04	2.895	0.
.405	9.227E-02	.905	2.177E-02	1.405	1.501E-01	1.905	1.350E-03	2.405	2.416E-04	2.905	0.
.415	8.950E-02	.915	2.161E-02	1.415	7.230E-03	1.915	1.348E-03	2.415	2.415E-04	2.915	0.
.425	8.695E-02	.925	2.144E-02	1.425	7.209E-03	1.925	1.346E-03	2.425	2.411E-04	2.925	0.
.435	8.458E-02	.935	1.076E-01	1.435	7.189E-03	1.935	1.345E-03	2.435	2.306E-04	2.935	0.
.445	8.241E-02	.945	2.002E-02	1.445	7.169E-03	1.945	1.343E-03	2.445	7.504E-02	2.945	0.
.455	8.037E-02	.955	1.988E-02	1.455	7.150E-03	1.955	1.341E-03	2.455	0.	2.955	0.
.465	7.849E-02	.965	1.976E-02	1.465	7.131E-03	1.965	1.339E-03	2.465	0.	2.965	0.
.475	7.675E-02	.975	1.963E-02	1.475	7.111E-03	1.975	1.338E-03	2.475	0.	2.975	0.
.485	7.510E-02	.985	1.952E-02	1.485	7.092E-03	1.985	1.336E-03	2.485	0.	2.985	0.
.495	7.358E-02	.995	1.940E-02	1.495	7.068E-03	1.995	1.335E-03	2.495	0.	2.995	0.
.505	7.215E-02	1.005	4.315E-02	1.505	8.768E-02	2.005	1.333E-03	2.505	0.	3.005	0.

TOTAL FLUX ENERGY SPECTRUM FOR THE PHASE I INFINITE MEDIUM

PHASE I, CASE 4, SHALE, K, P=0.30, S=0.0

ENERGY	FLUX	ENERGY	FLUX	ENERGY	FLUX	ENERGY	FLUX	ENERGY	FLUX	ENERGY	FLUX
.015	2.656E-07	.515	1.998E-01	1.015	8.044E-02	1.515	0.	2.015	0.	2.515	0.
.025	2.075E-04	.525	1.494E-01	1.025	8.001E-02	1.525	0.	2.025	0.	2.525	0.
.035	1.279E-02	.535	1.458E-01	1.035	7.958E-02	1.535	0.	2.035	0.	2.535	0.
.045	1.559E-01	.545	1.425E-01	1.045	7.917E-02	1.545	0.	2.045	0.	2.545	0.
.055	6.049E-01	.555	1.393E-01	1.055	7.878E-02	1.555	0.	2.055	0.	2.555	0.
.065	1.122E+00	.565	1.362E-01	1.065	7.840E-02	1.565	0.	2.065	0.	2.565	0.
.075	1.453E+00	.575	1.334E-01	1.075	7.805E-02	1.575	0.	2.075	0.	2.575	0.
.085	1.574E+00	.585	1.307E-01	1.085	7.771E-02	1.585	0.	2.085	0.	2.585	0.
.095	1.559E+00	.595	1.281E-01	1.095	7.739E-02	1.595	0.	2.095	0.	2.595	0.
.105	1.473E+00	.605	1.257E-01	1.105	7.707E-02	1.605	0.	2.105	0.	2.605	0.
.115	1.370E+00	.615	1.234E-01	1.115	7.674E-02	1.615	0.	2.115	0.	2.615	0.
.125	1.278E+00	.625	1.212E-01	1.125	7.643E-02	1.625	0.	2.125	0.	2.625	0.
.135	1.168E+00	.635	1.191E-01	1.135	7.615E-02	1.635	0.	2.135	0.	2.635	0.
.145	1.058E+00	.645	1.171E-01	1.145	7.587E-02	1.645	0.	2.145	0.	2.645	0.
.155	9.594E-01	.655	1.152E-01	1.155	7.560E-02	1.655	0.	2.155	0.	2.655	0.
.165	8.765E-01	.665	1.134E-01	1.165	7.534E-02	1.665	0.	2.165	0.	2.665	0.
.175	8.074E-01	.675	1.117E-01	1.175	7.509E-02	1.675	0.	2.175	0.	2.675	0.
.185	7.474E-01	.685	1.100E-01	1.185	7.485E-02	1.685	0.	2.185	0.	2.685	0.
.195	6.969E-01	.695	1.084E-01	1.195	7.463E-02	1.695	0.	2.195	0.	2.695	0.
.205	6.559E-01	.705	1.069E-01	1.205	7.441E-02	1.705	0.	2.205	0.	2.705	0.
.215	6.465E-01	.715	1.054E-01	1.215	7.421E-02	1.715	0.	2.215	0.	2.715	0.
.225	6.688E-01	.725	1.040E-01	1.225	7.399E-02	1.725	0.	2.225	0.	2.725	0.
.235	6.058E-01	.735	1.027E-01	1.235	7.379E-02	1.735	0.	2.235	0.	2.735	0.
.245	5.525E-01	.745	1.014E-01	1.245	7.359E-02	1.745	0.	2.245	0.	2.745	0.
.255	5.070E-01	.755	1.002E-01	1.255	7.341E-02	1.755	0.	2.255	0.	2.755	0.
.265	4.676E-01	.765	9.895E-02	1.265	7.323E-02	1.765	0.	2.265	0.	2.765	0.
.275	4.334E-01	.775	9.780E-02	1.275	7.305E-02	1.775	0.	2.275	0.	2.775	0.
.285	4.035E-01	.785	9.671E-02	1.285	7.288E-02	1.785	0.	2.285	0.	2.785	0.
.295	3.771E-01	.795	9.567E-02	1.295	7.272E-02	1.795	0.	2.295	0.	2.795	0.
.305	3.539E-01	.805	9.466E-02	1.305	7.257E-02	1.805	0.	2.305	0.	2.805	0.
.315	3.335E-01	.815	9.369E-02	1.315	7.242E-02	1.815	0.	2.315	0.	2.815	0.
.325	3.152E-01	.825	9.275E-02	1.325	7.228E-02	1.825	0.	2.325	0.	2.825	0.
.335	2.986E-01	.835	9.186E-02	1.335	7.214E-02	1.835	0.	2.335	0.	2.835	0.
.345	2.837E-01	.845	9.101E-02	1.345	7.200E-02	1.845	0.	2.345	0.	2.845	0.
.355	2.701E-01	.855	9.019E-02	1.355	7.188E-02	1.855	0.	2.355	0.	2.855	0.
.365	2.578E-01	.865	8.940E-02	1.365	7.175E-02	1.865	0.	2.365	0.	2.865	0.
.375	2.465E-01	.875	8.865E-02	1.375	7.164E-02	1.875	0.	2.375	0.	2.875	0.
.385	2.361E-01	.885	8.793E-02	1.385	7.152E-02	1.885	0.	2.385	0.	2.885	0.
.395	2.266E-01	.895	8.723E-02	1.395	7.141E-02	1.895	0.	2.395	0.	2.895	0.
.405	2.179E-01	.905	8.653E-02	1.405	7.131E-02	1.905	0.	2.405	0.	2.905	0.
.415	2.099E-01	.915	8.565E-02	1.415	7.120E-02	1.915	0.	2.415	0.	2.915	0.
.425	2.025E-01	.925	8.520E-02	1.425	7.109E-02	1.925	0.	2.425	0.	2.925	0.
.435	1.956E-01	.935	8.458E-02	1.435	7.097E-02	1.935	0.	2.435	0.	2.935	0.
.445	1.893E-01	.945	8.399E-02	1.445	7.077E-02	1.945	0.	2.445	0.	2.945	0.
.455	1.833E-01	.955	8.341E-02	1.455	6.995E-02	1.955	0.	2.455	0.	2.955	0.
.465	1.777E-01	.965	8.286E-02	1.465	1.041E+01	1.965	0.	2.465	0.	2.965	0.
.475	1.725E-01	.975	8.233E-02	1.475	0.	1.975	0.	2.475	0.	2.975	0.
.485	1.676E-01	.985	8.182E-02	1.485	0.	1.985	0.	2.485	0.	2.985	0.
.495	1.630E-01	.995	8.134E-02	1.495	0.	1.995	0.	2.495	0.	2.995	0.
.505	1.587E-01	1.005	8.088E-02	1.505	0.	2.005	0.	2.505	0.	3.005	0.

TOTAL FLUX ENERGY SPECTRUM FOR THE PHASE I INFINITE MEDIUM

PHASE I, CASE 5, SHALE, TH, P=0.30, S=0.0

ENERGY	FLUX	ENERGY	FLUX	ENERGY	FLUX	ENERGY	FLUX	ENERGY	FLUX	ENERGY	FLUX
.015	2.740E-07	.515	4.459E-01	1.015	1.085E-02	1.515	8.035E-03	2.015	6.138E-03	2.515	5.859E-03
.025	2.140E-04	.525	9.152E-02	1.025	1.075E-02	1.525	8.006E-03	2.025	6.129E-03	2.525	5.856E-03
.035	1.319E-02	.535	8.997E-02	1.035	1.066E-02	1.535	7.978E-03	2.035	6.120E-03	2.535	5.853E-03
.045	1.608E-01	.545	8.852E-02	1.045	1.056E-02	1.545	7.951E-03	2.045	6.111E-03	2.545	5.851E-03
.055	6.239E-01	.555	8.711E-02	1.055	1.047E-02	1.555	7.924E-03	2.055	6.102E-03	2.555	5.848E-03
.065	1.166E+00	.565	8.577E-02	1.065	1.039E-02	1.565	7.896E-03	2.065	6.092E-03	2.565	5.846E-03
.075	1.466E+00	.575	8.432E-02	1.075	1.031E-02	1.575	7.859E-03	2.075	6.083E-03	2.575	5.843E-03
.085	1.733E+00	.585	9.062E-01	1.085	1.023E-02	1.585	1.694E-01	2.085	6.074E-03	2.585	5.839E-03
.095	1.478E+00	.595	5.955E-02	1.095	1.015E-02	1.595	6.840E-03	2.095	6.066E-03	2.595	5.829E-03
.105	1.385E+00	.605	5.863E-02	1.105	1.007E-02	1.605	6.816E-03	2.105	6.057E-03	2.605	5.766E-03
.115	1.296E+00	.615	5.776E-02	1.115	9.995E-03	1.615	6.793E-03	2.115	6.050E-03	2.615	2.028E+00
.125	1.281E+00	.625	5.694E-02	1.125	9.920E-03	1.625	6.770E-03	2.125	6.042E-03	2.625	0.
.135	1.096E+00	.635	5.617E-02	1.135	9.849E-03	1.635	6.747E-03	2.135	6.035E-03	2.635	0.
.145	9.761E-01	.645	5.544E-02	1.145	9.779E-03	1.645	6.725E-03	2.145	6.028E-03	2.645	0.
.155	8.723E-01	.655	5.472E-02	1.155	9.711E-03	1.655	6.704E-03	2.155	6.021E-03	2.655	0.
.165	7.890E-01	.665	5.405E-02	1.165	9.645E-03	1.665	6.683E-03	2.165	6.014E-03	2.665	0.
.175	7.385E-01	.675	5.341E-02	1.175	9.580E-03	1.675	6.662E-03	2.175	6.008E-03	2.675	0.
.185	6.942E-01	.685	5.281E-02	1.185	9.517E-03	1.685	6.641E-03	2.185	6.002E-03	2.685	0.
.195	6.442E-01	.695	5.223E-02	1.195	9.456E-03	1.695	6.621E-03	2.195	5.997E-03	2.695	0.
.205	6.994E-01	.705	5.166E-02	1.205	9.396E-03	1.705	6.601E-03	2.205	5.991E-03	2.705	0.
.215	5.623E-01	.715	5.109E-02	1.215	9.339E-03	1.715	6.582E-03	2.215	5.985E-03	2.715	0.
.225	5.220E-01	.725	2.471E-01	1.225	9.281E-03	1.725	6.563E-03	2.225	5.979E-03	2.725	0.
.235	1.278E+00	.735	4.626E-02	1.235	9.224E-03	1.735	6.544E-03	2.235	5.974E-03	2.735	0.
.245	4.362E-01	.745	4.582E-02	1.245	9.168E-03	1.745	6.525E-03	2.245	5.968E-03	2.745	0.
.255	3.346E-01	.755	4.538E-02	1.255	9.114E-03	1.755	6.507E-03	2.255	5.961E-03	2.755	0.
.265	3.115E-01	.765	4.496E-02	1.265	9.061E-03	1.765	6.489E-03	2.265	5.955E-03	2.765	0.
.275	3.670E-01	.775	4.456E-02	1.275	9.009E-03	1.775	6.472E-03	2.275	5.950E-03	2.775	0.
.285	2.676E-01	.785	4.416E-02	1.285	8.959E-03	1.785	6.455E-03	2.285	5.944E-03	2.785	0.
.295	2.526E-01	.795	1.958E-01	1.295	8.909E-03	1.795	6.439E-03	2.295	5.939E-03	2.795	0.
.305	3.086E-01	.805	4.089E-02	1.305	8.861E-03	1.805	6.424E-03	2.305	5.934E-03	2.805	0.
.315	2.229E-01	.815	4.057E-02	1.315	8.813E-03	1.815	6.407E-03	2.315	5.929E-03	2.815	0.
.325	2.837E-01	.825	4.026E-02	1.325	8.767E-03	1.825	6.391E-03	2.325	5.925E-03	2.825	0.
.335	4.555E-01	.835	3.997E-02	1.335	8.721E-03	1.835	6.376E-03	2.335	5.920E-03	2.835	0.
.345	1.735E-01	.845	3.970E-02	1.345	8.677E-03	1.845	6.360E-03	2.345	5.916E-03	2.845	0.
.355	1.664E-01	.855	3.941E-02	1.355	8.633E-03	1.855	6.346E-03	2.355	5.912E-03	2.855	0.
.365	1.601E-01	.865	1.737E-01	1.365	8.590E-03	1.865	6.331E-03	2.365	5.909E-03	2.865	0.
.375	1.543E-01	.875	3.691E-02	1.375	8.549E-03	1.875	6.316E-03	2.375	5.905E-03	2.875	0.
.385	1.490E-01	.885	3.669E-02	1.385	8.507E-03	1.885	6.301E-03	2.385	5.902E-03	2.885	0.
.395	1.442E-01	.895	3.645E-02	1.395	8.467E-03	1.895	6.287E-03	2.395	5.899E-03	2.895	0.
.405	1.398E-01	.905	3.609E-02	1.405	8.428E-03	1.905	6.273E-03	2.405	5.896E-03	2.905	0.
.415	1.359E-01	.915	1.020E+00	1.415	8.389E-03	1.915	6.260E-03	2.415	5.894E-03	2.915	0.
.425	1.322E-01	.925	2.222E-02	1.425	8.351E-03	1.925	6.247E-03	2.425	5.891E-03	2.925	0.
.435	1.288E-01	.935	2.206E-02	1.435	8.313E-03	1.935	6.234E-03	2.435	5.889E-03	2.935	0.
.445	1.257E-01	.945	2.189E-02	1.445	8.276E-03	1.945	6.220E-03	2.445	5.884E-03	2.945	0.
.455	1.228E-01	.955	2.164E-02	1.455	8.240E-03	1.955	6.207E-03	2.455	5.880E-03	2.955	0.
.465	2.329E-01	.965	6.229E-01	1.465	8.204E-03	1.965	6.194E-03	2.465	5.876E-03	2.965	0.
.475	1.131E-01	.975	1.126E-02	1.475	8.168E-03	1.975	6.182E-03	2.475	5.872E-03	2.975	0.
.485	1.108E-01	.985	1.115E-02	1.485	8.133E-03	1.985	6.170E-03	2.485	5.869E-03	2.985	0.
.495	1.087E-01	.995	1.104E-02	1.495	8.098E-03	1.995	6.159E-03	2.495	5.865E-03	2.995	0.
.505	1.066E-01	1.005	1.094E-02	1.505	8.065E-03	2.005	6.148E-03	2.505	5.862E-03	3.005	0.

