

PACKAGE ID - 000436IBMPC02 SESOIL

KWIC TITLE - Code System Calculate One-Dimensional Vertical
Transport Unsaturated Soil Zone

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LIMITATION CODE -UNL **AUDIENCE CODE** - UNL

COMPLETION DATE - 07/01/1996 **PUBLICATION DATE** - 08/01/1994

DESCRIPTION - SESOIL, as an integrated screening-level soil compartment model, is designed to simultaneously model water transport, sediment transport, and pollutant fate. SESOIL is a one-dimensional vertical transport model for the unsaturated soil zone. Only one compound at a time can be considered. The model is based on mass balance and equilibrium partitioning of the chemical between different phases (dissolved, sorbed, vapor, and pure). The SESOIL model was designed to perform long-term simulations of chemical transport and transformations in the soil and uses theoretically derived equations to represent water transport, sediment transport on the land surface, pollutant transformation, and migration of the pollutant to the atmosphere and groundwater. Climatic data, compartment geometry, and soil and chemical property data are the major components used in the equations. SESOIL was developed as a screening-level model, utilizing less soil, chemical, and meteorological values as input than most other similar models. Output of SESOIL includes time-varying pollutant concentrations at various soil depths and pollutant loss from the unsaturated zone in terms of surface runoff, percolation to the groundwater, volatilization, and degradation. The February 1995 release corrects an error that caused the code to fail when average monthly air temperature was -10C and includes an improved iteration procedure for the mass balance equations in the model. PLEASE NOTE: The RISKPRO information management software (see OTHER PROG/OPER SYS INFO) was used by the developers of the New SESOIL User's Guide in their study and revisions of SESOIL. Using RISKPRO in conjunction with SESOIL is an option, and it may provide the easiest way to use SESOIL. The other option, use of SESOIL in stand-alone mode, has been tested and used. The stand-alone option is covered in 'Instructions for Running Stand-Alone SESOIL Code', and in 'A Seasonal Soil Compartment Model'.

PACKAGE CONTENTS - Media Directory; Software Abstract; Instructions for Running Stand-Alone SESOIL Code (Version October 1993, 3 pages); Software Requirements Record (3 pages); New SESOIL User's Guide; A Seasonal Soil Compartment Model (Draft); ORNL/TM-10672; Media Includes Source, Sample Problems Input and Output, Executable;

PACKAGE ID - 000436IBMPC02 SESOIL

PACKAGE CONTENTS - (CONT)

SOURCE CODE INCLUDED? - Yes

MEDIA QUANTITY - 1 3.5 Diskette

METHOD OF SOLUTION - The processes modeled by SESOIL are categorized into three cycles: hydrology, sediment, and pollutant transport. Each cycle is a separate sub-model within the SESOIL code. The hydrologic cycle is one-dimensional, considers vertical movement only, and focuses on the role of soil moisture in the soil compartment. The hydrologic cycle is an adaptation of the water balance dynamics theory of Eagleson (1978) and can be described as a dimensionless analytical representation of water balance in the soil column. An iteration technique is used to solve the mass balance equations in the hydrologic cycle. The sediment cycle is optional; it can be turned on or off by the user. If used, SESOIL employs the theoretical sediment yield model EROS (Foster et al., 1980), which considers the basic processes of soil detachment, transport, and deposition. The pollutant fate cycle focusses on the various chemical transport and transformation processes which may occur in the soil and uses calculated results from the hydrologic and sediment washload cycles. The ultimate fate and distribution of the contaminant is controlled by the processes interrelated by a mass balance equation for each soil layer (compartment) that is specified by the user. An iteration procedure is used to solve each equation. The soil compartment is a cell extending from the surface through the unsaturated zone to the upper level of the saturated soil zone, also referred to as the aquifer or groundwater table.

COMPUTER - IBM PC

OPERATING SYSTEMS - MS-DOS

PROGRAMMING LANGUAGES - FORTRAN 77

SOFTWARE LIMITATIONS - As many years as desired can be specified for computation using the model. Available storage for the output file is the only limitation in this regard. Care should be taken when applying SESOIL to sites with large vertical variation in soil properties since the hydrologic cycle assumes a homogenous soil profile.

SOURCE CODE AVAILABLE (Y/N) - Y

OTHER PROG/OPER SYS INFO - The RM Fortran compiler, Version 3.10.01, was used to create the executables included in package. The RISKPRO software referenced in the New SESOIL User's Guide and in the Instructions for Running Stand-Alone Code is not provided. RISKPRO is a proprietary system developed, supported, and available from General Sciences Corporation, 6100 Chevy Chase Drive, Laurel, MD 20707, Tel: (301) 953-2700. Approximate price: \$800-\$1000.

PACKAGE ID - 000436IBMPC02 SESOIL

HARDWARE REQS - Requirements include an IBM PC or compatible with minimum available RAM of 355 K and minimum available disk space of 1.25 MB for the code and generated output from the sample case.

TIME REQUIREMENTS - As an example, a ten-year simulation that includes all four layers with three sublayers per layer requires approximately 5.5 minutes to run and about 250000 bytes of storage on an IBM compatible 486 pc (50 MHZ). The author's executable ran in 4 minutes 21 seconds on a Northgate 486/66 using the sample input data.

REFERENCES - D.M. Hetrick, Instructions for Running Stand-Alone SESOIL Code, October 1993; D.M. Hetrick, Software Requirements Record, January 21, 1994; D.M. Hetrick, S.J. Scott, and M.J. Barden, The New SESOIL User's Guide, PUBL-SW-200-93, (Revision 1.6), August 1994; D.M. Hetrick, C.C. Travis, S.K. Leonard, and R.S. Kinerson, Qualitative Validation of Pollutant Transport Components of an Unsaturated Soil Zone Model (SESOIL), ORNL/TM-10672, March 1989.

ABSTRACT STATUS - Abstract first distributed March 1991. IBM PC version submitted May 1989. New version submitted 11/07/95. Another new version submitted 7/1/96. Tested by RSIC using the sample input files on a Northgate 486/66 running MS-DOS 6.2 using RM FORTRAN V2.4 and the MS Linker.

SUBJECT CLASS CODE - R

KEYWORDS -

COMPUTER PROGRAM DOCUMENTATION
ACID RAIN
PESTICIDES
LONG-RANGE TRANSPORT
S CODES
SOILS
ENVIRONMENTAL TRANSPORT
WATER QUALITY
POLLUTANTS
WATERSHEDS
WASTE DISPOSAL
GROUND WATER
SEDIMENTS
LEACHING
ENVIRONMENTAL EFFECTS

EDB SUBJECT CATEGORIES -

990200 540220 540210

SPONSOR - EPA

PACKAGE TYPE - TESTED