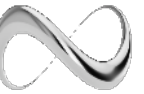
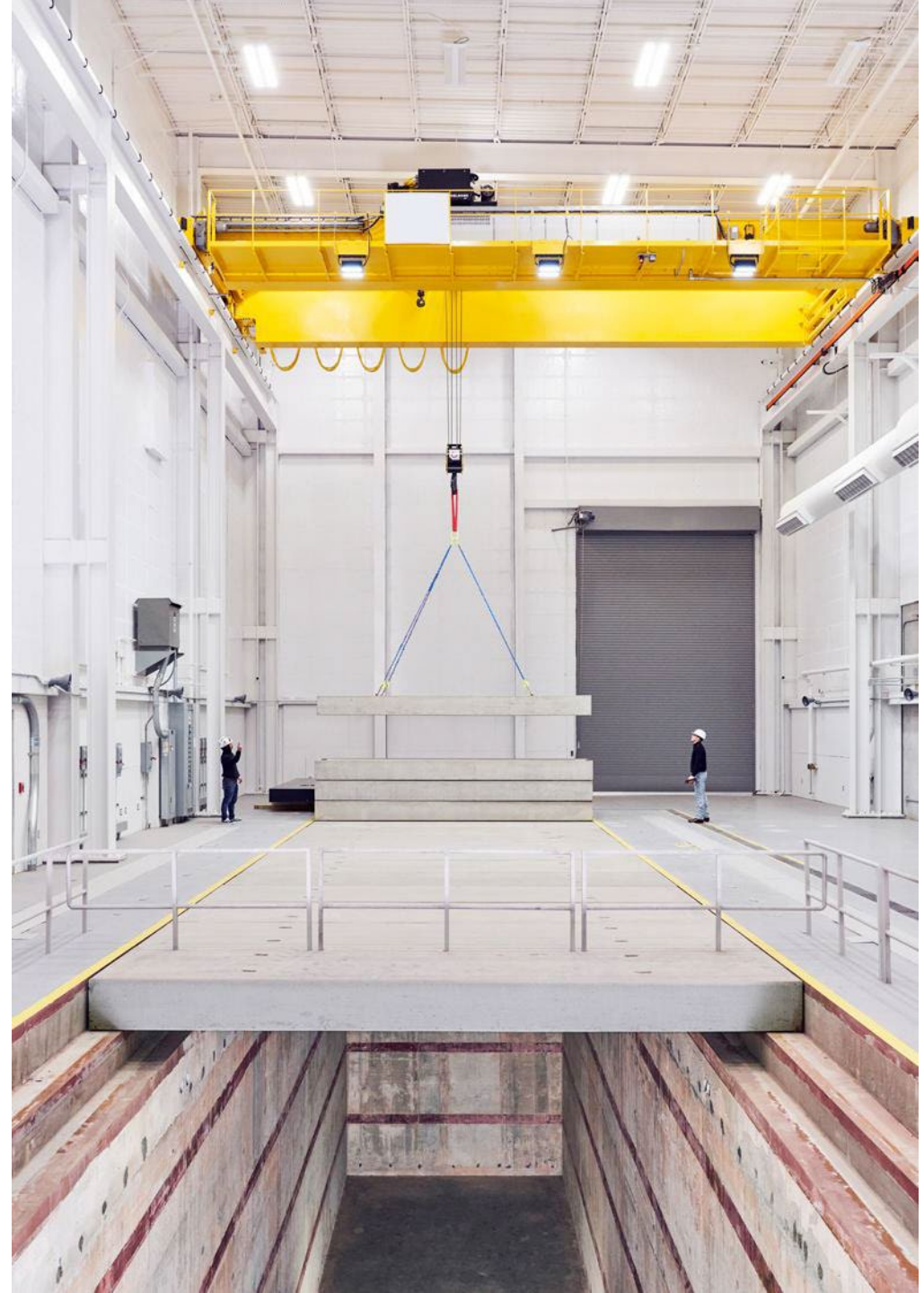


# INL MARVEL Produced Water Desalination

Nick Morriss – Natura Resources  
Together with:  
ConocoPhillips  
NOV



# What is Produced Water?

An existential threat to American Energy Dominance.