TOTAL FLUX ENERGY SPECTRUM FOR THE PHASE I INFINITE MEDIUM

PHASE I, CASE 6, SHALE, U, P=0.30, S=0.0

ENERGY	FLUX	ENERGY	FLUX	ENERGY	FLUX	ENERGY	FLUX	ENERGY	FLUX	ENERGY	FLUX
.015	2.744E-07	.515	1.479E-01	1.015	2.702E-02	1.515	9.306E-03	2.015	1.904E-03	2.515	0.
.025	2.143E-04	.525	9.786E-02	1.025	2.688E-02	1.525	9.287E-03	2.025	1.902E-03	2.525	0.
.035	1.321E-02	.535	9.622E-02	1.035	2.674E-02	1.535	9.269E-03	2.035	1.901E-03	2.535	0.
.045	1.610E-01	.545	9.470E-02	1.045	2.661E-02	1.545	9.252E-03	2.045	1.899E-03	2.545	0.
.055	6.243E-01	.555	9.322E-02	1.055	2.648E-02	1.555	9.235E-03	2.055	1.898E-03	2.555	0.
.065	1.178E+00	.565	9.184E-02	1.065	2.636E-02	1.565	9.218E-03	2.065	1.896E-03	2.565	0.
.075	1.423E+00	.575	9.053E-02	1.075	2.624E-02	1.575	9.199E-03	2.075	1.895E-03	2.575	0.
.085	1.521E+00	.585	8.927E-02	1.085	2.613E-02	1.585	5.226E-02	2.085	1.893E-03	2.585	0.
.095	1.588E+00	.595	8.777E-02	1.095	2.602E-02	1.595	8.910E-03	2.095	1.891E-03	2.595	0.
.105	1.391E+00	.605	1.478E+00	1.105	2.591E-02	1.605	8.896E-03	2.105	1.887E-03	2.605	0.
.115	1.292E+00	.615	4.954E-02	1.115	2.574E-02	1.615	8.883E-03	2.115	7.689E-02	2.615	0.
.125	1.184E+00	.625	4.875E-02	1.125	6.848E-01	1.625	8.869E-03	2.125	1.592E-03	2.625	0.
.135	1.086E+00	.635	4.799E-02	1.135	1.894E-02	1.635	8.855E-03	2.135	1.591E-03	2.635	0.
.145	9.995E-01	.645	4.728E-02	1.145	1.885E-02	1.645	8.842E-03	2.145	1.590E-03	2.645	0.
.155	9.284E-01	.655	4.657E-02	1.155	9.202E-02	1.655	8.826E-03	2.155	1.589E-03	2.655	0.
.165	8.239E-01	.665	9.484E-02	1.165	1.799E-02	1.665	7.514E-02	2.165	1.588E-03	2.665	0.
.175	7.472E-01	.675	4.418E-02	1.175	1.792E-02	1.675	8.434E-03	2.175	1.587E-03	2.675	0.
.185	8.354E-01	.685	4.360E-02	1.185	1.785E-02	1.685	8.422E-03	2.185	1.585E-03	2.685	0.
.195	6.290E-01	.695	4.303E-02	1.195	1.778E-02	1.695	8.411E-03	2.195	1.572E-03	2.695	0.
.205	5.792E-01	.705	4.247E-02	1.205	1.772E-02	1.705	8.400E-03	2.205	3.341E-01	2.705	0.
.215	5.461E-01	.715	4.195E-02	1.215	1.765E-02	1.715	8.380E-03	2.215	3.485E-04	2.715	0.
.225	5.149E-01	.725	4.145E-02	1.225	1.756E-02	1.725	1.886E-01	2.225	3.483E-04	2.725	0.
.235	4.803E-01	.735	4.098E-02	1.235	3.020E-01	1.735	7.406E-03	2.235	3.481E-04	2.735	0.
.245	6.108E-01	.745	4.052E-02	1.245	1.497E-02	1.745	7.390E-03	2.245	3.478E-04	2.745	0.
.255	4.156E-01	.755	4.004E-02	1.255	1.491E-02	1.755	7.332E-03	2.255	3.475E-04	2.755	0.
.265	3.707E-01	.765	2.112E-01	1.265	1.486E-02	1.765	9.302E-01	2.265	3.473E-04	2.765	0.
.275	3.495E-01	.775	3.610E-02	1.275	1.480E-02	1.775	2.596E-03	2.275	3.471E-04	2.775	0.
.285	3.308E-01	.785	6.594E-02	1.285	8.251E-02	1.785	2.592E-03	2.285	3.468E-04	2.785	0.
.295	7.610E-01	.795	3.484E-02	1.295	1.415E-02	1.795	2.588E-03	2.295	3.466E-04	2.795	0.
.305	2.638E-01	.805	7.272E-02	1.305	1.410E-02	1.805	2.585E-03	2.305	3.464E-04	2.805	0.
.315	2.521E-01	.815	3.353E-02	1.315	1.406E-02	1.815	2.580E-03	2.315	3.462E-04	2.815	0.
.325	2.416E-01	.825	3.321E-02	1.325	1.402E-02	1.825	2.576E-03	2.325	3.461E-04	2.825	0.
.335	2.322E-01	.835	3.291E-02	1.335	1.397E-02	1.835	2.565E-03	2.335	3.459E-04	2.835	0.
.345	2.234E-01	.845	3.262E-02	1.345	1.393E-02	1.845	1.308E-01	2.345	3.458E-04	2.845	0.
.355	1.149E+00	.855	3.234E-02	1.355	1.389E-02	1.855	1.944E-03	2.355	3.456E-04	2.855	0.
.365	1.519E-01	.865	3.207E-02	1.365	1.383E-02	1.865	1.941E-03	2.365	3.455E-04	2.865	0.
.375	1.462E-01	.875	3.182E-02	1.375	2.242E-01	1.875	1.938E-03	2.375	3.454E-04	2.875	0.
.385	1.409E-01	.885	3.158E-02	1.385	5.243E-02	1.885	1.935E-03	2.385	3.453E-04	2.885	0.
.395	1.362E-01	.895	3.134E-02	1.395	1.185E-02	1.895	1.932E-03	2.395	3.452E-04	2.895	0.
.405	1.318E-01	.905	3.110E-02	1.405	2.144E-01	1.905	1.929E-03	2.405	3.451E-04	2.905	0.
.415	1.279E-01	.915	3.087E-02	1.415	1.033E-02	1.915	1.927E-03	2.415	3.449E-04	2.915	0.
.425	1.242E-01	.925	3.064E-02	1.425	1.030E-02	1.925	1.924E-03	2.425	3.443E-04	2.925	0.
.435	1.209E-01	.935	1.537E-01	1.435	1.027E-02	1.935	1.921E-03	2.435	3.407E-04	2.935	0.
.445	1.177E-01	.945	2.860E-02	1.445	1.024E-02	1.945	1.919E-03	2.445	1.084E-01	2.945	0.
.455	1.148E-01	.955	2.841E-02	1.455	1.021E-02	1.955	1.916E-03	2.455	0.	2.955	0.
.465	1.122E-01	.965	2.823E-02	1.465	1.019E-02	1.965	1.914E-03	2.465	0.	2.965	0.
.475	1.097E-01	.975	2.805E-02	1.475	1.016E-02	1.975	1.911E-03	2.475	0.	2.975	0.
.485	1.073E-01	.985	2.788E-02	1.485	1.013E-02	1.985	1.909E-03	2.485	0.	2.985	0.
.495	1.051E-01	.995	2.772E-02	1.495	1.010E-02	1.995	1.907E-03	2.495	0.	2.995	0.
.505	1.031E-01	1.005	6.165E-02	1.505	1.253E-01	2.005	1.905E-03	2.505	0.	3.005	0.

TOTAL FLUX ENERGY SPECTRUM FOR THE PHASE I INFINITE MEDIUM

PHASE I, CASE 7, SHALE, K, P=0.10, S=0.5

ENERGY	FLUX	ENERGY	FLUX	ENERGY	FLUX	ENERGY	FLUX	ENERGY	FLUX	ENERGY	FLUX
.015	2.254E-07	.515	1.516E-01	1.015	6.113E-02	1.515	0.	2.015	0.	2.515	0.
.025	1.725E-04	.525	1.135E-01	1.025	6.081E-02	1.525	0.	2.025	0.	2.525	0.
.035	1.042E-02	.535	1.108E-01	1.035	6.048E-02	1.535	0.	2.035	0.	2.535	0.
.045	1.246E-01	.545	1.083E-01	1.045	6.017E-02	1.545	0.	2.045	0.	2.545	0.
.055	4.756E-01	.555	1.059E-01	1.055	5.987E-02	1.555	0.	2.055	0.	2.555	0.
.065	8.723E-01	.565	1.036E-01	1.065	5.959E-02	1.565	0.	2.065	0.	2.565	0.
.075	1.122E+00	.575	1.014E-01	1.075	5.933E-02	1.575	0.	2.075	0.	2.575	0.
.085	1.209E+00	.585	9.932E-02	1.085	5.907E-02	1.585	0.	2.085	0.	2.585	0.
.095	1.194E+00	.595	9.737E-02	1.095	5.883E-02	1.595	0.	2.095	0.	2.595	0.
.105	1.126E+00	.605	9.552E-02	1.105	5.858E-02	1.605	0.	2.105	0.	2.605	0.
.115	1.045E+00	.615	9.376E-02	1.115	5.833E-02	1.615	0.	2.115	0.	2.615	0.
.125	9.742E-01	.625	9.210E-02	1.125	5.810E-02	1.625	0.	2.125	0.	2.625	0.
.135	8.902E-01	.635	9.052E-02	1.135	5.787E-02	1.635	0.	2.135	0.	2.635	0.
.145	8.054E-01	.645	8.903E-02	1.145	5.765E-02	1.645	0.	2.145	0.	2.645	0.
.155	7.304E-01	.655	8.756E-02	1.155	5.745E-02	1.655	0.	2.155	0.	2.655	0.
.165	6.671E-01	.665	8.618E-02	1.165	5.726E-02	1.665	0.	2.165	0.	2.665	0.
.175	6.143E-01	.675	8.486E-02	1.175	5.707E-02	1.675	0.	2.175	0.	2.675	0.
.185	5.686E-01	.685	8.362E-02	1.185	5.688E-02	1.685	0.	2.185	0.	2.685	0.
.195	5.301E-01	.695	8.241E-02	1.195	5.671E-02	1.695	0.	2.195	0.	2.695	0.
.205	4.988E-01	.705	8.123E-02	1.205	5.655E-02	1.705	0.	2.205	0.	2.705	0.
.215	4.916E-01	.715	8.012E-02	1.215	5.639E-02	1.715	0.	2.215	0.	2.715	0.
.225	5.085E-01	.725	7.905E-02	1.225	5.623E-02	1.725	0.	2.225	0.	2.725	0.
.235	4.606E-01	.735	7.804E-02	1.235	5.608E-02	1.735	0.	2.235	0.	2.735	0.
.245	4.201E-01	.745	7.707E-02	1.245	5.593E-02	1.745	0.	2.245	0.	2.745	0.
.255	3.854E-01	.755	7.611E-02	1.255	5.579E-02	1.755	0.	2.255	0.	2.755	0.
.265	3.555E-01	.765	7.520E-02	1.265	5.565E-02	1.765	0.	2.265	0.	2.765	0.
.275	3.295E-01	.775	7.433E-02	1.275	5.551E-02	1.775	0.	2.275	0.	2.775	0.
.285	3.067E-01	.785	7.350E-02	1.285	5.539E-02	1.785	0.	2.285	0.	2.785	0.
.295	2.867E-01	.795	7.271E-02	1.295	5.527E-02	1.795	0.	2.295	0.	2.795	0.
.305	2.690E-01	.805	7.194E-02	1.305	5.515E-02	1.805	0.	2.305	0.	2.805	0.
.315	2.535E-01	.815	7.120E-02	1.315	5.503E-02	1.815	0.	2.315	0.	2.815	0.
.325	2.396E-01	.825	7.049E-02	1.325	5.493E-02	1.825	0.	2.325	0.	2.825	0.
.335	2.270E-01	.835	6.981E-02	1.335	5.482E-02	1.835	0.	2.335	0.	2.835	0.
.345	2.157E-01	.845	6.917E-02	1.345	5.472E-02	1.845	0.	2.345	0.	2.845	0.
.355	2.053E-01	.855	6.854E-02	1.355	5.462E-02	1.855	0.	2.355	0.	2.855	0.
.365	1.959E-01	.865	6.794E-02	1.365	5.453E-02	1.865	0.	2.365	0.	2.865	0.
.375	1.874E-01	.875	6.737E-02	1.375	5.444E-02	1.875	0.	2.375	0.	2.875	0.
.385	1.795E-01	.885	6.682E-02	1.385	5.435E-02	1.885	0.	2.385	0.	2.885	0.
.395	1.723E-01	.895	6.629E-02	1.395	5.427E-02	1.895	0.	2.395	0.	2.895	0.
.405	1.656E-01	.905	6.576E-02	1.405	5.419E-02	1.905	0.	2.405	0.	2.905	0.
.415	1.596E-01	.915	6.524E-02	1.415	5.411E-02	1.915	0.	2.415	0.	2.915	0.
.425	1.539E-01	.925	6.475E-02	1.425	5.403E-02	1.925	0.	2.425	0.	2.925	0.
.435	1.487E-01	.935	6.428E-02	1.435	5.393E-02	1.935	0.	2.435	0.	2.935	0.
.445	1.439E-01	.945	6.383E-02	1.445	5.379E-02	1.945	0.	2.445	0.	2.945	0.
.455	1.393E-01	.955	6.339E-02	1.455	5.318E-02	1.955	0.	2.455	0.	2.955	0.
.465	1.351E-01	.965	6.297E-02	1.465	7.910E+00	1.965	0.	2.465	0.	2.965	0.
.475	1.311E-01	.975	6.257E-02	1.475	0.	1.975	0.	2.475	0.	2.975	0.
.485	1.274E-01	.985	6.219E-02	1.485	0.	1.985	0.	2.485	0.	2.985	0.
.495	1.239E-01	.995	6.182E-02	1.495	0.	1.995	0.	2.495	0.	2.995	0.
.505	1.206E-01	1.005	6.147E-02	1.505	0.	2.005	0.	2.505	0.	3.005	0.

