

ThorConIsle Specs

ThorConIsle is a liquid fuel fission power plant providing low-cost, reliable electric power; replaceable Cans contain a reactor vessel, pump, heat exchanger, and fuel.

Power generation capacity 500 MW.

Power output 245 kV 50 or 60 Hz AC; optional HVDC for long transmission lines.

Fuel consumption 1.93 tonnes of 19.7% enriched uranium per year; additional fissile uranium-233 is converted from 4 tonnes thorium fuel and fissile Pu-239 from U-238.

Refueling CanShip replaces 500 ton Can every four years; CanShip replaces fuel salt every eight years; 7 days staggered refueling outage per 250 MW module.

Availability 95% planned availability; 500 MW turbine-generator maintenance outage 14 days.

Load following power can be ramped up or down at 5% per minute.

Unexpected load disconnect steam bypass allows fission reactor operation to continue, temporarily raising cooling water temperature, until load restoration or fission power-down.

External power none needed; ThorConIsle has black start capability.

Siting Protected navigable waterside location at up to 10 m depth.

Cooling 16 cubic meters per second seawater flow, 10°C temperature rise.

Lifetime Plant: 80 years; Can: 4 years to recycle; fuel salt: 8 years to fuel handling facility.

Decommissioning CanShip removes Cans and fuel salt casks; mildly radio-activated secondary loop removed with special handling; bulk of plant removed or reused.

Control rooms one within plant plus one per site.

Staffing plan 72 security; 42 operations; 30 maintenance; 65 other for 1,000 MW plant.

Capital plan \$1,200 million for dual ThorConIsle 1,000 MW power plant, plus costs for site, licenses, permits, fees, taxes.

Construction time two years from firm order to power generation; transmission lines, permitting, siting, cooling are local limiting issues.

Generated electricity cost \$0.03 per kWh

ThorConIsle Safety

Passive safety dependent only on materials properties and physics, not electronic or electrical safety-critical systems or valves.

Decay heat cooling one active and two passive systems.

Stable increasing fission raises temperature, increasing neutron absorption by U-238, expanding structural materials, so lowering fission rate.

Containment all radioactive fuel contained within primary loop, contained within Can, contained within cooling silo, contained in silo hall.

Radioactivity barriers minimum 3 barriers between radioactive materials and environment.

Silo cold wall continuous recirculation of radiantly heated cooling water to small surface pool; no valves to operate; provides decay heat cooling after shutdown.

Fuse valve fuel salt overheat would melt salt plug below reactor vessel, draining fuel salt to unmoderated drain tank where fission impossible.

Can rupture of primary loop would contain spilled fuel salt within Can, thence to passively cooled drain tank.

Walkaway safe abandoned plant will self-cool for 1.5 years before attention required.

Aircraft strike withstands vertical impact of 777 aircraft nine-ton engines.

Ship collision ThorConIsle protected by breakwater; hull wall of 3 m of sand between two 25 mm steel plates; interior silo and cold wall also protects Can containing radioactive materials.

Earthquake withstands 1.0 peak ground acceleration.

Tsunami massive hull firmly ballasted to seabed will withstand 18 m surge before floating.

Fission products the most environmentally troublesome radioactive fission products, including I-131, Sr-90, and Cs-137, are chemically bound to the fuel salt.

Tritium captured by getters in inert gas in power module hall and secondary heat exchanger cell; tritium penetrating heat exchangers captured by oxidation in solar salt loop.

Sabotage operators can not defeat safety functions; reactivity increases limited by flow orifices and slow motors; no tamperable safety-critical electrical, electronic, nor computer systems.

Weapons proliferation all fissile material in inaccessible high-radiation areas; uranium always low-enriched; plutonium always diluted with thorium, in fuel salt with hazardous fission products.