

and Hanna, 1986) is used, but stack tip downwash and BID are not used.

For rolling terrain (terrain not above stack height), plume centerline is horizontal at height of final rise above source.

Fumigation is not treated.

#### h. Horizontal Winds

Constant, uniform (steady-state) wind is assumed for each hour.

Straight line plume transport is assumed to all downwind distances.

Separate wind speed profile exponents (Irwin, 1979; EPA, 1980) for both rural and urban cases are used.

An optional treatment for calm winds is included for short term modeling.

#### i. Vertical Wind Speed

Vertical wind speed is assumed equal to zero.

#### j. Horizontal Dispersion

Rural dispersion coefficients from Turner (1969) are used, with no adjustments for surface roughness or averaging time.

Urban dispersion coefficients from Briggs (Gifford, 1976) are used.

Buoyancy induced dispersion (Pasquill, 1976) is included.

Six stability classes are used.

#### k. Vertical Dispersion

Rural dispersion coefficients from Turner (1969) are used, with no adjustments for surface roughness.

Urban dispersion coefficients from Briggs (Gifford, 1976) are used.

Buoyancy induced dispersion (Pasquill, 1976) is included.

Six stability classes are used.

Mixing height is accounted for with multiple reflections until the vertical plume standard deviation equals 1.6 times the mixing height; uniform vertical mixing is assumed beyond that point.

Perfect reflection is assumed at the ground.

#### l. Chemical Transformation

Chemical transformations are treated using exponential decay. Time constant is input by the user.

#### m. Physical Removal

Dry deposition effects for particles are treated using a resistance formulation in which the deposition velocity is the sum of the resistances to pollutant transfer within the surface layer of the atmosphere, plus a gravitational settling term (EPA, 1994), based on the modified surface depletion scheme of Horst (1983).

#### n. Evaluation Studies

Bowers, J.F. and A.J. Anderson, 1981. An Evaluation Study for the Industrial Source Complex (ISC) Dispersion Model, EPA Publication No. EPA-450/4-81-002. Office of Air Quality Planning & Standards, Research Triangle Park, NC.

Bowers, J.F., A.J. Anderson and W.R. Hargraves, 1982. Tests of the Industrial Source Complex (ISC) Dispersion Model at the Armco Middletown, Ohio Steel Mill. EPA Publication No. EPA-450/4-82-006. Office of Air Quality Planning & Standards, Research Triangle Park, NC.

Environmental Protection Agency, 1992. Comparison of a Revised Area Source

Algorithm for the Industrial Source Complex Short Term Model and Wind Tunnel Data. EPA Publication No. EPA-454/R-92-014. Office of Air Quality Planning & Standards, Research Triangle Park, NC. (NTIS No. PB 93-226751)

Environmental Protection Agency, 1992. Sensitivity Analysis of a Revised Area Source Algorithm for the Industrial Source Complex Short Term Model. EPA Publication No. EPA-454/R-92-015. Office of Air Quality Planning & Standards, Research Triangle Park, NC. (NTIS No. PB 93-226769)

Environmental Protection Agency, 1992. Development and Evaluation of a Revised Area Source Algorithm for the Industrial Source Complex Long Term Model. EPA Publication No. EPA-454/R-92-016. Office of Air Quality Planning & Standards, Research Triangle Park, NC. (NTIS No. PB 93-226777)

Environmental Protection Agency, 1994. Development and Testing of a Dry Deposition Algorithm (Revised). EPA Publication No. EPA-454/R-94-015. Office of Air Quality Planning & Standards, Research Triangle Park, NC. (NTIS No. PB 94-183100)

Scire, J.S. and L.L. Schulman, 1981.

Evaluation of the BLP and ISC Models with SF<sub>6</sub> Tracer Data and SO<sub>2</sub> Measurements at Aluminum Reduction Plants. Air Pollution Control Association Specialty Conference on Dispersion Modeling for Complex Sources, St. Louis, MO.

Schulman, L.L. and S.R. Hanna, 1986.

Evaluation of Downwash Modification to the Industrial Source Complex Model. *Journal of the Air Pollution Control Association*, 36: 258-264.

### A.7 Offshore and Coastal Dispersion Model (OCD)

#### Reference

DiCristofaro, D.C. and S.R. Hanna, 1989. OCD: The Offshore and Coastal Dispersion Model, Version 4. Volume I: User's Guide, and Volume II: Appendices. Sigma Research Corporation, Westford, MA. (NTIS Nos. PB 93-144384 and PB 93-144392)

#### Availability

This model code is available on the EPA's Internet SCRAM Web site and also on diskette (as PB 91-505230) from the National Technical Information Service (see Section A.0). Official contact at Minerals Management Service: Mr. Dirk Herkhof, Parkway Atrium Building, 381 Elden Street, Herndon, VA 20170, Phone: (703) 787-1735.

#### Abstract

(1) OCD is a straight-line Gaussian model developed to determine the impact of offshore emissions from point, area or line sources on the air quality of coastal regions. OCD incorporates overwater plume transport and dispersion as well as changes that occur as the plume crosses the shoreline. Hourly meteorological data are needed from both offshore and onshore locations. These include water surface temperature, overwater air temperature, mixing height, and relative humidity.

(2) Some of the key features include platform building downwash, partial plume penetration into elevated inversions, direct

use of turbulence intensities for plume dispersion, interaction with the overland internal boundary layer, and continuous shoreline fumigation.

#### a. Recommendations for Regulatory Use

OCD has been recommended for use by the Minerals Management Service for emissions located on the Outer Continental Shelf. OCD is applicable for overwater sources where onshore receptors are below the lowest source height. Where onshore receptors are above the lowest source height, offshore plume transport and dispersion may be modeled on a case-by-case basis in consultation with the appropriate reviewing authority (paragraph 3.0(b)).

#### b. Input Requirements

(1) Source data: Point, area or line source location, pollutant emission rate, building height, stack height, stack gas temperature, stack inside diameter, stack gas exit velocity, stack angle from vertical, elevation of stack base above water surface and gridded specification of the land/water surfaces. As an option, emission rate, stack gas exit velocity and temperature can be varied hourly.

(2) Meteorological data (over water): Wind direction, wind speed, mixing height, relative humidity, air temperature, water surface temperature, vertical wind direction shear (optional), vertical temperature gradient (optional), turbulence intensities (optional).

(3) Meteorological data (over land): Wind direction, wind speed, temperature, stability class, mixing height.

(4) Receptor data: Location, height above local ground-level, ground-level elevation above the water surface.

#### c. Output

(1) All input options, specification of sources, receptors and land/water map including locations of sources and receptors.

(2) Summary tables of five highest concentrations at each receptor for each averaging period, and average concentration for entire run period at each receptor.

(3) Optional case study printout with hourly plume and receptor characteristics. Optional table of annual impact assessment from non-permanent activities.

(4) Concentration files written to disk or tape can be used by ANALYSIS postprocessor to produce the highest concentrations for each receptor, the cumulative frequency distributions for each receptor, the tabulation of all concentrations exceeding a given threshold, and the manipulation of hourly concentration files.

#### d. Type of Model

OCD is a Gaussian plume model constructed on the framework of the MPTER model.

#### e. Pollutant Types

OCD may be used to model primary pollutants. Settling and deposition are not treated.

#### f. Source-Receptor Relationship

(1) Up to 250 point sources, 5 area sources, or 1 line source and 180 receptors may be used.

(2) Receptors and sources are allowed at any location.