



*United States
Nuclear Regulatory Commission*

DISPERSION MODELING CAPABILITIES

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Workshop on Atmospheric Dispersion Modeling
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Suzuki Model

- . Developed for Fall-deposit Thicknesses for Silicic Eruptions
 - Two-dimensional model for continuous-release
 - Particle size $>15 \mu\text{m}$
 - Turbulent dispersal of particles
 - Advection and Diffusion of the wind-blown plume
- . Validated for Yucca Mountain by comparison with Basaltic Volcano Cerro Negro, Nicaragua
- . Used by Center for Nuclear Waste Regulatory Analyses and by NRC

Gaussian Plume Model

- o Severe Accident Models:

 - Plume lift-off and plume rise

 - Capping of plume rise and expansion by inversion layers

 - Down-wind transport of the plume

 - Horizontal and vertical dispersion of the plume

 - Plume depletion by wet and dry deposition

- . Verification - International code comparisons

- . Needed Output

 - Expected values of early and latent fatalities and population dose

 - Wind rose weighting, weather sampling of on-site data

 - Linear no-threshold assumption simplifies the problem

Gaussian Plume Model, cont

- . Pre- and post-processing for input parameter uncertainty
- . Used Internationally - Users' Group Existing but Inactive
- . Code Developers Available for Consultation and Error Correction
No specific training available

Gaussian Plume Model, cont

o Incident Response - Real Time

Existing capability

Close-in (10 mile) needs

Used for protective action evaluation and recommendations

Individual dose estimates

Same processes as the more-elaborate severe accident code

Single weather sequence

. Training for Specific Code Users During Overall Incident Response
Training

Gaussian Plume Model, cont

o Incident Response, cont

Test Version

Fuel Cycle Facilities

Dense gas model, chemical reactions for UF_6

Reactors

Multiple meteorological stations - interpolation

Orographic features - 2-D modified Ross model

Poisson - 9-point Laplacian and relaxation technique

Grids: 50 mile, 25 mile, 10 mile squares

Reactor Design-Basis Accidents

o Site Suitability and Plant Design Feature Evaluation

Public Exposure

χ/Q (sec/m³) not exceeded more than 5% of the time overall (0.5% sector for some cases) usually Pasquill "F" stability

Shortest distance to "exclusion area" or low population zone boundary

Lateral spread includes wake effects and meander

Assumed 2-hour to 30-day exposures

Meteorologists evaluated parameters for all sites at one time

Used by licensees and NRC staff

Reactor Design-Basis Accidents cont

o Control Room Operator Exposure

Chemical as well as radiological exposures

Older model based on sparse wind tunnel data

Corrects for distance between release and receptor, size of the buildings

Newer model is only beginning to be used

Based on measurements at low wind speeds at 7 sites

For low wind speed can be up to 10^2 smaller

Used by licensees and NRC staff