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PROGRAM PLAN

for the

DEVELOPMENT, EVALUATION, and APPLICATION

of the

TERRAIN-RESPONSIVE ATMOSPHERIC CODE (TRAC)

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TABLE of CONTENTS

1. EXECUTIVE SUMMARY 1

1.1 The Terrain-Responsive Atmospheric Code (TRAC) . 1
1.2 Development Program 1
1.3 Conclusion 2

2.0 OBJECTIVE 3

3.0 DISPERSION MODELING AT THE DEPARTMENT OF ENERGY . . 3

4.0 THE ROCKY FLATS DISPERSION MODELING EFFORT 3

4.1 Model Development 4

4.2 Model Evaluation Program 7

4.2.1 Progress To Date 7
4.2.2 Interagency Review Committee 9

4.3 Model Application 9

4.3.1 Site-Specific Application 9
4.3.2 Intra- and Inter-Departmental Application 11

5.0 DEVELOPMENT PROGRAM 12

5.1 Model Development 15

Task I.1 Implement Real-time Upper Air Capability 15
Task I.2 Develop Prototype Wind Profiler with NOAA 15
Task I.3 Implement Alert Mode 17
Task I.4 Upgrade Computer System 17
Task I.5 Upgrade User Interface 17
Task I.6 Implement Real-time Plume Projections for State of Colorado 17
Task I.7 Evaluate Building Effects Module . . . 17
Task I.8 Upgrade Statistics Module 17
Task I.9 Incorporate Multiple Point Sources/ Area Sources 19
Task I.10 Incorporate Heavy Gas Dispersion . . . 19
Task I.11 Incorporate Chemical Transformations . 19
Task I.12 Incorporate Resuspension Source Term . 19
Task I.13 Develop Computer Aided Training Program 19
Task I.14 Implement Statistical Forecasting Capability 21

Task I.15 Incorporate Explosion Dispersion . . . 21
Task I.16 Implement Real-time HAZMAT Model . . . 21
Task I.17 Evaluate Mixing Depth Reflection . . . 21
Task I.18 Upgrade Near-source Resolution 21
Task I.19 Upgrade Windfield Code 23
Task I.20 Implement Default Source Term Data Base 23
Task I.21 Implement ARAC Interface 23
Task I.22 Upgrade Graphics 23
Task I.23 Upgrade Precipitation Monitoring/Modeling Capability 23
Task I.24 Upgrade Computer System 24
Task I.25 Implement Numerical Forecasting Capability 24

5.2 Model Evaluation 26

Task II.1 Complete Analysis of Summer 1987 Validation Study 26
Task II.2 Publish Theory in Peer-reviewed Journal 26
Task II.3 Document Model 26
Task II.4 Develop EPA Validation Protocol . . . 26
Task II.5 Conduct EPA Approval Process 28
Task II.6 Conduct Winter 1990 Validation Scoping Study 28
Task II.7 Develop Historical Meteorological Data Base 28
Task II.8 Benchmark Against EPA Model 28
Task II.9 Conduct Winter 1991 Full Field Validation 28
Task II.10 Validate Against ASCOT Data Base . . 30
Task II.11 Validate Against MATS Data Base . . . 30
Task II.12 Complete Sensitivity Analysis . . . 30
Task II.13 Benchmark Against CRAC2 Model 32
Task II.14 Benchmark Against MATHEW/ADPIC Model 32
Task II.15 Validate Against Long-term Data Base 32

5.3 Model Application 32

Task III.1 Operate/Maintain Emergency Response Capability 32
Task III.2 Operate/Maintain Risk Assessment Version 32
Task III.3 Conduct Health Effects Study of Hazardous Materials 34
Task III.4 Conduct Monitor Siting Study 34
Task III.5 Evaluate Maximum Credible Accident . 34
Task III.6 Conduct Monthly Analyses of Operational Releases 34
Task III.7 Respond to Request for Support/Studies 36

Task III.8 Operate/Maintain Regulatory Analysis Version 36
Task III.9 Operate/Maintain Real-time HAZMAT Version 36
Task III.10 Conduct Emergency Response Hazards Analyses 36
Task III.11 Conduct Analysis of Climatological Wind Patterns 36

6.0 PROGRAM 37

6.1 Technical Functions 37

6.1.1 Management 37
6.1.3 Computer Graphics 37
6.1.4 Real-time Data Acquisition 38
6.1.5 Computer Data Entry 38
6.1.6 Health Effects 38
6.1.7 Dispersion Meteorology 38
6.1.8 Statistics 38
6.1.9 User Interface 38
6.1.10 Technical Writing 39

6.2 Resource Requirements 39

6.2.1 Overall Program 39
6.2.2 Model Development 41
6.2.3 Model Evaluation 41
6.2.4 Model Application 41

6.3 Staffing 41

7.0 CONCLUSIONS 41

8.0 REFERENCES 43

LIST of FIGURES

Figure 1. Representative Airflow Patterns Developed by the TRAC Model Showing Surface Boundary Layer Streamlines 5

Figure 2. Comparison of Similarity-based Dispersion Approach in the TRAC Model to Standard Pasquill-Guifford Stability Curves 6

Figure 3. TRAC Model Representation of a Plume Simulated by Independent, Overlapped Puffs 6

Figure 4. Example of Transport and Growth of a TRAC Model Puff 6

Figure 5. Structure of the TRAC Model Evaluation Program . 7

Figure 6. Plume Center Line Trajectory for Downslope Tracer Test Conducted During the Summer 1987 Field Validation Study at the Rocky Flats Plant 8

Figure 7. Cross Section of Tracer Plume (y-z plane) Produced from SF_6 Data Sampled by Aircraft Flying Vertically-Stacked Plume Transects . . . 8

Figure 8. Histogram Summarizing Results of a TRAC Risk Assessment Run Using a Simulated Source Scenario 10

Figure 9. Regional Plume Path Map Produced by the TRAC Model Running in Standby Mode for Emergency Response 11

Figure 10. Example of Analysis of Excess Cancer Incidences 11

Figure 11. Time/Task Diagram for Tasks I.1-I.5 16

Figure 12. Time/Task Diagram for Tasks I.6-I.10 18

Figure 13. Time/Task Diagram for Tasks I.11-I.15 20

Figure 14. Time/Task Diagram for Tasks I.16-I.20 22

Figure 15. Time/Task Diagram for Tasks I.21-I.25 25

Figure 16. Time/Task Diagram for Tasks II.1-II.5 27

Figure 17. Time/Task Diagram for Tasks II.6-II.10 29

LIST of FIGURES (con't)

Figure 18. Time/Task Diagram for Tasks II.11-II.15 . . . 31

Figure 19. Time/Task Diagram for Tasks III.1-III.5 . . . 33

Figure 20. Time/Task Diagram for Tasks III.6-III.11 . . . 35

Figure 21. Organization of the TRAC Model Development Team for the FY-1990 Tasks 39

Figure 22. Month-by-Month Effort Loading for the Overall Model Development Program 42

LIST of TABLES

Table 1. Task-by-Task Breakdown of the Three Program Elements 13

Table 2. Summary of Effort and Funding Requirements for Tasks I.1-I.5 16

Table 3. Summary of Effort and Funding Requirements for Tasks I.6-I.10 18

Table 4. Summary of Effort and Funding Requirements for Tasks I.11-I.15 20

Table 5. Summary of Effort and Funding Requirements for Tasks I.16-I.20 22

Table 6. Summary of Effort and Funding Requirements for Tasks I.21-I.25 25

Table 7. Summary of Effort and Funding Requirements for Tasks II.1-II.5 27

Table 8. Summary of Effort and Funding Requirements for Tasks II.6-II.10 29

Table 9. Summary of Effort and Funding Requirements for Tasks II.11-II.15 31

Table 10. Summary of Effort and Funding Requirements for Tasks III.1-III.5 33

Table 11. Summary of Effort and Funding Requirements for Tasks III.6-III.11 35

Table 12. Effort Summary for the Overall TRAC Program . . 40

Table 13. Funding Summary for Overall TRAC Program 40

1. EXECUTIVE SUMMARY

1.1 The Terrain-Responsive Atmospheric Code (TRAC)

The Department of Energy (DOE) maintains a number of atmospheric dispersion models at several facilities. DOE applies modeling for Risk Assessment, Emergency Response, and Regulatory Compliance. The Rocky Flats Plant is developing a dispersion/dose code to meet DOE and other governmental requirements for dispersion modeling at the Rocky Flats Plant. The Terrain-Responsive Atmospheric Code (TRAC) is designed to realistically simulate the involved atmospheric conditions that occur around complex sites such as the Rocky Flats.

Our approach complements the fundamental research programs at DOE National Laboratories and other facilities. Proven research results are quickly transferred from the literature to applied use. In this way, the benefits of DOE-funded basic research are most rapidly realized.

Though developed for site-specific use, TRAC's theory is rigorous and general, and can be directly applied to other facilities. This potential is not speculative. Eight DOE facilities, two federal agencies, and three local agencies have asked to evaluate or use TRAC in upgrading their modeling capabilities.

1.2 Development Program

The TRAC model program plan will accelerate the final (and most resource-intensive) portions of the development cycle. The program includes three primary functional areas scheduled for completion during Fiscal Years (FY) 1990, 1991, and 1992:

- Model Development,
- Model Evaluation, and
- Model Application.

Fifty-one major technical tasks will be completed under the proposed program. Approximately 365 person-months of effort will be required to complete the tasks. The level of effort will be dominated by model evaluation tasks and application of the capability.

The TRAC Model Development Program will require the following funding to complete the three-year effort:

Fiscal Year	Funding ($1000s)
FY-1990	$1,509
FY-1991	1,611
FY-1992	775
Total	$3,895

Project schedules are projected and are subject to funding availability.

This TRAC development program will be implemented by an interdisciplinary team of experts in fields ranging from dispersion meteorology to health physics to computer science. The structure of the team is dynamic and will be modified as the program emphasis shifts.

1.3 Conclusion

The TRAC model represents a strong tool for meeting DOE's environmental and health protection goals at the Rocky Flats Plant. The three-year program plan described in this report will complete the development, evaluation, and implementation tasks required to fully utilize the TRAC model.

2.0 OBJECTIVE

The TRAC Model Development Program for FY-1990 - FY-1992 will complete the development, evaluation, and implementation of the Terrain-Responsive Atmospheric Code (TRAC), an atmospheric dispersion model written at the Rocky Flats Plant. The program will implement modifications recommended by an Interagency Review Committee and quantify the model's performance under a variety of atmospheric conditions. The results of this program will demonstrate the model's applicability at the Rocky Flats Plant and other DOE facilities. The capability will be applied to meet the needs of the Rocky Flats Plant and DOE.

3.0 DISPERSION MODELING AT THE DEPARTMENT OF ENERGY

Atmospheric dispersion modeling is the use of computer programs to predict the path and impact of plumes released into the atmosphere. Dispersion modeling can evaluate a hypothetical release, predict the path of an actual release, or interpolate among sparse pollutant monitoring data.

DOE maintains a number of atmospheric dispersion models at several facilities. DOE applies modeling in three areas:

- Risk Assessment,
- Emergency Response, and
- Regulatory Compliance.

DOE and other government agencies are placing an increased emphasis on atmospheric dispersion modeling as an environmental protection tool. DOE Order 6430.1[1] requires the use of modeling for Safety Analysis Reports. DOE Order 5400.xy[2] will require the use of site-specific models in environmental protection. DOE Order 5500.3A[3], recently released in draft form, will also require site-specific modeling for emergency preparedness applications. The Environmental Protection Agency's (EPA's) Clean Air Act (40 CRF Part 61)[4] requires dispersion modeling to demonstrate compliance with air quality and health protection standards. Both DOE and EPA are establishing rigorous requirements for the validation of applied models.

