

**CONSEQUENCE ASSESSMENT MODELS,  
ATMOSPHERIC MONITORING EQUIPMENT,  
AND ATMOSPHERIC PROJECTS  
DIRECTORY (1997 EDITION)**

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Stone & Webster**

**NUMUG Meeting  
South Bend, IN**

**October 10, 1997**

## BACKGROUND

### ● RESOURCE DOCUMENTS

- \* SCAPA, Second Edition of "Atmospheric Dispersion Modeling Resources" (March 1995)
  
- \* OFCM WG/ATD "Directory of Atmospheric Transport and Diffusion Models, Equipment, and Projects", FCM-I3-1993 (April 1993)
  
- \* OFCM AHG/MME , "Federal Directory of Mobile Meteorological Equipment and Capabilities", FCM-I5-1995 (December 1995)
  
- \* APAC Methodology Evaluation WG 5, Ex-Facility Radiological Dispersion, Draft Report, September 1996
  
- \* APAC Methodology Evaluation WG 6, Ex-Facility Chemical Dispersion, Draft Report, April 1997
  
- \* APAC Methodology Evaluation WG's 1, 2, 3, and 4 Draft Reports (1996-1997)

## BACKGROUND (CONTINUED)

- KEY SCOPING MEETINGS AND PRESENTATIONS

- \* Interdepartmental Committee on Meteorological Services and Supporting Research (ICMSSR) Meeting (7/2/96)
- \* OFCM WG/ATD Meeting (10/30/96)
- \* OFCM WG/ATD Meeting (1/9/97)
- \* OFCM WG/ATD Meeting (5/22/97)
- \* DoD Chemical and Biological Weapons Modeling Conference, AFTAC, PAFB (6/3/97)
- \* OFCM WG/ATD Meeting (9/4/97)

## SCOPE OF WORK

- Task A**● Identification and development of lists of candidate consequence assessment models, related atmospheric monitoring equipment, and related atmospheric projects to be included in the directory, inclusive of key points-of-contact.

Development of questionnaires to be sent to the key points-of-contact for consequence assessment models, related atmospheric monitoring equipment, and related atmospheric projects.

- Task B**● Communication and acquisition of completed questionnaires to individuals/organizations on the lists. Facilitation of acquisition of the maximum amount of available information by e-mail and phone follow-up.

Development of section for OFCM home page. Conceptualization approval, and development of extracted tables for all 3 topics. Preparation for project presentation to ICMSSR and status to WG/ATD.

- Task C**● Quality assurance of all acquired information from the points-of-contact that responded to each of the 3 questionnaires and configuration of questionnaire responses into a comprehensive draft report.

Development of appropriate extracted tables for all 3 topics.

- Task D**● Concurrence review by stakeholder federal agencies through WG/ATD and ICMSSR.

- Task E**● Development and publication of final report and web page attachment.

**PUBLICATION TARGET**

**2/28/98**

**CANDIDATE CONSEQUENCE ASSESSMENT MODELS**  
**BY FEDERAL AGENCY**

**A) Department of Agriculture (DOA) [0]**

None

**B) Department of Commerce (DOC) [19]**

- |                             |            |
|-----------------------------|------------|
| 1) ALOHA                    | 11) NGM    |
| 2) BIOGENIC EMISSIONS MODEL | 12) RADM   |
| 3) CAPITA                   | 13) RAMS   |
| 4) ETA                      | 14) ROM    |
| 5) HARM-II                  | 15) RPM    |
| 6) HYSPLIT4                 | 16) RSM    |
| 7) LAPS                     | 17) RUC    |
| 8) MAPS                     | 18) UAM-V  |
| 9) MM-5                     | 19) VAFTAD |
| 10) MRF-AVIATION            |            |