## Produced Water to Oil Ratio (WOR)

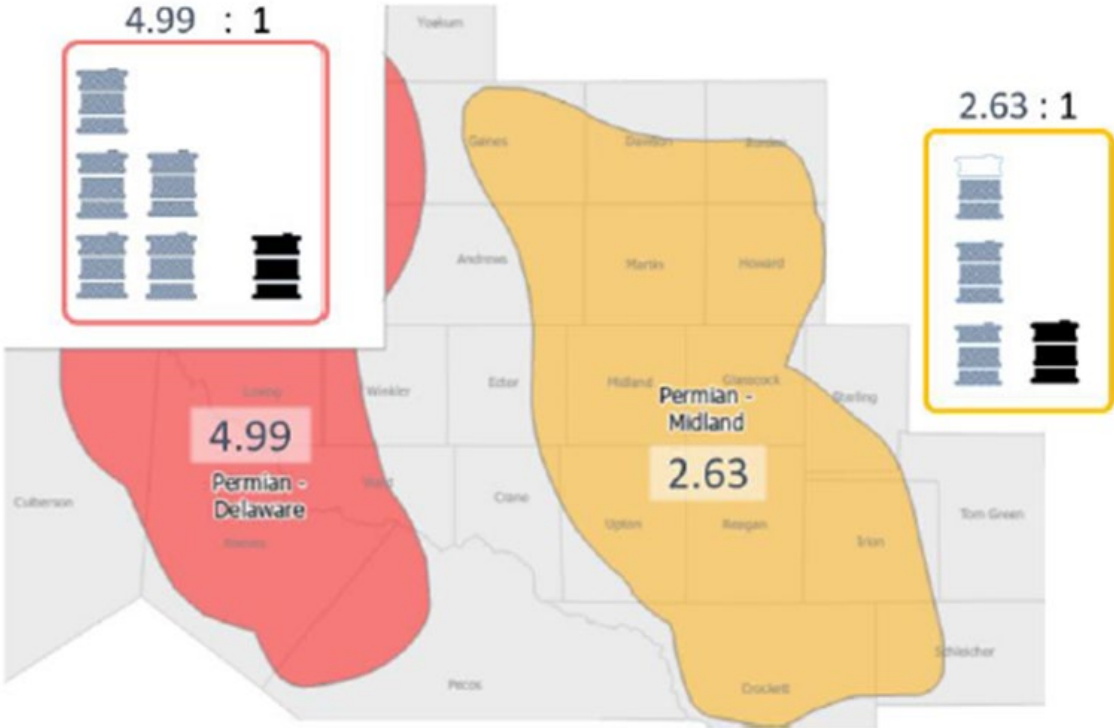


Figure 1. Produced Water to Oil Ratio (WOR), Permian Delaware and Midland Basins.

Image: Texas Produced Water Consortium

Produced Water is a byproduct of all O&G production globally

Permian Basin Produced Water Characteristics

~20 Million Barrels/Day is surfaced/injected

Highly saline brine

TDS: 70,000–130,000 mg/L

Includes NaCl, Elevated Ca, Sr, Ba, Moderate boron

High ammonia (300–800 mg/L)

Slightly acidic to neutral pH

Potential BTEX presence

Scaling tendency (CaCO<sub>3</sub>, Barite)

For reference:

