General Characteristics		
1	**Abstract of Model Capabilities**	FPEtool is a compilation of several modules grouped into 5 categories. These categories include SYSTEM SETUP, FIREFORM, MAKEFIRE, FIRE SIMULATOR, CORRIDOR, and 3rd ROOM. FIREFORM solves single-parameter questions (e.g., ceiling jet temperature, mass flow through a vent, upper layer temperature, etc.), while MAKEFIRE specifies fire heat release rate and pyrolysis rate as a function of time. FIRE SIMULATOR focuses on fire growth in a 1-room, 2-vent compartment with sprinkler and detector. The CORRIDOR routine predicts the characteristics of a moving smoke wave. Lastly, 3rd ROOM predicts smoke conditions developing in a room and the subsequent reduction in human visibility resulting from exposure to such conditions.
2	**Sponsor and/or Developing Organization**	**Sponsoring Organization:** General Services Administration Public Building Service Office of Real Property Management **Developing Organization:** National Institute of Standards and Technology (NIST) Building and Fire Research Laboratory Gaithersburg, MD 20899
3	**Last Custodian/ Point of Contact**	Mr. Walter W. Jones; Group Leader Fire Modeling and Applications Group Building and Fire Research Laboratory NIST Gaithersburg, MD 20899-001 PHN: 301/975-6853
4	**Life-Cycle**	FPEtool was first released in 1984. It began as several separate unrelated programs written in MSDOS BASICA. The code rapidly grew beyond the capability of QuickBasic to compile as a single executable file, so the code was divided into separate executable modules defined by function. Version 3.2 of the code was released in April 1995. Major enhancements contained in the latest version, as compared to earlier versions of the code include incorporation of an estimate of smoke conditions developing within a room receiving steady-state smoke leakage from an adjacent space, and an estimation of the human viability resulting from exposure to developing conditions within the room based upon the smoke temperature and toxicity.
5	**Model Description Summary**	FPEtool is a collection of computer simulation procedures providing numerical engineering calculations for fire phenomena. The main emphasis of the code is its applicability to fire engineering, fire risk, and life safety.
6	**Application Limitation**	See weaknesses.
7	**Strengths/ Limitations**	**Strengths**: FPEtool is a menu-driven code with relatively little computational expense, offering modeling capabilities desired for most Safety Analysis Report applications; Graphical output of select results are provided and the model does support multi-component fire sites and both natural and mechanically ventilated rooms; and, Contains a model for estimating the time to human untenability from heat and inhalation exposure in a space experiencing smoke infiltration. **Limitations:** Some of the models have noted limitations in accuracy and do not account for variation in room or fire characteristics in the horizontal dimension; Program does not offer for all computational models, the option of exiting ot of an input menu without first satisfying a minimum set of input requirements; Self-heating and self-energy effects are neglected; and, Module limitations make it more difficult to adjust the succession of time inputs and fire source term characteristics to ensure that the predictions are within the regime of applicability.
8	**Model References**	! Deal, S., "Technical Reference Guide for FPEtool Version 3.2", NIST (U.S.), NISTIR 5486, Gaithersburg, MD, 20899, April, 1995. ! Notarianni, K.A., and W.D. Davis, "Use of Computer Models to Predict Temperature and Smoke Movement in High Bay Spaces", NIST (U.S.), NISTIR 530, Gaithersburg, MD 20899, 1993. ! Nelson, H.E., and S. Deal, "Comparison of Four Fires with Four Fire Models", Proceedings of 3rd International Symposium, IAFSS, Edinburg, Scotland, pp. 719-728, 1992.
9	**Input Data/Parameter Requirements**	The program input is conducted by a series of on-screen menu-driven table entries. Generally, within several minutes, the input can be entered and processed. There is varying degrees of ease with which the user can move from one menu to another.

10	**Output Summary**	Program output is presented to the user by a number of different means depending upon the computational model or utility in use at the time. Intermediate results are generally provided on-screen via tables which are updated in the progression calculations. Fire simulation results can be written to a LOTUS spreadsheet file. The following outputs are available: ! Temperature characteristics of the average smoke layer; ! Height of smoke layer bottom above floor; ! Average oxygen for the smoke layer; ! Average carbon monoxide for the smoke layer; ! Average carbon dioxide for the smoke layer; ! Fire heat release rate; ! Fuel pyrolysis rate; ! Mean flame height above the base of the flames; ! Fire HRR supportable by plume entrained oxygen; ! Mass of lower layer air entrained into the plume; ! Lower Flammability Level sustaining combustion.
11	**Applications**	Single- and teo-room compartments connected by a corridor or interior vent. Maximum of two outside vents or pathways to the ambient environment. Only combustion of solid fuels is supported.
12	**User-Friendliness**	The SYSTEM PARAMETERS main menu item allows the user to specify alternative default path destination from input data and output files, changing warning flags and screen color pallet, switching between metric and English units, and saving these settings in case files for future applications.
13	**Hardware-Software Interface Constraints/ Requirements**	IBM PC-compatible computer with an 8086 or higher series processor. A minimum of 640 kilobytes RAM, and 3 megabytes of hard-disk space. The program graphics display drivers support CGA or better. A math coprocessor chip is not required, but will significantly improve calculation speed. DOS Version 3.1 or later.
14	**Operational Parameters**	In general, most FPEtool modules are easy to execute.
15	**Surety Considerations**	**Quality Assurance:** User's Manual **Benchmarking and V & V:** Benchmarking: No formal benchmarking has been performed. Verification: No formal source code verification has been performed. The current source code structure is convoluted and does not lend itself well to either modularization or modification. Validation Against Experimental Data: Formal validation of FPEtool has not been performed. Many of the components of FPEtool are based on experimental data and predictions from previous versions of FPEtool, which have been compared with data from a number of experiments.
16	**Runtime Characteristics**	Execution times were extremely fast with the exception of the FREEBURN and MAKEFIRE modules. Depending on the parameters chosen, the aggregate heat release rate and fuel consumption rate could take 30 minutes or greater.

Specific Characteristics

Part A: Source Term Submodel Type

A1	**Source Term Algorithm?**	✔YES NO

Part B: Dispersion Submodel Type (Not Applicable)

Part C: Transport Submodel Type (Not Applicable)

Part D: Fire Submodel Type

D1	**Radiant Energy**	Yes
D4	**Flash Fires**	Yes

Part E: Energetic Events Submodel Type (Not Applicable)		
Part F: Health Consequence Submodel Type (Not Applicable)		
Part G: Effects and Countermeasures Submodel Type (Not Applicable)		
Part H: Physical Features of Model (No Information Provided.)		
Part I: Model Input Requirements (See item 9)		
Part J: Model Output Capabilities		
J3	**Concentration Versus Time Plots**	Yes
J4	**Tabular at Fixed Downwind Locations**	Yes
Part K: Model Usage Considerations (See Items 5 - 7.)		