**CANDIDATE CONSEQUENCE ASSESSMENT MODELS**  
**BY FEDERAL AGENCY (CONTINUED)**

**C) Department of Defense (DoD) [52]**

- |                   |              |
|-------------------|--------------|
| 1) ABCSIM         | 27) HPS      |
| 2) ADAM           | 28) HRW      |
| 3) ADM            | 29) HYPACT   |
| 4) AFTOX          | 30) LES      |
| 5) AIRFLOS        | 31) LODI     |
| 6) AIRSIM         | 32) MESOWIND |
| 7) BFM            | 33) NOCSS    |
| 8) CAAMS          | 34) OMEGA    |
| 9) CANOPY         | 35) ORCHID   |
| 10) CBD-IMPACT    | 36) PPD      |
| 11) C-CSI         | 37) RAMS     |
| 12) COMIS         | 38) REEDM    |
| 13) CSU-RAMS      | 39) RTVSM    |
| 14) D2PC          | 40) SCIPUFF  |
| 15) EDGE FLOW     | 41) SES      |
| 16) EDMS          | 42) SLAB     |
| 17) FIREPLUME     | 43) SLAM     |
| 18) FSCBG         | 44) SMOKE    |
| 19) GAMUT         | 45) TADSIM   |
| 20) GASFLOW       | 46) TCAL     |
| 21) HASCAL        | 47) MACHWIND |
| 22) HELSO         | 48) TCON     |
| 23) HIGRAD        | 49) URBAN    |
| 24) HIS SYSTEM    | 50) VARYME   |
| 25) HOTMAC        | 51) VLSTRACK |
| 26) HOTMAC/RAPTAD | 52) WADOCT   |

**CANDIDATE CONSEQUENCE ASSESSMENT MODELS**  
**BY FEDERAL AGENCY (CONTINUED)**

**D) Department of Energy (DOE) [59]**

- |                  |                              |
|------------------|------------------------------|
| 1) 2DPUF         | 30) HGSYSTEM/UF <sub>6</sub> |
| 2) AI-RISK       | 31) HOTSPOT                  |
| 3) AIRRAD        | 32) HUDU                     |
| 4) ARAC          | 33) KBERT                    |
| 5) AREAEVAC      | 34) MAEROS-2                 |
| 6) ASTRAP        | 35) MATHEW/ADPIC             |
| 7) ATMOS1/ATMOS2 | 36) MAXIGASP                 |
| 8) AXAIR89Q      | 37) MDIFF                    |
| 9) BNLGPM        | 38) MELCOR                   |
| 10) CFAST        | 39) MESODIF                  |
| 11) COMPBRN III  | 40) MICROAIRDOS              |
| 12) CONTAIN      | 41) PLM89A                   |
| 13) DIFOUT       | 42) PLUME                    |
| 14) DOSEEP       | 43) POPGASP                  |
| 15) EMGRES       | 44) PUFFPLUME                |
| 16) EPICODE      | 45) RAC                      |
| 17) ERAD         | 46) RAMS/LPDM                |
| 18) FEM-PBL      | 47) RSAC-5                   |
| 19) FEM3C        | 48) SABLE                    |
| 20) FIRIN/FIRAC  | 49) TOXICGAS                 |
| 21) FPETool      | 50) TRAC                     |
| 22) FUSCRAC3     | 51) TRAC RA/HA               |
| 23) GASFLOW      | 52) TRAC HAZMAT              |
| 24) GAUS1        | 53) TRIAD                    |
| 25) GENII        | 54) VENTSAR                  |
| 26) GTM          | 55) VULCAN/KAMELEON          |
| 27) GXQ          | 56) WHAZAN                   |
| 28) HAZCON       | 57) WINDS                    |
| 29) HEFFTER      | 58) XQSTAT                   |
|                  | 59) MEPAS                    |

**CANDIDATE CONSEQUENCE ASSESSMENT MODELS**  
**BY FEDERAL AGENCY (CONTINUED)**

**E) Environmental Protection Agency (EPA) [18]**

- |             |             |
|-------------|-------------|
| 1) CALPUFF  | 10) PUFF    |
| 2) CAPITA   | 11) RAMS    |
| 3) CRSTER   | 12) RISK    |
| 4) CTDM     | 13) RVD     |
| 5) DEGADIS  | 14) SCREEN2 |
| 6) INPUFF   | 15) SDM     |
| 7) ISC-2    | 16) TOXST   |
| 8) MELSAR   | 17) TSCREEN |
| 9) MESOPUFF | 18) VALMET  |

**F) Federal Emergency Management Agency (FEMA) [1]**

- 1) CATS

**G) Department of Health (DOH) [1]**

- 1) RATCHET

**H) Department of Interior (DOI) [2]**

- 1) NUATMOS/CITPUFF  
2) VALDRIFT

**I) National Aeronautical and Space Administration (NASA) [2]**

- 1) KSC-EMERGE  
2) MARSS

**CANDIDATE CONSEQUENCE ASSESSMENT MODELS**  
**BY FEDERAL AGENCY (CONTINUED)**

**J) Nuclear Regulatory Commission (NRC) [10]**

- |           |            |
|-----------|------------|
| 1) ARCON  | 6) MESORAD |
| 2) EXTRAN | 7) PAVAN   |
| 3) IRDAM  | 8) RADTRAD |
| 4) MACCS2 | 9) RASCAL  |
| 5) MESOI  | 10) XOQDOQ |