Seawater ≈ 34,400 mg/L

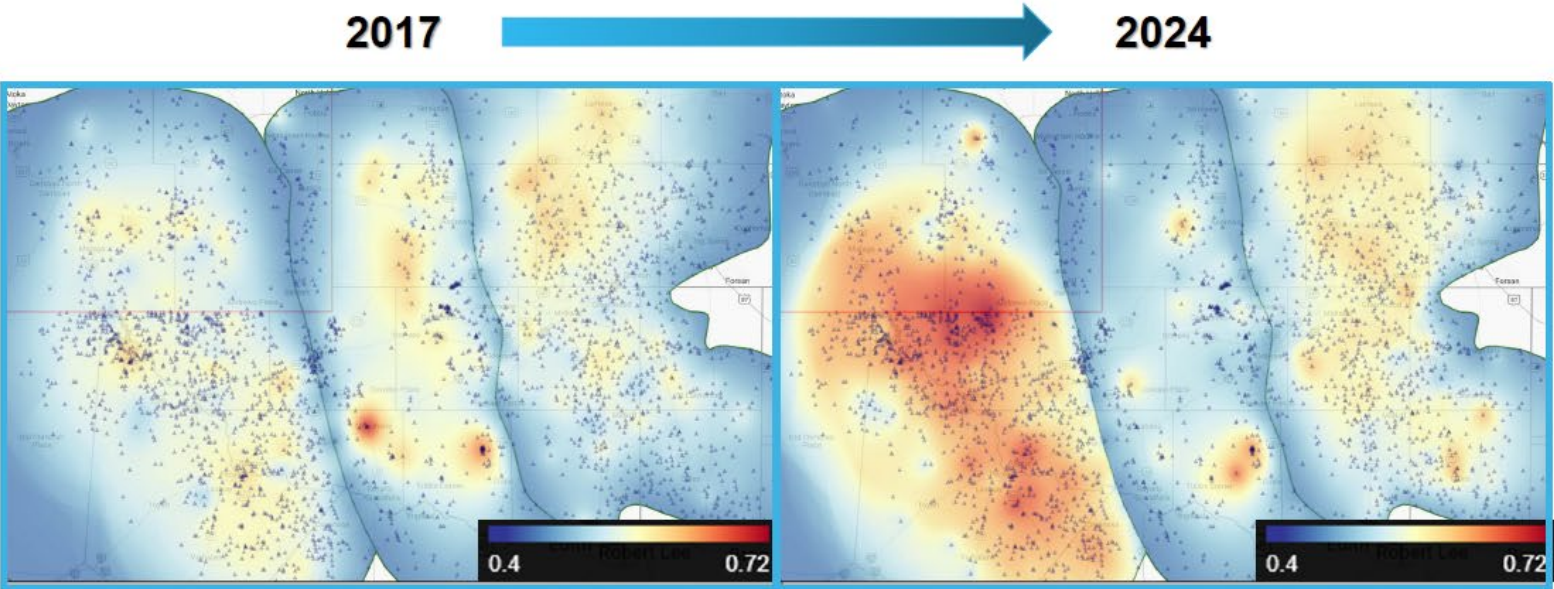
Permian produced water is typically 2–4× saltier than seawater

