OSWER Models Management Initiative

Phase II

Results of the Census of Model Users in Regional Hazardous Waste / Superfund Offices

December, 1990

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U.S. Environmental Protection Agency

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Appendices

1.0 Introduction

1.1 Purpose

This report presents the results of a nation-wide census of users of computerized environmental models. It provides an opportunity for those who responded to the Census to review the complete set of data collected from their counterparts in other EPA Regions and programs.

The Census was conducted as part of the Office of Solid Waste and Emergency Response's (OSWER) Models Management Initiative. It was a key element in the information collection strategy for Phase II of the initiative. The history of the Models Management Initiative and the objectives for Phases I and II are outlined below.

1.2 Background

OSWER is conducting the Models Management Initiative in response to management's concern about the ways in which models are used to support hazardous waste / Superfund decision-making and the levels of OSWER resources expended to support modeling and the collection of data for model inputs. The primary focus is on computerized models that predict environmental effects by performing computations and making estimates based on physical laws, probabilities, and statistics.

Phase I of the initiative began in early FY '89. The original emphasis was on describing various characteristics of the modeling environment, such as: key EPA organizations involved in model development, common model development procedures, types of computer hardware and software used for modeling, and available user support mechanisms. Phase I also included a collection of descriptive information on over 300 models of potential interest to OSWER programs.

The final product of Phase I was a report entitled "Promoting Appropriate Use of Models in Hazardous Waste / Superfund Programs." It included the following recommendations for improving future management of OSWER's computerized models: briefing OSWER Headquarters and Regional managers and ORD managers on the results of the study and clarifying roles and responsibilities for future efforts; conducting additional management studies; focusing on model usage in the EPA Regional offices and identifying the most widely used models; preparing guidelines for model development, calibration, verification, and peer review; developing a manual on alternative computing technologies for models; developing a selection and application guide for models; establishing user support networks and modeling support groups; and defining working relationships with ORD modeling centers.

In Phase II, OSWER began to focus on the needs identified in Phase I. In particular, emphasis was placed on assessing patterns of model usage in the EPA

Regional offices. The primary methods for collecting the required Phase II information were:

- distributing and collecting a modeling questionnaire (i.e., Census) from hazardous waste / Superfund staff in all Regional Offices and Headquarters
- interviewing hazardous waste / Superfund staff in three selected Regional Offices.

This report presents the results of the first method, the Census of model users. The Census results are also included in the final Phase II report, entitled "Report on the Usage of Computer Models in Hazardous Waste / Superfund Programs," along with other Phase II findings. Copies of the final Phase II report are being distributed to the Regional Waste Management Divisions and in OSWER and ORD at EPA Headquarters.

2.0 Census of Model Use

2.1. Census Objectives

One of the primary Phase II objectives was to report on RCRA and CERCLA model usage, based on a nationally representative set of information. There were two major challenges for achieving this objective. First, the chosen information collection method had to be relatively easy to administer and ensure an acceptable response rate, from a target audience of model users that is geographically disperse, has limited discretionary time for responding, and has widely varying levels of knowledge about modeling. Second, the information collected had to be sufficiently standardized to ensure that the key Phase II questions would be answered, and it would be possible to make comparisons across Regions and across programs.

The project team developed and distributed a Census of Model Usage designed to meet these challenges. The Census questionnaire was designed as a two-page, fill-in-the-blank form that could be completed in approximately fifteen minutes. The Census focused on the key Phase II questions:

- Who is using models?
- Which models are being used?
- What are models being used for?

Other supplementary questions/topics were also covered, such as:

- What is the profile of modeling experience for Regional Office staff?
- What is the quality and availability of documentation?
- Is modeling expertise available?
- Who is providing technical support?
- Are models being used appropriately?
- Is there a need for better management of models?
- Are models a valuable tool for supporting decision-making?

The Census was distributed nation-wide to staff in the RCRA and CERCLA programs. The target population for the RCRA program consisted of Permitting and Enforcement staffs in all ten Regions; the target population for the CERCLA program was Remedial Project Managers (RPMs), Enforcement RPMs, and On-Scene Coordinators (OSCs). In addition to Regional staff, Headquarters staff involved with RCRA and CERCLA modeling were also included in the distribution.

Specifically, staff in the following Headquarters branches received questionnaires:

- Information Management and Support Staff, OCEPP
- Toxics Integration Branch, OERR
- Site Policy and Guidance Branch, OERR
- Environmental Response Branch, OERR
- Technical Assessment Branch, OSW
- Permits Branch, OSW
- Special Wastes Branch, OSW
- Technical Assistance and Training Branch, OWPE.
- Technical Support Branch, OWPE

In this chapter, we present the findings from the Census. The first section provides highlights that answer the questions cited above. The remainder of this chapter follows the organization of the Census questionnaire itself (See Appendix A). For each topic, the highlights of the findings are followed by a more detailed discussion of the Census results, where appropriate.

2.2. Highlights of the Census Results

Who Responded to the Census?

- A total of 283 responses were received, with all ten EPA Regions responding to the Census.
- RCRA enforcement and permitting branches/sections from every Region are represented in the Census.
- Approximately forty-two percent of the Superfund RPMs and OSCs who were sent the Census questionnaire responded.
- Most respondents identified themselves as Environmental Engineers, Environmental Scientists, Geologists, and Chemical Engineers.
- A vast majority of the respondents identified themselves as having little or no expertise in modeling.
    - ❶ Most respondents (over 60 percent) have limited or no experience with modeling.
    - ❷ About a third of all Census respondents said that they had some academic or other coursework related to modeling, and/or have some hands-on experience with models.
    - ❸ Only 11 people (out of 283 respondents) identified themselves as modeling experts.

Who is Using Models?

- A majority of respondents (144) use modeling results to help them prepare recommendations or make decisions.
- A large percentage of respondents (64.3%) either review (181 respondents) or manage the review (62 respondents) of modeling applications developed by EPA or by PRPs.
- Almost a third of the people (76 in all) responding to this question have no involvement in models.
- Nearly a fifth of all respondents (54 in all) collect data for use in models and/or actually run the models themselves.
- There were no significant differences in modeling involvement between the RCRA and CERCLA programs.
- Over 50 percent of those who use modeling results (77 in all) classified themselves as having little or no experience with models.

Who is Providing Technical Support?

- Overall, respondents mentioned contractors as their most common source of technical support.
- Respondents from the RCRA Program rely on staff in their own division more frequently than they consult with their contractors.
- Respondents from the CERCLA Program rely on their own contractors more frequently than the technical staff in their own divisions.
- Respondents rely on EPA technical staff in their own or a related division more frequently than modeling experts in ORD's Regional Labs.

Are Models Being Used Appropriately?

- Census respondents are equally split on the issue of whether models are being used appropriately. Many comments were received from those who felt models were not being used appropriately. One Census respondent commented, "Models can be are useful when applied appropriately and when assumptions and errors are clearly identified. I have often seen models applied inappropriately." Another expressed concern that "models used in the NPL soil clean-up process are misused and unrealistic for field application".

Is There a Better Need for the Management of Models?

- Most respondents (153 in all) believe that there is a need for better management of models. Conversely, a relatively small number (10 in all) of respondents disagree or strongly disagree that there is such a need.

Are Models a Valuable Tool for Supporting Decision-Making?

- Most respondents (147 in all) believe that models are valuable tools for supporting decision-making; there was widespread agreement among respondents with the statement that, "Models are valuable tools for supporting decision-making".

Which RCRA and CERCLA Phases and Activities are Most Heavily Supported by Models?

- Models are used most heavily in support of six RCRA and CERCLA Phases in the following order:
  - Remedial Investigation/Feasibility Study
  - Remedial Design
  - Remedial Action
  - Permitting
  - "Other" Superfund Phases
  - "Other" RCRA Phases
- The most common modeling activity identified by Census respondents was the use of models for assessing groundwater transport and fate.

Which Models Are Being Used?

- Many different models are used to support many different RCRA and CERCLA phases and activities. In all, 115 distinct models were identified by Census respondents. The most frequently mentioned models were:
  - MODFLOW
  - HELP
  - RANDOM WALK
  - VHS
  - MINTEQ
  - ISC LT
  - PUFF
  - USGS 2D TRANSPORT
  - USGS 2D
  - DYNFLOW.

2.3. Detailed Results

This section describes the Census results in more detail. The information is organized according to the five questions/topics addressed by the Census Questionnaire (see Appendix A).

2.3.1. Question #1 -- Respondent Profile

A following profile of Census respondents was developed using information on respondents' organizational affiliation, address, program (RCRA vs. CERCLA), and job classification.[1] Table 2.3.1-1, Census Response By Region, presents the number of responses received from each Region and from EPA Headquarters.

Respondents were also asked to place themselves into one of the following three categories in terms of modeling education and/or experience:

- Modeling Expert. I have studied models extensively and/or have multiple years of hands-on experience with models.
- Knowledgeable Modeler. I have some academic or other coursework related to modeling, and/or have some hands-on experience with models.
- Novice/Inexperienced Modeler. I have completed little or no coursework on modeling and/or have had little or no hands-on experience with models.

Table 2.3.1-1 Census Response by Region

Region I:	20	Region VI:	30
Region II:	44	Region VII:	31
Region III:	25	Region VIII:	17
Region IV:	19	Region IX:	21
Region V:	44	Region X:	12
Headquarters:	20		
Total Responses:	283		

[1]These issues were addressed in Question 1 of the Census Questionnaire (see Appendix A).

Highlights for Question #1

- A total of 283 responses were received, with all ten EPA Regions responding to the Census.
- RCRA enforcement and permitting branches/sections from every Region are represented in the Census.
- Approximately forty-two percent of the Superfund RPMs and OSCs who were sent Census questionnaires responded.
- Most people responding to the Census identified themselves as Environmental Engineers, Environmental Scientists, Geologists, and Chemical Engineers.
- A vast majority of the people who responded to the Census identified themselves as having little or no expertise in modeling.
    - ❶ Most respondents (over 60 percent) have limited or no experience with modeling.
    - ❷ About a third of all Census respondents said that they had some academic or other coursework related to modeling, and/or have some hands-on experience with models.
    - ❸ Only 11 people (out of 283 respondents) identified themselves as modeling experts.

Discussion of Results for Question #1

Response By Region. More responses were received from Regions II and V than from any other Region. Regions III, VI, and VII also had relatively large numbers of people responding. Regions I, IV, VIII, IX, and Headquarters ranged from a low of only 12 people responding to a high of 21.

Response By Program (RCRA Vs. CERCLA). More responses were received from CERCLA personnel than from the RCRA program. Of the 283 total Census forms received, 202 came from the CERCLA program; 76 were received from RCRA. The remaining five respondents did not assign themselves to either program. A total of 484 Census forms were distributed to Superfund personnel across the country. This represents a 41.7% response rate for the CERCLA program (202 Census forms returned/484 Census forms sent). For the RCRA program, there were 49 Census packages mailed to 49 different section or branch chiefs across the Regions and at Headquarters. It was left to the discretion of these section and branch chiefs to distribute the Census forms to the appropriate persons in their sections and branches. The Census forms were returned by one or more staff members from RCRA enforcement and permitting branches/sections in every Region. Figure 2.3.1-1 provides a Region-by-Region and program-by-program comparison of responses.

Job Classifications. Census respondents were given an opportunity to include a job classification in their profile. Given the open ended nature of this question, a wide variety of responses were given. Table 2.3.1-2 presents the most popular responses.