TOTAL FLUX ENERGY SPECTRUM FOR THE PHASE 1 INFINITE MEDIUM

PHASE I, CASE 8, SHALE, TH, P=0.10, S=0.5

ENERGY	FLUX	ENERGY	FLUX	ENERGY	FLUX	ENERGY	FLUX	ENERGY	FLUX	ENERGY	FLUX
.015	2.325E-07	.515	3.379E-01	1.015	8.248E-03	1.515	6.111E-03	2.015	4.669E-03	2.515	4.457E-03
.025	1.779E-04	.525	6.957E-02	1.025	8.175E-03	1.525	6.089E-03	2.025	4.662E-03	2.525	4.455E-03
.035	1.074E-02	.535	6.838E-02	1.035	8.102E-03	1.535	6.067E-03	2.035	4.655E-03	2.535	4.453E-03
.045	1.284E-01	.545	6.728E-02	1.045	8.033E-03	1.545	6.046E-03	2.045	4.648E-03	2.545	4.451E-03
.055	4.902E-01	.555	6.622E-02	1.055	7.966E-03	1.555	6.026E-03	2.055	4.641E-03	2.555	4.449E-03
.065	9.055E-01	.565	6.520E-02	1.065	7.901E-03	1.565	6.005E-03	2.065	4.634E-03	2.565	4.447E-03
.075	1.131E+00	.575	6.409E-02	1.075	7.839E-03	1.575	5.977E-03	2.075	4.627E-03	2.575	4.445E-03
.085	1.330E+00	.585	6.885E-01	1.085	7.778E-03	1.585	1.287E-01	2.085	4.620E-03	2.585	4.442E-03
.095	1.132E+00	.595	4.526E-02	1.095	7.719E-03	1.595	5.202E-03	2.095	4.614E-03	2.595	4.435E-03
.105	1.059E+00	.605	4.456E-02	1.105	7.661E-03	1.605	5.184E-03	2.105	4.607E-03	2.605	4.388E-03
.115	9.890E-01	.615	4.390E-02	1.115	7.602E-03	1.615	5.167E-03	2.115	4.601E-03	2.615	1.542E+00
.125	9.764E-01	.625	4.327E-02	1.125	7.545E-03	1.625	5.149E-03	2.125	4.596E-03	2.625	0.
.135	8.351E-01	.635	4.269E-02	1.135	7.489E-03	1.635	5.132E-03	2.135	4.590E-03	2.635	0.
.145	7.432E-01	.645	4.213E-02	1.145	7.436E-03	1.645	5.115E-03	2.145	4.585E-03	2.645	0.
.155	6.639E-01	.655	4.159E-02	1.155	7.384E-03	1.655	5.099E-03	2.155	4.580E-03	2.655	0.
.165	6.004E-01	.665	4.108E-02	1.165	7.334E-03	1.665	5.083E-03	2.165	4.575E-03	2.665	0.
.175	5.618E-01	.675	4.059E-02	1.175	7.285E-03	1.675	5.067E-03	2.175	4.570E-03	2.675	0.
.185	5.280E-01	.685	4.014E-02	1.185	7.237E-03	1.685	5.051E-03	2.185	4.566E-03	2.685	0.
.195	4.899E-01	.695	3.970E-02	1.195	7.190E-03	1.695	5.036E-03	2.195	4.562E-03	2.695	0.
.205	5.318E-01	.705	3.926E-02	1.205	7.145E-03	1.705	5.021E-03	2.205	4.557E-03	2.705	0.
.215	4.275E-01	.715	3.883E-02	1.215	7.102E-03	1.715	5.006E-03	2.215	4.553E-03	2.715	0.
.225	3.969E-01	.725	1.878E-01	1.225	7.057E-03	1.725	4.992E-03	2.225	4.548E-03	2.725	0.
.235	9.717E-01	.735	3.516E-02	1.235	7.014E-03	1.735	4.970E-03	2.235	4.544E-03	2.735	0.
.245	3.316E-01	.745	3.482E-02	1.245	6.972E-03	1.745	4.963E-03	2.245	4.540E-03	2.745	0.
.255	2.543E-01	.755	3.449E-02	1.255	6.931E-03	1.755	4.949E-03	2.255	4.535E-03	2.755	0.
.265	2.368E-01	.765	3.417E-02	1.265	6.890E-03	1.765	4.936E-03	2.265	4.530E-03	2.765	0.
.275	2.789E-01	.775	3.387E-02	1.275	6.851E-03	1.775	4.923E-03	2.275	4.526E-03	2.775	0.
.285	2.034E-01	.785	3.357E-02	1.285	6.812E-03	1.785	4.910E-03	2.285	4.522E-03	2.785	0.
.295	1.920E-01	.795	1.488E-01	1.295	6.775E-03	1.795	4.898E-03	2.295	4.518E-03	2.795	0.
.305	2.345E-01	.805	3.108E-02	1.305	6.738E-03	1.805	4.885E-03	2.305	4.514E-03	2.805	0.
.315	1.694E-01	.815	3.083E-02	1.315	6.702E-03	1.815	4.872E-03	2.315	4.510E-03	2.815	0.
.325	2.156E-01	.825	3.060E-02	1.325	6.667E-03	1.825	4.860E-03	2.325	4.507E-03	2.825	0.
.335	3.462E-01	.835	3.038E-02	1.335	6.632E-03	1.835	4.848E-03	2.335	4.504E-03	2.835	0.
.345	1.319E-01	.845	3.017E-02	1.345	6.598E-03	1.845	4.836E-03	2.345	4.500E-03	2.845	0.
.355	1.265E-01	.855	2.995E-02	1.355	6.565E-03	1.855	4.825E-03	2.355	4.498E-03	2.855	0.
.365	1.216E-01	.865	1.320E-01	1.365	6.532E-03	1.865	4.814E-03	2.365	4.495E-03	2.865	0.
.375	1.173E-01	.875	2.805E-02	1.375	6.501E-03	1.875	4.802E-03	2.375	4.492E-03	2.875	0.
.385	1.132E-01	.885	2.788E-02	1.385	6.469E-03	1.885	4.791E-03	2.385	4.490E-03	2.885	0.
.395	1.096E-01	.895	2.771E-02	1.395	6.439E-03	1.895	4.780E-03	2.395	4.488E-03	2.895	0.
.405	1.063E-01	.905	2.743E-02	1.405	6.409E-03	1.905	4.770E-03	2.405	4.485E-03	2.905	0.
.415	1.032E-01	.915	7.751E-01	1.415	6.379E-03	1.915	4.760E-03	2.415	4.484E-03	2.915	0.
.425	1.005E-01	.925	1.689E-02	1.425	6.350E-03	1.925	4.750E-03	2.425	4.482E-03	2.925	0.
.435	9.789E-02	.935	1.677E-02	1.435	6.322E-03	1.935	4.740E-03	2.435	4.480E-03	2.935	0.
.445	9.553E-02	.945	1.664E-02	1.445	6.293E-03	1.945	4.730E-03	2.445	4.477E-03	2.945	0.
.455	9.320E-02	.955	1.645E-02	1.455	6.266E-03	1.955	4.721E-03	2.455	4.473E-03	2.955	0.
.465	1.770E-01	.965	6.252E-01	1.465	6.238E-03	1.965	4.711E-03	2.465	4.470E-03	2.965	0.
.475	8.596E-02	.975	8.559E-03	1.475	6.211E-03	1.975	4.702E-03	2.475	4.468E-03	2.975	0.
.485	8.420E-02	.985	8.477E-03	1.485	6.185E-03	1.985	4.693E-03	2.485	4.465E-03	2.985	0.
.495	8.256E-02	.995	8.398E-03	1.495	6.158E-03	1.995	4.684E-03	2.495	4.462E-03	2.995	0.
.505	8.096E-02	1.005	8.322E-03	1.505	6.133E-03	2.005	4.676E-03	2.505	4.460E-03	3.005	0.