4.0 THE ROCKY FLATS DISPERSION MODELING EFFORT

Following an evaluation of modeling needs at the facility, the Rocky Flats Plant began developing a dispersion/dose code in late 1982. The goal of our program is to produce a model that best supports environmental decision-making at Rocky Flats. The resulting model must realistically treat the complex atmospheric conditions and terrain which occur at Rocky Flats. We are achieving this goal by moving new technology from the research environment to direct application, and by customizing the code for specific users.

Our approach complements the fundamental research programs at DOE National Laboratories and other facilities. Proven research results are quickly transferred from the literature to applied use. In this way, the benefits of DOE-funded basic research are most rapidly realized.

The modeling effort at Rocky Flats includes three functional areas: model development, model evaluation, and model application. The following sections outline each functional area and discuss progress to date.

4.1 Model Development

Thirty-seven off-the-shelf dispersion models were evaluated for their applicability to Rocky Flats. Portions of several models were considered appropriate; however, no single model met all requirements. In addition, none included the major advancements in modeling science that have taken place during the last fifteen years. In response, we have developed an advanced model designed to meet the specialized needs of facilities, like the Rocky Flats Plant, with complex atmospheric conditions.

Called the "Terrain-Responsive Atmospheric Code" (TRAC), the model is based on a modification of the Gaussian Puff Approach[5,6]. The model simulates plume transport by developing three-dimensional wind-fields, then transporting puffs along independent nonlinear trajectories.

The key to this process is a realistic representation of the flow field. The model first interpolates wind, temperature, stability, and precipitation fields from observations at multiple locations. TRAC then perturbs the flow and stability fields to incorporate the effects of terrain channeling, thermal forcing (e.g., Urban Heat Island Effects and Differential Heating of Slopes), and varying surface roughness. The module outputs wind components, friction velocity components, log-linear wind profiles, stability, and potential temperature for each 1 km x 1 km grid in the study region. Figure 1 presents an example airflow field operationally produced by the TRAC model.

The traditional Pasquill-Guifford-Turner dispersion curves have been replaced with a more realistic Similarity Theory approach in

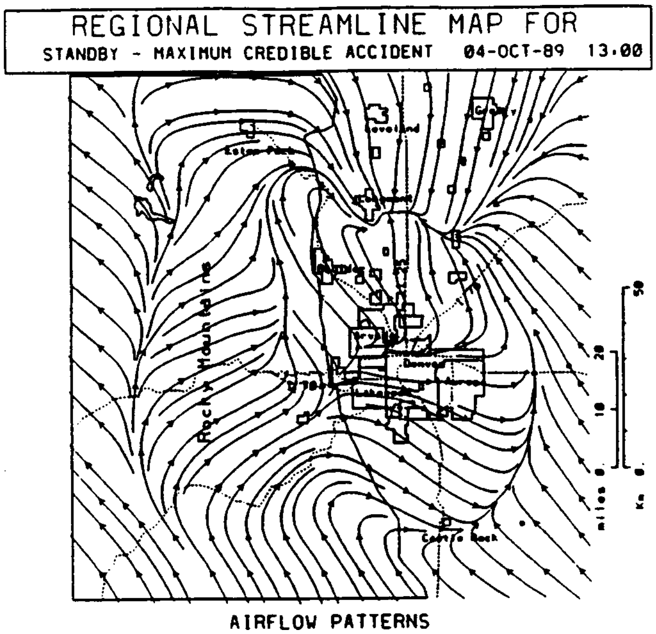

Figure 1. Representative Airflow Patterns Developed by the TRAC Model Showing Surface Boundary Layer Streamlines

the TRAC model. Modeled winds, potential temperatures, and surface cover types are used to calculate Monin-Obukhov Stability Scaling Lengths for grids in the study region. Turbulence intensities are then determined at varying heights and converted to dispersion rates. Figure 2 shows a comparison of the similarity approach to the standard Pasquill-Guifford-Turner dispersion envelope for a simplified case.

The TRAC model releases ellipsoids of simulated material from a user-input source location. As shown in Figure 3, continuous plumes are simulated by overlapping individual puffs. Puff transport is treated by advecting the puffs through the time-varying, three-dimensional windfields. Puffs change direction, speed, and vertical motion as they move from grid to grid. Figure 4 illustrates the transport and growth of a single puff during a typical TRAC model run.

The TRAC model also treats the effects of building wakes and cavities, plume rise, surface reflection, particulate settling, dry deposition, rainout and washout, surface roughness, and long-term resuspension. The result is a clear picture of the path, timing, and effects of an atmospheric release.

The TRAC model development program was initiated in 1982 with design of the basic theory. Theoretical development was completed in 1983 and creation of the computer algorithm begun. The more than 50,000 lines of FORTRAN code were completed and verification begun in mid-1984. Testing and revision of the code continued through most of 1985, when the first complete version of the model was made available for field testing in Risk Assessment applications. A major run-time optimization project was conducted in 1986.

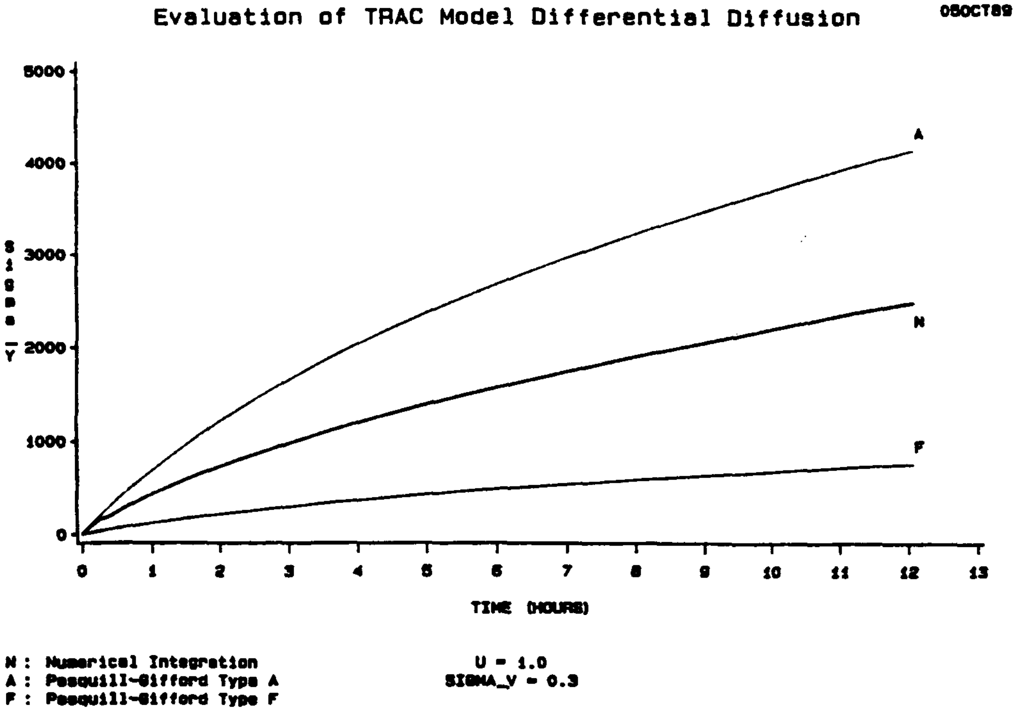

Figure 2. Comparison of Similarity-based Dispersion Approach in the TRAC Model to Standard Pasquill-Guifford Stability Curves

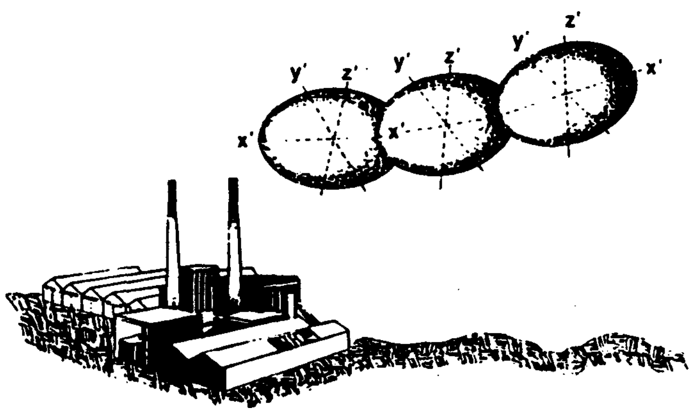

Figure 3. TRAC Model Representation of a Plume Simulated by Independent, Overlapped Puffs

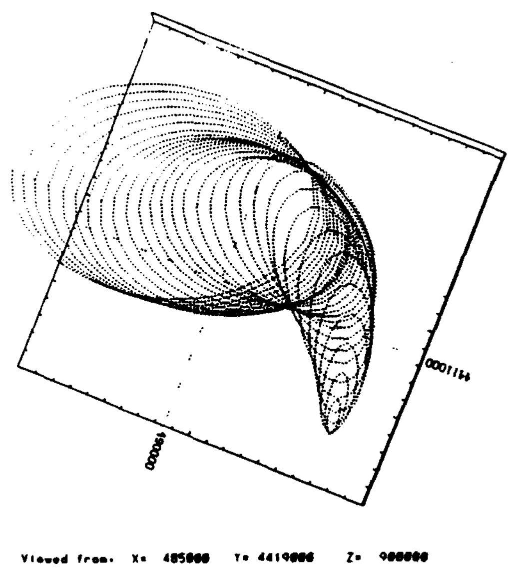

Figure 4. Example of Transport and Growth of a TRAC Model Puff

4.2 Model Evaluation Program

Dispersion modeling at DOE facilities is conducted in an environment of close public and regulatory scrutiny. In addition, upcoming DOE orders and federal regulations will require thorough evaluations before models are approved. Thus detailed evaluation is a fundamental component of our model development process. We have designed a model evaluation program that includes scientific review, code verification, sensitivity analysis, and full field validation. Figure 5 schematically presents the TRAC model evaluation program.

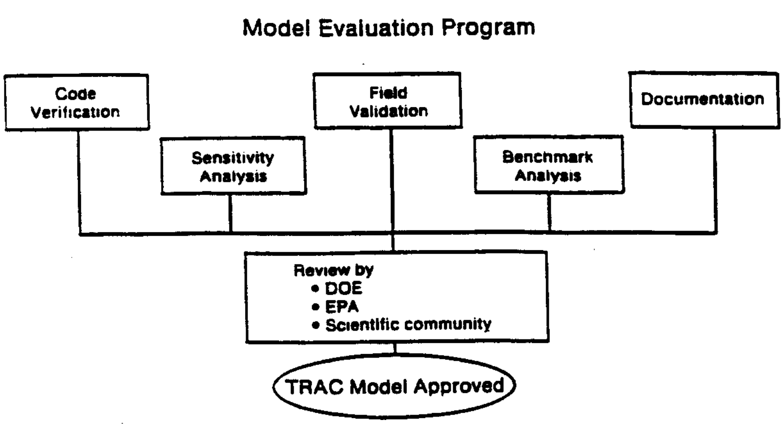

Figure 5. Structure of the TRAC Model Evaluation Program

4.2.1 Progress To Date

Model Evaluation was initiated in 1986. SRI International developed a series of study plans for validating TRAC on a modular basis[7]. Rockwell International and DOE used these plans to establish a full-scale evaluation program for the TRAC model. In 1987 Sandia National Laboratories was contracted to conduct the first of a three-part sensitivity/uncertainty analysis for TRAC[8]. Preliminary results from this study were presented to Rockwell International and DOE on September 15, 1987[9].

The first major field validation study, conducted during Summer 1987, centered on airborne tracking of tracer plumes[10]. The tests were designed to quantify TRAC's ability to predict the trajectory and dimensions of a plume during transport over complex terrain. Tracer tests were scheduled to obtain representative samples of the diurnal upslope, downslope, and transition airflow patterns that dominate the study region. Plumes were tracked and monitored by aircraft to distances of more than 80 km from the source. Figure 6 shows the plume center-line trajectory for one of the downslope tracer tests conducted during the study.