Figure 2.3.1-1. Response to the Census (By Region and Program)

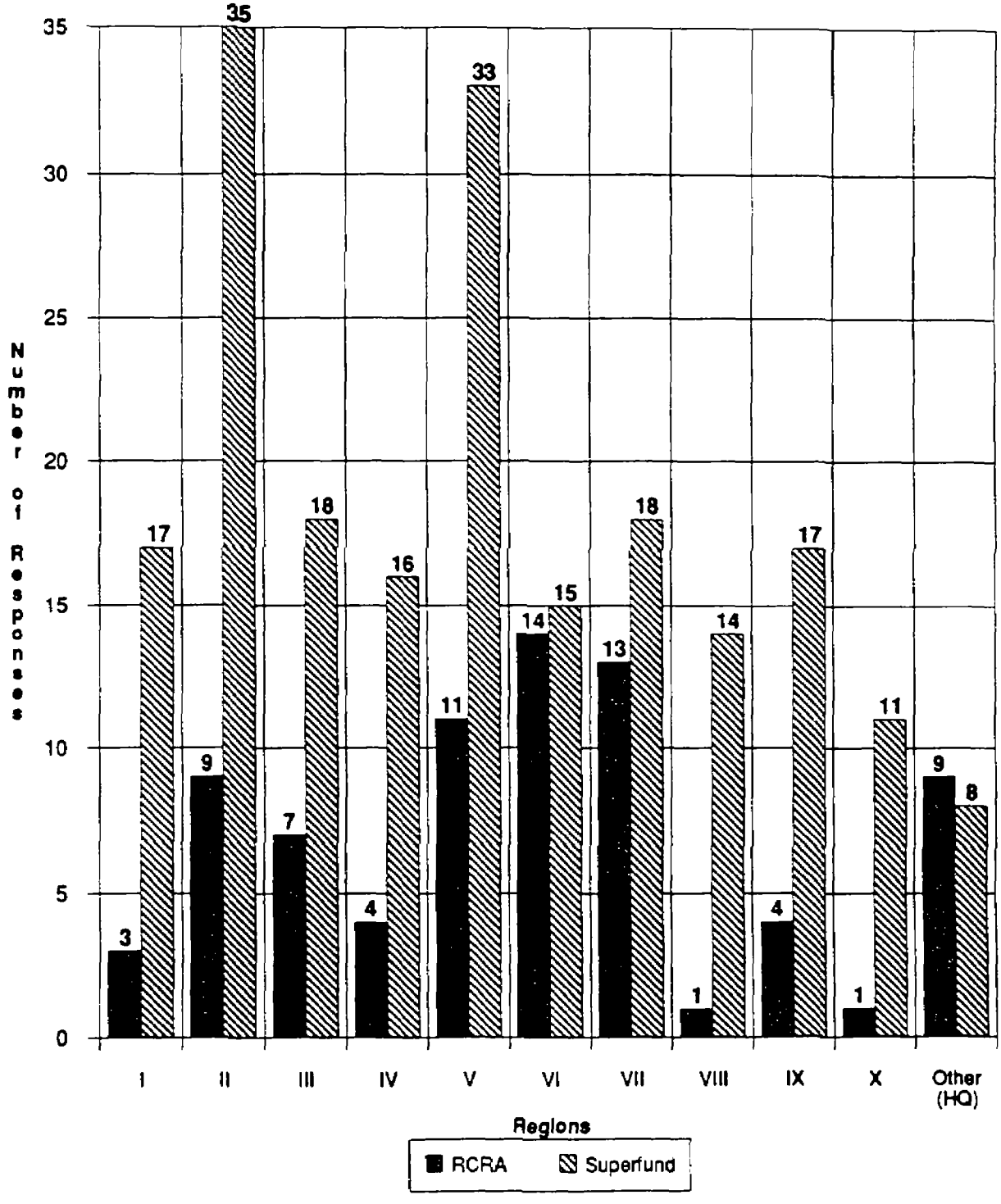


Table 2.3.1-2 Job Classifications

Job Classification	Number of Times Mentioned
■ Environmental Engineer	100
■ Environmental Scientist	51
■ Geologist	16
■ Chemical Engineer	15

Other job classifications mentioned were Environmental Protection Specialist (11), Remedial Program Manager (11), On-Scene Coordinator (11), Civil Engineer (6), Supervisory Environmental Scientist (5), Hydrologist (4), Hydrogeologist (4), Section Chief (3), and Geological Engineer (3).

Level of Modeling Education/Experience. Census respondents were asked to place themselves in a category based on their respective experiences with modeling.[2] These results are presented in Figure 2.3.1-2, Modeling Education & Experience, on the following page and highlighted below. Appendix B contains more detail by modeling involvement in each program - Figure B-3 Modeling Involvement for the RCRA Program (By Experience), and Figure B-4 Modeling Involvement for the CERCLA Program (By Experience) depict this information.

- **Modeling Experts.** A vast majority of the people who responded to the Census do not consider themselves to be experts in modeling. In fact, only 11 people across the country identified themselves as modeling experts. This is less than 4 percent of all Census respondents.[3]

- **Knowledgeable Modelers.** About a third of all Census respondents said that they had some academic or other coursework related to modeling, and/or have some hands-on experience with models.[4] A total of 86 respondents said they have had some modeling experience.

- **Novice/Inexperienced Modelers.** Most respondents (over 60 percent) have limited or no experience with modeling - a total of 165 people.[5]

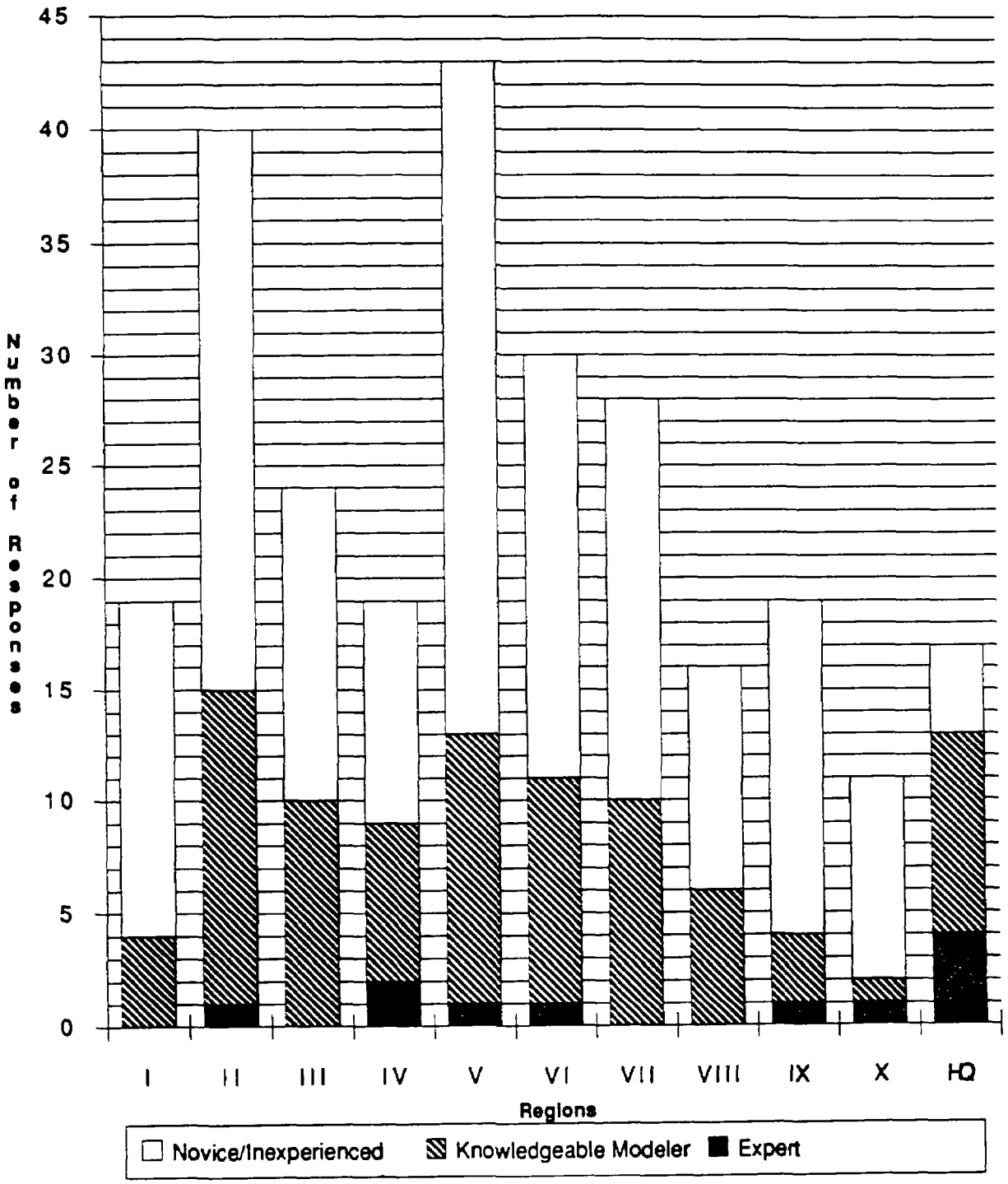
[2]These issues were presented in Question 1 of the Census. See Appendix A for details. Of the 283 census forms returned, only 257 persons had identified themselves with either the RCRA or Superfund programs and had classified themselves according to their modeling experience. 16 forms were received with one or both of these sets of information incomplete.

[3]11 out of 283 respondents identified themselves as being modeling experts. (11/283=3.89%).

[4]86 out of 283 respondents identified themselves as having experience with modeling. (86/283=30.39%).

[5]169 out of 283 respondents identified themselves as having limited or no experience with modeling. (169/283 = 59.72%).

Figure 2.3.1-2 Modeling Education/Experience



2.3.2. Question #2 -- Involvement With Modeling in RCRA/CERCLA Programs

Census respondents were asked to describe their involvement with modeling in the RCRA and CERCLA programs.[6] There were a total of 598 responses given for this question by 283 separate respondents. Specifically, they were asked to place themselves in any of the following categories[7]:

- a. I select models to be used for RCRA/CERCLA analyses.
- b. I run models.
- c. I review model applications by EPA technical staff, or EPA contractors/consultants.
- d. I review model applications by Superfund PRPs, RCRA facility owners, or their contractors/consultants.
- e. I manage the review of model applications.
- f. I use modeling results for preparing recommendations or making decisions.
- g. I collect data used to support model applications.
- h. I have no involvement with models in RCRA and Superfund.
- i. other.

On average, each respondent provided responses in about 2 of the 9 possible categories. Table 2.3.2-1, Responses to Modeling Involvement Questions, ranks the responses about modeling involvement from the most to least popular.

Table 2.3.2-1. Responses to Modeling Involvement Questions

Rank	Question	Responses	Percent of Respondents
1	f. I use modeling results.	144	50.88%
2	c. I review models used by EPA.	91	32.15%
3	d. I review models used by PRPs.	91	32.15%
4	h. I have no involvement.	76	26.85%
5	e. I manage model review.	62	21.91%
6	g. I collect data for models.	54	19.08%
7	b. I run models.	31	10.95%
8	i. other.	25	8.83%
9	a. I select models.	24	8.48%

[6]These issues are addressed in Question 2 on the Census Questionnaire. See Appendix A for details.

[7]Respondents could check as many categories as appropriate.

Highlights for Question #2

- A majority of respondents (144 in all) use modeling results to help them prepare recommendations or make decisions.
- A large percentage of respondents (64.3%) also review (181 respondents) or manage the review (62 respondents) of modeling applications developed by EPA or by PRPs.
- Almost a third of the people (76 in all) responding to this question have no involvement in models.
- Nearly a fifth of all respondents (54 in all) collect data for use in models and/or actually run the models themselves.
- There were no significant differences in modeling involvement between the RCRA and CERCLA programs.
- Over 50 percent of those who use modeling results (77 in all) classified themselves as having little or no experience with models.

Figure 2.3.2-1 presents a breakdown of the various response categories according to the respondents' level of modeling experience.

Discussion of Results for Question #2

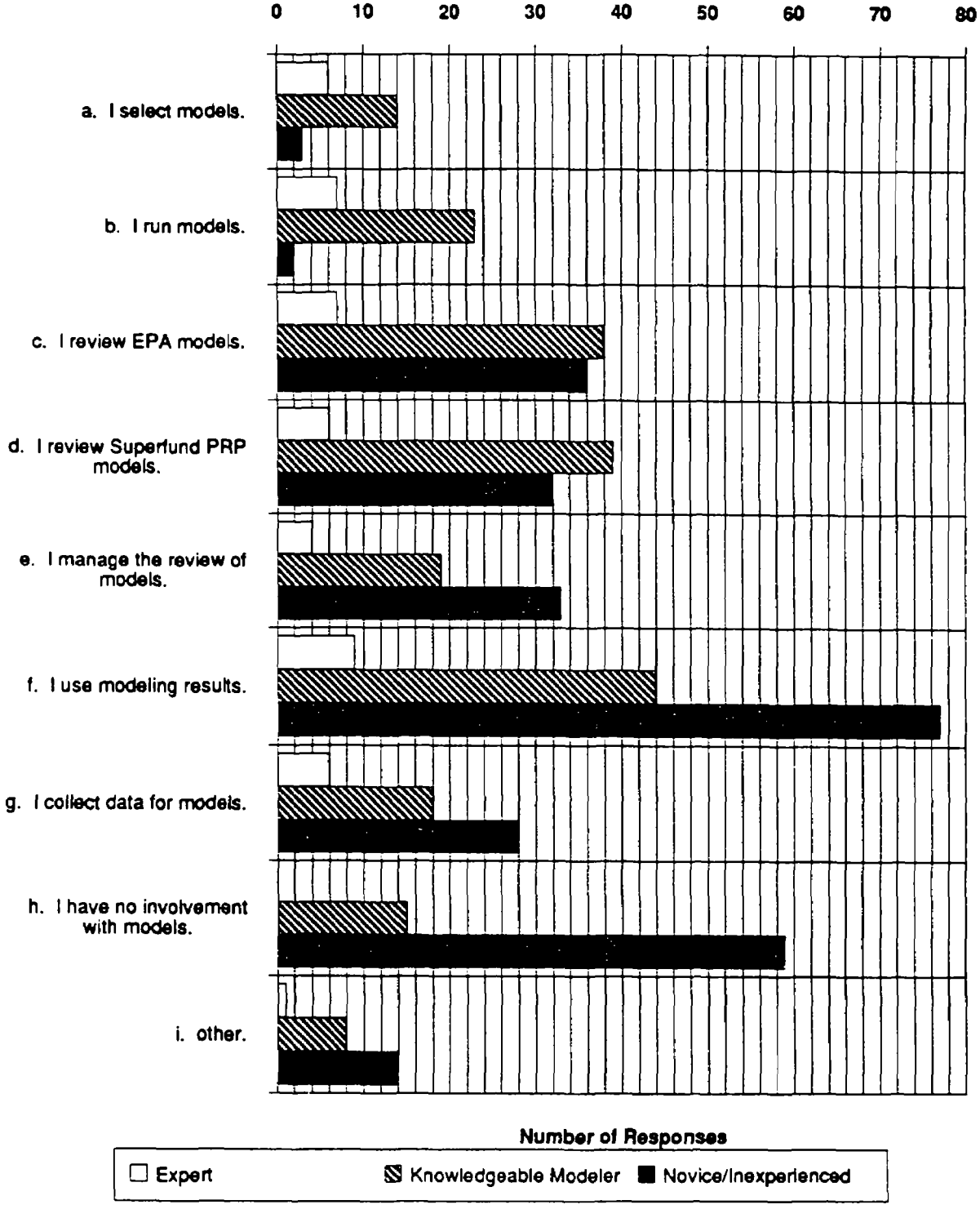
I Use Modeling Results. Of all of the statements considered by the Census respondents, this one received the largest response. Users of modeling results are equally distributed across all three levels of modeling experience. Seventy-seven inexperienced modelers said that they used modeling results.

