PLUME MODELING

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NATIONAL NUCLEAR SECURITY ADMINISTRATION

DEPARTMENT OF ENERGY

PLUME MODELING

- HOW ARE OVERLAPPING MODELING RESPONSIBILITIES RESOLVED?
- WHAT CAPABILITIES HAVE BEEN DEVELOPED TO SUPPORT OPERATIONAL REQUIREMENTS?

PLUME MODELING

DEPARTMENT OF HOMELAND SECURITY DIRECTION:

DETERMINE WHICH DISPERSION CODE BEST MODELS THE ACTUAL DISPERSION FROM A *GROUND LEVEL RDD*, SPECIFICALLY INCLUDING THE FOLLOWING CODES:

- **HAZARD PREDICTION AND ASSESSMENT CAPABILITY (HPAC)**
- **NATIONAL ATMOSPHERIC RELEASE ADVISORY CAPABILITY (NARAC)**

RDD/IND PREPAREDNESS WORKING GROUP

PHASE I PROGRESS REPORT, MARCH 2003

PLUME MODELING

DEPARTMENT OF HOMELAND SECURITY DIRECTION:

DHS WORKING THROUGH THE CONSEQUENCE MANAGEMENT SUBGROUP, WITH DOE, NRC, DOD, NOAA, NIST AND OTHER RELEVANT AGENCIES, SHOULD DETERMINE A *SINGLE PLUME MODEL* TO BE USED IN THE EVENT OF AN *RDD/IND INCIDENT*