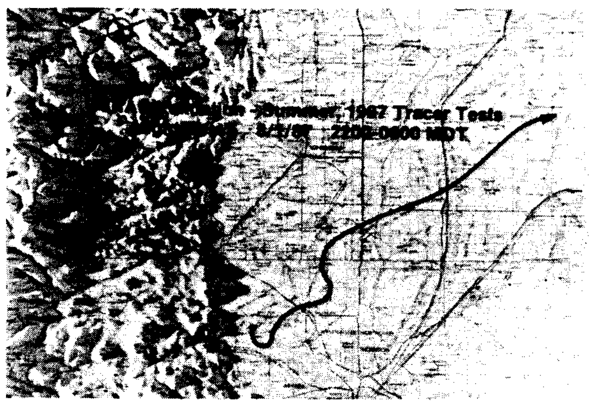

Figure 6.Plume Center Line Trajectory for Downslope Tracer Test Conducted During the Summer 1987 Field Validation Study at the Rocky Flats Plant

Three-dimensional plume transport, dispersion, and atmospheric databases were developed from the tracer tests. Figure 7 shows an example plume cross section, developed from airborne tracer concentrations measured at 0.1-second intervals. This cross section corresponds to transects taken through the tracer plume illustrated in Figure 6. Results from this project have been presented to DOE[11,12,13].

The TRAC Development Team has designed an extensive validation protocol for use in statistically comparing TRAC model predictions against the observations from the Summer 1987 tracer study[14]. The protocol utilizes more than 50 statistical tests which, when combined in a numerical weighting scheme, produce an objective, numerical score representing model performance. The Model Development Team is now analyzing the TRAC model. The team will then apply the same approach to other dispersion models in order to establish relative performance.

The Rocky Flats Plant has established a plan for fully documenting the TRAC model[15]. We will complete 13 individual documentation modules. The modules will be combined to form users guides, technical reference guides, and hardware/ software specifications for the code. The documents will target a wide range of audiences, including the general public, dispersion modelers, computer scientists, management, and users.

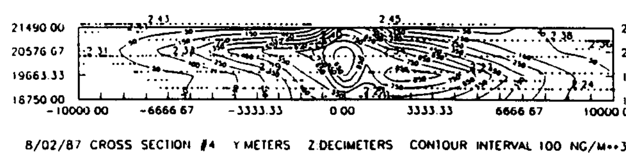

Figure 7. Cross Section of Tracer Plume (y-z plane) Produced from SF_6 Data Sampled by Aircraft Flying Vertically-Stacked Plume Transects

A series of seminars and workshops, including local, interagency, and international professional meetings, have been held to obtain peer review and recommendations.

4.2.2 Interagency Review Committee

In June 1987 the DOE Albuquerque Operations Office established an Interagency Review Committee for the TRAC model. The charter of the committee was to evaluate the technical/theoretical basis of the model, review plans for implementation and model validation, and make recommendations to DOE. A broad range of state and federal organizations were represented in the group, including DOE at three levels, four National Laboratories, the National Oceanic and Atmospheric Administration, three EPA organizations, and the Colorado Department of Health.

The Interagency Review Committee conducted a two-day review of the TRAC model in September 1987. Chief among the Committee's findings were:

- The theoretical basis of TRAC is approved,
- The model should be implemented for emergency response and risk assessment as quickly as possible,
- Specific recommendations for further development should be pursued,
- Additional evaluation tasks should be undertaken, and
- The model should be thoroughly published.

The detailed findings of the Committee have provided the basis for much of the TRAC model program plan for FY-1990 - FY-1992. A listing of the Committee members and a summary of the findings are presented in Appendix A of this plan.

4.3 Model Application

4.3.1 Site-Specific Application

Three versions of the TRAC model are complete or under development for use at the Rocky Flats Plant. The Risk Assessment version has been fully implemented on a VAX 8800 system and will be used to meet DOE Order 6430.1 requirements for development of Safety Analysis Reports.

The Rocky Flats Plant has adopted an advanced approach to Safety Analysis Reviews. Instead of calculating a single dose commitment based on a postulated "worst-case meteorology," a complete probability distribution is developed. The distribution includes the entire range of meteorological conditions, from worst case, through most probable, to "best case" as developed from a large meteorological data base. Figure 8 illustrates this

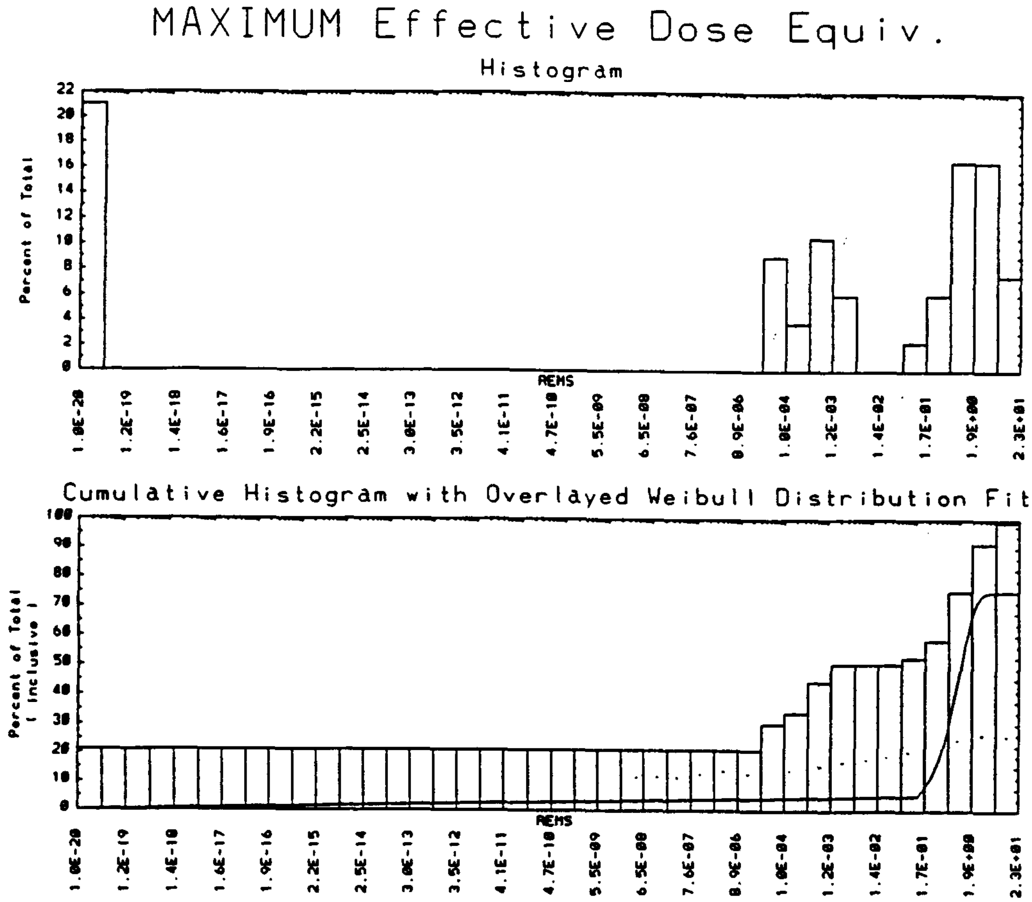

Figure 8. Histogram Summarizing Results of a TRAC Risk Assessment Run Using a Simulated Source Scenario

approach with an example probability histogram from a TRAC model run. The probability curve is combined with fault-tree statistics to provide a fully realistic evaluation of total risk.

An Emergency Response version of the TRAC model has been fully implemented in the Rocky Flats Emergency Operations Center. Operating on a dedicated MicroVAX computer system, the model automatically receives and analyzes real-time meteorological data from a network of 23 onsite and offsite observing stations. The data are automatically entered as initialization for the model, which produces plume path, concentration, and dose estimates. The model displays color graphics outputs on multiple screens for use by dispersion analysts and crisis management. The model operates continuously in "standby" mode, producing a new set of displays at approximately one-half hour intervals around the clock. Figure 9 is an example from an operational model run, illustrating projected impact areas for a simulated release.

The Emergency Response version of TRAC has been continuously operational since July 1988, and has produced more than 15,000 automatic plume projections.

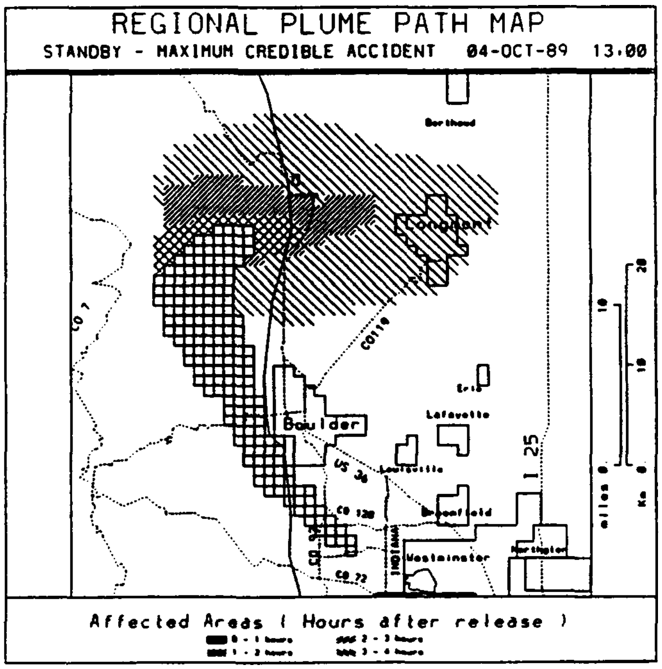

Figure 9. Regional Plume Path Map Produced by the TRAC Model Running in Standby Mode for Emergency Response

A special version of the model has been implemented for treating long-term, operational releases of hazardous materials from the Rocky Flats Plant. This version was developed to support a June 28, 1989 Agreement in Principle between the Governor of Colorado and the Secretary of Energy[16]. This latest version of the model simulates a continuous release of a hazardous substance throughout a year. The model analyzes flow patterns and changes puff trajectories at 15-minute intervals (more than 35,000 times during the year), then develops contour maps of annual average concentration and health effects. Figure 10 shows an example analysis of excess cancer incidence due to operational carbon tetrachloride releases.

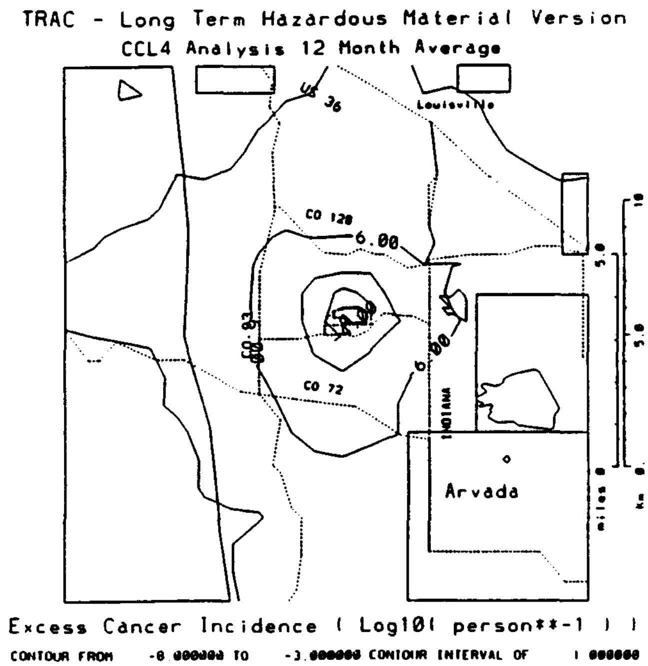

Figure 10. Example of Analysis of Excess Cancer Incidences

4.3.2 Intra- and Inter-Departmental Application

Though originally developed for site-specific use, TRAC's theory can be directly applied to other facilities. The modular format allows easy modification so that the model can be customized for any location. Though most powerful in areas with complex airflow patterns, TRAC's upgraded dispersion and deposition technology can also improve modeling capabilities at simpler sites.

