		General Characteristics
1	**Abstract of Model Capabilities**	The INPUFF (INtegrated PUFF) computer code is designed to simulate dispersion from semi-instantaneous or continuous point sources over a spatially and temporally variable wind field. The code can estimate concentrations from multiple point sources at up to 100 receptors with (x, y, z) specification. INPUFF is capable of simulating moving point sources as well as stationary sources.
2	**Sponsor and/or Developing Organization**	U.S. Environmental Protection Agency Atmospheric Sciences Research Laboratory Office of Research and Development Research Triangle Park, N.C. 27711
3	**Last Custodian/ Point of Contact**	Contacts: W.B. Petersen Atmospheric Sciences Research Laboratory Meteorology and Assessment Division U.S. Environmental Protection Agency Research Triangle Park, N.C. 27711 Phone: (919) 541-1376 L.G. Lavdas Research Meteorologist USDA, U.S. Forest Service Georgia Forestry Center Rte. 1, Box 182A, Dry Branch, GA 31020
4	**Life-Cycle**	Several requests to the EPA for assistance in modeling the air quality downwind of incineration ships prompted the development of an integrated puff model. ! INPUFF Version 2.1, date 12/04/86: Update is in subroutine CONCEN and only affects concentration estimates if LBID (Buoyancy Induced Dispersion) option is selected. ! INPUFF Version 2.2, date 1/27/88: Update is in subroutine CONCEN and only affects concentration estimates if LDEPS (Deposition and Settling) option is selected. ! INPUFF Version 2.3, date 9/2/88: Function XVY has been replaced, and minor change in subroutine CMBRMV.
5	**Model Description Summary**	The INPUFF (INtegrated PUFF) computer code is designed to simulate dispersion from semi-instantaneous or continuous point sources over a spatially and temporally variable wind field. The algorithm is based upon Gaussian puff assumptions including a vertically uniform wind direction field and no chemical reactions. INPUFF can estimate concentrations from multiple point sources at up to 100 receptors
6	**Application Limitation**	Chemical species are assumed to be non-buoyant and passive with respect to chemical reactivity.
7	**Strengths/ Limitations**	Principal strengths of the INPUFF code include the capabilities of handling time-dependent release rates and multiple release locations. Major weakness of the INPUFF code is its inability to model dense-gas dispersion.
8	**Model References**	! W.B. Petersen and L.G. Lavdas, “INPUFF 2.0 A Multiple Source Gaussian Puff Dispersion Algorithm — User’s Guide,” EPA/600/8-86/024. August 1986.

9	**Input Data/Parameter Requirements**	Project Title; Options of wind field specification, dispersion coefficient option, etc.; Coordinates of region to be modeled, etc.; Number of periods of simulation; simulation time (length of a meteorological period); number of sources; and number of receptors; x, y, and z coordinates of the receptor; (Optional) If LADT is TRUE then read this record; Format of unit 21 Met. Data; (Optional) If LADT is TRUE then read this record. East-west coordinate of the S.W. corner of meteorological region; North-south coordinate of the S.W. — corner of meteorological region; Number of grid squares in east-west — direction; Number of grid squares in north- south direction; East-west width of grid square; North-south width of grid square. Options of stack downwash, plume rise, buoyancy induced dispersion, puff combinations, and deposition/settling; Time between puff releases; “Sampling” time for concentrations; Time to start concentration calculations; Fraction of crosswind dispersion — for puff combination; Anemometer height; Wind direction; Wind speed; Mixing height; Stability class; Sigma phi, standard deviation of elevation angle; Sigma theta, standard deviation of azimuth angle; Air temperature; Minimum distance source to receptor; X Coordinate of source; Y Coordinate of source; Number of source emissions records; Time between source emissions; Deposition velocity; Settling velocity; Emission rate; Height of release; Stack gas temperature; Stack diameter; Stack gas velocity; Stack gas volume flow; Initial sigma Y; Initial sigma Z; Source direction; Source speed.
10	**Output Summary**	Output from INPUFF has eleven parts, three of which are optional. The output begins with printing the titles of the run. The next printed information is a list of model options, followed by a list of the source options and input. Next are the source data followed by a printout of meteorological conditions used in the execution of the model for the current simulation period. These are followed by five pieces of information regarding how INPUFF simulates the release, including: simulation period, simulation time, puff type. The next two output sections are optional if the printing of the intermediate concentrations is desired. A table of average concentrations is output giving averages for each receptor for all meteorological periods. This output is repeated for all sources. Finally a table of average concentrations for all sources is provided.
11	**Applications**	Not known.
12	**User-Friendliness**	The code is user friendly. However, time-related parameters (such as simulation period, meteorological period, and sampling period) are restrictive and have to be properly specified.
13	**Hardware-Software Interface Constraints/ Requirements**	**Computer operating system:** IBM-PC **Computer platform:** 300K-bytes for the executable **Disk space requirements:** 2-3 minutes for typical problem **Run execution time** (for a typical problem)**:** FORTRAN **Programming language:** Plotting software **Other computer peripheral information:** Extremely Portable.
14	**Operational Parameters**	**Identify whether the code has any error diagnostic messages to assist the user in troubleshooting operational problems:** Yes, several spread throughout the code. INPUFF can only run one scenario (single or multiple release locations) in a single run.
16	**Runtime Characteristics**	INPUFF is relatively easy to set up and run. The first run may take about 15-20 minutes while subsequent runs take as little as 3 minutes.

Specific Characteristics

Part A: Source Term Submodel Type

A1	**Source Term Algorithm?**	__YES ✔ NO

Part B: Dispersion Submodel Type

B1	**Gaussian**	**✔ Straight-line plume __Segmented plume __ Statistical plume __ Statistical puff**

Part C: Transport Submodel Type

C2	**Deterministic**	Yes
C4	**Frame of Reference**	**__ Eulerian ✔ Lagrangian __ Hybrid __ Eulerian-Lagrangian**

Part D: Fire Submodel Type (Not Applicable)		
Part E: Energetic Events Submodel Type (Not Applicable)		
Part F: Health Consequence Submodel Type (No Information Provided.)		
Part G: Effects and Countermeasures Submodel Type (No Information Provided.)		
Part H: Physical Features of Model		
H2	**Release Elevation**	_✔_ ground _✔_ roof
H6	**Mixing Layer**	_✔_ trapping ___ lofting _✔_ reflection ___ penetration ___ inversion breakup fumigation ___ temporal variability
H7	**Cloud Buoyancy**	_✔_ neutral [passive] ___ dense [negative] _✔_ plume risel [positive]
H10	**Deposition**	___ gravitational setting _✔_ dry deposition ___ precipitation scavenging ___ resistance theory deposition __ simple deposition velocity __ liquid deposition __ plateout and re-evaporation
Part I: Model Input Requirements		
I1	**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 __ concentration profile at end of jet affected zone Release dimensions: _✔_ point __ line __ area Release elevation: _✔_ ground _✔_ roof _✔_ stack
I2	**Meteorological Parameters**	Wind speed and wind direction: __single point __ single tower/multiple point _✔_ multiple towers Temperature: __ single point __ single tower/multiple point _✔_ multiple towers Dew point temperature: __ single point __ single tower/multiple point __ multiple towers Precipitation: __ single point __ single tower/multiple point __ multiple towers 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: See above.
Part J: Model Output Capabilities		
J4	**Tabular at Fixed Downwind Locations**	Yes
Part K: Model Usage Considerations (See Items 5 - 7.)		