General Characteristics		
1	**Abstract of Model Capabilities**	CAP88-PC is an approval system for demonstrating compliance with 40 CFR 61 Subpart H, the Clean Air Act (NSHAP) standard which applies to U.S. Department of Energy (DOE) facilities that emit radionuclides to air under normal operating conditions. The CAP88-PC software package allows users to perform full-featured dose and risk assessments in a personal computer environmental. CAP88-PC can be used for assessments of both collective populations and maximally-exposed individuals, and allow full editing of many environmental transport variables.
2	**Sponsor and/or Developing Organization**	Barry Parks U.S Dept. Of Energy, ER-8/GTN, 19901 Germanton Road, Germantown, MD 20874-1290 (301) 903-9649 (301)903-7074 **Fax** barry.parks@oer.doe.gov **sponsoring organization** barry.parks@oer.doe.gov **developing organization**
3	**Last Custodian/ Point of Contact**	Barry Parks U.S Dept. Of Energy, ER-8/GTN, 19901 Germanton Road, Germantown, MD 20874-1290 (301) 903-9649 (301)903-7074 **Fax** dxw@inel.gov **primary individual** dxw@inel.gov **secondary individual**
4	**Life-Cycle**	CAP88-PC traces its origins to the late 1970's when the U.S. Environmental Protection Agency (EPA) decided to regulate radionuclides under the authority of the Clean Air Act. EPA then began work with Oak Ridge National Laboratory (ORNL) to develop appropriate computer models for estimating doses from radionuclides in air. The first program developed was called AIRDOS (pronouced “AIR DOSE”). This model was lacking in many respects and was improved by ORNL with the addition of the RADRISK (RADiation RISK) and DARTAB (for Dose And Risk TABulation) programs. The combined AIRDOS, RADRISK, and DARTAB models are now referred to, collectively, as CAP88, which stands for “Clean Air Act Assessment Package-1988". CAP88 ran on large mainframe computers at ORNL, an expensive and time-consuming efftort. EPA and DOE began a cooperative project to produce a personal computer version of CAP88 at the Office of Radiation Program’s Las Vegas Facility in the late 1980s. The final software was released in March 1992. The software system consists of a single 3.25" distribution disk and a User’s Guide. CAP88-PC is offically distributed by DOE EH-232 and the Oak Ridge Radiation Shielding Information Center. Our office (DOE/ER) is now distributing a beta version of CAP88-PC Version 2.0, for testing and comment. It offers a new graphical user interface, new utilities for preparing and managing population and weather data, and several new decay chains. It is available for downloading on the World Wide Web at this URL. http://www.er.doe.gov/production/esh/cap88pc.html
5	**Model Description Summary**	CAP88-PC uses a modified Gaussian plume equation to estimate the average dispersion of radionuclides released from up to six sources. The sources may be either elevated stacks, such as a smokestack, or uniform area sources, such as a pile of uranium mill tailing. Plume rise is calculated assuming either a momentum or buoyancy-driven plume. Assessment are done for a cicular grid of distances and directions within a radius of 80 kilometers (50 miles) around the facility. The program computes radionuclide concentrations in air, rates of deposition on ground surfaces, concentrations in food and intake rates to people from ingestion of food produced in the assessment area.
6	**Application Limitation**	CAP88-PC does not address terrain height, building wake or trip downwash, multiple sources (i.e., all sources are co-located) or the skyshine pathway. Releases are assumed to be low-level, chronic and the model is not appropriate for assessment of accidental releases. Decay products are not grown in during plume transport. Rainfall is averaged over the assessment period (i.e., not episodic). Dose/risk conversion factors are from EPA circa 1988 and cannot be changed.
7	**Strengths/ Limitations**	**Strengths:** CAP88-PC uses the Gaussian plume model, which fits reality well is commonly used in similar models. The model is used by over 1,000 registered users around the world. **Limitations:** See limitations above (6)

8	**Model References**	**!** Parks, B.S., User's Guide for CAP88-PC, EPA 402-B-92-001, March 1992. **!** Fields, D.E; Miller, C.W.; Cotter, S.J. Validation of the AIRDOS-EPA computer code by simulating intermediate range transport of Kr-85 from the Savannah River Plant. Atmos. Environ. 18:2029-2036; 1984. **!** Maheras, S.J.; Ritter, P.D.; Leonard, P.R.; and Moore, R. Benchmarking of the CaP-88 and GENII computer codes using 1990 and 1991 monitored atmospheric releases from the Idaho National Engineering Laboratory, Health Phys. 67:509-517; November 1994.