Fourteen government facilities have asked to evaluate or use TRAC in upgrading their modeling capabilities. These include five National Laboratories, three DOE operational facilities, a National Oceanic and Atmospheric Administration Research Laboratory, the EPA, the Bureau of Reclamation, and three state and local agencies. The Australian Nuclear Science and Technology Organization is also evaluating the capability for application to emergency response needs.

5.0 DEVELOPMENT PROGRAM

The Rocky Flats Plant has designed a comprehensive program which will continue implementation of the TRAC model for risk assessment, emergency response, hazardous material assessment, and regulatory analysis. The program will accelerate the final (and most resource-intensive) portions of the development/installation cycle. The plans are projected and will depend on availability of plantsite and special-purpose monies.

Three major program elements comprise the plan:

- Model Development,
- Model Evaluation, and
- Model Application.

Table 1 presents a task-by-task breakdown of the three program elements.

TASK LISTING

I. MODEL DEVELOPMENT

I.1 Implement Real-time Upper Air Capability
I.2 Develop Prototype Wind Profiler with NOAA
I.3 Implement Alert Mode
I.4 Upgrade Computer System
I.5 Upgrade User Interface
I.6 Implement Real-time Plume Projections for State of Colorado
I.7 Evaluate Building Effects Module
I.8 Upgrade Statistics Module
I.9 Incorporate Multiple Point Sources/Area Sources
I.10 Incorporate Heavy Gas Dispersion
I.11 Incorporate Chemical Transformations
I.12 Incorporate Resuspension Source Term
I.13 Develop Computer Aided Training Program
I.14 Implement Statistical Forecasting Capability
I.15 Incorporate Explosion Dispersion
I.16 Implement Real-time HAZMAT Model
I.17 Evaluate Mixing Depth Reflection
I.18 Upgrade Near-source Resolution (Nesting)
I.19 Upgrade Windfield Code
I.20 Implement Default Source Term Data Base
I.21 Implement ARAC Interface
I.22 Upgrade Graphics
I.23 Upgrade Precipitation Monitoring/Modeling Capability
I.24 Upgrade Computer System
I.25 Implement Numerical Forecasting Capability

Table 1. Task-by-Task Breakdown of the Three Program Elements

TASK LISTING

II. MODEL EVALUATION

II.1 Complete Analysis of Summer 1987 Validation Study
II.2 Publish Theory in Peer-reviewed Journal
II.3 Document Model
II.4 Develop EPA Validation Protocol
II.5 Conduct EPA Approval Process
II.6 Conduct Winter 1990 Validation Scoping Study
II.7 Develop Historical Meteorological Data Base
II.8 Benchmark Against EPA Model
II.9 Conduct Winter 1991 Full Field Validation
II.10 Validate Against ASCOT Data Base
II.11 Validate Against MATS Data Base
II.12 Complete Sensitivity Analysis
II.13 Benchmark Against CRAC2 Model
II.14 Benchmark Against MATHEW/ADPIC Model
II.15 Validate Against Long-term Data Base

III. MODEL APPLICATION

III.1 Operate/Maintain Emergency Response Capability
III.2 Operate/Maintain Risk Assessment Version
III.3 Conduct Health Affects Study of Hazardous Materials
III.4 Conduct Monitor Siting Study
III.5 Evaluate Maximum Credible Accident
III.6 Conduct Monthly Analyses of Operational Releases
III.7 Respond to Requests for Support/Studies
III.8 Operate/Maintain Regulatory Analysis Version
III.9 Operate/Maintain Real-time HAZMAT Version
III.10 Conduct Emergency Response Hazards Analyses
III.11 Conduct Analysis of Climatological Wind Patterns

Table 1.(con't) Task-by-Task Breakdown of the Three Program Elements

5.1 Model Development

The development phase of the TRAC model program is designed to provide all capabilities necessary for risk assessment, emergency response, and regulatory analysis applications. Twenty-five tasks have been identified which complete the basic modeling package, incorporate user requests for additional capabilities, and respond to recommendations made by the Interagency Review Committee. Figures 11-15 present time/task diagrams for the development phase of the program. Tables 2-6 present a summary of effort and funding requirements for this area. The following sections discuss each task individually.

Task I.1 Implement Real-time Upper Air Capability

Sensitivity studies of the TRAC model have shown that continuous, real-time information about upper atmospheric winds and stability conditions are critical to accurate performance of the model. We will implement a real-time upper air capability in two stages. First, we will obtain a real-time telephone link to an upper air profiling capability operated by the National Oceanic and Atmospheric Administration's (NOAA's) Wave Propagation Laboratory. The upper air profilers, located at Denver's Stapleton Airport and Platteville, Colorado will provide continuous upper air data representative of the study region. The data will be automatically input into the Emergency Response version of the TRAC model, analyzed to produce needed model inputs, and injected directly into model runs. In the second phase of this task, we will install and operate an acoustic sounding capability (SODAR) at the Rocky Flats plantsite. Continuous data from this system will also be automatically input into the Emergency Response version of the TRAC model.

Task I.2 Develop Prototype Wind Profiler with NOAA

NOAA's Wave Propagation Laboratory has completed conceptual design of a wind profiling system targeted for air pollution modeling. The profiler will provide continuous, accurate monitoring of wind and temperature profiles in the first few thousand meters above ground level. In this task we will conduct a joint DOE-NOAA project to complete design and implementation of a prototype wind profiling unit, to be sited at the Rocky Flats Plant. Data from the prototype will be automatically telemetered to the TRAC model as a supplement to the upper air monitoring capability developed in Task I.1. Once testing is completed, the technology developed as part of this task will be made

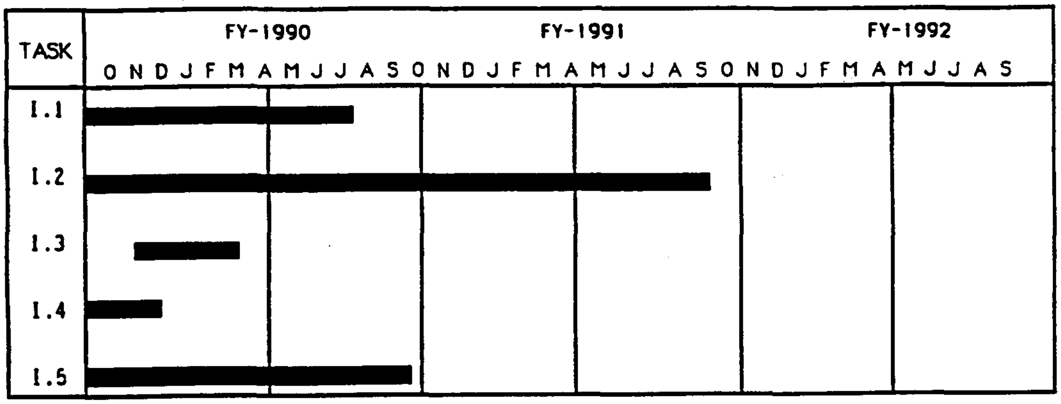

Figure 11. Time/Task Diagram for Tasks I.1-I.5

	TASKS	LOE PER-MOS	LABOR $ K	SVCS $ K	CAPITAL $ K	TTL $ K
I.1	Implement Real-time Upper Air Capability	4	21		110	131
I.2	Prototype Wind Profiler	6	31	800		831
I.3	Implement Alert Mode	1	5			5
I.4	Upgrade Computer System	1	5		80	85
I.5	Upgrade User Interface	6	31			31

Table 2. Summary of Effort and Funding Requirements for Tasks I.1-I.5

available to other DOE sites and the modeling/monitoring community.

Task I.3 Implement Alert Mode

The Model Development Team will complete implementation of an alert mode for the Emergency Response version of the TRAC model, operating in the Rocky Flats EOC. This task will provide automatic archival and hardcopy of selected model outputs and configure the system for rapid updates in the event of an emergency.

Task I.4 Upgrade Computer System

Task I.4 will upgrade the existing MicroVAX Computer System to a MicroVAX 3100 system, increasing the speed and reliability of the Emergency Response version of TRAC. CPU speed will be increased by approximately a factor of six in this upgrade, ensuring model runs within 15 minutes under all conditions.

Task I.5 Upgrade User Interface

The user interface for the Emergency Response version of the TRAC model will be upgraded in response to testing, upgraded model features, and user requests.

Task I.6 Implement Real-time Plume Projections for State of Colorado

In Task I.6, the Model Development Team will create and implement the software needed to drive selected real-time displays at the State of Colorado Emergency Operations Center. The Team will obtain and install the necessary communications and hardware links to provide real-time color graphics for this application.

Task I.7 Evaluate Building Effects Module

The TRAC model includes a complex building effects module. The Interagency Review Committee has requested that Rocky Flats evaluate the justification for including building effects in an applied dispersion model. The evaluation will be performed under Task I.7 and a formal report prepared. The model will be modified as necessary to incorporate the results of the evaluation.

Task I.8 Upgrade Statistics Module

The Risk Assessment version of the TRAC model statistically evaluates a selected source scenario over numerous meteorological situations. The results are analyzed and summarized. Task I.8 will upgrade the existing statistical capability, and provide

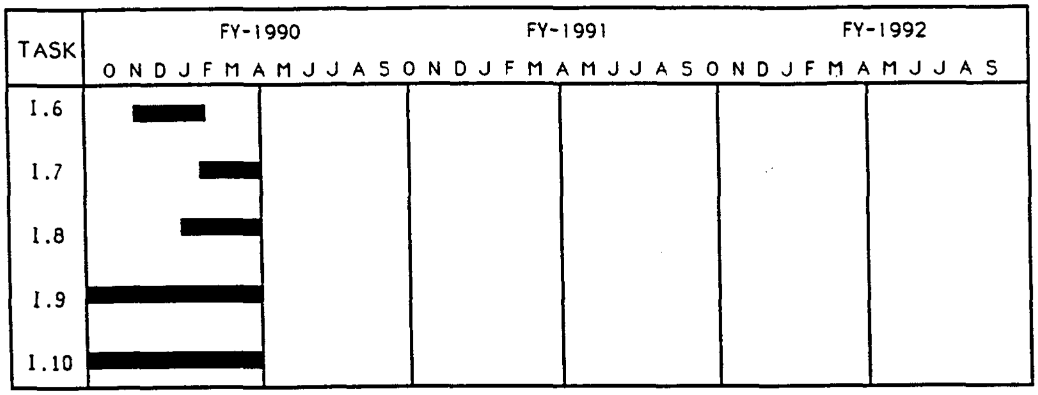

Figure 12. Time/Task Diagram for Tasks I.6-I.10

TASKS		LOE PER-MOS	LABOR $ K	SVCS $ K	CAPITAL $ K	TTL $ K
I.6	Real-time Projections for State	1	5		20	25
I.7	Evaluate Building Effects	1	5			5
I.8	Upgrade Statistics Module	1	5			5
I.9	Multiple Point/Area Sources	2	10			10
I.10	Heavy Gas Dispersion	6	31			31

Table 3. Summary of Effort and Funding Requirements for Tasks I.6-I.10

better definition of output distribution types.

Task I.9 Incorporate Multiple Point Sources/Area Sources

The Model Development Team will design, implement, test, and operate upgrades for the TRAC model to allow treatment of multiple point sources and area/volume sources in model runs. The capability will be used primarily in the Regulatory Compliance and Hazardous Materials versions of the model.

Task I.10 Incorporate Heavy Gas Dispersion

Many facilities have a potential for releases of heavier-than-air gases. Such clouds transport and disperse differently from neutral or buoyant gases. Task I.10 will develop a heavy gas dispersion module for the TRAC model. The code will be based on research recently conducted by Lawrence Livermore National Laboratories, the Oak Ridge National Laboratory, and the Nevada Test Site Heavy Gas Test Facility.

Task I.11 Incorporate Chemical Transformations

Modeling of hazardous and toxic chemical releases will require treatment of substances, such as nitric acid and sulfuric acid, which transform chemically during transport in the atmosphere. Task I.11 will identify algorithms that have been developed for modeling such transformations and incorporate them as appropriate in the TRAC model. The open literature, research results from DOE laboratories, and other nonproprietary treatments will be utilized wherever possible.