# Where does Produced Water go?



## Formation Pressure – Shallow Injection Intervals

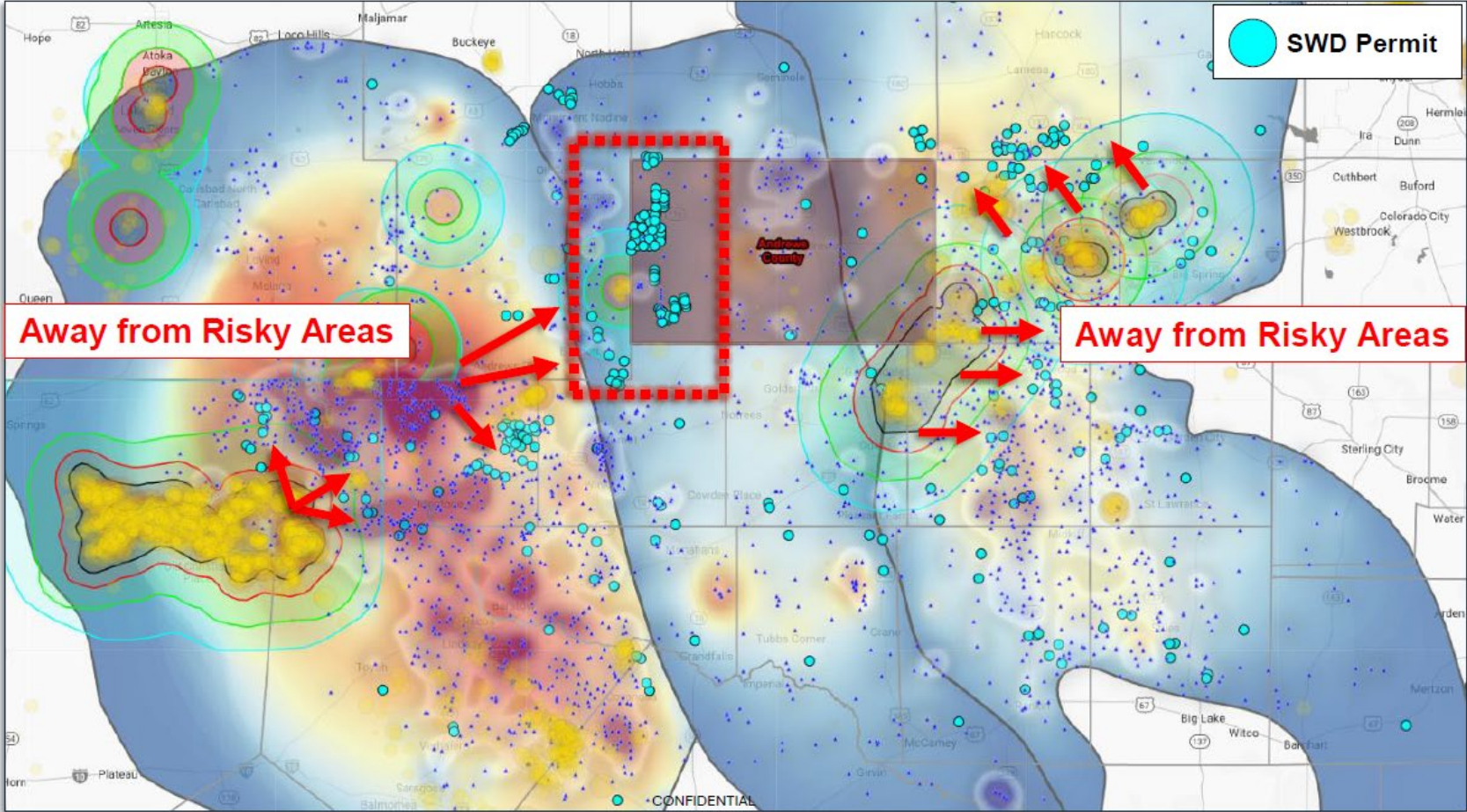
Shallow formation pressure continues to increase in areas experiencing high injection rates and high cumulative injection



Data from B3 Insight

*Static formation pressure gradient estimation, shallow injection intervals from B3 Insights' SIP (subsurface interval pressure) product*

