

Why a Molten Salt Fuel Cycle Necessitates a Conversation About Language

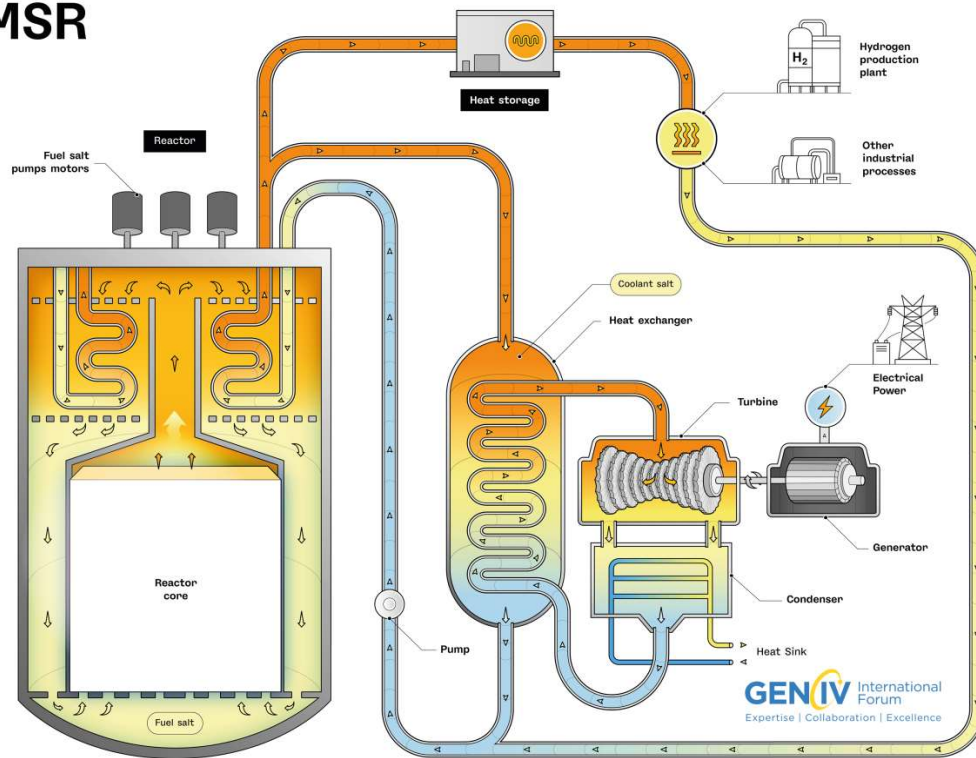
Michael Edmondson
UKNNL

3 – 7th November 2025, IAEA EVT2404560:

Joint IAEA-NEA-EC/JRC Workshop on the Taxonomy and Related Terminology of Fuel Cycles for MSRs

What is an MSR?

MSR

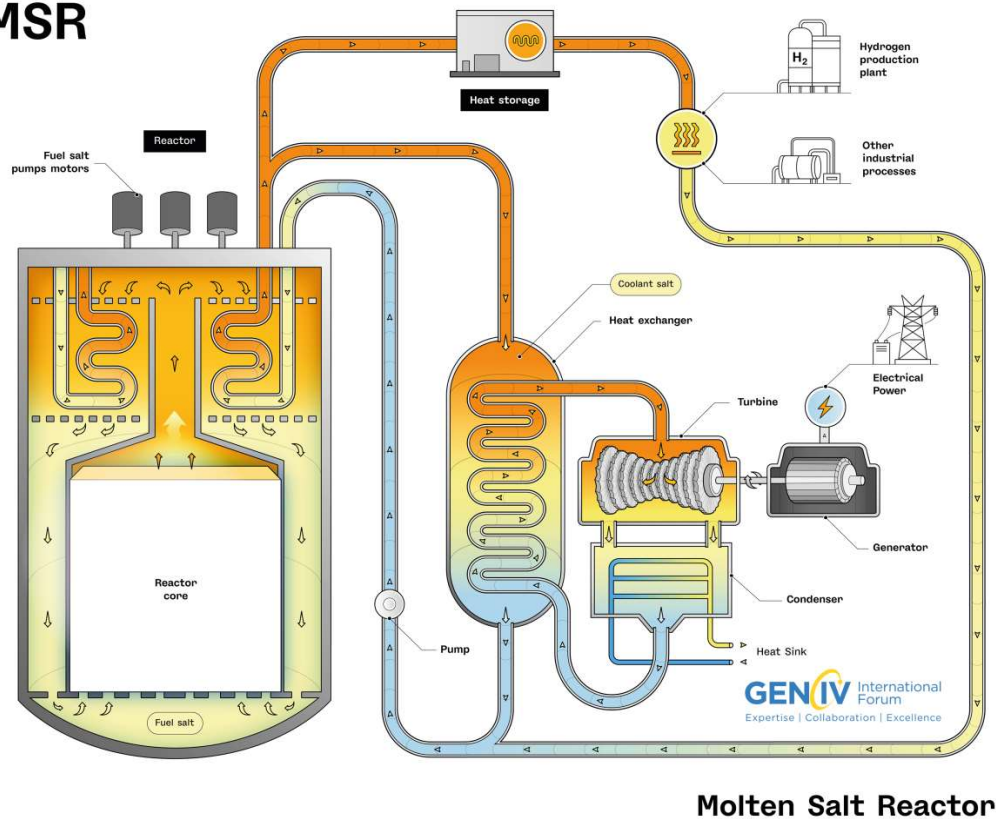


Molten Salt Reactor

- Gen IV technology
- Molten salt as coolant or, fuel and coolant
- Cl or F salt...

What is an MSR?

