

e. Pollutant Types

EDMS includes emission factors for carbon monoxide, nitrogen oxides, sulfur oxides, hydrocarbons, and suspended particles and calculates the dispersion for all except hydrocarbons.

f. Source-Receptor Relationship

(1) Within hardware and memory constraints, there is no upper limit to the number of sources and receptors that can be modeled simultaneously.

(2) The Gaussian point source equation estimates concentrations from point sources after determining the effective height of emission and the upwind and crosswind distance of the source from the receptor. Numerical integration of the Gaussian point source equation is used to determine concentrations from line sources (runways). Integration over area sources (parking lots), which includes edge effects from the source region, is done by considering finite line sources perpendicular to the wind at intervals upwind from the receptor. The crosswind integration is done analytically; integration upwind is done numerically by successive approximations. Terrain elevation differences between sources and receptors are neglected.

(3) A reasonable height above ground level may be specified for each receptor.

g. Plume Behavior

(1) Briggs final plume rise equations are used. If plume height exceeds mixing height, concentrations are assumed equal to zero. Surface concentrations are set to zero when the plume centerline exceeds mixing height.

(2) For roadways, plume rise is not treated.

(3) Building and stack tip downwash effects are not treated.

h. Horizontal Winds

(1) Steady state winds are assumed for each hour. Winds are assumed to be constant with altitude.

(2) Winds are entered manually by the user or automatically by reading previously loaded NCDC annual data files.

i. Vertical Wind Speed

Vertical wind speed is assumed to be zero.

j. Horizontal Dispersion

(1) Six stability classes are used (P–G classes A through F).

(2) Aircraft runways, vehicle parking lots, stationary sources, and training fires are modeled using PAL2. Either rural (Pasquill-Gifford) or urban (Briggs) dispersion settings may be specified globally for these sources.

(3) Vehicle roadways, aircraft taxiways, and aircraft queues are modeled using CALINE3. CALINE3 assumes urban dispersion curves. The user specifies terrain roughness.

k. Vertical Dispersion

(1) Six stability classes are used (P–G classes A through F).

(2) Aircraft runways, vehicle parking lots, stationary sources, and training fires are modeled using PAL2. Either rural (Pasquill-Gifford) or urban (Briggs) dispersion settings may be specified globally for these sources.

(3) Vehicle roadways, aircraft taxiways, and aircraft queues are modeled using

CALINE3. CALINE3 assumes urban dispersion curves. The user specifies terrain roughness.

l. Chemical Transformation

Chemical transformations are not accounted for.

m. Physical Removal

Deposition is not treated.

n. Evaluation Studies

None cited.

A.5 Industrial Source Complex Model (ISC3)

Reference

Environmental Protection Agency, 1995. User's Guide for the Industrial Source Complex (ISC3) Dispersion Models, Volumes 1 and 2. EPA Publication Nos. EPA-454/B-95-003a & b. Environmental Protection Agency, Research Triangle Park, NC. (NTIS Nos. PB 95-222741 and PB 95-222758, respectively)

Availability

The model code is available on the EPA's Internet SCRAM website. ISC3 (as PB 2002-500055) is also available on diskette from the National Technical Information Service (see Section A.0).

Abstract

The ISC3 model is a steady-state Gaussian plume model which can be used to assess pollutant concentrations from a wide variety of sources associated with an industrial source complex. This model can account for the following: Settling and dry deposition of particles; downwash; area, line and volume sources; plume rise as a function of downwind distance; separation of point sources; and limited terrain adjustment. ISC3 operates in both long-term and short-term modes.

a. Recommendations for Regulatory Use

ISC3 is appropriate for the following applications:

- Industrial source complexes;
- Rural or urban areas;
- Flat or rolling terrain;
- Transport distances less than 50 kilometers;
- 1-hour to annual averaging times; and
- Continuous toxic air emissions.

The following options should be selected for regulatory applications: For short term or long term modeling, set the regulatory "default option"; *i.e.*, use the keyword *DEFAULT*, which automatically selects stack tip downwash, final plume rise, buoyancy induced dispersion (BID), the vertical potential temperature gradient, a treatment for calms, the appropriate wind profile exponents, the appropriate value for pollutant half-life, and a revised building wake effects algorithm; set the "rural option" (use the keyword *RURAL*) or "urban option" (use the keyword *URBAN*); and set the "concentration option" (use the keyword *CONC*).

b. Input Requirements

Source data: Location, emission rate, physical stack height, stack gas exit velocity, stack inside diameter, and stack gas

temperature. Optional inputs include source elevation, building dimensions, particle size distribution with corresponding settling velocities, and surface reflection coefficients.

Meteorological data: ISC3 requires hourly surface weather data from the preprocessor program RAMMET, which provides hourly stability class, wind direction, wind speed, temperature, and mixing height. For ISCLT3, input includes stability wind rose (STAR deck), average afternoon mixing height, average morning mixing height, and average air temperature.

Receptor data: Coordinates and optional ground elevation for each receptor.

c. Output

Printed output options include:

- Program control parameters, source data, and receptor data;
- Tables of hourly meteorological data for each specified day;
- "N"-day average concentration or total deposition calculated at each receptor for any desired source combinations;
- Concentration or deposition values calculated for any desired source combinations at all receptors for any specified day or time period within the day;
- Tables of highest and second highest concentration or deposition values calculated at each receptor for each specified time period during a(n) "N"-day period for any desired source combinations, and tables of the maximum 50 concentration or deposition values calculated for any desired source combinations for each specified time period.

d. Type of Model

ISC3 is a Gaussian plume model. It has been revised to perform a double integration of the Gaussian plume kernel for area sources.

e. Pollutant Types

ISC3 may be used to model primary pollutants and continuous releases of toxic and hazardous waste pollutants. Settling and deposition are treated.

f. Source-Receptor Relationships

ISC3 applies user-specified locations for point, line, area and volume sources, and user-specified receptor locations or receptor rings.

User input topographic evaluation for each receptor is used. Elevations above stack top are reduced to the stack top elevation, *i.e.*, "terrain chopping".

User input height above ground level may be used when necessary to simulate impact at elevated or "flag pole" receptors, *e.g.*, on buildings.

Actual separation between each source-receptor pair is used.

g. Plume Behavior

ISC3 uses Briggs (1969, 1971, 1975) plume rise equations for final rise.

Stack tip downwash equation from Briggs (1974) is used.

Revised building wake effects algorithm is used. For stacks higher than building height plus one-half the lesser of the building height or building width, the building wake algorithm of Huber and Snyder (1976) is used. For lower stacks, the building wake algorithm of Schulman and Scire (Schulman