Task I.12 Incorporate Resuspension Source Term

Wind-generated resuspension from contaminated soils dominates operational releases of plutonium from the Rocky Flats Plant. In Task I.12, we will develop a resuspension source-term module for the TRAC model. This module will utilize resuspension emission factor equations to estimate variable emission rates as functions of wind speed, stability, precipitation, and ground cover. The module will be incorporated in the Risk Assessment and Regulatory Compliance versions of the model.

Task I.13 Develop Computer Aided Training Program

The Model Development Team will design, develop, and implement a computer aided instruction (CAI) program for training users of the TRAC model. The training will focus on preparation of input data and operation of the user interface.

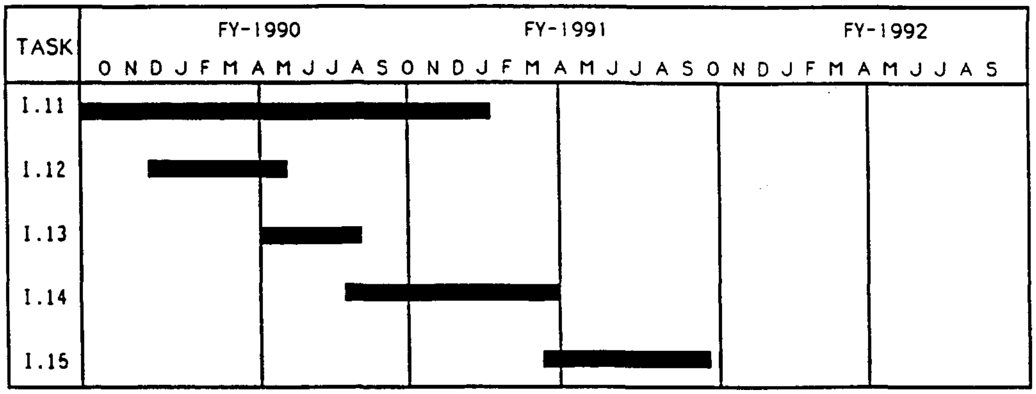

Figure 13. Time/Task Diagram for Tasks I.11-I.15

TASKS	LOE PER-MOS	LABOR $ K	SVCS $ K	CAPITAL $ K	TTL $ K
I.11 Chemical Transformations	12	62			62
I.12 Resuspension Source Term	2	10			10
I.13 Computer Aided Training	2	10		10	20
I.14 Statistical Forecasting Capability	2	10			10
I.15 Explosion Dispersion	3	16			16

Table 4. Summary of Effort and Funding Requirements for Tasks I.11-I.15

Task I.14 Implement Statistical Forecasting Capability

The TRAC model currently assumes persistence in meteorological fields in making real-time predictions for emergency response. Task I.14 will upgrade this forecasting approach on an interim basis. We will compare existing conditions to those at similar times of day and season for several past years. The model will select the historical conditions most similar to those in the real-time event. The model will then use the historical case as a predictor for the real-time situation. This task will implement the correlation algorithm and the associated historical data base.

Task I.15 Incorporate Explosion Dispersion

Many facilities have a potential for releasing explosions into the atmosphere. Such clouds transport and disperse differently from other release scenarios. Task I.15 will develop an explosion dispersion module for the TRAC model, based on the results of research recently conducted by Sandia National Laboratories and other research groups.

Task I.16 Implement Real-time HAZMAT Model

Task I.16 will produce a real-time Hazardous Material version of the TRAC model, operating in parallel with the Emergency Response version. The model will input usage/emissions information concerning nonradioactive hazardous materials at the facility and continuously produce displays of concentration, deposition, and health impacts. This capability will be used to supplement ambient monitoring of these hazardous materials in our overall environmental protection program.

Task I.17 Evaluate Mixing Depth Reflection

The Interagency Review Committee has requested that Rocky Flats compare the TRAC model's treatment of mixing depth reflection against other approaches. This comparison will be conducted under Task I.17 and a formal report prepared. The model will be modified as necessary to incorporate the results of the evaluation.

Task I.18 Upgrade Near-source Resolution

The Interagency Review Committee has recommended that TRAC's resolution of near-source dose and deposition patterns be improved. Task I.18 will develop a nested grid capability to meet this request.

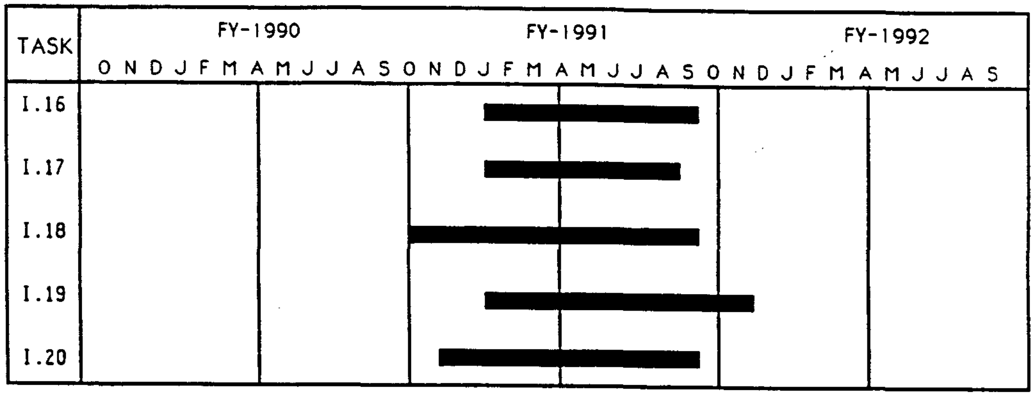

Figure 14. Time/Task Diagram for Tasks I.16-I.20

TASKS	LOE PER-MOS	LABOR $ K	SVCS $ K	CAPITAL $ K	TTL $ K
I.16 Real-time HAZMAT Model	4	21		40	61
I.17 Mixing Depth Reflection	3	16			16
I.18 Near Source Resolution	5	26			26
I.19 Upgrade Windfield Code	5	26			26
I.20 Default Source Terms	9	47			47

Table 5. Summary of Effort and Funding Requirements for Tasks I.16-I.20

Task I.19 Upgrade Windfield Code

Task I.19 will upgrade the existing windfield generation module in TRAC to include recent advances in modeling technology. A more rigorous approach to windfields and improved run-time efficiency will result.

Task I.20 Implement Default Source Term Data Base

Little will be known about actual release amounts during the first few minutes to hours of an emergency. Task I.20 will develop a data base of default source terms to be used in model analyses until observed or monitored source information becomes available. Based on Safety Analysis Reports, the data base will develop worst-case information for a variety of scenarios at all major buildings on the plantsite. The data base will be quickly accessible through the user interface in the Emergency Response version of the TRAC model.

Task I.21 Implement ARAC Interface

The ARAC modeling capability, operated from the Lawrence Livermore National Laboratories, will act as a complement to the TRAC system in our overall Emergency Response capability. In Task I.21, the Model Development Team will work with Lawrence Livermore personnel to develop a real-time interface for transmission of regional meteorological information to the ARAC Center at Livermore, California.

Task I.22 Upgrade Graphics

The existing graphics capability utilized in the TRAC model is based upon the National Center for Atmospheric Research's (NCAR's) graphics package. In Task I.22, the Model Development Team will review other graphics options now available (including Geographic Information System), design a new graphics system as appropriate, and implement the capability.

Task I.23 Upgrade Precipitation Monitoring/Modeling Capability

Sensitivity analyses of the TRAC model have shown that precipitation washout of particulate and gaseous plumes can dominate environmental and health effects from a release. Task I.23 will upgrade our current ability to monitor and simulate the effects of precipitation. We will implement a capability for obtaining digital radar data now being developed by the National Weather Service.

Task I.24 Upgrade Computer System

The computer system, installed in Task I.4, will be retired and replaced with upgraded hardware. This task is planned in response to the rapid advances being observed in the computer hardware industry.

Task I.25 Implement Numerical Forecasting Capability

Accurate predictions of changing wind and turbulence fields is critical to projection of plumes beyond 1-2 hours at the Rocky Flats Plant. Task I.25 will implement a mesoscale numerical forecasting capability from among those being developed at Los Alamos National Laboratories, Colorado State University, and other facilities. This task will take advantage of the upgraded computer system implemented in Task I.24 to ensure run time efficiency.

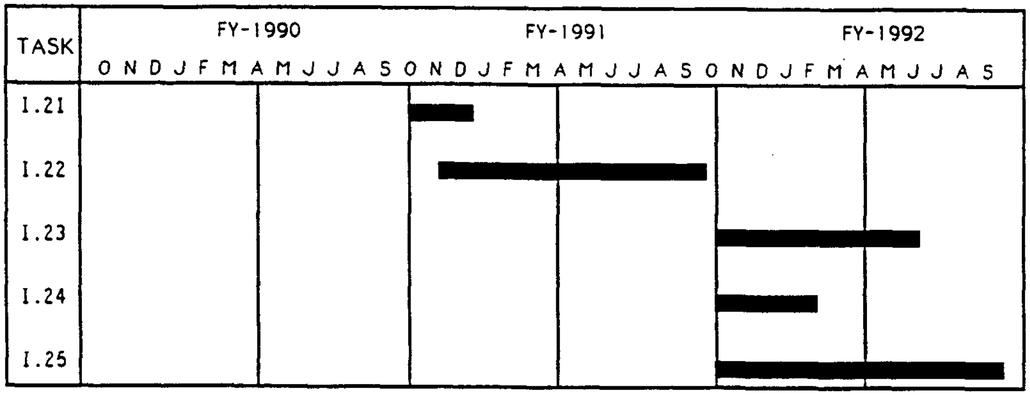

Figure 15. Time/Task Diagram for Tasks I.21-I.25

TASKS	LOE PER-MOS	LABOR $ K	SVCS $ K	CAPITAL $ K	TTL $ K
I.21 Implement ARAC Interface	1	5			5
I.22 Upgrade Graphics	4	21		10	31
I.23 Precipitation Monitoring/Modeling	4	21		20	41
I.24 Upgrade Computer System	2	10		80	90
I.25 Numerical Forecasting Capability	12	62			62

Table 6. Summary of Effort and Funding Requirements for Tasks I.21-I.25

5.2 Model Evaluation

The evaluation phase of the program will establish the accuracy of the TRAC model under both site-specific and general conditions. Fifteen tasks have been identified which verify the code, validate the model against tracer experiments, compare TRAC to standard dispersion models, publish the model theory under peer review, and fully document the model.

Figures 16-18 present task/time diagrams for the evaluation phase of the program. Tables 7-9 present a summary of effort and funding requirements for this area. The following sections discuss each task individually.

Task II.1 Complete Analysis of Summer 1987 Validation Study

A series of field tracer experiments was performed at Rocky Flats during the Summer of 1987. Task II.1 will complete the comparison of the TRAC model against the tracer data. The TRAC model will be run for the atmospheric conditions of the tracer tests. Model outputs will be paired against tracer observations. These paired data sets will be statistically evaluated to quantify the accuracy and precision of the TRAC model.

Task II.2 Publish Theory in Peer-reviewed Journal

The theoretical basis of TRAC will be reviewed through formal publication. This peer review process will allow a full evaluation of the model theory by the international atmospheric modeling community. In Task II.2, meteorological and dispersion theory will be published in the Journal of Applied Meteorology. The schedule for this task terminates with submittal of a manuscript to the journal.

Task II.3 Document Model

The Model Development Team will fully document the TRAC model in a series of 13 major documentation modules. Using a desktop publishing system, the modules will be combined to form users guides, technical reference guides, and hardware/software specifications for the code. The documents will target a wide range of audiences.