**K) Department of State (DOS) [0]**

None

**L) Department of Transportation [2]**

- 1) ARCHIE
- 2) CASRAM

**M) Trade Groups [2]**

- 1) HGSYSTEM (API)
- 2) MAAP-DOSE (EPRI)

**N) Nuclear Utilities [1]**

- 1) PGEMS

**O) International [7]**

- |                   |                          |
|-------------------|--------------------------|
| 1) AQPAC (Canada) | 5) HEGADAS (Netherlands) |
| 2) COSYMA         | 6) UFOTRI (Germany)      |
| 3) EMGRES         | 7) VDI (Germany)         |
| 4) ETMOD (Canada) |                          |

# **CONSEQUENCE ASSESSMENT MODELS QUESTIONNAIRE**

## **GENERAL CHARACTERISTICS**

- 1) **Abstract of Model Capabilities (100-150 words)**
- 2) **Sponsor/Developing Organization**
- 3) **Current Custodians (primary, secondary)**
- 4) **Life-Cycle (development history, planned enhancements)**
- 5) **Model Description Summary (200-250 words)**
- 6) **Application Limitations (limiting model assumptions)**
- 7) **Strengths/Weaknesses (identify 3-5 of each)**
- 8) **Model References (technical support documents [up to 5])**
- 9) **Input Data/Parameters Requirements (brief synopsis)**
- 10) **Output Summary (100-150 words)**
- 11) **Applications (locations where model has been applied)**
- 12) **User-Friendliness (indicate type of user interface)**
- 13) **Hardware-Software Interface Constraints/Requirements (operating system, disk space req., run exec. time, programming language)**
- 14) **Operational Parameters (error diagnostics, setup time)**
- 15) **Surety Considerations (quality assurance documentation, benchmark runs, verification with field experiments)**

**CONSEQUENCE ASSESSMENT MODELS QUESTIONNAIRE**  
**SPECIFIC CHARACTERISTICS**

**A) Source Term Submodel Type (10 Questions)**

No Source Term Algorithm

Chemical Consequence Assessment Models

Radiological Consequence Assessment Models

Weapons Consequence Assessment Models

**B) Dispersion Submodel Type (9 Questions)**

Gaussian

Similarity

Stochastic

Gradient Transport

Particle-In-Cell

Box

Turbulent Kinetic Energy (TKE)-Driven

Particle

Multiple Capabilities (e.g., Gaussian puff and particle options)

**CONSEQUENCE ASSESSMENT MODELS QUESTIONNAIRE**  
**SPECIFIC CHARACTERISTICS**

**C) Transport Submodel Type (4 Questions)**

Prognostic

Deterministic

Stochastic

Frame of Reference (eulerian, lagrangian, hybrid)

**D) Fire Submodel Type (4 Questions)**

Radiant Energy

Fireballs

Jet Fires

Flash Fires

**E) Energetic Events Submodel Type (9)**

Blast Overpressures

Dust Explosions

Deflagrations

Detonations

Vapor Cloud Explosions

Boiling Liquid Expanding Vapor Explosions (BLEVEs)

Missile Generation

High Explosives/Nuclear Detonations

**CONSEQUENCE ASSESSMENT MODELS QUESTIONNAIRE**  
**SPECIFIC CHARACTERISTICS**

**F) Health Consequence Submodel Type (17 Questions)**

**Health effects (fatalities, cancers, latent cancers)**

**Health criteria (IDLH, STEL, TLV, TWA, ERPG, TEEL, AEGL, etc.)**

**Zones within flammable limits (UFL, LFL)**

**Blast overpressure regions**

**Fire radiant energy zones**

**Risk quantification**

**Concentration (single value, time-history, integrated dose)**

**Probits**

**Cloudshine (finite cloud, semi-infinite cloud, other)**

**Groundshine (short-term, long-term)**

**Inhalation (short-term, long-term, Total Effective Dose Equivalent, uptake of respirable fraction of particle spectra)**

**Resuspension (short-term, long-term, Anspaugh)**

**Food/Water Ingestion (dynamic, static)**

**Skin Dose (Absorption, other)**

**Dose Assessment (ICRP-60 criteria, organs, pathways)**

**Health Effects (early, latent)**

**Biological Weapons Consequences**

**CONSEQUENCE ASSESSMENT MODELS QUESTIONNAIRE**  
**SPECIFIC CHARACTERISTICS**

**G) Effects and Countermeasures Submodel Type (8 Questions)**

**Evacuation**

**Sheltering**

**Interdiction**

**Spray/Foam**

**Land Contamination**

**Economic Costs**

- \* **Decontamination**
- \* **Interdiction**
- \* **Foodstuff losses**
- \* **Relocation**
- \* **Facility downtime**
- \* **Denial of facility access**

