Small and Modular Nuclear Reactors: The Hyperion Power Module

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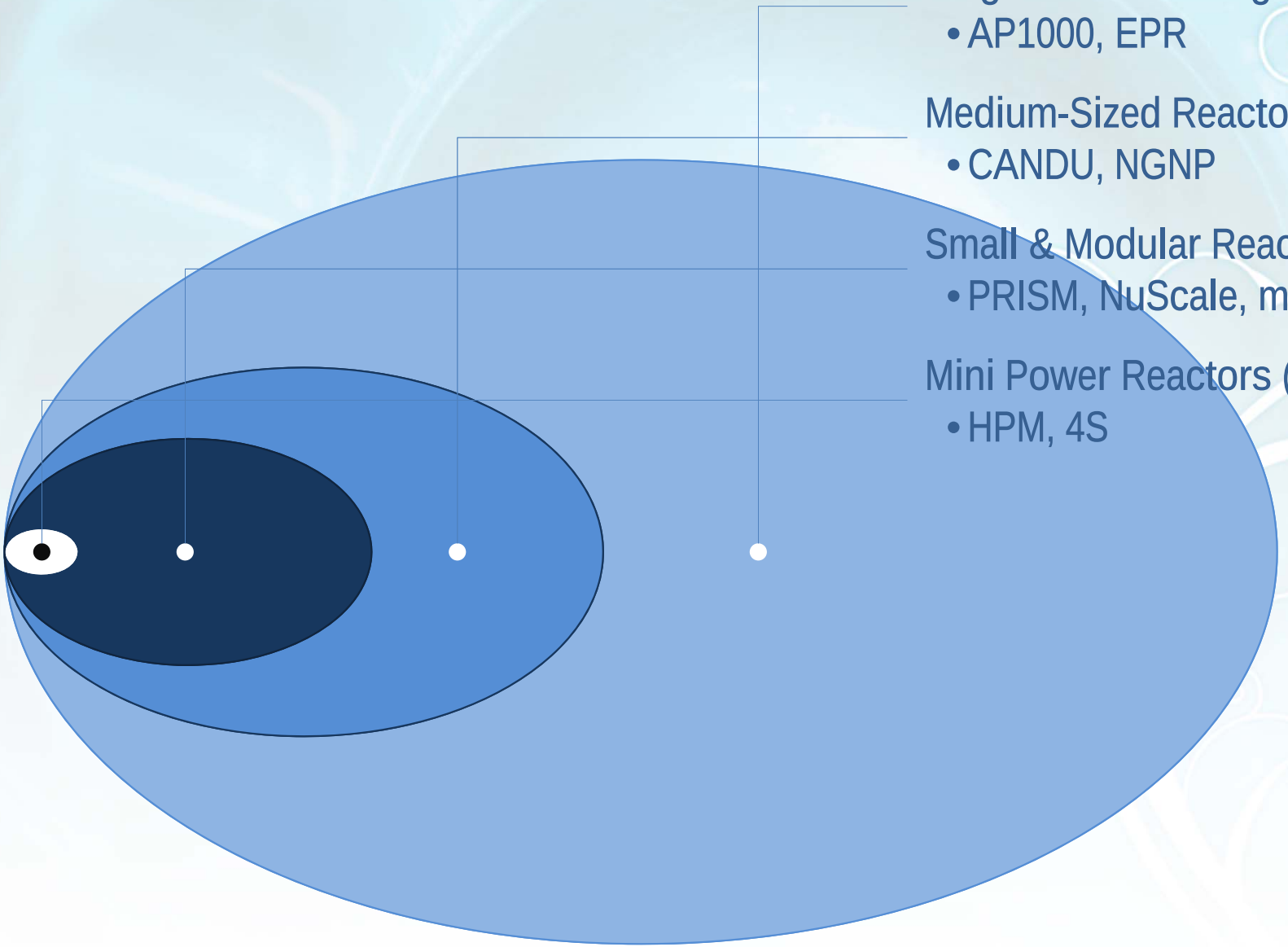
Reactor Sizes



Large Traditional Light Water Reactors:
- AP1000, EPR

Medium-Sized Reactors: <700 MWe
- CANDU, NGNP

Small & Modular Reactors (SMR): <300 MWe
- PRISM, NuScale, mPower

Mini Power Reactors (MPR): <50 MWe
- HPM, 4S

Hyperion Power GENERATION

HPM Applications

Niche Markets

- **Remote off-grid community power**
- **Dedicated power**
  - **hospitals, factories, foundries, government centers, water treatment, irrigation, universities**
- **Baseload for renewable energy**
- **Remote mining, oil production & refining**
- **Military facilities**

