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Fact Sheet: Computer Models Used to Support Cleanup Decision Making at Hazardous and Radioactive Waste Sites

Quick Reference Fact Sheet

BACKGROUND

Mathematical models that characterize the source, transport, fate, and effects of hazardous and radioactive materials are used to help determine cleanup priorities and select remedial options at sites contaminated with radioactive materials.

A joint Interagency Environmental Pathway Modeling Working Group has been established by the EPA Offices of Radiation and Indoor Air (ORIA) and Solid Waste and Emergency Response (OSWER), the DOE Office of Environmental Restoration and Waste Management (EM), and the Nuclear Regulatory Commission (NRC) Office of Nuclear Material Safety and Safeguards (NMSS). The purpose of the Working Group is to promote the appropriate and consistent use of mathematical environmental models in the remediation and restoration of sites contaminated by radioactive substances.

The Working Group has published reports intended to be used by technical staff responsible for identifying and implementing flow and transport models to support cleanup decisions at hazardous and radioactive waste sites. This fact sheet is one of a series of fact sheets that summarize the Working Group's reports.

REPORT

Purpose

The EPA, DOE, and NRC joint program sponsored a mail survey in 1990 and 1991 to identify radiologic and nonradiologic environmental transfer or pathway computer models that have been used or are being used to support cleanup of hazardous and radioactive waste sites. The intent of the survey was to gather basic administrative and technical information on the extent and type of modeling efforts being conducted by EPA, DOE, and NRC at hazardous and radioactive waste sites, and to identify a point of contact for further followup.

Contents of Report

The report includes an introduction, description of the survey and model classification scheme, survey results, conclusions, and references. The appendix contains descriptions and references for the models reported in the survey.

The raw data from the questionnaire are compiled in tables. Table 1 lists the names of the respondents, their organizations, addresses, phone numbers, and models used. Table 2 provides an alphabetical list of models, model types, and references. Table 3 includes the model, site type, contaminant, endpoint, level-of-effort, validation (yes/no), and publication information. Table 4 summarizes the organizations that sponsored development of the reported models. Table 5 provides an index of existing environmental pathway models.

Method

Questionnaires were widely distributed to approximately 550 persons within the three sponsoring agencies, national laboratories, universities, and consulting engineering firms.

The report presents a database of user model/information pertaining to each model, including:

- Site type
- Sponsoring agency
- Media/category
- Level of effort

- Validation/calibration
- End points
- Publications

Findings

Eighty-seven persons responded to the survey, representing a response rate of 16 percent. Individuals responded from 38 different companies, facilities, or agencies. The respondents were responsible primarily for DOE sites. More than 75 percent of the reported site types were DOE-related.

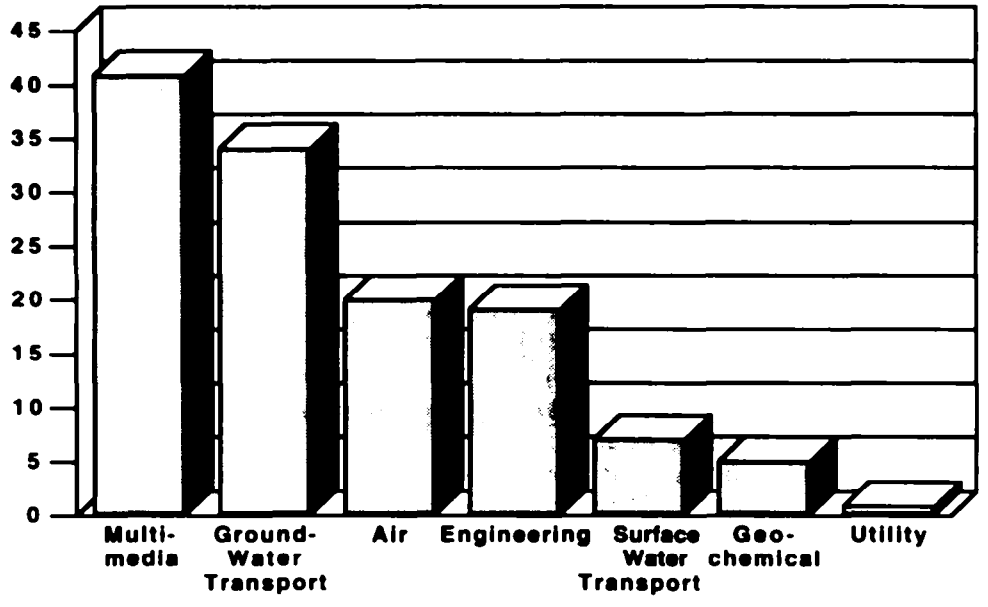
Respondents reported using 127 different computer models. Most were developed by or for the EPA, DOE, or NRC, but a substantial number (24 percent) were sponsored by other groups such as private corporations, universities, and other government agencies. The overwhelming majority of models are being used for the more general purpose of finding environmental concentrations of contaminants and radon dose commitments. Some other uses include risk assessment, water levels, flow rates, riprap sizing, and radon emanation.

