7342 U-007-307.66

NIELSON, K., ROGERS AND V. C. ROGERS, RAETRAD VERSION 3.1 USER MANUAL, PREPARED FOR STATE OF FLORIDA AND THE U. S. ENVIRONMENT CORP, SALT LAKE CITY UTAH - (USED AS A REFERENCE IN OU 5 RI REPORT - APPENDIX A)

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RAETRAD

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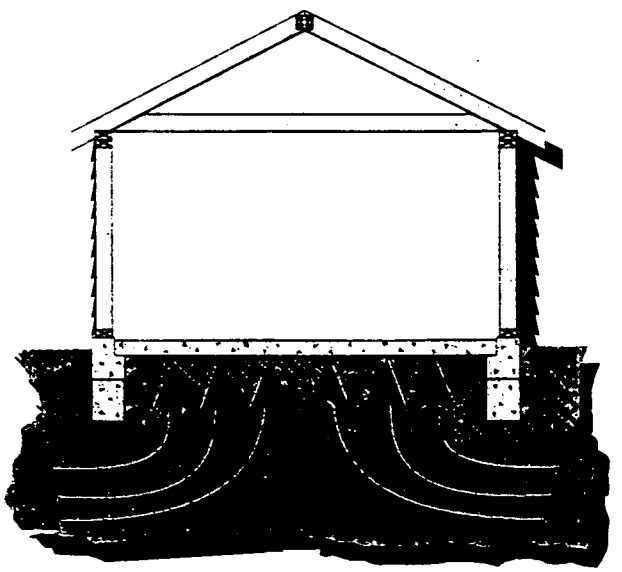

RAdon Emanation and TRAnsport into Dwellings

Rogers & Associates Engineering Corporation

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RAE-9127/10-2R1
July 1993

RAETRAD

Version 3.1

User Manual

by

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EPA Interagency Agreement RWFL 933783-01
Contract 68-DO-0097 to
Sanford Cohen & Associates, Inc., McLean, VA

Prepared for:

State of Florida
Department of Community Affairs
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IF-7342

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Section 1

INTRODUCTION

The RAETRAD computer code (RAdon Emanation and TRAnsport into Dwellings) provides a simple, inexpensive means of estimating the rates of radon gas entry into slab-on-grade dwellings from underlying soils and concrete components. It models houses of varied sizes and rectangular shapes on soils with any distribution of radon source strengths, physical properties, water contents, and gas transport properties. RAETRAD first calculates the flow of air through the soil and into the house due to a pressure difference between the house and the outside. It then calculates the radon gas generation rates from the decay of radium in the concrete and soil layers. It next calculates the movement of the radon through the soil and concrete and into the house. Finally, it calculates the average indoor radon concentration, assuming that all the air in the house is well mixed. Version 3.1 of RAETRAD is written for use under a Windows® environment on IBM®-compatible personal computers.

RAETRAD features an efficient, numerical-analytical algorithm for solving the steady-state air flow and radon generation and transport equations in 2-dimensional elliptical-cylindrical geometry. It utilizes complete, multiphase equations[1-2] to account for radon generation, exchange among solid, liquid and gas phases, and transport by diffusion (concentration driven) and advection (with pressure-driven air flow). It provides a broad range of input alternatives that include empirically-based default values[3-4] for unknown parameters such as radon diffusivity, air permeability, and soil moisture for cases where generic values are preferred.

This user manual describes the background and purpose for which RAETRAD was developed, the house-soil configuration that is modeled, and the installation and operating environment needed to operate the model. The start-up definitions are described, and reference problems are presented to assure proper function of the software. The creation of input data files to model specific cases then is described, along with alteration and processing of these files. The analysis results then are described along with management alternatives for using and manipulating them. Input files and printed results for several sample problems are provided in the appendices.

1.1 BACKGROUND AND PURPOSE

Radiation doses from inhaled radon (^{222}Rn) decay products are a significant cause of lung cancer,[5-6] and are the dominant source of natural radiation exposure in the U.S. population.[7] Most radon exposure occurs indoors, where concentrations usually are about five times greater than outdoors,[5-6] but in some cases reach hundreds to thousands of times the typical outdoor levels of 0.2-0.5 picocuries per liter (pCi L^{-1}). Indoor radon comes mainly from decay of naturally-occurring radium (^{226}Ra) in underlying soils, although contributions from water, building materials, outdoor air, and other sources sometimes are important.[8] Radon gas accumulates upon entry through the foundation because it is diluted more slowly indoors than radon that diffuses directly into the atmosphere from outdoor soil surfaces. If sufficient radon enters a building and if its dilution by outside air is small, it can accumulate

to levels that pose significant health risks with chronic exposure. Highly elevated indoor radon levels usually result from elevated soil radium concentrations, foundation cracks, openings or pores that permit radon entry, negative indoor pressures that draw soil gas indoors from foundation soils, low dilution rates of indoor air by outdoor air, and combinations of these effects. The U.S. Environmental Protection Agency (EPA) suggests that indoor levels averaging 4 pCi L^{-1} or higher warrant remedial action.[5-6]

To help reduce public health risks from indoor radon, the Florida Department of Community Affairs (DCA) is developing standards for constructing radon-resistant buildings.[9-11] The technical basis for the standards is being developed under the Florida Radon Research Program (FRRP), co-sponsored by the DCA and EPA. The FRRP addresses both buildings (designs, materials, dynamics, and basic processes) and radon source potentials, and uses supporting mathematical models to efficiently estimate the complex effects of various soil conditions, water tables, foundation and house design and construction details, and occupant habits. The RAETRAD model, originally developed by Rogers and Associates Engineering Corporation (RAE), was extended, used[12-14] and documented[15] under the FRRP, and is now being placed in the public domain to make it accessible for broader use in this and other public and private research programs and applications.

1.2 HOUSE MODEL CONFIGURATION

The RAETRAD algorithm to compute radon entry into a house represents the house floor, foundation, and vicinity soils by 2-dimensional arrays of properties for use in finite-difference calculations. The arrays are oriented in the vertical and radial (horizontal) dimensions, with the origin being at the house floor slab in the vertical dimension and at the horizontal center of symmetry in the radial dimension, as illustrated in Figure 1-1. The vertical cross-sectional view illustrated in Figure 1-1 represents the modeled region of the house foundation and soils from the center of the house to the defined extent of outdoor soils. The house floor plan is defined to have a rectangular shape, with user-specified dimensions, as illustrated in Figure 1-2. The house is represented in the numerical calculations by an ellipse of equivalent area. The house floor slab, cracks, footings, and foundation soils, are defined to have elliptical-cylindrical symmetry so that they can be analyzed by efficient, 2-dimensional finite-difference calculations. The elliptical-cylindrical model thus considers the aspect ratio (length/width) of the rectangular house to represent it more accurately than conventional, circular-cylindrical or 2-dimensional cartesian geometries.

Depending on the amount of information available to characterize the house and its foundation soils, RAETRAD can analyze either simple or relatively complex problems. It is designed to represent as many discrete regions as desired (i.e., concrete slab, footings, fill soil, foundation soil layers, etc.). Each region is assumed to be homogeneous, and may be comprised of one or more contiguous numerical mesh units. For each defined region, individual values are defined for the radium concentration, the radon emanation coefficient, the density, porosity, water content, radon diffusion coefficient, air permeability, radon adsorption coefficient, and anisotropies of the diffusion and permeability coefficients. Figure 1-3 illustrates the definitions of these numerical mesh properties and related boundary conditions for the regions illustrated in Figure 1-1.

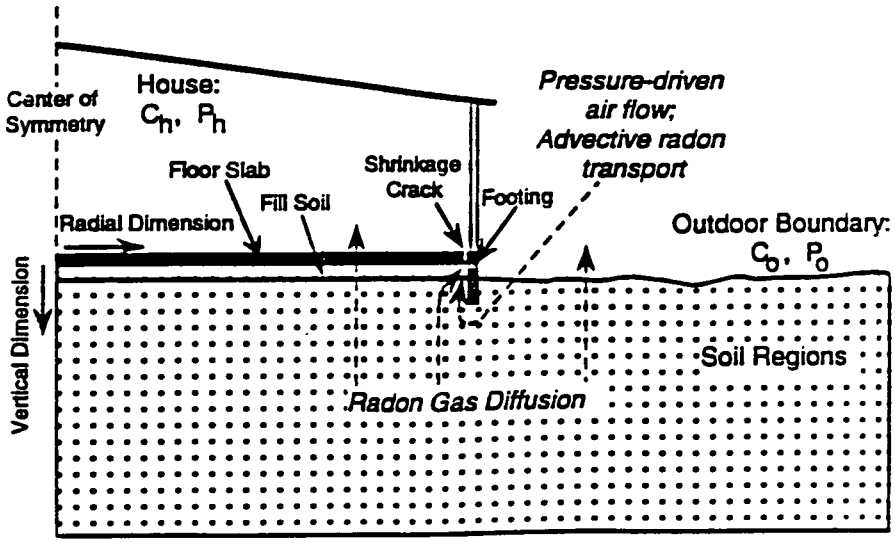

Figure 1-1. Two-dimensional grid and boundaries used to define slab and soil regions for indoor radon and air entry calculations.

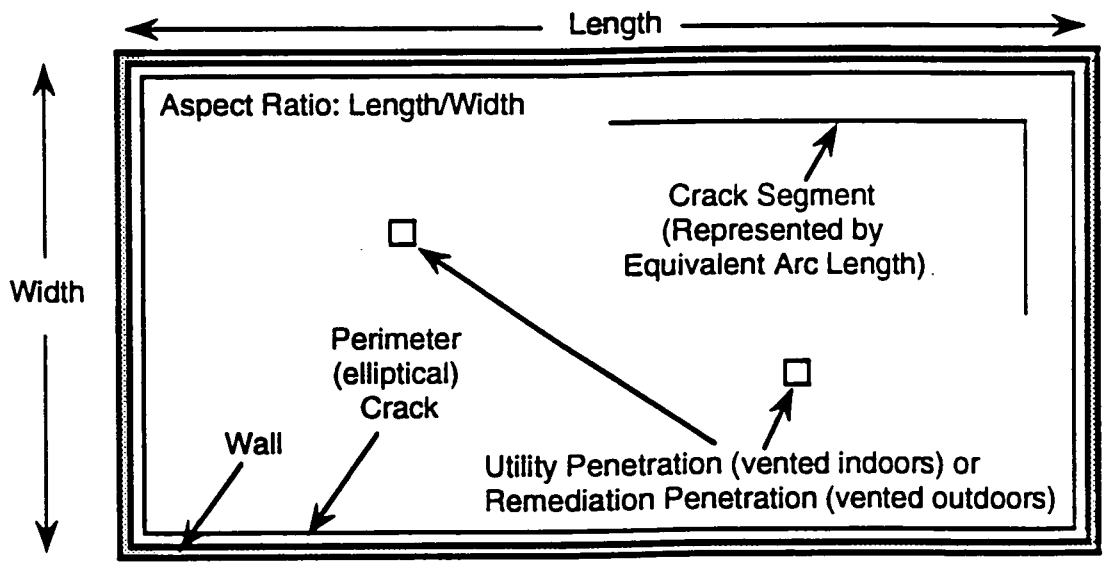

Figure 1-2. Rectangular floor plan, cracks, and openings represented by the RAETRAD model.

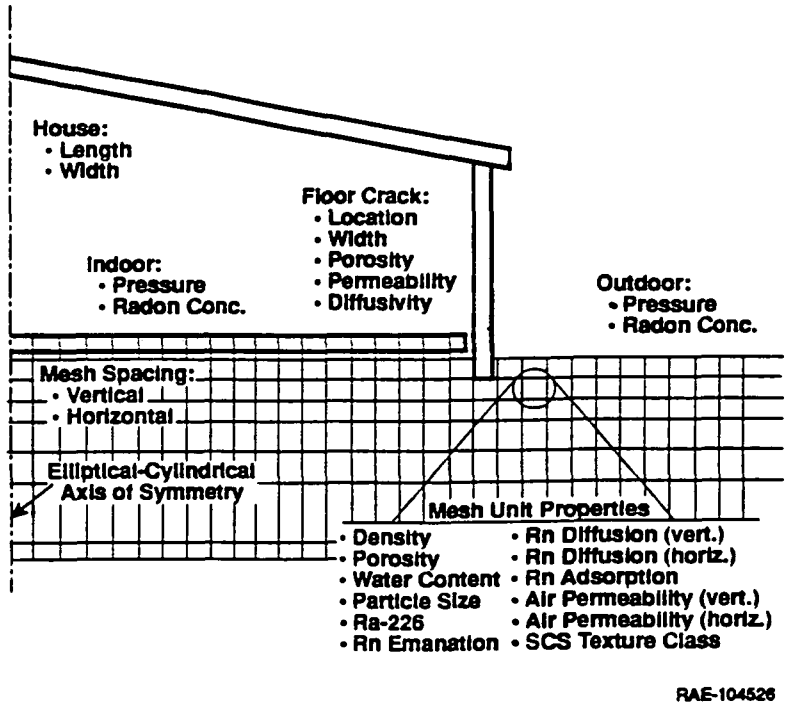

Figure 1-3. Parameters used to define numerical mesh units and boundary conditions for RAETRAD calculations.

The equations solved by RAETRAD are the differential equation for steady-state air flow and the differential radon balance equation for steady-state radon generation and transport.[1-2] The differential equation for air flow characterizes steady-state pressure-driven air flow from the equation of continuity and the equation-of-state for gases under isothermal expansion:

$$\partial(P/P_0)/\partial t = \nabla\cdot(K/\mu)\nabla P = 0, \qquad (1)$$

where $\partial(P/P_0)/\partial t$ = time derivative of the fractional change in soil air pressure (s^{-1})

P = air pressure in the soil pore space = P_{bulk}/ε_a (Pa)

P_{bulk} = air pressure on a bulk-space basis (Pa)

ε_a = $\varepsilon(1-S)$ = air-filled porosity (dimensionless)

ε = soil porosity (dimensionless: cm^3 pore space per cm^3 bulk space)

S = soil water saturation fraction (dimensionless)

∇ = gradient operator

K = bulk soil air permeability (cm^2)

μ = dynamic viscosity of air (1.8×10^{-5} Pa s)

∇P = air pressure gradient (Pa cm^{-1}).

The finite-difference equations are applied to air velocities in bulk space. However for use in the radon balance equation, air flow velocities are computed between soil or interface boundaries from Darcy's law for the air-filled pore space as:

$$v = -K/(\mu\varepsilon_a)\ \nabla P \tag{2}$$

where v = soil air velocity in the air-filled pore space (cm s^{-1}).

The equation solved for the radon concentrations also is expressed in terms of bulk soil space to accommodate the material differences in different regions. It is written as:

$$\partial C_b/\partial t = \nabla \cdot f_a D \nabla (C_b/f_s) + \nabla \cdot [(K/\mu)(C_b/f_s)\ \nabla P] - \lambda C_b + R\rho\lambda E = 0 \tag{3}$$

where $\partial/\partial t$ = time derivative (s^{-1})

C_b = $f_s C_a$ = ^{222}Rn concentration in bulk soil space (pCi cm^{-3})

f_s = $\varepsilon(1-S+Sk_H) + \rho k_a$

k_H = ^{222}Rn distribution coefficient (water/air) from Henry's Law (0.26 pCi cm^{-3} water per pCi cm^{-3} air at 20°C)

ρ = soil bulk density (g cm^{-3}, dry basis)

k_a = $k_{ao} \exp(-bS)$

k_{ao} = dry-surface adsorption coefficient for ^{222}Rn (cm^3 g^{-1})

b = adsorption-moisture correlation constant (g cm^{-3})

C_a = ^{222}Rn concentration in air-filled pore space (pCi cm^{-3})

f_a = $\varepsilon(1-S+Sk_H)$

D = diffusion coefficient for ^{222}Rn in soil pores (cm^2 s^{-1})

λ = ^{222}Rn decay constant (2.1×10^{-6} s^{-1})

R = soil ^{226}Ra concentration (pCi g^{-1})

E = total ^{222}Rn emanation coefficient (air+water) (dimensionless).

This equation applies to gas-phase advective transport of radon, and to combined gas-phase and liquid-phase diffusive transport of radon. The four respective terms defining radon concentration changes in equation (3) represent radon diffusion, advective transport of radon by soil gas movement, radon decay, and radon generation by emanation from soil minerals. The factor f_a physically corresponds to the effective porosity in which radon is distributed, including the gas-phase and liquid-phase components. The factor f_s similarly represents the effective porosity containing radon, but includes also an equivalent pore volume for radon adsorbed on solid pore surfaces.

The combined-phase diffusive transport is characterized by appropriate moisture- and porosity-dependent values of the pore-average diffusion coefficient, D.[1-2] This approach is important to correctly characterize radon diffusion in unsaturated soil pores that may have small intermittent water blockages, but that still may transmit significant radon flux.[16] Liquid-phase advective transport of radon is not addressed in RAETRAD because it generally is much smaller than the other modes of transport. Radon fluxes between different soil layers or regions and at the top surface or interface are calculated as

$$F = -D\, f_a\, \nabla C_a - (K/\mu)\, \nabla P\, C_a, \qquad (4)$$

where F = bulk flux of ^{222}Rn (pCi cm^{-2} s^{-1}).

The first (diffusive) term of equation (4) results from Fick's law, which describes radon flux in a single phase.[17-18] The second (advective) term in equation (2) represents the radon flux from bulk air movement in the air-filled pore space.

The 2-dimensional finite-difference forms of equations (1) to (4) are coupled with analytical functions for modeling air and radon entry in certain discontinuity regions such as floor cracks to increase computational speed and efficiency. Analytical functions also are used to define default values of input parameters for cases in which more specific values are unavailable.[3] The resulting numerical-analytical algorithm provides fast but detailed calculations while retaining the operational simplicity and minimal input requirements previously associated with 1-dimensional calculations.[19] The RAETRAD algorithm assumes isothermal conditions except as thermal gradients affect the user definitions of indoor air pressure and air exchange rate.

1.3 OPERATING ENVIRONMENT AND INSTALLATION

The following description of RAETRAD v3.1 installation, along with certain other parts of this user manual, assume user familiarity with the IBM®-compatible Disk Operating System (DOS) and with Microsoft Windows.® The DOS and Windows manuals should be consulted regarding procedures for their use. Before installing RAETRAD, it is recommended that one or more backup copies be made. RAETRAD software incorporates no special copy protection; therefore standard backup procedures are adequate. After making backup copies, the original RAETRAD disk should be stored in a safe place. The backups should be used for installing and running RAETRAD.

RAETRAD is designed for use in the Microsoft Windows 3.1 environment. It is recommended that the IBM®-compatible personal computer system be equipped with a math co-processor, with at least 3 Mbytes of unused RAM, and with a VGA color monitor and graphics system. RAETRAD will prompt the user if one or more of these features is not found, but will then attempt to proceed. Although the user is cautioned that RAETRAD may not execute properly if any of these features is missing, he has the option to proceed anyway, and can verify proper execution by analysis of sample problems furnished with the code. The computer system also should be equipped with a printer capable of printing 132 characters per line to avoid inconvenient truncation or wrap-around of printed output.

For installation of RAETRAD onto either a floppy or hard disk system, an automated installation program is included on the RAETRAD v3.1 diskette. The installation program will create a RAETRAD subdirectory for the program files at a user-specified disk location. To begin installation, ensure that the RAETRAD v3.1 diskette is inserted properly into the appropriate disk drive. Since the installation program is a Windows application, Windows must be running before installation can begin.

From the *PROGRAM MANAGER* in Windows, the *File Menu* should be pulled down to select the *RUN* option. At the prompt, enter `n:install`, where `n` is the disk drive in which the RAETRAD v3.1 diskette is located (for example, `b:install`). The installation program will then clear the screen and proceed.

The user is next prompted to specify the disk location where the new RAETRAD subdirectory will be created. Since the installation program needs to create a new RAETRAD subdirectory, no existing subdirectories should have the name "RAETRAD" in the specified root. A list of the disk drives connected to the system is displayed. The user moves through the directory tree by double clicking (with the mouse) on the selected drives and/or directories. As this is done, the selected location is updated at the top of the installation window. When a suitable location is found, selecting the *OK* button will direct the installation program to proceed.

The installation program then will create a RAETRAD subdirectory and proceed to install the RAETRAD v3.1 files into it. When the files have all been installed, the installation program will create a new program group for the RAETRAD files (*RAETRAD* Icon) on your desktop. At this point, RAETRAD is fully installed on your system and ready for use.

1.4 SOFTWARE SUPPORT AND DEVELOPMENT

Rogers and Associates Engineering Corporation (RAE) has released version 3.1 of RAETRAD to the public domain to make it openly available for public and private use outside the FRRP and EPA as well as for continued use within these organizations. As part of their continuing interest in radon research and in specifically continuing to improve and extend the RAETRAD model and computer code, the authors encourage users to submit written comments regarding their experience with RAETRAD. In particular, problems noted in using the model, code errors and/or needed improvements should be brought to their attention. Although future, improved versions may become available, present arrangements do not provide for active support (such as telephone support) for users of this software. Therefore,

RAE has also released the RAETRAD source code and technical descriptions[15] so that knowledgeable users can also participate in future developments. Accordingly, RAE encourages user reciprocation in openly exchanging scientific developments in connection with this model and software. Correspondence related to RAETRAD should be directed to:

RAETRAD Development
Rogers & Associates Engineering Corporation
P. O. Box 330
Salt Lake City, Utah 84110-0330

Section 2
GETTING STARTED

This section describes the main RAETRAD menus and gives step by step descriptions of the various choices for execution. It also describes the method for defining input/output paths for RAETRAD files, and the analysis of a sample problem that can be used to test RAETRAD for correct operation after initial setup. RAETRAD is designed with a user-friendly interface for the inexperienced user. On-line instructions and assistance are provided to prompt and assist the user.

At the start of program execution, the following screen is displayed:

RAETRAD - Version 3.1

RAdon **E**manation and **TRA**nsport into **D**wellings
Rogers & Associates Engineering Corporation

press any key to continue

2.1 MAIN MENU OPTIONS

Upon pressing any key, RAETRAD displays the main menu, as illustrated in the following display box. Any of the five menu options is selected either by pressing the appropriate number and then the <ENTER> key, or by pressing the arrow keys until the desired option is highlighted and then pressing the <ENTER> key. The <ESC> key can be used to back up one step in the user dialogue. For example, if an erroneous selection is made, pressing the <ESC> key will re-display the main menu for an alternative selection.

MAIN MENU

OPTIONS

1. INPUT FILES
2. RAETRAD ANALYSIS
3. RAETRAD RESULTS
4. I/O PATHS
5. EXIT

ENTER YOUR CHOICE

Press the number of the selection that you wish. It will become highlighted.

The *INPUT FILES* option allows the user to create, modify and delete RAETRAD input files that each describe a single model scenario to be analyzed. Creation of a new input file is prompted by a detailed user dialogue, described in Section 3, that includes a screen display of the house and soils being selected. Options for altering existing input files also are available under this option.

The *RAETRAD ANALYSIS* option lists all existing RAETRAD input files found on the input disk unit for selection of those to be analyzed. Up to 30 files can be selected for batch analysis. Section 4 describes the operation and options available for RAETRAD analysis.

The *RAETRAD RESULTS* option lists all existing RAETRAD output files found on the designated disk unit. They can be selected by name for summary review on the screen, for detailed examination on the screen, or for hard-copy printout. Section 5 describes the options and operations for managing the output files.

The *I/O PATHS* option allows the user to specify the disk location of the RAETRAD system files and data files. It is recommended that the data files be kept in a subdirectory that is separate from the RAETRAD system files. This will assist in organizing and managing data files and should help prevent accidental deletion of the RAETRAD system files. The paths specified are saved to diskette for later reference.

The *EXIT* option prepares an exit from RAETRAD. However an additional query allows a return to the main menu or a final exit from RAETRAD.

2.2 DEFINING I/O PATHS

The first option that should be selected from the Main Menu upon initial startup of RAETRAD is #4, *I/O PATHS*. This option allows the user to specify the disk location of the

RAETRAD system and data files. It is recommended that the user keep data files in a subdirectory that is separate from the RAETRAD system files. This will assist in organizing and managing data files and should help prevent accidental deletion of RAETRAD system files. Upon selecting the *I/O PATHS* option, the following menu appears on the screen:

I/O PATHS

OPTIONS

1. LOCATION OF DATA FILES
2. LOCATION OF SYSTEM FILES
3. RETURN TO MAIN MENU

ENTER YOUR CHOICE

Press the number of the selection that you wish. It will become highlighted.