I Review Model Applications by EPA Technical Staff. Almost half of the responses received from the census are from those who participate in the review of model applications in one way or another. Almost one-third of all respondents said that they review model applications by EPA technical staff or EPA contractors/consultants.[8] In total, 91 respondents said that they conduct this type of review. A few experts as well as some of the inexperienced modelers review these applications in the RCRA and CERCLA programs.

I Review Model Applications Used by Superfund PRPs/RCRA Facility Owners, Etc. Almost a third of the people responding to the Census said that they review model applications developed outside of EPA[9]. These may include models developed by Superfund PRPs, RCRA facility owners, and their contractors and/or consultants. In the RCRA program, people with all levels of experience appear to be reviewing these model applications. A large number of knowledgeable and novice modelers associated with the CERCLA program said that they review models developed by their technical staff or contractors. Twenty-eight of the 53 people who said that they conduct this review for the CERCLA program have little or no modeling experience.

[8]32.15% of all respondents said that they conduct reviews of model applications developed by EPA technical staff or EPA contractors and/or consultants. (91/283=32.15%).
[9]91/283=32.15%.

Figure 2.3.2-1 Modeling Involvement (By Experience)



I Manage the Review of Model Applications. Almost one-quarter of all persons responding (69 in all) said they they manage the review of models.[10]

I Select Models for Use in RCRA/Superfund Analyses. A little more than 8 percent of all respondents said that they select models to be used for RCRA/Superfund analyses.[11] Models are selected mostly by experts and knowledgeable modelers. There are, however, three people selecting models who identified themselves as having little or no modeling experience.

2.3.3. Question #3-- Sources of Technical Support for Modeling

Question 3 of the Census Questionnaire asked respondents to rank their sources of technical support.[12] For those that apply, they were asked to rank different sources of technical support in the order of frequency in which they are used. Table 2.3.3-1, Most Common Sources of Technical Support, and Figure 2.3.3-1, Sources of Technical Support (Totals), present the number of responses for the first most common, second most common, and third most common rankings. The first, second, and third rankings for each source of technical support is provided.

Table 2.3.3-1. Most Common Sources of Technical Support

Sources of Technical Support	most common (1)	next common (2)	next most common (3)	rank	totals	weighted totals[13]
a. your own Division	50	46	10	2	106	252
b. another Division in your Region/Office	21	26	23	3	70	138
c. EPA's ORD Labs	9	16	17	4	42	76
d. OSWER at EPA Headquarters	6	6	4	6	16	34
e. ORD at EPA Headquarters	3	6	1	7	10	22
f. contractors or consultants	69	37	15	1	121	296
g. other	11	7	9	5	27	56

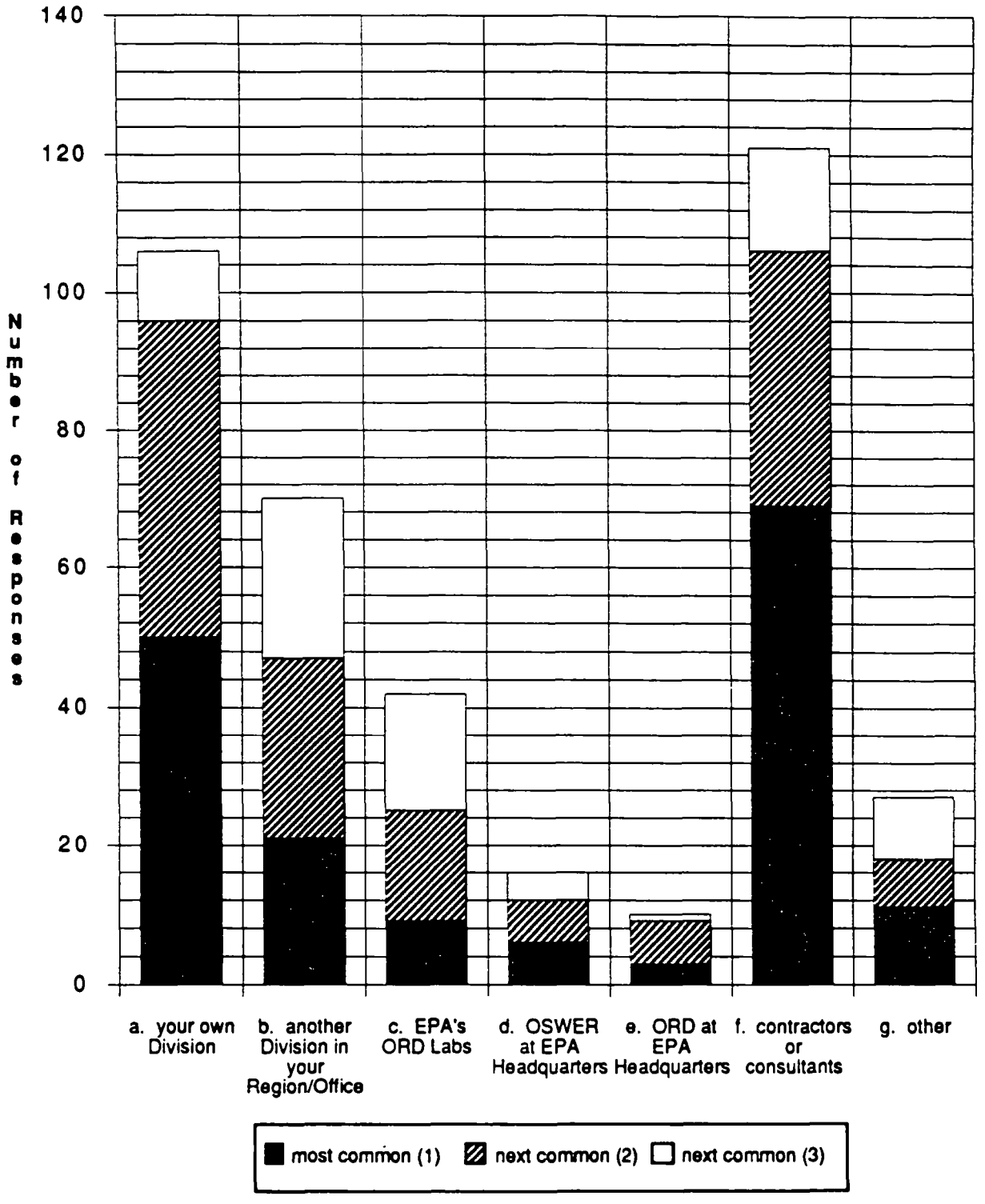
1062/283=21.91%.

[11]23/270=8.52%.

[12]The completeness of the responses to this question varied considerably. Many of the people who responded to this question did so correctly and completely - they ranked all of the sources of technical support that they use. Many others, however, used "X's" to mark their choices. The number of responses for each source of technical support varies.

[13]These weighted totals were calculated by assigning values to each ranking (either 1, 2 or 3), multiplying that ranking by the number of responses received, and then adding all values for each source of technical support. For example, for "a. your own division", the weighted total of 252 was calculated in the following way: (50 x 3) + (46 x 2) + (10 x 1) = 252.

Figure 2.3.3-1 Sources of Technical Support (Totals)



Highlights for Question #3

- Overall, respondents mentioned contractors as their most common source of technical support.
- Respondents from the RCRA Program rely on staff in their own division more frequently than they consult with their contractors.
- Respondents from the CERCLA Program rely on contractors more frequently than the technical staff in their own divisions.
- Respondents rely on EPA technical staff in their own or a related division more frequently than modeling experts in ORD's Regional Labs.
- Among the comments received concerning technical support were:
    - "I seek an appropriate EPA expert."
    - "I have never asked for technical support."
    - "I use other Federal agencies (e.g., NOAA)."
    - "I use my Environmental Response Team for technical support."
    - "I have no involvement in modeling therefore I have never used technical support."

2.3.4. Question #4 -- Opinions on Assorted Modeling Issues

Census respondents were asked to express their opinions on the following issues related to modeling:

- I am satisfied with the model documentation I have used.
- Model documentation is available to me.
- There are modeling experts in my Regional office.
- Technical expertise in modeling is readily available to me.
- In general, models are being used appropriately.
- There is a need for better management of models.
- Models are valuable tools for supporting decision-making.

For each of these statements, Census respondents were asked to strongly agree, agree, agree/disagree, disagree, strongly disagree, or have no opinion (don't know). The percentages presented in the discussions and charts to follow do not account for those respondents who who chose "don't know/no opinion". The responses to each of these statements are discussed below and presented in Table 2.3.4-1, Opinions on Modeling.

Figure B-7 Modeling Opinions (Totals) in Appendix B, presents the opinions provided by Census respondents on various issues relating to modeling.

Table 2.3.4-1 Opinions on Modeling

strongly agree	agree	agree/ disagree	disagree	strongly disagree	don't know/ no opinion	Totals Without "Don't knows"	Ave. Response Without "Don't knows"
1	2	3	4	5	6		
I am satisfied with the model documentation I have used.							
0	51	56	35	15	118	157	3.09
Model documentation is readily available to me.							
2	57	45	62	27	82	193	3.28
There are modeling experts in my Regional office.							
12	83	43	29	31	77	198	2.92
Technical expertise in modeling is readily available to me.							
13	82	55	46	25	54	221	2.95
In general, models are being used appropriately.							
0	38	63	39	25	110	165	3.31
There is a need for better management of models.							
57	96	30	9	1	82	193	1.97
Models are valuable tools for supporting decision-making.							
49	98	53	13	7	55	220	2.23

Highlights for Question #4

- Most respondents (153 in all) believe that there is a need for better management of models. Conversely, a relatively small number of respondents (10 in all) disagree or strongly disagree that there is such a need.
- Most respondents (147 in all) believe that models are valuable tools for supporting decision-making; there was widespread agreement among respondents with the statement that, "Models are valuable tools for supporting decision-making."
- Respondents were split on issues concerning:
  - Their satisfaction with modeling documentation,
  - The availability of modeling documentation,
  - The existence of Regional modeling experts,
  - The availability of technical expertise, and
  - Whether or not models were being used appropriately.

2.3.5. Question #5 -- Use of Models in RCRA and CERCLA Programs

Census respondents were asked to identify the models used in RCRA and CERCLA. Among those phases they could choose were:

CERCLA Phases

- Preliminary Assessment
- Site Inspection
- Remedial Investigation or Removal Site Evaluation and Feasibility Study
- Remedial Design or Removal Design
- Remedial Action or Removal Action
- Operation and Maintenance
- Closure and Post-Closure
- Enforcement
- Other

RCRA Phases

- Permitting
- Corrective Action Design
- Corrective Action
- Corrective Action Operation and Maintenance
- Enforcement
- Other

Census respondents were also asked to identify those activities where they used models. Among the activities they could choose from were:

- Estimating Groundwater Contamination Levels
- Setting Target Groundwater Clean-up Levels
- Assessing Groundwater Transport
- Assessing Migration in the Unsaturated Zone
- Assessing Surface Water Transport
- Assessing Volatilization Into Air
- Assessing Air Dispersion
- Designing Monitoring Networks (e.g., wells, caps)
- As a Substitute for Leaching Tests
- Design of Liners
- Design of Landfills
- Design of Incinerators
- Estimating Exposures (ecosystem)
- Estimating Exposures (human)
- Risk Assessment
- Other Applications

A total of 115 different models were identified by Census respondents. Table 2.3.5-1 lists those models most frequently mentioned. Appendix C contains a detailed listing of the models identified by each Region, for each program as well as listings of models mentioned by Region, program, and activity.

Table 2.3.5-1. Models Most Frequently Mentioned

Model Name	Number of Times Mentioned
MODFLOW	29
HELP	24
RANDOM WALK	21
VHS	17
MINTEQ	18
ISC LT	16
PUFF	13
USGS 2D TRANSPORT	12
USGS 2D	12
DYNFLOW	12

Another way to view the models mentioned is to identify those models that were mentioned to support various RCRA and Superfund phases and activities. Tables 2.3.5-2 and 2.3.5-3 present the models mentioned by phase and by activity.