Task II.4 Develop EPA Validation Protocol

The EPA Model Approval Process requires a detailed statistical validation protocol. In Task II.4, the Model Development Team will prepare a protocol to cover all phases of our validation program. The protocol will establish the field tests to be conducted, the statistical measures to be applied, and the criteria for approval or

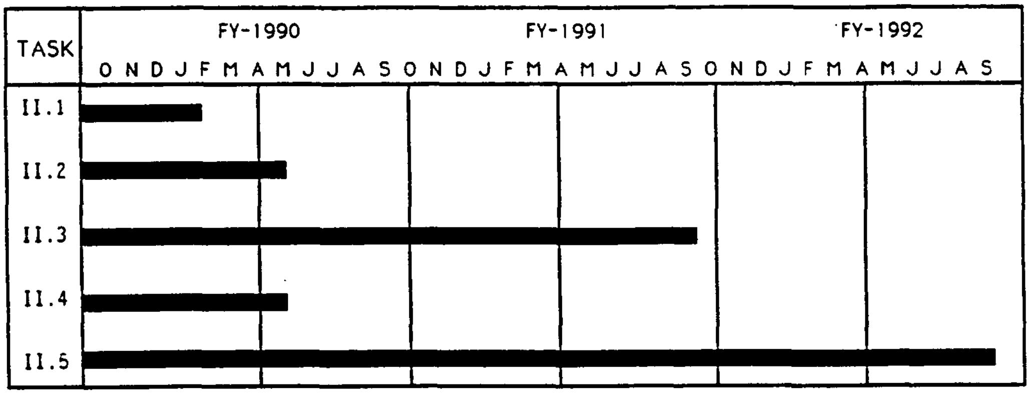

Figure 16. Time/Task Diagram for Tasks II.1-II.5

TASKS	LOE PER-MOS	LABOR $ K	SVCS $ K	CAPITAL $ K	TTL $ K
II.1 Summer 1987 Validation	3	16			16
II.2 Publish Theory	4	21			21
II.3 Document Model	40	208		24	232
II.4 EPA Validation Protocol	3	16			16
II.5 EPA Approval Process	6	31			31

Table 7. Summary of Effort and Funding Requirements for Tasks II.1-II.5

disapproval of the TRAC model for Regulatory Compliance use.

Task II.5 Conduct EPA Approval Process

The Model Development Team will work closely with EPA to ensure that all model-approved requirements are fully met. The team will provide information, interpret data, and conduct additional analyses as requested by EPA. This task includes all the necessary presentations and reporting that will be identified during the extended approval process.

Task II.6 Conduct Winter 1990 Validation Scoping Study

This task will provide critical background information for use in planning the major validation field study described in Task II.9. Approximately six tests will be conducted, with tracer releases from Rocky Flats during daytime and nighttime conditions. A limited number of tests will involve releases from downtown Denver to assist in characterization of the Denver Brown Cloud. Both airborne and mobile ground-based sampling of the plume will be conducted. This study will establish typical plume transport patterns and monitoring needs for a winter tracer study along the Front Range of Colorado. The results will be used in final planning for the major, full-scale validation study.

Task II.7 Develop Historical Meteorological Data Base

A large amount of raw archived meteorological data exists for the Denver Metropolitan area. These data will be obtained, decoded, quality assured, and compiled into a comprehensive data base. The data will be utilized for historical health effect studies at the Rocky Flats Plant and made available to the scientific community.

Task II.8 Benchmark Against EPA Model

We anticipate that the TRAC model will produce results significantly different from existing dispersion models. The Interagency Review Committee has requested that TRAC be systematically compared to other codes and any differences quantified.

In Task II.8 TRAC will be benchmarked against an EPA standard dispersion model. The two models will be run using identical input data sets. Differences in intermediate and final outputs will be identified and evaluated.

Task II.9 Conduct Winter 1991 Full Field Validation

Task II.9 will quantify the accuracy and precision of the TRAC dispersion model under wintertime conditions at the Rocky Flats Plant. This will be accomplished by releasing

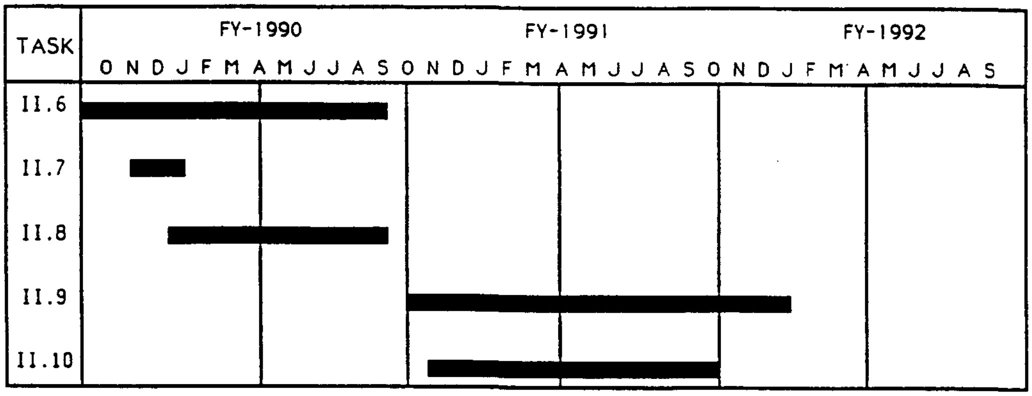

Figure 17. Time/Task Diagram for Tasks II.6-II.10

TASKS	LOE PER-MOS	LABOR $ K	SVCS $ K	CAPITAL $ K	TTL $ K
II.6 1990 Validation Scoping	**5**	**26**	**150**		**176**
II.7 Historical Meteorological Data Base	**1**	**5**			**5**
II.8 Benchmark EPA Model	**5**	**26**			**26**
II.9 Full Field Validation	**12**	**62**	**520**		**582**
II.10 Validate Against ASCOT	**5**	**26**			**26**

Table 8. Summary of Effort and Funding Requirements for Tasks II.6-II.10

controlled amounts of an identifiable, inert tracer substance. The path and dispersion of the tracer plume will be monitored by an extensive array of ground samplers. This network will be supplemented by real-time, mobile sampling in ground vehicles and aircraft. The resulting plume measurements will be compared to TRAC model predictions to establish the code's performance. Twelve tests are planned over a four-week period. The tests will be designed to meet DOE and EPA requirements for model validation.

Task II.10 Validate Against ASCOT Data Base

The Interagency Review Committee has recommended that the TRAC model be validated against existing data sets from across the country. Such comparisons will more generally test TRAC's validity while avoiding the costs of collecting additional tracer data. These comparisons will also establish TRAC's applicability to sites other than Rocky Flats.

Task II.10 will validate the TRAC model against the ASCOT tracer data base. Developed by the Lawrence Livermore National Laboratories, the ASCOT set represents dispersion under complex terrain conditions in California and western Colorado.

Task II.11 Validate Against MATS Data Base

Task II.11 will validate TRAC against the MATS data base developed at the Savannah River Laboratory. This data set is becoming a benchmark within DOE; many existing models have been tested against it.

Task II.12 Complete Sensitivity Analysis

The TRAC Sensitivity Analysis will establish the model's overall uncertainty. The task will also determine TRAC's sensitivity to variations in input information and ranking modules by their importance to final results. We will use this information to optimize model run time and establish accuracy requirements for input data.

Task II.12 will complete evaluation of the model's sensitivity to meteorological inputs (a task begun in FY-1987). We will then conduct additional statistical tests to determine the model's sensitivity to variations in source information. The overall uncertainty of the model will be established (placing "error bars" on the final results). Internal modules will be evaluated and ranked by importance.

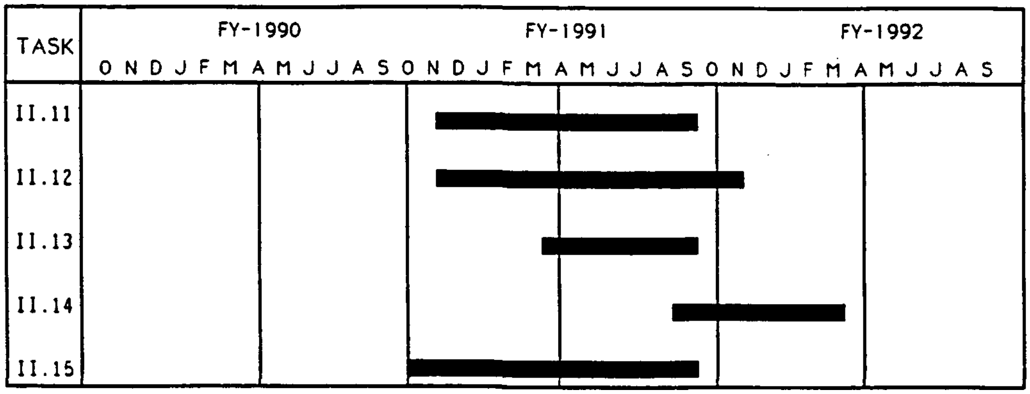

Figure 18. Time/Task Diagram for Tasks II.11-II.15

TASKS	LOE PER-MOS	LABOR $ K	SVCS $ K	CAPITAL $ K	TTL $ K
II.11 Validate Against MATS	5	26			26
II.12 Complete Sensitivity Analysis	6	31	85		116
II.13 Benchmark Against CRAC2 Model	4	21			21
II.14 Benchmark MATHEW/ADPIC Model	4	21			21
II.15 Validate Long-term Data Base	6	31			31

Table 9. Summary of Effort and Funding Requirements for Tasks II.11-II.15

Task II.13 Benchmark Against CRAC2 Model

Task II.13 will compare TRAC to Sandia National Laboratory's CRAC2 code, a DOE standard for risk assessment. The two models will be run using identical input data sets. Differences in intermediate and final outputs will be identified and evaluated.

Task II.14 Benchmark Against MATHEW/ADPIC Model

A benchmark analysis similar to Task II.13 will be conducted. In this task TRAC will be compared to MATHEW/ADPIC, DOE's central capability for Emergency Response modeling. The two models will be run using identical input data sets. Differences in intermediate and final outputs will be identified and evaluated.

Task II.15 Validate Against Long-term Data Base

Task II.15 will validate the TRAC model against a long-term air quality data base to be provided by the EPA. The analysis will evaluate TRAC's ability to accurately predict impacts from extended, operational releases.

5.3 Model Application

The Rocky Flats Plant has accelerated installation of the TRAC model for Risk Assessment, Emergency Response, and Hazardous Materials applications. Our focus is shifting toward application of the capability to meet Rocky Flats Plant and DOE needs. Figures 19 and 20 present task/time diagrams for application of the TRAC model. Tables 10-11 present a summary of effort and funding requirements for this area. Application tasks are discussed below.

Task III.1 Operate/Maintain Emergency Response Capability

The Rocky Flats Plant will operate and maintain the Emergency Response version of TRAC. The necessary day-to-day operational, quality assurance, and maintenance tasks associated with a critical emergency response product will be conducted. The capability will be utilized as appropriate in tests, exercises, and responses. All appropriate training for developers, users, technicians, and crisis managers will be performed.

Task III.2 Operate/Maintain Risk Assessment Version

The Rocky Flats Plant will operate and maintain the Risk Assessment version of the TRAC model. All necessary maintenance and quality

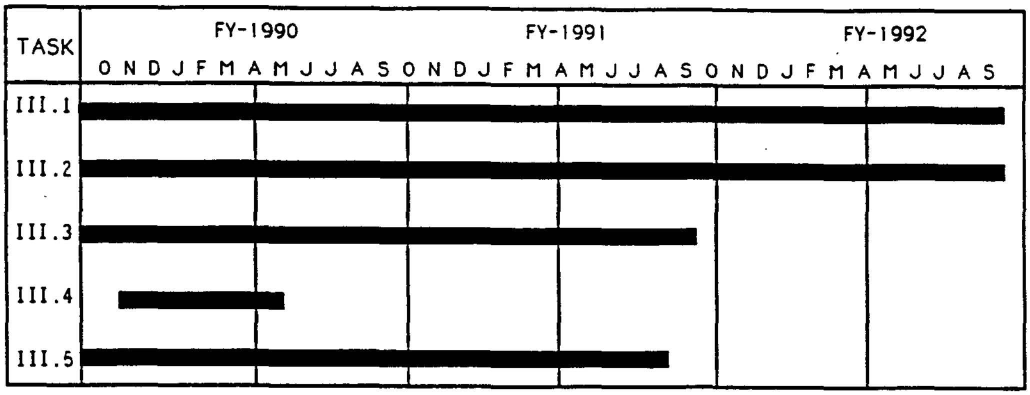

Figure 19. Time/Task Diagram for Tasks III.1-III.5

TASKS	LOE PER-MOS	LABOR $ K	SVCS $ K	CAPITAL $ K	TTL $ K
III.1 Emergency Response Capability	18	94	50		144
III.2 Risk Assessment Version	12	62			62
III.3 Hazardous Materials	12	62			62
III.4 Monitor Siting Study	3	16			16
III.5 Maximum Credible Accident	4	21			21

Table 10. Summary of Effort and Funding Requirements for Tasks III.1-III.5

assurance activities will be conducted. The software will be customized on an ongoing basis as requested by users. Operational and training support will be provided as appropriate. The Model Development Team will also provide support to users for interpretation of model results.

