the D_2O; ejected thoria redeposits on the surface of the particles, trapping many of the fission products that had absorbed on the surface[4] 4) Our irradiated slurry had an overpressure of oxygen, contained a palladium catalyst, and was in other ways different from the slurry used by Gardner. However, our slurry is more representative of that expected from an aqueous homogeneous reactor.

To date no method for leaching of fission products from irradiated thoria or urania slurry has been found which does not completely change the properties of the slurry solids or dissolve a prohibitive fraction of the oxide.

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Comment on Doppler Broadened Absorption

Since the paper "Accurate Doppler Broadened Absorption"[1] was printed in the June 1963 issue of Nuclear Science and Engineering, Dr. Joseph J. Devaney of the Los Alamos Scientific Laboratory has written to us about his extensive earlier work[2-8] on this subject. Using essentially the same expression for the Doppler broadening as Eq. (7) of the above paper, Devaney and his collaborators have applied a coded digital computation to U^{238}, Th, Pu^{239}, Pu^{240}, Mo, Hf, W.

We regret our oversight in not having given credit to this very useful work. On the other hand, these reports have not compared the accurate treatment with the more approximate ψ-function method, and, in this sense, our work can be considered to supplement his.

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Effect of Neutron Spectrum on the Branching Ratio of the $Ni^{58}(n,p)$ Co^{58} Reaction

The effect of branching ratio on the thermal neutron absorption corrections for nickel activation measurements has been discussed fully by Martin and Clare[1]. These authors show that an error of ±10% in the branching ratio can produce an error of ±5% in measured fast-neutron doses using nickel activation monitors in a thermal neutron flux of $\sim 10^{14}$ $n.cm^{-2} sec.^{-1}$ and that the error is greater in higher thermal-neutron fluxes. It is, therefore, important to know the effect of neutron-spectrum variation on the branching ratio if nickel is to be used as an accurate fast-neutron dose monitor in different reactor facilities.

The mean branching ratio $\bar{k}$ for a given neutron spectrum is defined by Martin and Clare[1] in terms of the mean neutron activation cross-section of the Ni^{58} (n,p) reaction, $\bar{\sigma}_a$. The product $\bar{k}\,\bar{\sigma}_a$ is the cross section for activation of Ni^{58} to the ground state Co^{58}, and $(1 - \bar{k})\,\bar{\sigma}_a$ is the cross section for activation of Ni^{58} to the isomeric state Co^{58}. Barry[2] measured the activation cross-section for the Ni^{58} (n,p) reaction as a function of neutron energy E, and obtained a value of $\bar{\sigma}_a = (111 \pm 12)mb$ by averaging the results over a 'fission spectrum'. This result is in good agreement with the value obtained by Wright (private communication) of 107 *mb* relative to 65 *mb* for the $S^{32}(n,p)$ reaction by comparison of nickel and sulphur monitors in a hollow fuel element in PLUTO.

Cross[3] has determined the branching ratio as a

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function of neutron energy by following the build-up of the 810 keV γ-radiation that follows β-decay from the isomeric to the ground state of Co^{58}.

The mean branching ratio has been calculated for five different spectra, listed in Table I, using the results of Barry[2] and Cross[3]. The spectra for the fuel-channel wall and X-hole in a Calder Hall reactor[4] and the PLUTO Materials Testing Reactor hollow fuel element facilities[5] have been calculated by Wright[6] using the Monte Carlo method. The spectrum at the Calder Hall pressure vessel[4] was calculated by J. Butler (A. E. R. E., Harwell - private communication) and the 'fission neutron spectrum' is that determined by Cranberg[7].

It is clear from the results given in Table I, considering the wide variation in spectra investigated, that the mean branching ratio may be considered to be independent of spectrum variations. This independence of spectrum variations results from most of the activation being by neutrons having energies in the range 2-6 MeV. In this range the branching ratio varies from 0.82 to 0.71 with a mean value of 0.76.

Hogg *et al*[8] measured the branching ratio in ETR to be 0.66, Passell and Heath[9] give two values, 0.68 and 0.71, corresponding to two different positions in EBR -1, while Mellish *et al*[10] obtained a value of 0.71 in the cores of BEPO and DIDO. These determinations give mean values of the branching ratio for the neutron spectrum present in each investigation. This difference in measured and calculated values of $\bar{k}$ is unsatisfactory and could lead to an error of 15% in measured nickel doses in a thermal-neutron flux of $\sim 10^{14}$ $n.cm^{-2} sec^{-1}$ using $\bar{k} = 0.66$ if the value of 0.76 is correct. The error would be greater in higher thermal-neutron fluxes.

TABLE I
Mean Branching Ratio for Different Neutron Spectra

Neutron spectrum position	Mean branching ratio, $\bar{k}$
Calder fuel-channel wall	0.76_0
Calder X-hole	0.76_0
Calder pressure vessel - reactor mid-plane	0.75_5
PLUTO - hollow fuel element	0.75_5
Fission neutron spectrum	0.76_5

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