Table 2.3.5-2. Models Mentioned By Phase

Phase	Number of Models Mentioned
RI/FS (Superfund)	67
Remedial/Removal Design (Superfund)	32
Other Phase (RCRA)	25
Permitting (RCRA)	21
Other Phase (Superfund)	17
Corrective Action (RCRA)	14
Remedial Action (Superfund)	14

Table 2.3.5-3. Models Mentioned By Activity

Activity	Number of Models Mentioned
Other Applications	48
Assessing Groundwater Transport	39
Estimating Groundwater Contamination Levels	30
Risk Assessment	21
Estimating Human Exposures	18
Assessing Migration	17
Assessing Air Dispersion	17

Highlights for Question #5

- Many different models are used to support various RCRA and CERCLA phases and activities mentioned above. In all, 115 distinct models were mentioned to support various RCRA and CERCLA phases and activities. The most frequently mentioned models are:
  - MODFLOW
  - HELP
  - RANDOM WALK
  - VHS
  - MINTEQ
  - ISC LT
  - PUFF
  - USGS 2D TRANSPORT
  - USGS 2D
  - DYNFLOW
- Models are used most heavily in support of the following six RCRA and CERCLA Phases:
  - Remedial Investigation/Feasibility Study
  - Remedial Design
  - Remedial Action
  - Permitting
  - "Other" Superfund Phases
  - "Other" RCRA Phases
- The most common modeling activity identified by Census respondents was the use of models for assessing groundwater transport and fate.

- There were many models mentioned only one time to support a specific phase, activity or in a single Region.

Discussion of Results for Question #5

Models Used By Phase. Many different models were mentioned by Census respondents in support of many different phases. Figure 2.3.5-1, Model Use (By Activity), shows the number of times models were mentioned to support activities in the various phases of the RCRA and CERCLA programs.

Model Use By Activity. Models were mentioned in association with the process of assessing of groundwater transport more times than any other single Superfund or RCRA activity. Figure 2.3.5-2, Model Use (By Activity) shows the number of times models were mentioned to support various activities in the RCRA and CERCLA programs. Other activities where model use was frequently mentioned were estimating groundwater contamination levels, assessing migration in the unsaturated zone, assessing air dispersion, and other. Among those other activities mentioned were:

- River Sediment Transport
- Leaking Underground Storage Tanks
- Budgeting, Planning and Projecting
- Evaluating Options
- Predicting the Size of Retention Area
- Estimating Groundwater Levels and Flow
- Designing Extraction Systems
- Assessing Potential Remediation
- Assessing Economic Impacts
- Conducting a Vertical Conduit Evaluation, and
- Writing a Waste Analysis Plan.

Figure 2.3.5-1 Model Use (By Phase)

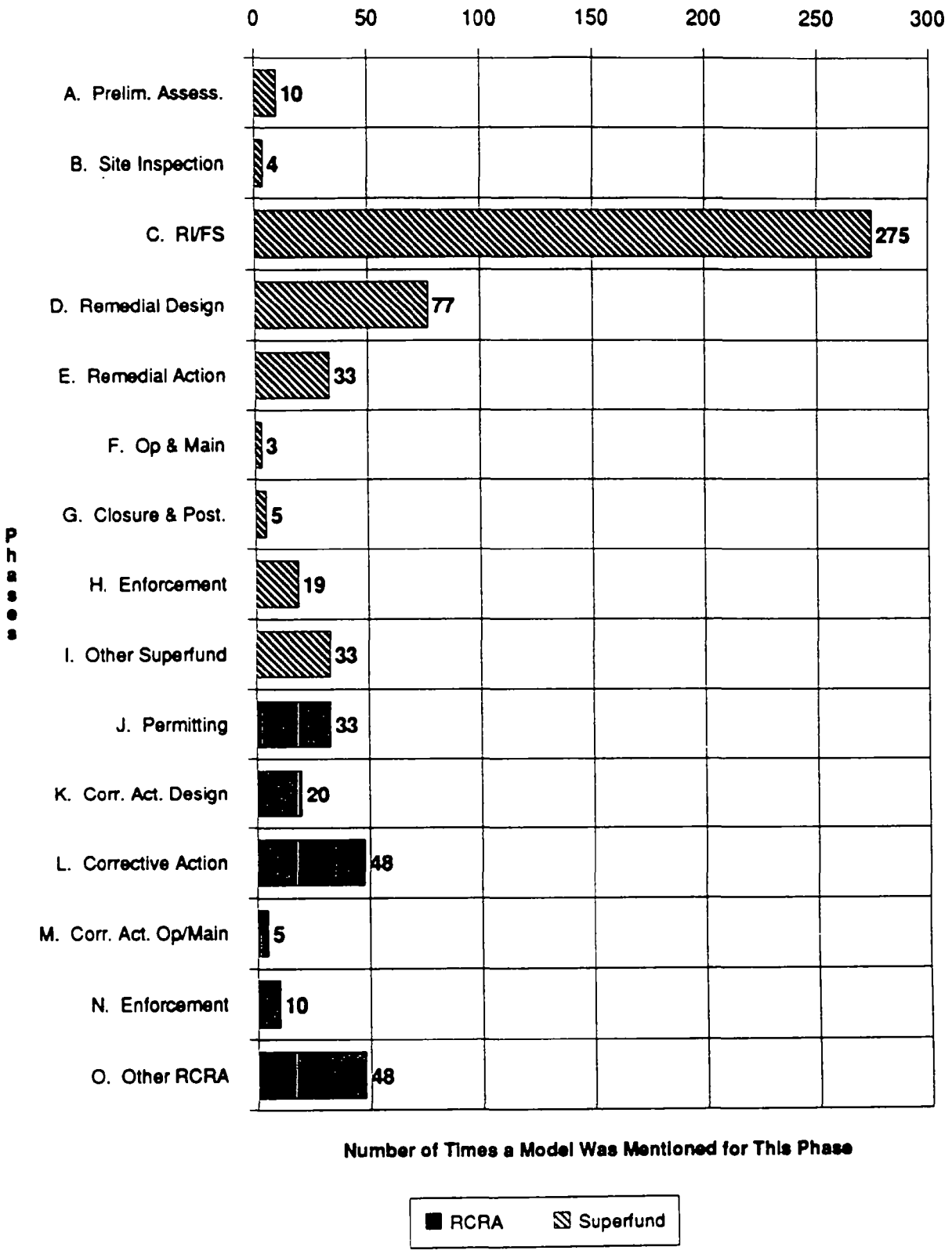
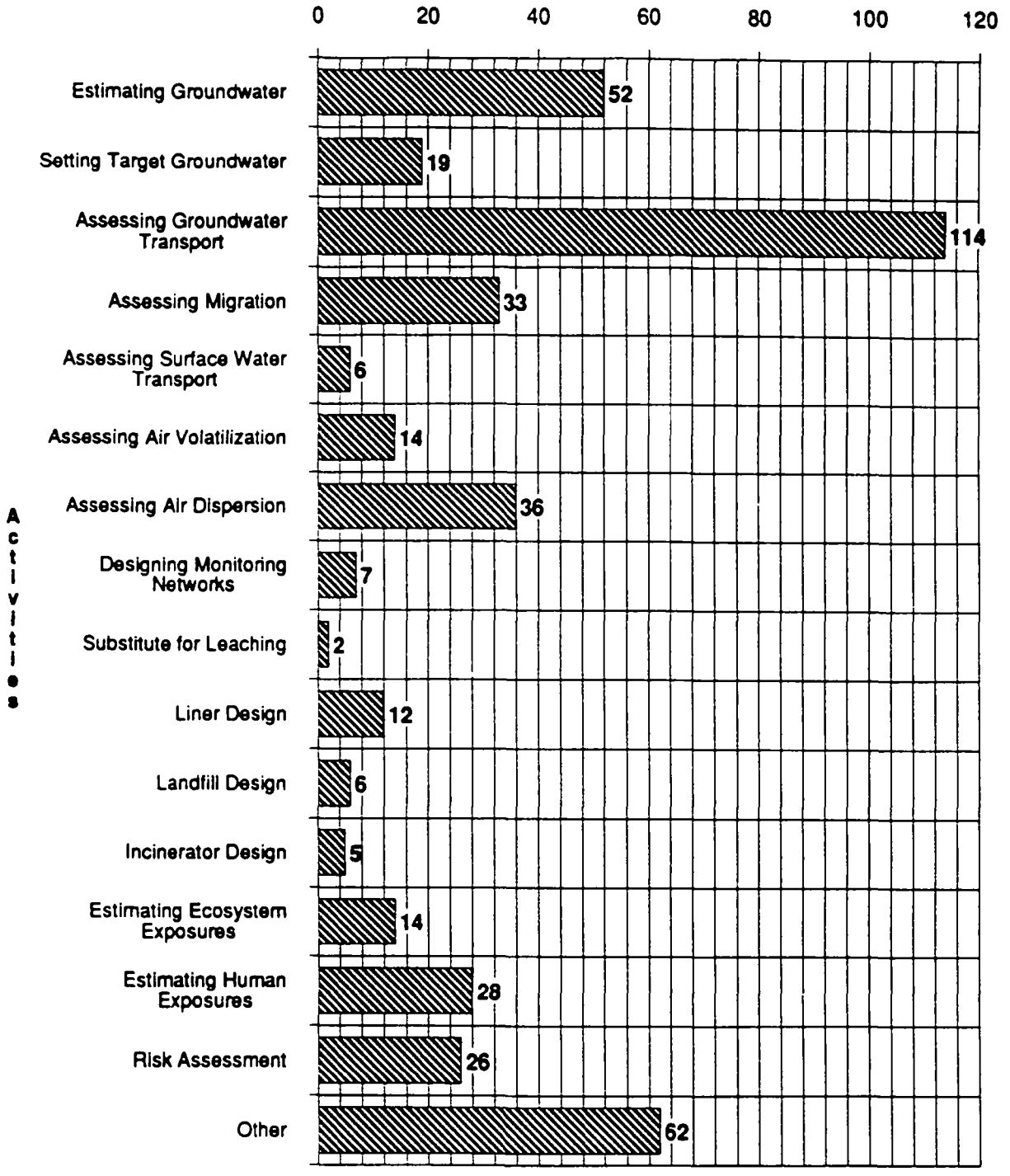


Figure 2.3.5-2 Model Use (By Activity)



Census Questionnaire

OSWER Models Management Initiative

Questionnaire Instruction Sheet

The enclosed questionnaire consists of five questions and an open comment area. In order to limit the scope of your responses, we ask that you: (1) consider only your modeling activities in the last four years; and (2) define models as "mathematical, computer-based models which help predict environmental effects." The questionnaire uses multiple choice and fill-in-the-blank questions, and should take less than 15 minutes to complete.

1. Fill out information about yourself. Data will be recorded and analyzed with respect to location, program, and job classification, not by an individual's name.

2. Describe your involvement with modeling in the RCRA and Superfund programs. Check as many options as apply to you.

3. Identify the organizations which provide modeling technical support. This question will give insight to who is currently providing the majority of technical support.

4. Evaluate seven statements regarding model documentation, Regional expertise, and model use.

5. Identify which models you have used or reviewed in the last four years. Name as many specific models as you can. Relate the models to the phase of your program, and the activity within the program.

Space is provided for additional comments on modeling. Topics relevant to the Models Management Initiative include the selection, application, validation, review, and support of computer models. Please include any comments or opinions you would like to express. If needed, attach additional pages to the questionnaire.

Return the questionnaire in the enclosed, pre-addressed envelope to Mary Lou Melley of the OSWER Information Management Staff, Mail Code OS-110, 401 M St., SW, Washington, DC, 20460; phone, 382-5760; EPA Email, M.MELLEY.

Please return the completed questionnaire in the enclosed envelope via EPA pouch mail by March 30, 1990.

1. Respondent Profile

Name: _____ **Mail Code:** _____ **Program:** ❑ **RCRA** ❑ **Superfund**

Region/Office: _____ **Division:** _____ **Branch:** _____

Job Classification: (e.g. Chem Eng.) _____

Please describe yourself in terms of modeling education/experience:

- ❑ a. Modeling expert (i.e extensive study, multiple years of hands-on experience)
- ❑ b. Knowledgeable modeler (i.e. some academic/other coursework, some hands-on experience)
- ❑ c. Novice/inexperienced modeler (i.e little or no coursework, little or no hands-on experience)

2. Which of the following best describe your involvement with modeling in the RCRA and Superfund programs? *(check all that apply)*

- ❑ a. I select models to be used for RCRA/Superfund analyses
- ❑ b. I run models
- ❑ c. I review model applications by EPA technical staff, or EPA contractors/consultants
- ❑ d. I review model applications by Superfund PRPs, RCRA facility owners, or their contractors/consultants
- ❑ e I manage the review of model applications
- ❑ f. I use modeling results for preparing recommendations or making decisions
- ❑ g. I collect data used to support model applications
- ❑ h I have no involvement with models in RCRA and Superfund
- ❑ i. other (please specify) _____

3. When you need assistance in using a model or reviewing a model application, who supplies technical support? *(for those that apply, rank from most common to least common -- i e , 1 = most common, 2 = next most common, etc.)*

- ___ a. your own Division
- ___ b another Division in your Region/Office
- ___ c. EPA's Office of Research and Development laboratories
- ___ d OSWER at EPA Headquarters
- ___ e. ORD at EPA Headquarters
- ___ f contractors/consultants
- ___ g other (please specify) _____

4 Please circle the number corresponding to your opinion on the following statements.

	strongly agree	agree	agree/ disagree	disagree	strongly disagree	don't know/ no opinion
a. I am satisfied with the model documentation I have used.	1	2	3	4	5	6
b. Model documentation is readily available to me	1	2	3	4	5	6
c. There are modeling experts in my Regional office.	1	2	3	4	5	6
d. Technical expertise in modeling is readily available to me.	1	2	3	4	5	6
e. In general, models are being used appropriately in the the RCRA and Superfund programs.	1	2	3	4	5	6
f. There is a need for better management of models.	1	2	3	4	5	6
g. Models are valuable tools for supporting decision-making in the RCRA and Superfund programs.	1	2	3	4	5	6

Other comments related to computer model use in the RCRA and Superfund programs:

Return to: Mary Lou Melley, Mail Code OS-110, OSWER IM Staff, 401 M St. SW, Washington, DC 20460

5. Consider your RCRA/Superfund experience in the last four years. In the first column of the table below, enter the codes for the Superfund or RCRA phases in which you have used or reviewed models. For each phase, enter the codes for the activities or applications which were supported by the model. For each activity, enter the model which was used. For models, use either the acronyms listed on the right or other acronyms as needed. Identify the names of as many models as possible, but include phases and activities even if you cannot recall the specific name of the model. If you need additional space, copy this page and continue.

