

1º Taller regional sobre reactores nucleares  
de investigación en Am. Latina, Chile  
21-25 jan., 1991

28/123

T. IV - 09

## CORRECTION FACTORS IN THE OUT-OF-CORE DETECTORS SIGNALS TO CONSIDER NEUTRON FLUX REDISTRIBUTION EFFECTS

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### Summary

It is known that reactivity measurements depend strongly on the detector position in the reactor core. This dependence is due to the neutron spatial flux redistribution [1]. For safe operation of a nuclear plant it is necessary to take in account this effect in order to have credit in the reactivity measurement. This work shows a method to correct the spatial effect in reactivity measurements.

The correction is introduced directly in the detectors signals through correction factors, which are obtained from computational calculations using the HAMMER and CITATION codes. The cross-sections have been generated from HAMMER code and used by the diffusion code CITATION to obtain fluxes in detectors positions. In that way, the correction factors have been calculated as a ratio of perturbed flux to the reference flux (non-perturbed flux). The reference flux corresponds the situation where the reactor is critical, and the perturbed flux refers to the distribution after control rod motion starting from the critical position. Five configurations of critical control rod position have been studied in this work. For each critical configuration, five perturbed configurations have been studied.

To verify the good adequacy of these correction factors, a rod drop experiment have been realized. Three out-of-core detectors have been utilized to measure the integral reactivity. The integral reactivities obtained with the detectors signals without correction showed discrepancies among them, whereas, good agreement have been obtained with the application of these correction factors in the detectors signals, i.e., the reactivity values determined from the corrected detectors signals converge to the same value and this value is in good agreement with the calculated value, as shown in table 1. Figures 1 and 2 show the reactivities as a function of time without and with the correction factors. Satisfactory results have been obtained utilizing the method showed in this work. Therefore in order to obtain a correct value of reactivity from out-of-core detectors, it's necessary to correct the measurements to take into account the effect here described.

### References

1. Moreira, J.M.L., "Space-Time Analysis of Reactivity Measurements". PhD Thesis, (1984).
2. Moreira, J.M.L., "Accuracy of the Model-Local Method for Reactivity Determination". Nucl. Sci. Energy, 98, 244-254 (1988).
3. Moreira, J.M.L., "Space-Time Analysis of Reactor-Control Rod-worth Measurements". Nucl. Sci. Energy, 86, 91-105 (1984).
4. Ferreira, P.S.B., Alves, M.A.P., Coelho, P.R.P., "Calibração de Barras de Controle do Reactor IPEN/MB-01". Internal Report.