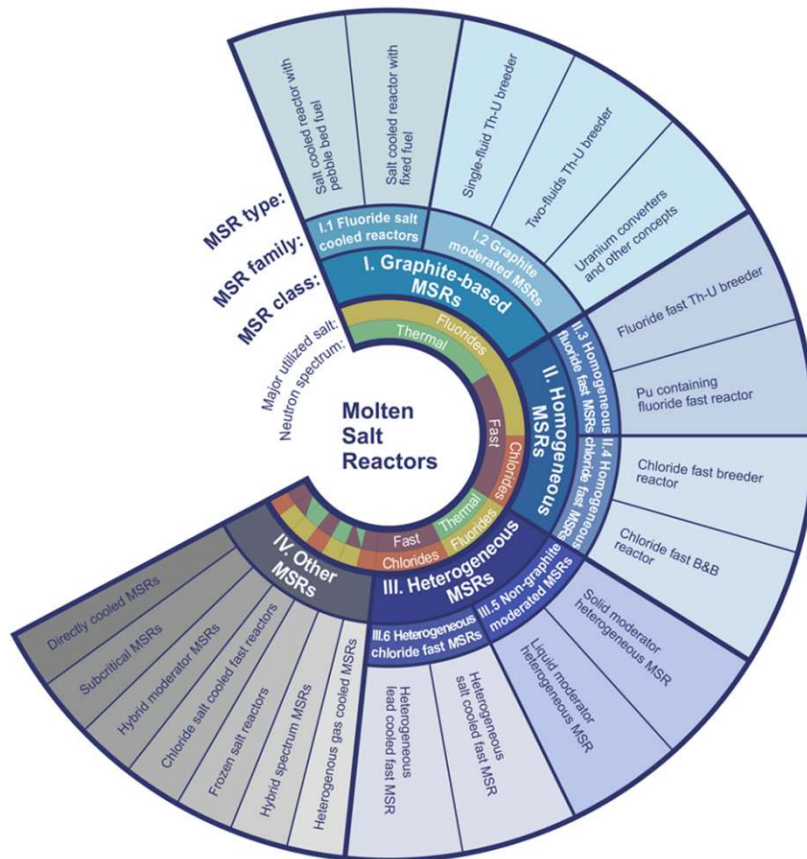
MSR



- Gen IV technology
- Molten salt as coolant or, fuel and coolant
- Cl or F salt...
....oh, and nitrate
- Fast, thermal, epithermal spectrum...
- Breeder, burner, breeder-burner...

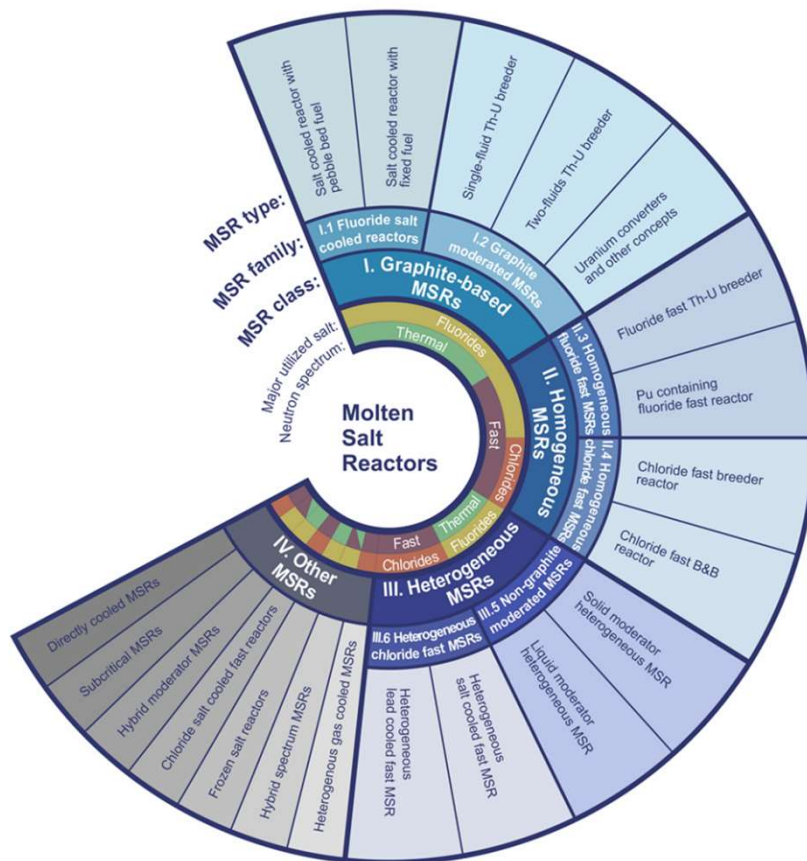
CAMBRIDGE
ATOMWORKS

What is an MSR?



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What is an MSR?



- So, an MSR might be a lot of things
- As a community we need to be able to articulate the variety and possibilities
- To do that we need to be able to communicate with clarity

Molten Salt Reactors

How is a MSR different to solid fuelled reactors?

What are the advantages? This is design specific!

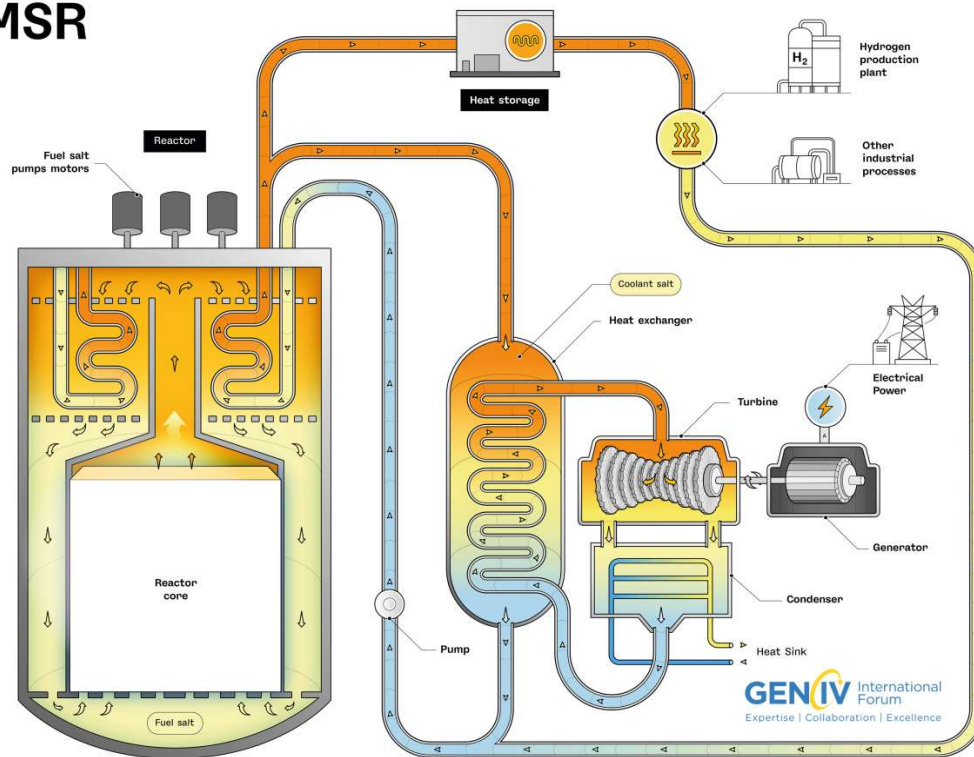
What are the disadvantages? This is design specific!