Phase (use codes A-P)	**Activities, Applications** (use codes 1-16)	**Models** (use model acronymns)
Example: D	1	USGS2D
	6	ISCLT
☐	☐	______
	☐	______
	☐	______
	☐	______
	☐	______
☐	☐	______
	☐	______
	☐	______
	☐	______
	☐	______
☐	☐	______
	☐	______
	☐	______
	☐	______
	☐	______
☐	☐	______
	☐	______
	☐	______
	☐	______
	☐	______
☐	☐	______
	☐	______
	☐	______
	☐	______
	☐	______

PHASES
(codes for use in Question 5)

Superfund

A. Preliminary Assessment
B. Site Inspection (including use of models for site screening)
C. Remedial Investigation or Removal Site Evaluation and Feasibility Study
D. Remedial Design or Removal Design
E. Remedial Action or Removal Action
F. Operation and Maintenance
G. Closure and Post-Closure
H. Enforcement
I. Other Superfund Phase (please specify) ______

RCRA

J. Permitting
K. Corrective Action Design
L. Corrective Action
M. Corrective Action Operation and Maintenance
N. Enforcement
O Other RCRA Phase (please specify) ______

ACTIVITIES, APPLICATIONS
(codes for use in Question 5)

1. estimating groundwater contamination levels
2. setting target groundwater clean-up levels
3. assessing groundwater transport
4. assessing migration in the unsaturated zone
5. assessing surface water transport
6. assessing volatilization into air
7. assessing air dispersion
8. designing monitoring networks (e.g., wells, caps)
9. as a substitute for leaching tests
10 design of liners
11. design of landfills
12. design of incinerators
13. estimating exposures (ecosystem)
14 estimating exposures (human)
15. risk assessment
16. Other applications (please specify) ______

SELECTED MODEL ACRONYMS
(for use in Question 5)

Groundwater

AT123D
BIOPLUME
CAPTURE
EQ3/EQ6
MOC
MODFLOW
ONED1
PLASM
PLUME2D
PRESSURE BUILD UP
RANDOM WALK
RESSQ
RITZ
SESOIL
SLUG TEST
SOLUTE
SUTRA
SWIFT
USGS 2D,3D FLOW
USGS 2D TRANSPORT
VHS

Air

ALOHA
CHARM
FDM
ISC LT,ST
PROBLEM POCS
PUFF
SAFEMODS
SIMS
TEM8
TRACEII
VALLEY

Engineering

BALANCE
FLEX
GARDS
HELP
SOILINER

Other

EXAMS
HSPF
MINTEQ
PRZM
QUAL 2,2E,TX
SARAH
SWMM
WASP TOXIWASP
WATEQ

Detailed Census Results

Figure B-1. Census Response (By Region)

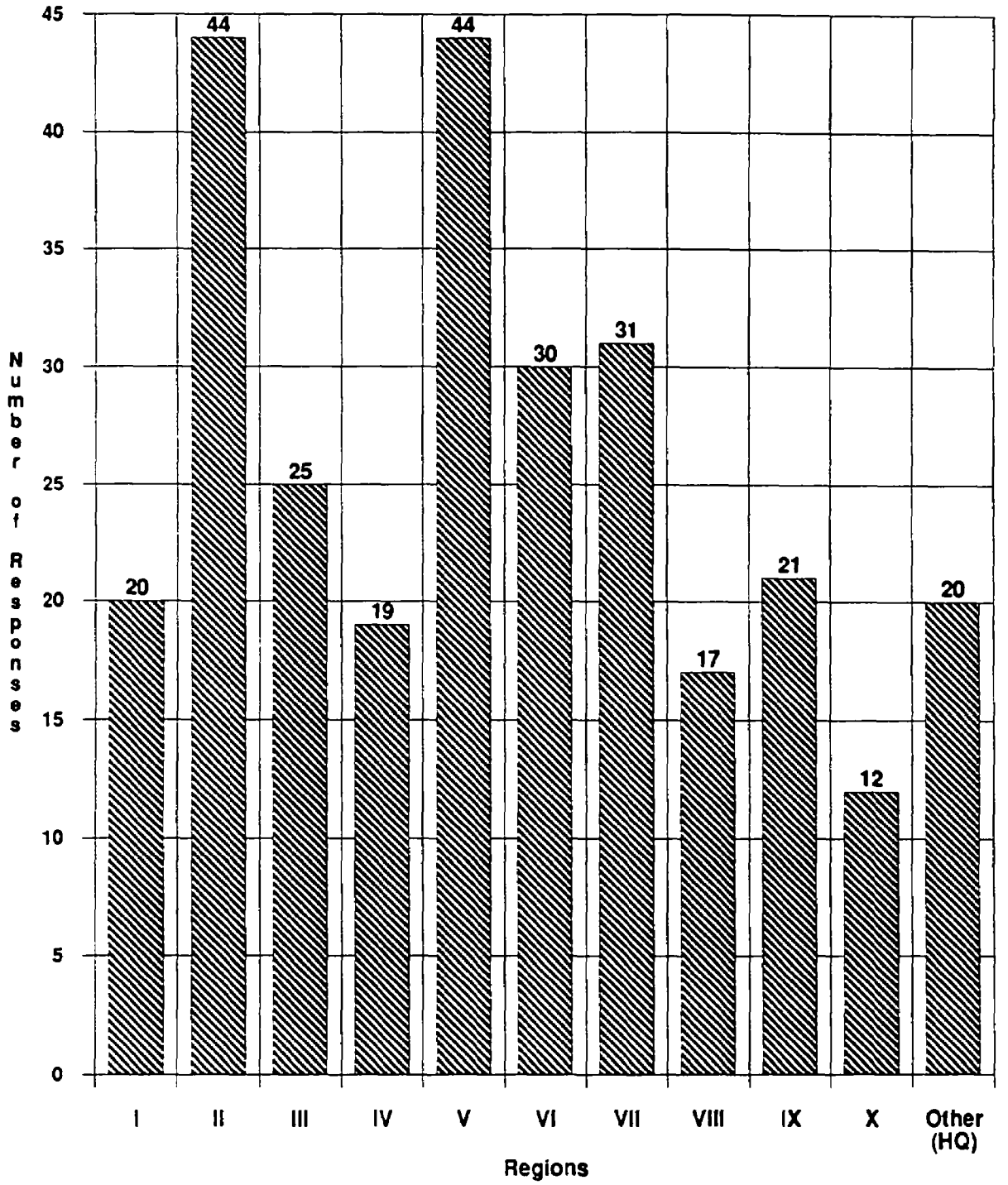


Figure B-2. Education & Experience (By Program in Percentages)

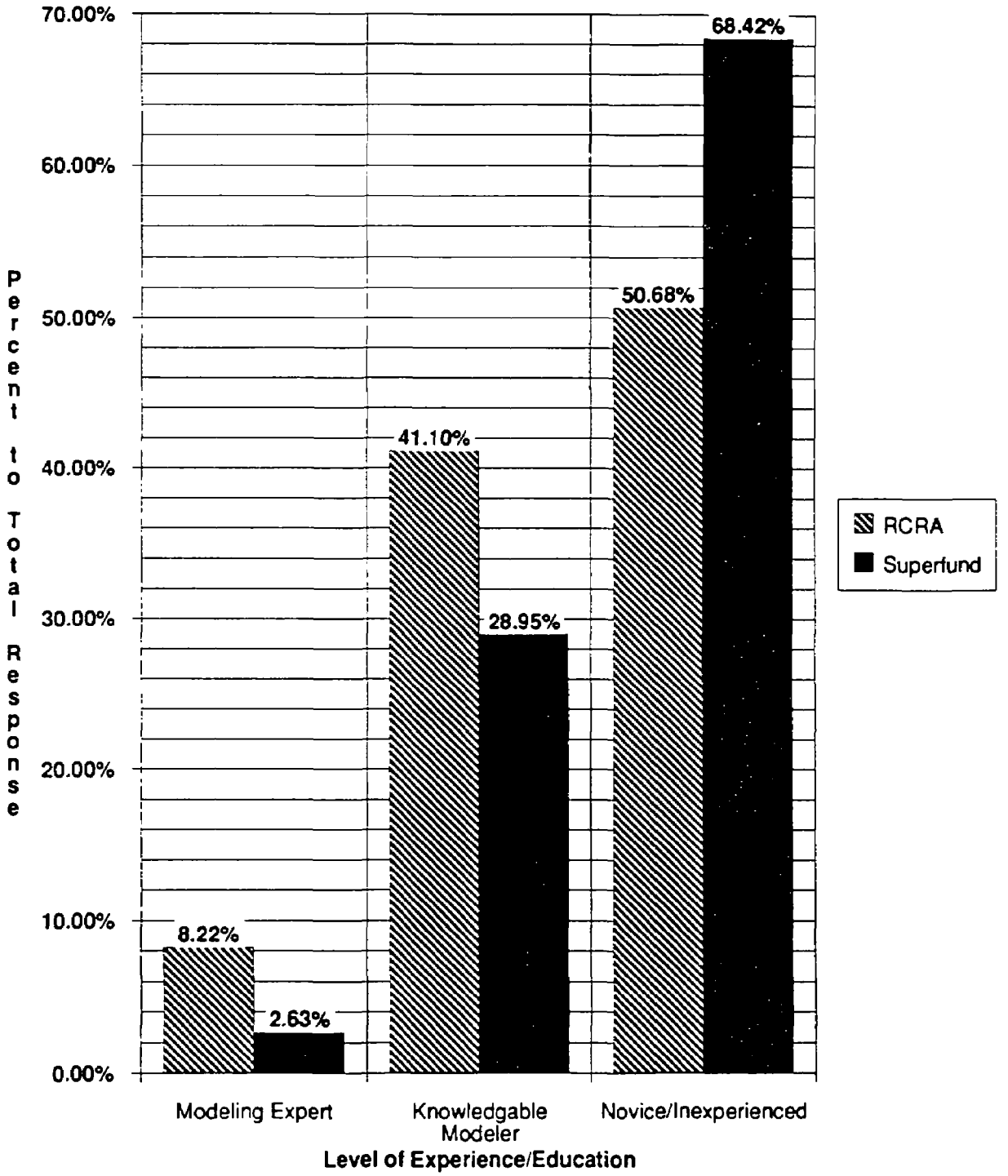


Figure B-3. Modeling Involvement for the RCRA Program (By Experience)