TOTAL FLUX ENERGY SPECTRUM FOR THE PHASE I INFINITE MEDIUM

PHASE I, CASE 9, SHALE, U, P=0.10, S=0.5

ENERGY	FLUX	ENERGY	FLUX	ENERGY	FLUX	ENERGY	FLUX	ENERGY	FLUX	ENERGY	FLUX
.015	2.327E-07	.515	1.121E-01	1.015	2.054E-02	1.515	7.074E-03	2.015	1.447E-03	2.515	0.
.025	1.781E-04	.525	7.438E-02	1.025	2.043E-02	1.525	7.060E-03	2.025	1.446E-03	2.525	0.
.035	1.075E-02	.535	7.313E-02	1.035	2.032E-02	1.535	7.046E-03	2.035	1.445E-03	2.535	0.
.045	1.286E-01	.545	7.197E-02	1.045	2.022E-02	1.545	7.033E-03	2.045	1.444E-03	2.545	0.
.055	4.904E-01	.555	7.085E-02	1.055	2.013E-02	1.555	7.021E-03	2.055	1.443E-03	2.555	0.
.065	9.145E-01	.565	6.980E-02	1.065	2.003E-02	1.565	7.008E-03	2.065	1.442E-03	2.565	0.
.075	1.098E+00	.575	6.881E-02	1.075	1.995E-02	1.575	6.993E-03	2.075	1.441E-03	2.575	0.
.085	1.168E+00	.585	6.784E-02	1.085	1.986E-02	1.585	3.971E-02	2.085	1.439E-03	2.585	0.
.095	1.216E+00	.595	6.670E-02	1.095	1.978E-02	1.595	6.773E-03	2.095	1.438E-03	2.595	0.
.105	1.063E+00	.605	1.123E+00	1.105	1.970E-02	1.605	6.763E-03	2.105	1.435E-03	2.605	0.
.115	9.860E-01	.615	3.765E-02	1.115	1.956E-02	1.615	6.753E-03	2.115	5.844E-02	2.615	0.
.125	9.025E-01	.625	3.705E-02	1.125	5.205E-01	1.625	6.742E-03	2.125	1.210E-03	2.625	0.
.135	8.273E-01	.635	3.648E-02	1.135	1.440E-02	1.635	6.732E-03	2.135	1.210E-03	2.635	0.
.145	7.611E-01	.645	3.593E-02	1.145	1.433E-02	1.645	6.722E-03	2.145	1.209E-03	2.645	0.
.155	7.066E-01	.655	3.539E-02	1.155	6.992E-02	1.655	6.710E-03	2.155	1.208E-03	2.655	0.
.165	6.270E-01	.665	7.206E-02	1.165	1.367E-02	1.665	5.710E-02	2.165	1.208E-03	2.665	0.
.175	5.685E-01	.675	3.358E-02	1.175	1.362E-02	1.675	6.412E-03	2.175	1.207E-03	2.675	0.
.185	6.354E-01	.685	3.314E-02	1.185	1.357E-02	1.685	6.403E-03	2.185	1.205E-03	2.685	0.
.195	4.784E-01	.695	3.270E-02	1.195	1.351E-02	1.695	6.395E-03	2.195	1.195E-03	2.695	0.
.205	4.404E-01	.705	3.228E-02	1.205	1.347E-02	1.705	6.386E-03	2.205	2.559E-01	2.705	0.
.215	4.153E-01	.715	3.188E-02	1.215	1.342E-02	1.715	6.371E-03	2.215	2.651E-04	2.715	0.
.225	3.915E-01	.725	3.150E-02	1.225	1.335E-02	1.725	1.433E-01	2.225	2.649E-04	2.725	0.
.235	3.652E-01	.735	3.114E-02	1.235	2.295E-01	1.735	5.630E-03	2.235	2.647E-04	2.735	0.
.245	4.643E-01	.745	3.079E-02	1.245	1.137E-02	1.745	5.610E-03	2.245	2.645E-04	2.745	0.
.255	3.159E-01	.755	3.043E-02	1.255	1.133E-02	1.755	5.575E-03	2.255	2.643E-04	2.755	0.
.265	2.818E-01	.765	1.605E-01	1.265	1.129E-02	1.765	7.070E-01	2.265	2.641E-04	2.765	0.
.275	2.656E-01	.775	2.744E-02	1.275	1.125E-02	1.775	1.974E-03	2.275	2.640E-04	2.775	0.
.285	2.515E-01	.785	5.011E-02	1.285	6.270E-02	1.785	1.971E-03	2.285	2.638E-04	2.785	0.
.295	5.784E-01	.795	2.648E-02	1.295	1.075E-02	1.795	1.968E-03	2.295	2.636E-04	2.795	0.
.305	2.005E-01	.805	5.526E-02	1.305	1.072E-02	1.805	1.964E-03	2.305	2.635E-04	2.805	0.
.315	1.916E-01	.815	2.548E-02	1.315	1.069E-02	1.815	1.961E-03	2.315	2.633E-04	2.815	0.
.325	1.837E-01	.825	2.524E-02	1.325	1.065E-02	1.825	1.958E-03	2.325	2.632E-04	2.825	0.
.335	1.765E-01	.835	2.501E-02	1.335	1.062E-02	1.835	1.950E-03	2.335	2.631E-04	2.835	0.
.345	1.698E-01	.845	2.479E-02	1.345	1.059E-02	1.845	9.939E-02	2.345	2.630E-04	2.845	0.
.355	8.728E-01	.855	2.458E-02	1.355	1.056E-02	1.855	1.470E-03	2.355	2.629E-04	2.855	0.
.365	1.155E-01	.865	2.438E-02	1.365	1.051E-02	1.865	1.475E-03	2.365	2.628E-04	2.865	0.
.375	1.111E-01	.875	2.418E-02	1.375	1.704E-01	1.875	1.473E-03	2.375	2.627E-04	2.875	0.
.385	1.071E-01	.885	2.400E-02	1.385	3.984E-02	1.885	1.471E-03	2.385	2.626E-04	2.885	0.
.395	1.035E-01	.895	2.382E-02	1.395	9.006E-03	1.895	1.467E-03	2.395	2.626E-04	2.895	0.
.405	1.002E-01	.905	2.364E-02	1.405	1.629E-01	1.905	1.467E-03	2.405	2.625E-04	2.905	0.
.415	9.718E-02	.915	2.346E-02	1.415	7.851E-03	1.915	1.464E-03	2.415	2.623E-04	2.915	0.
.425	9.442E-02	.925	2.329E-02	1.425	7.828E-03	1.925	1.463E-03	2.425	2.619E-04	2.925	0.
.435	9.184E-02	.935	1.168E-01	1.435	7.806E-03	1.935	1.461E-03	2.435	2.592E-04	2.935	0.
.445	8.948E-02	.945	2.174E-02	1.445	7.785E-03	1.945	1.459E-03	2.445	8.237E-02	2.945	0.
.455	8.727E-02	.955	2.159E-02	1.455	7.764E-03	1.955	1.457E-03	2.455	0.	2.955	0.
.465	8.523E-02	.965	2.145E-02	1.465	7.743E-03	1.965	1.455E-03	2.465	0.	2.965	0.
.475	8.333E-02	.975	2.132E-02	1.475	7.722E-03	1.975	1.453E-03	2.475	0.	2.975	0.
.485	8.155E-02	.985	2.119E-02	1.485	7.701E-03	1.985	1.452E-03	2.485	0.	2.985	0.
.495	7.989E-02	.995	2.107E-02	1.495	7.675E-03	1.995	1.450E-03	2.495	0.	2.995	0.
.505	7.834E-02	1.005	4.685E-02	1.505	9.521E-02	2.005	1.449E-03	2.505	0.	3.005	0.

TOTAL FLUX ENERGY SPECTRUM FOR THE PHASE I INFINITE MEDIUM

PHASE I, CASE 10, SHALE, K, P=0.30, S=0.5

ENERGY	FLUX	ENERGY	FLUX	ENERGY	FLUX	ENERGY	FLUX	ENERGY	FLUX	ENERGY	FLUX
.015	3.707E-07	.515	1.820E-01	1.015	7.379E-02	1.515	0.	2.015	0.	2.515	0.
.025	2.679E-04	.525	1.370E-01	1.025	7.339E-02	1.525	0.	2.025	0.	2.525	0.
.035	1.528E-02	.535	1.338E-01	1.035	7.300E-02	1.535	0.	2.035	0.	2.535	0.
.045	1.729E-01	.545	1.307E-01	1.045	7.262E-02	1.545	0.	2.045	0.	2.545	0.
.055	6.307E-01	.555	1.278E-01	1.055	7.226E-02	1.555	0.	2.055	0.	2.555	0.
.065	1.121E+00	.565	1.250E-01	1.065	7.192E-02	1.565	0.	2.065	0.	2.565	0.
.075	1.412E+00	.575	1.224E-01	1.075	7.159E-02	1.575	0.	2.075	0.	2.575	0.
.085	1.503E+00	.585	1.199E-01	1.085	7.128E-02	1.585	0.	2.085	0.	2.585	0.
.095	1.472E+00	.595	1.175E-01	1.095	7.099E-02	1.595	0.	2.095	0.	2.595	0.
.105	1.380E+00	.605	1.153E-01	1.105	7.069E-02	1.605	0.	2.105	0.	2.605	0.
.115	1.276E+00	.615	1.132E-01	1.115	7.039E-02	1.615	0.	2.115	0.	2.615	0.
.125	1.186E+00	.625	1.112E-01	1.125	7.011E-02	1.625	0.	2.125	0.	2.625	0.
.135	1.082E+00	.635	1.093E-01	1.135	6.983E-02	1.635	0.	2.135	0.	2.635	0.
.145	9.775E-01	.645	1.074E-01	1.145	6.957E-02	1.645	0.	2.145	0.	2.645	0.
.155	8.855E-01	.655	1.057E-01	1.155	6.933E-02	1.655	0.	2.155	0.	2.655	0.
.165	8.081E-01	.665	1.040E-01	1.165	6.909E-02	1.665	0.	2.165	0.	2.665	0.
.175	7.437E-01	.675	1.024E-01	1.175	6.886E-02	1.675	0.	2.175	0.	2.675	0.
.185	6.880E-01	.685	1.009E-01	1.185	6.864E-02	1.685	0.	2.185	0.	2.685	0.
.195	6.412E-01	.695	9.946E-02	1.195	6.844E-02	1.695	0.	2.195	0.	2.695	0.
.205	6.031E-01	.705	9.804E-02	1.205	6.824E-02	1.705	0.	2.205	0.	2.705	0.
.215	5.943E-01	.715	9.670E-02	1.215	6.805E-02	1.715	0.	2.215	0.	2.715	0.
.225	6.145E-01	.725	9.542E-02	1.225	6.786E-02	1.725	0.	2.225	0.	2.725	0.
.235	5.566E-01	.735	9.420E-02	1.235	6.767E-02	1.735	0.	2.235	0.	2.735	0.
.245	5.075E-01	.745	9.302E-02	1.245	6.749E-02	1.745	0.	2.245	0.	2.745	0.
.255	4.655E-01	.755	9.187E-02	1.255	6.732E-02	1.755	0.	2.255	0.	2.755	0.
.265	4.294E-01	.765	9.076E-02	1.265	6.715E-02	1.765	0.	2.265	0.	2.765	0.
.275	3.979E-01	.775	8.971E-02	1.275	6.699E-02	1.775	0.	2.275	0.	2.775	0.
.285	3.704E-01	.785	8.871E-02	1.285	6.683E-02	1.785	0.	2.285	0.	2.785	0.
.295	3.462E-01	.795	8.776E-02	1.295	6.669E-02	1.795	0.	2.295	0.	2.795	0.
.305	3.248E-01	.805	8.683E-02	1.305	6.654E-02	1.805	0.	2.305	0.	2.805	0.
.315	3.060E-01	.815	8.593E-02	1.315	6.641E-02	1.815	0.	2.315	0.	2.815	0.
.325	2.892E-01	.825	8.508E-02	1.325	6.628E-02	1.825	0.	2.325	0.	2.825	0.
.335	2.740E-01	.835	8.426E-02	1.335	6.615E-02	1.835	0.	2.335	0.	2.835	0.
.345	2.604E-01	.845	8.348E-02	1.345	6.604E-02	1.845	0.	2.345	0.	2.845	0.
.355	2.479E-01	.855	8.272E-02	1.355	6.593E-02	1.855	0.	2.355	0.	2.855	0.
.365	2.365E-01	.865	8.200E-02	1.365	6.581E-02	1.865	0.	2.365	0.	2.865	0.
.375	2.262E-01	.875	8.131E-02	1.375	6.571E-02	1.875	0.	2.375	0.	2.875	0.
.385	2.166E-01	.885	8.065E-02	1.385	6.560E-02	1.885	0.	2.385	0.	2.885	0.
.395	2.079E-01	.895	8.001E-02	1.395	6.550E-02	1.895	0.	2.395	0.	2.895	0.
.405	1.999E-01	.905	7.936E-02	1.405	6.540E-02	1.905	0.	2.405	0.	2.905	0.
.415	1.926E-01	.915	7.874E-02	1.415	6.531E-02	1.915	0.	2.415	0.	2.915	0.
.425	1.858E-01	.925	7.815E-02	1.425	6.521E-02	1.925	0.	2.425	0.	2.925	0.
.435	1.795E-01	.935	7.758E-02	1.435	6.510E-02	1.935	0.	2.435	0.	2.935	0.
.445	1.736E-01	.945	7.704E-02	1.445	6.493E-02	1.945	0.	2.445	0.	2.945	0.
.455	1.681E-01	.955	7.651E-02	1.455	6.422E-02	1.955	0.	2.455	0.	2.955	0.
.465	1.630E-01	.965	7.600E-02	1.465	9.547E+00	1.965	0.	2.465	0.	2.965	0.
.475	1.582E-01	.975	7.552E-02	1.475	0.	1.975	0.	2.475	0.	2.975	0.
.485	1.537E-01	.985	7.506E-02	1.485	0.	1.985	0.	2.485	0.	2.985	0.
.495	1.495E-01	.995	7.461E-02	1.495	0.	1.995	0.	2.495	0.	2.995	0.
.505	1.456E-01	1.005	7.419E-02	1.505	0.	2.005	0.	2.505	0.	3.005	0.