DETERMINATION TO BE MADE BY 8 JULY 2003

RDD/IND PREPAREDNESS WORKING GROUP

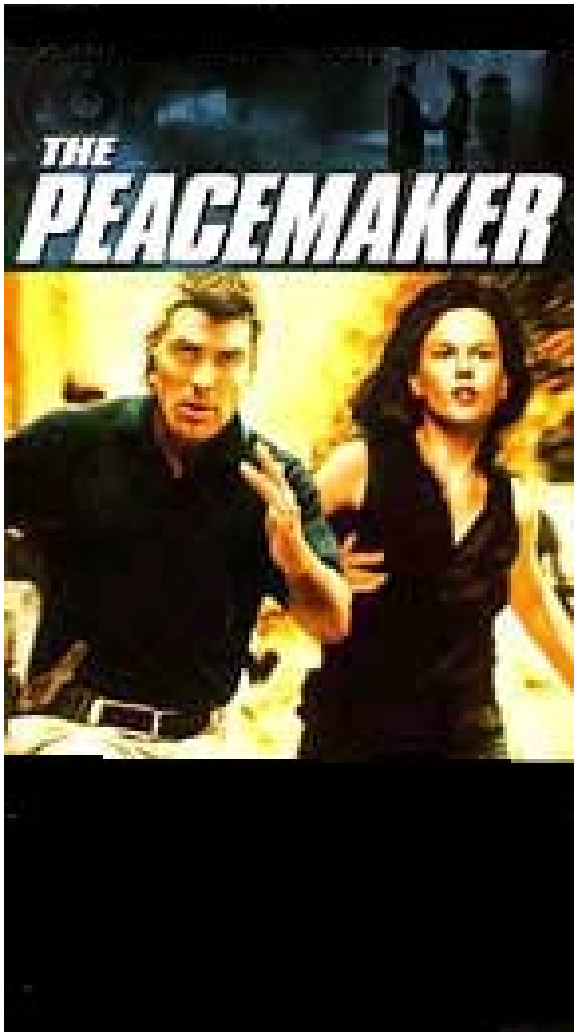
PHASE II, MEETINGS ON 5 AND 6 JUNE 2003

PLUME MODELING

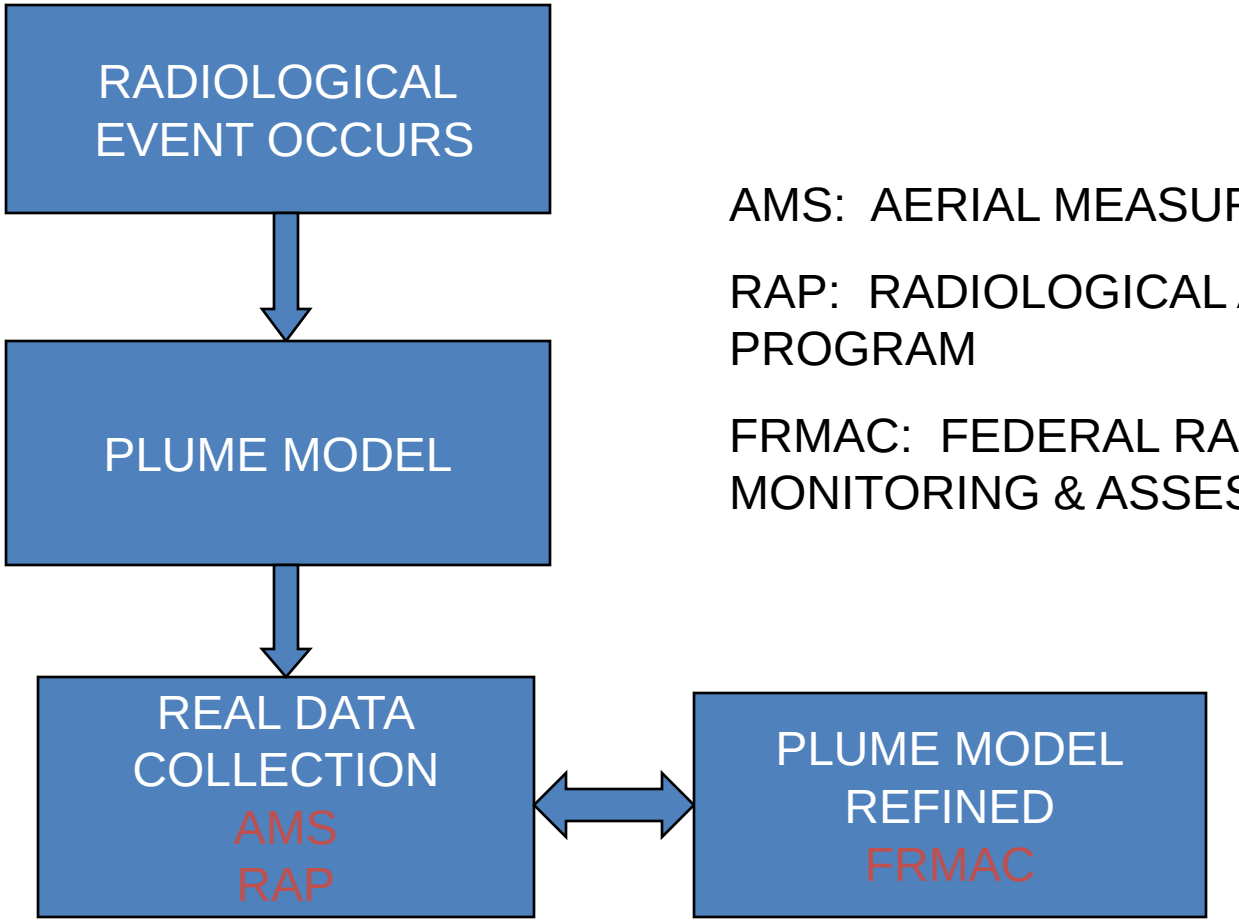
OFFICE OF EMERGENCY RESPONSE (NA-42)