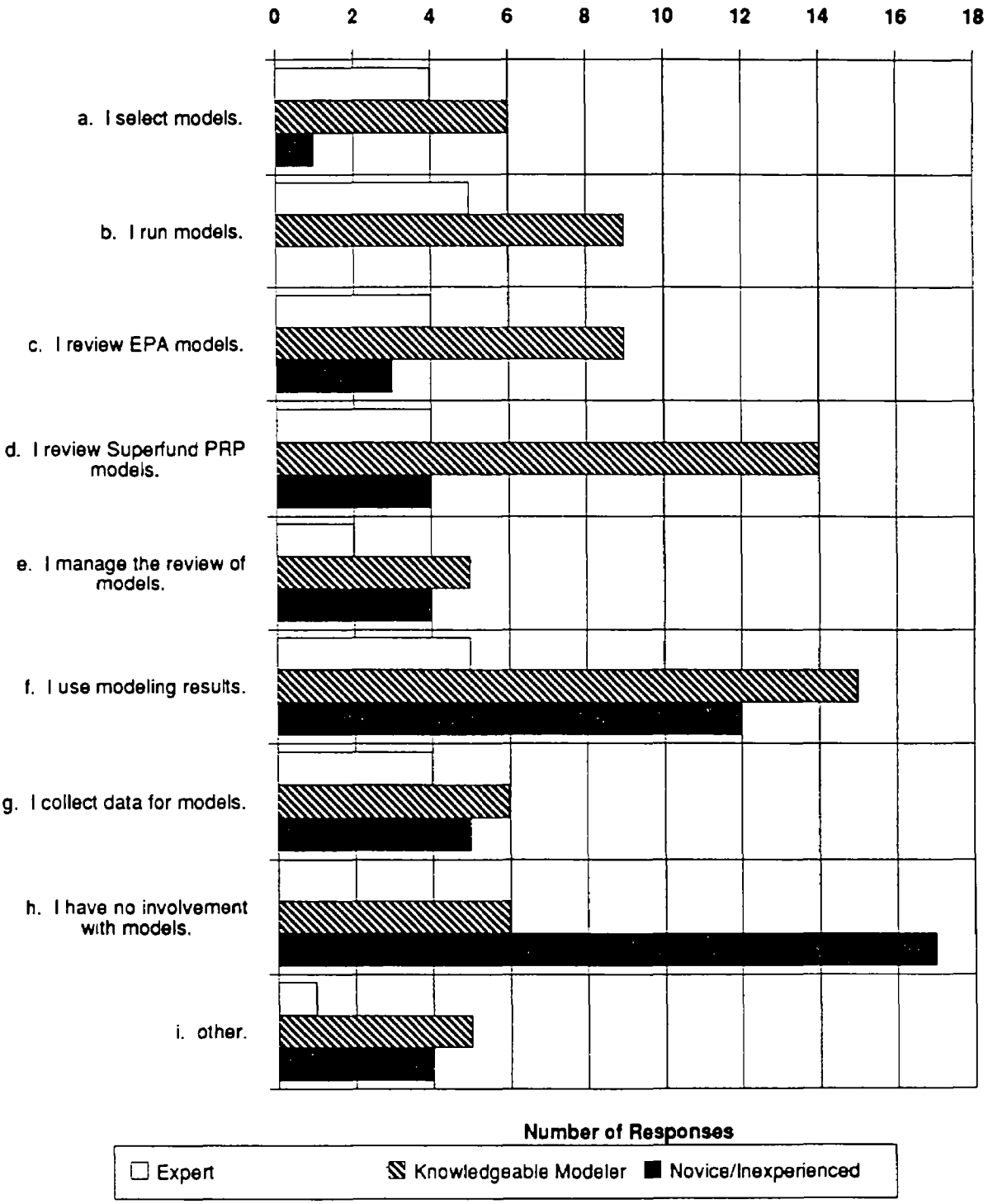


Figure B-4. Modeling Involvement for the CERCLA Program (By Experience)

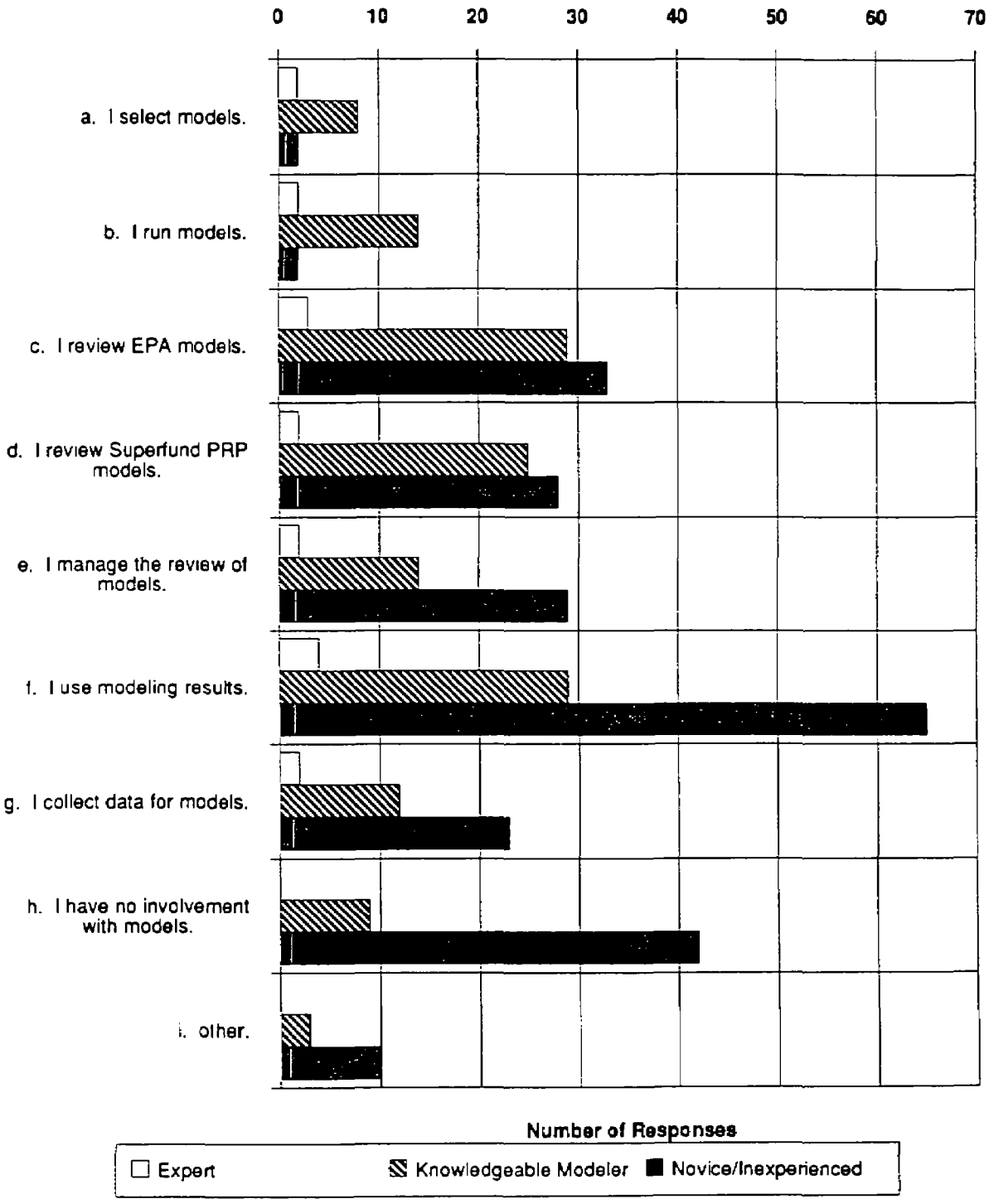


Figure B-5. Sources of Technical Support (RCRA Program)

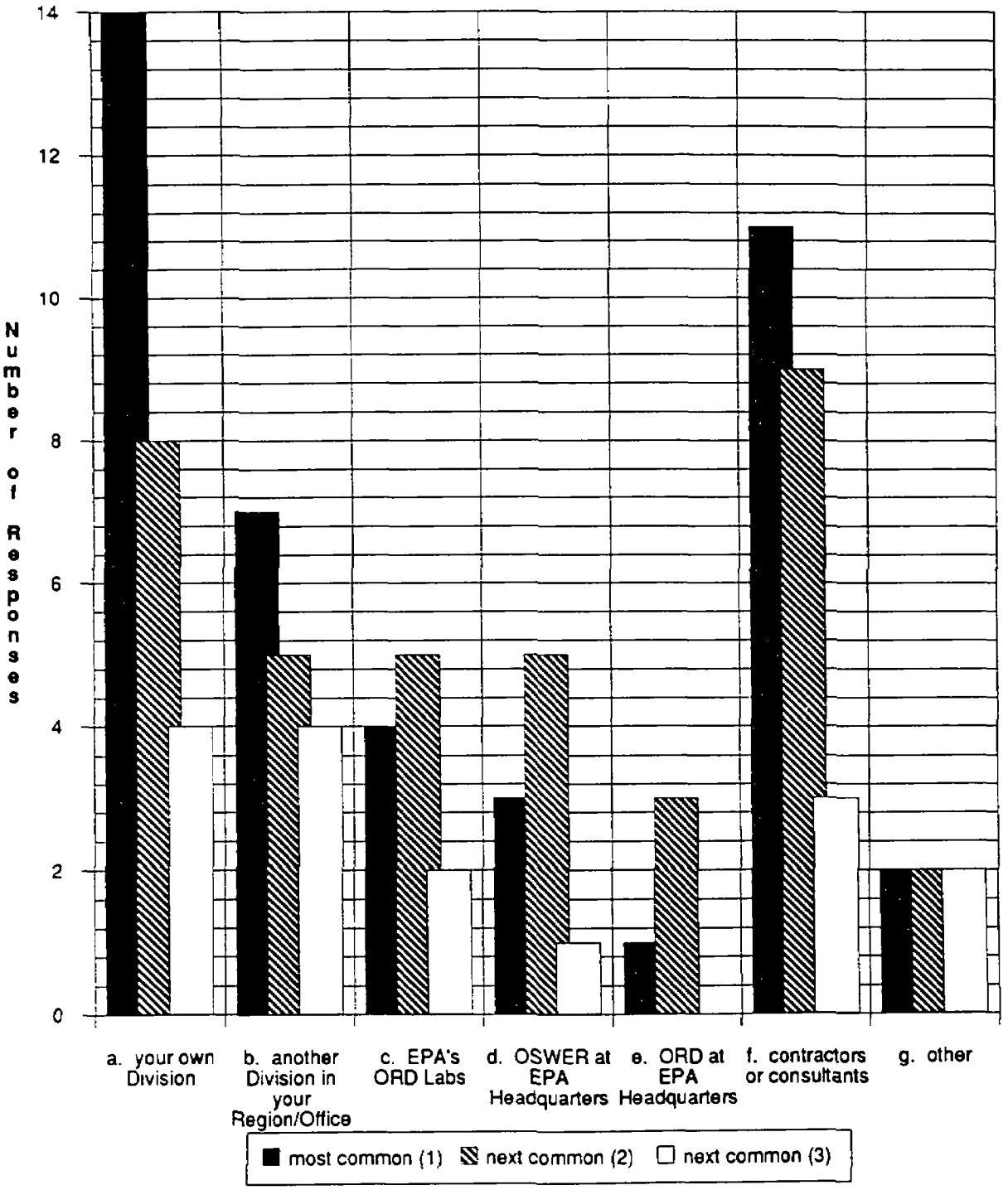


Figure B-6. Sources of Technical Support (Superfund Program)

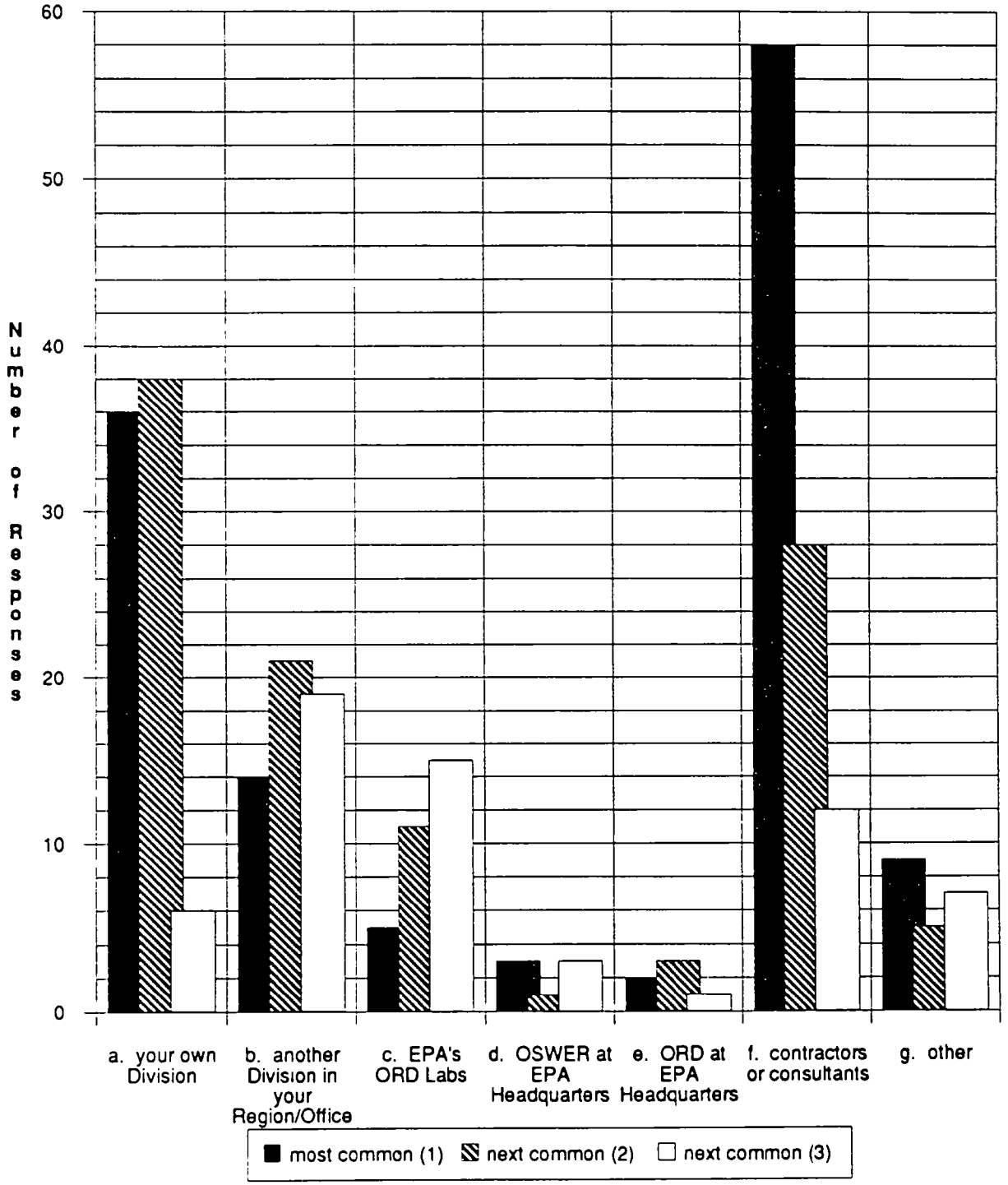


Figure B-7. Modeling Opinions (Totals)