The specification of system and data file locations should include full path names, as illustrated by the examples below.

Example Specifications of File Locations for RAETRAD

`c:\RAETRAD\DATA`	*(hard disk subdirectory for RAETRAD data files)*
`c:\RAETRAD\SYS`	*(hard disk subdirectory for RAETRAD system files)*
`a:`	*(floppy disk for Raetrad system files)*
`b:`	*(floppy disk for raetrad data files)*

Once the appropriate disk file locations have been specified, RAETRAD records them on disk, and will use the specified locations until otherwise directed. The user can now proceed with scenario definitions and analyses by choosing #3 or <ESC> to return to the main menu. Input data files for RAETRAD processing contain the user-specified name with the extension .RAE. Output results files created by RAETRAD have the same user-specified name with the

extension .OTn, where n is a version number to distinguish multiple analyses of a file with the same name.

2.3 RUNNING A SAMPLE PROBLEM

The input and output files for six sample problems are furnished with the RAETRAD version 3.1 program diskette to assist in verifying correct installation and operation of RAETRAD. The sample problems illustrate several of the features and options of RAETRAD version 3.1. Most of the input parameters for the sample problems are the default parameters. It is recommended that upon initial RAETRAD installation and setup, at least one of the sample problems should be processed to compare results with those furnished. A printed listing of each of the sample problem input files is presented in Appendix A, and a printed listing of each of the corresponding output files is presented in Appendix B.

To analyze one of the sample input files, the Main Menu Option 2 should be selected. Using the arrow keys, the desired input file then is highlighted and is selected with the space bar. Processing is initiated with the <ENTER> key, and begins after responding to the file detail and printing/storage questions. Section 4 describes this process in more detail. Comparison of the results from one of the sample problems, such as *def1* with the printed results in Appendix B will help verify proper functioning of the RAETRAD code after installation on a new system.

Section 3
CREATING INPUT FILES

Selection of *INPUT FILES* from the Main Menu allows the user to create, modify and delete model analysis scenarios for processing by RAETRAD. The following menu is displayed after selecting the *INPUT FILES* option:

INPUT FILES

OPTIONS

1. CREATE A NEW INPUT FILE
2. MODIFY/REVIEW AN EXISTING INPUT FILE
3. DELETE AN EXISTING INPUT FILE
4. RETURN TO MAIN MENU

ENTER YOUR CHOICE

Press the number of the selection that you wish. It will become highlighted.
Press <ENTER> to proceed, a new number, or the arrow keys.

Creation of a new input file for RAETRAD analysis is guided by a detailed user dialogue that is initiated by selection of Option #1, *CREATE A NEW INPUT FILE*. Alterations to the input file, such as changing of selected parameters, can be accomplished by selection of Option #2, *MODIFY/REVIEW AN EXISTING INPUT FILE*. Deletion of existing input files can be accomplished with Option #3, and return to the Main Menu is accomplished with Option #4. Once the user has become familiar with the input file structure, the parameters of choice, and use of RAETRAD, DOS-Editing of input files will be found to be more efficient.

3.1 CREATE FILE: QUERIES AND DEFAULTS

Upon selection of the *CREATE A NEW INPUT FILE* option from the Input Files Menu, the computer will graphically display a house and a list of up to 17 default soil and concrete classes that can be utilized in the analysis. The user is next prompted by a long list of queries to guide his selection of the appropriate parameters to define the desired soil and concrete regions and the house structural features (Figure 1-2). These are documented in detail, along with the default options offered by RAETRAD, in Table 3-1. To simplify and expedite the data entry procedure, most default parameters are displayed along with the query for their entry, and can be selected by pressing the <ENTER> key, with no additional

input. To specify an alternative entry, its numerical value is typed, in the appropriate units, followed by <ENTER>. As with most other sections of the RAETRAD code, the <ESC> key allows the user to back up to re-address the previous question. As the questions are answered, the displayed information and house on the screen are updated to show the added information.

As indicated by Table 3-1, several global model parameters first are defined. These include the maximum soil depth and radial extent to be considered in the numerical analysis. These are as illustrated by the soil, slab, and footing regions in Figures 1-1 and 1-2, and with present array dimensioning, they can not exceed 30 and 40 mesh units, respectively, including the floor slab. The size of the uniform radial mesh units next is specified within the range of 0.25 to 1 ft.

House parameters are next defined in the user dialogue, including the height of the indoor air volume, and the width and length of the rectangular house. For houses with more complex floor plans, the width should be estimated as an average narrow dimension and a corresponding length that preserves the total house area. The house ventilation rate then is specified, along with the indoor pressure and radon concentration to be used as boundary conditions for the air flow and radon calculations. The indoor radon concentration specified here generally has negligible effect on the resulting calculation of radon entry rate and indoor radon because it is very small compared to typical sub-slab radon concentrations.

Floor slab parameters next are specified, including the concrete thickness, radium concentration, bulk density, radon emanation coefficient, porosity, and material type. The material type, defined on the right-hand side of the screen, specifies a label that appears on the printout, and also selects the set of default parameters that will be available for the succeeding queries for water content, radon transport properties, and radon adsorption. The default porosity is computed as shown in Table 3-1 if no alternative is entered. The default water content and dry adsorption coefficient of the concrete is defined in the *RAETRAD.SYS* file, and potentially can be altered by the user. Default diffusion coefficients and permeabilities are obtained from soil-based empirical correlations.[3]

Outdoor air pressure and radon concentration boundary conditions next are defined, followed by the detailed definition of soil layers. For each layer, the thickness and number of vertical mesh units first are defined, followed by the radium concentration, bulk dry density, radon emanation coefficient, porosity, and material type. Again, the material type selects the default moisture and adsorption properties, which are used in turn for calculation of the default diffusion and permeability parameters.[3] In specifying soil layer thicknesses, a coarse, 1-ft. vertical mesh spacing generally is suitable, but may give a small bias because of the finite-difference numerical method employed in RAETRAD.[15] This is generally overcome by specification of a small (approximately 0.03-0.1 ft) additional layer at the top of the soil profile (just beneath the slab).[15] It should have the same properties as the adjacent underlying soil. Its thickness can be subtracted from the underlying layer to compensate for the extra soil thickness. Sample problem 1a (def1a___.RAE) in Appendices A and B shows use of this extra layer beneath the house compared to the identical problem 1 where it was not used (def1____.RAE). The default soil moistures stored in the RAETRAD.SYS file correspond approximately to the soil water contents at a matric potential of -0.3-bars (-30

kPa), which is sometimes used to represent the drained, field-capacity water content of the given soil type.[4]

Parameters describing the foundation footing and stem wall next are requested, as defined in Table 3-1. The depth of the footing is specified using the vertical arrow keys to obtain a depth that corresponds to one of the previously-chosen soil layers. Its depth is displayed in feet, even though it is selected to coincide with a certain number of vertical mesh units. The radium concentration, density, radon emanation coefficient, porosity, material type, water content, radon diffusion coefficient, air permeability, and adsorption coefficient next are defined in the same way as done previously for the concrete floor slab. The thickness of fill soil next is specified, corresponding to the difference in elevation between the bottom of the floor slab and the top of the surrounding outdoor soil surface. On the graphic display, this selection again is made using the vertical arrow keys, which alter the elevation of the outdoor soil surface with respect to the floor slab. Again, the selection is based on vertical mesh spacing, but is displayed in units of feet.

The location and distribution of floor cracks and penetration openings finally are defined as indicated on the last page of Table 3-1. After specifying the number of crack positions to be considered, each is defined by its location (distance from the house perimeter) using the horizontal arrow keys to step across the specified radial mesh positions. The screen displays the equivalent ellipse for the specified house shape, and shows the selected crack or opening position during selection. Next the crack width, number of openings (or elliptical crack), and number of remediation penetrations are specified. Remediation penetrations are defined as openings that ventilate their radon effluent to the outside of the house, and are subject to potentially different (user-specified) pressure and radon boundary conditions than those used for the interior of the house. For crack segments that do not have the complete elliptical symmetry, an arc length may be specified, and radon entry will be reduced from the ellipse-based value by the fraction of elliptical distance specified for the arc. Finally, the porosity and the vertical diffusion coefficient and air permeability of the crack volume are specified, potentially accounting for accumulated soil or intentional fill material placed in the crack.

When the questions are answered completely, the user is prompted for a file name. This name should *not* include a path statement, but will utilize the path specified earlier under the *I/O PATHS* option of the Main Menu. The file creation process can be repeated for as many file as can be stored.

Table 3-1. RAETRAD input data requests.

INPUT	COMMENTS	DEFAULT VALUE
Global Scenario Parameters		
Maximum soil depth (ft.)	Depth from the slab base to the lowest soil depth. Up to 29 soil layers are allowed.	20
Maximum radial extent (ft.)	Maximum horizontal distance from the house center to be analyzed. Up to 40 units are allowed (40 1-ft. units; 20 0.5-ft. units).	40
Radial unit size (ft.)	Must be at least 0.25 ft. and must not exceed 1 ft.	1
Scenario title	User description of model case being analyzed	none
File name	The suffix .RAE will be appended for storage of the data file.	none
House Parameters		
Indoor height (ft.)	Height of the room or volume where radon accumulates.	8
Width of house (ft.)	The smaller dimension of the rectangular house. The minor radius of the equivalent ellipse equals this width divided by $\sqrt{\pi}$.	28.4
Length of house (ft.)	The larger dimension of the rectangular house.	54.3
House air exchange rate (hr^{-1})	The rate of dilution of house air with radon-free air.	0.5
Indoor air pressure (Pa)	Ordinarily defined relative to outdoor air pressure	-2.4
Indoor radon concentration (pCi/L)	Boundary condition used in diffusion calculations	2

Table 3-1. RAETRAD input data requests (continued)

INPUT	COMMENTS	DEFAULT VALUE
Floor Slab Parameters		
Slab thickness (cm)	Vertical thickness of the concrete floor slab	10.16
Slab radium (pCi/g)	Radium-226 concentration in the slab concrete	1
Slab density (g/cm^3)	Bulk dry density of the slab concrete	2.1
Emanation (fraction)	Radon emanation coefficient of the slab concrete	0.1
Slab porosity	Total dry porosity. Default value calculated as P = 1 - [density/(2.7 g/cm^3)].	0.222 see comment
Material type	Material number used to specify default properties. Numbers 13 and 14 refer to concretes.	13 (Concrete 1)
Water saturation (fraction)	The fraction of the concrete pore volume that is occupied by water. Default value obtained from material file.	0.769 see comment
Radon diffusion coefficients (cm^2/s)	Diffusion coefficients for radon in concrete in the radial and vertical directions. Default values are calculated from moisture and porosity.[3]	(calculated) see comment
Air permeability (cm^2)	Air permeabilities for concrete in the radial and vertical directions. Default values are calculated from moisture, porosity, and effective particle size.[3]	(calculated) see comment
Adsorption coefficient (cm^3/g)	Dry-basis radon adsorption coefficient for the slab concrete. Default value obtained from material file.	1
Outdoor Parameters		
Outdoor air pressure (Pa)	Reference value from which indoor pressure is measured.	0
Outdoor radon concentration (pCi/L)	Boundary radon concentration used in diffusion calculations	0

Table 3-1. RAETRAD input data requests (continued)

INPUT	COMMENTS	DEFAULT VALUE
Soil Layer Parameters		
Layer thickness (ft.)	Total thickness of the specified soil layer	1
Number of vertical mesh units	The number of equally-spaced mesh divisions of the specified soil layer. (Total soil units ≤29)	1
Radium (pCi/g)	Radium-226 concentration in the soil layer.	0.3
Density (g/cm^3)	Bulk dry density of the soil layer	1.6
Radon Emanation (fraction)	Radon emanation coefficient of the soil layer	0.2
Porosity	Total dry-basis pore volume fraction. Default value calculated as P = 1 - [density/(2.7 g/cm^3)].	0.407 see comment
Material type	Material number used to specify default properties. Numbers 1-12 refer to soil types.	1 (sand)
Water saturation (fraction)	The fraction of the soil pore volume that is occupied by water. Default value obtained from material file.	0.213 see comment
Radon diffusion coefficients (cm^2/s)	Diffusion coefficients for radon in soil in the radial and vertical directions. Default values are calculated from moisture and porosity.[3]	(calculated) see comment
Air permeability (cm^2)	Air permeabilities for soil in the radial and vertical directions. Default values are calculated from moisture, porosity, and effective particle size.[3]	(calculated) see comment
Adsorption coefficient (cm^3/g)	Dry-basis radon adsorption coefficient for the soil. Default value obtained from material file.	see comment
Footing Parameters		
Footing depth (mesh units)	The combined footing and stem wall depth is entered by stepping arrow keys in vertical mesh units. The resulting depth is displayed in feet.	0
Footing radium (pCi/g)	Radium-226 concentration in the footing and stem-wall concrete	1
Footing density (g/cm^3)	Bulk dry density of the footing and stem-wall concrete	2.1
Emanation (fraction)	Radon emanation coefficient of the footing and stem-wall concrete	0.1
Porosity	Total dry porosity. Default value calculated as P = 1 - [density/(2.7 g/cm^3)].	0.222 see comment
Material type	Material number used to specify default properties. Numbers 13 and 14 refer to concretes.	13 (Concrete 1)

Table 3-1. RAETRAD input data requests (continued)

INPUT	COMMENTS	DEFAULT VALUE
Footing Parameters (continued)		
Water saturation (fraction)	The fraction of the concrete pore volume that is occupied by water. Default value obtained from material file.	0.769 see comment
Radon diffusion coefficients (cm^2/s)	Diffusion coefficients for radon in footing and stem-wall in the radial and vertical directions. Default values are calculated from moisture and porosity.(3)	(calculated) see comment
Air permeability (cm^2)	Air permeabilities for the footing and stem-wall in the radial and vertical directions. Default values are calculated from moisture, porosity, and effective particle size.(3)	(calculated) see comment
Adsorption coefficient (cm^3/g)	Dry-basis radon adsorption coefficient for the footing and stem-wall concrete. Default value obtained from material file.	1
Fill soil thickness (ft.)	Thickness of fill soil between the ground level (outdoor reference) and the base of the slab.	0
Cracks and Openings		
Crack location (radial mesh units)	Distance from the house perimeter to the crack	1
Crack width (cm)	Radial width of the floor crack	1
Number of utility openings	These are openings (or a full elliptical crack) that are open to the house (pressure, radon, and flux).	elliptical cack
Number of remediation penetrations	These openings are subject to different radon and pressure boundary conditions than the house, and ventilate their effluent outdoors instead of indoors.	elliptical crack
Arc length (cm)	The length of a crack that is not a complete ellipse, but is longer than a point penetration	1
Crack volume porosity	The porosity of the volume constituting the floor crack (or penetration opening).	0.6
Crack volume vertical air permeability (cm^2)	The vertical air permeability of the volume constituting the floor crack (or penetration opening).	$1x10^{-4}$ cm^2
Crack volume vertical radon diffusion coefficient (cm^2/s)	The vertical radon diffusion coefficient of the volume constituting the floor crack (or penetration opening).	0.06 cm^2/s

3.2 ALTERING INPUT FILES

Selected parameters in existing RAETRAD input files can be altered by opening them with the *MODIFY/REVIEW* option of the Input Files Menu. New files can also be created with the *MODIFY/REVIEW* option by using an existing input file as the basis for a new one, and only altering certain parameters. Under this option, a previously-created file is read, and its data in any of three categories are displayed as requested from the options on the screen below. The user can modify or review parameters in any or all of the categories indicated by options 1, 2, or 3, and can then save the possibly altered file (Option #4) under either the existing file name or a new name.

MODIFY/REVIEW FILES

OPTIONS

1. HOUSE CHARACTERISTICS
2. FLOOR OPENINGS
3. FOUNDATION & SOIL PARAMETERS
4. SAVE MODIFIED INPUT DATA
5. RETURN TO MAIN MENU

ENTER YOUR CHOICE

Press the number of the selection that you wish. It will become highlighted.
Press <ENTER> to proceed, a new number, or the arrow keys.

3.3 DOS-EDITING OF INPUT AND SYSTEM FILES

An option available to the more experienced user for creation, and in particular, modification of RAETRAD input data files is through DOS editing. RAETRAD locates input files via the .RAE filename extension, and therefore accepts files created by a DOS editor as well as those created under its Windows® menus. To assist in editing RAETRAD input files with a DOS editor, the contents and formats of RAETRAD input files are documented in Table 3-2. The user may refer also to the printed input files for the sample problems, as contained in Appendix A.

Table 3-2. Description of RAETRAD input file parameters.

Line	Format	Description
1	A12	Name of the input file.
2	A80	Scenario description/Title
3	F6.0[a]	Maximum Soil depth analyzed (ft)
	F7.0	Width of the dwelling (ft)
	F7.0	Length of the dwelling (ft)
	F9.0	Indoor pressure (Pa)
	F9.0	Indoor radon boundary concentration (pCi/L)
	F9.0	Air exchange rate (1/hr)
	F9.0	Room height (ft)
4	F6.0	Outdoor pressure (Pa)
	F7.0	Outdoor radon boundary concentration (pCi/L)
	F8.0	Radial unit of measurement (ft.)
	F8.0[a]	Minor radius of the equivalent ellipse (ft.)
	F8.0[a]	Major radius of the equivalent ellipse (ft.)
	F8.0[a]	Total radial mesh units (radial units)
5	F8.0	Depth of footing (ft.)
	F9.0	Thickness of fill (ft.)
	I4	Number of vertical units for footing (vertical units)
	I4	Number of vertical units for fill (vertical units)
	I4	Number of soil layers (excluding foundation & footings)
	I4	Number of cracks or openings

[a] Unused in RAETRAD analysis.

Table 3-2. Description of RAETRAD input file parameters (continued)

Line	Format	Description
		[Line 6 is repeated for each crack location.]
6	F7.0	Distance from house center to crack (crack radius) (ft.)
	F8.0	Width of the crack or opening (cm)
	I4	Number of utility openings at this radius (≤5); Use -1 for elliptical crack; Remediation penetrations may occur at only one radius; A radius may be specified only once.
	I4	Number of remediation openings at this radius (≤5); Use -1 for elliptical crack; Remediation penetrations may occur at only one radius; A radius may be specified only once.
	F10.0	Local pressure above crack (Pa)
	F10.0	Local radon concentration above crack (pCi/L)
	F10.0	Arc length of crack (cm); Unused for complete ellipse.
	F8.0	Porosity of opening volume
	F12.0	Vertical permeability of opening volume (cm^2)
	F12.0	Vertical diffusion coefficient of opening volume (cm^2/s)
		[Line 7 is repeated for each soil layer]
7	F9.0[a]	Thickness of the layer (ft.)
	I4	Left bound radial position of the mesh region
	I4	Right bound radial position of the mesh region
	I4	Top vertical mesh unit of the layer
	I4	Bottom vertical mesh unit of the layer
	F8.0	Vertical mesh size for the layer (ft.)
	F9.0	Radium concentration for the layer (pCi/g)
	F7.0	Bulk dry density for the layer (g/cm^3)
	F7.0	Radon emanation coefficient (fraction)
	F11.0	Soil porosity (fraction)
	F11.0	Fraction of soil water saturation
	F11.0	Soil particle diameter (cm); Use material default if =0
	F11.0	Radial diffusion coefficient (cm^2/s); Code computes if =0
	F11.0	Vertical diffusion coefficient (cm^2/s); Code computes if =0
	F11.0	Radial air permeability (cm^2); Code computes if =0
	F11.0	Vertical air permeability (cm^2); Code computes if =0
	F11.0	Radon adsorption coefficient (cm^3/g); Use material default if =0
	I4	Material number (defined in RAETRAD.SYS)

[a] Unused in RAETRAD analysis.

The DOS editor also may be used to alter the default specifications for the soil and concrete materials, as contained in the soil library file, *RAETRAD.SYS*. These default specifications are provided to assist in defining model parameters by generic values when actual values are unknown. They may be modified to include particular materials or properties commonly employed by the user besides or instead of those listed in the furnished RAETRAD.SYS file. A total of 19 materials may be included in this file, 17 of which are presently defined. Each line of the file is for a separate material, and has the format F10.0, F10.0, F10.0, and A8 for the radon adsorption coefficient, the water saturation fraction, the soil particle diameter, and the soil name, respectively. The water contents presently specified for the 12 soil textural classes correspond approximately to the values at a matric potential of -0.3 bars (-30 kPa), which is sometimes used to represent the drained, field-capacity water content of a soil.[4] Table 3-3 presents the numeric values presently specified in the RAETRAD.SYS file.

Table 3-3. Materials and properties defined in the RAETRAD.SYS file.

Material Number	Material Name	Radon Adsorption Coefficient	Water Saturation Fraction	Particle Diameter (cm)
1	Sand	0.358	0.213	442.
2	Loamy sand	0.669	0.289	339.
3	Sandy loam	1.174	0.461	302.
4	Sandy clay loam	2.719	0.472	294.
5	Sandy clay	4.193	0.548	250.
6	Loam	2.018	0.646	199.
7	Clay loam	3.462	0.712	161.
8	Silty loam	1.469	0.805	114.
9	Clay	6.537	0.832	92.
10	Silty clay loam	3.531	0.908	56.
11	Silty clay	4.816	0.940	39.
12	Silt	0.878	0.970	46.
13	Concrete 1	1.0	0.769	2.9
14	Concrete 2	1.0	0.853	28.4
15	Fine gravel	0.1	0.05	2000.
16	Medium gravel	0.1	0.02	5000.
17	Coarse gravel	0.1	0.005	15,000.
18	User defined	--	--	--
19	User defined	--	--	--

Section 4
PROCESSING INPUT FILES

Model analyses are performed by RAETRAD for scenarios defined by input data files by selecting the *RAETRAD ANALYSIS* option, #2, from the Main Menu. This option scans the data directory for the RAETRAD input files (designated by the .RAE file name extension) and displays their names on the screen. The user then is instructed to use the arrow keys to move the cursor to select the files for processing. Both selection and de-selection are accomplished by setting the cursor on the desired file name and pressing the <SPACE> bar. Each selected file will blink to identify its selection status. When the desired files have been selected, the <ENTER> key should be pressed. RAETRAD then will ask if it should save and print each model calculation as it is analyzed, or just save each. RAETRAD also will ask if the pressure and radon concentration arrays should be included as part of the output.

Upon selection of the desired files and answering of the output questions, RAETRAD proceeds analyzing each of the selected input files. The processing window will display to the user the current file being processed or printed. When processing is completed, the user is notified by a return to the Main Menu for other activity or for termination.

Section 5
VIEWING AND PRINTING OUTPUT

The results of RAETRAD analyses can be viewed or printed by selecting the *RAETRAD RESULTS* option, #3, from the Main Menu. This provides several options for viewer examination of the RAETRAD results.

5.1 VIEWING SUMMARY OUTPUT

The option to *REVIEW SUMMARY OUTPUT* scans the data directory for the RAETRAD output files and displays their names on the screen. The user is instructed to select the desired output file by moving the cursor with the arrow keys, and then selecting (or deselecting) it with the <SPACE> bar. After selecting the file, the <ENTER> key should be pressed.

RAETRAD next displays graphically a diagram showing the air and radon entry rates for the cracks and penetrations of the scenario, and the overall house radon entry rate and radon concentration. No data are shown for remediation ventilation systems, since they are not contributing directly to the indoor radon entry or air entry into the structure.

5.2 VIEWING AND PRINTING DETAILED OUTPUT

The option to *REVIEW DETAILED OUTPUT* also scans the data directory for the RAETRAD output files and displays their names on the screen. The user is instructed to select the desired output file by moving the cursor with the arrow keys, and then selecting (or deselecting) it with the <SPACE> bar. After selecting the file, the <ENTER> key should be pressed.

RAETRAD next prompts the user to specify the desired output device. The results file can be sent or displayed on either the printer or the terminal. If sending the output to a printer, the printer must be previously initialized, if necessary, to print 132 characters per line. The screen will display only 80 characters per line, and therefore will show only part of the printout image at a time. To facilitate viewing of the right-hand side of the printout, the <End> and <Home> keys are designed to toggle the display between the left 80 and right 80 characters of the RAETRAD results output. The user may scan the printout image vertically using the <PgUp> and <PgDn> keys.