Operations subject to regulatory authority of host country

Market Goal: generate electricity for < US$0.10 per kWh anywhere in the world

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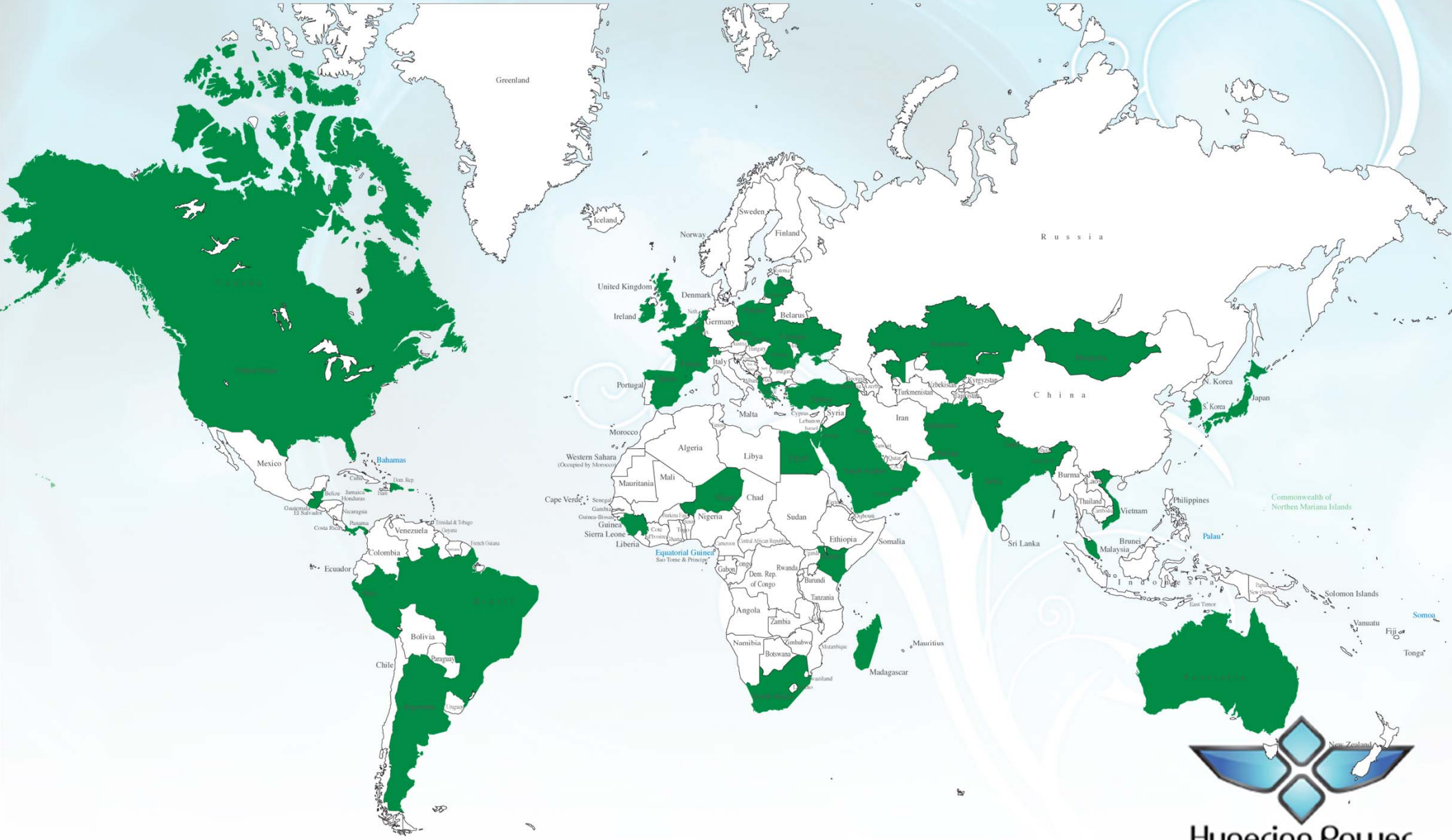
Initial Market Pull