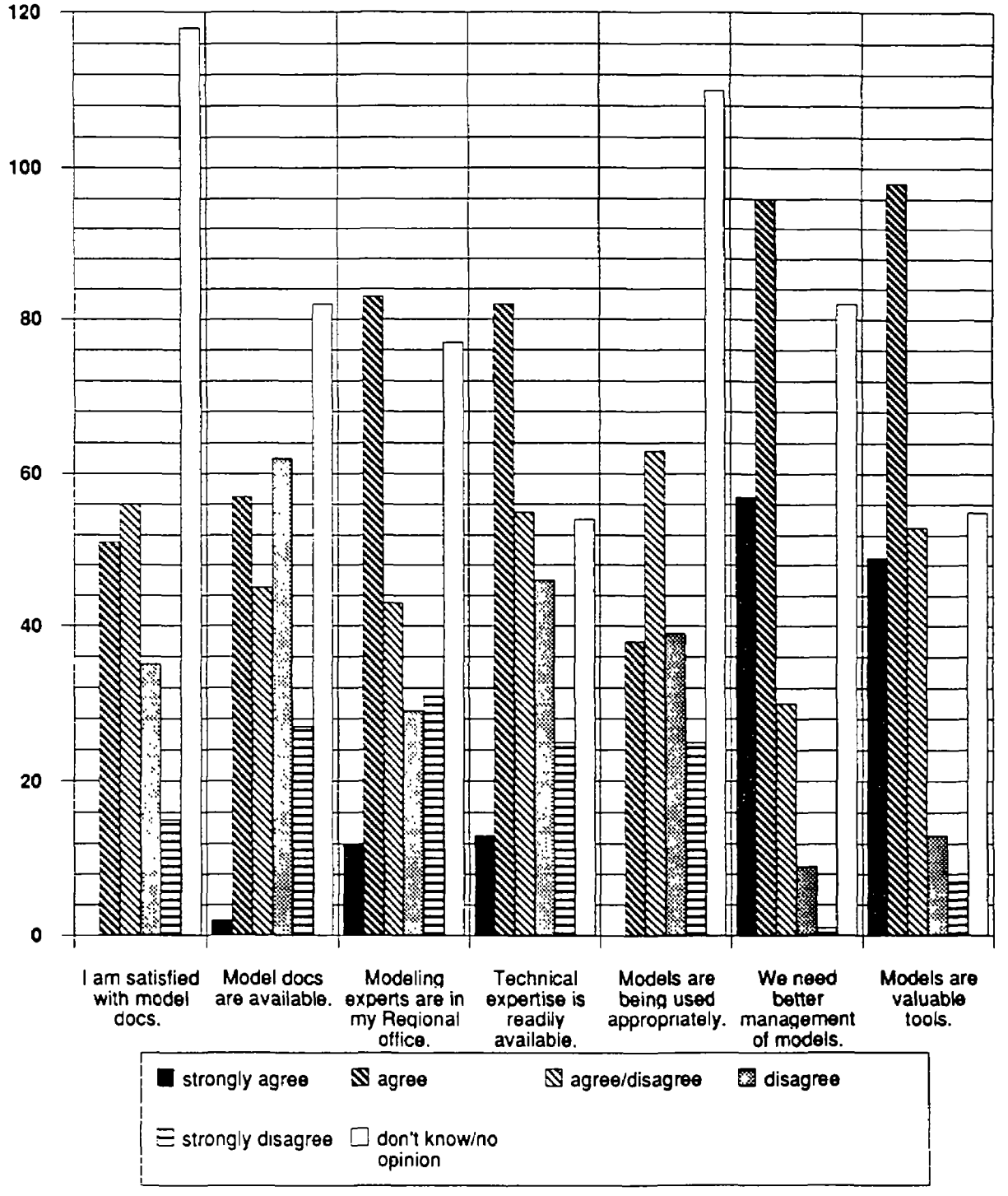


Table of Models (By Region & Program)

List of Models Mentioned

List of Model Names By Phase

List of Model Names by Activity

List of Model Names by Region

Note: Some inconsistencies exist in the way Census respondents identified various models. Because there are no conventions for model names, respondents may have provided different names for the same model. For example, in one case a model was identified by its common name, "PLASM," whereas another person named the model by its developers' names, "PRICKETT-LONNQUIST." Also, some questions have been raised about how respondents assigned Activity Types for a particular model. For example, a groundwater model is listed under the activity of "assessing volatilization into air." While this may be an incorrect entry, it is also possible that a groundwater model was used as part of a larger modeling project dealing with volatilization. Obvious errors have been corrected to the greatest extent possible, but in order to preserve the integrity of the data, ambiguous responses have not been altered. It is our belief that the existence of a few anomalies does not affect the overall conclusions of this study.

Model Names by Region & Program

Region	REGION I		REGION II		REGION III		REGION IV		REGION V		REGION VI		REGION VII		REGION VIII		REGION IX		REGION X	
Superfund/RCRA	S	R	S	R	S	R	S	R	S	R	S	R	S	R	S	R	S	R	S	R
3D ADVECTION-DISPERSION	X																			
ABEL					X									X						
ADMIN REC. DATA BASE											X									
ALOHA			X				X		X											
AQUA FEM									X											
AT123D			X						X											
BALANCE			X				X	X						X						
BEN					X									X						
BIOKINETIC UPTAKE																			X	
BOX MODEL															X					
BUDGET																				
CAPGRAPH						X														
CAPTURE							X	X	X											
CFEST			X																	
CHARM					X								X							
CHEMFLOW			X																	
CHEMPLUS													X							
CHEMRANK			X																	
COM						X												X		
CONTRACTOR DEVEL MODEL												X								
CORA			X			X			X				X							
CYNTRAK																	X			
DESIGN AIR STRIPPER							X													

Model Names by Region & Program

Region	REGION I		REGION II		REGION III		REGION IV		REGION V		REGION VI		REGION VII		REGION VIII		REGION IX		REGION X	
Superfund/RCRA	S	R	S	R	S	R	S	R	S	R	S	R	S	R	S	R	S	R	S	R
DISP. MODELING-OIL SPILLS									X											
DOE,EIA ENERGY MODEL																				
DRI MACRO MODEL																				
DYNFLOW	X					X											X			
DYNTRACK						X											X			
EPACML													X							
EPACMS																				
EXAMS																			X	
EXPERT-CES						X														
FDM																				
FEMSEEP			X																	
FGETS													X							
FLEX				X		X														
GARDS						X														
GEOEASE																			X	
GEOPHYSICAL SURVEY			X																	
GPTRAC													X							
GROUNDWATER						X														
GSTARS															X					
HASP/ERT													X							
HEC-6															X					
HELP	X	X		X	X	X	X		X						X					
HWANG SOIL VOLATILIZATION													X							
ICF COPYRIGHTED MODEL																				
IMPACT	X																			

Model Names by Region & Program

Region	REGION I		REGION II		REGION III		REGION IV		REGION V		REGION VI		REGION VII		REGION VIII		REGION IX		REGION X	
Superfund/RCRA	S	R	S	R	S	R	S	R	S	R	S	R	S	R	S	R	S	R	S	R
INTERP GEO-PHYSICAL DATA													X							
ISC	X								X								X			
ISC LT	X		X						X		X		X						X	
ISC ST	X													X			X			
KRIGLING (GEOSTO)	X																			
LINER LOCATION MODEL																				
LLM																				
LOTUS SPREAD-SHEET MODEL																			X	
MINTEQ							X	X											X	
MMSOILS																				
MOC			X				X	X	X								X		X	
MODFLOW	X	X	X				X	X				X	X	X			X			
MYGRT			X										X							
ONEDI							X	X												
OTHER PROPRIE-TARY MODELS																	X			
PC GEMS														X						
PC TRANSPORT	X																X			
PESSQ																				
PLASM	X						X	X						X						
PLUME 2D							X		X											
PRESTO	X																			
PRICKELL & LONQUIST														X						
PRZM							X	X												
PUFF					X		X													
RANDOM WALK			X		X		X	X				X		X			X		X	

Model Names by Region & Program

Region	REGION I		REGION II		REGION III		REGION IV		REGION V		REGION VI		REGION VII		REGION VIII		REGION IX		REGION X	
Superfund/RCRA	S	R	S	R	S	R	S	R	S	R	S	R	S	R	S	R	S	R	S	R
RCMS COST ACCOUNTING													X							
RCRA RISK-COST ANAL. MODEL																				
RESOURCE																				
RESSQ							X	X				X					X			
REVENUE																				
RISK MODELING												X								
RITZ			X		X				X					X						
RPM																				
RPR DATA BASE											X									
SAFER					X															
SAFTMOD													X							
SARAH																				
SCREEN							X													
SEDCAM																			X	
SEDQUAZ																			X	
SESOIL					X												X			
SIMS															X					
SLUGTEST									X											
SOIL CONS. SERVICE																				
SOILINER				X																
SOLUTE					X			X		X		X		X						
SUPERTREE																				
SURFACE MINING MODEL														X						
SURFER		X			X															
SUTRA	X	X																		
SWIFT					X															
TARGET																	X			

(4) Model Names by Region & Program

Model Names by Region & Program

Region	REGION I		REGION II		REGION III		REGION IV		REGION V		REGION VI		REGION VII		REGION VIII		REGION IX		REGION X	
Superfund/RCRA	S	R	S	R	S	R	S	R	S	R	S	R	S	R	S	R	S	R	S	R
TEM8																	X			
USGS 2, 3D TRANSPORT			X																	
USGS 2D	X		X		X		X			X	X								X	
USGS 2D FLOW									X											
USGS 2D TRANSPORT									X			X		X						
USGS 3D			X		X															
USGS 3D FLOW	X		X											X			X			
USLE, MUSLE																	X			
UST MODEL (CUSTOM DESIGN)				X																
UTIL DATA INSTITUTE MODEL																				
VALLEY																				
VHS	X			X	X		X		X	X			X	X						
VIP																				
VOIS TRIP	X																			
WAP				X																
WASP																			X	
WATEQ		X					X	X		X										
WATEVAL			X																	
WETLANDS MODEL			X																	
WHAZAM					X															

Models Mentioned

Model Name	Number of Mentions
3D ADVECTION-DISPERSION	1
ABEL	2
ADMINISTRATIVE RECORDS DATABASE	2
ALOHA	8
AQUA FEM	2
AT123D	4
BALANCE	4
BEN	2
BIOKINETIC UPTAKE	1
BOX	1
BUDGET	
CAPGRAPH	1
CAPTURE	3
CFEST	1
CHARM	4
CHEMFLOW	3
CHEMPLUS	1
CHEMRANK	3
COM	2
CONTRACTOR DEVEL MODEL	1
CORA	4
CYNTRAK	1
DESIGN AIR STRIPPER	1
DISP MODELING OF OIL SPILLS	1
DOE EIA ENERGY MODEL	1
DRI MACRO	1
DYNFLOW	12
DYNTRAK	8
EPACML	3
EXAMS	1
EXPERT CES	1
FDM	2
FEMSEEP	2
FGETS	2
FLEX	2
GARDS	1
GEOEASE	1
GEOPHYSICAL SURVEY	1
GPTRAC	2
GROUNDWATER	1
GSTARS	1

Model Name	Number of Mentions
HASP/ERT	6
HEC/6	1
HELP	**24**
HWANG SOIL MODEL	1
ICF COPYRIGHTED MODEL	1
IMPACT	1
INTERP GEOPHYSICAL DATA	1
ISC LT	**16**
ISC	2
ISC-ST	9
KRIGLING (GEOSTO)	1
LINER LOCATION MODEL	9
LOTUS SPREADSHEET MODEL	2
MINTEQ	**18**
MM SOILS	3
MOC	7
MODFLOW	**29**
MYGRT	6
ONEDI	1
OTHER PROPRIETARY MODEL	3
PC GEMS	2
PC TRANSPORT	1
PESSQ	1
PLASM	7
PLUME 2D	3
PRICKELL/LONQUIST	1
PRZM	2
PUFF	**13**
RANDOM WALK	**21**
RCMS COST ACCOUNTING	1
RCRA RISK COST ANAL MODEL	5
RESOURCE	1
RESSQ	5
REVENUE	1
RISK MODELING	1
RITZ	7
RPM	2
SAFER	2
SAFTMOD	1