Section 6
SAMPLE PROBLEMS

The input and output files for several sample problems are illustrated in Appendices A and B. The sample problems are for a slab-on-grade house, defined primarily from the RAETRAD default options. The house measures 28.4 x 54.3 ft with a total area of 1542 square feet. The fill thickness is defined to be 1 foot below the floor slab. A 3-ft stem wall and footing are specified, providing a 2-ft. depth with respect to the outdoor soil level. For these rectangular dimensions, an aspect ratio of 1.9 and an equivalent minor elliptical radius of 16 ft. are calculated. Indoor pressure and radon boundary conditions are specified as -2.4 Pa and 2.0 pCi/L, respectively. Outdoor pressure and radon boundary conditions are defined to be zero.

The floor slab of the house is analyzed in the different sample problem files as if it had several different combinations of cracks, penetration openings, and remediation vents. Table 6-1 summarizes the combinations of slab openings represented in the sample problems. The volume of the floor openings was defined to have a porosity of 0.6, a vertical radon diffusion coefficient of 0.06 cm^2/s, and a vertical air permeability of $1x10^{-4}$ cm^2. The soil beneath the house was defined to be sand, with default properties, except for its radium distribution, which is defined in Table 6-2.

Table 6-1. Floor-slab openings used in the sample problems.

Case	File Name	Floor-Slab Openings
1	def1____.RAE	Perimeter crack[a]
2	def2____.RAE	Perimeter crack[a] plus 2 utility penetrations[b] 3 ft from center
3	def3____.RAE	Perimeter crack[a] plus 2 passive sub-slab vents[c] at 10 ft from center
4	def4____.RAE	No crack, 2 passive sub-slab vents[c] at 10 ft from center
5	def5____.RAE	No crack, 2 active sub-slab vents[d] at 10 ft from center
6	def6____.RAE	Perimeter crack[a], 2 active sub-slab vents[d] at 10 ft from center

[a] 1 cm wide
[b] 10 cm x 10 cm
[c] 10 cm x 10 cm, at -5 Pa pressure
[d] 10 cm x 10 cm, at -20 Pa pressure

Table 6-2. Radium distributions for sample problems.

Distance Below Slab (ft.)	Radium Concentration (pCi/g)
slab	1.0
0-1	0.5
2-5	8.0
6-20	4.0

Comparing the indoor radon concentration in case def1a with that in case def1 shows virtually no difference (2.73 pCi/L vs. 2.75 pCi/L, respectively). The altered near-surface radon gradient produced by the 8 pCi/g soil below the 0.5 pCi/g fill in this case reduces the finite-difference bias. If the soils all had a uniform radium concentration of 2 pCi/g, the def1a case would be about 8% higher than the def1 case.

Adding the two utility penetrations (case def2) only slightly increased the calculated indoor radon level to 2.79 pCi/L. The addition of two passive sub-slab vents (case def3) very slightly reduced the indoor radon level from the def1 case by 0.006 pCi/L. Eliminating the perimeter floor crack in case def4 and keeping the passive sub-slab vents greatly reduced the indoor radon level to 0.7 pCi/L. Adding more suction pressure to the vents made virtually no difference 0.703 pCi/L for def5 vs. 0.704 pCi/L for def4). Using active sub-slab ventilation with the perimeter floor crack (case def6) also made little difference (2.73 pCi/L for def6 vs. 2.75 for def1).

Although other slab, soil, and radon source properties would alter these results, the test cases demonstrate the versatility and relative simplicity of the RAETRAD code for modeling different conditions affecting radon entry. Although caution and good judgment must be exercised in utilizing the default parameters provided by RAETRAD, they provide a simple and rapid means of using this model for relatively detailed but rapid estimates of indoor radon entry.

The analysis included as *def1a* is identical to that for *def1* except that it includes a thin mesh row at the top of the soil column just beneath the slab. The complete input and output listings for these problems are presented in Appendices A and B, respectively. As illustrated by the sample output listings, the primary input parameters are listed at the beginning of each printout in three sections: the house parameters (dimensions, footings, fill, equivalent ellipse, etc.), the floor openings (type, location, dimensions, etc.), and the foundation and soil properties (Location, radiological parameters, and physical parameters). The calculated results are shown next, adjacent to a rotated diagram of the house. Starting at the center, the air entry rate is listed for each radial mesh segment, followed by the radon flux and the radon entry rate. The totals for the house are given just outside the house, followed by corresponding values for the exposed outdoor soil. At the bottom of the page the calculated

indoor radon concentration is printed, along with the ventilation rate and indoor height used to compute it from the total indoor entry rate.

The two tables that follow show the arrays of pressures and radon concentrations throughout the modeled system. The pressures all are mesh-average values. Therefore, the pressure at the base of the floor crack (-1.14 Pa for case def1) is less-negative than might be expected for the -2.4 Pa indoor pressure. The actual pressure drop across the crack can be estimated from the pressure at its base, which is calculated as:

$$P_c = P_{in} + \left(\frac{\mu}{K_c} \right) \frac{Q_c T_s}{A_c} \tag{5}$$

where P_c = air pressure at base of crack (Pa)

P_{in} = indoor air pressure

K_c = air permeability of the crack (cm^2)

Q_c = air flow rate through the crack (cm^3/s)

t_s = thickness of the slab (cm)

A_c = area of the crack (cm^2).

For the def1 example case, $K_c = 10^{-4}$ cm^2, Q_c = 0.053 cfm = 25 cm/s, T_s = 0.328 ft = 10 cm, and A_c = 4,680 cm^2, so that from equation (5), P_c = -2.39 Pa. This corresponds to a pressure drop of only 0.01 Pa across the crack, as might be expected.

Section 7
LITERATURE REFERENCES

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APPENDIX A

INPUT FILES FOR SAMPLE PROBLEMS

FILE LISTING FOR: def1____.rae

```
def1____
Default House: Perimeter Crack   (DEFAULT CASE 1)
 20.00  28.40  54.30    -2.40     2.00  0.5000    8.0000
  0.00   0.00   1.000  16.023  30.635  40.000  22.468
   3.000    1.000   3   1   3   1
 16.023   1.000  -1   0   -2.4000    2.0000    4681.8  0.6000  10.000E-05  60.000E-03
    0.328   1  17   1   1   0.328    1.000  2.100  0.100  2.220E-01  0.000E+00  0.000E+00  0.000E+00  0.000E+00  0.000E+00  0.000E+00  0.000E+00  13
    1.000   1  40   2   2   1.000    0.500  1.600  0.200  4.070E-01  0.000E+00  0.000E+00  0.000E+00  0.000E+00  0.000E+00  0.000E+00  0.000E+00   1
    4.000   1  40   3   6   1.000    8.000  1.600  0.200  4.070E-01  0.000E+00  0.000E+00  0.000E+00  0.000E+00  0.000E+00  0.000E+00  0.000E+00   1
   15.000   1  40   7  21   1.000    4.000  1.600  0.200  4.070E-01  0.000E+00  0.000E+00  0.000E+00  0.000E+00  0.000E+00  0.000E+00  0.000E+00   1
    1.000  17  17   2   2   1.000    1.000  2.100  0.100  2.220E-01  0.000E+00  0.000E+00  0.000E+00  0.000E+00  0.000E+00  0.000E+00  0.000E+00  13
    1.000  17  17   3   3   1.000    1.000  2.100  0.100  2.220E-01  0.000E+00  0.000E+00  0.000E+00  0.000E+00  0.000E+00  0.000E+00  0.000E+00  13
    1.000  17  17   4   4   1.000    1.000  2.100  0.100  2.220E-01  0.000E+00  0.000E+00  0.000E+00  0.000E+00  0.000E+00  0.000E+00  0.000E+00  13
```


000038

7342

000039

FILE LISTING FOR: def1a___.rae

```
def1a___
Default House: Perimeter Crack w/0.1 layer (DEFAULT CASE 1a)
 20.00  28.40  54.30    -2.40     2.00  0.5000    8.0000
  0.00   0.00   1.000  16.023  30.635  40.000  22.468
   3.000    1.000   4   2   4   1
 16.023   1.000  -1   0   -2.4000    2.0000    4681.8  0.6000  10.000E-05  60.000E-03
    0.328   1  17   1   1   0.328    1.000  2.100  0.100  2.220E-01  0.000E+00  0.000E+00  0.000E+00  0.000E+00  0.000E+00  0.000E+00  0.000E+00  13
    0.100   1  16   2   2   0.100    0.500  1.600  0.200  4.070E-01  0.000E+00  0.000E+00  0.000E+00  0.000E+00  0.000E+00  0.000E+00  0.000E+00   1
    0.900   1  40   3   3   0.900    0.500  1.600  0.200  4.070E-01  0.000E+00  0.000E+00  0.000E+00  0.000E+00  0.000E+00  0.000E+00  0.000E+00   1
    4.000   1  40   4   7   1.000    8.000  1.600  0.200  4.070E-01  0.000E+00  0.000E+00  0.000E+00  0.000E+00  0.000E+00  0.000E+00  0.000E+00   1
   15.000   1  40   8  22   1.000    4.000  1.600  0.200  4.070E-01  0.000E+00  0.000E+00  0.000E+00  0.000E+00  0.000E+00  0.000E+00  0.000E+00   1
    0.100  17  17   2   2   0.100    1.000  2.100  0.100  2.220E-01  0.000E+00  0.000E+00  0.000E+00  0.000E+00  0.000E+00  0.000E+00  0.000E+00  13
    0.900  17  17   3   3   0.900    1.000  2.100  0.100  2.220E-01  0.000E+00  0.000E+00  0.000E+00  0.000E+00  0.000E+00  0.000E+00  0.000E+00  13
    1.000  17  17   4   4   1.000    1.000  2.100  0.100  2.220E-01  0.000E+00  0.000E+00  0.000E+00  0.000E+00  0.000E+00  0.000E+00  0.000E+00  13
    1.000  17  17   5   5   1.000    1.000  2.100  0.100  2.220E-01  0.000E+00  0.000E+00  0.000E+00  0.000E+00  0.000E+00  0.000E+00  0.000E+00  13
```

FILE LISTING FOR: def2____.rae

```
def2____
Default House: Perimeter Crack + 2 Ut. Pens 3ft from center (CASE2)
 20.00  28.40  54.30     -2.40      2.00  0.5000     8.0000
  0.00   0.00   1.000  16.023  30.635  40.000  22.468
   3.000     1.000   3   1   3   2
 16.023    1.000  -1   0   -2.4000     2.0000     4681.8  0.6000  10.000E-05  60.000E-03
  3.023   10.000   2   0   -2.4000     2.0000    10.0000  0.6000  10.000E-05  60.000E-03
    0.328   1  17   1   1   0.328     1.000  2.100  0.100  2.220E-01  0.000E+00  0.000E+00  0.000E+00  0.000E+00  0.000E+00  0.000E+00  0.000E+00  13
    1.000   1  40   2   2   1.000     0.500  1.600  0.200  4.070E-01  0.000E+00  0.000E+00  0.000E+00  0.000E+00  0.000E+00  0.000E+00  0.000E+00   1
    4.000   1  40   3   6   1.000     8.000  1.600  0.200  4.070E-01  0.000E+00  0.000E+00  0.000E+00  0.000E+00  0.000E+00  0.000E+00  0.000E+00   1
   15.000   1  40   7  21   1.000     4.000  1.600  0.200  4.070E-01  0.000E+00  0.000E+00  0.000E+00  0.000E+00  0.000E+00  0.000E+00  0.000E+00   1
    1.000  17  17   2   2   1.000     1.000  2.100  0.100  2.220E-01  0.000E+00  0.000E+00  0.000E+00  0.000E+00  0.000E+00  0.000E+00  0.000E+00  13
    1.000  17  17   3   3   1.000     1.000  2.100  0.100  2.220E-01  0.000E+00  0.000E+00  0.000E+00  0.000E+00  0.000E+00  0.000E+00  0.000E+00  13
    1.000  17  17   4   4   1.000     1.000  2.100  0.100  2.220E-01  0.000E+00  0.000E+00  0.000E+00  0.000E+00  0.000E+00  0.000E+00  0.000E+00  13
```


000040

2342

000041

FILE LISTING FOR: def3____.rae

```
def3____
Default House:Perimeter Crack + 2 Pass. Vents @10ft & -5 Pa (CASE3)
 20.00  28.40  54.30    -2.40     2.00  0.5000    8.0000
  0.00   0.00   1.000  16.023  30.635  40.000  22.468
   3.000    1.000   3   1   3   2
 16.023   1.000  -1   0   -2.4000    2.0000    4681.8  0.6000  10.000E-05  60.000E-03
 10.023  10.000   0   2   -5.0000    2.0000   10.0000  0.6000  10.000E-05  60.000E-03
    0.328   1  17   1   1   0.328    1.000  2.100  0.100  2.220E-01  0.000E+00  0.000E+00  0.000E+00  0.000E+00  0.000E+00  0.000E+00  0.000E+00  13
    1.000   1  40   2   2   1.000    0.500  1.600  0.200  4.070E-01  0.000E+00  0.000E+00  0.000E+00  0.000E+00  0.000E+00  0.000E+00  0.000E+00   1
    4.000   1  40   3   6   1.000    8.000  1.600  0.200  4.070E-01  0.000E+00  0.000E+00  0.000E+00  0.000E+00  0.000E+00  0.000E+00  0.000E+00   1
   15.000   1  40   7  21   1.000    4.000  1.600  0.200  4.070E-01  0.000E+00  0.000E+00  0.000E+00  0.000E+00  0.000E+00  0.000E+00  0.000E+00   1
    1.000  17  17   2   2   1.000    1.000  2.100  0.100  2.220E-01  0.000E+00  0.000E+00  0.000E+00  0.000E+00  0.000E+00  0.000E+00  0.000E+00  13
    1.000  17  17   3   3   1.000    1.000  2.100  0.100  2.220E-01  0.000E+00  0.000E+00  0.000E+00  0.000E+00  0.000E+00  0.000E+00  0.000E+00  13
    1.000  17  17   4   4   1.000    1.000  2.100  0.100  2.220E-01  0.000E+00  0.000E+00  0.000E+00  0.000E+00  0.000E+00  0.000E+00  0.000E+00  13
```

FILE LISTING FOR: def4____.rie

```
def4____
Default House: No P. Crack + 2 Pass Vents @ 10ft & -5 Pa (CASE4)
 20.00  28.40  54.30    -2.40     2.00  0.5000    8.0000
  0.00   0.00   1.000  16.023  30.635  40.000  22.468
   3.000    1.000   3   1   3   1
 10.023  10.000   0   2   -5.0000    2.0000   10.0000  0.6000  10.000E-05  60.000E-03
    0.328   1  17   1   1   0.328    1.000  2.100  0.100  2.220E-01  0.000E+00  0.000E+00  0.000E+00  0.000E+00  0.000E+00  0.000E+00  0.000E+00  13
    1.000   1  40   2   2   1.000    0.500  1.600  0.200  4.070E-01  0.000E+00  0.000E+00  0.000E+00  0.000E+00  0.000E+00  0.000E+00  0.000E+00   1
    4.000   1  40   3   6   1.000    8.000  1.600  0.200  4.070E-01  0.000E+00  0.000E+00  0.000E+00  0.000E+00  0.000E+00  0.000E+00  0.000E+00   1
   15.000   1  40   7  21   1.000    4.000  1.600  0.200  4.070E-01  0.000E+00  0.000E+00  0.000E+00  0.000E+00  0.000E+00  0.000E+00  0.000E+00   1
    1.000  17  17   2   2   1.000    1.000  2.100  0.100  2.220E-01  0.000E+00  0.000E+00  0.000E+00  0.000E+00  0.000E+00  0.000E+00  0.000E+00  13
    1.000  17  17   3   3   1.000    1.000  2.100  0.100  2.220E-01  0.000E+00  0.000E+00  0.000E+00  0.000E+00  0.000E+00  0.000E+00  0.000E+00  13
    1.000  17  17   4   4   1.000    1.000  2.100  0.100  2.220E-01  0.000E+00  0.000E+00  0.000E+00  0.000E+00  0.000E+00  0.000E+00  0.000E+00  13
```


000012

FILE LISTING FOR: def5____.rae

```
def5____
Default House:No P. Crack + 2 Act Vents @ 10ft & -20 Pa (CASE5)
 20.00  28.40  54.30    -2.40     2.00  0.5000    8.0000
  0.00   0.00   1.000  16.023  30.635  40.000  22.468
   3.000    1.000   3   1   3   1
 10.023  10.000   0   2  -20.0000    2.0000   10.0000  0.6000  10.000E-05  60.000E-03
    0.328   1  17   1   1   0.328    1.000  2.100  0.100  2.220E-01  0.000E+00  0.000E+00  0.000E+00  0.000E+00  0.000E+00  0.000E+00  0.000E+00  13
    1.000   1  40   2   2   1.000    0.500  1.600  0.200  4.070E-01  0.000E+00  0.000E+00  0.000E+00  0.000E+00  0.000E+00  0.000E+00  0.000E+00   1
    1.000   1  40   2   2   1.000    0.500  1.600  0.200  4.070E-01  0.000E+00  0.000E+00  0.000E+00  0.000E+00  0.000E+00  0.000E+00  0.000E+00   1
    4.000   1  40   3   6   1.000    8.000  1.600  0.200  4.070E-01  0.000E+00  0.000E+00  0.000E+00  0.000E+00  0.000E+00  0.000E+00  0.000E+00   1
   15.000   1  40   7  21   1.000    4.000  1.600  0.200  4.070E-01  0.000E+00  0.000E+00  0.000E+00  0.000E+00  0.000E+00  0.000E+00  0.000E+00   1
    1.000  17  17   2   2   1.000    1.000  2.100  0.100  2.220E-01  0.000E+00  0.000E+00  0.000E+00  0.000E+00  0.000E+00  0.000E+00  0.000E+00  13
    1.000  17  17   3   3   1.000    1.000  2.100  0.100  2.220E-01  0.000E+00  0.000E+00  0.000E+00  0.000E+00  0.000E+00  0.000E+00  0.000E+00  13
    1.000  17  17   4   4   1.000    1.000  2.100  0.100  2.220E-01  0.000E+00  0.000E+00  0.000E+00  0.000E+00  0.000E+00  0.000E+00  0.000E+00  13
```

FILE LISTING FOR: def6____.rae

```
def6____
Default House:Perm. Crack + 2 Act. Vents @ 10ft & -20 Pa (CASE6)
 20.00  28.40  54.30    -2.40     2.00  0.5000    8.0000
  0.00   0.00   1.000  16.023  30.635  40.000  22.468
   3.000    1.000   3   1   3   2
 16.023   1.000  -1   0   -2.4000    2.0000    4681.8  0.6000  10.000E-05  60.000E-03
 10.023  10.000   0   2  -20.0000    2.0000   10.0000  0.6000  10.000E-05  60.000E-03
    0.328   1  17   1   1   0.328    1.000  2.100  0.100  2.220E-01  0.000E+00  0.000E+00  0.000E+00  0.000E+00  0.000E+00  0.000E+00  0.000E+00  13
    1.000   1  40   2   2   1.000    0.500  1.600  0.200  4.070E-01  0.000E+00  0.000E+00  0.000E+00  0.000E+00  0.000E+00  0.000E+00  0.000E+00   1
    4.000   1  40   3   6   1.000    8.000  1.600  0.200  4.070E-01  0.000E+00  0.000E+00  0.000E+00  0.000E+00  0.000E+00  0.000E+00  0.000E+00   1
   15.000   1  40   7  21   1.000    4.000  1.600  0.200  4.070E-01  0.000E+00  0.000E+00  0.000E+00  0.000E+00  0.000E+00  0.000E+00  0.000E+00   1
    1.000  17  17   2   2   1.000    1.000  2.100  0.100  2.220E-01  0.000E+00  0.000E+00  0.000E+00  0.000E+00  0.000E+00  0.000E+00  0.000E+00  13
    1.000  17  17   3   3   1.000    1.000  2.100  0.100  2.220E-01  0.000E+00  0.000E+00  0.000E+00  0.000E+00  0.000E+00  0.000E+00  0.000E+00  13
    1.000  17  17   4   4   1.000    1.000  2.100  0.100  2.220E-01  0.000E+00  0.000E+00  0.000E+00  0.000E+00  0.000E+00  0.000E+00  0.000E+00  13
```

APPENDIX B

PRINTED OUTPUT FROM SAMPLE PROBLEMS

SCENARIO TITLE: Default House: Perimeter Crack (DEFAULT CASE 1)
FILE NAME: defl____
RUN DATE: 12/30/1992 @ 14:06

RAETRAD v3.1
RAdon Emanation and TRAnsport into Dwellings
developed by Rogers & Associates Engineering Corporation

==========: INPUT PARAMETERS :==========

HOUSE:

Dimensions	:	28.4 x 54.3 ft.		Equiv. ellipse radius	:	16	ft.	Outdoor Pressure	:	.00	Pa
Area	:	1542 sq. ft.		Aspect ratio	:	1.912		Indoor Rn Bnd.	:	2.00	pCi/L
Fill thickness	:	1 units (1.0ft.)		Circumference	:	153.4	ft.	Outdoor Rn Bnd.	:	.00	pCi/L
Footing depth	:	3 units (3.0ft.)		Indoor pressure	:	-2.4	Pa.	Radial Mesh Units	:	1.00	ft.

