Uranium Enrichment: Feed, Tails and Separative Work (SWU)

Natural uranium feed, depleted tails and separative work units to produce enriched uranium at a chosen product and tails assay.

Method: Enrichment mass balance and the separative work value function

Input parameters

Unit system: SI

Parameter	Value	Unit
Enriched product mass	1,000.0	kg
Product assay (U-235)	4.5000	%
Feed assay (natural 0.711 %)	0.71100	%
Tails assay	0.25000	%

Calculated results

Parameter	Value	Unit
Feed mass	9,219.1	kg
Tails mass	8,219.1	kg
Separative work (kg-SWU)	6,871.1	
Separative work per kg of product	6.8711	
Feed per kg of product	9.2191	
Fraction of the feed U-235 recovered in the product	68.652	%

Notes for this case

• Mass balances F = P + T and F x_f = P x_p + T x_t; separative work with the value function V(x) = (2x − 1)ln[x/(1 − x)]. A lower tails assay saves feed but costs more SWU.

Formula and method

$$F = P\frac{x_p - x_t}{x_f - x_t}, \quad SWU = PV(x_p) + TV(x_t) - FV(x_f), \quad V(x) = (2x-1)\ln\frac{x}{1-x}$$

Variables

P	Enriched product mass	kg
x_p	Product assay (U-235)	-
x_f	Feed assay (natural 0.711 %)	-
x_t	Tails assay	-
F	Feed mass	kg
T	Tails mass	kg
SWU	Separative work (kg-SWU)	-
SWU/P	Separative work per kg of product	-
F/P	Feed per kg of product	-
η_{235}	Fraction of the feed U-235 recovered in the product	-

Method and standards

Enrichment cascade value function.

Assumptions and limits

- Ideal cascade value function; uranium masses (not UF_6).

References

Enrichment mass balance and the separative work value function

Report details

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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/uranium-enrichment-swu

Open this case on calc.firecad.com →

Reopens the calculator with the inputs of this report.