Therefore, we need to be able to communicate differences in designs



What is “The Core”?

MSR



Molten Salt Reactor

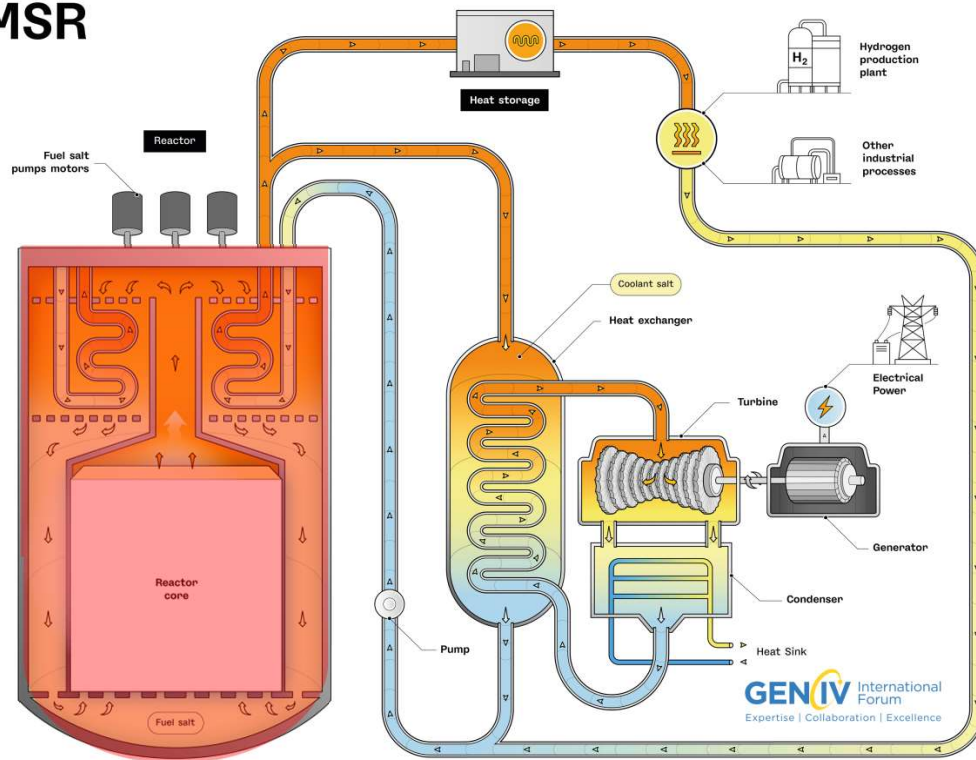
 **Britannica**

“All reactors have a core, a central region that contains the fuel, fuel cladding, coolant, and (where separate from the latter) moderator.”

[Nuclear reactor - Thermal, Intermediate, Fast | Britannica](#)

What is “The Core”?

MSR



Molten Salt Reactor



Britannica

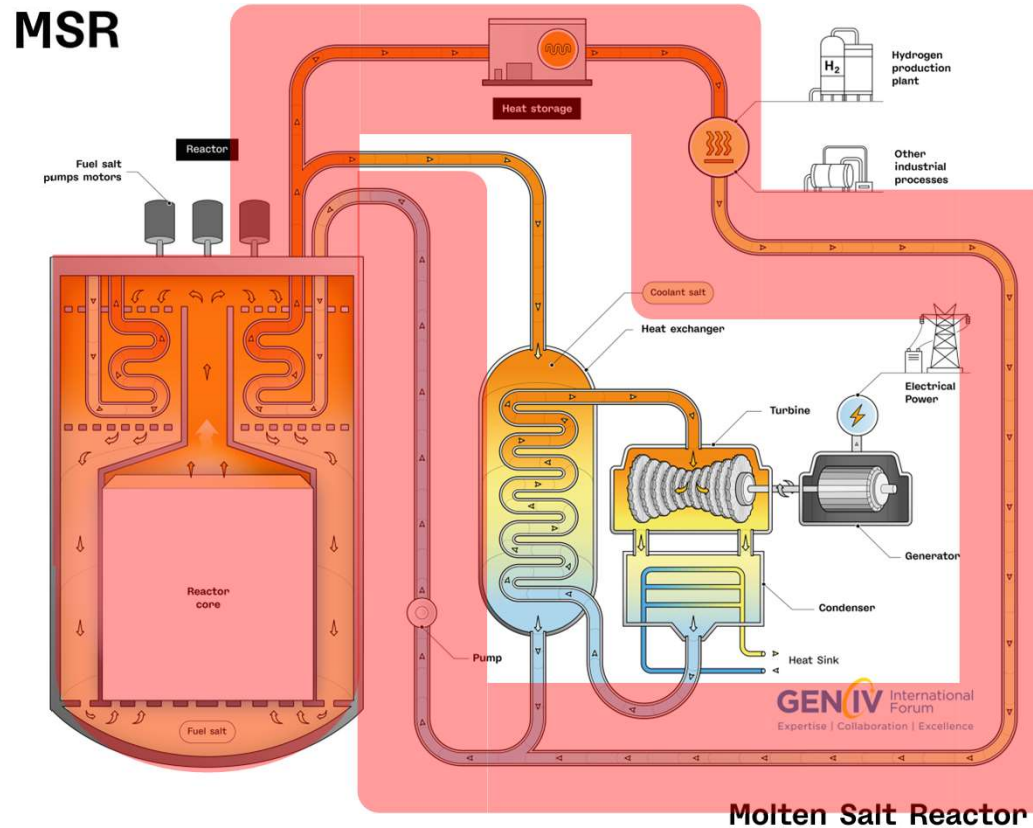
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[Nuclear reactor - Thermal, Intermediate, Fast | Britannica](#)

Cladding?



What is “The Core”?