LOOR OPENINGS:

Crack or Penetr. Type	Number of Penetrations	Loc. Frm Permtr ft	Local Pressure Pa	Local Rn Bndry pCi/L	Radial Width cm	Arc Length cm	Porosity	Perm. cm2	Diff. cm2/s
Elliptical Crack		.000	-2.40	2.00	1.00	4681.8	.600	1.00E-04	6.00E-02

FOUNDATION & SOILS:

Lyr No.	Thickness ft	Vrt. Div.	Ra226 pCi/g	Dens. g/cm3	Eman. frac.	Tot. Poros	Sat'n frac.	P.Diam cm	Diff.Rad cm2/s	Diff.Ver cm2/s	Perm.Rad cm2	Perm.Ver cm2	Kads cc/g	Material
FLR	.328	1	1.0	2.100	.100	.222	.769	.000290	6.29E-04	6.29E-04	1.23E-12	1.23E-12	.000098	Concl
1	1.000	1	.5	1.600	.200	.407	.213	.044200	2.71E-02	2.71E-02	2.18E-07	2.18E-07	.027786	Sand
2	4.000	4	8.0	1.600	.200	.407	.213	.044200	2.71E-02	2.71E-02	2.18E-07	2.18E-07	.027786	Sand
3	15.000	15	4.0	1.600	.200	.407	.213	.044200	2.71E-02	2.71E-02	2.18E-07	2.18E-07	.027786	Sand
FTG	3.300	3	1.0	2.100	.100	.222	.769	.000290	6.29E-04	6.29E-04	1.23E-12	1.23E-12	.000098	Concl

SCENARIO TITLE: Default House: Perimeter Crack (DEFAULT CASE 1)
FILE NAME: def1____

RAETRAD
RAdon Emanation and TRAnsport into Dwell.
developed by Rogers & Associates Engineering Corpora

===: ANALYSIS RESULTS :===

RADON ENTRY PROFILE:

	Radial Positn ft	Air Entry Rate cfm	Eff. Radon Flux pCi/m2s	Radon Entry Rate pCi/s
-House Center-				
	1.00	1.67E-07	2.35E-01	1.31E-01
	2.00	5.01E-07	2.35E-01	3.93E-01
	3.00	8.35E-07	2.35E-01	6.55E-01
	4.00	1.17E-06	2.35E-01	9.17E-01
	5.00	1.50E-06	2.35E-01	1.18E+00
	6.00	1.83E-06	2.34E-01	1.44E+00
	7.00	[illegible].15E-06	[illegible].34E-01	1.70E+00
	[illegible]	[illegible]	[illegible]-01	1.95E+00
	9.00	2.78E-06	2.32E-01	2.21E+00
	10.00	3.09E-06	2.32E-01	2.45E+00
	11.00	3.38E-06	2.30E-01	2.70E+00
	12.00	3.65E-06	2.29E-01	[illegible].94E+00
	13.00	3.89E-06	2.27E-01	3.17E+00
	14.00	4.07E-06	2.25E-01	3.39E+00
	15.00	4.15E-06	2.22E-01	3.59E+00
Elliptical crack	16.00	5.30E-02	5.97E+00	1.03E+02
	17.00	1.29E-06	8.01E-02	1.47E+00
INDOOR TOTAL		5.31E-02	9.32E-01	1.34E+02
	18.00	-7.49E-03	4.86E-01	9.49E+01
	19.00	-6.44E-03	4.67E-01	9.64E+01
	20.00	-5.34E-03	4.54E-01	9.89E+01
	21.00	-4.47E-03	4.47E-01	1.02E+02
	22.00	-3.80E-03	4.43E-01	1.06E+02
	23.00	-3.30E-03	4.41E-01	1.11E+02
	24.00	-2.91E-03	4.40E-01	1.15E+02
	25.00	-2.60E-03	4.40E-01	1.20E+02
	26.00	-2.36E-03	4.39E-01	1.25E+02
	27.00	-2.17E-03	4.39E-01	1.30E+02
	28.00	-2.01E-03	4.39E-01	1.35E+02
	29.00	-1.88E-03	4.40E-01	1.40E+02
	30.00	-1.78E-03	4.40E-01	1.45E+02
	31.00	-1.69E-03	4.40E-01	1.50E+02
	32.00	-1.62E-03	4.40E-01	1.55E+02
	33.00	-1.57E-03	4.40E-01	1.60E+02
	34.00	-1.53E-03	4.40E-01	1.65E+02
	35.00	-1.50E-03	4.40E-01	1.70E+02
	36.00	-1.48E-03	4.40E-01	1.74E+02
	37.00	-1.47E-03	4.40E-01	1.79E+02
	38.00	-1.48E-03	4.40E-01	1.84E+02
	39.00	-1.49E-03	4.40E-01	1.89E+02
	40.00	-1.52E-03	4.40E-01	1.94E+02

INDOOR RADON : 2.752 pCi/L (assuming .5000 ach & 8.00 ft Height)

CPU Calc. Time: 32.00 seconds

000047

SCENARIO TITLE: Default House: Perimeter Crack (DEFAULT CASE 1)
FILE NAME: defl____

RAETRAD v3.1
RAdon Emanation and TRAnsport into Dwellings
developed by Rogers & Associates Engineering Corporation

Suction Pressures, (- .0010 Pa) depth (ft.)------>

	.0	1.0	2.0	3.0	4.0	5.0	6.0	7.0	8.0	9.0	10.0	11.0	12.0	13.0	14.0	15.0	16.0	17.0	18.0	19.0	20.0	.0
1	292	292	290	287	283	277	271	264	257	250	243	236	230	224	219	214	210	207	205	203	203	0
2	292	292	291	288	283	278	272	265	257	250	243	236	230	224	218	214	210	207	204	203	202	0
3	294	294	293	289	285	279	272	265	257	250	243	235	229	223	218	213	209	206	204	202	201	0
4	297	297	295	292	287	280	273	266	258	250	242	235	228	222	216	212	208	204	202	201	200	0
5	301	301	299	295	289	282	275	266	258	249	241	234	226	220	215	210	206	203	200	199	198	0
6	307	307	304	300	293	285	276	267	258	249	240	232	225	218	212	208	203	200	198	196	195	0
7	314	314	311	305	297	288	278	268	257	248	238	230	222	216	210	205	201	197	195	193	193	0
8	323	323	319	312	303	292	280	268	257	246	236	227	219	212	206	201	197	194	192	190	189	0
9	335	335	330	321	309	296	282	269	256	244	[illegible]	224	216	209	202	197	193	190	188	186	185	0
10	350	350	344	332	317	300	284	268	254	241	229	220	211	204	198	193	189	186	183	182	181	0
11	371	371	362	346	325	304	284	266	250	236	224	214	206	199	193	188	184	181	178	177	176	0
12	399	399	385	362	334	307	283	262	245	230	218	208	200	192	187	182	178	175	173	172	171	[illegible]
13	440	440	417	381	342	308	279	256	237	222	210	200	192	185	180	176	172	169	167	166	165	0
14	500	500	458	402	346	302	269	245	226	212	200	191	184	178	173	169	165	163	161	160	159	0
15	596	596	513	422	339	286	252	229	212	199	189	181	174	169	165	161	158	156	155	154	153	0
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
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[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
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[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
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[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
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[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
18	[illegible]	[illegible]	46	102	138	153	157	157	154	151	148	146	143	141	139	137	136	135	134	134	133	0
19	0	0	38	75	104	121	130	134	135	135	135	134	132	131	130	129	128	128	127	127	127	0
20	0	0	30	58	81	97	108	115	119	121	122	122	122	122	122	121	121	121	120	120	120	0
21	0	0	24	46	65	80	91	99	104	108	110	111	112	113	113	113	114	114	114	113	113	0
22	0	0	19	37	53	67	77	85	91	96	99	102	103	105	105	106	106	107	107	107	107	0
23	0	0	16	31	45	57	67	75	81	86	90	93	95	97	98	99	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	0
24	0	0	13	26	38	49	58	66	72	77	81	85	87	89	91	92	93	94	95	95	95	0
25	0	0	12	23	33	43	51	58	64	70	74	78	80	83	85	86	87	88	89	89	90	0
26	0	0	10	20	29	38	45	52	58	63	68	71	74	77	79	81	82	83	84	84	84	0
27	0	0	9	18	26	34	41	47	53	58	62	66	69	71	74	75	77	78	79	79	80	0
28	0	0	8	16	23	30	37	43	48	53	57	61	64	67	69	71	72	73	74	75	75	0
29	0	0	7	14	21	27	34	39	44	49	53	56	60	62	65	67	68	69	70	71	71	0
30	0	0	7	13	19	25	31	36	41	45	49	53	56	59	61	63	64	66	66	67	67	0
31	0	0	6	12	18	23	29	33	38	42	46	49	53	55	57	59	61	62	63	64	64	0
32	0	0	6	11	16	22	27	31	36	40	43	47	50	52	54	56	58	59	60	61	61	0
33	0	0	5	10	15	20	25	29	34	38	41	44	47	50	52	54	55	57	58	58	59	0
34	0	0	5	10	15	19	24	28	32	36	39	42	45	48	50	52	53	54	55	56	56	0
35	0	0	5	9	14	18	23	27	31	34	38	41	43	46	48	50	51	53	53	54	54	0
36	0	0	5	9	13	18	22	26	29	33	36	39	42	44	46	48	50	51	52	53	53	0
37	0	0	4	9	13	17	21	25	29	32	35	38	41	43	45	47	49	50	51	51	52	0
38	0	0	4	9	13	17	21	24	28	31	34	37	40	42	44	46	48	49	50	50	51	0
39	0	0	4	8	12	16	20	24	28	31	34	37	39	42	44	46	47	48	49	50	50	0
40	0	0	4	8	12	16	20	24	27	31	34	37	39	41	44	45	47	48	49	49	50	0

SCENARIO TITLE: Default House: Perimeter Crack (DEFAULT CASE 1)
FILE NAME: def1____

RASTRAD v3
RAdon Emanation and TRAnsport into Dwellin
developed by Rogers & Associates Engineering Corporati

Soil Gas Radon Concentrations (1.00000 pCi/Liter) depth (ft.) ------>

	.0	1.0	2.0	3.0	4.0	5.0	6.0	7.0	8.0	9.0	10.0	11.0	12.0	13.0	14.0	15.0	16.0	17.0	18.0	19.0	20.0	.0
1	3888	3977	4323	4505	4536	4421	4152	3947	3791	3673	3584	3516	3465	3426	3398	3376	3360	3349	3341	3336	3334	0
2	3887	3976	4322	4504	4535	4420	4151	3946	3790	3672	3583	3515	3464	3426	3397	3376	3360	3349	3341	3336	3334	0
3	3886	3974	4320	4502	4533	4418	4149	3944	3789	3671	3582	3514	3463	3425	3396	3375	3360	3348	3341	3336	3334	0
4	3883	3971	4317	4498	4530	4414	4145	3941	3786	3668	3579	3512	3462	3424	3395	3374	3359	3348	3340	3335	3333	0
5	3879	3967	4312	4494	4525	4409	4140	3936	3781	3664	3576	3510	3459	3422	3394	3373	3358	3347	3339	3335	3332	0
6	3874	3961	4307	4487	4518	4402	4134	3930	3776	3660	3572	3506	3457	3419	3392	3371	3356	3346	3338	3334	3332	0
7	3866	3954	4299	4479	4509	4393	4125	3922	3768	3653	3566	3501	3453	3416	3389	3369	3355	3344	3337	3333	3331	0
8	3857	3945	4289	4468	4497	4381	4113	3911	3759	3645	3559	3496	3448	3413	3386	3367	3353	3343	3336	3332	3330	0
9	3845	3932	4275	4453	4481	4364	4097	3896	3746	3634	3550	3488	3442	3408	3383	3364	3351	3341	3334	3330	3328	0
10	3830	3916	4258	4434	4460	4342	4076	3877	3730	3620	3539	3480	3435	3403	3378	3361	3348	3339	3333	3329	3327	0
11	3810	3896	4236	4408	4431	4313	4048	3853	3709	3604	3526	3469	3427	3396	3373	3357	3345	3336	3331	3327	3325	0
12	3786	3872	4207	4373	4392	4273	4011	3821	3683	3583	3510	3456	3417	3389	3368	3353	3342	3334	3329	3325	3324	0
13	3756	3841	4169	4326	4336	4217	3961	3779	3650	3557	3490	3441	3406	3380	3362	3348	3338	3331	3326	3323	3322	0
14	3720	3804	4122	4262	4255	4137	3894	3726	3609	3526	3467	3425	3394	3371	3355	3343	3334	3328	3324	3321	3320	0
15	3675	3758	4065	4176	4130	4022	3803	3659	3560	3491	3442	3406	3380	3361	3348	3337	3330	3325	3321	3319	3318	0
16	3473	3688	4006	4081	3911	3854	3687	3579	3505	3453	3415	3387	3366	3351	3340	3332	3326	3322	3319	3317	3316	0
17	1328	2173	1451	2960	3464	3626	3552	3492	3447	3413	3387	3367	3352	3341	3333	3326	3322	3318	3316	3315	3314	0
18	0	0	1412	2539	3166	3436	3429	3411	3392	3375	3360	3348	3339	3331	3325	3321	3318	3315	3314	3313	3312	0
19	0	0	1357	2362	2994	3304	3334	3344	3344	3341	3336	3331	3326	3322	3319	3316	3314	3312	3311	3311	3310	0
20	0	0	1321	2276	2897	3217	3265	3292	3306	3312	3315	3315	3315	3314	3312	3311	3310	3310	3309	3309	3308	0
21	0	0	1300	2231	2841	3163	3218	3254	3276	3290	3298	3302	3305	3306	3307	3307	3307	3307	3307	3307	3307	0
22	0	0	1288	2207	2809	3129	3187	3227	3254	3272	3284	3292	3297	3300	3302	3304	3304	3305	3305	3305	3305	0
23	0	0	1282	2193	2789	3107	3166	3208	3238	3259	3273	3283	3290	3295	3298	3300	3302	3303	3304	3304	3304	0
24	0	0	1279	2186	2778	3094	3152	3195	3226	3249	3265	3277	3285	3291	3295	3298	3300	3301	3302	3303	3303	0
25	0	0	1278	2182	2771	3085	3143	3186	3218	3242	3259	3272	3281	3288	3292	3296	3298	3300	3301	3302	3302	0
26	0	0	1277	2179	2768	3080	3137	3180	3212	3237	3255	3268	3278	3285	3290	3294	3297	3299	3300	3301	3301	0
27	0	0	1277	2178	2765	3077	3133	3176	3208	3233	3251	3265	3275	3283	3289	3293	3296	3298	3299	3300	3300	0
28	0	0	1277	2178	2764	3075	3131	3173	3206	3230	3249	3263	3274	3281	3287	3292	3295	3297	3298	3299	3300	0
29	0	0	1278	2178	2764	3074	3129	3172	3204	3229	3247	3261	3272	3280	3286	3291	3294	3296	3298	3299	3299	0
30	0	0	1278	2178	2764	3073	3128	3171	3203	3227	3246	3260	3271	3279	3285	3290	3293	3296	3297	3298	3299	0
31	0	0	1278	2179	2764	3073	3128	3170	3202	3227	3245	3260	3270	3279	3285	3290	3293	3295	3297	3298	3299	0
32	0	0	1279	2179	2764	3073	3128	3169	3201	3226	3245	3259	3270	3278	3284	3289	3293	3295	3297	3298	3298	0
33	0	0	1279	2180	2764	3073	3127	3169	3201	3226	3244	3259	3270	3278	3284	3289	3292	3295	3297	3298	3298	0
34	0	0	1279	2180	2764	3073	3127	3169	3201	3225	3244	3258	3269	3278	3284	3289	3292	3295	3296	3297	3298	0
35	0	0	1280	2180	2764	3073	3127	3169	3201	3225	3244	3258	3269	3277	3284	3288	3292	3294	3296	3297	3298	0
36	0	0	1280	2180	2765	3073	3127	3169	3201	3225	3244	3258	3269	3277	3284	3288	3292	3294	3296	3297	3298	0
37	0	0	1280	2181	2765	3073	3128	3169	3201	3225	3244	3258	3269	3277	3284	3288	3292	3294	3296	3297	3298	0
38	0	0	1280	2181	2765	3074	3128	3169	3201	3225	3244	3258	3269	3277	3283	3288	3292	3294	3296	3297	3298	0
39	0	0	1280	2181	2765	3074	3128	3169	3201	3225	3244	3258	3269	3277	3283	3288	3292	3294	3296	3297	3298	0
40	0	0	1280	2181	2765	3074	3128	3169	3201	3225	3244	3258	3269	3277	3283	3288	3292	3294	3296	3297	3298	0

SCENARIO TITLE: Default House: Perimeter Crack w/0.1 layer (DEFAULT CASE 1a)
FILE NAME: defla___
RUN DATE: 10/30/1992 @ 14:08

RAETRAD v3.1
RAdon Emanation and TRAnsport into Dwellings
developed by Rogers & Associates Engineering Corporation

==========: INPUT PARAMETERS :==========

HOUSE:

Dimensions	:	28.4 x 54.3 ft.	Equiv. ellipse radius	:	16	ft.	Outdoor Pressure	:	.00	Pa
Area	:	1542 sq. ft.	Aspect ratio	:	1.912		Indoor Rn Bnd.	:	2.00	pCi/L
Fill thickness	:	2 units (1.0ft.)	Circumference	:	153.4	ft.	Outdoor Rn Bnd.	:	.00	pCi/L
Footing depth	:	4 units (3.0ft.)	Indoor pressure	:	-2.4	Pa.	Radial Mesh Units	:	1.00	ft.

DOR OPENINGS:

Crack or Penetration Type	Number of Penetrations	Loc. Frm Permtr ft	Local Pressure Pa	Local Rn Bndry pCi/L	Radial Width cm	Arc Length cm	Porosity	Perm. cm2	Diff. cm2/s
Elliptical Crack		.000	-2.40	2.00	1.00	4681.8	.600	1.00E-04	6.00E-02

FOUNDATION & SOILS:

Lyr No.	Thickness ft	Vrt. Div.	Ra226 pCi/g	Dens. g/cm3	Eman. frac.	Tot. Poros	Sat'n frac.	P.Diam cm	Diff.Rad cm2/s	Diff.Ver cm2/s	Perm.Rad cm2	Perm.Ver cm2	Kads cc/g	Material
FLR	.328	1	1.0	2.100	.100	.222	.769	.000290	6.29E-04	6.29E-04	1.23E-12	1.23E-12	.000098	Concl
1	.100	1	.5	1.600	.200	.407	.213	.044200	2.71E-02	2.71E-02	2.18E-07	2.18E-07	.027786	Sand
2	.900	1	.5	1.600	.200	.407	.213	.044200	2.71E-02	2.71E-02	2.18E-07	2.18E-07	.027786	Sand
3	4.000	4	8.0	1.600	.200	.407	.213	.044200	2.71E-02	2.71E-02	2.18E-07	2.18E-07	.027786	Sand
4	15.000	15	4.0	1.600	.200	.407	.213	.044200	2.71E-02	2.71E-02	2.18E-07	2.18E-07	.027786	Sand
FTG	1.000	4	1.0	2.100	.100	.222	.769	.000290	6.29E-04	6.29E-04	1.23E-12	1.23E-12	.000098	Concl

SCENARIO TITLE: Default House: Perimeter Crack w/0.1 layer (DEFAULT CASE 1a)
FILE NAME: defle___

RAETRAD v3
RAdon Emanation and TRAnsport into Dwellin
developed by Rogers & Associates Engineering Corporati

==================================: ANALYSIS RESULTS :==================================

RADON ENTRY PROFILE:

```
-House Center-
|          o
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   |       o
    |      o
    |      o
    |      o
    |       Elliptical crack
     |-----O=====
               Y
               Y
               Y
```

Radial Positn ft	Air Entry Rate cfm	Eff. Radon Flux pCi/m2s	Radon Entry Rate pCi/s
1.00	1.64E-07	2.15E-01	1.20E-01
2.00	4.91E-07	2.15E-01	3.59E-01
3.00	8.17E-07	2.15E-01	5.99E-01
4.00	1.14E-06	2.14E-01	8.38E-01
5.00	1.47E-06	2.14E-01	1.08E+00
6.00	1.79E-06	2.14E-01	1.31E+00
7.00	2.10E-06	2.14E-01	1.55E+00
8.00	2.41E-06	2.13E-01	1.79E+00
9.00	2.71E-06	2.13E-01	2.02E+00
10.00	3.00E-06	2.12E-01	2.25E+00
11.00	3.28E-06	2.12E-01	2.48E+00
12.00	3.53E-06	[illegible].11E-01	2.70E+00
13.00	3.74E-06	2.09E-01	2.92E+00
14.00	3.88E-06	2.08E-01	3.13E+00
15.00	3.87E-06	2.06E-01	3.33E+00
16.00	5.76E-02	6.04E+00	1.05E+02
17.00	1.32E-06	7.44E-02	1.37E+00
INDOOR TOTAL	5.77E-02	3.24E-01	1.32E+02
18.00	-8.07E-03	4.82E-01	9.42E+01
19.00	-6.94E-03	4.64E-01	9.59E+01
20.00	-5.78E-03	4.53E-01	9.85E+01
21.00	-4.84E-03	4.46E-01	1.02E+02
22.00	-4.13E-03	4.42E-01	1.06E+02
23.00	-3.58E-03	4.40E-01	1.11E+02
24.00	-3.17E-03	4.39E-01	1.15E+02
25.00	-2.84E-03	4.39E-01	1.20E+02
26.00	-2.58E-03	4.39E-01	1.25E+02
27.00	-2.37E-03	4.39E-01	1.30E+02
28.00	-2.20E-03	4.39E-01	1.35E+02
29.00	-2.06E-03	4.39E-01	1.40E+02
30.00	-1.95E-03	4.39E-01	1.45E+02
31.00	-1.85E-03	4.40E-01	1.50E+02
32.00	-1.78E-03	4.40E-01	1.55E+02
33.00	-1.72E-03	4.40E-01	1.60E+02
34.00	-1.67E-03	4.40E-01	1.64E+02
35.00	-1.64E-03	4.40E-01	1.69E+02
36.00	-1.62E-03	4.40E-01	1.74E+02
37.00	-1.62E-03	4.40E-01	1.79E+02
38.00	-1.62E-03	4.40E-01	1.84E+02
39.00	-1.64E-03	4.40E-01	1.89E+02
40.00	-1.67E-03	4.40E-01	1.94E+02

INDOOR RADON : 2.729 pCi/L (assuming .5000 ach & 8.00 ft Height)

CPU Calc. Time: 34.00 seconds

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SCENARIO TITLE: Default House: Perimeter Crack w/0.1 layer (DEFAULT CASE 1a)
FILE NAME: defla___

RAETRAD v3.1
RAdon Emanation and TRAnsport into Dwellings
developed by Rogers & Associates Engineering Corporation

Suction Pressures. (- .0010 Pa) depth (ft.)----->

	.0	.1	1.0	2.0	3.0	4.0	5.0	6.0	7.0	8.0	9.0	10.0	11.0	12.0	13.0	14.0	15.0	16.0	17.0	18.0	19.0	20.0	.0
1	335	335	334	331	327	321	314	307	298	290	281	273	265	257	250	244	239	234	231	228	226	225	0
2	336	336	335	332	328	322	315	307	298	290	281	272	264	257	250	244	238	234	230	227	226	225	0
3	338	338	337	334	330	323	316	308	299	290	281	272	264	256	249	243	237	233	229	226	225	224	0
4	342	342	341	337	332	326	318	309	299	290	280	271	262	255	247	241	236	231	228	225	223	222	0
5	347	347	345	342	336	329	320	310	300	290	279	270	261	253	246	239	234	229	225	223	221	220	0
6	353	353	352	348	341	332	322	311	300	289	278	268	259	251	243	237	231	226	223	220	218	217	0
7	362	362	360	355	347	337	325	313	301	289	277	266	256	248	240	233	228	223	219	217	215	214	0
8	373	373	371	365	355	343	329	315	301	287	275	263	253	244	236	229	224	219	215	213	211	210	0
9	387	387	384	376	364	349	333	316	300	285	272	260	249	240	232	225	219	215	211	208	206	206	0
10	406	406	402	391	376	357	337	317	299	282	268	255	244	235	226	220	214	209	206	203	201	201	0
11	431	431	426	411	389	364	340	316	296	278	262	249	238	228	220	214	208	204	200	198	196	195	0
12	465	465	457	435	405	372	341	314	290	271	255	241	230	221	213	207	201	197	194	192	190	189	0
13	513	513	500	465	422	378	339	307	282	262	245	232	221	212	205	199	194	190	187	185	184	183	0
14	588	588	561	503	438	378	330	295	269	249	233	221	211	203	196	191	186	183	180	178	177	176	0
15	717	717	646	546	451	365	310	275	250	232	219	208	199	192	187	182	178	175	173	171	170	169	0
16	1030	990	750	583	453	324	272	244	226	212	202	194	187	181	176	173	169	167	165	163	162	162	0
17	1895	1760	888	50	159	211	213	206	198	190	184	178	173	169	166	163	160	158	157	156	155	155	0
18	0	0	0	50	110	149	166	170	170	168	166	163	160	157	155	153	151	150	149	148	147	147	0
19	0	0	0	41	81	112	131	141	146	148	148	148	147	145	144	143	142	141	141	140	140	140	0
20	0	0	0	32	62	87	105	117	125	129	132	133	134	134	134	134	133	133	133	132	132	132	0
21	0	0	0	26	50	70	87	99	107	113	118	120	122	123	124	125	125	125	125	125	125	125	0
22	0	0	0	21	40	58	72	84	93	100	105	109	111	113	115	116	117	117	117	118	118	118	0
23	0	0	0	[illegible]	34	49	62	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	104	106	108	109	[illegible]	[illegible]	111	111	111	0
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	29	44	[illegible]	63	72	79	84	89	93	96	98	100	102	103	103	104	104	105	0
25	0	0	0	13	25	36	46	56	64	71	76	81	85	88	91	93	95	96	97	98	98	99	0
26	0	0	0	11	22	32	41	50	57	64	69	74	78	82	84	87	89	90	91	92	93	93	0
27	0	0	0	10	19	28	37	44	51	58	63	68	72	75	78	81	83	84	86	87	87	87	0
28	0	0	0	9	17	25	33	40	47	53	58	63	67	70	73	76	78	79	81	82	82	83	0
29	0	0	0	8	16	23	30	37	43	48	53	58	62	65	68	71	73	75	76	77	78	78	0
30	0	0	0	7	14	21	28	34	40	45	50	54	58	61	64	67	69	71	72	73	74	74	0
31	0	0	0	7	13	19	25	31	37	42	46	51	54	58	61	63	65	67	68	69	70	70	0
32	0	0	0	6	12	18	24	29	34	39	44	48	51	54	57	60	62	64	65	66	67	67	0
33	0	0	0	6	11	17	22	27	32	37	41	45	49	52	55	57	59	61	62	63	64	64	0
34	0	0	0	5	11	16	21	26	31	35	39	43	46	49	52	55	57	58	60	61	61	62	0
35	0	0	0	5	10	15	20	25	29	34	38	41	45	48	50	53	55	56	58	59	59	60	0
36	0	0	0	5	10	15	19	24	28	32	36	40	43	46	49	51	53	55	56	57	58	58	0
37	0	0	0	5	10	14	19	23	27	31	35	39	42	45	47	50	52	53	55	56	56	57	0
38	0	0	0	5	9	14	18	23	27	31	34	38	41	44	46	49	51	52	54	55	55	56	0
39	0	0	0	5	9	14	18	22	26	30	34	37	40	43	46	48	50	52	53	54	55	55	0
40	0	0	0	5	9	14	18	22	26	30	34	37	40	43	46	48	50	51	53	54	54	55	0