TOTAL FLUX ENERGY SPECTRUM FOR THE PHASE I INFINITE MEDIUM

PHASE I, CASE II, SHALE, TH, P=0.30, S=0.5

ENERGY	FLUX	ENERGY	FLUX	ENERGY	FLUX	ENERGY	FLUX	ENERGY	FLUX	ENERGY	FLUX
.015	3.817E-07	.515	4.047E-01	1.015	9.962E-03	1.515	7.381E-03	2.015	5.640E-03	2.515	5.387E-03
.025	2.758E-04	.525	8.398E-02	1.025	9.874E-03	1.525	7.354E-03	2.025	5.631E-03	2.525	5.384E-03
.035	1.573E-02	.535	8.255E-02	1.035	9.787E-03	1.535	7.329E-03	2.035	5.623E-03	2.535	5.382E-03
.045	1.781E-01	.545	8.122E-02	1.045	9.702E-03	1.545	7.303E-03	2.045	5.615E-03	2.545	5.380E-03
.055	6.493E-01	.555	7.994E-02	1.055	9.621E-03	1.555	7.279E-03	2.055	5.606E-03	2.555	5.377E-03
.065	1.162E+00	.565	7.870E-02	1.065	9.542E-03	1.565	7.253E-03	2.065	5.597E-03	2.565	5.375E-03
.075	1.423E+00	.575	7.738E-02	1.075	9.466E-03	1.575	7.220E-03	2.075	5.589E-03	2.575	5.372E-03
.085	1.649E+00	.585	8.310E-01	1.085	9.393E-03	1.585	1.553E-01	2.085	5.581E-03	2.585	5.369E-03
.095	1.395E+00	.595	5.464E-02	1.095	9.322E-03	1.595	6.284E-03	2.095	5.573E-03	2.595	5.360E-03
.105	1.297E+00	.605	5.379E-02	1.105	9.251E-03	1.605	6.262E-03	2.105	5.565E-03	2.605	5.306E-03
.115	1.207E+00	.615	5.299E-02	1.115	9.180E-03	1.615	6.241E-03	2.115	5.558E-03	2.615	1.863E+00
.125	1.188E+00	.625	5.224E-02	1.125	9.111E-03	1.625	6.220E-03	2.125	5.551E-03	2.625	0.
.135	1.015E+00	.635	5.153E-02	1.135	9.044E-03	1.635	6.199E-03	2.135	5.544E-03	2.635	0.
.145	9.017E-01	.645	5.086E-02	1.145	8.979E-03	1.645	6.179E-03	2.145	5.540E-03	2.645	0.
.155	8.047E-01	.655	5.021E-02	1.155	8.917E-03	1.655	6.159E-03	2.155	5.534E-03	2.655	0.
.165	7.271E-01	.665	4.959E-02	1.165	8.856E-03	1.665	6.140E-03	2.165	5.528E-03	2.665	0.
.175	6.799E-01	.675	4.900E-02	1.175	8.797E-03	1.675	6.121E-03	2.175	5.522E-03	2.675	0.
.185	6.386E-01	.685	4.845E-02	1.185	8.739E-03	1.685	6.102E-03	2.185	5.519E-03	2.685	0.
.195	5.924E-01	.695	4.792E-02	1.195	8.683E-03	1.695	6.083E-03	2.195	5.512E-03	2.695	0.
.205	6.428E-01	.705	4.740E-02	1.205	8.628E-03	1.705	6.065E-03	2.205	5.507E-03	2.705	0.
.215	5.166E-01	.715	4.688E-02	1.215	8.576E-03	1.715	6.048E-03	2.215	5.501E-03	2.715	0.
.225	4.796E-01	.725	2.266E-01	1.225	8.522E-03	1.725	6.031E-03	2.225	5.496E-03	2.725	0.
.235	1.174E+00	.735	4.245E-02	1.235	8.470E-03	1.735	6.013E-03	2.235	5.491E-03	2.735	0.
.245	4.005E-01	.745	4.204E-02	1.245	8.419E-03	1.745	5.996E-03	2.245	5.485E-03	2.745	0.
.255	3.071E-01	.755	4.164E-02	1.255	8.369E-03	1.755	5.979E-03	2.255	5.480E-03	2.755	0.
.265	2.859E-01	.765	4.126E-02	1.265	8.320E-03	1.765	5.963E-03	2.265	5.474E-03	2.765	0.
.275	3.368E-01	.775	4.089E-02	1.275	8.272E-03	1.775	5.947E-03	2.275	5.469E-03	2.775	0.
.285	2.455E-01	.785	4.053E-02	1.285	8.226E-03	1.785	5.932E-03	2.285	5.464E-03	2.785	0.
.295	2.318E-01	.795	1.796E-01	1.295	8.181E-03	1.795	5.917E-03	2.295	5.459E-03	2.795	0.
.305	2.831E-01	.805	3.752E-02	1.305	8.136E-03	1.805	5.901E-03	2.305	5.455E-03	2.805	0.
.315	2.044E-01	.815	3.723E-02	1.315	8.092E-03	1.815	5.886E-03	2.315	5.450E-03	2.815	0.
.325	2.602E-01	.825	3.695E-02	1.325	8.050E-03	1.825	5.871E-03	2.325	5.446E-03	2.825	0.
.335	4.178E-01	.835	3.668E-02	1.335	8.008E-03	1.835	5.857E-03	2.335	5.442E-03	2.835	0.
.345	1.591E-01	.845	3.642E-02	1.345	7.969E-03	1.845	5.843E-03	2.345	5.438E-03	2.845	0.
.355	1.526E-01	.855	3.616E-02	1.355	7.929E-03	1.855	5.829E-03	2.355	5.435E-03	2.855	0.
.365	1.468E-01	.865	1.593E-01	1.365	7.890E-03	1.865	5.816E-03	2.365	5.432E-03	2.865	0.
.375	1.415E-01	.875	3.387E-02	1.375	7.851E-03	1.875	5.802E-03	2.375	5.429E-03	2.875	0.
.385	1.366E-01	.885	3.366E-02	1.385	7.813E-03	1.885	5.788E-03	2.385	5.426E-03	2.885	0.
.395	1.322E-01	.895	3.345E-02	1.395	7.777E-03	1.895	5.775E-03	2.395	5.423E-03	2.895	0.
.405	1.282E-01	.905	3.313E-02	1.405	7.740E-03	1.905	5.763E-03	2.405	5.421E-03	2.905	0.
.415	1.245E-01	.915	9.355E-01	1.415	7.705E-03	1.915	5.750E-03	2.415	5.418E-03	2.915	0.
.425	1.212E-01	.925	2.039E-02	1.425	7.670E-03	1.925	5.738E-03	2.425	5.416E-03	2.925	0.
.435	1.181E-01	.935	2.024E-02	1.435	7.635E-03	1.935	5.727E-03	2.435	5.414E-03	2.935	0.
.445	1.152E-01	.945	2.010E-02	1.445	7.601E-03	1.945	5.714E-03	2.445	5.410E-03	2.945	0.
.455	1.125E-01	.955	1.987E-02	1.455	7.568E-03	1.955	5.702E-03	2.455	5.406E-03	2.955	0.
.465	2.135E-01	.965	7.546E-01	1.465	7.535E-03	1.965	5.691E-03	2.465	5.402E-03	2.965	0.
.475	1.037E-01	.975	1.034E-02	1.475	7.502E-03	1.975	5.680E-03	2.475	5.399E-03	2.975	0.
.485	1.015E-01	.985	1.024E-02	1.485	7.470E-03	1.985	5.669E-03	2.485	5.396E-03	2.985	0.
.495	9.957E-02	.995	1.014E-02	1.495	7.438E-03	1.995	5.658E-03	2.495	5.393E-03	2.995	0.
.505	9.765E-02	1.005	1.005E-02	1.505	7.409E-03	2.005	5.640E-03	2.505	5.390E-03	3.005	0.

TOTAL FLUX ENERGY SPECTRUM FOR THE PHASE I INFINITE MEDIUM

PHASE I, CASE 12, SHALE, U, P=0.30, S=0.5

ENERGY	FLUX	ENERGY	FLUX	ENERGY	FLUX	ENERGY	FLUX	ENERGY	FLUX	ENERGY	FLUX
.015	3.818E-07	.515	1.342E-01	1.015	2.479E-02	1.515	8.540E-03	2.015	1.748E-03	2.515	0.
.025	2.759E-04	.525	8.977E-02	1.025	2.466E-02	1.525	8.523E-03	2.025	1.746E-03	2.525	0.
.035	1.574E-02	.535	8.827E-02	1.035	2.453E-02	1.535	8.507E-03	2.035	1.745E-03	2.535	0.
.045	1.781E-01	.545	8.687E-02	1.045	2.441E-02	1.545	8.491E-03	2.045	1.744E-03	2.545	0.
.055	6.491E-01	.555	8.552E-02	1.055	2.429E-02	1.555	8.476E-03	2.055	1.742E-03	2.555	0.
.065	1.172E+00	.565	8.425E-02	1.065	2.418E-02	1.565	8.460E-03	2.065	1.741E-03	2.565	0.
.075	1.382E+00	.575	8.305E-02	1.075	2.407E-02	1.575	8.443E-03	2.075	1.739E-03	2.575	0.
.085	1.451E+00	.585	8.189E-02	1.085	2.397E-02	1.585	4.793E-02	2.085	1.738E-03	2.585	0.
.095	1.497E+00	.595	8.053E-02	1.095	2.387E-02	1.595	8.178E-03	2.095	1.737E-03	2.595	0.
.105	1.303E+00	.605	1.355E+00	1.105	2.377E-02	1.605	8.165E-03	2.105	1.733E-03	2.605	0.
.115	1.204E+00	.615	4.545E-02	1.115	2.361E-02	1.615	8.152E-03	2.115	7.053E-02	2.615	0.
.125	1.099E+00	.625	4.471E-02	1.125	6.280E-01	1.625	8.140E-03	2.125	1.461E-03	2.625	0.
.135	1.005E+00	.635	4.402E-02	1.135	1.737E-02	1.635	8.127E-03	2.135	1.461E-03	2.635	0.
.145	9.236E-01	.645	4.337E-02	1.145	1.729E-02	1.645	8.116E-03	2.145	1.460E-03	2.645	0.
.155	8.566E-01	.655	4.272E-02	1.155	8.437E-02	1.655	8.101E-03	2.155	1.460E-03	2.655	0.
.165	7.595E-01	.665	8.697E-02	1.165	1.650E-02	1.665	6.893E-02	2.165	1.459E-03	2.665	0.
.175	6.882E-01	.675	4.053E-02	1.175	1.644E-02	1.675	7.741E-03	2.175	1.458E-03	2.675	0.
.185	7.686E-01	.685	3.999E-02	1.185	1.637E-02	1.685	7.731E-03	2.185	1.456E-03	2.685	0.
.195	5.786E-01	.695	3.947E-02	1.195	1.631E-02	1.695	7.721E-03	2.195	1.444E-03	2.695	0.
.205	5.325E-01	.705	3.896E-02	1.205	1.625E-02	1.705	7.710E-03	2.205	3.066E-01	2.705	0.
.215	5.020E-01	.715	3.848E-02	1.215	1.619E-02	1.715	7.693E-03	2.215	3.202E-04	2.715	0.
.225	4.731E-01	.725	3.802E-02	1.225	1.611E-02	1.725	1.730E-01	2.225	3.200E-04	2.725	0.
.235	4.413E-01	.735	3.759E-02	1.235	2.769E-01	1.735	6.798E-03	2.235	3.198E-04	2.735	0.
.245	5.609E-01	.745	3.717E-02	1.245	1.373E-02	1.745	6.784E-03	2.245	3.196E-04	2.745	0.
.255	3.816E-01	.755	3.673E-02	1.255	1.368E-02	1.755	6.734E-03	2.255	3.193E-04	2.755	0.
.265	3.404E-01	.765	1.937E-01	1.265	1.363E-02	1.765	8.534E-01	2.265	3.191E-04	2.765	0.
.275	3.208E-01	.775	3.312E-02	1.275	1.358E-02	1.775	2.383E-03	2.275	3.189E-04	2.775	0.
.285	3.037E-01	.785	6.048E-02	1.285	7.565E-02	1.785	2.380E-03	2.285	3.187E-04	2.785	0.
.295	6.983E-01	.795	3.196E-02	1.295	1.298E-02	1.795	2.376E-03	2.295	3.185E-04	2.795	0.
.305	2.421E-01	.805	6.670E-02	1.305	1.294E-02	1.805	2.372E-03	2.305	3.183E-04	2.805	0.
.315	2.313E-01	.815	3.076E-02	1.315	1.289E-02	1.815	2.368E-03	2.315	3.182E-04	2.815	0.
.325	2.217E-01	.825	3.046E-02	1.325	1.286E-02	1.825	2.364E-03	2.325	3.180E-04	2.825	0.
.335	2.131E-01	.835	3.019E-02	1.335	1.282E-02	1.835	2.355E-03	2.335	3.179E-04	2.835	0.
.345	2.050E-01	.845	2.992E-02	1.345	1.278E-02	1.845	1.200E-01	2.345	3.178E-04	2.845	0.
.355	1.054E+00	.855	2.967E-02	1.355	1.274E-02	1.855	1.785E-03	2.355	3.176E-04	2.855	0.
.365	1.394E-01	.865	2.942E-02	1.365	1.269E-02	1.865	1.782E-03	2.365	3.175E-04	2.865	0.
.375	1.341E-01	.875	2.919E-02	1.375	2.056E-01	1.875	1.779E-03	2.375	3.174E-04	2.875	0.
.385	1.293E-01	.885	2.897E-02	1.385	4.808E-02	1.885	1.776E-03	2.385	3.173E-04	2.885	0.
.395	1.249E-01	.895	2.875E-02	1.395	1.087E-02	1.895	1.774E-03	2.395	3.172E-04	2.895	0.
.405	1.209E-01	.905	2.853E-02	1.405	1.967E-01	1.905	1.771E-03	2.405	3.171E-04	2.905	0.
.415	1.173E-01	.915	2.832E-02	1.415	9.477E-03	1.915	1.769E-03	2.415	3.170E-04	2.915	0.
.425	1.139E-01	.925	2.811E-02	1.425	9.450E-03	1.925	1.766E-03	2.425	3.165E-04	2.925	0.
.435	1.108E-01	.935	1.410E-01	1.435	9.424E-03	1.935	1.764E-03	2.435	3.133E-04	2.935	0.
.445	1.080E-01	.945	2.623E-02	1.445	9.398E-03	1.945	1.762E-03	2.445	9.947E-02	2.945	0.
.455	1.053E-01	.955	2.606E-02	1.455	9.372E-03	1.955	1.759E-03	2.455	0.	2.955	0.
.465	1.028E-01	.965	2.589E-02	1.465	9.347E-03	1.965	1.757E-03	2.465	0.	2.965	0.
.475	1.005E-01	.975	2.573E-02	1.475	9.323E-03	1.975	1.755E-03	2.475	0.	2.975	0.
.485	9.839E-02	.985	2.558E-02	1.485	9.297E-03	1.985	1.753E-03	2.485	0.	2.985	0.
.495	9.640E-02	.995	2.543E-02	1.495	9.266E-03	1.995	1.751E-03	2.495	0.	2.995	0.
.505	9.453E-02	1.005	5.655E-02	1.505	1.149E-01	2.005	1.749E-03	2.505	0.	3.005	0.

