

C R I T I C A L I T Y A C C I D E N T C O D E
I D E N T I F I C A T I O N S H E E T S

AGNES

DRAFT

GENERAL I NFORMATI ONS (1)

Designation of the code	AGNES	
Summary (General purpose)	Models the transient criticality of a fissile solution contained in a cylindrical vessel with vertical walls. Temperature, radiolytic gas void and boiling void feedback are taken into account. Cooling by natural convection of air outside of core or forced cooling by water can be calculated. Total number of fission is calculated based on the power profile.	
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Status of code	First version released (date and reference number)	AGNES (1985)
	Current version released (date and reference number)	AGNES2 (2002)
	Current development	AGNES3
	Language program / Modularity	Fortran 77
	Operating system (windows, linux, unix,...)	Linux and Windows
	Software requirements (fortran compiler,...)	Fortran compiler
	Portability (PC / Workstation)	Workstation, PC

	Availability / Web site	
	Typical running time (for one calculation)	200 s → 2 min.
Comments		

GENERAL INFORMATION (2)

User Interface	ASCII text type input file and output file
Calculated Standard Outputs / and Units	Time(s), Power(w), Energy(J), Period(s), Reactivity(cent) [net, total feedback, fuel temperature, void, evaporation], Temperature(°C) [fuel, tank wall, coolant, structural materials], void volume(%), evaporated mass(kg)
Graphic editor	
Quality Assurance	Description of code modeling(report). Selection of Experimental Benchmarks(reports).
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Comments	

GENERAL INFORMATION (3)

Fissile Materials	Physical Forms				
	Solution	Powder	Metal	Fuel rods	...
Uranium	Nitrate				
Plutonium	Nitrate				
Mixed Plutonium / Uranium	Nitrate				
Geometry description	Cylindrical for neutronics and void migration. 1D thermal calculation (core->wall->coolant).				
Comments					

DESCRIPTION OF MODELS USED

Neutronic Power / Kinetics	Point kinetic equation, Transport or diffusion theory, ...	Point kinetic equation.
Reactivity and Reactivity feedback	Transport or diffusion theory, mathematical formulas, input or calculated data (reactivity insertion, temperature coefficients: Doppler, dilatation, ...)	Reactivity inserted by step, ramp or any pattern described in reactivity insertion table. All kinetics parameters and reactivity feedback coefficients (doppler, void) should be given by input file.
Thermal hydraulics Hydrodynamics	Thermal (heat conduction, convection, boiling...) / Meshing and region	Heat conduction. 1D heat transfer. Cooling by natural convection of air or cooling by force. Boiling is modeled by means of a conservation equation.
	Multi-phase flow	Radiolytic gas bubble formation and migration.
	Fluid motion / Meshing and region	
	Pressure modeling	
Radiolysis	Radiolytic formation and migration models	Radiolytic gas bubble is modeled by modified energy model.
Data libraries	Neutronics - kinetics (cross sections libraries, k_{∞} , neutron lifetime, delayed neutrons)	Kinetic parameters and reactivity feedback coefficients should be calculated with suitable codes before running AGNES code.
	Thermal and hydrodynamics (heat capacity, ...)	No internal data.
	Radiolysis (yield, threshold formation, velocity ...)	No internal data.

VALIDATION BASE OF THE CODE

Summary of the main assumptions in the code	The power is calculated with point kinetic equation and a power profile assuming fundamental neutronic mode. The temperature feedback reactivity takes into account Doppler effect and solution expansion. Radiolytic gas void calculation is based on a modified energy balance model.	
Limitations to the use of the code	Aqueous solution of fissile media.	
Experimental benchmarks	TRACY: Uranyl nitrate(10%, 350-450 g/Lit., $\phi=50\text{cm}$). Reactivity pulse or ramp from 0.3 to 3\$	
Past Accidents	Tokai-Mura (JCO, 1999).	
Codes comparison	Validation of the modeling with standard codes (neutronics, thermal, ...)	
	Accidents code	
Domain of validation and level of confidence	Comparison with experimental data from TRACY experiments show good agreement for first peak power and total energy released (within 20%).	
References	<p>K.Nakajima, et al., "A Kinetics Code for Criticality Accident Analysis of Fissile Solution Systems: AGNES2," JAERI-Data/Code 2002-004</p> <p>K.Nakajima, et al., "TRACY Transient Experiment Databook 1)Pulse Withdrawal Experiment," JAERI-Data/Code 2002-005 (2002).</p> <p>K.Nakajima, et al., "TRACY Transient Experiment Databook 2)Ramp Withdrawal Experiment," JAERI-Data/Code 2002-006 (2002).</p> <p>K.Nakajima, et al., "TRACY Transient Experiment Databook 1)Ramp Feed Experiment," JAERI-Data/Code 2002-007 (2002).</p>	