SCENARIO TITLE: Default House: Perimeter Crack w/0.1 layer (DEFAULT CASE 1a)
FILE NAME: defla___

RAETRAD v3
RAdon Emanation and TRAnsport into Dwellinc
developed by Rogers & Associates Engineering Corporatic

Soil Gas Radon Concentrations (1.00000 pCi/Liter) depth (ft.) ----->

	.0	.1	1.0	2.0	3.0	4.0	5.0	6.0	7.0	8.0	9.0	10.0	11.0	12.0	13.0	14.0	15.0	16.0	17.0	18.0	19.0	20.0	.0
1	3551	3558	3721	4128	4357	4424	4335	4086	3897	3753	3644	3562	3499	3452	3417	3390	3370	3356	3345	3338	3334	3332	0
2	3551	3557	3720	4128	4356	4423	4334	4085	3896	3752	3643	3561	3499	3452	3416	3390	3370	3356	3345	3338	3334	3331	0
3	3549	3556	3719	4126	4354	4421	4332	4083	3894	3751	3642	3560	3497	3451	3415	3389	3370	3355	3345	3338	3333	3331	0
4	3548	3554	3717	4124	4352	4418	4329	4080	3891	3748	3640	3558	3496	3449	3414	3388	3369	3354	3344	3337	3333	3331	0
5	3545	3552	3714	4121	4348	4414	4325	4076	3887	3744	3636	3555	3493	3447	3413	3387	3368	3353	3343	3337	3332	3330	0
6	3541	3548	3711	4117	4344	4409	4319	4070	3882	3739	3632	3551	3490	3444	3410	3385	3366	3352	3342	3336	3331	3329	0
7	3536	3543	3706	4111	4337	4401	4311	4062	3874	3732	3626	3546	3486	3441	3407	3383	3364	3351	3341	3335	3331	3329	0
8	3530	3537	3699	4104	4328	4391	4300	4052	3864	3724	3618	3539	3481	3437	3404	3380	3362	3349	3340	3333	3329	3328	0
9	3522	3529	3691	4094	4317	4378	4286	4038	3851	3712	3608	3531	3474	3431	3400	3376	3359	3347	3338	3332	3328	3326	0
10	3512	3519	3680	4081	4301	4360	4267	4019	3834	3697	3596	3521	3466	3425	3395	3372	3356	3344	3336	3330	3327	3325	0
11	3500	3506	3667	4065	4280	4335	4241	3994	3812	3679	3581	3509	3456	3417	3389	3368	3353	3342	3334	3328	3325	3324	0
12	3484	3490	3650	4043	4251	4301	4204	3960	3783	3654	3561	3493	3444	3408	3382	3363	3349	3338	3331	3326	3323	3322	0
13	3465	3471	3629	4014	4211	4251	4153	3914	3744	3624	3537	3475	3430	3398	3374	3357	3344	3335	3329	3324	3322	3320	0
14	3440	3446	3603	3976	4154	4177	4080	3851	3694	3585	3509	3454	3415	3386	3365	3350	3339	3331	3326	3322	3320	3318	0
15	3402	3409	3569	3928	4078	4060	3972	3766	3632	3540	3476	3430	3397	3374	3356	3344	3334	3328	3323	3320	3318	3317	0
16	3277	3303	3524	3881	3992	3855	3814	3657	3556	3488	3439	3405	3379	3360	3347	3337	3329	3324	3320	3317	3316	3315	0
17	1224	1503	2149	1141	2935	3433	3598	3529	3475	3433	3402	3378	3361	3347	[illegible]	[illegible]	3324	3320	3317	3315	3314	3313	0
18	0	0	0	1403	2522	3146	3417	3413	3398	3381	3366	3353	3343	3334	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	3312	3312	3311	0
19	0	0	0	1350	2350	2981	3290	3322	3334	3336	3334	3330	3326	3322	3319	3316	3314	3312	3311	3310	3310	3309	0
20	0	0	0	1315	2268	2887	3208	3257	3284	3299	3307	3310	3312	3312	3311	3311	3310	3309	3309	3308	3308	3308	0
21	0	0	0	1296	2225	2834	3156	3212	3248	3271	3285	3294	3299	3303	3304	3305	3306	3306	3306	3306	3306	3306	0
22	0	0	0	1285	2202	2803	3124	3182	3222	3250	3269	3281	3289	3295	3299	3301	3303	3304	3304	3305	3305	3305	0
23	0	0	0	1280	2190	2785	3103	3162	3204	3235	3256	3271	3281	3289	3294	3297	3300	3301	3302	3303	3303	3304	0
24	0	0	0	1277	2183	2775	3091	3149	3192	3224	3247	3263	3275	3284	3290	3294	3297	3299	3301	3302	3302	3303	0
25	0	0	0	1276	2179	2769	3083	3140	3184	3216	3240	3258	3271	3280	3287	3292	3295	3298	3299	3301	3301	3302	0
26	0	0	0	1276	2177	2765	3078	3135	3178	3211	3235	3253	3267	3277	3284	3290	3294	3296	3298	3300	3300	3301	0
27	0	0	0	1276	2177	2764	3075	3132	3175	3207	3232	3250	3264	3275	3282	3288	3292	3295	3297	3299	3300	3300	0
28	0	0	0	1276	2177	2763	3074	3129	3172	3205	3230	3248	3262	3273	3281	3287	3291	3294	3297	3298	3299	3300	0
29	0	0	0	1277	2177	2762	3073	3128	3171	3203	3228	3247	3261	3272	3280	3286	3290	3294	3296	3298	3299	3299	0
30	0	0	0	1277	2177	2762	3072	3127	3170	3202	3227	3246	3260	3271	3279	3285	3290	3293	3296	3297	3298	3299	0
31	0	0	0	1278	2178	2763	3072	3127	3169	3201	3226	3245	3259	3270	3278	3285	3289	3293	3295	3297	3298	3299	0
32	0	0	0	1278	2178	2763	3072	3127	3169	3201	3226	3244	3259	3270	3278	3284	3289	3292	3295	3297	3298	3298	0
33	0	0	0	1278	2179	2763	3072	3127	3169	3201	3225	3244	3258	3269	3278	3284	3289	3292	3295	3296	3298	3298	0
34	0	0	0	1279	2179	2763	3072	3127	3169	3201	3225	3244	3258	3269	3277	3284	3288	3292	3295	3296	3297	3298	0
35	0	0	0	1279	2179	2764	3073	3127	3168	3200	3225	3244	3258	3269	3277	3284	3288	3292	3294	3296	3297	3298	0
36	0	0	0	1279	2180	2764	3073	3127	3169	3200	3225	3244	3258	3269	3277	3283	3288	3292	3294	3296	3297	3298	0
37	0	0	0	1280	2180	2764	3073	3127	3169	3200	3225	3244	3258	3269	3277	3283	3288	3292	3294	3296	3297	3298	0
38	0	0	0	1280	2180	2764	3073	3127	3169	3200	3225	3243	3258	3269	3277	3283	3288	3292	3294	3296	3297	3298	0
39	0	0	0	1280	2180	2764	3073	3127	3169	3200	3225	3243	3258	3269	3277	3283	3288	3292	3294	3296	3297	3298	0
40	0	0	0	1280	2180	2764	3073	3127	3169	3200	3225	3243	3258	3269	3277	3283	3288	3292	3294	3296	3297	3298	0

SCENARIO TITLE: Default House: Perimeter Crack + 2 Ut. Pens 3ft from center (CASE2)
FILE NAME: def2____
RUN DATE: 11 11 1992 9 14:09

RAETRAD v3.1
RAdon Emanation and TRAnsport into Dwellings
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==========: INPUT PARAMETERS :==========

HOUSE:

Dimensions	: 28.4 x 54.3 ft.	Equiv. ellipse radius	: 16 ft.	Outdoor Pressure	: .00 Pa
Area	: 1542 sq. ft.	Aspect ratio	: 1.912	Indoor Rn Bnd.	: 2.00 pCi/L
Fill thickness	: 1 units (1.0ft.)	Circumference	: 153.4 ft.	Outdoor Rn Bnd.	: .00 pCi/L
Footing depth	: 3 units (3.0ft.)	Indoor pressure	: -2.4 Pa.	Radial Mesh Units	: 1.00 ft.

LOOR OPENINGS:

Crack or Penetration Type	Number of Penetrations	Loc. Frm Permtr ft	Local Pressure Pa	Local Rn Bndry pCi/L	Radial Width cm	Arc Length cm	Porosity	Perm. cm2	Diff. cm2/s
Elliptical Crack		.000	-2.40	2.00	1.00	4681.8	.600	1.00E-04	6.00E-02
Floor slab opening	2	13.000	-2.40	2.00	10.00	10.0	.600	1.00E-04	6.00E-02

FOUNDATION & SOILS:

Lyr No.	Thickness ft	Vrt. Div.	Ra226 pCi/g	Dens. g/cm3	Eman. frac.	Tot. Poros	Sat'n frac.	P.Diam cm	Diff.Rad cm2/s	Diff.Ver cm2/s	Perm.Rad cm2	Perm.Ver cm2	Kads cc/g	Material
FLR	.328	1	1.0	2.100	.100	.222	.769	.000290	6.29E-04	6.29E-04	1.23E-12	1.23E-12	.000098	Concl
1	1.300	1	.5	1.600	.200	.407	.213	.044200	2.71E-02	2.71E-02	2.18E-07	2.18E-07	.027786	Sand
2	4.000	4	8.0	1.600	.200	.407	.213	.044200	2.71E-02	2.71E-02	2.18E-07	2.18E-07	.027786	Sand
3	15.000	15	4.0	1.600	.200	.407	.213	.044200	2.71E-02	2.71E-02	2.18E-07	2.18E-07	.027786	Sand
FTG	3.000	3	1.0	2.100	.100	.222	.769	.000290	6.29E-04	6.29E-04	1.23E-12	1.23E-12	.000098	Concl

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SCENARIO TITLE: Default House: Perimeter Crack + 2 Ut. Pens 3ft from center (CASE2)
FILE NAME: def2____

RAETRAD ·
RAdon Emanation and TRAnsport into Dwell:
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==: ANALYSIS RESULTS :==

RADON ENTRY PROFILE:

```
-House Center-
|        o
|        o
|        .Floor slab opening
 |       o
 |       o
 |       o
  |      o
  |      o
  |      o
   |     o
   |     o
   |     o
    |    o
    |    o
    |    o
    |     Elliptical crack
     |-----O=====
             Y
             Y
             Y
```

Radial Positn ft	Air Entry Rate cfm	Eff. Radon Flux pCi/m2s	Radon Entry Rate pCi/s
1.00	1.66E-07	2.35E-01	1.31E-01
2.00	4.97E-07	2.34E-01	3.92E-01
3.00	7.55E-04	9.04E-01	2.52E+00
4.00	1.16E-06	2.34E-01	9.15E-01
5.00	1.49E-06	2.34E-01	1.18E+00
6.00	1.82E-06	2.34E-01	1.44E+00
7.00	2.14E-06	2.34E-01	1.69E+00
8.00	2.46E-06	2.33E-01	1.95E+00
9.00	2.77E-06	2.32E-01	2.20E+00
10.00	3.08E-06	2.31E-01	2.45E+00
11.00	3.37E-06	2.30E-01	2.70E+00
12.00	3.64E-06	2.29E-01	2.94E+00
13.00	3.88E-06	2.27E-01	3.17E+00
14.00	4.06E-06	2.25E-01	3.39E+00
15.00	4.14E-06	2.22E-01	3.59E+00
16.00	5.29E-02	5.96E+00	1.03E+02
17.00	1.29E-06	8.01E-02	1.47E+00
INDOOR TOTAL	5.37E-02	9.44E-01	1.35E+02
18.00	-7.57E-03	4.86E-01	9.48E+01
19.00	-6.51E-03	4.67E-01	9.64E+01
20.00	-5.40E-03	4.54E-01	9.89E+01
21.00	-4.52E-03	4.47E-01	1.02E+02
22.00	-3.85E-03	4.43E-01	1.06E+02
23.00	-3.34E-03	4.41E-01	1.11E+02
24.00	-2.94E-03	4.40E-01	1.15E+02
25.00	-2.64E-03	4.39E-01	1.20E+02
26.00	-2.39E-03	4.39E-01	1.25E+02
27.00	-2.20E-03	4.39E-01	1.30E+02
28.00	-2.04E-03	4.39E-01	1.35E+02
29.00	-1.91E-03	4.39E-01	1.40E+02
30.00	-1.80E-03	4.40E-01	1.45E+02
31.00	-1.72E-03	4.40E-01	1.50E+02
32.00	-1.65E-03	4.40E-01	1.55E+02
33.00	-1.59E-03	4.40E-01	1.60E+02
34.00	-1.55E-03	4.40E-01	1.65E+02
35.00	-1.52E-03	4.40E-01	1.69E+02
36.00	-1.50E-03	4.40E-01	1.74E+02
37.00	-1.49E-03	4.40E-01	1.79E+02
38.00	-1.50E-03	4.40E-01	1.84E+02
39.00	-1.51E-03	4.40E-01	1.89E+02
40.00	-1.54E-03	4.40E-01	1.94E+02

INDOOR RADON : 2.787 pCi/L (assuming .5000 ach & 8.00 ft Height)

CPU Calc. Time: 48.00 seconds

000055

SCENARIO TITLE: Default House: Perimeter Crack • 2 Ut. Pens 3ft from center (CASE2)
FILE NAME: def2____

RAETRAD v3.1
RAdon Emanation and TRAnsport into Dwellings
developed by Rogers & Associates Engineering Corporation

Suction Pressures, (- .0010 Pa) depth (ft.)----->

	.0	1.0	2.0	3.0	4.0	5.0	6.0	7.0	8.0	9.0	10.0	11.0	12.0	13.0	14.0	15.0	16.0	17.0	18.0	19.0	20.0	.0
1	1091	1091	1006	906	816	741	678	626	583	546	514	487	464	444	428	414	403	394	387	383	381	0
2	1142	1142	1016	900	808	733	672	621	579	543	511	485	462	442	426	412	401	392	386	382	380	0
3	1991	1275	1015	879	787	717	660	612	571	536	506	480	458	439	423	409	398	390	383	379	377	0
4	1009	1009	913	825	753	693	642	598	560	527	498	473	452	433	418	405	394	386	379	375	373	0
5	862	862	820	766	713	664	620	581	546	515	488	465	444	426	411	399	388	380	374	370	368	0
6	770	770	747	712	673	634	597	562	530	502	477	454	435	418	403	391	381	373	368	364	362	0
7	707	707	693	668	638	606	573	542	513	487	463	442	424	408	394	382	373	366	360	357	355	0
8	663	663	652	633	608	579	550	522	495	471	449	429	411	396	383	373	364	357	352	348	347	0
9	633	633	623	605	582	556	529	502	477	454	433	414	398	384	372	362	353	347	342	339	337	0
10	613	613	603	585	561	535	508	482	458	436	416	399	383	370	359	350	342	336	332	329	327	0
11	604	604	592	571	544	516	488	462	438	417	398	382	368	356	345	337	330	325	320	318	316	0
12	606	606	590	563	530	498	467	440	417	396	379	364	351	340	331	323	317	312	309	306	305	0
13	623	623	599	560	517	478	444	416	394	375	359	345	334	324	316	309	304	299	296	294	293	0
14	663	663	621	562	502	453	417	389	368	351	337	325	315	307	300	294	290	286	283	282	281	0
15	741	741	659	565	476	419	382	357	339	325	314	304	296	289	284	279	275	272	270	269	268	0
16	[illegible]	[illegible]	[illegible]	[illegible]	420	365	338	320	308	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	267	264	261	259	257	256	255	0
17	1931	964	[illegible]	213	280	289	286	280	275	270	265	261	257	254	251	248	246	245	244	243	242	0
18	[illegible]	[illegible]	[illegible]	[illegible]	202	227	238	242	243	242	241	240	238	236	235	233	232	231	230	230	229	0
19	0	0	55	110	153	181	198	208	214	217	218	219	219	219	219	218	218	218	217	217	217	0
20	0	0	44	86	121	148	166	179	188	193	197	200	202	203	204	204	204	205	205	205	205	0
21	0	0	36	69	99	122	141	155	165	173	178	182	185	188	189	190	191	192	192	193	193	0
22	0	0	29	57	82	103	121	135	146	154	161	166	170	173	176	177	179	180	181	181	181	0
23	0	[illegible]	[illegible]	[illegible]	[illegible]	85	105	118	130	139	146	152	156	160	163	165	167	168	169	170	170	0
24	0	0	21	41	60	77	92	105	116	125	132	139	144	148	151	154	156	158	159	160	160	0
25	0	0	18	36	52	68	81	94	104	113	121	127	133	137	141	144	146	148	149	150	150	0
26	0	0	16	32	46	60	73	84	94	103	110	117	122	127	131	134	137	139	140	141	141	0
27	0	0	14	28	41	54	66	76	86	94	101	108	113	118	122	125	128	130	132	133	133	0
28	0	0	13	25	37	49	60	69	78	86	94	100	105	110	114	117	120	122	124	125	125	0
29	0	0	12	23	34	45	55	64	72	80	87	93	98	103	107	110	113	115	117	118	118	0
30	0	0	11	21	31	41	50	59	67	74	81	87	92	97	101	104	107	109	111	112	112	0
31	0	0	10	19	29	38	47	55	62	69	76	82	87	91	95	98	101	103	105	106	107	0
32	0	0	9	18	27	35	44	51	59	65	71	77	82	86	90	93	96	98	100	101	102	0
33	0	0	9	17	25	33	41	48	55	62	68	73	78	82	86	89	92	94	96	97	97	0
34	[illegible]	0	8	16	24	32	39	46	53	59	65	70	74	79	82	86	88	90	92	93	93	0
35	0	0	8	15	23	30	37	44	50	56	62	67	72	76	79	82	85	87	89	90	90	0
36	0	0	7	15	22	29	36	42	49	54	60	65	69	73	77	80	82	85	86	87	88	0
37	0	0	7	14	21	28	35	41	47	53	58	63	67	71	75	78	80	82	84	85	86	0
38	0	0	7	14	21	28	34	40	46	52	57	62	66	70	73	76	79	81	82	84	84	0
39	0	0	7	14	21	27	34	40	46	51	56	61	65	69	73	76	78	80	81	82	83	0
40	0	0	7	14	20	27	33	39	45	51	56	60	65	69	72	75	78	79	81	82	82	0

SCENARIO TITLE: Default House: Perimeter Crack + 2 Ut. Pens 3ft from center (CASE2)
FILE NAME: def2____

RAETRAD v
RAdon Emanation and TRAnsport into Dwelli
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Soil Gas Radon Concentrations (1.00000 pCi/Liter) depth (ft.) ------>

	.0	1.0	2.0	3.0	4.0	5.0	6.0	7.0	8.0	9.0	10.0	11.0	12.0	13.0	14.0	15.0	16.0	17.0	18.0	19.0	20.0	.0
1	3526	3605	4023	4273	4354	4274	4036	3858	3723	3621	3544	3486	3442	3409	3385	3366	3353	3343	3336	3332	3330	0
2	3409	3509	3993	4270	4357	4277	4039	3859	3724	3622	3544	3486	3442	3409	3384	3366	3353	3343	3336	3332	3330	0
3	1541	3219	3959	4276	4367	4285	4044	3862	3725	3622	3544	3486	3442	3409	3384	3366	3352	3343	3336	3332	3330	0
4	3532	3617	4069	4318	4388	4297	4051	3866	3727	3623	3544	3485	3441	3408	3383	3365	3352	3342	3335	3331	3329	0
5	3691	3773	4150	4360	4410	4310	4058	3870	3729	3623	3544	3485	3440	3407	3383	3364	3351	3341	3335	3331	3329	0
6	3758	3843	4197	4389	4428	4321	4064	3872	3729	3622	3542	3483	3439	3406	3381	3363	3350	3341	3334	3330	3328	0
7	3790	3875	4222	4405	4438	4326	4065	3871	3727	3620	3540	3480	3436	3404	3380	3362	3349	3340	3333	3329	3327	0
8	3802	3888	4231	4411	4440	4325	4063	3867	3722	3615	3535	3477	3433	3401	3377	3360	3347	3338	3332	3328	3327	0
9	3802	3888	4230	4407	4434	4318	4054	3859	3714	3608	3529	3471	3429	3397	3374	3357	3345	3337	3331	3327	3325	0
10	3795	3880	4221	4395	4420	4302	4039	3844	3702	3597	3520	3464	3423	3393	3371	3355	3343	3335	3329	3326	3324	0
11	3780	3865	4202	4373	4395	4277	4015	3823	3684	3582	3508	3455	3416	3387	3366	3351	3340	3333	3328	3324	3323	0
12	3757	3842	4176	4341	4358	4239	3980	3794	3660	3563	3494	3443	3407	3381	3361	3347	3337	3330	3326	3323	3321	0
[illegible]	3728	3812	4139	4294	4303	4185	3932	3754	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	3328	3324	3321	3320	0
14	3691	3774	4091	4229	4221	4105	3865	3701	3588	3510	3454	3414	3385	3364	3349	3338	3331	3325	3321	3319	3318	0
15	3644	3726	4032	4142	4093	3988	3774	3635	3541	3475	3429	3396	3372	3355	3342	3333	3327	3322	3319	3317	3316	0
16	3437	3654	3972	4045	3870	3819	3658	3556	3487	3438	3403	3378	3359	3345	3335	3328	3323	3319	3317	3315	3314	0
17	1323	2162	1420	2910	3423	3592	3525	3471	3430	3399	3376	3359	3346	3336	3328	3323	3319	3316	3314	3313	3312	0
18	0	0	1381	2498	3129	3406	3405	3392	3377	3363	3350	3340	3333	3326	3322	3318	3315	3313	3312	3311	3311	0
19	0	0	1331	2329	2963	3278	3313	3327	3331	3330	3327	3324	3320	3318	3315	3313	3312	3310	3310	3309	3309	0
20	0	0	1300	2249	2871	3195	3247	3277	3294	3303	3307	3309	3310	3310	3309	3309	3308	3308	3308	3307	3307	0
21	0	0	1283	2208	2819	3144	3203	3241	3266	3281	3291	3297	3301	3303	3304	3305	3305	3306	3306	3306	3306	0
22	0	0	1274	2187	2790	3113	3173	3216	3245	3265	3278	3287	3293	3297	3300	3302	3303	3304	3304	3304	3304	0
23	0	0	1270	2177	2773	3093	3154	3198	3230	3252	3268	3279	3287	3292	3296	3299	3301	3302	3303	3303	3303	0
24	0	0	1268	2171	2764	3082	3142	3186	3219	3243	3261	3273	3282	3288	3293	3296	3299	3300	3301	3302	3302	0
25	0	0	1268	2169	2759	3075	3134	3179	3212	3237	3255	3268	3278	3285	3291	3294	3297	3299	3300	3301	3301	0
26	0	0	1269	2168	2757	3071	3129	3173	3207	3232	3251	3265	3275	3283	3289	3293	3296	3298	3299	3300	3301	0
27	0	0	1270	2168	2756	3069	3126	3170	3204	3229	3248	3263	3273	3281	3287	3292	3295	3297	3298	3299	3300	0
28	0	0	1271	2169	2755	3068	3124	3168	3201	3227	3246	3261	3272	3280	3286	3291	3294	3296	3298	3299	3299	0
29	0	0	1271	2170	2756	3067	3124	3167	3200	3225	3245	3259	3270	3279	3285	3290	3293	3296	3297	3298	3299	0
30	0	0	1272	2171	2756	3067	3123	3166	3199	3224	3244	3258	3270	3278	3284	3289	3293	3295	3297	3298	3299	0
31	0	0	1273	2172	2757	3067	3123	3166	3199	3224	3243	3258	3269	3278	3284	3289	3292	3295	3297	3298	3298	0
32	0	0	1274	2173	2757	3068	3123	3166	3198	3224	3243	3257	3269	3277	3284	3288	3292	3295	3296	3297	3298	0
33	0	0	1275	2173	2758	3068	3123	3166	3198	3223	3243	3257	3268	3277	3283	3288	3292	3294	3296	3297	3298	0
34	0	0	1275	2174	2759	3068	3123	3166	3198	3223	3242	3257	3268	3277	3283	3288	3292	3294	3296	3297	3298	0
35	0	0	1276	2175	2759	3069	3124	3166	3198	3223	3242	3257	3268	3277	3283	3288	3291	3294	3296	3297	3298	0
36	0	0	1276	2175	2760	3069	3124	3166	3198	3223	3242	3257	3268	3276	3283	3288	3291	3294	3296	3297	3298	0
37	0	0	1276	2175	2760	3069	3124	3166	3198	3223	3242	3257	3268	3276	3283	3288	3291	3294	3296	3297	3297	0
38	0	0	1276	2176	2760	3069	3124	3166	3198	3223	3242	3257	3268	3276	3283	3288	3291	3294	3296	3297	3297	0
39	0	0	1277	2176	2760	3070	3124	3166	3198	3223	3242	3257	3268	3276	3283	3288	3291	3294	3296	3297	3297	0
40	0	0	1277	2176	2760	3070	3124	3166	3199	3223	3242	3257	3268	3276	3283	3288	3291	3294	3296	3297	3297	0

SCENARIO TITLE: Default House:Perimeter Crack + 2 Pass. Vents @10ft & -5 Pa (CASE3)
FILE NAME: def3____
RUN DATE: 10/30/1992 @ 14:07

RAETRAD v3.1
RAdon Emanation and TRAnsport into Dwellings
developed by Rogers & Associates Engineering Corporation

==========: INPUT PARAMETERS :==========

HOUSE:

Dimensions	:	28.4 x 54.3 ft.	Equiv. ellipse radius	:	16 ft.	Outdoor Pressure	:	.00 Pa
Area	:	1542 sq. ft.	Aspect ratio	:	1.912	Indoor Rn Bnd.	:	2.00 pCi/L
Fill thickness	:	1 units (1.0ft.)	Circumference	:	153.4 ft.	Outdoor Rn Bnd.	:	.00 pCi/L
Footing depth	:	3 units (3.0ft.)	Indoor pressure	:	-2.4 Pa.	Radial Mesh Units	:	1.00 ft.

