Reactivity Feedback from Fuel, Moderator and Void

Reactivity change from fuel (Doppler), moderator temperature and void changes using their coefficients, in pcm and in dollars, such as the power defect.

Method: Linear reactivity coefficients

Input parameters

Unit system: SI

Parameter	Value	Unit
Fuel (Doppler) coefficient (pcm/K)	-2.5000	
Fuel temperature change	600.00	K
Moderator temperature coefficient (pcm/K)	-30.000	
Moderator temperature change	15.000	K
Void coefficient (pcm per % void)	-100.00	
Void change (% points)	0	
Delayed neutron fraction	0.65000	%

Calculated results

Parameter	Value	Unit
Fuel feedback (pcm)	-1,500.0	
Moderator feedback (pcm)	-450.00	
Void feedback (pcm)	0	
Total (pcm)	-1,950.0	
Total in dollars	-3.0000	

Notes for this case

• Linear feedback $\Delta\rho = \Sigma\alpha_i\,\Delta T_i$ with constant coefficients (pcm = 10^{-5}). Coefficients change with burn-up, boron and temperature; integrate over the range for large changes. Negative feedback is what makes power reactors self-limiting.

Formula and method

$$\Delta\rho = \alpha_f \Delta T_f + \alpha_m \Delta T_m + \alpha_v \Delta\alpha$$

Variables

α_f	Fuel (Doppler) coefficient (pcm/K)	-
ΔT_f	Fuel temperature change	K
α_m	Moderator temperature coefficient (pcm/K)	-
ΔT_m	Moderator temperature change	K
α_v	Void coefficient (pcm per % void)	-
$\Delta\alpha$	Void change (% points)	-
β	Delayed neutron fraction	-
$\Delta\rho_f$	Fuel feedback (pcm)	-
$\Delta\rho_m$	Moderator feedback (pcm)	-
$\Delta\rho_v$	Void feedback (pcm)	-
$\Delta\rho$	Total (pcm)	-
$\Delta\rho/\beta$	Total in dollars	-

Method and standards

Reactivity feedback.

Assumptions and limits

- Constant coefficients; independent effects.

References

Linear reactivity coefficients

Report details

Report reference	FCC-FFEZ-PHST (the same inputs always give the same reference)
Generated	23 November 2026, 17:34 UTC
Calculator	Reactivity Feedback from Fuel, Moderator and Void
Method last reviewed	17 November 2026
Software release	FireCAD Calc, release of 22 November 2026
Release checks	3 reference cases of this calculator, computed independently, are checked on every release

Results are for engineering estimation. Verify critical designs against the referenced standards and your own data.

This calculator online

https://calc.firecad.com/boilers-power-plant/nuclear-power/reactivity-temperature-feedback

Open this case on calc.firecad.com →

Reopens the calculator with the inputs of this report.