Britannica

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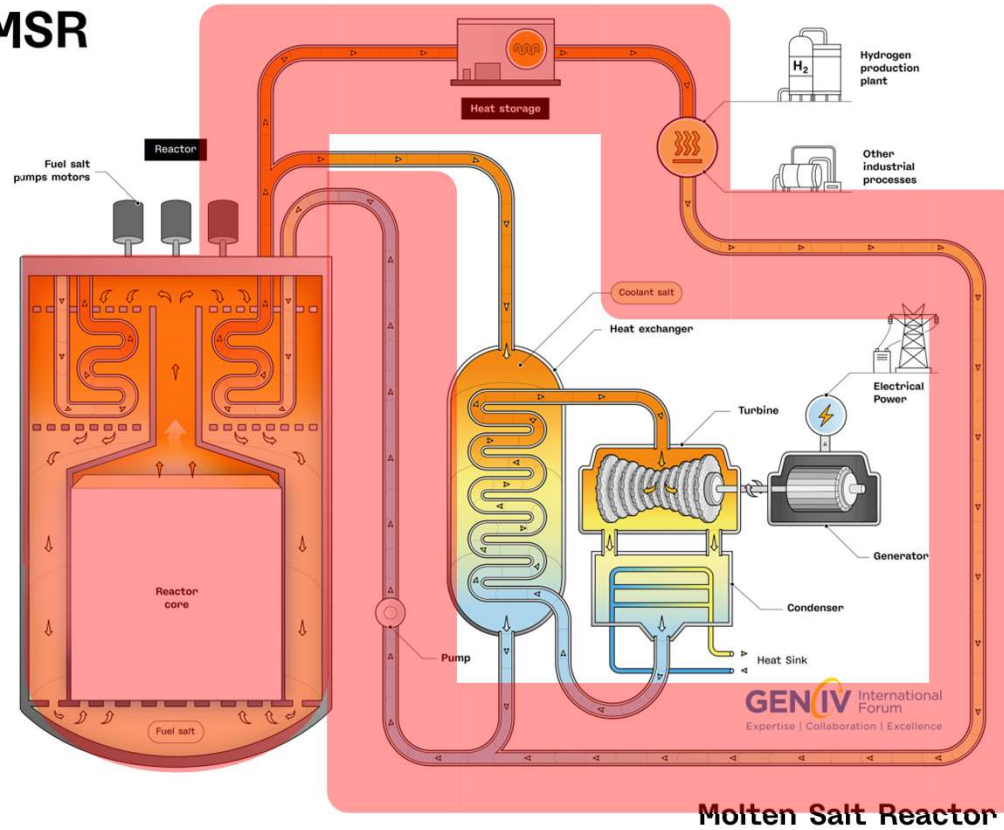
[Nuclear reactor - Thermal, Intermediate, Fast | Britannica](#)

But there's also fuel here?

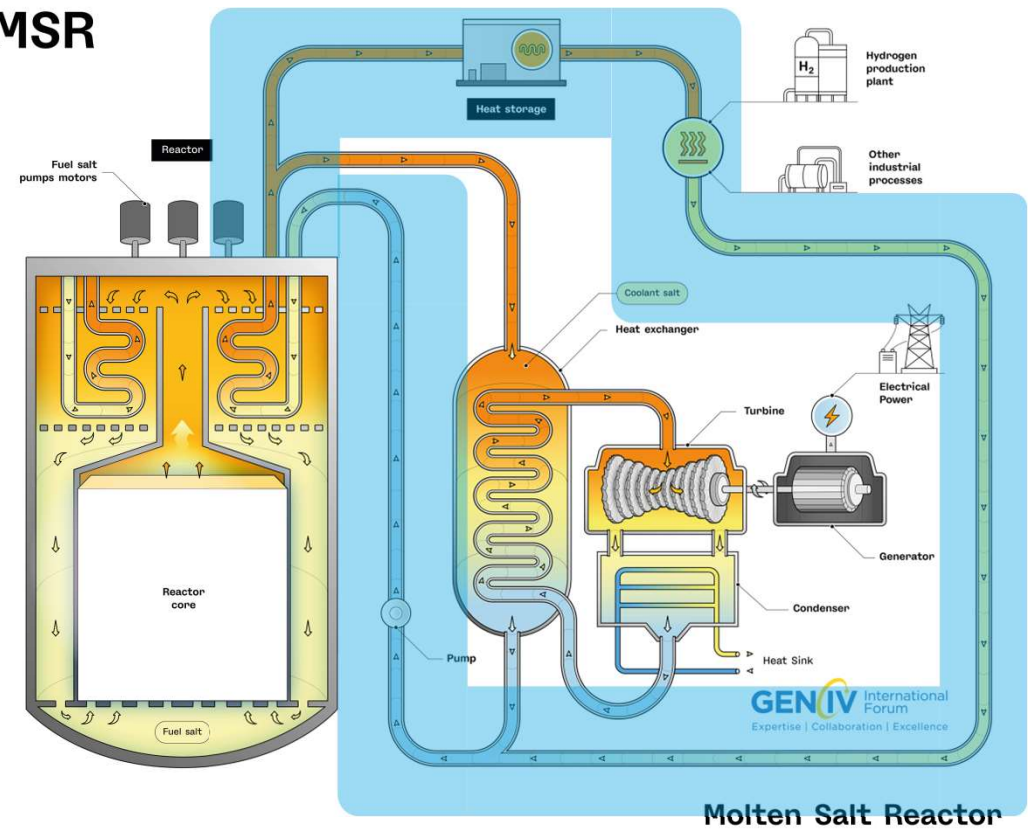


What is “The primary flow loop”?