CRACK DETAILS:

Crack or Penetration Type	Number of Penetrations	Loc. Frm Permtr ft	Local Pressure Pa	Local Rn Bndry pCi/L	Radial Width cm	Arc Length cm	Porosity	Perm. cm2	Diff. cm2/s
Elliptical Crack		.000	-2.40	2.00	1.00	4681.8	.600	1.00E-04	6.00E-02
Remediation Penetration	2	6.000	-5.00	2.00	10.00	10.0	.600	1.00E-04	6.00E-02

FOUNDATION & SOILS:

Lyr No.	Thickness ft	Vrt. Div.	Ra226 pCi/g	Dens. g/cm3	Eman. frac.	Tot. Poros	Sat'n frac.	P.Diam cm	Diff.Rad cm2/s	Diff.Ver cm2/s	Perm.Rad cm2	Perm.Ver cm2	Kada cc/g	Material
FLR	.328	1	1.0	2.100	.100	.222	.769	.000290	6.29E-04	6.29E-04	1.23E-12	1.23E-12	.000098	Concl
1	1.000	1	.5	1.600	.200	.407	.213	.044200	2.71E-02	2.71E-02	2.18E-07	2.18E-07	.027786	Sand
2	4.000	4	8.0	1.600	.200	.407	.213	.044200	2.71E-02	2.71E-02	2.18E-07	2.18E-07	.027786	Sand
3	15.000	15	4.0	1.600	.200	.407	.213	.044200	2.71E-02	2.71E-02	2.18E-07	2.18E-07	.027786	Sand
FTG	3.000	3	1.0	2.100	.100	.222	.769	.000290	6.29E-04	6.29E-04	1.23E-12	1.23E-12	.000098	Concl

SCENARIO TITLE: Default House:Perimeter Crack + 2 Pass. Vents @10ft & -5 Pa (CASE3) RAETRAD \
FILE NAME: def3____
RAdon Emanation and TRAnsport into Dwelli
developed by Rogers & Associates Engineering Corporat

==: ANALYSIS RESULTS :==

RADON ENTRY PROFILE:

	Radial Positn ft	Air Entry Rate cfm	Eff. Radon Flux pCi/m2s	Radon Entry Rate pCi/s
-House Center-				
o	1.00	1.67E-07	2.35E-01	1.31E-01
o	2.00	4.99E-07	2.35E-01	3.93E-01
o	3.00	8.31E-07	2.35E-01	6.55E-01
o	4.00	1.16E-06	2.35E-01	9.17E-01
o	5.00	1.49E-06	2.35E-01	1.18E+00
o	6.00	1.82E-06	2.34E-01	1.44E+00
o	7.00	2.14E-06	2.34E-01	1.70E+00
o	8.00	2.46E-06	2.33E-01	1.95E+00
o	9.00	2.77E-06	2.32E-01	2.20E+00
Remediation penetration	10.00	3.07E-06	2.30E-01	2.44E+00
o	11.00	3.36E-06	2.30E-01	2.70E+00
o	12.00	3.63E-06	2.29E-01	2.94E+00
o	13.00	3.87E-06	2.27E-01	3.17E+00
o	14.00	4.05E-06	2.25E-01	3.39E+00
o	15.00	4.13E-06	2.22E-01	3.59E+00
Elliptical crack	16.00	5.29E-02	5.95E+00	1.03E+02
|-----Oxxxxx	17.00	1.29E-06	8.01E-02	1.47E+00
	INDOOR TOTAL	5.29E-02	9.30E-01	1.33E+02
Y				
Y	18.00	-7.61E-03	4.85E-01	9.48E+01
Y	19.00	-6.54E-03	4.67E-01	9.63E+01
Y	20.00	-5.43E-03	4.54E-01	9.88E+01
Y	21.00	-4.54E-03	4.47E-01	1.02E+02
Y	22.00	-3.87E-03	4.43E-01	1.06E+02
Y	23.00	-3.35E-03	4.41E-01	1.11E+02
Y	24.00	-2.96E-03	4.40E-01	1.15E+02
Y	25.00	-2.65E-03	4.39E-01	1.20E+02
Y	26.00	-2.41E-03	4.39E-01	1.25E+02
Y	27.00	-2.21E-03	4.39E-01	1.30E+02
Y	28.00	-2.05E-03	4.39E-01	1.35E+02
Y	29.00	-1.92E-03	4.39E-01	1.40E+02
Y	30.00	-1.81E-03	4.40E-01	1.45E+02
Y	31.00	-1.73E-03	4.40E-01	1.50E+02
Y	32.00	-1.65E-03	4.40E-01	1.55E+02
Y	33.00	-1.60E-03	4.40E-01	1.60E+02
Y	34.00	-1.56E-03	4.40E-01	1.65E+02
Y	35.00	-1.53E-03	4.40E-01	1.69E+02
Y	36.00	-1.51E-03	4.40E-01	1.74E+02
Y	37.00	-1.50E-03	4.40E-01	1.79E+02
Y	38.00	-1.51E-03	4.40E-01	1.84E+02
Y	39.00	-1.52E-03	4.40E-01	1.89E+02
Y	40.00	-1.55E-03	4.40E-01	1.94E+02

INDOOR RADON : 2.746 pCi/L (assuming .5000 ach & 8.00 ft Height)

CPU Calc. Time: 48.00 seconds

000059

SCENARIO TITLE: Default House:Perimeter Crack + 2 Pass. Vents @10ft & -5 Pa (CASE3)
FILE NAME: def3____

RAETRAD v3.1
RAdon Emanation and TRAnsport into Dwellings
developed by Rogers & Associates Engineering Corporation

Suction Pressures, (- .0010 Pa) depth (ft.)------>

	.0	1.0	2.0	3.0	4.0	5.0	6.0	7.0	8.0	9.0	10.0	11.0	12.0	13.0	14.0	15.0	16.0	17.0	18.0	19.0	20.0	.0
1	1539	1539	1524	1496	1456	1409	1356	1302	1247	1194	1144	1098	1056	1019	986	959	936	917	904	895	890	0
2	1548	1548	1532	1502	1461	1412	1357	1302	1246	1192	1142	1095	1053	1016	983	956	933	914	901	892	887	0
3	1567	1567	1549	1516	1470	1417	1360	1301	1244	1189	1137	1090	1048	1010	978	950	927	909	895	886	882	0
4	1597	1597	1576	1537	1485	1425	1363	1300	1240	1183	1130	1082	1039	1001	969	941	918	900	887	878	874	0
5	1642	1642	1614	1565	1503	1435	1365	1298	1233	1174	1119	1071	1027	990	957	930	907	889	876	867	863	0
6	1705	1705	1667	1602	1526	1445	1366	1292	1223	1161	1105	1056	1012	974	942	915	893	875	862	854	849	0
7	1797	1797	1737	1647	1549	1452	1363	1282	1209	1144	1087	1037	993	956	924	897	876	859	846	838	833	0
8	1936	1936	1829	1696	1568	1453	1352	1264	1188	1121	1064	1014	970	934	903	877	856	839	827	819	815	0
9	2163	2163	1939	1736	1573	1441	1331	1238	1160	1092	1035	986	944	908	878	853	833	817	806	798	794	0
10	4121	2583	2023	1737	1549	1408	1294	1201	1122	1056	1000	953	913	879	850	827	808	793	782	775	772	0
11	2058	2058	1844	1646	1483	1351	1242	1151	1076	1013	960	915	878	846	820	798	780	767	757	750	747	0
12	1764	1764	1660	1525	1393	1275	1175	1091	1021	963	914	873	839	810	786	767	751	739	730	724	721	0
13	1585	1585	1516	1409	1293	1186	1095	1020	957	906	863	827	797	772	751	733	719	709	701	696	693	0
14	1479	1479	1413	1308	1189	1087	1005	939	887	843	807	777	752	731	713	699	687	677	671	666	664	0
15	1442	1442	1353	1223	1075	973	903	851	810	777	749	725	706	689	674	663	653	645	640	636	634	0
16	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	755	729	708	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
17	2053	1233	153	478	627	660	663	657	648	639	629	619	611	602	595	589	584	580	577	575	574	0
18	0	0	153	334	457	520	551	565	571	572	571	568	564	560	556	553	550	547	545	544	543	0
19	0	0	126	252	351	417	459	485	501	511	516	518	519	519	518	517	516	515	514	514	513	0
20	0	0	101	198	279	341	386	418	440	455	466	473	477	480	482	483	484	484	484	484	484	0
21	0	0	82	160	228	284	328	362	387	406	420	430	438	444	448	451	453	454	455	456	456	0
22	0	0	68	132	191	241	282	316	342	363	379	392	402	410	415	420	423	426	427	428	429	0
23	0	0	57	112	162	207	245	278	304	326	344	358	369	378	385	391	395	398	401	402	403	0
24	0	0	49	96	140	180	215	246	272	294	312	327	339	349	358	364	369	373	376	378	379	0
25	0	0	42	84	123	159	191	220	245	266	284	300	313	323	332	339	345	349	353	355	356	0
26	0	0	37	74	109	141	171	198	221	242	260	276	289	300	309	317	323	328	331	333	334	0
27	0	0	33	66	97	127	154	179	201	221	239	254	268	279	288	296	302	307	311	313	315	0
28	0	0	30	59	88	115	140	163	185	204	221	236	249	260	269	277	284	289	293	295	296	0
29	0	0	27	54	80	105	128	150	170	188	205	219	232	243	253	261	267	272	276	279	280	0
30	0	0	25	50	73	96	118	139	158	175	191	205	217	228	238	246	252	257	261	264	265	0
31	0	0	23	46	68	89	110	129	147	164	179	192	205	215	225	232	239	244	248	250	252	0
32	0	0	21	43	63	84	103	121	138	154	168	182	193	204	213	221	227	232	236	239	240	0
33	0	0	20	40	60	79	97	114	130	146	160	172	184	194	203	211	217	222	226	228	229	0
34	0	0	19	38	57	75	92	108	124	139	152	165	176	186	194	202	208	213	217	219	221	0
35	0	0	18	36	54	71	88	104	119	133	146	158	169	179	187	195	201	206	209	212	213	0
36	0	0	18	35	52	69	85	100	115	128	141	153	163	173	181	189	195	200	203	206	207	0
37	0	0	17	34	50	67	82	97	111	125	137	149	159	169	177	184	190	195	198	201	202	0
38	0	0	17	33	49	65	80	95	109	122	134	146	156	165	173	181	186	191	195	197	198	0
39	0	0	16	33	48	64	79	94	107	120	133	144	154	163	171	178	184	189	192	195	196	0
40	0	0	16	32	48	64	79	93	107	120	132	143	153	162	170	177	183	188	191	194	195	0

SCENARIO TITLE: Default House:Perimeter Crack + 2 Pass. Vents @10ft & -5 Pa (CASE3)
FILE NAME: def3____

RAETRAD v3
RAdon Emanation and TRAnsport into Dwellinc
developed by Rogers & Associates Engineering Corporatic

Soil Gas Radon Concentrations (1.00000 pCi/Liter) depth (ft.) ----->

	.0	1.0	2.0	3.0	4.0	5.0	6.0	7.0	8.0	9.0	10.0	11.0	12.0	13.0	14.0	15.0	16.0	17.0	18.0	19.0	20.0	.0
1	3859	3946	4285	4452	4466	4337	4065	3865	3717	3609	3529	3471	3428	3397	3374	3357	3345	3337	3331	3327	3325	0
2	3858	3945	4283	4450	4464	4334	4063	3862	3715	3607	3528	3470	3428	3396	3374	3357	3345	3336	3331	3327	3325	0
3	3856	3943	4280	4446	4459	4329	4057	3858	3712	3604	3526	3468	3426	3395	3373	3356	3344	3336	3330	3327	3325	0
4	3852	3939	4275	4439	4450	4320	4049	3851	3706	3600	3522	3466	3424	3394	3371	3355	3343	3335	3330	3326	3324	0
5	3847	3934	4268	4429	4439	4308	4038	3842	3699	3594	3518	3462	3421	3391	3370	3354	3342	3334	3329	3325	3324	0
6	3837	3924	4256	4415	4423	4292	4024	3830	3689	3587	3512	3457	3418	3389	3367	3352	3341	3333	3328	3325	3323	0
7	3821	3908	4238	4394	4401	4271	4006	3816	3678	3578	3505	3452	3413	3385	3365	3350	3339	3332	3327	3324	3322	0
8	3789	3875	4205	4363	4372	4246	3985	3799	3664	3567	3496	3445	3408	3381	3362	3348	3337	3330	3325	3322	3321	0
9	3688	3789	4145	4320	4338	4216	3961	3779	3648	3554	3486	3438	3402	3377	3358	3345	3335	3329	3324	3321	3320	0
10	2005	3454	4046	4269	4299	4184	3934	3756	3630	3539	3475	3429	3395	3371	3354	3342	3333	3327	3322	3320	3319	0
11	3584	3670	4057	4242	4264	4149	3902	3729	3608	3522	3461	3418	3387	3365	3349	3338	3330	3324	3321	3318	3317	0
12	3627	3708	4047	4208	4221	4106	3863	3696	3581	3501	3445	3406	3378	3358	3344	3334	3327	3322	3319	3317	3316	0
13	3610	3690	4012	4158	4161	4046	3811	3654	3549	3477	3427	3392	3368	3351	3339	3330	3324	3320	3317	3315	3314	0
14	3569	3648	3959	4086	4071	3962	3742	3602	3510	3448	3406	3377	3357	3343	3333	3326	3321	3317	3315	3313	3312	0
15	3512	3590	3892	3989	3930	3840	3651	3537	3464	3416	3384	3361	3346	3334	3327	3321	3317	3314	3313	3311	3311	0
16	3274	3505	3825	3881	3692	3669	3539	3462	3414	3382	3360	3344	3334	3326	3320	3316	3314	3312	3310	3310	3309	0
17	1300	2113	1298	2702	3250	3453	3414	3385	3363	3347	3336	3328	3322	3318	3314	3312	3310	3309	3308	3308	3308	0
18	0	0	1256	2334	2981	3285	3308	3315	3317	3316	3314	3312	3311	3310	3309	3308	3307	3307	3306	3306	3306	0
19	0	0	1230	2197	2840	3175	3229	3260	3278	3288	3295	3299	3301	3302	3303	3304	3304	3304	3305	3305	3305	0
20	0	0	1219	2142	2769	3109	3176	3220	3248	3266	3279	3287	3292	3296	3299	3300	3302	3302	3303	3303	3303	0
21	0	0	1217	2121	2734	3072	3142	3192	3226	3249	3266	3277	3285	3291	3295	3297	3299	3301	3301	3302	3302	0
22	0	0	1220	2115	2719	3052	3122	3173	3210	3237	3256	3270	3279	3286	3291	3295	3297	3299	3300	3301	3301	0
23	0	0	1224	2115	2713	3041	3110	3162	3200	3228	3249	3264	3275	3283	3288	3293	3296	3298	3299	3300	3300	0
24	0	0	1229	2118	2712	3037	3104	3155	3193	3222	3244	3260	3271	3280	3286	3291	3294	3296	3298	3299	3300	0
25	0	0	1234	2123	2714	3036	3101	3151	3189	3218	3240	3257	3269	3278	3284	3289	3293	3296	3297	3298	3299	0
26	0	0	1239	2128	2717	3037	3100	3150	3187	3216	3238	3254	3267	3276	3283	3288	3292	3295	3297	3298	3298	0
27	0	0	1243	2132	2720	3039	3101	3149	3186	3215	3237	3253	3266	3275	3282	3288	3291	3294	3296	3297	3298	0
28	0	0	1247	2137	2724	3041	3102	3149	3186	3214	3236	3252	3265	3274	3282	3287	3291	3294	3296	3297	3298	0
29	0	0	1250	2141	2727	3043	3103	3150	3186	3214	3235	3252	3264	3274	3281	3287	3291	3293	3295	3297	3297	0
30	0	0	1252	2144	2730	3045	3105	3151	3186	3214	3235	3252	3264	3274	3281	3286	3290	3293	3295	3296	3297	0
31	0	0	1255	2147	2733	3047	3106	3152	3187	3214	3235	3252	3264	3273	3281	3286	3290	3293	3295	3296	3297	0
32	0	0	1257	2150	2735	3049	3107	3153	3188	3215	3236	3252	3264	3273	3281	3286	3290	3293	3295	3296	3297	0
33	0	0	1258	2152	2737	3050	3108	3153	3188	3215	3236	3252	3264	3273	3280	3286	3290	3293	3295	3296	3297	0
34	0	0	1260	2154	2739	3052	3110	3154	3189	3215	3236	3252	3264	3273	3280	3286	3290	3293	3295	3296	3297	0
35	0	0	1261	2155	2740	3053	3110	3155	3189	3216	3236	3252	3264	3273	3280	3286	3290	3293	3295	3296	3297	0
36	0	0	1262	2156	2741	3054	3111	3155	3190	3216	3237	3252	3264	3273	3281	3286	3290	3293	3295	3296	3297	0
37	0	0	1263	2157	2742	3055	3112	3156	3190	3216	3237	3252	3264	3274	3281	3286	3290	3293	3295	3296	3297	0
38	0	0	1263	2158	2743	3055	3112	3156	3190	3217	3237	3252	3264	3274	3281	3286	3290	3293	3295	3296	3297	0
39	0	0	1264	2158	2743	3055	3112	3157	3191	3217	3237	3252	3264	3274	3281	3286	3290	3293	3295	3296	3297	0
40	0	0	1264	2159	2744	3056	3113	3157	3191	3217	3237	3253	3264	3274	3281	3286	3290	3293	3295	3296	3297	0

000061

SCENARIO TITLE: Default House: No P. Crack + 2 Pass Vents @ 10ft & -5 Pa (CASE4)
FILE NAME: def4____
RUN DATE: 10/30/1992 @ 14:10

RAETRAD v3.1
RAdon Emanation and TRAnsport into Dwellings
developed by Rogers & Associates Engineering Corporation

==========: INPUT PARAMETERS :==========

HOUSE:

Dimensions	: 28.4 x 54.3 ft.	Equiv. ellipse radius	: 16 ft.	Outdoor Pressure	: .00 Pa
Area	: 1542 sq. ft.	Aspect ratio	: 1.912	Indoor Rn Bnd.	: 2.00 pCi/L
Fill thickness	: 1 units (1.0ft.)	Circumference	: 153.4 ft.	Outdoor Rn Bnd.	: .00 pCi/L
Footing depth	: 3 units (3.0ft.)	Indoor pressure	: -2.4 Pa.	Radial Mesh Units	: 1.00 ft.

DOOR OPENINGS:

Crack or Penetration Type	Number of Penetrations	Loc. Frm Permtr ft	Local Pressure Pa	Local Rn Sndry pCi/L	Radial Width cm	Arc Length cm	Porosity	Perm. cm2	Diff. cm2/s
Remediation Penetration	2	6.000	-5.00	2.00	10.00	10.0	.600	1.00E-04	6.00E-02

FOUNDATION & SOILS:

Lyr No.	Thickness ft	Vrt. Div.	Ra226 pCi/g	Dens. g/cm3	Eman. frac.	Tot. Poros	Sat'n frac.	P.Diam cm	Diff.Rad cm2/s	Diff.Ver cm2/s	Perm.Rad cm2	Perm.Ver cm2	Kads cc/g	Material
FLR	.328	1	1.0	2.100	.100	.222	.769	.000290	6.29E-04	6.29E-04	1.23E-12	1.23E-12	.000098	Concl
1	1.000	1	.5	1.600	.200	.407	.213	.044200	2.71E-02	2.71E-02	2.18E-07	2.18E-07	.027786	Sand
2	4.000	4	8.0	1.600	.200	.407	.213	.044200	2.71E-02	2.71E-02	2.18E-07	2.18E-07	.027786	Sand
3	15.000	15	4.0	1.600	.200	.407	.213	.044200	2.71E-02	2.71E-02	2.18E-07	2.18E-07	.027786	Sand
FTG	3.000	3	1.0	2.100	.100	.222	.769	.000290	6.29E-04	6.29E-04	1.23E-12	1.23E-12	.000098	Concl

===: ANALYSIS RESULTS :===

RADON ENTRY PROFILE:

-House Center-	Radial Positn ft	Air Entry Rate cfm	Eff. Radon Flux pCi/m2s	Radon Entry Rate pCi/s
O	1.00	1.89E-07	2.35E-01	1.31E-01
O	2.00	5.68E-07	2.35E-01	3.94E-01
O	3.00	9.47E-07	2.35E-01	6.56E-01
O	4.00	1.33E-06	2.35E-01	9.18E-01
O	5.00	1.70E-06	2.35E-01	1.18E+00
O	6.00	2.08E-06	2.34E-01	1.44E+00
O	7.00	2.46E-06	2.34E-01	1.70E+00
O	8.00	2.84E-06	2.33E-01	1.95E+00
O	9.00	3.22E-06	2.33E-01	2.21E+00
Remediation penetration	10.00	3.59E-06	2.30E-01	2.44E+00
O	11.00	3.97E-06	2.30E-01	2.70E+00
O	12.00	4.36E-06	2.29E-01	2.94E+00
O	13.00	4.74E-06	2.27E-01	3.17E+00
O	14.00	5.12E-06	2.25E-01	3.39E+00
O	15.00	5.50E-06	2.23E-01	3.61E+00
O	16.00	5.88E-06	2.21E-01	3.82E+00
|-----O=====	17.00	1.90E-06	8.14E-02	1.50E+00
Y	INDOOR TOTAL	5.04E-05	2.38E-01	3.41E+01
Y				
Y	18.00	-1.55E-04	5.09E-01	9.95E+01
Y	19.00	-1.35E-04	4.86E-01	1.00E+02
Y	20.00	-1.15E-04	4.69E-01	1.02E+02
Y	21.00	-9.80E-05	4.59E-01	1.05E+02
Y	22.00	-8.51E-05	4.52E-01	1.09E+02
Y	23.00	[illegible]	4.49E-01	1.13E+02
Y	24.00	-6.73E-05	4.46E-01	1.17E+02
Y	25.00	-6.11E-05	4.45E-01	1.22E+02
Y	26.00	-5.61E-05	4.44E-01	1.26E+02
Y	27.00	-5.20E-05	4.44E-01	1.31E+02
Y	28.00	-4.86E-05	4.43E-01	1.36E+02
Y	29.00	-4.58E-05	4.43E-01	1.41E+02
Y	30.00	-4.35E-05	4.43E-01	1.46E+02
Y	31.00	-4.16E-05	4.43E-01	1.51E+02
Y	32.00	-4.00E-05	4.43E-01	1.56E+02
Y	33.00	-3.88E-05	4.42E-01	1.60E+02
Y	34.00	-3.79E-05	4.42E-01	1.65E+02
Y	35.00	-3.72E-05	4.42E-01	1.70E+02
Y	36.00	-3.68E-05	4.42E-01	1.75E+02
Y	37.00	-3.67E-05	4.42E-01	1.80E+02
Y	38.00	-3.68E-05	4.42E-01	1.85E+02
Y	39.00	-3.72E-05	4.42E-01	1.90E+02
Y	40.00	-3.79E-05	4.42E-01	1.95E+02