# Where does Produced Water go?



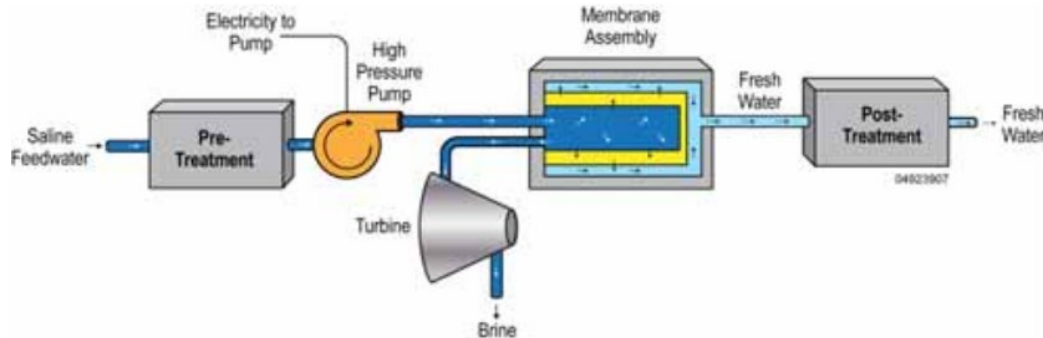
Data from B3 Insight

# Why not use this Water for Beneficial Reuse?

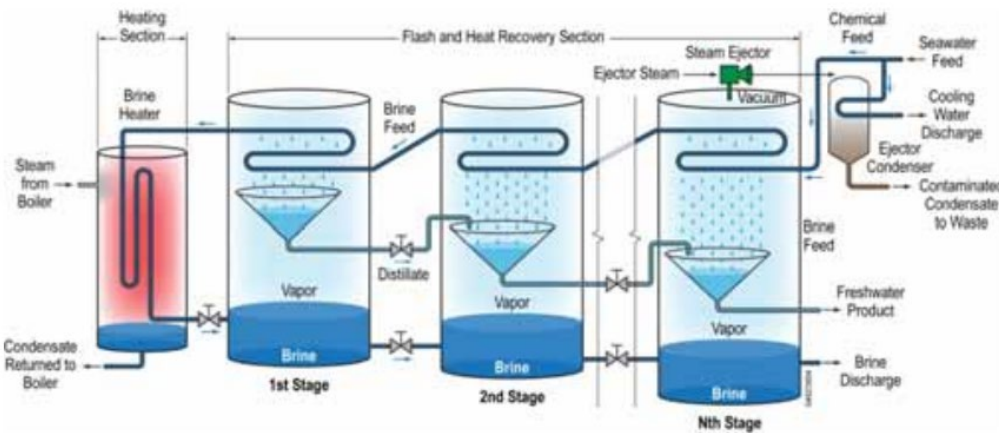


*Treating this water for any use beyond reinjection, is fundamentally an energy problem.*

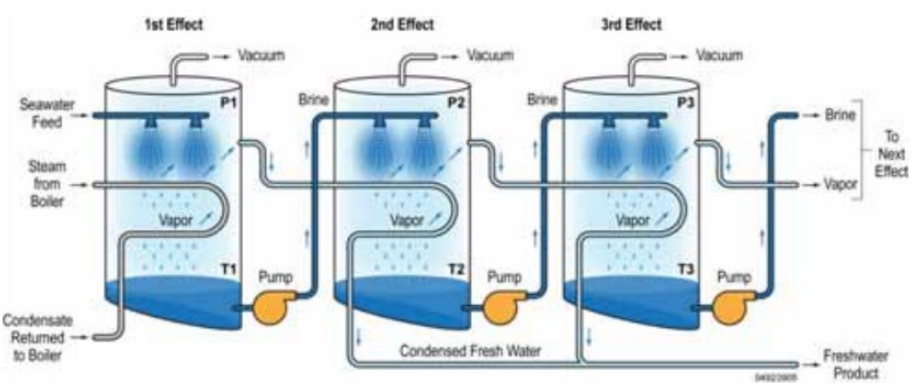
# Our test at INL with MARVEL is to Integrate Nuclear Heat with Desalination Technologies



