

## NRU Structural Materials and Conditions

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Assembly	Alloy	Irradiation conditions
Loop pressure tubes	Zr-2.5Nb Pressure Tubes – various manufacturing routes	Up to 8 yrs irradiation, 250-300°C Up to $6 \times 10^{25}$ n/m <sup>2</sup> (E>1MeV)
Loop liner tubes – high strength secondary containment	Zr-2.5Nb (3 available)	Up to 9.5 yrs irradiation, 50 °C Up to $7.3 \times 10^{25}$ n/m <sup>2</sup> (E>1MeV)
Control rod shroud tube	Zr-2 annealed tube: 4-11/16" OD x 0.046" wall X-750 spring: nominally 3-7/16" ID and 3/16" wire ASTM B637 N07750 Type 1, 2 or 3 304 SS rings riveted at either end of the assembly	Up to 44 yrs, 35 °C. Zr-2: up to $2.9 \times 10^{27}$ n/m <sup>2</sup> (E<0.625 eV) X-750: $\sim 4 \times 10^{26}$ n/m <sup>2</sup> (E<0.625 eV), 10 dpa, 5000 appm He 304: $2 \times 10^{26}$ n/m <sup>2</sup> (E<0.625 eV), 2 dpa, 900 appm He
Blowdown Test Facility pressure tube	347 stainless tube 4.25" OD x 0.313" wall thickness	8 yrs irradiation, temp not constant, varied from 40 to 300°C, 10.5 MPa $6.6 \times 10^{26}$ n/m <sup>2</sup> (E<0.625 eV) , $2 \times 10^{24}$ n/m <sup>2</sup> (E>1 MeV) 4 dpa damage, 1600 appm Helium
Lower header cups	304 stainless steel (43 available) top tapered part scales to $\sim 7/16$ " or 11 mm thick x $\sim 1.6$ " or 40 mm long	Up to 44 yrs irradiation, 35 °C $4.1 \times 10^{26}$ n/m <sup>2</sup> (E<0.625 eV) 2 dpa, 800 appm He
Vessel baffle plate	304 or 347 stainless steel plate 1" x 3.75" x 2 ft long	44 yrs irradiation, 35°C 0.4 dpa, 135 appm He
Vessel bolts	Inconel X-750	44 yrs irradiation, 35°C Less than 0.4 dpa and 135 appm He
Loop fuel carriage tie rod	Inconel X-750, AMS-5667 $\frac{1}{2}$ " bar (10 available)	life limit is 1000 days 250 to 300 °C
Iodine rods, Vessel, Re-entrant can	Aluminum Alloys Al -5052 Alcan 57S	44 yrs, 35 to 55 °C Up to $2.3 \times 10^{27}$ n/m <sup>2</sup> (E<0.625 eV) 0.25 dpa, 4.5 Si atom %
Thermal column	Graphite	44 yrs, 15 to 230 °C Up to $7.1 \times 10^{26}$ n/m <sup>2</sup> (E<0.625 eV)
Biological Shield/Interspace concrete	Heavy concrete	60 yrs, 27 to 49 °C Up to $2.5 \times 10^{21}$ n/m <sup>2</sup> (E<0.625 eV) $3.6 \times 10^{19}$ n/m <sup>2</sup> (E> 1MeV)