INDOOR RADON : .704 pCi/L (assuming .5000 ach & 8.00 ft Height)

CPU Calc. Time: 47.00 seconds

SCENARIO TITLE: Default House. No P. Crack + 2 Pass Vents @ 10ft & -5 Pa (CASE4)
FILE NAME: def4____

RAETRAD v3.1
RAdon Emanation and TRAnsport into Dwellings
developed by Rogers & Associates Engineering Corporation

Suction Pressures. (- .0010 Pa) depth (ft.)----->

	.0	1.0	2.0	3.0	4.0	5.0	6.0	7.0	8.0	9.0	10.0	11.0	12.0	13.0	14.0	15.0	16.0	17.0	18.0	19.0	20.0	.0
1	1433	1433	1418	1390	1352	1305	1254	1201	1149	1098	1050	1006	966	931	900	873	852	834	822	813	809	0
2	1442	1442	1426	1397	1356	1308	1255	1201	1148	1096	1048	1003	963	928	897	871	849	832	819	811	806	0
3	1461	1461	1443	1410	1365	1313	1258	1201	1145	1092	1043	998	958	922	891	865	844	827	814	805	801	0
4	1490	1490	1469	1430	1379	1321	1260	1199	1141	1086	1036	990	949	914	883	857	836	819	806	798	793	0
5	1534	1534	1507	1458	1397	1330	1262	1196	1134	1077	1025	979	938	902	872	846	825	808	796	787	783	0
6	1597	1597	1558	1494	1418	1339	1262	1190	1124	1064	1011	964	923	888	857	832	811	795	783	775	771	0
7	1689	1689	1628	1537	1439	1345	1257	1179	1109	1047	993	946	905	870	840	815	795	779	767	760	756	0
8	1828	1828	1719	1584	1456	1343	1245	1160	1087	1024	970	923	883	849	820	796	776	761	750	742	739	0
9	2057	2057	1827	1621	1458	1328	1221	1133	1059	995	942	896	857	824	796	774	755	741	730	723	719	0
10	4086	2485	1906	1615	1429	1291	1183	1094	1021	960	908	864	827	796	770	749	731	718	708	702	698	0
11	1926	1926	1709	1512	1355	1229	1128	1044	975	917	869	828	794	765	741	722	706	693	684	678	675	0
12	1605	1605	1505	1378	1256	1149	1058	983	920	868	825	788	757	732	710	692	678	667	659	654	651	0
13	1395	1394	1336	1246	1147	1056	978	913	859	814	776	744	718	695	677	661	649	639	632	628	625	0
4	1250	1250	1205	1128	1037	956	890	836	792	755	724	698	676	658	642	629	619	611	605	601	599	0
	1155	1155	[illegible]	[illegible]	[illegible]	947	793	753	720	693	670	650	633	619	[illegible]	[illegible]	588	581	576	573	571	0
	1107	1107	1058	956	782	721	689	666	647	630	615	601	590	579	570	562	556	[illegible]	547	545	544	0
7	1933	1057	133	412	539	572	579	578	574	567	560	553	546	540	534	529	525	521	518	517	516	0
18	0	0	133	289	396	453	482	498	505	508	508	506	504	501	498	496	493	491	490	489	488	0
19	0	0	110	219	305	364	403	428	443	453	459	462	464	464	464	464	463	462	462	461	461	0
20	0	0	88	172	244	299	339	369	389	404	414	421	426	429	431	433	433	434	434	434	434	0
21	0	0	72	140	200	250	289	320	343	360	373	383	391	396	400	403	405	407	408	408	409	0
22	0	0	60	116	168	212	249	279	303	322	337	349	358	366	371	375	379	381	383	384	384	0
23	0	0	50	98	143	183	217	246	270	290	306	319	329	338	344	349	354	357	359	360	361	0
24	0	0	43	85	124	159	191	218	241	261	278	291	303	312	319	325	330	334	336	338	339	0
25	0	0	38	74	109	140	169	195	217	237	253	267	279	289	297	303	308	312	315	317	318	0
26	0	0	33	65	96	125	152	175	197	215	232	246	258	268	276	283	288	293	296	298	299	0
27	0	0	30	58	86	112	137	159	179	197	213	227	239	249	257	264	270	275	278	280	281	0
28	0	0	27	53	78	102	124	145	164	181	197	210	222	232	241	248	254	258	262	264	265	0
29	0	0	24	48	71	93	114	133	151	168	182	195	207	217	226	233	239	243	247	249	250	0
30	0	0	22	44	65	86	105	123	140	156	170	183	194	204	212	219	225	230	233	236	237	0
31	0	0	21	41	61	80	98	115	131	146	159	172	182	192	200	207	213	218	221	224	225	0
32	0	0	19	38	57	74	92	108	123	137	150	162	173	182	190	197	203	207	211	213	214	0
33	0	0	18	36	53	70	86	102	116	130	142	154	164	173	181	188	194	198	202	204	205	0
34	0	0	17	34	50	66	82	97	111	124	136	147	157	166	174	180	186	190	194	196	197	0
35	0	0	16	32	48	64	78	93	106	119	130	141	151	159	167	174	179	184	187	189	190	0
36	0	0	16	31	46	61	75	89	102	114	126	136	146	154	162	168	174	178	181	184	185	0
37	0	0	15	30	45	59	73	87	99	111	122	133	142	150	158	164	170	174	177	179	180	0
38	0	0	15	29	44	58	72	85	97	109	120	130	139	147	155	161	166	171	174	176	177	0
39	0	0	15	29	43	57	71	83	96	107	118	128	137	146	153	159	164	169	172	174	175	0
40	0	0	14	29	43	57	70	83	95	107	117	127	136	145	152	158	163	167	171	173	174	0

SCENARIO TITLE: Default House: No P. Crack + 2 Pass Vents @ 10ft & -5 Pa (CASE4)
FILE NAME: def4____

RAETRAD v.
RAdon Emanation and TRAnsport into Dwelli:
developed by Rogers & Associates Engineering Corporat

Soil Gas Radon Concentrations (1.00000 pCi/Liter) depth (ft.) ----->

	.0	1.0	2.0	3.0	4.0	5.0	6.0	7.0	8.0	9.0	10.0	11.0	12.0	13.0	14.0	15.0	16.0	17.0	18.0	19.0	20.0	.0
1	3863	3951	4289	4457	4471	4343	4070	3870	3722	3613	3533	3474	3431	3399	3376	3359	3346	3338	3332	3328	3326	0
2	3862	3950	4288	4455	4469	4340	4068	3867	3720	3611	3532	3473	3430	3399	3375	3358	3346	3337	3331	3328	3326	0
3	3860	3948	4285	4451	4464	4335	4063	3863	3716	3609	3530	3472	3429	3398	3374	3358	3346	3337	3331	3327	3326	0
4	3857	3945	4281	4445	4457	4326	4055	3857	3711	3605	3526	3469	3427	3396	3373	3357	3345	3336	3330	3327	3325	0
5	3853	3940	4275	4436	4446	4315	4045	3848	3704	3599	3522	3466	3424	3394	3372	3355	3344	3335	3330	3326	3325	0
6	3845	3932	4264	4423	4431	4300	4032	3837	3695	3592	3517	3461	3421	3391	3370	3354	3342	3334	3329	3325	3324	0
7	3831	3918	4248	4404	4410	4280	4015	3824	3685	3584	3510	3456	3417	3388	3367	3352	3341	3333	3328	3325	3323	0
8	3802	3888	4218	4375	4384	4257	3996	3808	3672	3574	3502	3450	3412	3384	3364	3349	3339	3332	3327	3323	3322	0
9	3707	3808	4162	4335	4351	4230	3974	3790	3657	3562	3493	3443	3406	3380	3361	3347	3337	3330	3325	3322	3321	0
10	2043	3483	4067	4287	4316	4200	3948	3769	3640	3548	3482	3434	3400	3375	3357	3344	3334	3328	3324	3321	3319	0
11	3608	3694	4079	4262	4284	4168	3919	3744	3619	3531	3469	3424	3392	3369	3352	3340	3332	3326	3322	3319	3318	0
12	3650	3731	4070	4232	4245	4129	3883	3713	3594	3512	3454	3412	3383	3362	3347	3336	3329	3323	3320	3318	3317	0
13	3636	3717	4040	4186	4190	4074	3834	3673	3563	3488	3436	3399	3373	3355	3342	3332	3326	3321	3318	3316	3315	0
14	3604	3684	3995	4122	4106	3994	3769	3622	3525	3460	3415	3384	3362	3347	3336	3328	3322	3318	3316	3314	3313	0
15	3568	3647	3942	4036	3974	3877	3680	3559	3480	3428	3393	3368	3351	3338	3330	3323	3319	3316	3314	3312	3312	0
16	3529	3616	3894	3940	3743	3708	3568	3484	3430	3394	3369	3351	3339	3330	3323	3319	3315	3313	3312	3311	3310	0
17	1329	2141	1327	2755	3294	3488	3441	3405	3378	3359	3345	3334	3327	3321	3317	3314	3312	3310	3309	3309	3308	0
18	0	0	1286	2374	3017	3314	3331	3333	3330	3326	3322	3318	3315	3313	3311	3310	3309	3308	3307	3307	3307	0
19	0	0	1254	2228	2869	3199	3249	3276	3290	3298	3302	3304	3305	3305	3306	3306	3306	3306	3306	3306	3305	0
20	0	0	1238	2166	2792	3129	3192	3233	3258	3274	3285	3291	3296	3299	3301	3302	3303	3303	3304	3304	3304	0
21	0	0	1232	2140	2753	3088	3156	3203	3235	3256	3271	3281	3288	3293	3296	3299	3300	3302	3302	3303	3303	0
22	0	0	1231	2130	2734	3065	3133	3183	3218	3243	3261	3273	3282	3288	3293	3296	3298	3300	3301	3302	3302	0
23	0	0	1234	2128	2726	3052	3120	3170	3206	3233	3253	3267	3277	3285	3290	3294	3297	3298	3300	3300	3301	0
24	0	0	1237	2129	2723	3046	3112	3162	3199	3227	3247	3262	3273	3282	3288	3292	3295	3297	3299	3300	3300	0
25	0	0	1241	2132	2723	3044	3108	3157	3194	3222	3243	3259	3271	3279	3286	3290	3294	3296	3298	3299	3299	0
26	0	0	1245	2136	2725	3044	3106	3154	3191	3219	3241	3257	3269	3278	3284	3289	3293	3295	3297	3298	3299	0
27	0	0	1248	2140	2727	3045	3106	3153	3190	3218	3239	3255	3267	3276	3283	3288	3292	3295	3297	3298	3298	0
28	0	0	1251	2143	2730	3046	3106	3153	3189	3217	3238	3254	3266	3276	3282	3288	3292	3294	3296	3297	3298	0
29	0	0	1254	2146	2733	3048	3107	3153	3189	3216	3237	3253	3266	3275	3282	3287	3291	3294	3296	3297	3298	0
30	0	0	1256	2149	2735	3049	3108	3154	3189	3216	3237	3253	3265	3275	3282	3287	3291	3294	3296	3297	3297	0
31	0	0	1258	2152	2737	3051	3109	3154	3189	3216	3237	3253	3265	3274	3281	3287	3291	3293	3295	3297	3297	0
32	0	0	1260	2154	2739	3052	3110	3155	3190	3216	3237	3253	3265	3274	3281	3286	3290	3293	3295	3296	3297	0
33	0	0	1262	2156	2741	3054	3111	3156	3190	3217	3237	3253	3265	3274	3281	3286	3290	3293	3295	3296	3297	0
34	0	0	1263	2157	2743	3055	3112	3156	3191	3217	3237	3253	3265	3274	3281	3286	3290	3293	3295	3296	3297	0
35	0	0	1264	2159	2744	3056	3113	3157	3191	3217	3237	3253	3265	3274	3281	3286	3290	3293	3295	3296	3297	0
36	0	0	1265	2160	2745	3057	3114	3158	3191	3218	3238	3253	3265	3274	3281	3286	3290	3293	3295	3296	3297	0
37	0	0	1265	2161	2746	3057	3114	3158	3192	3218	3238	3253	3265	3274	3281	3286	3290	3293	3295	3296	3297	0
38	0	0	1266	2161	2746	3058	3114	3158	3192	3218	3238	3253	3265	3274	3281	3286	3290	3293	3295	3296	3297	0
39	0	0	1266	2162	2747	3058	3115	3158	3192	3218	3238	3253	3265	3274	3281	3286	3290	3293	3295	3296	3297	0
40	0	0	1266	2162	2747	3058	3115	3158	3192	3218	3238	3253	3265	3274	3281	3286	3290	3293	3295	3296	3297	0

SCENARIO TITLE: Default House:No P. Crack + 2 Act Vents @ 10ft & -20 Pa (CASE5)
FILE NAME: def5____
RUN DATE: 11.30/1992 @ 14:09

RAETRAD v3.1
RAdon Emanation and TRAnsport into Dwellings
developed by Rogers & Associates Engineering Corporation

==========: INPUT PARAMETERS :==========

HOUSE:

Dimensions	:	28.4	x 54.3 ft.	Equiv. ellipse radius	:	16	ft.	Outdoor Pressure	:	.00	Pa
Area	:	1542	sq. ft.	Aspect ratio	:	1.912		Indoor Rn Bnd.	:	2.00	pCi/L
Fill thickness	:	1	units (1.0ft.)	Circumference	:	153.4	ft.	Outdoor Rn Bnd.	:	.00	pCi/L
Footing depth	:	3	units (3.0ft.)	Indoor pressure	:	-2.4	Pa.	Radial Mesh Units	:	1.00	ft.

DOOR OPENINGS:

Crack or Penetration Type	Number of Penetrations	Loc. Frm Permtr ft	Local Pressure Pa	Local Rn Bndry pCi/L	Radial Width cm	Arc Length cm	Porosity	Perm. cm2	Diff. cm2/s
Remediation Penetration	2	6.000	-20.00	2.00	10.00	10.0	.600	1.00E-04	6.00E-02

FOUNDATION & SOILS:

Lyr No.	Thickness ft	Vrt. Div.	Ra226 pCi/g	Dens. g/cm3	Eman. frac.	Tot. Poros	Sat'n frac.	P.Diam cm	Diff.Rad cm2/s	Diff.Ver cm2/s	Perm.Rad cm2	Perm.Ver cm2	Kads cc/g	Material
FLR	.328	1	1.0	2.100	.100	.222	.769	.000290	6.29E-04	6.29E-04	1.23E-12	1.23E-12	.000098	Concl
1	1.000	1	.5	1.600	.200	.407	.213	.044200	2.71E-02	2.71E-02	2.18E-07	2.18E-07	.027786	Sand
2	4.000	4	8.0	1.600	.200	.407	.213	.044200	2.71E-02	2.71E-02	2.18E-07	2.18E-07	.027786	Sand
3	15.000	15	4.0	1.600	.200	.407	.213	.044200	2.71E-02	2.71E-02	2.18E-07	2.18E-07	.027786	Sand
FTG	1.000	3	1.0	2.100	.100	.222	.769	.000290	6.29E-04	6.29E-04	1.23E-12	1.23E-12	.000098	Concl

SCENARIO TITLE: Default House:No P. Crack + 2 Act Vents @ 10ft & -20 Pa (CASE5)
FILE NAME: def5____

RAETRAD v3
RAdon Emanation and TRAnsport into Dwellin
developed by Rogers & Associates Engineering Corporati

================================== ANALYSIS RESULTS ==================================

RADON ENTRY PROFILE:

-House Center-

Remediation penetration

Radial Positn ft	Air Entry Rate cfm	Eff. Radon Flux pCi/m2s	Radon Entry Rate pCi/s
1.00	1.87E-07	2.35E-01	1.31E-01
2.00	5.61E-07	2.35E-01	3.94E-01
3.00	[illegible].35E-07	[illegible].35E-01	6.56E-01
4.00	1.31E-06	2.35E-01	9.18E-01
5.00	1.68E-06	2.35E-01	1.18E+00
6.00	2.05E-06	2.34E-01	1.44E+00
7.00	2.43E-06	2.34E-01	1.70E+00
8.00	2.79E-06	2.33E-01	1.95E+00
9.00	3.16E-06	2.33E-01	2.21E+00
10.00	3.59E-06	2.30E-01	2.44E+00
11.00	3.91E-06	2.30E-01	2.70E+00
12.00	4.30E-06	2.29E-01	2.94E+00
13.00	4.68E-06	2.27E-01	3.17E+00
14.00	5.06E-06	2.25E-01	3.39E+00
15.00	5.44E-06	2.23E-01	3.60E+00
16.00	5.82E-06	2.20E-01	3.81E+00
17.00	1.89E-06	8.13E-02	1.50E+00
INDOOR TOTAL	4.98E-05	2.38E-01	3.41E+01
18.00	-5.94E-04	5.08E-01	9.93E+01
19.00	-5.20E-04	4.85E-01	1.00E+02
20.00	[illegible]	[illegible]-01	[illegible].02E+02
21.00	-3.77E-04	4.58E-01	1.05E+0[illegible]
22.00	-3.27E-04	4.52E-01	1.08E+02
23.00	-2.89E-04	4.48E-01	1.13E+02
24.00	-2.59E-04	4.46E-01	1.17E+02
25.00	-2.35E-04	4.45E-01	1.22E+02
26.00	-2.16E-04	4.44E-01	1.26E+02
27.00	-2.00E-04	4.43E-01	1.31E+02
28.00	-1.87E-04	4.43E-01	1.36E+02
29.00	-1.76E-04	4.43E-01	1.41E+02
30.00	-1.67E-04	4.43E-01	1.46E+02
31.00	-1.60E-04	4.42E-01	1.51E+02
32.00	-1.54E-04	4.42E-01	1.56E+02
33.00	-1.49E-04	4.42E-01	1.60E+02
34.00	-1.46E-04	4.42E-01	1.65E+02
35.00	-1.43E-04	4.42E-01	1.70E+02
36.00	-1.42E-04	4.42E-01	1.75E+02
37.00	-1.41E-04	4.42E-01	1.80E+02
38.00	-1.42E-04	4.42E-01	1.85E+02
39.00	-1.43E-04	4.42E-01	1.90E+02
40.00	-1.46E-04	4.42E-01	1.95E+02

INDOOR RADON : .703 pCi/L (assuming .5000 ach & 8.00 ft Height)

CPU Calc. Time: 48.00 seconds

000097

SCENARIO TITLE: Default House:No P. Crack + 2 Act Vents @ 10ft & -20 Pa (CASE5)
FILE NAME: def5____

RAETRAD v3.1
RAdon Emanation and TRAnsport into Dwellings
developed by Rogers & Associates Engineering Corporation

Suction Pressures, (- .0100 Pa) depth (ft.)----->

	.0	1.0	2.0	3.0	4.0	5.0	6.0	7.0	8.0	9.0	10.0	11.0	12.0	13.0	14.0	15.0	16.0	17.0	18.0	19.0	20.0	.0
1	573	573	567	556	541	522	502	480	459	439	420	402	386	372	360	349	341	334	329	325	323	0
2	577	577	570	559	542	523	502	480	459	438	419	401	385	371	359	348	340	333	328	324	322	0
3	584	584	577	564	546	525	503	480	458	437	417	399	383	369	356	346	337	331	325	322	320	0
4	596	596	587	572	552	528	504	480	456	434	414	396	380	365	353	343	334	327	322	319	317	0
5	613	613	603	583	559	532	505	478	454	431	410	391	375	361	349	338	330	323	318	315	313	0
6	639	639	623	598	567	535	505	476	449	426	404	386	369	355	343	333	324	318	313	310	308	0
7	675	675	651	615	576	538	503	471	443	419	397	378	362	348	336	326	318	312	307	304	302	0
8	731	731	687	634	582	537	498	464	435	410	388	369	353	339	328	318	310	304	300	297	295	0
9	823	823	731	648	583	531	488	453	423	398	377	358	343	330	319	309	302	296	292	289	288	0
10	1634	994	762	646	571	516	473	438	408	384	363	346	331	318	308	299	293	287	283	281	279	0
11	770	770	684	605	542	492	451	418	390	367	347	331	318	306	296	289	282	277	274	271	270	0
12	642	642	602	551	502	459	423	393	368	347	330	315	303	293	284	277	271	[illegible]	[illegible]	[illegible]	[illegible]	0
13	558	558	534	498	459	422	391	365	343	325	310	298	287	278	271	265	260	256	253	251	250	0
14	500	500	482	451	415	382	356	334	317	302	290	279	270	263	257	252	247	244	242	240	239	0
15	462	462	444	411	369	339	317	301	288	277	268	260	253	247	242	238	235	232	230	229	228	0
16	443	443	423	382	313	288	275	266	259	252	246	241	236	232	228	225	222	220	219	218	217	0
17	272	256	53	165	215	229	232	231	229	227	224	221	218	216	214	212	210	208	207	207	206	0
18	0	0	53	116	158	181	193	199	202	203	203	203	202	200	199	198	197	196	196	195	195	0
19	0	0	44	87	122	146	161	171	177	181	184	185	185	186	186	185	185	185	185	184	184	0
20	0	0	35	69	97	120	136	147	156	161	166	168	170	172	172	173	173	174	174	174	174	0
21	0	0	29	56	80	100	116	128	137	144	149	153	156	158	160	161	162	163	163	163	163	0
22	0	0	24	46	67	85	100	112	121	129	135	140	143	146	148	150	151	152	153	153	154	0
23	0	0	20	39	57	73	87	98	108	116	122	127	132	135	138	140	141	143	143	144	144	0
24	0	0	17	34	50	64	76	87	97	104	111	116	121	125	128	130	132	133	135	135	136	0
25	0	0	15	30	43	56	68	78	87	95	101	107	111	115	119	121	123	125	126	127	127	0
26	0	0	13	26	38	50	61	70	79	86	93	98	103	107	110	113	115	117	118	119	120	0
27	0	0	12	23	34	45	55	64	72	79	85	91	95	99	103	106	108	110	111	112	112	0
28	0	0	11	21	31	41	50	58	66	72	79	84	89	93	96	99	101	103	105	106	106	0
29	0	0	10	19	28	37	46	53	61	67	73	78	83	87	90	93	95	97	99	100	100	0
30	0	0	9	18	26	34	42	49	56	62	68	73	78	81	85	88	90	92	93	94	95	0
31	0	0	8	16	24	32	39	46	52	58	64	69	73	77	80	83	85	87	89	89	90	0
32	0	0	8	15	23	30	37	43	49	55	60	65	69	73	76	79	81	83	84	85	86	0
33	0	0	7	14	21	28	35	41	47	52	57	61	66	69	72	75	77	79	81	82	82	0
34	0	0	7	14	20	27	33	39	44	49	54	59	63	66	69	72	74	76	77	78	79	0
35	0	0	6	13	19	25	31	37	42	47	52	56	60	64	67	69	72	73	75	76	76	0
36	0	0	6	12	19	24	30	36	41	46	50	55	58	62	65	67	70	71	73	73	74	0
37	0	0	6	12	18	24	29	35	40	44	49	53	57	60	63	66	68	70	71	72	72	0
38	0	0	6	12	18	23	29	34	39	44	48	52	56	59	62	64	67	68	70	70	71	0
39	0	0	6	12	17	23	28	33	38	43	47	51	55	58	61	64	66	67	69	70	70	0
40	0	0	6	12	17	23	28	33	38	43	47	51	55	58	61	63	65	67	68	69	70	0

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SCENARIO TITLE: Default House:No P. Crack + 2 Act Vents @ 10ft & -20 Pa (CASES)
FILE NAME: def5____

RAETRAD v.
RAdon Emanation and TRAnsport into Dwelli:
developed by Rogers & Associates Engineering Corporat:

