Decay Heat after Reactor Shutdown (Way-Wigner)

Fission-product decay heat as a fraction of operating power after shutdown, the decay power and the energy released between two times, by the Way-Wigner formula.

Method: Way–Wigner approximation for fission-product decay heat

Input parameters

Unit system: SI

Parameter	Value	Unit
Operating thermal power before shutdown	3,000.0	MW
Operating time at that power	365.25	d
Time after shutdown	1.0000	h
Later time (for energy released from t to t_2)	24.000	h

Calculated results

Parameter	Value	Unit
Decay heat fraction at t	1.0125	%
Decay heat power at t	30.376	MW
Decay heat fraction at t_2	0.44379	%
Decay energy released between t and t_2	1,423.2	GJ
Average decay power between t and t_2	17.188	MW

Notes for this case

• Way–Wigner: P/P_0 = 0.0622[t^−0.2 − (t + T_0)^−0.2], times in seconds. Accuracy about ±50 % below 10 s and above 100 days; within roughly 10–20 % in between. Licensing calculations use the ANS-5.1 decay-heat standard instead.

Formula and method

$$\frac{P}{P_0} = 0.0622\left[t^{-0.2} - (t+T_0)^{-0.2}\right], \quad E = 0.0622 P_0 \left[\frac{t^{0.8} - (t+T_0)^{0.8}}{0.8}\right]_t^{t_2}$$

Variables

P_0	Operating thermal power before shutdown	W
T_0	Operating time at that power	s
t	Time after shutdown	s
t_2	Later time (for energy released from t to t_2)	s
P/P_0	Decay heat fraction at t	-
$P(t)$	Decay heat power at t	W
$P(t_2)/P_0$	Decay heat fraction at t_2	-
E	Decay energy released between t and t_2	J
$\bar{P}$	Average decay power between t and t_2	W

Method and standards

Way–Wigner decay-heat estimate.

Assumptions and limits

- Fission products only; actinide decay heat (U-239, Np-239) is not included.

References

Way–Wigner approximation for fission-product decay heat

Report details

Report reference	FCC-AMQZ-75W0 (the same inputs always give the same reference)
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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/decay-heat-after-shutdown

Open this case on calc.firecad.com →

Reopens the calculator with the inputs of this report.