MSR

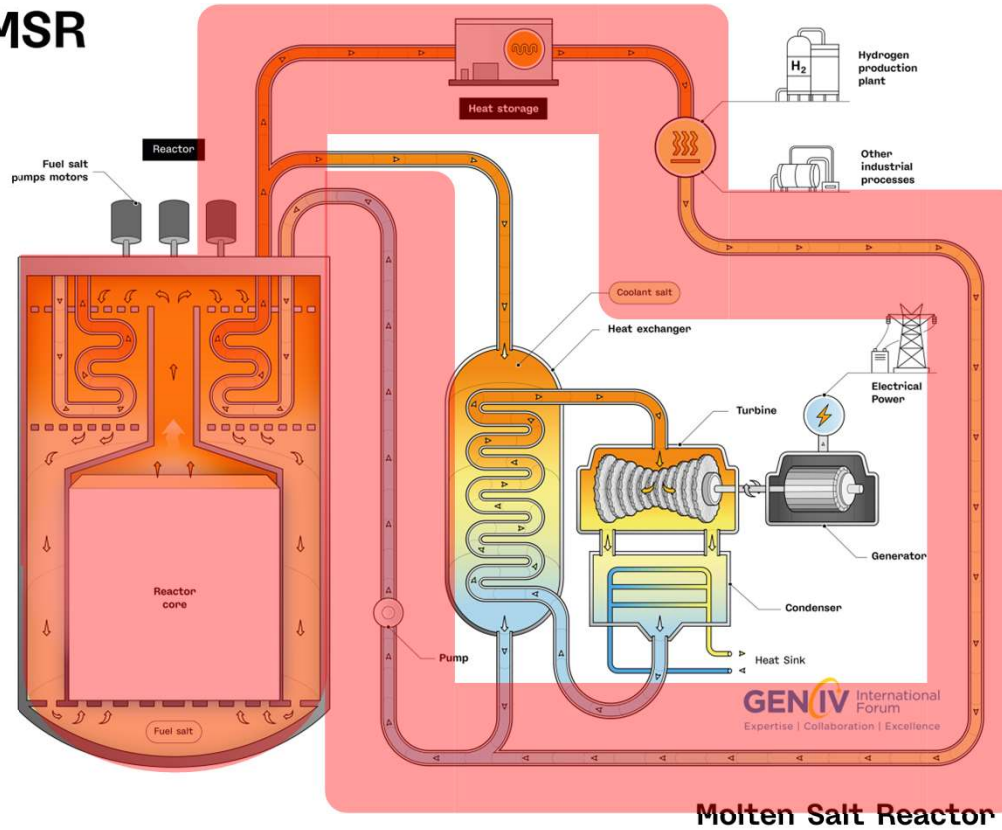


MSR

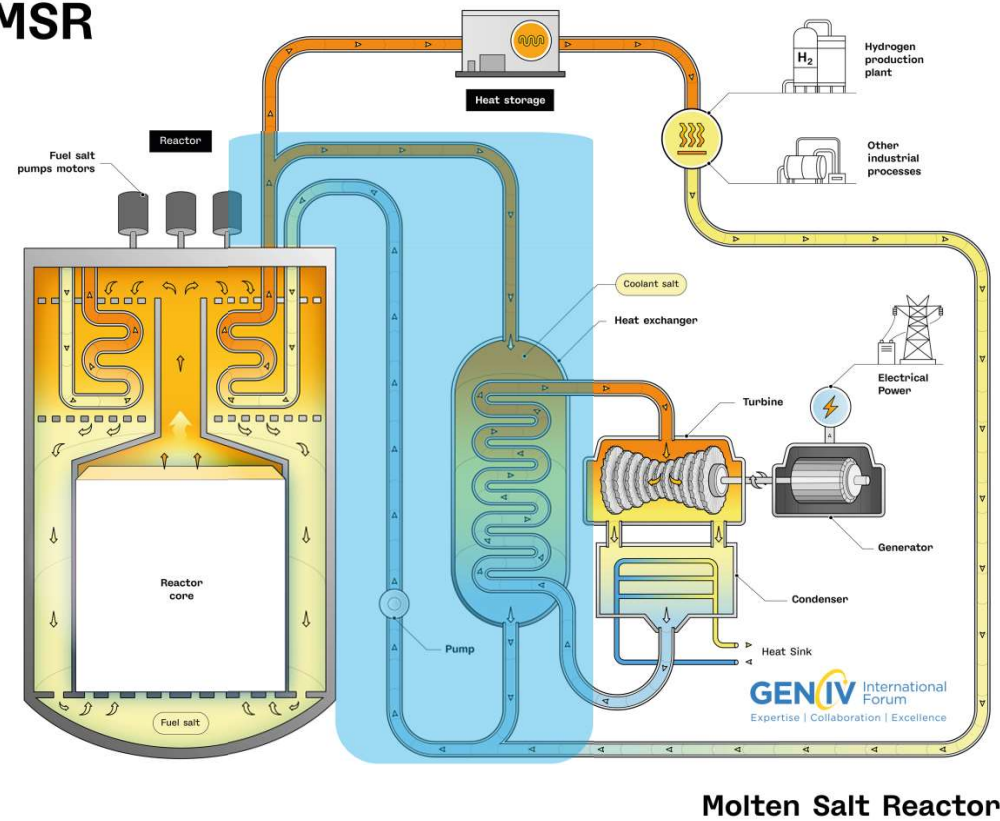


What is “The primary flow loop”?