**Decontamination**

**Weapons Consequence Assessment Models**

## **CONSEQUENCE ASSESSMENT MODELS QUESTIONNAIRE** **SPECIFIC CHARACTERISTICS**

### **H) Physical Features of Model (17)**

**Stability Classification/Turbulence Typing**

**Release Elevation**

**Aerodynamic Effects from Buildings and Obstacles**

**Horizontal Plume Meander; Horizontal/Vertical Wind Shear**

**Mixing Layer (trapping, lofting, inversion breakup fumigation, etc)**

**Cloud Buoyancy (neutral, dense, plume rise [positive])**

**Cloud Liquid Droplet Formation/Aerosolization**

**(Radio)chemical Transformation and In-Cloud Conversion Processes**

**Deposition (gravitational setting, dry deposition, precipitation scavenging)**

**Resuspension**

**Radionuclide Ingrowth and Decay**

**Temporally and Spatially Variant Mesoscale Processes**

- \* **Urban heat island**
- \* **Canopies**
- \* **Complex terrain (land) effects (mountain-valley wind reversals, anabatic winds, katabatic winds)**
- \* **Complex terrain (land-water) effects (seabreeze airflow trajectory reversals, TIBL definition, etc)**
- \* **Thunderstorm outflow**

## CONSEQUENCE ASSESSMENT MODELS QUESTIONNAIRE SPECIFIC CHARACTERISTICS

### I) Model Input Requirements

- Radio(chemical) and Weapon Release Parameters
  - \* Release rate (Continuous, time dependent, instantaneous)
  - \* Release container characteristics (Vapor temperature, tank diameter, tank height, tank temperature, tank pressure, nozzle diameter, pipe length)
  - \* Jet release (Initial size, shape, and concentration profile at end of jet affected zone)
  - \* Release dimensions (Point, line, area)
  - \* Release elevation (Ground, roof, stack)
- Meteorological Parameters
  - \* Wind speed
  - \* Wind direction
  - \* Temperature
  - \* Dew point temperature
  - \* Precipitation
  - \* Turbulence typing parameters (Temperature difference, sigma theta, sigma phi, Monin-Obukhov length, roughness length, cloud cover, incoming solar radiation, user-specified)
  - \* Four-dimensional meteorological fields from prognostic model

**CONSEQUENCE ASSESSMENT MODELS QUESTIONNAIRE**  
**SPECIFIC CHARACTERISTICS**

**J) Model Output Capabilities**

**Hazard Zone**

**Graphic Contours**

**Concentration versus Time plots**

**Tabular at fixed downwind locations**

**Health effects (toxicity indices [e.g., ERPG's, PAG's], potential fatalities, cancers, other adverse effects)**

**Number of people affected**

**Graphic contours of probability of exceeding concentration**

**F-N probability distribution curves**

# ATMOSPHERIC EQUIPMENT QUESTIONNAIRE

## **A) Equipment Description**

Location (Address, Latitude/Longitude, UTM Coordinates)

Equipment Inventory (each instrument type)

- \* Description (manufacturer, model number, operational characteristics)
- \* Grade (operations, research)
- \* Quantity, Condition, Portability

## **B) Data Description**

- \* Type (analog, digital)
- \* Accessibility
- \* Availability on www
- \* Accuracy

## **C) Organizational**

Ownership Organization (Point-of-Contact, Organization, Address, Phone, Fax, E-Mail)

Participating Organization(s) (Point-of-Contact, Organization, Address, Phone, Fax, E-Mail)