Model Name	Number of Mentions
SARAH	1
SCREEN	1
SEDCAM	2
SEDQUAZ	1
SESOIL	3
SIMS	1
SLUGTEST	1
SOIL CONS SERVICE	1
SOILINER	2
SOLUTE	9
SUPERTREE	1
SURFACE MINING	1
SURFER	2
SUTRA	2
SWIFT	4
TARGET	3
TEM8	2
USGS 2D FLOW	8
USGS 2D TRANSPORT	**12**
USGS 2D	**12**
USGS 3D	2
USGS 3D FLOW	1
USLE,MUSLE	1
UST MODEL (CUSTOM DESIGN)	5
UTIL DATA INSTITUTE MODEL	2
VALLEY	2
VHS	**17**
VIP	1
VOIS TRIP	1
WAP	1
WASP	5
WATEQ	5
WATEVAL	3
WETLANDS MODEL	1
WHAZAM	2

A. Preliminary Assessment (Superfund) - 4

ALOHA
PLASM
PLUME 2D
PUFF

B. Site Inspection (Superfund) - 1

RITZ

C. Remedial Investigation (Superfund) - 67

3-D ADVECTION-DISPERSION
ALOHA
AQUA FEM
AT123D
BALANCE
BIOKINETIC UPTAKE
CAPTURE
CFEST
CHEMFLOW
CHEMRANK
CONTRACTOR DEVEL MODEL
CORA
DYNFLOW
DYNTRAK
EXAMS
FEDM
FEMSEEP
FGETS
GEOEASE
GEOPHYSICAL SURVEY
GSTARS
HEC-6
HELP
HWANG SOIL VOLATILIZATION
IMPACT
INTERN GEOPHYSICAL DATA
ISC
ISC LT
ISC ST
MINTEQ
MOC
MODFLOW
MYGRT
ONEDI

OTHER PROPRIETARY MODELS
PESSQ
PLASM
PLUME 2D
PRESTO
PRZM
RANDOM WALK
RESSQ
RISK MODELING
RITZ
SEDCAM
SEDQUAZ
SESOIL
SIMS
SLUGTEST
SOIL CONS. SERVICE
SOILINER
SOLUTE
SUTRA
SWIFT
TARGET
TEM8
USGS 2D
USGS 2D FLOW
USGS 2D TRANSPORT
USGS 3D
USLE, MUSLE
VALLEY
VHS
WASP
WATEQ
WATEVAL
WETLANDS MODEL

D. Remedial Design (Superfund) - 32

BALANCE
BOX MODEL
CAPTURE
CHEMFLOW
CHEMPLUS
CHEMRANK
DESIGN AIR STRIPPER
HASP/ERT
HELP
KRIGLING (GEOSTO)
MINTEQ
MOC

MODFLOW
OTHER PROPRIETARY MODELS
PC TRANSPORT
PUFF
RANDOM WALK
RESSQ
RITZ
SCREEN
SESOIL
SOLUTE
SURFER
TARGET
USGS 2D
USGS 2D FLOW
USGS 2D TRANSPORT
USGS 3D
USGS 3D FLOW
VHS
VOIS TRIP
WATEVAL

E. Remedial Action (Superfund) - 14

ALOHA
BALANCE
CHARM
CHEMFLOW
CHEMRANK
CORA
MOC
PUFF
RCMS COST ACCOUNTING
RITZ
SAFER
VHS
WATEVAL
WHAZAM

F. Operation and Maintenance (Superfund) - 1

HELP

G. Closure and Post Closure (Superfund) - 1

HELP

H. Enforcement (Superfund) - 12

COM
CYNTRAK
DYNFLOW
DYNTRAK
LOTUS SPREADSHEET MODEL
MODFLOW
MYGRT
RANDOM WALK
RESSQ
RPM
SOLUTE
SUPERTREE

I. Other Superfund Phase - 17

ADMIN REC. DATA BASE
ALOHA
BUDGET
CHARM
CORA
DISP. MODELING-OIL SPILLS
EPACML
GPTRAC
HASP/ERT
ISC LT
MODFLOW
RESOURCE
REVENUE
RPR DATA BASE
SAFTMOD
VHS
VIP

J. Permitting (RCRA) - 21

BALANCE
EXPERT-CES
FLEX
GARDS
GROUNDWATER
HELP
ISC LT
ISC ST
MODFLOW

PLASM
PRICKELL & LONQUIST
PUFF
RANDOM WALK
SOILINER
SOLUTE
SURFACE MINING MODEL
USGS 2, 3D TRANSPORT
USGS 2D
USGS 3D FLOW
VHS
WAP

K. Corrective Action Design (RCRA) - 9

CAPTURE
MINTEQ
MODFLOW
PRZM
RANDOM WALK
SOLUTE
USGS 3D FLOW
VHS
WATEQ

L. Corrective Action (RCRA) - 14

CAPGRAPH
COM
DYNFLOW
DYNTRACK
ISC ST
MINTEQ
MODFLOW
PC GEMS
PLASM
RANDOM WALK
RITZ
SOLUTE
USGS 3D FLOW
VHS

M. Corrective Action Operation (RCRA) - 3

MODFLOW
RANDOM WALK
SOLUTE

N. Enforcement (RCRA) - 7

ABEL
BEN
MODFLOW
PLUME 2D
USGS 2D
USGS 2D TRANSPORT
VHS

O. Other RCRA Phases - 25

DOE, EIA ENERGY MODEL
DRI MACRO MODEL
EPACML
EPACMS
HELP
ICF COPYRIGHTED MODEL
ISC LT
LINER LOCATION MODEL
LLM
MINTEQ
MMSOILS
MODFLOW
PC GEMS
PUFF
RANDOM WALK
RCRA RISK-COST ANAL MODEL
RITZ
SARAH
SURFER
SUTRA
UST MODEL (CUSTOM DESIGN)
UTIL DATA INSTITUTE MODEL
VALLEY
VHS
WATEQ

1. Estimating Groundwater Contamination Levels (30)

3-D ADVECTION-DISPERSION
AQUA FEM
BALANCE
DYNFLOW
EPACML
FEMSEEP
GPTRAC
LINER LOCATION MODEL
MOC
MODFLOW
MYGRT
ONEDI
OTHER PROPRIETARY MODELS
PC GEMS
PLASM
PLUME 2D
PRICKELL & LONQUIST
RANDOM WALK
RITZ
SESOIL
SOILINER
SOLUTE
SURFACE MINING MODEL
SWIFT
TARGET
USGS 2D
USGS 2D TRANSPORT
VHS
WATEQ
WATEVAL

2. Setting Groundwater Clean-Up Levels (12)

AT123D
CONTRACTOR DEVEL MODEL
EPACMS
LINER LOCATION MODEL
LOTUS SPREADSHEET MODEL
MINTEQ
MODFLOW
OTHER PROPRIETARY MODELS
RCRA RISK-COST ANAL MODEL
SWIFT
USGS 2D FLOW
USGS 2D TRANSPORT

3. Assessing Groundwater Transport (39)

AQUA FEM
AT123D
BALANCE
CAPTURE
CFEST
DYNFLOW
DYNTRACK
FEMSEEP
GPTRAC
HELP
LINER LOCATION MODEL
LOTUS SPREADSHEET MODEL
MINTEQ
MOC
MODFLOW
MYGRT
PC TRANSPORT
PESSQ
PLASM
PLUME 2D
RANDOM WALK
RCRA RISK-COST ANAL MODEL
RESSQ
SAFTMOD
SESOIL
SLUGTEST
SOLUTE
SWIFT
TARGET
USGS 2, 3D TRANSPORT
USGS 2D
USGS 2D FLOW
USGS 2D TRANSPORT
USGS 3D
USGS 3D FLOW
UST MODEL (CUSTOM DESIGN)
VHS
WATEQ
WATEVAL

4. Assessing Migration in the Unsaturated Zone (17)

CHEMFLOW
CHEMRANK
EPACML
HELP
LINER LOCATION MODEL
MINTEQ
PRZM
RCRA RISK-COST ANAL MODEL
RESSQ
RITZ
SESOIL
SOLUTE
SURFER
SUTRA
UST MODEL (CUSTOM DESIGN)
VHS
VIP

5. Assessing Surface Water Transport (6)

EXAMS
HELP
MODFLOW
USLE, MUSLE
UST MODEL (CUSTOM DESIGN)
WASP

6. Assessing Volatilization Into Air (12)

ALOHA
DESIGN AIR STRIPPER
HWANG SOIL VOLATILIZATION
ISC LT
MODFLOW
PLASM
PUFF
SARA
SIMS
TEM8
UST MODEL (CUSTOM DESIGN)
VOIS TRIP

7. Assessing Air Dispersion (17)

ALOHA
BOX MODEL
CAMEO
CHARM
CHEMPLUS
DYNFLOW
FDM
ISC
ISC LT
ISC ST
PUFF
RANDOM WALK
RITZ
SAFER
SCREEN
TEM8
VALLEY
WHAZAM

8. Designing Monitoring Networks (6)

CAPTURE
HELP
HELP
MODFLOW
OTHER PROPRIETARY MODELS
RANDOM WALK
USGS 2D

9. As a Substitute for Leaching Tests (2)

HELP
MINTEQ

10. Design of Liners (4)

EXPERT-CES
FLEX
HELP
SOILINER

11. Design of Landfills (2)

GROUNDWATER
HELP

12. Design of Incinerators (3)

BALANCE
ISC LT
ISC ST

13. Estimating Exposures [Ecosystem] (11)

DYNFLOW
DYNTRACK
FGETS
HASP/ERT
LLM
MINTEQ
MMSOILS
USGS 2D FLOW
USGS 2D TRANSPORT
UTIL DATA INSTITUTE MODEL
WASP

14. Estimating Exposures [Human] (18)

CHARM
DYNFLOW
DYNTRACK
FDM
HASP/ERT
ISC LT
ISC ST
LLM
MINTEQ
MMSOILS
MYGRT
PUFF
SAFER
USGS 2D FLOW
USGS 2D TRANSPORT
UTIL DATA INSTITUTE MODEL
WASP
WHAZAM

15. Risk Assessment (21)

BIOKINETIC UPTAKE
COM
CYNTRAK
DOE, EIA ENERGY MODEL
DYNTRACK
DYNTRAK
FGETS
ICF COPYRIGHTED MODEL
ISC
ISC LT
ISC ST
LINER LOCATION MODEL
LLM
MINTEQ
MMSOILS
MYGRT
PUFF
RCRA RISK-COST ANAL MODEL
RISK MODELING
VHS
WASP

16. Other Applications (48)

ABEL
ALOHA
BEN
BUDGET
CAPGRAPH
CAPTURE
CORA
DISP. MODELING-OIL SPILLS
DRI MACRO MODEL
DYNFLOW
DYNTRACK
DYNTRAK
GARDS
GEOEASE
GEOPHYSICAL SURVEY
GSTARS
HASP/ERT
HEC-6
HELP
IMPACT
INTERP GEOPHYSICAL DATA
ISC ST

KRIGLING (GEOSTO)
MINTEQ
MODFLOW
MYGRT
PRESTO
RANDOM WALK
RCMS COST ACCOUNTING
RESOURCE
RESSQ
REVENUE
RPM
SEDCAM
SEDQUAZ
SOIL CONS. SERVICE
SUPERTREE
SURFER
SUTRA
USGS 2D
USGS 3D
USGS 3D FLOW
UST MODEL (CUSTOM DESIGN)
VHS
WAP
WASP
WATEQ
WETLANDS MODEL

EPA Headquarters - (3)

ICF COPYRIGHTED MODEL
BUDGET
RCRA RISK-COST ANALYSIS MODEL

Region I - (6)

ISC LT
ISC ST
MODFLOW
WATEQ
PC TRANSPORT
HELP

Region II - (13)

WATEVAL
ISC LT
WETLANDS MODEL
AT123D
MYGRT
FEMSEEP
MODFLOW
ALOHA
CFEST
UST MODEL
FLEX
CORA
GEOPHYSICAL SURVEY

Region III - (9)

HELP
VHS
GROUNDWATER
DYNFLOW
SWIFT
CHARM
RANDOM WALK
USGS 2, 3D TRANSPORT
USGS 2D

Region IV - (8)

SOLUTE
MINTEQ
ALOHA
DISPERSION MODELING-OIL SPILLS
MODFLOW
MOC
RANDOM WALK
PLASM

Region V - (8)

HELP
AT123D
ALOHA
USGS 2D
USGS 2D FLOW
SLUGTEST
AQUA FEM
VHS

Region VI - (4)

RPR DATA BASE
RANDOM WALK
USGS 2D
USGS 2D TRANSPORT

Region VII - (13)

MODFLOW
SAFTMOD
VHS
ISC LT
ISC ST
RANDOM WALK
HASP-ERT
HWANG SOIL VOLATILIZATION
CHARM
MYGRT
CORA
INTERP GEOPHYSICAL DATA
FGETS

Region VIII - (4)

BOX MODELS
ALOHA
USGS 2D
USGS 2D TRANSPORT

Region IX - (9)

MODFLOW
RANDOM WALK
SESOIL
OTHER PROPRIETARY MODELS
DYNTRAK
PUFF
USLE,MUSLE
CFEST
TARGET

Region X - (6)

SEDCAM
BIOKINETIC UPDATE
GEOEASE
USGS 2D
MOC
MINTEQ