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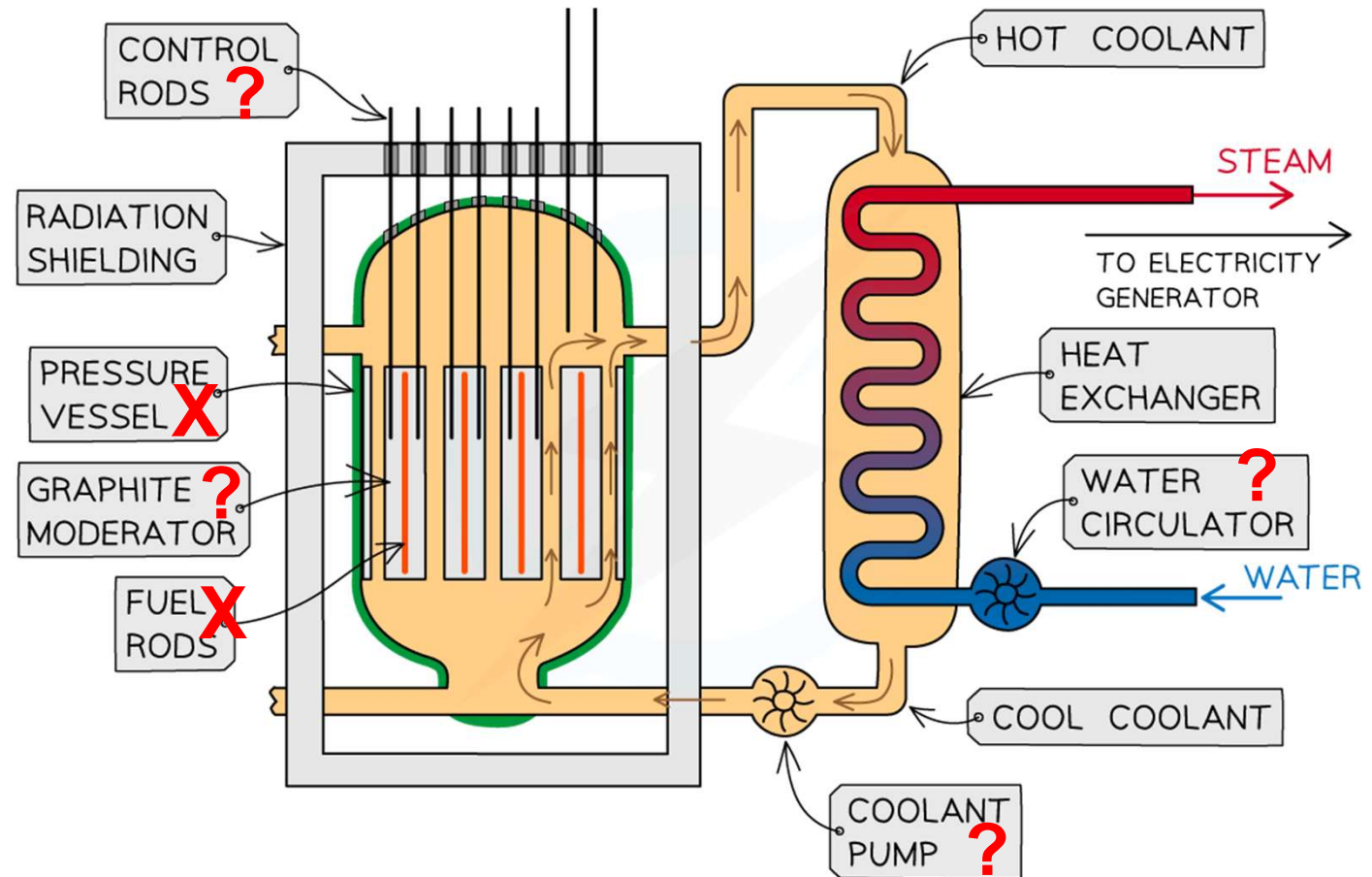


MSR



Molten Salt Reactors

Fluid fuel
challenges
conventional
terminology



[The Nuclear Reactor - A Level Physics Revision Notes](#)

What other possibilities do MSR open up?

Lots of different fuel cycles:

Open Cycle

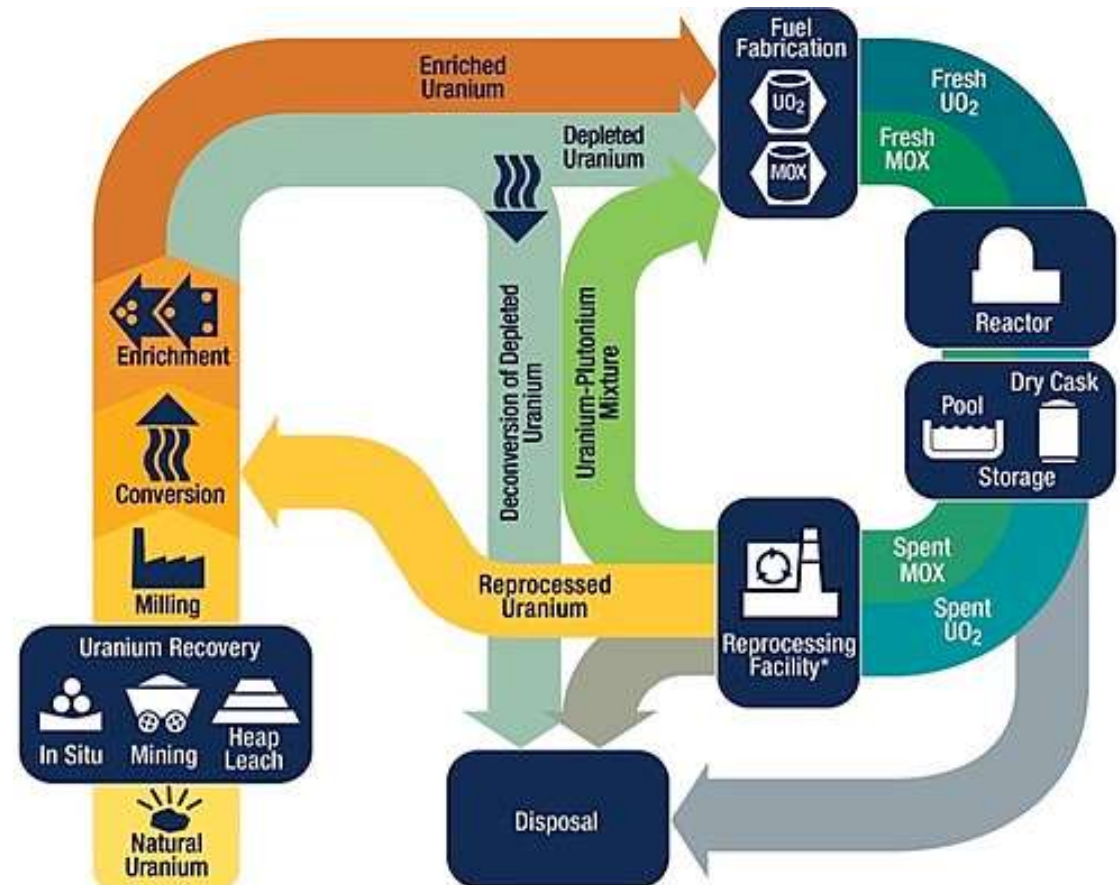
- Dispose of fuel salt after use

MonoCycle and MultiCycle (Closed)