TOTAL FLUX ENERGY SPECTRUM FOR THE PHASE I INFINITE MEDIUM

PHASE I, CASE 13, SHALE, K, P=0.10, S=1.0

ENERGY	FLUX	ENERGY	FLUX	ENERGY	FLUX	ENERGY	FLUX	ENERGY	FLUX	ENERGY	FLUX
.015	2.460E-07	.515	1.479E-01	1.015	5.977E-02	1.515	0.	2.015	0.	2.515	0.
.025	1.845E-04	.525	1.110E-01	1.025	5.945E-02	1.525	0.	2.025	0.	2.525	0.
.035	1.092E-02	.535	1.084E-01	1.035	5.913E-02	1.535	0.	2.035	0.	2.535	0.
.045	1.280E-01	.545	1.059E-01	1.045	5.882E-02	1.545	0.	2.045	0.	2.545	0.
.055	4.809E-01	.555	1.035E-01	1.055	5.853E-02	1.555	0.	2.055	0.	2.555	0.
.065	8.722E-01	.565	1.012E-01	1.065	5.826E-02	1.565	0.	2.065	0.	2.565	0.
.075	1.113E+00	.575	9.912E-02	1.075	5.799E-02	1.575	0.	2.075	0.	2.575	0.
.085	1.195E+00	.585	9.710E-02	1.085	5.774E-02	1.585	0.	2.085	0.	2.585	0.
.095	1.176E+00	.595	9.520E-02	1.095	5.750E-02	1.595	0.	2.095	0.	2.595	0.
.105	1.107E+00	.605	9.339E-02	1.105	5.726E-02	1.605	0.	2.105	0.	2.605	0.
.115	1.026E+00	.615	9.167E-02	1.115	5.702E-02	1.615	0.	2.115	0.	2.615	0.
.125	9.554E-01	.625	9.004E-02	1.125	5.680E-02	1.625	0.	2.125	0.	2.625	0.
.135	8.724E-01	.635	8.850E-02	1.135	5.657E-02	1.635	0.	2.135	0.	2.635	0.
.145	7.890E-01	.645	8.704E-02	1.145	5.636E-02	1.645	0.	2.145	0.	2.645	0.
.155	7.152E-01	.655	8.561E-02	1.155	5.616E-02	1.655	0.	2.155	0.	2.655	0.
.165	6.530E-01	.665	8.425E-02	1.165	5.597E-02	1.665	0.	2.165	0.	2.665	0.
.175	6.012E-01	.675	8.297E-02	1.175	5.579E-02	1.675	0.	2.175	0.	2.675	0.
.185	5.564E-01	.685	8.175E-02	1.185	5.561E-02	1.685	0.	2.185	0.	2.685	0.
.195	5.186E-01	.695	8.057E-02	1.195	5.544E-02	1.695	0.	2.195	0.	2.695	0.
.205	4.880E-01	.705	7.942E-02	1.205	5.528E-02	1.705	0.	2.205	0.	2.705	0.
.215	4.809E-01	.715	7.833E-02	1.215	5.513E-02	1.715	0.	2.215	0.	2.715	0.
.225	4.774E-01	.725	7.729E-02	1.225	5.498E-02	1.725	0.	2.225	0.	2.725	0.
.235	4.505E-01	.735	7.630E-02	1.235	5.482E-02	1.735	0.	2.235	0.	2.735	0.
.245	4.108E-01	.745	7.535E-02	1.245	5.468E-02	1.745	0.	2.245	0.	2.745	0.
.255	3.769E-01	.755	7.441E-02	1.255	5.454E-02	1.755	0.	2.255	0.	2.755	0.
.265	3.476E-01	.765	7.352E-02	1.265	5.440E-02	1.765	0.	2.265	0.	2.765	0.
.275	3.222E-01	.775	7.267E-02	1.275	5.427E-02	1.775	0.	2.275	0.	2.775	0.
.285	2.999E-01	.785	7.185E-02	1.285	5.415E-02	1.785	0.	2.285	0.	2.785	0.
.295	2.803E-01	.795	7.108E-02	1.295	5.403E-02	1.795	0.	2.295	0.	2.795	0.
.305	2.631E-01	.805	7.033E-02	1.305	5.391E-02	1.805	0.	2.305	0.	2.805	0.
.315	2.478E-01	.815	6.961E-02	1.315	5.380E-02	1.815	0.	2.315	0.	2.815	0.
.325	2.342E-01	.825	6.891E-02	1.325	5.370E-02	1.825	0.	2.325	0.	2.825	0.
.335	2.219E-01	.835	6.825E-02	1.335	5.359E-02	1.835	0.	2.335	0.	2.835	0.
.345	2.109E-01	.845	6.762E-02	1.345	5.350E-02	1.845	0.	2.345	0.	2.845	0.
.355	2.007E-01	.855	6.701E-02	1.355	5.340E-02	1.855	0.	2.355	0.	2.855	0.
.365	1.916E-01	.865	6.642E-02	1.365	5.331E-02	1.865	0.	2.365	0.	2.865	0.
.375	1.832E-01	.875	6.586E-02	1.375	5.322E-02	1.875	0.	2.375	0.	2.875	0.
.385	1.755E-01	.885	6.533E-02	1.385	5.314E-02	1.885	0.	2.385	0.	2.885	0.
.395	1.684E-01	.895	6.481E-02	1.395	5.306E-02	1.895	0.	2.395	0.	2.895	0.
.405	1.619E-01	.905	6.429E-02	1.405	5.298E-02	1.905	0.	2.405	0.	2.905	0.
.415	1.560E-01	.915	6.378E-02	1.415	5.290E-02	1.915	0.	2.415	0.	2.915	0.
.425	1.505E-01	.925	6.330E-02	1.425	5.282E-02	1.925	0.	2.425	0.	2.925	0.
.435	1.454E-01	.935	6.284E-02	1.435	5.273E-02	1.935	0.	2.435	0.	2.935	0.
.445	1.406E-01	.945	6.240E-02	1.445	5.259E-02	1.945	0.	2.445	0.	2.945	0.
.455	1.362E-01	.955	6.197E-02	1.455	5.200E-02	1.955	0.	2.455	0.	2.955	0.
.465	1.320E-01	.965	6.156E-02	1.465	7.733E+00	1.965	0.	2.465	0.	2.965	0.
.475	1.282E-01	.975	6.117E-02	1.475	0.	1.975	0.	2.475	0.	2.975	0.
.485	1.245E-01	.985	6.080E-02	1.485	0.	1.985	0.	2.485	0.	2.985	0.
.495	1.211E-01	.995	6.044E-02	1.495	0.	1.995	0.	2.495	0.	2.995	0.
.505	1.179E-01	1.005	6.010E-02	1.505	0.	2.005	0.	2.505	0.	3.005	0.

TOTAL FLUX ENERGY SPECTRUM FOR THE PHASE I INFINITE MEDIUM

PHASE I, CASE 14, SHALE, TH, P=0.10, S=1.0

ENERGY	FLUX	ENERGY	FLUX	ENERGY	FLUX	ENERGY	FLUX	ENERGY	FLUX	ENERGY	FLUX
.015	2.536E-07	.515	3.294E-01	1.015	8.066E-03	1.515	5.976E-03	2.015	4.566E-03	2.515	4.360E-03
.025	1.901E-04	.525	6.802E-02	1.025	7.995E-03	1.525	5.955E-03	2.025	4.559E-03	2.525	4.358E-03
.035	1.125E-02	.535	6.686E-02	1.035	7.924E-03	1.535	5.934E-03	2.035	4.552E-03	2.535	4.356E-03
.045	1.319E-01	.545	6.578E-02	1.045	7.856E-03	1.545	5.913E-03	2.045	4.547E-03	2.545	4.354E-03
.055	4.954E-01	.555	6.474E-02	1.055	7.790E-03	1.555	5.893E-03	2.055	4.539E-03	2.555	4.353E-03
.065	9.049E-01	.565	6.375E-02	1.065	7.727E-03	1.565	5.873E-03	2.065	4.532E-03	2.565	4.351E-03
.075	1.122E+00	.575	6.267E-02	1.075	7.665E-03	1.575	5.846E-03	2.075	4.526E-03	2.575	4.348E-03
.085	1.313E+00	.585	6.731E-01	1.085	7.605E-03	1.585	1.258E-01	2.085	4.519E-03	2.585	4.345E-03
.095	1.115E+00	.595	4.425E-02	1.095	7.548E-03	1.595	5.088E-03	2.095	4.513E-03	2.595	4.338E-03
.105	1.041E+00	.605	4.357E-02	1.105	7.491E-03	1.605	5.070E-03	2.105	4.507E-03	2.605	4.293E-03
.115	9.708E-01	.615	4.292E-02	1.115	7.433E-03	1.615	5.053E-03	2.115	4.501E-03	2.615	1.508E+00
.125	9.574E-01	.625	4.231E-02	1.125	7.378E-03	1.625	5.036E-03	2.125	4.495E-03	2.625	0.
.135	8.184E-01	.635	4.174E-02	1.135	7.324E-03	1.635	5.019E-03	2.135	4.490E-03	2.635	0.
.145	7.279E-01	.645	4.120E-02	1.145	7.272E-03	1.645	5.003E-03	2.145	4.485E-03	2.645	0.
.155	6.501E-01	.655	4.066E-02	1.155	7.221E-03	1.655	4.987E-03	2.155	4.480E-03	2.655	0.
.165	5.877E-01	.665	4.016E-02	1.165	7.172E-03	1.665	4.971E-03	2.165	4.475E-03	2.665	0.
.175	5.498E-01	.675	3.969E-02	1.175	7.124E-03	1.675	4.956E-03	2.175	4.470E-03	2.675	0.
.185	5.166E-01	.685	3.925E-02	1.185	7.077E-03	1.685	4.940E-03	2.185	4.466E-03	2.685	0.
.195	4.793E-01	.695	3.881E-02	1.195	7.032E-03	1.695	4.925E-03	2.195	4.462E-03	2.695	0.
.205	5.202E-01	.705	3.839E-02	1.205	6.988E-03	1.705	4.911E-03	2.205	4.458E-03	2.705	0.
.215	4.181E-01	.715	3.796E-02	1.215	6.945E-03	1.715	4.897E-03	2.215	4.453E-03	2.715	0.
.225	3.882E-01	.725	1.836E-01	1.225	6.902E-03	1.725	4.883E-03	2.225	4.449E-03	2.725	0.
.235	9.502E-01	.735	3.438E-02	1.235	6.859E-03	1.735	4.869E-03	2.235	4.445E-03	2.735	0.
.245	3.243E-01	.745	3.405E-02	1.245	6.818E-03	1.745	4.855E-03	2.245	4.440E-03	2.745	0.
.255	2.487E-01	.755	3.372E-02	1.255	6.778E-03	1.755	4.841E-03	2.255	4.436E-03	2.755	0.
.265	2.315E-01	.765	3.341E-02	1.265	6.739E-03	1.765	4.828E-03	2.265	4.431E-03	2.765	0.
.275	2.727E-01	.775	3.312E-02	1.275	6.700E-03	1.775	4.815E-03	2.275	4.427E-03	2.775	0.
.285	1.988E-01	.785	3.282E-02	1.285	6.662E-03	1.785	4.802E-03	2.285	4.423E-03	2.785	0.
.295	1.877E-01	.795	1.454E-01	1.295	6.625E-03	1.795	4.790E-03	2.295	4.419E-03	2.795	0.
.305	2.293E-01	.805	3.039E-02	1.305	6.589E-03	1.805	4.778E-03	2.305	4.415E-03	2.805	0.
.315	1.656E-01	.815	3.015E-02	1.315	6.554E-03	1.815	4.765E-03	2.315	4.412E-03	2.815	0.
.325	2.108E-01	.825	2.992E-02	1.325	6.520E-03	1.825	4.753E-03	2.325	4.408E-03	2.825	0.
.335	3.384E-01	.835	2.971E-02	1.335	6.486E-03	1.835	4.742E-03	2.335	4.405E-03	2.835	0.
.345	1.289E-01	.845	2.950E-02	1.345	6.453E-03	1.845	4.730E-03	2.345	4.402E-03	2.845	0.
.355	1.236E-01	.855	2.929E-02	1.355	6.420E-03	1.855	4.719E-03	2.355	4.399E-03	2.855	0.
.365	1.189E-01	.865	1.290E-01	1.365	6.388E-03	1.865	4.708E-03	2.365	4.397E-03	2.865	0.
.375	1.146E-01	.875	2.743E-02	1.375	6.357E-03	1.875	4.697E-03	2.375	4.394E-03	2.875	0.
.385	1.107E-01	.885	2.726E-02	1.385	6.327E-03	1.885	4.686E-03	2.385	4.392E-03	2.885	0.
.395	1.071E-01	.895	2.709E-02	1.395	6.297E-03	1.895	4.676E-03	2.395	4.390E-03	2.895	0.
.405	1.039E-01	.905	2.683E-02	1.405	6.267E-03	1.905	4.665E-03	2.405	4.388E-03	2.905	0.
.415	1.009E-01	.915	7.578E-01	1.415	6.239E-03	1.915	4.656E-03	2.415	4.386E-03	2.915	0.
.425	9.821E-02	.925	1.651E-02	1.425	6.210E-03	1.925	4.646E-03	2.425	4.384E-03	2.925	0.
.435	9.568E-02	.935	1.640E-02	1.435	6.182E-03	1.935	4.636E-03	2.435	4.382E-03	2.935	0.
.445	9.337E-02	.945	1.627E-02	1.445	6.155E-03	1.945	4.626E-03	2.445	4.379E-03	2.945	0.
.455	9.118E-02	.955	1.609E-02	1.455	6.128E-03	1.955	4.617E-03	2.455	4.376E-03	2.955	0.
.465	1.730E-01	.965	6.112E-01	1.465	6.101E-03	1.965	4.607E-03	2.465	4.373E-03	2.965	0.
.475	8.402E-02	.975	8.371E-03	1.475	6.075E-03	1.975	4.598E-03	2.475	4.370E-03	2.975	0.
.485	8.230E-02	.985	8.291E-03	1.485	6.049E-03	1.985	4.589E-03	2.485	4.368E-03	2.985	0.
.495	8.070E-02	.995	8.213E-03	1.495	6.023E-03	1.995	4.581E-03	2.495	4.365E-03	2.995	0.
.505	7.913E-02	1.005	8.138E-03	1.505	5.998E-03	2.005	4.573E-03	2.505	4.363E-03	3.005	0.

