Fission Product Inventory and Activity at Shutdown

Activity of a fission product such as iodine-131 in a reactor core from power, operating time and fission yield, at shutdown and after a decay period.

Method: Fission product build-up and decay

Input parameters

Unit system: SI

Parameter	Value	Unit
Reactor thermal power	3,000.0	MW
Cumulative fission yield of the nuclide (I-131 about 0.029)	2.8900	%
Half-life of the nuclide	8.0252	d
Operating time at power	365.00	d
Time after shutdown	2.0000	d

Calculated results

Parameter	Value	Unit
Fission rate	9.3623e+19	1/s
Saturation activity γF	2,705.7	PBq
Activity at shutdown	2,705.7	PBq
Activity after the decay time	2,276.4	PBq
Activity per MW thermal at shutdown (Ci)	24,376	

Notes for this case

• A = γF(1 − e^(−λT_op))e^(−λt_d) with F = P/200 MeV; precursor chains are lumped into the cumulative yield and neutron capture of the nuclide is neglected. Iodine-131 reaches about 25,000 Ci per MW thermal at saturation.

Formula and method

$$A = \gamma \frac{P}{E_f} \left(1 - e^{-\lambda T_{op}}\right) e^{-\lambda t_d}$$

Variables

P	Reactor thermal power	W
γ	Cumulative fission yield of the nuclide (I-131 about 0.029)	-
$T_{1/2}$	Half-life of the nuclide	s
T_{op}	Operating time at power	s
t_d	Time after shutdown	s
$\dot{F}$	Fission rate	1/s
A_{sat}	Saturation activity γF	Bq
A_0	Activity at shutdown	Bq
A	Activity after the decay time	Bq
A/P	Activity per MW thermal at shutdown (Ci)	-

Method and standards

Fission product inventory.

Assumptions and limits

- Constant power; no neutron capture of the product.

References

Fission product build-up and decay

Report details

Report reference	FCC-YX19-2C8Y (the same inputs always give the same reference)
Generated	23 November 2026, 17:35 UTC
Calculator	Fission Product Inventory and Activity at Shutdown
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/fission-product-activity

Open this case on calc.firecad.com →

Reopens the calculator with the inputs of this report.