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HPM Key Characteristics

1. Transportable

- 1.5 x 2.5 meter unit fits into standard fuel transport container

2. Safety

- All credible accident scenarios resolved within the design
- Underground siting – safe from natural & manmade events
- Lead bismuth (LBE) is non-reactive in air and water, and provides shielding during transport

3. Minimal In-core Components

- Operational reliability is enhanced by the reduction of moving mechanical parts

4. Sealed Core – Safe and Secure

- Factory sealed
- No in-field refueling
- Operates at ambient pressure; no pressure vessel

5. Operational Simplicity

- Operation limited to reactivity adjustments to maintain constant temperature output

6. Isolated Power Production

- Steam and electric components separated from reactor for maintenance & safety
- Allows existing generation facilities to be retrofitted (HPM replaces heat source)

- Market Goal: Generate electricity for < US $0.10 per kwh
- Each unit will generate approximately 70MWt and 25MWe
- Overnight costs at $2,000 - $4,000 per KW capacity

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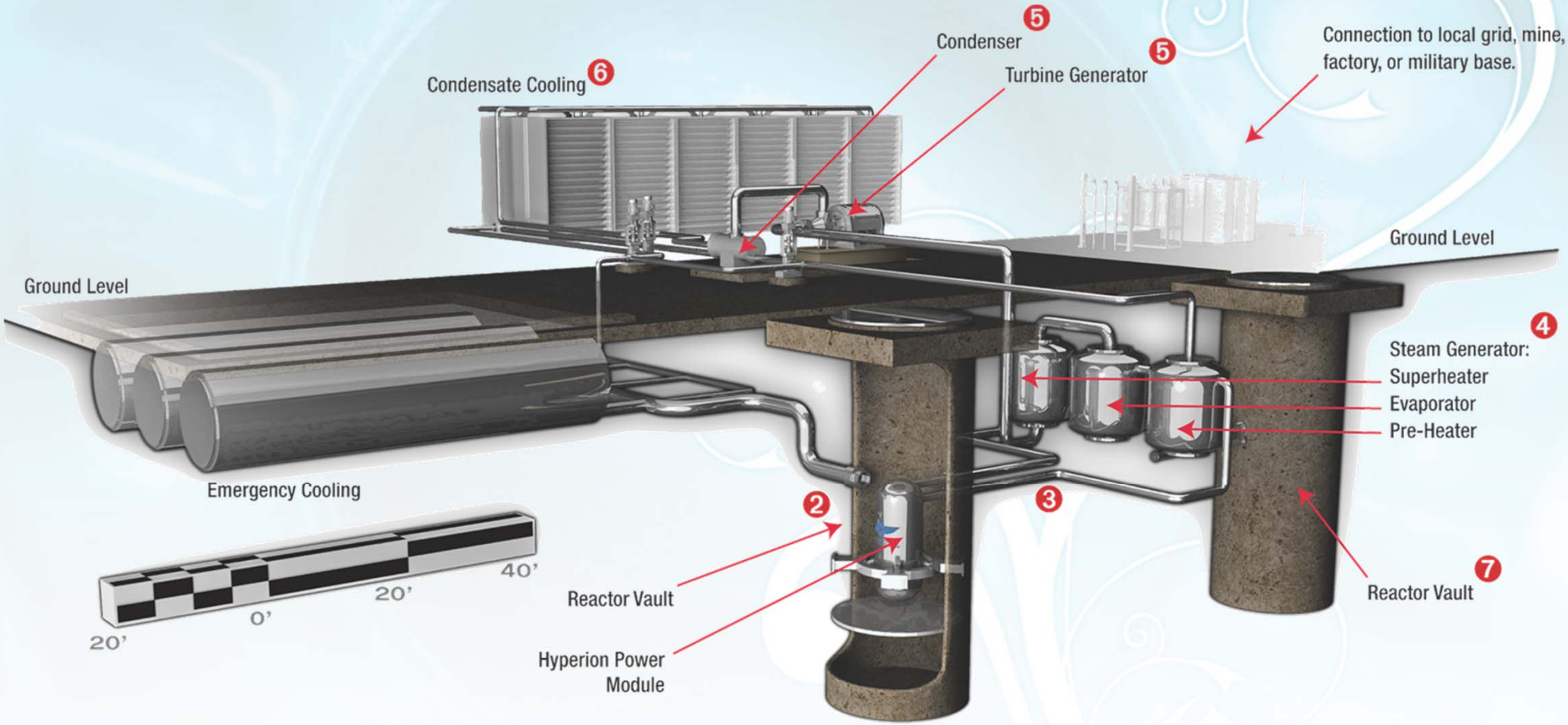
Hyperion Power Module
Conceptual Plant Configuration