TOTAL FLUX ENERGY SPECTRUM FOR THE PHASE 1 INFINITE MEDIUM

PHASE I, CASE 15, SHALE, U, P=0.10, S=1.0

ENERGY	FLUX	ENERGY	FLUX	ENERGY	FLUX	ENERGY	FLUX	ENERGY	FLUX	ENERGY	FLUX
.015	2.538E-07	.515	1.073E-01	1.015	2.008E-02	1.515	6.917E-03	2.015	1.415E-03	2.515	0.
.025	1.903E-04	.525	7.272E-02	1.025	1.998E-02	1.525	6.903E-03	2.025	1.414E-03	2.525	0.
.035	1.126E-02	.535	7.150E-02	1.035	1.987E-02	1.535	6.889E-03	2.035	1.413E-03	2.535	0.
.045	1.320E-01	.545	7.037E-02	1.045	1.977E-02	1.545	6.877E-03	2.045	1.412E-03	2.545	0.
.055	4.955E-01	.555	6.927E-02	1.055	1.968E-02	1.555	6.865E-03	2.055	1.411E-03	2.555	0.
.065	9.135E-01	.565	6.824E-02	1.065	1.959E-02	1.565	6.852E-03	2.065	1.410E-03	2.565	0.
.075	1.090E+00	.575	6.727E-02	1.075	1.950E-02	1.575	6.838E-03	2.075	1.409E-03	2.575	0.
.085	1.154E+00	.585	6.633E-02	1.085	1.942E-02	1.585	3.883E-02	2.085	1.408E-03	2.585	0.
.095	1.197E+00	.595	6.522E-02	1.095	1.934E-02	1.595	6.623E-03	2.095	1.406E-03	2.595	0.
.105	1.045E+00	.605	1.098E+00	1.105	1.926E-02	1.605	6.613E-03	2.105	1.403E-03	2.605	0.
.115	9.680E-01	.615	3.681E-02	1.115	1.913E-02	1.615	6.603E-03	2.115	5.714E-02	2.615	0.
.125	8.851E-01	.625	3.622E-02	1.125	5.088E-01	1.625	6.592E-03	2.125	1.104E-03	2.625	0.
.135	8.108E-01	.635	3.566E-02	1.135	1.407E-02	1.635	6.582E-03	2.135	1.103E-03	2.635	0.
.145	7.455E-01	.645	3.513E-02	1.145	1.401E-02	1.645	6.573E-03	2.145	1.102E-03	2.645	0.
.155	6.919E-01	.655	3.460E-02	1.155	6.835E-02	1.655	6.561E-03	2.155	1.102E-03	2.655	0.
.165	6.137E-01	.665	7.045E-02	1.165	1.337E-02	1.665	5.583E-02	2.165	1.101E-03	2.665	0.
.175	5.564E-01	.675	3.283E-02	1.175	1.332E-02	1.675	6.269E-03	2.175	1.100E-03	2.675	0.
.185	6.217E-01	.685	3.240E-02	1.185	1.326E-02	1.685	6.261E-03	2.185	1.179E-03	2.685	0.
.195	4.681E-01	.695	3.197E-02	1.195	1.321E-02	1.695	6.253E-03	2.195	1.169E-03	2.695	0.
.205	4.309E-01	.705	3.156E-02	1.205	1.317E-02	1.705	6.244E-03	2.205	2.403E-01	2.705	0.
.215	4.062E-01	.715	3.117E-02	1.215	1.312E-02	1.715	6.230E-03	2.215	2.592E-04	2.715	0.
.225	3.829E-01	.725	3.080E-02	1.225	1.305E-02	1.725	1.401E-01	2.225	2.591E-04	2.725	0.
.235	3.572E-01	.735	3.045E-02	1.235	2.243E-01	1.735	5.505E-03	2.235	2.589E-04	2.735	0.
.245	4.541E-01	.745	3.011E-02	1.245	1.112E-02	1.745	5.494E-03	2.245	2.587E-04	2.745	0.
.255	3.090E-01	.755	2.975E-02	1.255	1.108E-02	1.755	5.452E-03	2.255	2.585E-04	2.755	0.
.265	2.756E-01	.765	1.569E-01	1.265	1.104E-02	1.765	6.912E-01	2.265	2.583E-04	2.765	0.
.275	2.598E-01	.775	2.683E-02	1.275	1.100E-02	1.775	1.930E-03	2.275	2.582E-04	2.775	0.
.285	2.459E-01	.785	4.899E-02	1.285	6.129E-02	1.785	1.927E-03	2.285	2.580E-04	2.785	0.
.295	5.655E-01	.795	2.589E-02	1.295	1.051E-02	1.795	1.924E-03	2.295	2.579E-04	2.795	0.
.305	1.961E-01	.805	5.402E-02	1.305	1.048E-02	1.805	1.921E-03	2.305	2.577E-04	2.805	0.
.315	1.873E-01	.815	2.491E-02	1.315	1.045E-02	1.815	1.918E-03	2.315	2.576E-04	2.815	0.
.325	1.796E-01	.825	2.468E-02	1.325	1.041E-02	1.825	1.914E-03	2.325	2.575E-04	2.825	0.
.335	1.726E-01	.835	2.445E-02	1.335	1.038E-02	1.835	1.907E-03	2.335	2.573E-04	2.835	0.
.345	1.660E-01	.845	2.424E-02	1.345	1.035E-02	1.845	9.717E-02	2.345	2.572E-04	2.845	0.
.355	8.533E-01	.855	2.403E-02	1.355	1.032E-02	1.855	1.445E-03	2.355	2.571E-04	2.855	0.
.365	1.129E-01	.865	2.383E-02	1.365	1.028E-02	1.865	1.443E-03	2.365	2.570E-04	2.865	0.
.375	1.086E-01	.875	2.364E-02	1.375	1.666E-01	1.875	1.441E-03	2.375	2.570E-04	2.875	0.
.385	1.047E-01	.885	2.346E-02	1.385	3.895E-02	1.885	1.438E-03	2.385	2.569E-04	2.885	0.
.395	1.012E-01	.895	2.329E-02	1.395	8.806E-03	1.895	1.436E-03	2.395	2.568E-04	2.895	0.
.405	9.796E-02	.905	2.311E-02	1.405	1.593E-01	1.905	1.434E-03	2.405	2.567E-04	2.905	0.
.415	9.501E-02	.915	2.294E-02	1.415	7.676E-03	1.915	1.432E-03	2.415	2.566E-04	2.915	0.
.425	9.230E-02	.925	2.277E-02	1.425	7.654E-03	1.925	1.430E-03	2.425	2.562E-04	2.925	0.
.435	8.979E-02	.935	1.142E-01	1.435	7.633E-03	1.935	1.428E-03	2.435	2.536E-04	2.935	0.
.445	8.748E-02	.945	2.125E-02	1.445	7.612E-03	1.945	1.426E-03	2.445	8.054E-02	2.945	0.
.455	8.532E-02	.955	2.111E-02	1.455	7.591E-03	1.955	1.425E-03	2.455	0.	2.955	0.
.465	8.332E-02	.965	2.097E-02	1.465	7.571E-03	1.965	1.423E-03	2.465	0.	2.965	0.
.475	8.146E-02	.975	2.084E-02	1.475	7.550E-03	1.975	1.421E-03	2.475	0.	2.975	0.
.485	7.972E-02	.985	2.072E-02	1.485	7.530E-03	1.985	1.419E-03	2.485	0.	2.985	0.
.495	7.810E-02	.995	2.060E-02	1.495	7.505E-03	1.995	1.418E-03	2.495	0.	2.995	0.
.505	7.658E-02	1.005	4.581E-02	1.505	9.308E-02	2.005	1.416E-03	2.505	0.	3.005	0.

TOTAL FLUX ENERGY SPECTRUM FOR THE PHASE 1 INFINITE MEDIUM

PHASE I, CASE 16, SHALE, K, P=0.40, S=1.0

ENERGY	FLUX	ENERGY	FLUX	ENERGY	FLUX	ENERGY	FLUX	ENERGY	FLUX	ENERGY	FLUX
.015	7.734E-07	.515	1.785E-01	1.015	7.324E-02	1.515	0.	2.015	0.	2.515	0.
.025	4.858E-04	.525	1.360E-01	1.025	7.284E-02	1.525	0.	2.025	0.	2.525	0.
.035	2.409E-02	.535	1.328E-01	1.035	7.245E-02	1.535	0.	2.035	0.	2.535	0.
.045	2.386E-01	.545	1.290E-01	1.045	7.208E-02	1.545	0.	2.045	0.	2.545	0.
.055	7.792E-01	.555	1.268E-01	1.055	7.172E-02	1.555	0.	2.055	0.	2.555	0.
.065	1.286E+00	.565	1.241E-01	1.065	7.138E-02	1.565	0.	2.065	0.	2.565	0.
.075	1.544E+00	.575	1.215E-01	1.075	7.106E-02	1.575	0.	2.075	0.	2.575	0.
.085	1.594E+00	.585	1.190E-01	1.085	7.075E-02	1.585	0.	2.085	0.	2.585	0.
.095	1.532E+00	.595	1.167E-01	1.095	7.046E-02	1.595	0.	2.095	0.	2.595	0.
.105	1.418E+00	.605	1.145E-01	1.105	7.016E-02	1.605	0.	2.105	0.	2.605	0.
.115	1.300E+00	.615	1.123E-01	1.115	6.986E-02	1.615	0.	2.115	0.	2.615	0.
.125	1.201E+00	.625	1.103E-01	1.125	6.958E-02	1.625	0.	2.125	0.	2.625	0.
.135	1.091E+00	.635	1.085E-01	1.135	6.931E-02	1.635	0.	2.135	0.	2.635	0.
.145	9.823E-01	.645	1.067E-01	1.145	6.905E-02	1.645	0.	2.145	0.	2.645	0.
.155	8.878E-01	.655	1.049E-01	1.155	6.880E-02	1.655	0.	2.155	0.	2.655	0.
.165	8.088E-01	.665	1.032E-01	1.165	6.857E-02	1.665	0.	2.165	0.	2.665	0.
.175	7.432E-01	.675	1.017E-01	1.175	6.834E-02	1.675	0.	2.175	0.	2.675	0.
.185	6.868E-01	.685	1.002E-01	1.185	6.813E-02	1.685	0.	2.185	0.	2.685	0.
.195	6.375E-01	.695	9.873E-02	1.195	6.792E-02	1.695	0.	2.195	0.	2.695	0.
.205	6.012E-01	.705	9.732E-02	1.205	6.773E-02	1.705	0.	2.205	0.	2.705	0.
.215	5.919E-01	.715	9.597E-02	1.215	6.754E-02	1.715	0.	2.215	0.	2.715	0.
.225	6.117E-01	.725	9.471E-02	1.225	6.735E-02	1.725	0.	2.225	0.	2.725	0.
.235	5.538E-01	.735	9.350E-02	1.235	6.716E-02	1.735	0.	2.235	0.	2.735	0.
.245	5.048E-01	.745	9.234E-02	1.245	6.698E-02	1.745	0.	2.245	0.	2.745	0.
.255	4.630E-01	.755	9.119E-02	1.255	6.681E-02	1.755	0.	2.255	0.	2.755	0.
.265	4.269E-01	.765	9.009E-02	1.265	6.664E-02	1.765	0.	2.265	0.	2.765	0.
.275	3.955E-01	.775	8.905E-02	1.275	6.648E-02	1.775	0.	2.275	0.	2.775	0.
.285	3.681E-01	.785	8.805E-02	1.285	6.633E-02	1.785	0.	2.285	0.	2.785	0.
.295	3.440E-01	.795	8.711E-02	1.295	6.618E-02	1.795	0.	2.295	0.	2.795	0.
.305	3.228E-01	.805	8.619E-02	1.305	6.604E-02	1.805	0.	2.305	0.	2.805	0.
.315	3.040E-01	.815	8.530E-02	1.315	6.590E-02	1.815	0.	2.315	0.	2.815	0.
.325	2.873E-01	.825	8.444E-02	1.325	6.577E-02	1.825	0.	2.325	0.	2.825	0.
.335	2.722E-01	.835	8.363E-02	1.335	6.565E-02	1.835	0.	2.335	0.	2.835	0.
.345	2.586E-01	.845	8.285E-02	1.345	6.553E-02	1.845	0.	2.345	0.	2.845	0.
.355	2.461E-01	.855	8.210E-02	1.355	6.541E-02	1.855	0.	2.355	0.	2.855	0.
.365	2.349E-01	.865	8.138E-02	1.365	6.532E-02	1.865	0.	2.365	0.	2.865	0.
.375	2.246E-01	.875	8.070E-02	1.375	6.521E-02	1.875	0.	2.375	0.	2.875	0.
.385	2.151E-01	.885	8.005E-02	1.385	6.511E-02	1.885	0.	2.385	0.	2.885	0.
.395	2.064E-01	.895	7.941E-02	1.395	6.501E-02	1.895	0.	2.395	0.	2.895	0.
.405	1.985E-01	.905	7.877E-02	1.405	6.491E-02	1.905	0.	2.405	0.	2.905	0.
.415	1.912E-01	.915	7.815E-02	1.415	6.482E-02	1.915	0.	2.415	0.	2.915	0.
.425	1.844E-01	.925	7.750E-02	1.425	6.472E-02	1.925	0.	2.425	0.	2.925	0.
.435	1.781E-01	.935	7.700E-02	1.435	6.462E-02	1.935	0.	2.435	0.	2.935	0.
.445	1.723E-01	.945	7.646E-02	1.445	6.446E-02	1.945	0.	2.445	0.	2.945	0.
.455	1.668E-01	.955	7.593E-02	1.455	6.382E-02	1.955	0.	2.455	0.	2.955	0.
.465	1.618E-01	.965	7.543E-02	1.465	9.474E+00	1.965	0.	2.465	0.	2.965	0.
.475	1.570E-01	.975	7.495E-02	1.475	0.	1.975	0.	2.475	0.	2.975	0.
.485	1.526E-01	.985	7.449E-02	1.485	0.	1.985	0.	2.485	0.	2.985	0.
.495	1.484E-01	.995	7.406E-02	1.495	0.	1.995	0.	2.495	0.	2.995	0.
.505	1.445E-01	1.005	7.364E-02	1.505	0.	2.005	0.	2.505	0.	3.005	0.