- PUREX
- Advanced PUREX – e.g. GANEX, iSANEX

...but why introduce water if you don't need to

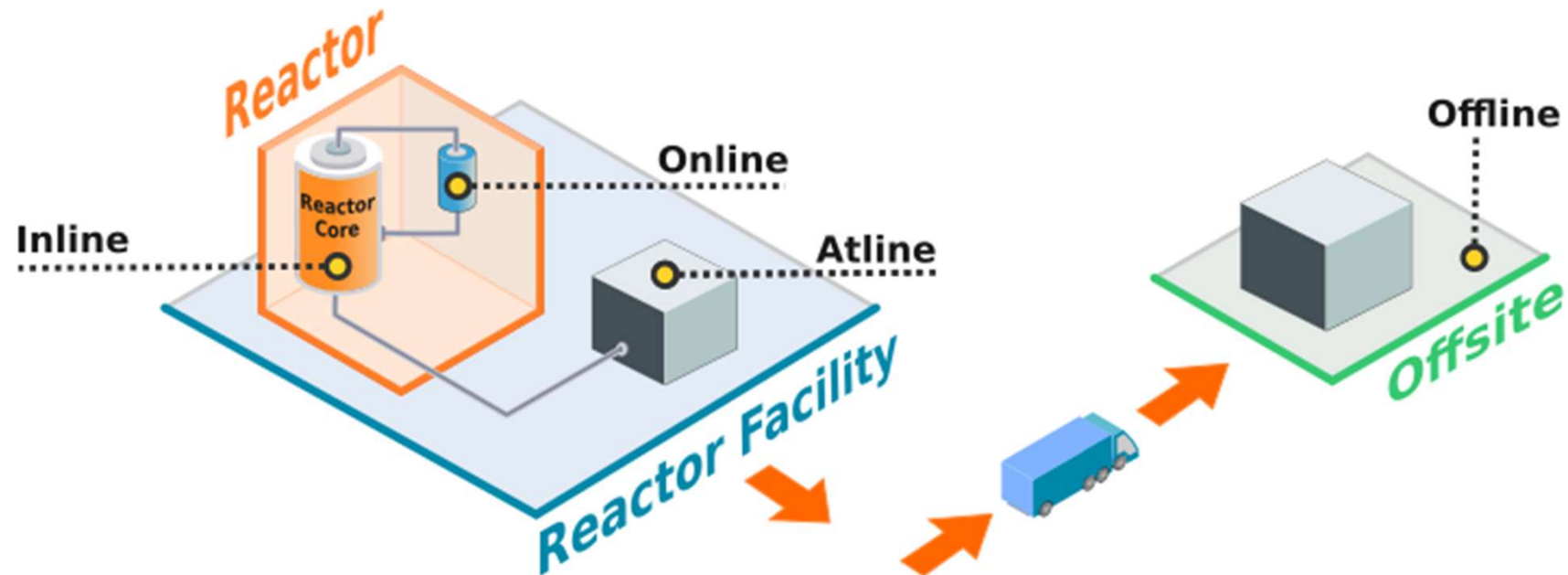
- Pyrochemical Processing
- Reductive Extraction
- Fluoride Volatility



[Nuclear fuel cycle - Wikipedia](#)