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HPM Technical Overview

Reactor Power	70MW $_{thermal}$
Electrical Output	25MW $_{electric}$
Lifetime	7 – 10 years
Size (meters)	1.5w x 2.5h
Weight (tonnes)	Less than 50 (Incl. vessel, fuel and primary coolant LBE)
Structural Material	HT-9 or T-91
Coolant	LBE (45% Pb, 55% Bi wt%)
Fuel	HT-9 or T-91 clad, uranium nitride
Enrichment (% U-235)	<20%
Refuel on Site	No
Sealed Core	Yes
Passive Shutdown	Yes
Active Shutdown	Yes
Transportable	Yes – intact core
Factory Fueled	Yes
Safety & Control Elements	Two redundant shutdown systems

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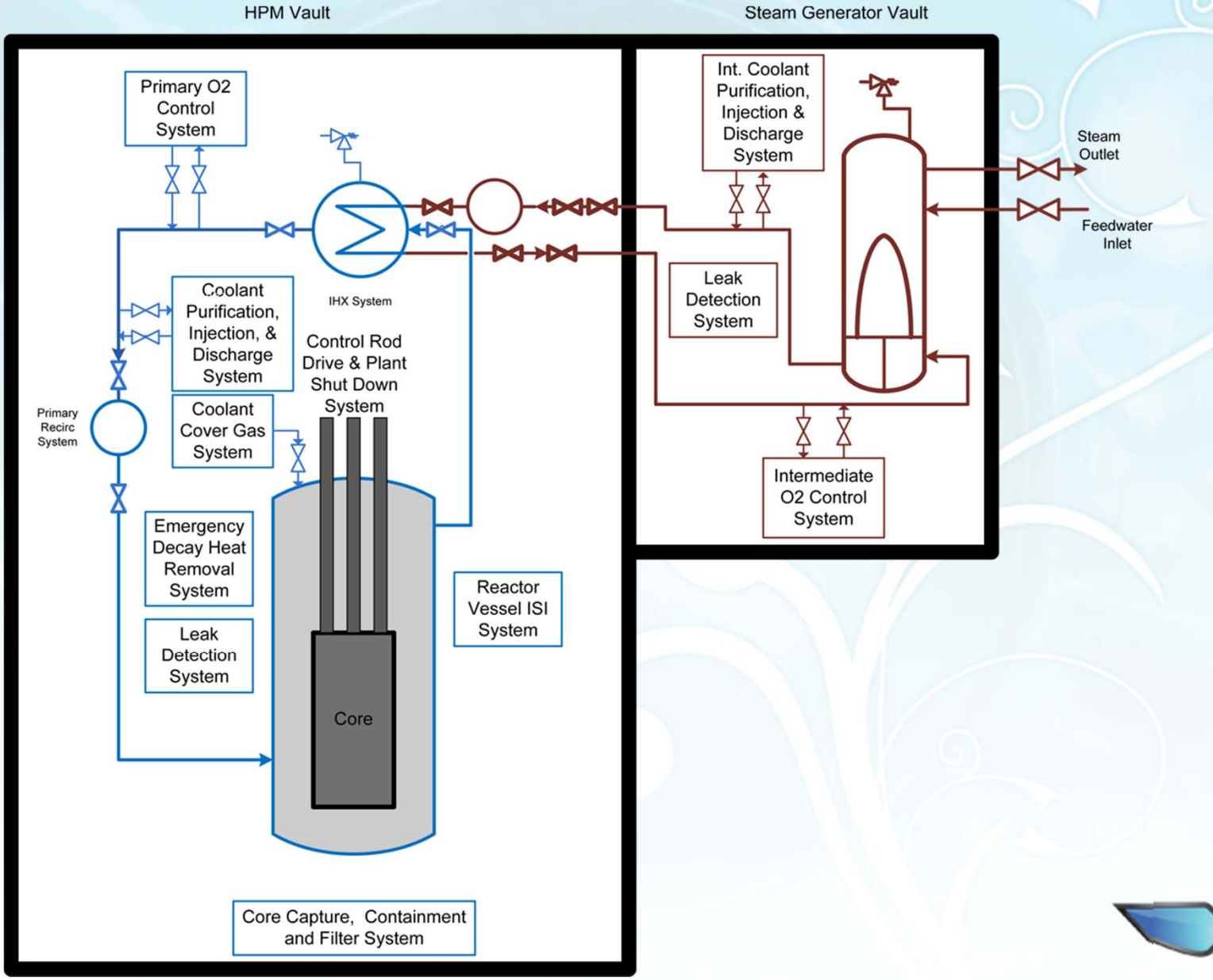
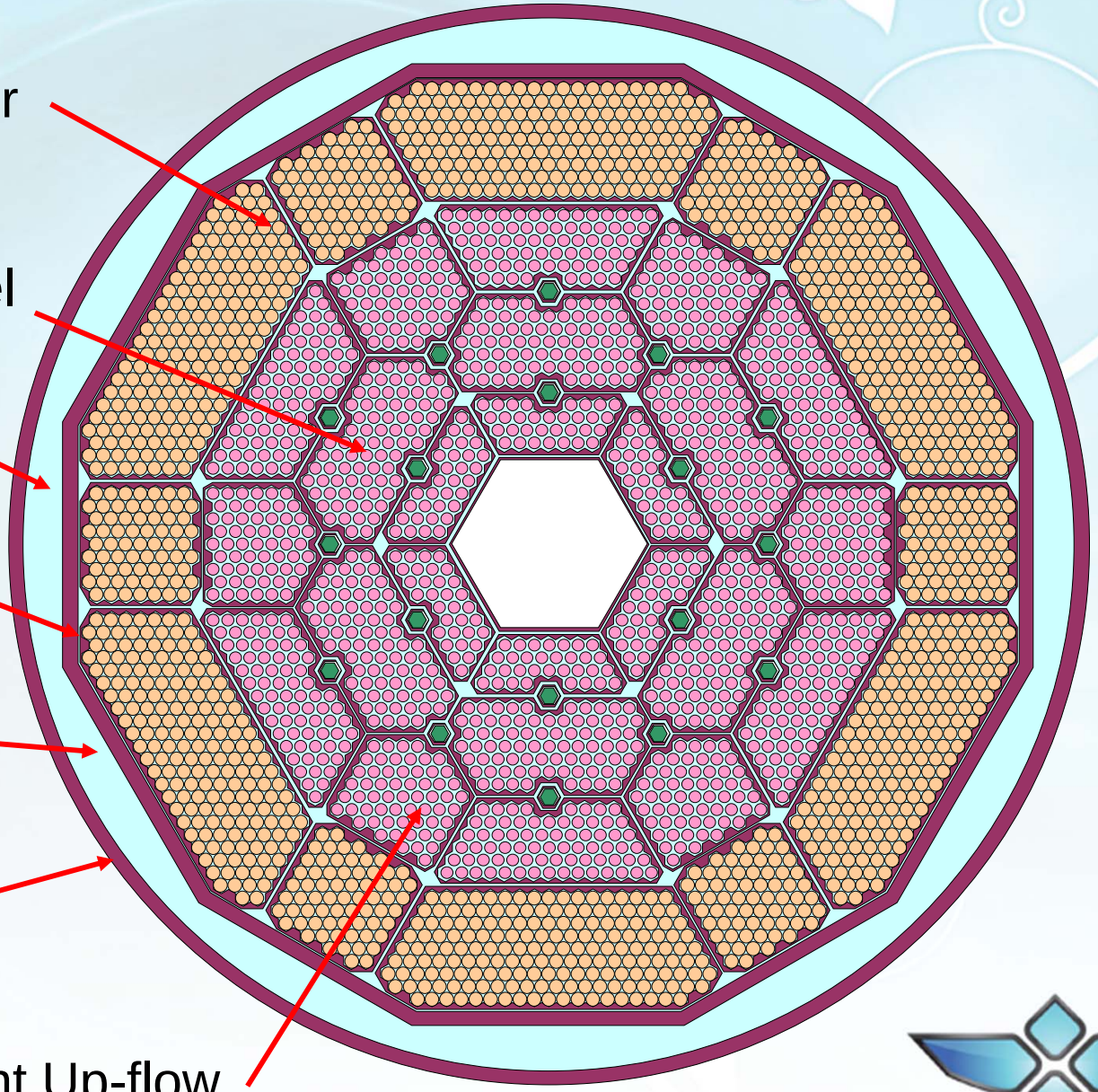
HPM NSSS Simplified Diagram