8	**Model References (Cont.)**	**!** Moore, R.E. Baes, C.F. III, McDowell-Boyer, L.M. Watson, A.P., Hoffman, F.O., Pleasant, J.C. Miller, C.W. "AIRDOS-EPA: A Compterized Methodology for Estimating Environmental Concentrations and Dose to Man from Airborne Releases of Radionuclides., ORNL-5532, EPA 520/1-79-009, U.S. EPA Office of Radiation Programs, Washington, D.C., 20460. **!** EPA 520/1-89-005 Risk Assessment Methodology: Draft Environmental Impact Statement for Proposed NESHAPS for Radionuclides, Volume 1, Background Information Document, U.S. EPA, Office of Radiation Programs, Washington, D.C. 20460, February 1989.
9	**Input Data/Parameter Requirements**	Stack height and diameter, source term (Ci/yr) for each required specks, flow rate (for momentum driven plumes), calories/second (for buoyant plumes), radionuclides, clearance class, particle size, annual average wind speed/direction/stabililty data, fractions of food that are home grown, from the assessment area and imported, population distributions, mixing, lid height, rainfall rate, average annual termperature, density of beef and milk cattle, fraction of cultivated land.
10	**Output Summary**	Effective dose equivalent of maximally exposed individual, person-rem for collective population, individual lifetime risk, deaths/year for the collective popuation.
11	**Applications**	All DOE facilities, required to demonstrate compliance with 40 CFR 61 Subpart H, the Clean Air Ac t standard which applies to U.S. Department of Energy (DOE) facilities that emit radionuclides to air. Other facilities that are required to demonstrate compliance are uranium mines elemental phosphorus plants, uranium mill tailings piles, metal extraction industry, coal fired power plants, NRC licensees, radiopharmaceuticals, accelerators, universities, nuclear power plants, radioactive waste disposal sites (WIPP, Yucca Mountain).
12	**User-Friendliness**	Windows 3.1-based menus and icons and on-screen help, in version 2 (beta). Menus in version 1, DOS-based.
13	**Hardware-Software Interface Constraints/ Requirements**	**Computer operating system:** DOS/Windows 3.1 **Computer platform:** Any Wintel DOS/Windows **Disk space requirements:** 2 megabytes for version 1, 10 megabytes for version 2. **Run execution time** (for a typical problem)**:** less than 1 minute, assuming a 486 processor or better. **Programming language:** C++, Fortran, Visual Basic **Other computer peripheral information:**
14	**Operational Parameters**	**Identify whether the code has any error diagnostic messages to assist the user in troubleshooting operational problems:** The code sends error messages to the screen which are documented in the manual. **Set up time for: Typical times are: *first-time user:*** An hour ***experienced user:*** 5 minutes
15	**Surety Considerations**	**All quality assurance documentation:** Maheras, S.J.; Ritter, P.D.; Leonard, P.R.; and Moore, R. Benchmarking of the CAP-88 and GENII computer codes using 1990 and 1991 monitored atmospheric releases from the Idaho National Engineering Laboratory, Health Phys. 67:509-517; November 1994. Fields, D.E.; Milller, C.W.; Cotter, S.J. Validation of the AIRDOS-EPA computer codes by simulating intermediate range transport of Kr-85 from the Savannah River Plant. Atmos. Environ. 18:2029-2036; 1984. **Benchmark runs:** A sample problem is supplied with the program **Validation calculations:** **Verification with field experiments that has been performed with respect to this code:** Fields, D.E.; Miller, C.W.; Cotter, S.J. Validation of the AIRDOS-EPA computer code by simulating intermediate range transport of Kr-85 from the Savannah River Plant. Atmos. Environ. **18:2029-2036;1984.**
16	**Runtime Characteristics**	Less than 5 minutes on a 486 or better.
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 (Not Applicable)		
Part D: Fire Submodel Type (Not Applicable)		
Part E: Energetic Events Submodel Type (Not Applicable)		
Part F: Health Consequence Submodel Type (Not Applicable)		
Part G: Effects and Countermeasures Submodel Type (No Information Provided.)		
Part H: Physical Features of Model		
H1	**Stability Classification Turbulence Typing**	**Pasquill-Gilfford-Turner:** Yes **STAR:** Yes **Irwin:** **Sigma theta:** **Richardson number:** **Monin-Obukhov length:** **TKE-driven:** **Split sigma:**
Part I: Model Input Requirements (See Item 9)		
Part J: Model Output Capabilities (See Item 10)		
Part K: Model Usage Considerations (No Information Provided.)		