General Characteristics		
1	**Abstract of Model Capabilities**	FIRAC/FIRIN is designed to predict the distribution of temperatures, pressures, flows, and radioactive material, among others, within a network system. It is designed to model airflows in an arbitrary connected network system of confinement areas and supporting ventilation systems. Confinement systems include gloveboxes, rooms, cells, etc. Airflow modeling includes the assessment of the movement of pollutants released within such compartments. The submodel FIRIN allows the evaluation of user-specified parameters such as energy, temperature, pressure, or mass addition. It is used to calculate the source terms generated by potential accident scenarios in nuclear facilities, estimating the mass generation rate and size distribution of radioactive material. FIRIN is designed to provide mass and energy input into FIRAC. Using the FIRIN/FIRAC code allows the user to evaluate the radioactive source terms within the facility and the source terms that will be released from the facility.
2	**Sponsor and/or Developing Organization**	**Sponsoring Organization:** Nuclear Regulatory Commission (NRC) **Developing Organization:** Joint collaboration of Los Alamos National Laboratory (LANL), Westinghouse Hanford Company (WHC), and the New Mexico State University. FIRIN was originally developed by Pacific Northwest National Laboratory (PNNL), and was extensively modified prior to its incorporation into FIRAC/FIRIN.
3	**Last Custodian/ Point of Contact**	Mr. William Gregory Los Alamos National Laboratory Los Alamos, NM PHN: 505/667-1120
4	**Life-Cycle**	FIRAC Cray Version (1985). FIRAC/FIRIN (PC Version 1) (1992). FIRAC/FIRIN (PC Version 2) (1993).
5	**Model Description Summary**	FIRAC/FIRIN is designed to predict the radioactive and non-radioactive source terms that lead to gas dynamic, material transport, and heat transfer in a nuclear facility during a fire scenario. Source terms include both initial source terms (within the facility) and source terms outside of the facility. As such, FIRAC/FIRIN capabilities are directed towards non-reactor nuclear facilities, in which compartments are connected through ventilation systems. The FIRAC/FIRIN capabilities are divided into the following major categories: Gas dynamic models; Material transport models; Heat transfer models; Fire models; and, Source term models.
6	**Application Limitation**	See weaknesses.
7	**Strengths/ Limitations**	**Strengths:** Excellent user interface; Widely used throughout the DOE complex for high hazard facilities; Ability to model quite complex network configurations; and, All HVAC components within a ventilation system could be easily addressed. **Limitations:** Code is limited since spatial variations can only be handled in an approximate way; Bi-directional flow in ductwork is not allowed in the lumped-parameter formulations; Only one fire compartment can be modeled at a time; Inability to model fire mitigation; and, Inability to model horizontal location of the fire.
8	**Model References**	! B.D. Nichols, and W.S. Gregory, “FIRAC User’s Manual: A Computer Code to Simulate Fire Accidents in Nuclear Facilities”, NUREG/CR-4561 (LA-10678-M), Los Alamos National Laboratories for the Nuclear Regulatory Commission, April 1986. ! W.S. Gregory, Et al., “FIRAC-PC User’s Manual” (Draft),Engineering and Safety Analysis Group (N-6), Los Alamos National Laboratory, Los Alamos, NM. ! M.K. Chan, et al., “User’s Manual for FIRIN - A Computer Code to Estimate Accidental Fire and Radioactive Airborne Releases in Nuclear Fuel Cycle Facilities”, NUREG/CR-3037 (PNL-4532), Pacific Northwest National Laboratory for the Nuclear Regulatory Commission, February, 1989.
9	**Input Data/Parameter Requirements**	Input to FIRAC/FIRIN is relatively easy. The input is organized into 2 major areas: (1) a network of components representing all compartments, cells, etc., and their associated connecting ventilation system, and (2) a fire compartment and its options which specifies the simulation to be modeled. These include: Fire compartment thermal effects; Smoke source term versus time; Radioactive source term versus time; Particle size distribution.

10	**Output Summary**	The output of FIRAC/FIRIN is organized into 2 major areas: (1) FIRIN fire compartment submodule output, and (2) FIRAC ventilation system submodule output. These include: FIRAC node summary; FIRAC branch summary; Node summary for 1 species; and, Branch summary for 1 species.
11	**Applications**	FIRAC/FIRIN has a wide range of applicability to various situations and sources. The code is essentially site independent. FIRAC/FIRIN could be used in a wide range of fire accident scenarios and facility reconfigurations, along with a wide variety of default combustible sources and radioactive material forms.
12	**User-Friendliness**	FIRAC/FIRIN has an easy to use interface which makes most code applications relatively simple.
13	**Hardware-Software Interface Constraints/ Requirements**	IBM-PC, or fully comparable, with VGA graphics board and monitor. Math coprocessor with an 80386 or greater machine (suggested Pentium at least 90 MHz). A 5-1/4 inch or 3-1/2 inch high density disk drive is required to install FIRAC/FIRIN from the distribution disk. A mouse is also desirable, but not required. DOS 3.X or higher. SVS FORTRAN, if changes to the code are needed and the code is to be recompiled.
14	**Operational Parameters**	Generally easy to operate code.
15	**Surety Considerations**	**Quality Assurance:** B.D. Nichols, and W.S. Gregory, "FIRAC User's Manual: A Computer Code to Simulate Fire Accidents in Nuclear Facilities", NUREG/CR-4561 (LA-10678-M), Los Alamos National Laboratories for the Nuclear Regulatory Commission, April 1986. W.S. Gregory, Et al., "FIRAC-PC User's Manual" (Draft),Engineering and Safety Analysis Group (N-6), Los Alamos National Laboratory, Los Alamos, NM. M. K. Chan, et al., "User's Manual for FIRIN - A Computer Code to Estimate Accidental Fire and Radioactive Airborne Releases in Nuclear Fuel Cycle Facilities", NUREG/CR-3037 (PNL-4532), Pacific Northwest National Laboratory for the Nuclear Regulatory Commission, February, 1989. **Benchmarking and V & V:** Allison, T.L., "Fire Load Verification for RTF Room 9, 15, and 17", EPD-SR-92-1159, Westinghouse Savannah River Company, Aiken, SC, November, 1992. W.S. Gregory, et. Al., "FIRAC Code Predictions of Kerosene Pool Fire Tests" (unpublished report), May 23, 1989. S. Claybrook, Numerical Applications Incorporated, Personal Communication, "Comparison of FIRIN Predictions to 1986 LLNL Enclosure Fire Tests 9 na 10", June, 1992.
16	**Runtime Characteristics**	Minimal, compared to input preparation.

Specific Characteristics

Part A: Source Term Submodel Type

A1	**Source Term Algorithm?**	_✔_YES __NO
A3	**For Radiological Consequence Assessment Models**	**Gaseous releases: _✔_ noble gases _✔_ iodines _✔_ other non-reactive gases** **Aerosol releases: Yes** **Chemistry _✔_ Isotopic exchange _✔_ Physical properties capability**

Part B: Dispersion Submodel Type (Not Applicable)

Part C: Transport Submodel Type (Not Applicable)

Part D: Fire Submodel Type

D1	**Radiant Energy**	Yes
D3	**Jet Fires**	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		
J2	**Graphic Contours and Resolution**	Yes
J4	**Tabular at Fixed Downwind Locations**	Yes
Part K: Model Usage Considerations (See Items 5 - 7.)		