Soil Gas Radon Concentrations (1.00000 pCi/Liter) Depth (ft.) ------>

	.0	1.0	2.0	3.0	4.0	5.0	6.0	7.0	8.0	9.0	10.0	11.0	12.0	13.0	14.0	15.0	16.0	17.0	18.0	19.0	20.0	.0
1	3773	3858	4171	4293	4261	4101	3833	3654	3536	3459	3407	3374	3351	3336	3326	3319	3315	3312	3310	3309	3308	0
2	3773	3858	4169	4290	4255	4095	3827	3650	3533	3456	3406	3372	3350	3335	3325	3319	3314	3311	3309	3308	3308	0
3	3774	3859	4167	4283	4244	4083	3816	3641	3526	3451	3402	3369	3348	3334	3324	3318	3314	3311	3309	3308	3307	0
4	3775	3859	4163	4271	4227	4063	3799	3627	3516	3444	3396	3365	3345	3331	3323	3317	3313	3310	3308	3307	3307	0
5	3777	3862	4157	4255	4203	4037	3777	3610	3503	3434	3389	3360	3341	3329	3320	3315	3311	3309	3307	3307	3306	0
6	3781	3866	4149	4232	4170	4003	3748	3588	3486	3422	3380	3354	3336	3325	3318	3313	3310	3308	3306	3306	3305	0
7	3788	3874	4139	4200	4128	3961	3714	3562	3467	3408	3370	3346	3331	3321	3314	3310	3308	3306	3305	3305	3304	0
8	3800	3885	4122	4155	4074	3911	3675	3533	3446	3392	3358	3337	3324	3316	3311	3308	3306	3304	3304	3303	3303	0
9	3930	4030	4097	4087	4006	3855	3632	3500	3422	3374	3345	3328	3317	3311	3307	3305	3303	3303	3302	3302	3302	0
10	2951	3664	3926	3979	3927	3794	3585	3465	3395	3354	3331	3317	3309	3305	3302	3301	3301	3301	3301	3301	3301	0
11	3486	3565	3814	3886	3849	3731	3535	3427	3366	3333	3315	3305	3300	3298	3298	3298	3298	3299	3299	3299	3300	0
12	3382	3455	3715	3795	3766	3661	3479	3383	3333	3309	3297	3293	3291	3292	3293	3294	3296	3297	3297	3298	3298	0
13	3291	3361	3620	3695	3665	3574	3410	3332	3297	3283	3279	3279	3282	3285	3288	3291	3293	3295	3296	3297	3297	0
14	3213	3282	3527	3577	3527	3460	3326	3273	3256	3255	3259	3266	3272	3278	3283	3287	3290	3293	3294	3295	3296	0
15	3149	3215	3434	3434	3327	3310	3227	3209	3214	3226	3240	3252	3263	3272	3278	3284	3288	3291	3293	3294	3295	0
16	3095	3167	3356	3280	3023	3126	3119	3143	3172	3199	3221	3240	3254	3265	3274	3281	3285	3289	3291	3293	3294	0
17	1262	1977	842	1880	2589	2939	3020	3084	3135	3174	3205	3228	3246	3260	3270	3278	3283	3287	3290	3292	3293	0
18	0	0	792	1690	2407	2827	2951	3040	3106	3155	3191	3219	3240	3255	3267	3275	3282	3286	3289	3291	3292	0
19	0	0	848	1676	2353	2777	2913	3013	3086	3141	3181	3212	3234	3251	3264	3273	3280	3285	3288	3290	3291	0
20	0	0	908	1715	2358	2767	2899	3000	3076	3132	3175	3207	3231	3249	3262	3272	3279	3284	3288	3290	3291	0
21	0	0	959	1765	2386	2777	2901	2997	3072	3129	3172	3204	3228	3247	3260	3271	3278	3283	3287	3289	3291	0
22	0	0	1002	1813	2421	2797	2911	3002	3073	3128	3171	3203	3227	3246	3260	3270	3278	3283	3287	3289	3290	0
23	0	0	1037	1856	2456	2821	2926	3011	3078	3131	3172	3203	3227	3246	3259	3270	3277	3283	3287	3289	3290	0
24	0	0	1066	1893	2488	2844	2942	3021	3085	3135	3174	3205	3228	3246	3260	3270	3277	3283	3287	3289	3290	0
25	0	0	1091	1925	2517	2866	2958	3032	3092	3140	3177	3207	3229	3247	3260	3270	3277	3283	3287	3289	3290	0
26	0	0	1111	1952	2542	2886	2973	3043	3100	3145	3181	3209	3231	3248	3261	3270	3278	3283	3287	3289	3290	0
27	0	0	1128	1974	2564	2903	2986	3053	3107	3151	3185	3212	3233	3249	3262	3271	3278	3283	3287	3289	3290	0
28	0	0	1143	1994	2582	2919	2998	3063	3114	3156	3189	3214	3235	3250	3262	3272	3279	3284	3287	3289	3291	0
29	0	0	1155	2010	2598	2932	3009	3071	3121	3161	3192	3217	3236	3252	3263	3272	3279	3284	3287	3290	3291	0
30	0	0	1165	2024	2612	2943	3018	3079	3127	3165	3195	3219	3238	3253	3264	3273	3280	3284	3288	3290	3291	0
31	0	0	1174	2036	2623	2953	3026	3085	3132	3169	3198	3222	3240	3254	3265	3274	3280	3285	3288	3290	3291	0
32	0	0	1181	2046	2633	2961	3033	3091	3136	3172	3201	3224	3241	3255	3266	3274	3281	3285	3288	3290	3291	0
33	0	0	1187	2055	2641	2968	3039	3095	3140	3175	3203	3226	3243	3256	3267	3275	3281	3285	3289	3291	3291	0
34	0	0	1192	2062	2648	2974	3044	3099	3143	3178	3205	3227	3244	3257	3268	3275	3281	3286	3289	3291	3292	0
35	0	0	1197	2067	2654	2979	3048	3103	3146	3180	3207	3228	3245	3258	3268	3276	3282	3286	3289	3291	3292	0
36	0	0	1200	2072	2658	2983	3051	3105	3148	3182	3209	3229	3246	3259	3269	3276	3282	3286	3289	3291	3292	0
37	0	0	1203	2076	2662	2986	3054	3107	3150	3183	3210	3230	3247	3259	3269	3277	3282	3286	3289	3291	3292	0
38	0	0	1204	2078	2665	2988	3056	3109	3151	3184	3210	3231	3247	3260	3269	3277	3282	3287	3289	3291	3292	0
39	0	0	1206	2080	2666	2990	3057	3110	3152	3185	3211	3231	3247	3260	3269	3277	3282	3287	3289	3291	3292	0
40	0	0	1206	2081	2667	2990	3057	3110	3152	3185	3211	3232	3248	3260	3270	3277	3283	3287	3290	3291	3292	0

SCENARIO TITLE: Default House:Perm. Crack + 2 Act. Vents @ 10ft & -20 Pa (CASE6)
FILE NAME: def6____
RUN DATE: 12/30/1992 @ 14:06

RAETRAD v3.1
RAdon Emanation and TRAnsport into Dwellings
developed by Rogers & Associates Engineering Corporation

==========: INPUT PARAMETERS :==========

HOUSE:

Dimensions	:	28.4 x 54.3 ft.		Equiv. ellipse radius	:	16	ft.	Outdoor Pressure	:	.00 Pa
Area	:	1542 sq. ft.		Aspect ratio	:	1.912		Indoor Rn Bnd.	:	2.00 pCi/L
[illegible]	:	1 units (1.0ft.)		Circumference	:	153.4	ft.	Outdoor Rn Bnd.	:	.00 pCi/L
Footing depth	:	3 units (3.0ft.)		Indoor pressure	:	-2.4	Pa.	Radial Mesh Units	:	1.00 ft.

LOOR OPENINGS:

Type of Penetration Type	Number of Penetrations	Loc. From Permtr ft	Local Pressure Pa	Local Rn Bndry pCi/L	Radial Width cm	Arc Length cm	Porosity	Perm. cm2	Diff. cm2/s
Elliptical Crack		.000	-2.40	2.00	1.00	4681.8	.600	1.00E-04	6.00E-02
Remediation Penetration	2	6.000	-20.00	2.00	10.00	10.0	.600	1.00E-04	6.00E-02

FOUNDATION & SOILS:

Lyr No.	Thickness ft	Vrt. Div.	Ra226 pCi/g	Dens. g/cm3	Eman. frac.	Tot. Poros	Sat'n frac.	P.Diam cm	Diff.Rad cm2/s	Diff.Ver cm2/s	Perm.Rad cm2	Perm.Ver cm2	Kads cc/g	Material
FLR	.328	1	1.0	2.100	.100	.222	.769	.000290	6.29E-04	6.29E-04	1.23E-12	1.23E-12	.000098	Concl
1	1.000	1	.5	1.600	.200	.407	.213	.044200	2.71E-02	2.71E-02	2.18E-07	2.18E-07	.027786	Sand
2	4.000	4	8.0	1.600	.200	.407	.213	.044200	2.71E-02	2.71E-02	2.18E-07	2.18E-07	.027786	Sand
3	15.000	15	4.0	1.600	.200	.407	.213	.044200	2.71E-02	2.71E-02	2.18E-07	2.18E-07	.027786	Sand
FTG	3.000	3	1.0	2.100	.100	.222	.769	.000290	6.29E-04	6.29E-04	1.23E-12	1.23E-12	.000098	Concl

SCENARIO TITLE: Default House:Perm. Crack + 2 Act. Vents @ 10ft & -20 Pa (CASE6)
FILE NAME: def6___

RAETRAD
RAdon Emanation and TRAnsport into Dwell
developed by Rogers & Associates Engineering Corpora

==========================: ANALYSIS RESULTS :==========================

RADON ENTRY PROFILE:

	Radial Positn ft	Air Entry Rate cfm	Eff. Radon Flux pCi/m2s	Radon Entry Rate pCi/s
-House Center-	------	---------	--------	--------
| o	1.00	1.64E-07	2.35E-01	1.31E-01
| o	2.00	4.93E-07	2.35E-01	3.93E-01
| o	3.00	8.20E-07	2.35E-01	6.55E-01
| o	4.00	1.15E-06	2.35E-01	9.17E-01
| o	5.00	1.47E-06	2.34E-01	1.18E+00
| o	6.00	1.79E-06	2.34E-01	1.44E+00
| o	7.00	2.11E-06	2.34E-01	1.70E+00
| o	8.00	2.41E-06	2.33E-01	1.95E+00
| o	9.00	2.71E-06	2.32E-01	2.21E+00
| Remediation penetration	10.00	3.07E-06	2.30E-01	2.44E+00
| o	11.00	3.30E-06	2.30E-01	2.70E+00
| o	12.00	3.58E-06	2.29E-01	2.94E+00
| o	13.00	3.82E-06	2.27E-01	3.16E+00
| o	14.00	4.01E-06	2.25E-01	3.38E+00
| o	15.00	4.09E-06	2.22E-01	3.59E+00
| Elliptical crack	16.00	5.23E-02	5.91E+00	1.02E+02
|-----O=====	17.00	1.28E-06	8.00E-02	1.47E+00
Y	INDOOR TOTAL	5.24E-02	9.25E-01	1.32E+02
Y				
Y	18.00	-7.99E-03	4.84E-01	9.46E+01
Y	19.00	-6.88E-03	4.66E-01	9.62E+01
Y	20.00	-5.72E-03	4.53E-01	9.87E+01
Y	21.00	-4.79E-03	4.46E-01	1.02E+02
Y	22.00	-4.08E-03	4.43E-01	1.06E+02
Y	23.00	-3.54E-03	4.41E-01	1.11E+02
Y	24.00	-3.13E-03	4.40E-01	1.15E+02
Y	25.00	-2.81E-03	4.39E-01	1.20E+02
Y	26.00	-2.55E-03	4.39E-01	1.25E+02
Y	27.00	-2.34E-03	4.39E-01	1.30E+02
Y	28.00	-2.17E-03	4.39E-01	1.35E+02
Y	29.00	-2.04E-03	4.39E-01	1.40E+02
Y	30.00	-1.92E-03	4.39E-01	1.45E+02
Y	31.00	-1.83E-03	4.40E-01	1.50E+02
Y	32.00	-1.76E-03	4.40E-01	1.55E+02
Y	33.00	-1.70E-03	4.40E-01	1.60E+02
Y	34.00	-1.65E-03	4.40E-01	1.64E+02
Y	35.00	-1.62E-03	4.40E-01	1.69E+02
Y	36.00	-1.60E-03	4.40E-01	1.74E+02
Y	37.00	-1.60E-03	4.40E-01	1.79E+02
Y	38.00	-1.60E-03	4.40E-01	1.84E+02
Y	39.00	-1.62E-03	4.40E-01	1.89E+02
Y	40.00	-1.65E-03	4.40E-01	1.94E+02

INDOOR RADON : 2.731 pCi/L (assuming .5000 ach & 8.00 ft Height)

CPU Calc. Time: 47.00 seconds

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SCENARIO TITLE: Default House:Perm. Crack + 2 Act. Vents @ 10ft & -20 Pa (CASE6)
FILE NAME: def6____

RAETRAD v3.1
RAdon Emanation and TRAnsport into Dwellings
developed by Rogers & Associates Engineering Corporation

Suction Pressures. (- .0100 Pa) depth (ft.)----->

	.0	1.0	2.0	3.0	4.0	5.0	6.0	7.0	8.0	9.0	10.0	11.0	12.0	13.0	14.0	15.0	16.0	17.0	18.0	19.0	20.0	.0
1	556	556	551	540	524	506	486	465	444	424	405	388	372	358	346	336	328	321	316	312	311	0
2	560	560	554	542	526	507	486	465	444	423	404	387	371	357	345	335	326	320	315	311	310	0
3	567	567	560	547	530	509	487	464	443	422	402	385	369	355	343	333	324	318	313	309	308	0
4	579	579	571	555	535	512	488	464	441	419	399	382	366	352	340	330	321	315	310	306	305	0
5	597	597	586	566	542	515	488	462	438	416	395	377	361	347	335	325	317	310	306	302	301	0
6	622	622	606	581	550	519	488	460	434	410	390	371	355	341	330	320	312	305	301	297	296	0
7	658	658	634	598	559	521	486	455	428	404	382	364	348	334	323	313	305	299	295	292	290	0
8	714	714	670	616	565	520	481	448	419	395	373	355	339	326	315	306	298	292	288	285	283	0
9	806	806	713	630	565	513	471	437	408	383	362	344	329	316	306	297	290	284	280	277	276	0
10	1629	978	744	627	552	498	456	421	393	369	349	332	318	306	295	287	281	275	272	269	268	0
11	[illegible]	[illegible]	553	[illegible]	[illegible]	473	433	401	[illegible]	352	333	318	304	293	284	277	271	[illegible]	[illegible]	[illegible]	[illegible]	0
12	617	617	577	528	481	440	405	376	352	333	316	302	290	280	272	265	260	256	252	250	249	0
13	528	528	506	473	436	402	373	348	328	311	297	285	275	266	259	253	249	245	242	240	239	0
14	464	464	449	423	391	362	338	318	302	288	277	267	259	252	246	241	237	234	231	230	229	0
15	417	417	406	381	345	319	300	286	274	264	256	248	242	236	232	228	225	222	220	219	219	0
16	[illegible]	[illegible]	[illegible]	351	321	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	213	211	209	208	208	0
17	[illegible]	[illegible]	50	154	[illegible]	[illegible]	[illegible]	[illegible]	218	216	213	211	208	206	204	202	200	199	198	198	197	0
18	0	0	50	108	149	170	182	188	192	193	193	193	192	191	190	189	188	188	187	187	187	0
19	0	0	41	82	115	137	152	162	168	172	175	176	177	177	177	177	177	177	176	176	176	0
20	0	0	33	65	92	113	128	140	148	153	157	160	162	164	165	165	165	166	166	166	166	0
21	0	0	27	53	76	94	110	121	130	137	142	146	149	151	153	154	155	155	156	156	156	0
22	0	0	22	44	63	80	[illegible]	[illegible]	[illegible]	[illegible]	128	133	137	139	142	143	144	145	146	146	147	0
23	0	0	19	37	54	69	82	93	102	110	116	121	125	129	131	133	135	136	137	137	138	0
24	0	0	16	32	47	60	72	83	92	99	106	111	115	119	122	124	126	127	128	129	129	0
25	0	0	14	28	41	53	64	74	83	90	96	102	106	110	113	116	118	119	120	121	121	0
26	0	0	13	25	37	48	58	67	75	82	88	94	98	102	105	108	110	112	113	114	114	0
27	0	0	11	22	33	43	52	60	68	75	81	86	91	95	98	101	103	105	106	107	107	0
28	0	0	10	20	30	39	47	55	62	69	75	80	84	88	92	94	97	98	100	101	101	0
29	0	0	9	18	27	35	43	51	58	64	69	74	79	83	86	89	91	93	94	95	95	0
30	0	0	8	17	25	33	40	47	53	59	65	70	74	78	81	84	86	88	89	90	90	0
31	0	0	8	16	23	30	37	44	50	56	61	65	70	73	76	79	81	83	84	85	86	0
32	0	0	7	14	22	28	35	41	47	52	57	62	66	69	72	75	77	79	80	81	82	0
33	0	0	7	14	20	27	33	39	44	49	54	59	62	66	69	72	74	76	77	78	78	0
34	0	0	6	13	19	25	31	37	42	47	52	56	60	63	66	69	71	73	74	75	75	0
35	0	0	6	12	18	24	30	35	40	45	50	54	57	61	64	66	68	70	71	72	72	0
36	0	0	6	12	18	23	29	34	39	44	48	52	56	59	62	64	66	68	69	70	70	0
37	0	0	6	11	17	23	28	33	38	42	47	51	54	57	60	63	65	66	67	68	69	0
38	0	0	6	11	17	22	27	32	37	41	46	50	53	56	59	61	63	65	66	67	67	0
39	0	0	6	11	16	22	27	32	36	41	45	49	52	55	58	61	63	64	65	66	67	0
40	0	0	6	11	16	22	27	32	36	41	45	49	52	55	58	60	62	64	65	66	66	0

SCENARIO TITLE: Default House:Perm. Crack + 2 Act. Vents @ 10ft & -20 Pa (CASE6)
FILE NAME: def6____

RAETRAD v.
RAdon Emanation and TRAnsport into Dwelli:
developed by Rogers & Associates Engineering Corporat:

Soil Gas Radon Concentrations (1.00000 pCi/Liter) depth (ft.) ----->

	.0	1.0	2.0	3.0	4.0	5.0	6.0	7.0	8.0	9.0	10.0	11.0	12.0	13.0	14.0	15.0	16.0	17.0	18.0	19.0	20.0	.0
1	3775	3860	4173	4296	4264	4104	3836	3657	3539	3461	3409	3375	3352	3337	3327	3320	3315	3312	3310	3309	3308	0
2	3775	3860	4171	4293	4258	4098	3830	3653	3536	3458	3407	3374	3351	3336	3326	3319	3315	3312	3310	3309	3308	0
3	3775	3860	4169	4285	4247	4086	3819	3644	3529	3453	3404	3371	3349	3335	3325	3319	3314	3311	3309	3308	3308	0
4	3776	3861	4165	4274	4230	4067	3803	3631	3519	3446	3398	3367	3346	3333	3323	3317	3313	3311	3309	3308	3307	0
5	3778	3863	4159	4257	4206	4040	3780	3613	3506	3436	3391	3362	3342	3330	3321	3316	3312	3309	3308	3307	3307	0
6	3782	3867	4151	4234	4173	4006	3752	3591	3489	3424	3382	3355	3338	3326	3319	3314	3310	3308	3307	3306	3306	0
7	3790	3875	4140	4202	4130	3964	3718	3565	3470	3410	3372	3348	3332	3322	3315	3311	3309	3307	3306	3305	3305	0
8	3801	3886	4122	4155	4075	3914	3678	3536	3449	3395	3361	3339	3326	3317	3312	3309	3306	3305	3304	3304	3304	0
9	3944	4046	4096	4084	4005	3857	3635	3504	3425	3377	3348	3330	3319	3312	3308	3306	3304	3303	3303	3303	3303	0
10	2936	3635	3905	3968	3923	3796	3589	3470	3400	3358	3334	3320	3311	3306	3304	3302	3302	3301	3301	3301	3301	0
11	3436	3513	3778	3867	3844	3733	3540	3432	3371	3337	3318	3308	3303	3300	3299	3299	3299	3300	3300	3300	3300	0
12	3311	3383	3664	3770	3759	3664	3485	3390	3340	3314	3302	3296	3294	3294	3295	3296	3297	3297	3298	3299	3299	0
13	3195	3263	3554	3665	3658	3580	3419	3341	3304	3289	3283	3283	3285	3287	3290	3292	3294	3295	3297	3297	3298	0
14	3083	3148	3444	3544	3525	3471	3339	3285	3265	3262	3265	3270	3275	3281	3285	3289	3291	3294	3295	3296	3297	0
15	2962	3024	3332	3404	3336	3328	3244	3222	3224	3234	3246	3257	3266	3274	3280	3285	3289	3292	3294	3295	3295	0
16	2537	2874	3235	3260	3049	3151	3139	3158	3183	3207	3227	3244	3257	3268	3276	3282	3287	3290	3292	3294	3294	0
17	1200	1924	873	1942	2629	2968	3041	3100	3146	3183	3211	3233	3250	3262	3272	3279	3285	3288	3291	3293	3294	0
18	0	0	826	1737	2445	2855	2972	3056	3117	3163	3198	3224	3243	3258	3269	3277	3283	3287	3290	3292	3293	0
19	0	0	875	1714	2387	2803	2933	3028	3097	3149	3188	3216	3238	3254	3266	3275	3281	3286	3289	3291	3292	0
20	0	0	930	1746	2386	2790	2917	3013	3086	3140	3181	3211	3234	3251	3264	3273	3280	3285	3288	3291	3292	0
21	0	0	977	1790	2410	2797	2917	3010	3081	3136	3177	3208	3232	3249	3262	3272	3279	3284	3288	3290	3291	0
22	0	0	1017	1834	2442	2815	2925	3013	3082	3135	3176	3207	3230	3248	3261	3271	3279	3284	3288	3290	3291	0
23	0	0	1050	1874	2474	2836	2938	3021	3086	3137	3177	3207	3230	3248	3261	3271	3278	3284	3287	3290	3291	0
24	0	0	1078	1909	2504	2858	2953	3030	3092	3141	3179	3208	3231	3248	3261	3271	3278	3284	3287	3290	3291	0
25	0	0	1101	1938	2531	2878	2968	3040	3099	3145	3181	3210	3232	3249	3262	3271	3278	3284	3287	3290	3291	0
26	0	0	1120	1964	2554	2896	2981	3051	3106	3150	3185	3212	3233	3250	3262	3272	3279	3284	3287	3290	3291	0
27	0	0	1136	1985	2574	2913	2994	3060	3113	3155	3188	3215	3235	3251	3263	3272	3279	3284	3288	3290	3291	0
28	0	0	1150	2004	2592	2927	3006	3069	3119	3160	3192	3217	3237	3252	3264	3273	3279	3284	3288	3290	3291	0
29	0	0	1161	2019	2607	2940	3016	3077	3125	3164	3195	3219	3238	3253	3265	3273	3280	3285	3288	3290	3291	0
30	0	0	1171	2033	2620	2950	3024	3084	3131	3168	3198	3222	3240	3254	3265	3274	3280	3285	3288	3290	3291	0
31	0	0	1179	2044	2631	2960	3032	3090	3136	3172	3201	3224	3242	3256	3266	3275	3281	3285	3289	3291	3291	0
32	0	0	1186	2053	2640	2967	3038	3095	3140	3175	3204	3226	3243	3257	3267	3275	3281	3286	3289	3291	3292	0
33	0	0	1192	2061	2648	2974	3044	3099	3143	3178	3206	3227	3244	3258	3268	3276	3282	3286	3289	3291	3292	0
34	0	0	1197	2068	2654	2980	3049	3103	3146	3181	3208	3229	3245	3258	3268	3276	3282	3286	3289	3291	3292	0
35	0	0	1201	2073	2660	2984	3052	3106	3149	3183	3209	3230	3246	3259	3269	3277	3282	3286	3289	3291	3292	0
36	0	0	1204	2078	2664	2988	3055	3109	3151	3184	3211	3231	3247	3260	3269	3277	3283	3287	3290	3291	3292	0
37	0	0	1207	2081	2667	2991	3058	3111	3153	3186	3212	3232	3248	3260	3270	3277	3283	3287	3290	3292	3292	0
38	0	0	1208	2083	2670	2993	3060	3112	3154	3187	3212	3232	3248	3261	3270	3277	3283	3287	3290	3292	3292	0
39	0	0	1209	2085	2671	2994	3061	3113	3155	3187	3213	3233	3249	3261	3270	3278	3283	3287	3290	3292	3293	0
40	0	0	1210	2086	2672	2995	3061	3114	3155	3187	3213	3233	3249	3261	3270	3278	3283	3287	3290	3292	3293	0