The reported models were classified by the environmental media they simulate and by their major purpose (see table on page 3). Models related to multi-media environmental pathways constituted the largest category of models in use by respondents with 41 models reported. Multi-media models integrate several media (e.g., air, ground water, food chain, soil) into one simulation. Respondents reported using 34 different ground-water transport models, 20 air models (which sometimes included related soil deposition and agricultural uptake parameters), and 19 engineering models, which included performance assessment, accident, and radiation dose models. Seven surface water transport and five geochemical models also were reported. The geochemical models were often used to predict the relative abundance or concentration of various contaminant species, to determine whether a dissolved pollutant will precipitate during transport in surface or ground water, or to determine whether a solid pollutant might dissolve under certain aqueous conditions.

Based on a compilation of known environmental pathway models (extrapolated from the published literature and reviews) the models reported in the survey represent approximately 25 percent of known models used in environmental pathway analyses. Whether the models not identified in the survey are actually being used to support cleanup decisions could not be answered due to the relatively small number of respondents. The report recognizes the dynamic nature of model development and application.

Approximately 60 percent of the identified models in the survey were used at only one site. Only a few models appeared to be used across a large number of sites.

Major Types of Environmental Computer Models Reported in Use



Models in Use Identified in Survey

	Multimedia	Air	Surface Water	Ground Water	Geochemical	Eng./Perfor./Accid.	Screening	Detailed	Rad. Dose
3d Moong Cell									
AFTOX		•							
AIRDOS (-EPA, -PC)		•						•	
ARCL	•								•
BALANCE					•			•	
BARRIER						•		•	•
Bechtel Proprietary				•					
BIOTRAN		•							•
BRUNZOG						•			
CAP—88		•						•	
CASCADER	•								
CFEST				•				•	
CHARM		•							
COMPLY		•							•
CONDOS—II		•							•
CONSOL						•			
CREAMS			•	•					•
CYLSEC									•
DARTAB		•							•
DCM3D				•					
DECHEM	•								•
DECOM	•								•
DITTY	•								•
DOSES	•								•
DOSTOMAN	•								•
DPCT				•				•	•
EQ3/6					•				
FLASH/FLAME				•		•			
FLOWPATH				•					
FLOWTHROUGH									
FT WORK	•								
GCDT3DH	•								
GENII	•								•
GENMOD	•								•
GEOFLOW				•					
GW FLOW				•			•		
HARM—II		•							
HEC—1, —2			•					•	
HELP						•			
HRS—1	•						•		
HSPF			•						•
HYDROGEOCHEM					•			•	
IMPACTS (PART61) (-BRC)	•						•		•
INPUFF		•							
ISCST/SCLT		•							
ISOSHLD (—II)	•					•			•
LTSAMP		•							
MACCS						•			•
MAT123D				•					
MEPAS	•						•		•
MESOI		•							•
MILDOS (—AREA)	•								•
MINTEQ (—A1, —A2)			•		•			•	
ML CODE		•							•

	Multimedia	Air	Surface Water	Ground Water	Geochemical	Eng./Perfor./Accid.	Screening	Detailed	Rad. Dose
MOC				•				•	•
MOD3D				•				•	
MODFLOW				•				•	
MT3D				•				•	
NEFTRAN II				•				•	•
NEWBOX						•			
NUREG—0707	•								•
ODAST				•			•		
ODRECH6,7	•								
ONSITE/MAXI1	•					•			•
PAGAN	•					•			
PATH	•								•
PATHRAE EPA, HAZ, RAD	•								•
PATHRISK	•								
PC—SLOPE						•			
PHREEQE					•			•	
PLASM				•					
PORFLO—3				•					•
PORMC—3				•					•
PRESTO—II EPA, CPG, POP	•								•
RAECOM		•							•
RADRISK		•							•
RANDOM WALK				•					
RASCAL						•			•
RESRAD	•								•
RETC,F77				•					
RHRS—LC	•						•		•
RSAC—3		•				•			•
SBUHYD			•						
SCREEN		•							
SEFTRAN				•					
SFRIPE						•			
SIMS		•							
SOIL				•					
SOLUTE				•			•		
SOURCE 2									•
SPUR	•								
STABL, STABL5						•			
STABR						•			
STEPH						•			
STRIP 1B	•								
SUMO	•								
SWIFT (II, III)				•				•	•
TARGET									
TDRECH	•								
TEMPEST/FLESCOT			•						
THEM									
TOUGH				•				•	•
TRACR3D				•				•	•
UDAD	•								•
UNSAT-2 (-H)				•				•	
UTEXAS2						•			
UTM	•								•
VAM2D (-3D)				•				•	•

CONTACTS

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REPORTS

Computer Models Used to Support Cleanup Decision-Making at Hazardous and Radioactive Waste Sites, EPA 402-R-93-005, March 1993. Also available from the National Technical Information Center (NTIS), (703) 487-4650, PB93-183333/XAB.

Environmental Characteristics of EPA, NRC, and DOE Sites Contaminated with Radioactive Substances, EPA 402-R-93-011, March 1993. NTIS, PB93-185551/XAB.

Environmental Pathway Models — Ground-Water Modelling in Support of Remedial Decision-Making at Sites Contaminated with Radioactive Material, EPA 402-R-93-009, March 1993. NTIS, PB93-196657/XAB.

Technical Guide to Ground-Water Model Selection at Sites Contaminated with Radioactive Substances, EPA 402-R-94-012, September 1994. NTIS, PB94-205804/XAB.