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MEASUREMENTS MADE DURING THE COMMISSIONING OF THE WINDSCALE ADVANCED GAS-COOLED REACTOR (WAGR)*

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DISCLAIMER

As the fuel elements for the WAGR were available before the reactor was ready for loading, a series of measurements were carried out with this fuel in the approach to critical facility - APEX; and in the zero energy reactor - HERO. These measurements consisted of two unreflected approach to critical builds, critical builds with two different reflectors and critical builds with each perturber in WAGR (e.g. control rods, absorbers etc.) loaded in turn into the central channel.

These experiments were analysed to produce empirical lattice constants and extrapolation lengths for absorbers and thus enable fairly precise estimates of the loading pattern to be calculated (i.e. the number and position of control rods and absorbers).

The reactor was then loaded to full size following the pattern derived from this work by way of a series of near critical cores containing an ever increasing number of absorber s and control rods. Estimates of reactivity and control rod effectiveness were made at every stage by means of the source jerk equipment. The excess reactivity of this fully loaded core was determined by absorbing the excess reactivity by nitrogen poisoning (air pressure approximately 1,000 cm Hg) and the gamma, thermal and epithermal flux distributions determined for different positions of the main control rods. These measurements were in good agreement with the predictions.

The main bank of 15 control rods was calibrated by air pressure, rod slope using absorber changes to alter the balance point, source jerk, pulsatron and rod drop techniques. The most interesting feature of these results is the good agreement between the standard air pressure technique and the calibration obtained using absorber changes.

Measurements were also made of the reactivity worths of individual rods and these were found to differ by a factor of 5 depending on the control rod configuration loaded into the core. The normal two group treatment of the core and control rods, however, proved capable of predicting these results with reasonable accuracy.

The effect of core temperature on control rod effectiveness was determined by measuring rod slopes as the reactor cooled uniformly from 250°C and was shown to be less than ± 3%. The isothermal temperature coefficient was also determined during this run, a value of -3.3×10^{-5}/°C in the range 100-250°C being obtained.

Pressure drops around the main circuit and blower characteristics were measured at four different coolant densities over the range of circulator vane settings. The hot wire anemometers and the flow adjusters ('gags') which are situated in every channel, were calibrated during these runs and measurements were also made of the flow distribution with two and three circulators operating. On the basis of these measurements and the flux distribution previously determined the gags were set to their operational pattern.

Blower characteristics and pressure drops around the circuits were also determined with typical experiments loaded for the large and small experimental loop tubes.

Burst cartridge detection equipment, which operates on a 16 x 16 matrix, was commissioned by loading an enriched uranium/aluminium foil on a dummy stringer. Impingement from adjoining channels, the variation of sample flow with gag position and the effect of variation of soak and count times were investigated.