Task III.3 Conduct Health Effects Study of Hazardous Materials

The TRAC Model Development Team will apply the TRAC model in a study of the health effects from operational releases of hazardous materials at the Rocky Flats Plant. This study will be conducted in support of the June 28, 1989 Agreement in Principle between the State of Colorado and the Department of Emergency concerning environmental protection at the Rocky Flats Plant. The Project Team, working with EPA and the Colorado Department of Health, will select hazardous substances of interest, compile long-term, operational emissions data bases, and compile meteorological data bases. The patterns and extent of long-term environmental and health impacts (e.g., excess cancer incidences) will result from this study.

Task III.4 Conduct Monitor Siting Study

In Task III.4, the Rocky Flats Plant will use the TRAC model in an ambient air quality monitoring network design study. This study will be conducted jointly with the EPA and the Colorado Department of Health to determine the optimum locations for monitoring operational releases of radionuclides and hazardous materials from the Rocky Flats Plant.

Task III.5 Evaluate Maximum Credible Accident

The Model Development Team will work with other Rocky Flats Plant groups to conduct a review and revision of the Plant's Maximum Credible Accident Analysis. The Maximum Credible Accident is the emergency upon which the design for emergency planning (such as emergency planning zones) is based. Once the source scenario for the revised Maximum Credible Accident is established, the Model Development Team will estimate impacts on the environment and public health. These model results will be used for establishing public protection needs in emergency response.

Task III.6 Conduct Monthly Analyses of Operational Releases

The Rocky Flats Plant will analyze operational releases of hazardous and radioactive substances from the Rocky Flats Plant on a monthly basis. This ongoing project

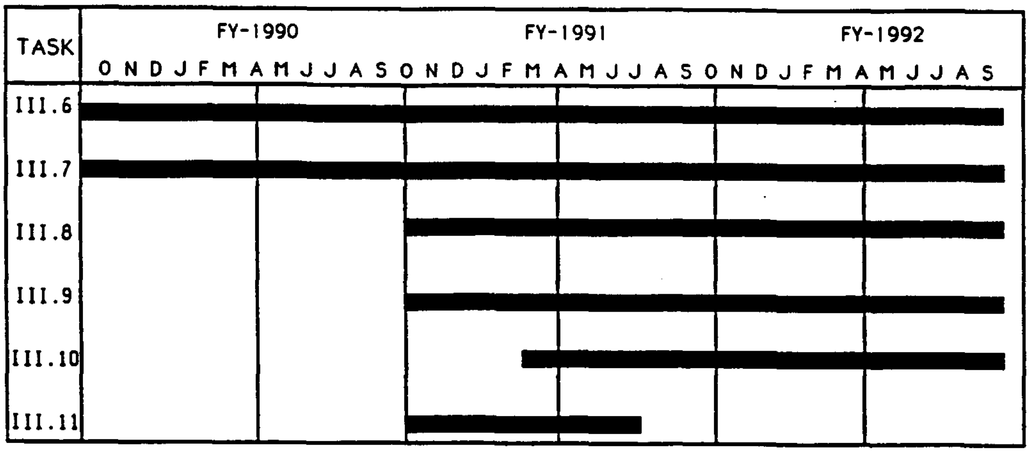

Figure 20. Time/Task Diagram for Tasks III.6-III.11

TASKS	LOE PER-MOS	LABOR $ K	SVCS $ K	CAPITAL $ K	TTL $ K
III.6 Monthly Analyses of Operational Releases	8	42			42
III.7 Support/Studies	72	374			374
III.8 Regulatory Analysis Version	8	42			42
III.9 Real-time HAZMAT Version	8	42			42
III.10 Hazards Analyses	6	31			31
III.11 Climatological Wind Patterns	6	31			31

Table 11. Summary of Effort and Funding Requirements for Tasks III.6-III.11

will support the June 28, 1989 Agreement in Principle between the State of Colorado and the Department of Energy. The analyses will produce contour maps of concentration and health effects to be used as a supplement to ambient air monitoring.

Task III.7 Respond to Request for Support/Studies

The Model Development Team will respond to internal, DOE, and external requests for support and studies appropriate to the Rocky Flats Plant.

Task III.8 Operate/Maintain Regulatory Analysis Version

Once developed, the Regulatory Analysis version of the TRAC model will be applied to a variety of plantsite needs. These will include demonstration of compliance with 40 CFR 61 Clean Air Act regulations, development of Environmental Analyses, and development of Environmental Impact Statements. The hardware and software associated with operating this version of the model will be maintained, quality assured, and customized as necessary to meet user requirements. The Model Development Team will provide appropriate user training.

Task III.9 Operate/Maintain Real-time HAZMAT Version

The real-time hazardous materials version of the TRAC model, implemented under Task I.16, will be maintained and operated. Necessary maintenance and quality assurance functions will be performed on an ongoing basis. The capability will be customized as necessary to meet user needs. Support will be provided to users for training and interpretation of model results.

Task III.10 Conduct Emergency Response Hazards Analyses

The Rocky Flats Plant will conduct an extensive series of hazards analyses as the basis for improved emergency preparedness at the facility. The TRAC model will be used to estimate environmental and public health impacts from accident scenarios developed as part of the study. This study will involve several hundreds or thousands of individual model runs.

Task III.11 Conduct Analysis of Climatological Wind Patterns

The TRAC Development Team will analyze wind patterns at Rocky Flats and along the Front Range of Colorado to determine a detailed climatology of such patterns. More than 175,000 wind patterns will be analyzed and categorized as part of this project.

6.0 PROGRAM

Completion of the program described above will require substantial effort in several technical areas. A multi-disciplinary technical team will be assembled and dedicated to the program. Figure 21 presents the organization of the TRAC Model Development Team for FY-1990 tasks. The structure shown has been specifically designed to meet the needs of the FY-1990 program. The structure is dynamic and will be reviewed and modified as necessary for FY-1991 and FY-1992 efforts.

6.1 Technical Functions

Ten technical functions have been established for the FY-1990 program. These functions represent areas of expertise rather than specific staff positions. A team approach is being applied to each function; most tasks will be performed by staff members working together. The following sections summarize the TRAC program technical functions.

6.1.1 Management

The program management function will have overall responsibility for design of the TRAC development program, establishment of goals, and schedule development. This position will manage the day-to-day activities of the technical staff and provide technical support as appropriate.

The management function will also have overall responsibility for financial, human resource, and logistical management of the TRAC program. This position will track the program's budget and ensure that training, facilities planning, and other personnel support is provided.

6.1.2 TRAC Software Development

The software development function will provide systems design and programming support for the development, evaluation, and implementation of TRAC. The function will modify, optimize, and verify existing software and develop new software for the model. This function will also analyze, quality assure, and reformat archival meteorological and other data.

6.1.3 Computer Graphics

The graphics programming function will design, develop, and install an upgraded color graphics capability for the TRAC model. The function will create a series of graphical displays and hardcopy outputs for all modeling applications. Graphical products will include base maps, plume trajectory maps, affected area maps, and dose contour maps.

6.1.4 Real-time Data Acquisition

The real-time data acquisition programming function will upgrade and modify the real-time meteorological data acquisition system for the TRAC model. The function will create software to acquire, decode, analyze, and communicate data from multiple telemetry streams.

6.1.5 Computer Data Entry

The computer data entry function will provide data transcription and computer data entry support for the program. The function will transcribe meteorological and other scientific data from strip charts to worksheets. The function will also enter data from worksheets to computer files, and conduct extensive quality control checks.

6.1.6 Health Effects

The health effects function will develop, evaluate, and implement health effects theory for the TRAC model. The position will review and adapt existing theory from the published literature, review and utilize recent research results from other groups, and develop new technology as necessary.

6.1.7 Dispersion Meteorology

The dispersion meteorology function will develop, evaluate, and implement dispersion meteorology theory for the TRAC model. The position will review and adapt existing theory from the published literature, review and utilize recent research results from other groups, and develop new technology as necessary. The position will support other team members in application of meteorological approaches.

6.1.8 Statistics

The statistical function will coordinate validation of the TRAC model and other codes against tracer data bases. This will include the development of statistical protocols, coordination of onsite tracer studies, compilation of validation data bases, and comparison of TRAC and other models against the data bases.

6.1.9 User Interface

The user interface function will design, develop, and implement upgraded user interface capabilities for all versions of the TRAC model. The function will create the software necessary to ensure user-friendly input sequences for all model users.

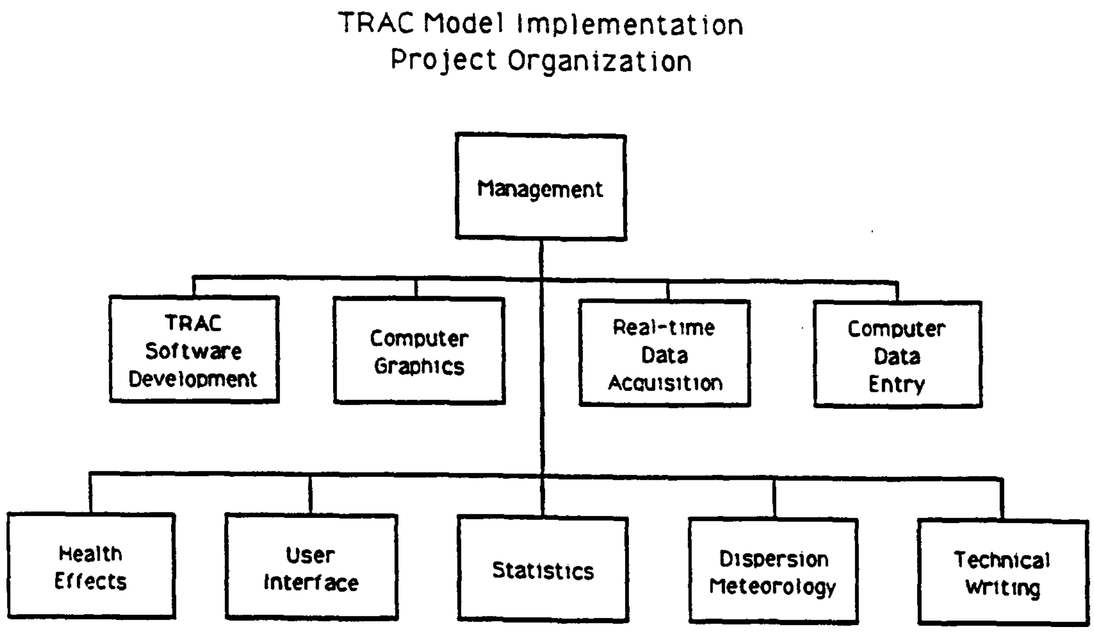

Figure 21. Organization of the TRAC Model Development Team for the FY-1990 Tasks

6.1.10 Technical Writing

The technical writing function will provide professional writing and editing support for the TRAC model development program. The function will design, research, and prepare operator's manuals for each version of the model. The function will assist in preparation of reference documents for the model, and will prepare other documentation as appropriate. The technical writing function will also be responsible for technical editing of all documentation produced by the team.