## **D) Programmatic Considerations**

Associated Program(s) Supported by Equipment

Availability for Loan or Purchase

Potential Applications to Other Programs

Miscellaneous Information

## **ATMOSPHERIC PROJECTS QUESTIONNAIRE**

### **A) Project Identification**

**Project Type**

- \* **Intra-agency**
- \* **Interagency**
- \* **International**

**Project Code Number**

**Project Title**

### **B) Project Organization**

**Lead Agency**

**Supporting Agency(ies)**

**Cooperative Funding Sought (Yes, No)**

**Sponsoring Organization**

**Performing Organization(s)**

**Participating Organization(s)**

## ATMOSPHERIC PROJECTS QUESTIONNAIRE

### **C) Project Description**

**Associated Program(s) Supported by Project**

**Project Objectives (100-150 words)**

**Project Description and Life-History (250 words)**

- \* **Progress to date**
- \* **FY97-98 goals**
- \* **Out-year goals**

**Expected Completion Date**

**Potential for Follow-On Projects/Tasks**

**Resultant Data Bases or Technical Products**

- \* **Computer platform**
- \* **Software**
- \* **Other**

**Potential Applications to Other Programs**

**Regulatory Implications of Project Products**

**Comparison to Field Tracer Studies (if applicable)**

**Miscellaneous Project Information**

**CONSEQUENCE ASSESSMENT MODELS, ATMOSPHERIC  
MONITORING EQUIPMENT, AND ATMOSPHERIC PROJECTS  
DIRECTORY (1997 EDITION)**

**EXTRACT TABLES**

- I Model Acquisition
- II Model Pedigree and Quality
- III Model Platforms
- IV Chemical Consequence Source Terms
- V Radiological Consequence Source Terms
- VI Weapons Consequence Source Terms
- VII Dispersion Submodels
- VIII Transport Submodels
- IX Fire Submodels
- X Energetic Events Submodels
- XI Chemical Health Consequences
- XII Radiological Health Consequences
- XIII Weapons Health Consequences
- XIV Chemical Effects and Countermeasures
- XV Radiological Effects and Countermeasures
- XVI Weapons Effects and Countermeasures
- XVII Physical Features of Models I
- XVIII Physical Features of Models II
- XIX Equipment Availability
- XX Equipment Availability to Other Programs
- XXI Projects with Applicability to Other Programs
- XXII Projects with Regulatory Implications

**CONSEQUENCE ASSESSMENT MODELS, ATMOSPHERIC  
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**VOLUME 1: OVERVIEW AND USER GUIDE**

**1.0 INTRODUCTION**

**1.1 Background**

**1.2 Purpose**

**1.3 Objectives**

**2.0 METHODOLOGY**

**2.1 Definition of Survey Parameters**

**2.1.1 Consequence Assessment Models**

**2.1.2 Atmospheric Monitoring Equipment**

**2.1.3 Atmospheric Projects**

**2.2 Determination of Applicable Models, Equipment, and Projects**

**2.3 Establishment of Useful Extract Tables**

**3.0 USER GUIDE**

**3.1 How to Use the Survey Information Volumes**

**3.2 How to Use the Extract Tables Volumes**

**4.0 REFERENCES**

**5.0 GLOSSARY**

**6.0 ACRONYMS**

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**VOLUME 2: CONSEQUENCE ASSESSMENT MODELS: SURVEY INFORMATION  
(Books 1-5)**

- 1.0 Listing of Consequence Assessment Models by Federal Agency
- 2.0 Survey Results of 175 Models (Sorted Alphabetically)

**VOLUME 3: CONSEQUENCE ASSESSMENT MODELS: EXTRACT TABLES  
(Books 1-3)**

- 1.0 Discussion of Applicable Extract Tables
- 2.0 Extract Tables I-XVIII for 175 Models (as applicable)

**VOLUME 4: ATMOSPHERIC EQUIPMENT: SURVEY INFORMATION  
(Books 1-5)**

- 1.0 Listing of Atmospheric Equipment by Federal Agency
- 2.0 Survey Results of 500 Equipment (Sorted Alphabetically)

**VOLUME 5: ATMOSPHERIC EQUIPMENT: EXTRACT TABLES  
(Books 1-3)**

- 1.0 Discussion of Applicable Extract Tables
- 2.0 Extract Tables XIX-XX for 500 Equipment (as applicable)

**CONSEQUENCE ASSESSMENT MODELS, ATMOSPHERIC  
MONITORING EQUIPMENT, AND ATMOSPHERIC PROJECTS  
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**TABLE OF CONTENTS (CONT.)**

**VOLUME 6: ATMOSPHERIC PROJECTS: SURVEY INFORMATION  
(Books 1-2)**

- 1.0 Listing of Atmospheric Projects by Federal Agency
- 2.0 Survey Results of 66 Projects (Sorted Alphabetically)

**VOLUME 7: ATMOSPHERIC PROJECTS: EXTRACT TABLES  
(Books 1-2)**

- 1.0 Discussion of Applicable Extract Tables
- 2.0 Extract Tables XXI-XXII for 66 Projects (as applicable)

**NOTE: IN ORDER TO COMPLY WITH THE DOI REGULATORY CRITERIA ON  
DEFORESTATION, VERY FEW VOLUMES WILL BE PRINTED. WWW  
ACCESS WILL BE PROVIDED.**