Fluid Fuel Reactors, 1958, Ch. 16
Lecture Notes, p1/3
Raluca Scarlat, January 2017

Ch 16 p673 ARE

1500 F 815°C

1200 F 649°C

BeO moderated

Inconel tubes & vessel – 2" thick vessel - corrosion was unknown

⌀ 52" 1.32 m
H 44" 1.12 m

for reflector/moderator only
coolant: liquid sodium

2 independent sodium loops also used for decay heat similarly cooled, in another double-radiator

fuel salt
finned tube radiator HX, tubes radiating to water tubes

Helium coolant

Control

fission chambers in reflectors
ionization chambers outside the RV

3 safety shim rods; 1 control rod

ANNULUS
Helium circulating system
electrical heaters
outer annulus

- cools control & safety rods
- warms up the core at S/U by keeping temps isothermal
- monitor for leakage

Drain tanks - kept heated
- dry Helium - for moving salt around

Pumps - @ high point
- also expansion volume

Inconel - Heliarc welding - inert gas shielded electric arc

Concrete pits below ground

Manual fuel injection $^{235}UF_4$ - NaF (molten)

Then covered with concrete blocks for shielding.

Carrier salt: NaF - ZrF_4 ← added to the carrier salt @ fuel pump bowl

61 kg ^{235}U → for criticality

3.84 g/L → ^{235}U concentration

38.8 L - core volume ⇒ 14.9 kg ^{235}U → critical mass

Reactivity coefficient $-(6)\,10^{-5}$ $(\Delta k/k)/°F$

↑ fuel expansion coefficient

↓ very fast

stabilized the core

> 200 kW → reactor was controlled on load following

Xenon less than 5% ^{135}Xe retained in the fuel

expected: 27 hr operation ⇒ $(2)\,10^{-3}$ $\Delta k/k$ poisoning

if all Xe remained

1/4 of fuel inventory in the core

neutron energy > ^{135}Xe abs. resonances

detection limit: 5% of this poisoning

NONE was detected

" Xe is not retained in the fuel "

leak cover gas @ fuel pump

3wk 19 days

4wk 9d

fuel syst: 462 hr / 221 nucl. operation

Na syst: 635 hr

Summary 96 MWh

3days 74 h @ ~1MW.

26 d 4wk

DISMANTLED