This report may not be published without the approval of the Patent Branch, AEC.
DISCLAIMER

This report was prepared as an account of work sponsored by an agency of the United States Government. Neither the United States Government nor any agency thereof, nor any of their employees, makes any warranty, express or implied, or assumes any legal liability or responsibility for the accuracy, completeness, or usefulness of any information, apparatus, product, or process disclosed, or represents that its use would not infringe privately owned rights. Reference herein to any specific commercial product, process, or service by trade name, trademark, manufacturer, or otherwise does not necessarily constitute or imply its endorsement, recommendation, or favoring by the United States Government or any agency thereof. The views and opinions of authors expressed herein do not necessarily state or reflect those of the United States Government or any agency thereof.
DISCLAIMER

 Portions of this document may be illegible in electronic image products. Images are produced from the best available original document.
The deviation from the expected coolant flow distribution within the SNAP 2 reactor is due to the filling and draining of the "unfed" peripheral flow channels.

An analysis of the cross-flow in a simulated SNAP 2 model omitting the 'unfed' peripheral channels was made. The results of this investigation are presented herein.
INTRODUCTION

The object of this report is to present the results of a study to substantiate the conclusion given in Reference (2), that the deviation from the desired flow distribution in the SNAP 2 reactor is due to the "unfed" or "dead-end" peripheral channels.

As suggested in Reference (2), the effect of the peripheral "unfed" channels could be made more evident by removing those channels from the flow network and repeating the same analysis as conducted in Reference (2). This modification was made and the first generation computer code for the analysis of flow in complex network, HOSS-I, was used in the study of this report.

THEORY AND METHODS

The theory used and the methods developed for the analysis of coolant cross-flow in SNAP reactors have been discussed in detail in References (1) and (2).

The problem discussed herein is essentially the same as presented in Reference (2). The same resistance and initial flow values were used to give a basis of comparison, upon the omission of the "unfed" peripheral channels. See Figures 1, 2 and 3 in Reference (2) for a complete illustration of the flow network and geometry involved.

RESULTS AND DISCUSSION

The results of this study clearly indicate that the extensive cross-flow which exists in the SNAP 2 reactor is caused, in large part, by the "unfed" peripheral channels drawing coolant from the "fed" interior coolant channels. A flow map is presented as Figure (1), showing the magnitude and direction of flows in the various channels of the flow model. These flows are plotted radially and axially in Figures 2, 3, 4, and 5.

From Figure 1, the flow pattern is found to deviate considerably from the smooth flow obtained in the network of Reference (2). It was concluded that this deviation is due to the fact that the "unfed" peripheral channel is no longer present to assist in carrying the overflow from the undersize F channel. Channel F is approximately one-half the size of a normal tri-cusp channel. As the vertical channels are filled, "F"
cannot carry as much coolant as the interior channels and a back-flow is established to compensate for this difference. This "back-flow" continues at a decreasing rate until the seventh horizontal increment where the "backflow" is also felt in channel "D".

The axial and radial flows are compared to the results obtained in Reference (2) in Figures 2, 3, 4, and 5, where the Reference (2) results are plotted as solid lines. From these graphs it can be seen that the omission of the "unfed" peripheral channel results in a marked decrease in cross-flow between vertical channels and thereby substantially increases the vertical flow. The overall effect is to yield a flow profile that better approximates the desired flow pattern within the reactor core.

A map of the pressures in the flow model (with zero pressure at the exit) is given in Figure 6. It was found that an average pressure drop across the reactor from the inlet plenum to the outlet plenum of about 0.186 psi exists without the peripheral "unfed" channels. This pressure drop is closer to the desired 0.2 psi value than the 0.184 psi pressure drop obtained when the "unfed" channels were present.

Based upon the results of this investigation it is recommended that the "unfed" peripheral channels either be eliminated from the core design or be "fed" by orificing these channels to the inlet and outlet plenum. One way of eliminating the "unfed" channels, if it is feasible from a design point of view, would be to extend the filler block material into these channels. It is further recommended that a heat transfer and design analysis be made of these modifications to determine which would be more effective and to determine their effect upon the temperature profile within the core.
REFERENCES


Figure 2

Calculated Axial Flow Rates Along the Length of Axial Flow Channels in the SNAP-2 Reactor Excluding Peripheral "Unfed" Channel
Figure 3

Calculated Radial Flow Rates
Along the radius of the SNAP-2 Reactor
Excluding Peripheral "Unfed" Channels
Figure 4

Calculated Radial Flow Rates Along the Length of Axial Flow Channels in the SNAP-2 Reactor Excluding Peripheral "Unfed" Channel
FIGURE 5
CALCULATED AXIAL FLOW RATES ALONG THE RADIUS OF THE SNAP-2 REACTOR EXCLUDING PERIPHERAL UNFED CHANNEL
Figure 6

Pressure Map for the SNAP-2 Reactor Flow Model
Excluding Peripheral "Unfed" Channel