General Characteristics		
1	**Abstract of Model Capabilities**	FIRAC estimates radioactive and non-radioactive source terms and predicts fire-induced flows and thermal and material transport within the facilities. It is applicable to any facility with or without ventilation systems. It is a fast-running code with a user-friendly interface, and includes source term models for fires.
2	**Sponsor and/or Developing Organization**	Nuclear Regulatory Commission (NRC) Department of Energy (DOE); DOE/EH
3	**Last Custodian/ Point of Contact**	Mr. William S. Gregory MS-K575 Los Alamos National Laboratory Los Alamos, NM *7545 PHN: 505/667-1120 E-mail: bgregory@lanl.gov
4	**Life-Cycle**	FIRAC is one of a family of codes designed to provide improved safety analysis methods for the nuclear industry. Its predecessors include: TVENT (a code to analyze tornado-induced gas dynamics); TORAC (a code to analyze tornado-induced gas dynamics and material transport); EXPAC (a code to analyze explosion-induced gas dynamics and material transport); and, FIRAC-PC (FIRAC running on a PC platform).
5	**Model Description Summary**	FIRAC is designed to estimate radioactive and non-radioactive source terms and predict fire-induced flows and thermal and material transport within the facilities. Particular focus is on transport through the ventilation system of these facilities. FIRAC includes a fire compartment module based on the FIRIN computer code, which was developed at Pacific Northwest National Laboratory (PNNL). The FIRIN module calculates fuel mass loss rates and energy generation rates within the fire compartment. It can also calculate the generation rate and size distribution of radioactive particles that become airborne as a result of a fire in a nuclear facility. More recently, a second fire module, based on the CFAST computer code, was added to FIRAC. CFAST was dveloped by the National Institute of Standards and Technology (NIST) to model fire growth and smoke transport in multi-compartment structures. The new combined code is called FIRAC2.
6	**Application Limitation**	! Diffusion and turbulence within the control volume is not modeled; and, ! Multi-dimensional flow within a room can not be easily or accurately simulated.
7	**Strengths/ Limitations**	**Strengths**: Fast running; User-friendly user interface; Inclusion of source term models for fires; and, no limit on the number of flow paths. **Limitations:** Momentum balance ignores spatial acceleration term; PC Version may be slow running on relatively large problems; and, Multi-gas species are not included in the EOS.
8	**Model References**	! S.W. Claybrook, "FIRAC/CFAST Preprocessor: User's Manual", Numerical Applications Incorporated document NAI9411-01, July, 1994; ! B.D. Nichols et al, "FIRAC User's Manual: A Computer Code to Simulate Fire Accidents in Nuclear Facilities", Los Alamos National Laboratory Manual LA-10678-M, April, 1986; and, ! W.S. Gregory et al, "FIRAC-PC User's Manual", Los Alamos National Laboratory draft report, May, 1992.
9	**Input Data/Parameter Requirements**	Data and input boundary condition requirements are: ! Up to five gas species can be included in each calculation; ! Input is available to describe ventialtion system components such as blower, dampers, and filters; and, ! Time-dependent user-specified boundary conditions for pressure, temperature, mass fractions, and velocities can be specified. A FIRAC2 preprocessor runs on IBM PC and compatible computers with EGA and VGA graphics capability. The input to the preprocessor is via data windows.
10	**Output Summary**	Both printer and graphics output files are generated by FIRAC. A post-processor program called POST can be used to display the FIRAC plot files.
11	**Applications**	FIRAC is applicable to any facility (i.e., buildings, tanks, multiple rooms, etc.) with and without ventilation systems. It is applicable to multi-species gas mixing/transport problems, as well as aerosol transport problems.

12	**User-Friendliness**	Input is via a Graphical User Interface (GUI). Input error checking is performed.
13	**Hardware-Software Interface Constraints/ Requirements**	Machine/operating system options include CRAY, IBM PC, and SUN.
14	**Operational Parameters**	FIRAC does not appear to have a high degree of operability. Users indicated that the code can fail without any meaningful error message and regularly fails. Users also reported that interaction with the original code developers is typically required to complete calculations.
15	**Surety Considerations**	**Quality Assurance:** No Software Development Plan & Requirements. **Error Handling/Reporting:** Needs improvement. **Benchmarking and V & V:** B.D. Nichols et al, "Fire-Accident Analysis Code (FIRAC) Verification", 19th DOE/NRC Nuclear Air Cleaning Conference, Los Alamos National Laboratory; and, W.S. Gregory et al, "FIRAC Code Predictions of Kerosene Pool Fire Tests", Unpublished, Los Alamos National Laboratory report, May 23, 1989.
16	**Runtime Characteristics**	Execution time depends on problem size and duration of the transient. It ranges from a few seconds to a few minutes.
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
Part K: Model Usage Considerations (See items 5 -7.)		