

# RALEIGH RESEARCH REACTOR II (NCSCR-2)

## GENERAL

**REACTOR TYPE:** Aqueous homogenous, fully enriched (93%) uranium, light water moderated, graphite reflected, uncooled

**HISTORY:** June 1955 Modified from NCSCR-1 to NCSCR-2  
May 1957 Criticality achieved as NCSCR-2  
December 1958 Modified from NCSCR-2 to NCSCR-4 during relocation to the Bureau of Mines Building

**DESIGNER/BUILDER:** North Carolina State College and Atomics International

## REACTOR PHYSICS

**MAXIMUM POWER:** 500 watts thermal

**NEUTRON FLUX:** Average Thermal -  $3 \times 10^9$  n/cm<sup>2</sup>·sec, Average Fast -  $3 \times 10^9$  n/cm<sup>2</sup>·sec.

**CORE PARAMETERS:** Core Excess = 0.36%  $\Delta k/k$

## CORE LOADING

**SHAPE:** Cylinder, 10.6875 inch diameter, 5.71 inches high with hemispherical bottom with 5.344 inch radius

**CRITICAL MASS:** 766.5 grams <sup>235</sup>U

**CORE LOADING:** 775.7 grams <sup>235</sup>U in form of 1.29 kg UO<sub>2</sub>SO<sub>4</sub>, enrichment 93%, diluted in 13.628 liter H<sub>2</sub>O solution

**POWER DENSITY:** 0.0367 kW/liter

## FUEL ASSEMBLY DATA

**FORM & COMPOSITION:** (not applicable)

**CLADDING:** (not applicable)

**SUBASSEMBLIES:** (not applicable)

## CORE HEAT TRANSFER

COOLANT FLOW AREA: (not available)

COOLANT FLOW RATE: (not available)

TEMPERATURES: (not available)

## CONTROL

**CONTROL RODS:** Two combined regulating and safety rods, stainless steel tubes, 0.98 inch O.D., 12 inches long containing 0.9 inch diameter B<sub>4</sub>C. Worth of one rod = 2.8%  $\Delta k/k$

**SCRAM MECHANISM:** Gravity fall of both rods

## REACTOR VESSEL and OVERALL DIMENSIONS

**FORM:** Cylinder with hemispherical bottom, type 347 stainless steel, inside diameter = 10.6875 inches, wall thickness = 0.0625 inches, overall height = 14.406 inches

**WORKING PRESSURE:** 15 inches H<sub>2</sub>O vacuum

**DIMENSIONS:** Octagon, 17 feet across flats, 11 feet high

## REFLECTOR and SHIELDING

**REFLECTOR:** Graphite, forming cube of 5 feet

**SHIELDING:** On sides: 4 inches lead, 6 feet heavy concrete containing barytes and colmanite ore

On top: 0.25 inches boral, 2 inches lead, 3 inches steel, 3 feet heavy concrete

## CONTAINMENT

**TYPE & MATERIAL:** Core vessel contained in secondary enclosure: 0.0625 inch thick aluminum cylinder, 34.06 inches long, free space filled with graphite

Shielded reactor located below ground level in center of 57 feet diameter reactor hall, surrounded by laboratories

## RESEARCH FACILITIES

One 1 inch vertical exposure tube  
One 3 inch diameter horizontal beam tube (tangential to core)  
Four 4 inch diameter horizontal beam tubes (radial to vessel surface)  
One 60 x 60 inch thermal column with 6 access ports

## COST

**REACTOR:** Design and construction \$25,000 (Building, shielding, etc. available from NCSCR-1)

**SUPPORT FACILITY:** Available from NCSCR-1

## REMARKS

*When the Raleigh Research Reactor (NCSCR-1) developed a reactor vessel leak and was shutdown, the Raleigh Research Reactor II (NCSCR-2) was designed and installed to allow additional time to complete the engineering design for modification to the R-3 Reactor which would employ MTR-type fuel. Thus, the NCSCR-2 was an "interim" facility intended to bridge the time period between the NCSCR-1 shutdown and R-3 Reactor installation. The reduced authorized power level of the NCSCR-2 Reactor (500 watts), as compared to the NCSCR-1 Reactor (10 Kw), was a result of not reinstalling the catalytic recombiner system for this interim facility.*