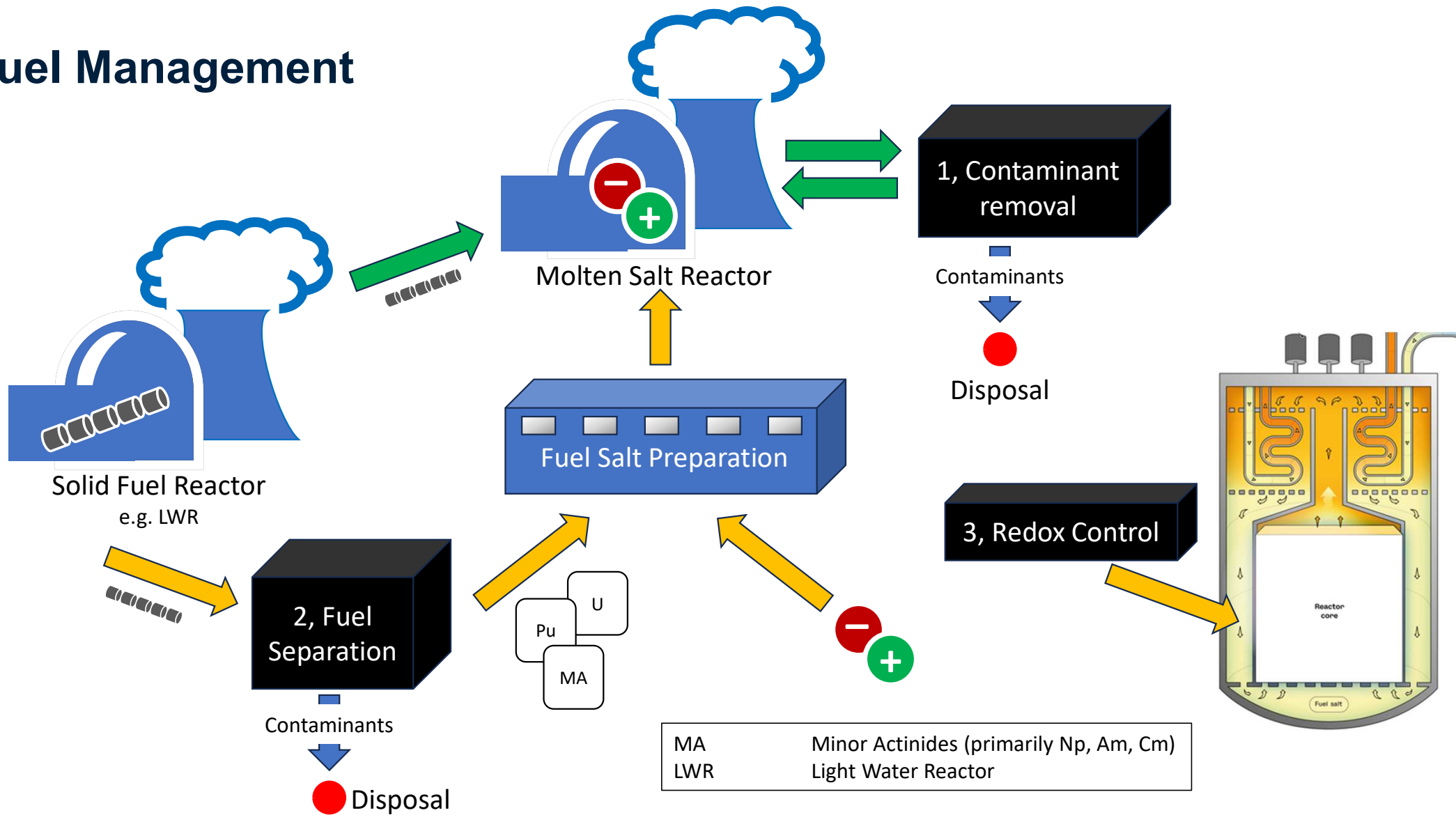
MSR Terminology

**MSR Unique selling point = ability to process fuel during operation
(because fuel can be pumped)**

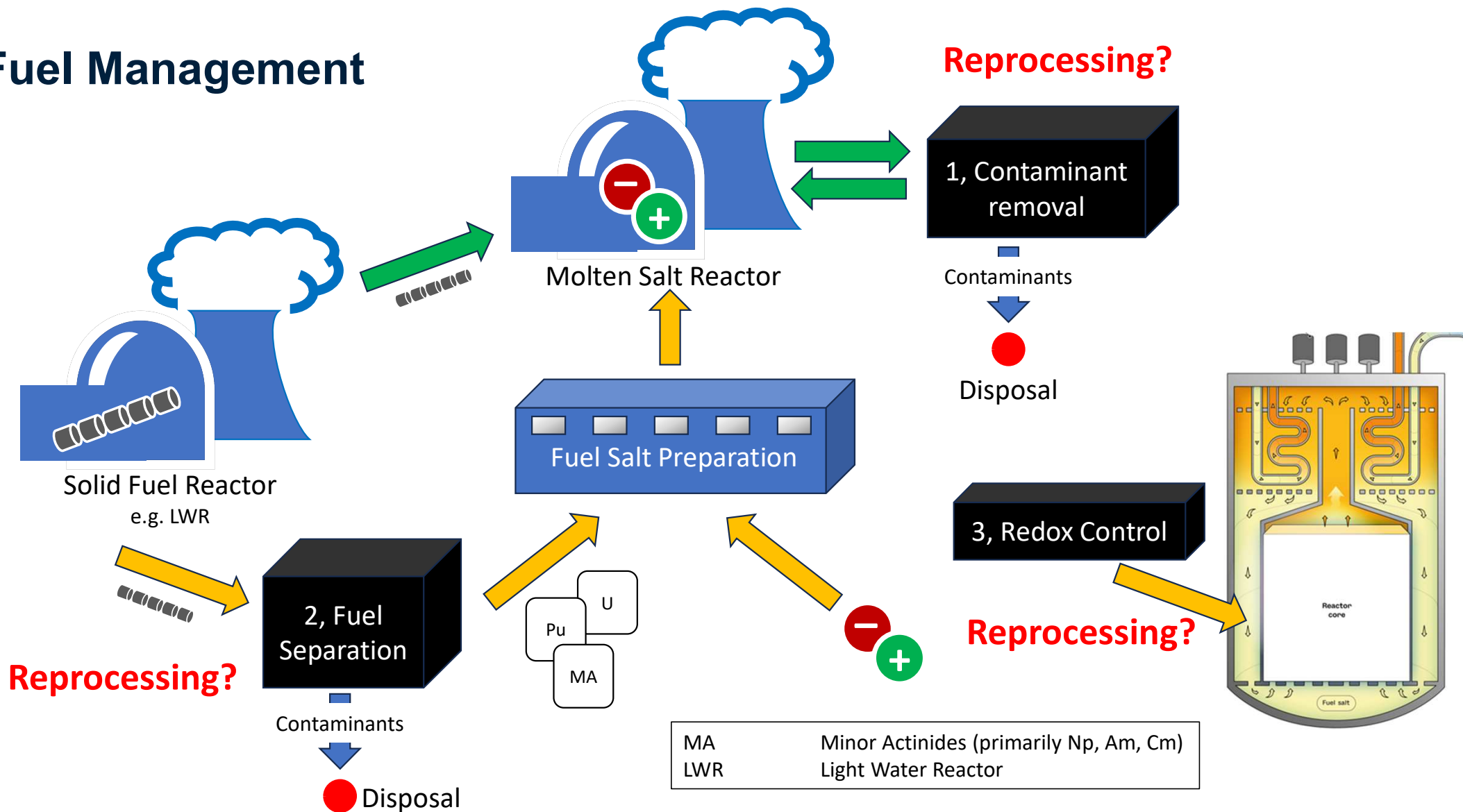


**Remove neutron poisons and inhibitors to operation and the reactor can run
'indefinitely' (subject to addition of 'top-up fuel')**

Fuel Management



Fuel Management



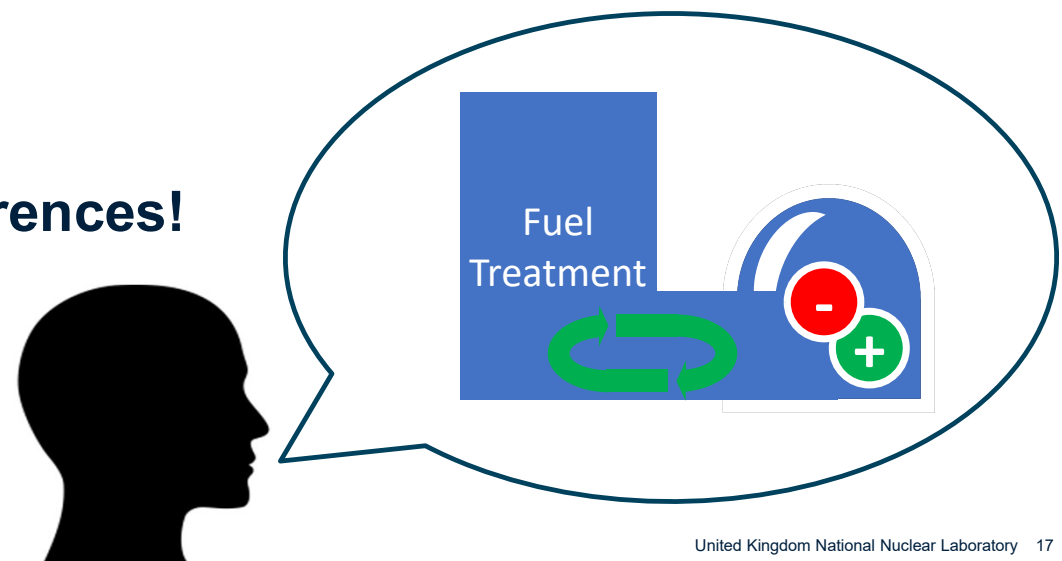
Conclusion

The Molten Salt Fuel Cycle is much more nuanced than classical fuel cycles because there are more options. This is great, but we need to be able to explain clearly what we are talking about

Taxonomy of reactors is a big step in the right direction

Taxonomy of fuel cycles even better

...but only if we can articulate the differences!



Thank you

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