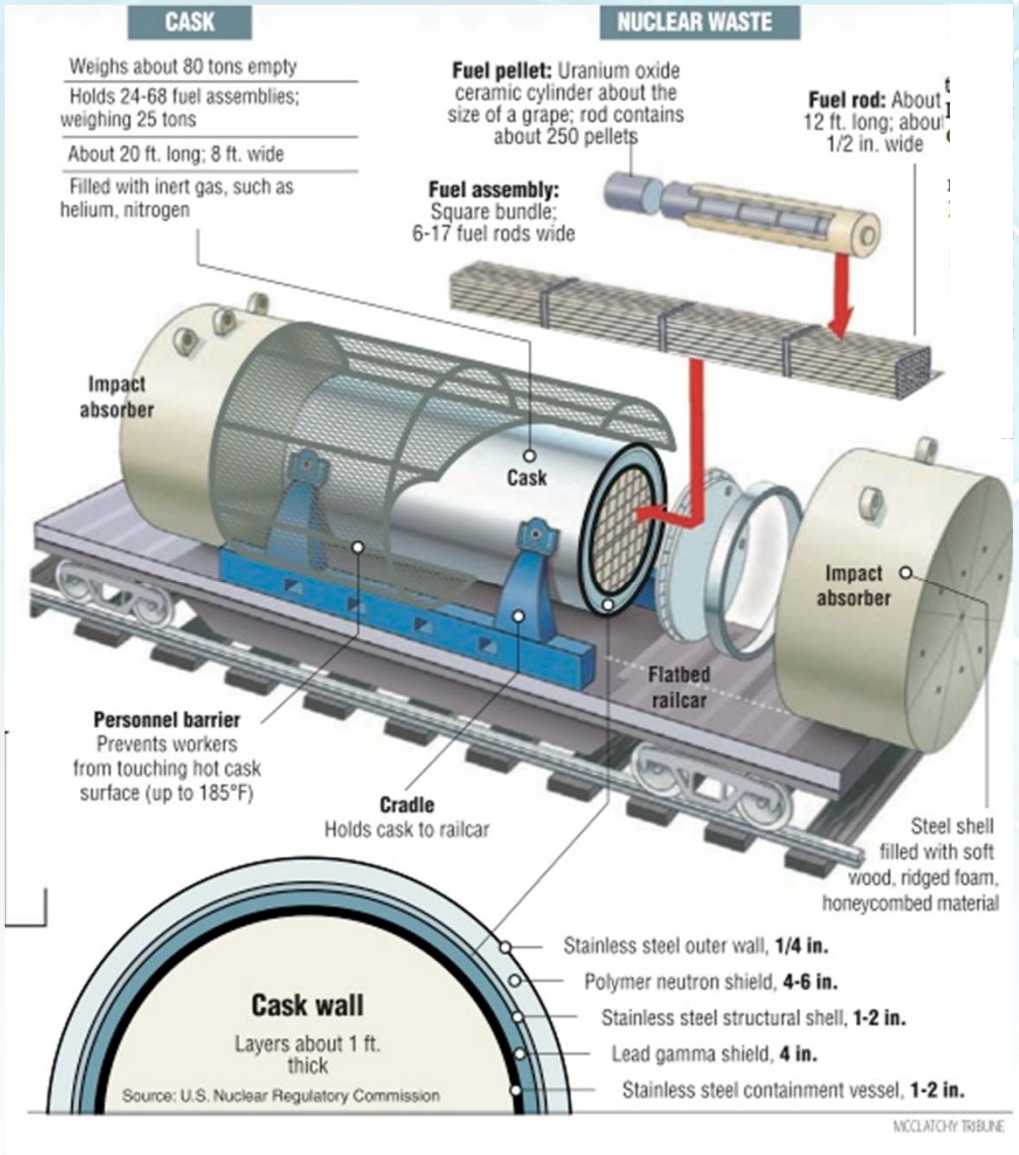


Reactor Vessel Plan View



NRC Licensed Shipping Cask

- **Vessel and core designed for transport in licensed cask envelope**
- **Working with cask designer on differences in:**
  - **Weight**
  - **Volume**
  - **Decay Heat**
  - **Crit Safety**



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Summary

- **HPM design will:**
  - **Demonstrate a high level of safety (e.g., underground containment)**
  - **Demonstrate security (e.g., sealed vessel, no on-site refueling)**
  - **Demonstrate safeguards (non-proliferation) goals by burning TRU and generating comparable Pu to LWRs (wt %) w/ higher burnup**
  - **Meet customer requirements**
  - **Optimized for operational life & reliability**

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