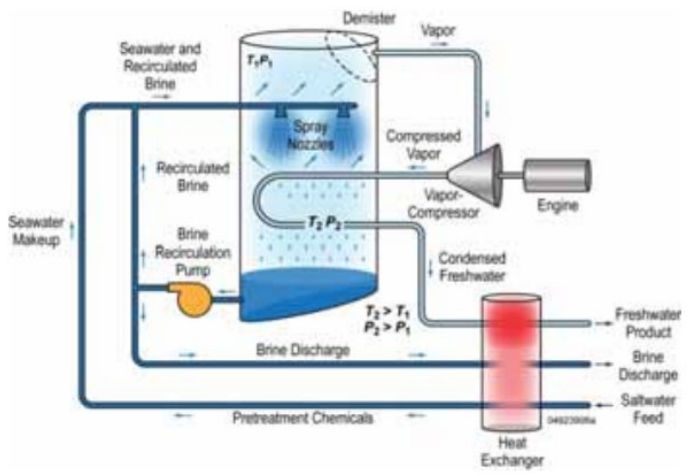
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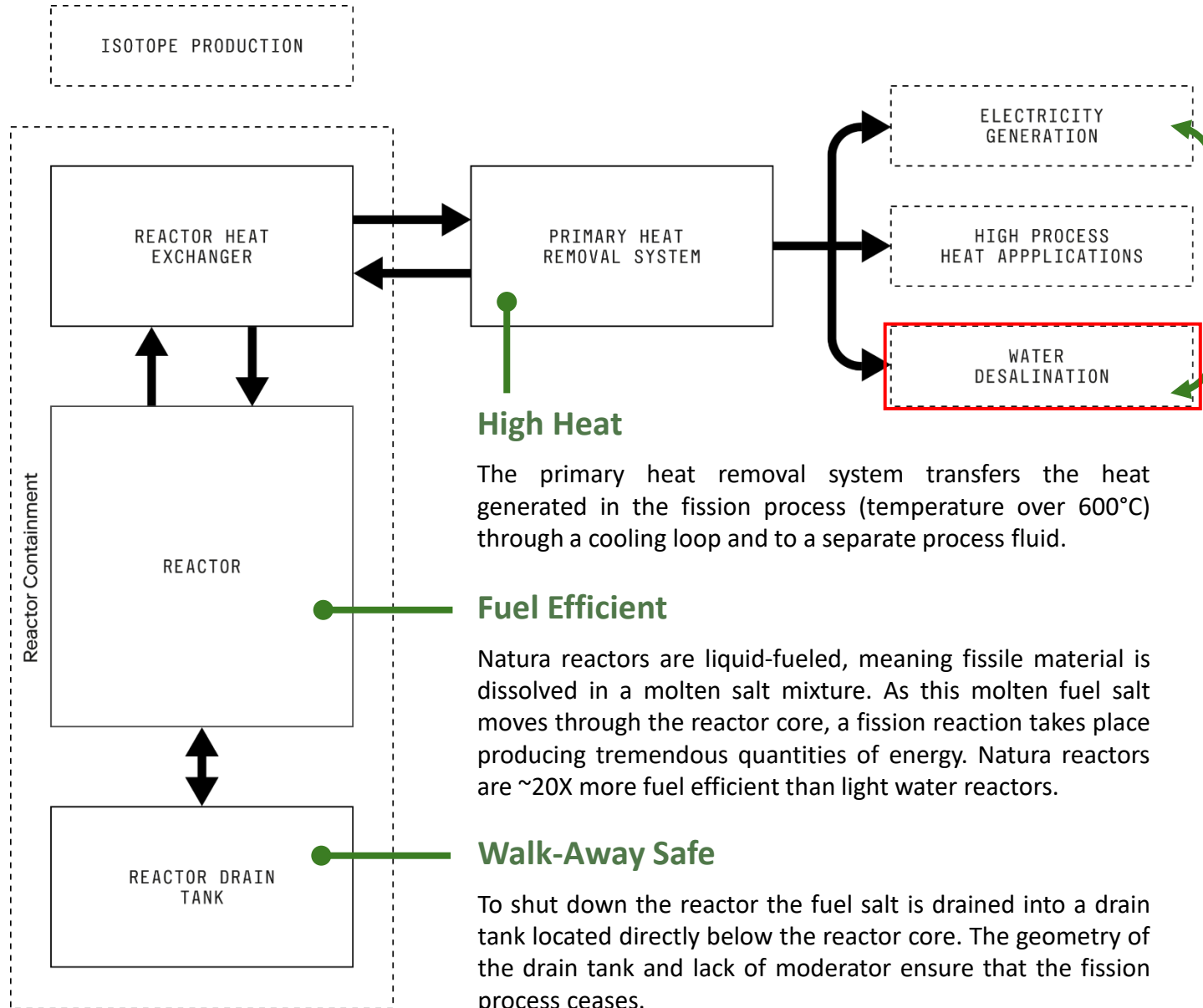
MED



MVC / TVC

## Modular Production & Assembly

The Natura MSR-100 is a small modular reactor capable of producing 100MWe. It is designed for factory fabrication and onsite assembly, allowing it to be rapidly deployed at scale to meet the world's energy needs



### High Heat

The primary heat removal system transfers the heat generated in the fission process (temperature over 600°C) through a cooling loop and to a separate process fluid.

### Fuel Efficient

Natura reactors are liquid-fueled, meaning fissile material is dissolved in a molten salt mixture. As this molten fuel salt moves through the reactor core, a fission reaction takes place producing tremendous quantities of energy. Natura reactors are ~20X more fuel efficient than light water reactors.

### Walk-Away Safe

To shut down the reactor the fuel salt is drained into a drain tank located directly below the reactor core. The geometry of the drain tank and lack of moderator ensure that the fission process ceases.

## Desalination and Flexible Power

Natura reactors are flexible in their potential end use applications including electricity generation, and process heat applications such as produced water desalination.

Configuration options include power and desalination only and combined power + desalination options.

- Treated water 500,000+ bbl/day
- Co-generates 250,000 bbl/day + 80 MWe power
- Power only up to 100MWe



Thank You