TOTAL FLUX ENERGY SPECTRUM FOR THE PHASE I INFINITE MEDIUM

PHASE I, CASE 17, SHALE, TH, P=0.40, S=1.0

ENERGY	FLUX	ENERGY	FLUX	ENERGY	FLUX	ENERGY	FLUX	ENERGY	FLUX	ENERGY	FLUX
.015	7.941E-07	.515	3.947E-01	1.015	9.906E-03	1.515	7.340E-03	2.015	5.613E-03	2.515	5.364E-03
.025	4.988E-04	.525	8.341E-02	1.025	9.818E-03	1.525	7.314E-03	2.025	5.604E-03	2.525	5.362E-03
.035	2.474E-02	.535	8.199E-02	1.035	9.732E-03	1.535	7.288E-03	2.035	5.596E-03	2.535	5.360E-03
.045	2.450E-01	.545	8.067E-02	1.045	9.648E-03	1.545	7.263E-03	2.045	5.588E-03	2.545	5.357E-03
.055	7.998E-01	.555	7.939E-02	1.055	9.567E-03	1.555	7.239E-03	2.055	5.579E-03	2.555	5.355E-03
.065	1.328E+00	.565	7.817E-02	1.065	9.488E-03	1.565	7.213E-03	2.065	5.571E-03	2.565	5.353E-03
.075	1.553E+00	.575	7.687E-02	1.075	9.413E-03	1.575	7.181E-03	2.075	5.563E-03	2.575	5.351E-03
.085	1.740E+00	.585	8.240E-01	1.085	9.339E-03	1.585	1.542E-01	2.085	5.554E-03	2.585	5.347E-03
.095	1.450E+00	.595	5.427E-02	1.095	9.269E-03	1.595	6.251E-03	2.095	5.547E-03	2.595	5.340E-03
.105	1.332E+00	.605	5.343E-02	1.105	9.198E-03	1.605	6.229E-03	2.105	5.539E-03	2.605	5.291E-03
.115	1.229E+00	.615	5.264E-02	1.115	9.128E-03	1.615	6.208E-03	2.115	5.532E-03	2.615	1.052E+00
.125	1.202E+00	.625	5.189E-02	1.125	9.059E-03	1.625	6.187E-03	2.125	5.525E-03	2.625	0.
.135	1.022E+00	.635	5.118E-02	1.135	8.992E-03	1.635	6.167E-03	2.135	5.518E-03	2.635	0.
.145	9.055E-01	.645	5.052E-02	1.145	8.928E-03	1.645	6.147E-03	2.145	5.512E-03	2.645	0.
.155	8.063E-01	.655	4.986E-02	1.155	8.866E-03	1.655	6.127E-03	2.155	5.506E-03	2.655	0.
.165	7.273E-01	.665	4.925E-02	1.165	8.806E-03	1.665	6.100E-03	2.165	5.502E-03	2.665	0.
.175	6.786E-01	.675	4.867E-02	1.175	8.747E-03	1.675	6.089E-03	2.175	5.496E-03	2.675	0.
.185	6.370E-01	.685	4.812E-02	1.185	8.689E-03	1.685	6.070E-03	2.185	5.491E-03	2.685	0.
.195	5.904E-01	.695	4.759E-02	1.195	8.634E-03	1.695	6.052E-03	2.195	5.486E-03	2.695	0.
.205	6.401E-01	.705	4.707E-02	1.205	8.580E-03	1.705	6.034E-03	2.205	5.481E-03	2.705	0.
.215	5.143E-01	.715	4.656E-02	1.215	8.527E-03	1.715	6.017E-03	2.215	5.476E-03	2.715	0.
.225	4.773E-01	.725	2.249E-01	1.225	8.474E-03	1.725	6.000E-03	2.225	5.470E-03	2.725	0.
.235	1.167E+00	.735	4.216E-02	1.235	8.422E-03	1.735	5.983E-03	2.235	5.466E-03	2.735	0.
.245	3.981E-01	.745	4.175E-02	1.245	8.371E-03	1.745	5.965E-03	2.245	5.460E-03	2.745	0.
.255	3.052E-01	.755	4.135E-02	1.255	8.322E-03	1.755	5.949E-03	2.255	5.455E-03	2.755	0.
.265	2.841E-01	.765	4.097E-02	1.265	8.273E-03	1.765	5.932E-03	2.265	5.449E-03	2.765	0.
.275	3.345E-01	.775	4.061E-02	1.275	8.225E-03	1.775	5.917E-03	2.275	5.444E-03	2.775	0.
.285	2.438E-01	.785	4.025E-02	1.285	8.179E-03	1.785	5.901E-03	2.285	5.439E-03	2.785	0.
.295	2.301E-01	.795	1.782E-01	1.295	8.134E-03	1.795	5.886E-03	2.295	5.435E-03	2.795	0.
.305	2.811E-01	.805	3.727E-02	1.305	8.089E-03	1.805	5.871E-03	2.305	5.430E-03	2.805	0.
.315	2.029E-01	.815	3.697E-02	1.315	8.046E-03	1.815	5.856E-03	2.315	5.426E-03	2.815	0.
.325	2.583E-01	.825	3.669E-02	1.325	8.003E-03	1.825	5.841E-03	2.325	5.422E-03	2.825	0.
.335	4.148E-01	.835	3.642E-02	1.335	7.962E-03	1.835	5.827E-03	2.335	5.418E-03	2.835	0.
.345	1.579E-01	.845	3.617E-02	1.345	7.921E-03	1.845	5.813E-03	2.345	5.414E-03	2.845	0.
.355	1.514E-01	.855	3.591E-02	1.355	7.881E-03	1.855	5.800E-03	2.355	5.411E-03	2.855	0.
.365	1.456E-01	.865	1.581E-01	1.365	7.844E-03	1.865	5.786E-03	2.365	5.408E-03	2.865	0.
.375	1.403E-01	.875	3.363E-02	1.375	7.806E-03	1.875	5.773E-03	2.375	5.405E-03	2.875	0.
.385	1.355E-01	.885	3.343E-02	1.385	7.769E-03	1.885	5.760E-03	2.385	5.402E-03	2.885	0.
.395	1.311E-01	.895	3.322E-02	1.395	7.732E-03	1.895	5.747E-03	2.395	5.399E-03	2.895	0.
.405	1.271E-01	.905	3.291E-02	1.405	7.696E-03	1.905	5.734E-03	2.405	5.397E-03	2.905	0.
.415	1.235E-01	.915	9.203E-01	1.415	7.661E-03	1.915	5.722E-03	2.415	5.395E-03	2.915	0.
.425	1.201E-01	.925	2.026E-02	1.425	7.626E-03	1.925	5.710E-03	2.425	5.393E-03	2.925	0.
.435	1.171E-01	.935	2.011E-02	1.435	7.592E-03	1.935	5.698E-03	2.435	5.390E-03	2.935	0.
.445	1.142E-01	.945	1.996E-02	1.445	7.558E-03	1.945	5.686E-03	2.445	5.387E-03	2.945	0.
.455	1.115E-01	.955	1.975E-02	1.455	7.525E-03	1.955	5.675E-03	2.455	5.383E-03	2.955	0.
.465	2.118E-01	.965	7.486E-01	1.465	7.493E-03	1.965	5.663E-03	2.465	5.379E-03	2.965	0.
.475	1.027E-01	.975	1.028E-02	1.475	7.460E-03	1.975	5.652E-03	2.475	5.376E-03	2.975	0.
.485	1.006E-01	.985	1.018E-02	1.485	7.429E-03	1.985	5.642E-03	2.485	5.373E-03	2.985	0.
.495	9.867E-02	.995	1.009E-02	1.495	7.397E-03	1.995	5.631E-03	2.495	5.370E-03	2.995	0.
.505	9.677E-02	1.005	9.995E-03	1.505	7.368E-03	2.005	5.622E-03	2.505	5.367E-03	3.005	0.

TOTAL FLUX ENERGY SPECTRUM FOR THE PHASE I INFINITE MEDIUM

PHASE I, CASE 1B, SHALE, U, P=0.00, S=1.0

ENERGY	FLUX	ENERGY	FLUX	ENERGY	FLUX	ENERGY	FLUX	ENERGY	FLUX	ENERGY	FLUX
.015	7.931E-07	.515	1.308E-01	1.015	2.461E-02	1.515	8.483E-03	2.015	1.738E-03	2.515	0.
.025	4.982E-04	.525	8.914E-02	1.025	2.448E-02	1.525	8.465E-03	2.025	1.737E-03	2.525	0.
.035	2.471E-02	.535	8.764E-02	1.035	2.435E-02	1.535	8.449E-03	2.035	1.735E-03	2.535	0.
.045	2.447E-01	.545	8.625E-02	1.045	2.423E-02	1.545	8.433E-03	2.045	1.734E-03	2.545	0.
.055	7.985E-01	.555	8.491E-02	1.055	2.411E-02	1.555	8.418E-03	2.055	1.733E-03	2.555	0.
.065	1.336E+00	.565	8.364E-02	1.065	2.400E-02	1.565	8.403E-03	2.065	1.731E-03	2.565	0.
.075	1.510E+00	.575	8.245E-02	1.075	2.390E-02	1.575	8.386E-03	2.075	1.730E-03	2.575	0.
.085	1.539E+00	.585	8.131E-02	1.085	2.380E-02	1.585	4.758E-02	2.085	1.728E-03	2.585	0.
.095	1.555E+00	.595	7.999E-02	1.095	2.370E-02	1.595	8.122E-03	2.095	1.727E-03	2.595	0.
.105	1.338E+00	.605	1.345E+00	1.105	2.360E-02	1.605	8.110E-03	2.105	1.723E-03	2.605	0.
.115	1.226E+00	.615	4.512E-02	1.115	2.345E-02	1.615	8.097E-03	2.115	7.006E-02	2.615	0.
.125	1.113E+00	.625	4.440E-02	1.125	6.232E-01	1.625	8.085E-03	2.125	1.455E-03	2.625	0.
.135	1.014E+00	.635	4.371E-02	1.135	1.725E-02	1.635	8.073E-03	2.135	1.453E-03	2.635	0.
.145	9.281E-01	.645	4.306E-02	1.145	1.717E-02	1.645	8.061E-03	2.145	1.452E-03	2.645	0.
.155	8.587E-01	.655	4.241E-02	1.155	8.373E-02	1.655	8.047E-03	2.155	1.451E-03	2.655	0.
.165	7.600E-01	.665	8.633E-02	1.165	1.638E-02	1.665	6.842E-02	2.165	1.451E-03	2.665	0.
.175	6.877E-01	.675	4.024E-02	1.175	1.632E-02	1.675	7.689E-03	2.175	1.450E-03	2.675	0.
.185	7.668E-01	.685	3.970E-02	1.185	1.625E-02	1.685	7.679E-03	2.185	1.448E-03	2.685	0.
.195	5.771E-01	.695	3.919E-02	1.195	1.619E-02	1.695	7.669E-03	2.195	1.438E-03	2.695	0.
.205	5.307E-01	.705	3.868E-02	1.205	1.613E-02	1.705	7.659E-03	2.205	3.045E-01	2.705	0.
.215	5.000E-01	.715	3.820E-02	1.215	1.608E-02	1.715	7.643E-03	2.215	3.186E-04	2.715	0.
.225	4.710E-01	.725	3.775E-02	1.225	1.600E-02	1.725	1.717E-01	2.225	3.184E-04	2.725	0.
.235	4.392E-01	.735	3.732E-02	1.235	2.748E-01	1.735	6.754E-03	2.235	3.182E-04	2.735	0.
.245	5.578E-01	.745	3.690E-02	1.245	1.363E-02	1.745	6.741E-03	2.245	3.180E-04	2.745	0.
.255	3.795E-01	.755	3.647E-02	1.255	1.358E-02	1.755	6.695E-03	2.255	3.178E-04	2.755	0.
.265	3.384E-01	.765	1.923E-01	1.265	1.353E-02	1.765	8.472E-01	2.265	3.175E-04	2.765	0.
.275	3.189E-01	.775	3.288E-02	1.275	1.348E-02	1.775	2.369E-03	2.275	3.173E-04	2.775	0.
.285	3.019E-01	.785	6.003E-02	1.285	7.508E-02	1.785	2.365E-03	2.285	3.171E-04	2.785	0.
.295	6.937E-01	.795	3.173E-02	1.295	1.289E-02	1.795	2.362E-03	2.295	3.170E-04	2.795	0.
.305	2.406E-01	.805	6.620E-02	1.305	1.284E-02	1.805	2.358E-03	2.305	3.168E-04	2.805	0.
.315	2.298E-01	.815	3.053E-02	1.315	1.280E-02	1.815	2.354E-03	2.315	3.166E-04	2.815	0.
.325	2.203E-01	.825	3.024E-02	1.325	1.276E-02	1.825	2.350E-03	2.325	3.165E-04	2.825	0.
.335	2.117E-01	.835	2.997E-02	1.335	1.272E-02	1.835	2.341E-03	2.335	3.163E-04	2.835	0.
.345	2.036E-01	.845	2.970E-02	1.345	1.269E-02	1.845	1.191E-01	2.345	3.162E-04	2.845	0.
.355	1.046E+00	.855	2.945E-02	1.355	1.265E-02	1.855	1.774E-03	2.355	3.161E-04	2.855	0.
.365	1.384E-01	.865	2.921E-02	1.365	1.260E-02	1.865	1.771E-03	2.365	3.160E-04	2.865	0.
.375	1.331E-01	.875	2.896E-02	1.375	2.041E-01	1.875	1.769E-03	2.375	3.159E-04	2.875	0.
.385	1.283E-01	.885	2.875E-02	1.385	4.772E-02	1.885	1.766E-03	2.385	3.158E-04	2.885	0.
.395	1.240E-01	.895	2.854E-02	1.395	1.080E-02	1.895	1.763E-03	2.395	3.157E-04	2.895	0.
.405	1.200E-01	.905	2.832E-02	1.405	1.951E-01	1.905	1.761E-03	2.405	3.156E-04	2.905	0.
.415	1.164E-01	.915	2.811E-02	1.415	9.410E-03	1.915	1.758E-03	2.415	3.155E-04	2.915	0.
.425	1.131E-01	.925	2.790E-02	1.425	9.384E-03	1.925	1.756E-03	2.425	3.151E-04	2.925	0.
.435	1.100E-01	.935	1.399E-01	1.435	9.358E-03	1.935	1.754E-03	2.435	3.122E-04	2.935	0.
.445	1.071E-01	.945	2.604E-02	1.445	9.332E-03	1.945	1.751E-03	2.445	9.005E-02	2.945	0.
.455	1.045E-01	.955	2.587E-02	1.455	9.307E-03	1.955	1.749E-03	2.455	0.	2.955	0.
.465	1.020E-01	.965	2.570E-02	1.465	9.283E-03	1.965	1.747E-03	2.465	0.	2.965	0.
.475	9.976E-02	.975	2.555E-02	1.475	9.258E-03	1.975	1.745E-03	2.475	0.	2.975	0.
.485	9.762E-02	.985	2.539E-02	1.485	9.234E-03	1.985	1.743E-03	2.485	0.	2.985	0.
.495	9.564E-02	.995	2.525E-02	1.495	9.204E-03	1.995	1.741E-03	2.495	0.	2.995	0.
.505	9.378E-02	1.005	5.613E-02	1.505	1.141E-01	2.005	1.739E-03	2.505	0.	3.005	0.

☆ U.S. Government Printing Office: 1979 — 677-013/51