6.2 Resource Requirements

The resources required for the proposed program have been determined by scoping each of the 51 identified tasks. Required levels of effort were estimated from the planning study conducted by SRI International, and from experience gained in early phases of the program.

6.2.1 Overall Program

Approximately 365 person-months of effort will be required to complete the overall TRAC program. The effort will be distributed over three fiscal years, with approximately 133 person-months needed in FY-1990, 152 person-months in FY-1991 and 76 person-months in FY-1992. As shown in Table 12, most effort will be directed toward applications, followed by nearly equal commitments to development and evaluation.

Funding at a level of approximately $3,895,000 will be required to complete the program, with $1,509,000 required in FY-1990, $1,611,000 required in FY-1991, and $775,000 required in FY-1992. As shown in Table 13, most of the funding requirements focus on the areas of development and evaluation.

Labor and services costs dominate the overall funding requirements for the program. Two tasks, development of a prototype wind profiler with NOAA, and the Winter 1991 full-field validation drive the required services funding. Acquisition of upgraded computer systems and upper air monitoring capabilities dominate the capital costs.

More detailed discussions for the three functional program areas are presented below.

LEVEL OF EFFORT (Pers-Mon)

	FISCAL YEAR			
	'90	'91	'92	TOT
I. MODEL DEVELOPMENT	44	37	18	99
II. MODEL EVALUATION	45	55	9	109
III. MODEL APPLICATION	48	60	49	157
TOTAL	137	152	76	365

Table 12. Effort Summary for the Overall TRAC Program

FUNDING REQUIRED ($1,000s)

	FISCAL YEAR			
	'90	'91	'92	TOT
I.	834	652	196	1,682
II.	408	630	308	1,346
III.	267	329	271	867
TOT	1,509	1,611	775	3,895

Table 13. Funding Summary for Overall TRAC Program

6.2.2 Model Development

Approximately 95 person-months of effort will be required in this functional area over the three-year life of the project, with funding requirements of $1,682,000. Development of the prototype wind profiler with NOAA is the most resource intensive of the 25 tasks in this area. Effort and costs peak in FY-1990.

6.2.3 Model Evaluation

A total of approximately 109 person-months of effort will be required in this functional area over the three-year life of the project, with total funding requirements of $1,346,000. Field validation dominates the efforts and costs in this area, with a peak in FY-1991.

6.2.4 Model Application

A total of approximately 157 person-months of effort will be required in this functional area, with total funding requirements of $867,000. Modeling operations and anticipated "special studies" dominate the funding and effort in this area, with a peak in FY-1991 as products become available and are approved.

6.3 Staffing

The staffing required to complete the 365 person-months of effort will be provided by the facility prime contractor and from contracted services.

Figure 22 shows the month-by-month effort loading for the overall model development program.

7.0 CONCLUSIONS

The Terrain-Responsive Atmospheric Code represents a strong tool for meeting DOE's environmental and health protection goals at the Rocky Flats Plant. It can also provide a cost-effective means of upgrading capabilities at other DOE facilities. The three-year program plan described above will complete our development, evaluation, and implementation tasks and fully utilize the TRAC model.

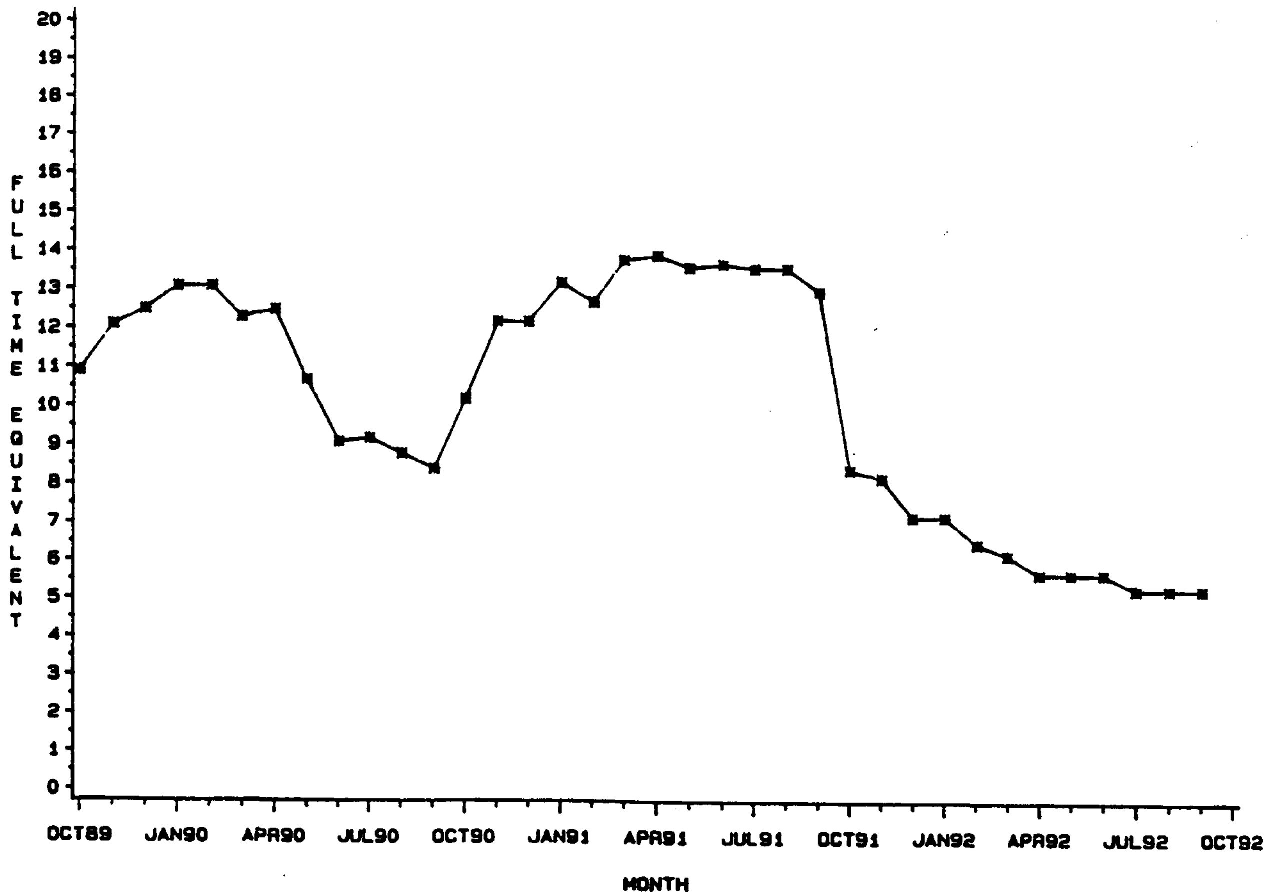

Figure 22. Month-by-Month Effort Loading for the Overall Model Development Program

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Appendix A

INTERAGENCY REVIEW COMMITTEE

INTERAGENCY REVIEW COMMITTEE

In June 1987 the DOE Albuquerque Operations Office established an Interagency Review Committee for the TRAC model. The charter of the committee was to evaluate the technical/theoretical basis of the model, review plans for implementation and model validation, and make recommendations to DOE.

MEMBERSHIP

A broad range of state and federal organizations were represented in the group, including:

- DOE Headquarters - Mr. James Fairobent,
- DOE Albuquerque Operations Office
  - Mr. Gene Runkle,
- DOE Rocky Flats Area Office - Mr. Ronald Reed,
- Pacific Northwest Laboratories - Mr. James Vanner Ramsdell,
- Lawrence Livermore National Laboratories
  - Dr. Marvin Dickerson,
- Los Alamos National Laboratories - Dr. Sumner Barr,
- Oak Ridge National Laboratories - Dr. Frank Kornegay,
- NOAA Air Resources Laboratory, INEL
  - Mr. C. Ray Dickson
  - Mr. Eugene Start,
- U.S. Environmental Protection Agency, Office of Air Quality Planning and Standards
  - Mr. Joseph Tikvart,
- U. S. Environmental Protection Agency, Meteorology Laboratory
  - Mr. William Peterson,
- Colorado Department of Health
  - Mr. Frank Rogers
  - Mr. Alan Dresser.

ACTIVITIES

The Interagency Review Committee participated in a June, 1987 TRAC Evaluation Workshop. The purpose of the workshop was to obtain peer input in planning an evaluation process for the TRAC model. The Committee met in closed session as part of the workshop to begin the technical review process.

During the summer of 1987 the Committee studied all published documents relating to the TRAC model. On September 21-22, 1987 the Committee met at the Rocky Flats Plant to complete a formal review of the model. The objectives of the meeting were to:

- Discuss the documents reviewed over the summer,
- Review the theoretical basis of the model with the author,
- Review the progress and interim results of the Evaluation Program established for the TRAC model,
- Review proposed plans for final development, evaluation, and

implementation of the model, and
- Make formal recommendations for application of the TRAC model.

The Committee completed its review of the TRAC model and reported its findings on September 22, 1987.

FINDINGS

The Interagency Review Committee presented formal findings in four areas: Summary, Model Development, Model Evaluation, and Model Implementation.

Summary

The Committee's overall findings were:

- The theoretical basis of TRAC is approved,
- The model should be implemented for emergency response and risk assessment as quickly as possible,
- Specific recommendations for further development should be pursued,
- Additional evaluation tasks should be undertaken, and
- The model should be thoroughly published.

In recommending that TRAC be implemented as quickly as possible, the Committee identified priority development and evaluation tasks that should be completed prior to model application. The Committee suggested that additional tasks be completed as near-future upgrades to TRAC.

Model Development

The Committee reviewed a series of development tasks planned by Rocky Flats. All proposed tasks were approved and divided into two categories: immediate needs and near-future actions. These tasks included:

<u>Immediate Tasks</u>

- Code Optimization,
- Upgrade to ICRP 26/30 Dose Methodology,
- Install Criticality Module for TRAC,
- Incorporate Resuspension.

The committee presented four additional findings for immediate action in the development area. Two of these findings were listed as "recommendations," requiring changes in the TRAC model theory. The other two were identified as "concerns," requesting further evaluation of existing model components. These findings are summarized below:

- <u>RECOMMENDATION</u>: Improve near-source concentration, dose, and deposition resolution,

- <u>RECOMMENDATION</u>: Ensure that puff volumes always increase,

- CONCERN: Evaluate the need for the building wake effects treatment now existing in the TRAC model,

- CONCERN: Evaluate the TRAC model's approach to dispersion near the mixing depth level.

Near-Future Tasks

- Upgrade Windfield Code,
- Heavy Gas Dispersion,
- Explosion Dispersion,
- Upgrade Statistics Module.

Model Evaluation

The Committee approved the evaluation tasks currently planned by Rocky Flats in two categories: immediate needs and near-future actions. These tasks included:

Immediate Tasks

- Step-through Verification,
- Complete FY-1987 Tracer Validation Tests,
- Validate Against MATS Data Base,
- Complete Sensitivity Analysis,
- Benchmark Against CRAC2 Model.

Near-Future Tasks

- Benchmark Against MATHEW/ADPIC Model,
- Benchmark Against AIRDOS/EPA Model,
- Conduct Winter Tracer Tests at Rocky Flats,
- Validate Against ASCOT Data Base.

Model Implementation

The Committee recommended that the TRAC model be quickly implemented for emergency response and risk assessment. It found that TRAC should be installed for regulatory analysis applications after the other versions were fully operational. Specific Committee findings are listed below:

General

- Complete the model development tasks listed as "immediate" above,
- Complete the model evaluation tasks listed as "immediate" above.

Emergency Response

- Prepare User's Guide for application,
- Integrate capability into overall emergency response program.

Risk Assessment

- Prepare User's Guide for application.

Regulatory Analysis

- Prepare User's Guide for application.

FUTURE ACTIONS

Following presentation of its findings to the Department of Energy and Rockwell International, the Interagency Review Committee disbanded. The Committee agreed to reconvene at the request of the Department of Energy.