	General Characteristics	
1	**Abstract of Model Capabilities**	VULCAN is applicable to internal compartment fires and external pool and jet fires.
2	**Sponsor and/or Developing Organization**	Norwegian Oil and Gas Industries Defense Special Weapons Agency (DSWA)
3	**Last Custodian/ Point of Contact**	SINTEF (Norway) Sandia National Laboratories (SNL)
4	**Life-Cycle**	VULCAN is based extensively on the KAMELEON fire codes developed by B.F. Magnussen and his colleagues at SINTEF/NTH.
5	**Model Description Summary**	VULCAN is a finite difference field model which solves the governing equations (PDES) on a grid. VULCAN includes combustion, soot, turbulence, and thermal radiation models. It uses a “first principles” approach to solve the basic conservation equations.
6	**Application Limitation**	See weaknesses.
7	**Strengths/ Limitations**	**Strengths:** Applicable to a wide-range of problems/fires; Able to predict, a priori, how a fire will develop and spread heat and smoke;Very little reliance on empirical parameters; Provides detailed spatial and temporal information; Submodels contain fundamental physical processes; and, Can simulate large eddy transport. **Limitations:** Limited to cartesian coordinate systems; Limited to hydrocarbon-based fuels; Permits only 1 or 2 fuel types; No radioactive source term calculation capability; Very CPU intensive; Requires expertise with CFD; Limited flame spreading model for solid materials; and, No fire suppression capability.
8	**Model References**	! J. Holen, M. Brostrom, and B.F> Magnussen, “Finite Difference Calculation of Pool Fires”, Proceedings of 23rd International Symposium on Combustion, pp. 1677-1683, 1990. ! L.A. Gritzo, et al. “Heat Transfer to the Fuel Surface in Large Pool Fires”, Transport Phenomenon in Combustion, S.H. Choa (editor), Taylor and Francis Publishing, Washington, D.C., 1995. ! L.A. Gritzo, et al., “Wind-Induced Interaction of a Large Cylindrical Calorimeter and an Engulfing JRE Pool Fire”, Symposium on Thermal Science & Engineering in Honor of C.L. Tien, Berkeley, CA, November 14, 1995.
9	**Input Data/Parameter Requirements**	User must generate grid, define fuels, objects , and boundary conditions. All thermophysical fuel and object parameters must be inputted. In addition, wind boundaries and fuel releases from jets must be specified.
10	**Output Summary**	VULCAN provides detailed output at every grid point for every time step of x-, y-, and z-velocity components, density, turbulence quantities/parameters, temperature, species, radiative heat flux, pool evaporation rate, temperatures of objects, heat flux to objects, absorption coefficient, and pressure.
11	**Applications**	Applicable to hydrocarbon pool or jet fires in the open, or in an enclosure. Could also be applied to a multi-compartment fire.
12	**User-Friendliness**	Requires expert user and familiarity with CFD and fire modeling. Pre- and post-processors greatly aid in generation of input deck, and outputting results in graphical format.
13	**Hardware-Software Interface Constraints/ Requirements**	Workstation, preferably Silicon Graphics, to take advantage of integrated graphics and calculations. The faster the computer, the better. FORTRAN Compiler, C Compiler, Test Editor.
14	**Operational Parameters**	Needs expert-level user.

15	**Surety Considerations**	J. Holen, M. Brostrom, and B.F. Magnussen, "Finite Difference Calculation of Pool Fires", Proceedings of 23rd International Symposium on Combustion, pp. 1677-1683, 1990. L.A. Gritzo, et al. "Heat Transfer to the Fuel Surface in Large Pool Fires", Transport Phenomenon in Combustion, S.H. Choa (editor), Taylor and Francis Publishing, Washington, D.C., 1995. L.A. Gritzo, et al., "Wind-Induced Interaction of a Large Cylindrical Calorimeter and an Engulfing JRE Pool Fire", Symposium on Thermal Science & Engineering in Honor of C.L. Tien, Berkeley, CA, November 14, 1995.
16	**Runtime Characteristics**	4-24 hours, depending on the workstation.
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
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.)		