PROCEDURES

PLUME MODELING



PLUME MODELING



AMS: AERIAL MEASURING SYSTEM

RAP: RADIOLOGICAL ASSISTANCE PROGRAM

FRMAC: FEDERAL RADIOLOGICAL MONITORING & ASSESSMENT CENTER

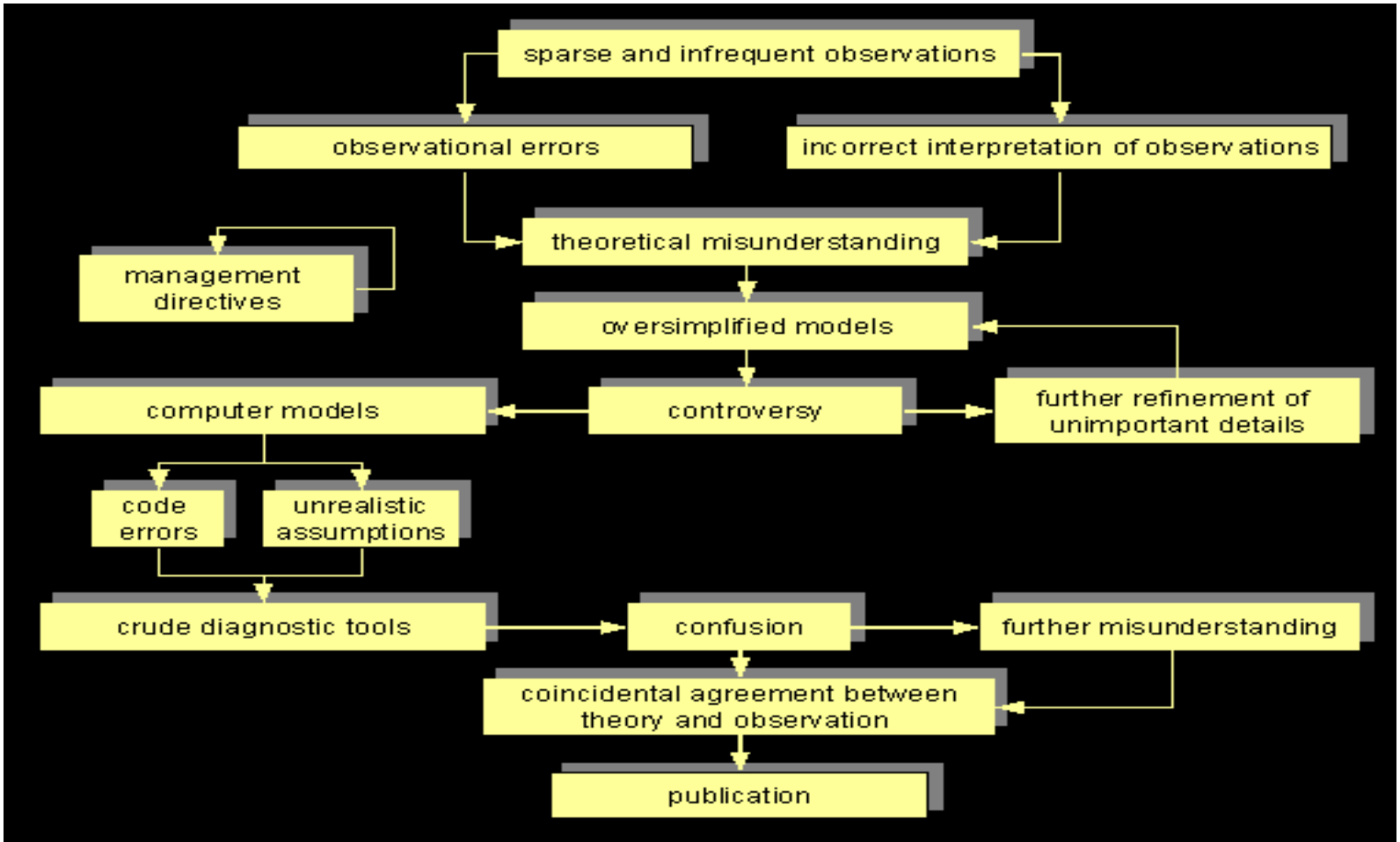
PLUME MODELING

TWO MAJOR CAPABILITIES (MODELS) OF CONCERN:

HPAC: SECOND-ORDER CLOSURE INTEGRATED PUFF (SCIPUFF) MODEL, WHICH IS A LAGRANGIAN MODEL THAT EMPLOYS THE GAUSSIAN PUFF NUMERICAL METHOD - AN ARBITRARY TIME-DEPENDENT CONCENTRATION FIELD IS REPRESENTED BY SUPERPOSITION OF THREE-DIMENSIONAL GAUSSIAN DISTRIBUTIONS - AND BASES ITS TURBULENCE PARAMETERIZATION ON SECOND-ORDER CLOSURE THEORIES

NARAC: EVALUATES THE 3-D ADVECTION-DIFFUSION EQUATION BY SOLVING AN APPROPRIATE STOCHASTIC DIFFERENTIAL EQUATION (SDE) FOR MANY (TYPICALLY HUNDEREDS OF THOUSANDS) TEST PARTICLES VIA A LAGRANGIAN MONTE CARLO METHOD.

PLUME MODELING



PLUME MODELING

Will Pendergrass, the meteorologist in charge, said field engineer Randy White and systems specialist Ed Dumas were surprised at an early finding of their work. New stations detected a large wind-direction difference, or bias, between downtown Washington and Reagan National Airport, which is the official source of weather information for the capital.

Twelve months of readings found that airport winds generally flow up and down the Potomac River, while readings downtown consistently "vary from that by 40 to 90 degrees," Pendergrass said: "If you used the airport data, you have a really good chance of having a forecast plume go in the wrong direction."

"Clearly, if we're receiving data from National Airport, and they're 90 degrees wrong, we would be notifying people 90 degrees in the wrong direction that they would be at risk," said Ned Ingraham, acting chief information officer for Washington, whose office is working with NOAA.

Washington Post
June 2, 2003

PLUME MODELING

In general, modeling is never precise enough to draw definitive conclusions, and DOD did not have accurate information on source term (such as the quantity and purity - concentration - of the agent) and meteorological conditions (such as wind and weather patterns) essential to valid modeling. In particular the models DOD selected were not fully developed and validated for long-range environmental fallout; the source term assumptions were not accurate; the plume height was underestimated; the modeling only considered the effects on health of a single bombing; field-testing at Dugway Proving Ground did not realistically simulate the actual bombing conditions; and divergence in results among models.

GAO Highlights
Preliminary Assessment of DOD Plume Modeling for U.S. Troops' Exposure to Chemical Agents June 2, 2003

PLUME MODELING

SO, WHEREARE WE?

WHAT CAPABILITIES HAVE BEEN DEVELOPED TO SUPPORT OPERATIONAL REQUIREMENTS?

NARAC, HPAC, AND A HOST OF OTHERS ….. BUT

"UNFORTUNATELY, MANY USERS OF SUCH MODELS ARE COMPLETELY UNAWARE OF THOSE ASSUMPTIONS AND CONSTRAINTS AND MISTAKENLY BELIEVE THAT THE PRECISION ACHIEVABLE WITH COMPUTERS EQUATES WITH ACCURACY"

Error Propagation in Air Dispersion Modeling

Milton R. Beychok, Consulting Engineer

AND **GIGO STILL APPLIES.**

PLUME MODELING

HOW ARE OVERLAPPING MODELING RESPONSIBILITIES RESOLVED?

IT STILL DEPENDS ON THE SITUATION AND IT IS DOUBTFUL THAT A SINGLE MODEL WILL BE USED FOR ALL RDD/IND INCIDENTS.

PERHAPS A DECISION MATRIX WHICH DEFINES WHICH *FEDERAL* PLUME MODEL RECEIVES PRIORITY FOR A SPECIFIC SET OF CIRCUMSTANCES CAN BE DEVELOPED.