REPP

1. Name of Program: REPP.
2. Computer for Which Program is Designed: The REPP code is designed to operate on the UNIVAC 1108 computer system.
3. Nature of Physical Problem Solved: The REPP computer code provides a method for evaluating fuel temperatures and critical heat flux margins for a fixed reactor core and fuel design. It is a useful tool for determining the number of fuel pins required to maintain specified heat flux margins from burnout at a given reactor power level. It also may be used to determine the diameter of a fuel pin when designing within fuel centerline temperature limits and at a specified reactor power level. It is used to evaluate the sintering effect on fuel temperature. Pressure drop and coolant properties for single phase and two phase flow for fuel operating at average reactor conditions and a theoretical hot pin, hot channel condition may also be evaluated.
4. Method of Solution: The mathematical model in REPP is a right circular cylindrical core containing fuel pins arrayed uniformly in a triangular or square lattice. The fuel centerline temperature is based on 21 radial nodes in the fuel pin and incorporates a variable thermal conductivity. A flux depression may be delineated in the input which is independent of the radial nodal mesh utilized in the code. The effect of fuel sintering on fuel temperature is optional and when used, the void diameter at the center of the fuel is determined. Nominal and hot channel thermal and hydraulic conditions are predicted at each nodal location based on an energy and momentum balance. The Keenan and Keyes steam tables, provided in a subroutine, are used to evaluate the coolant properties at each node. The local energy generated and transferred to the coolant is determined from input consisting of the reactor power and a normalized axial power profile. The axial power distribution specified may be independent of the nodal mesh utilized in the code. A Lagrangian interpolation routine is used to expand the input array to be consistent with the nodal mesh used in the code. Integration is performed when required using Simpson's rule. The fuel spacer model uses the deStordeur technique to predict the pressure drop across spiral wire wrap, honeycomb, lenticular wire, or wire type spacers at the option of the user.
5. Restrictions on the Complexity of the Problem: The effect of the restricted coolant flow areas in the corners of encased fuel assemblies on fluid flow (an inherent flow problem especially in two phase flow) is not calculated. Also, the cold wall influence on burnout heat flux is not evaluated. Interchannel mixing and flow distribution present some uncertainty. However, since the sizing technique is based on a theoretical hot channel, these restrictions need not be serious provided sufficient data on fuel performance are known to provide input to the code. Another restriction, the number of node capability (10 minimum to 100 maximum axial and 21 fuel pin radial nodes) has proven not to seriously effect the accuracy of the results. The code is limited at present to water cooled reactors. However, replacement of the steam tables with proper property values can extend the use of the code to other coolants. Also, the W-2 and W-3 burnout correlations presently used can be replaced to accommodate other burnout correlations.
6. Typical Running Time: The running time is very dependent on the complexity of the problem. Should the input describe initial conditions relatively close to the solution, the running time may be as short as 8 to 10 sec. Otherwise the iterative solution may require 30 sec. A single pass through the code requires from 2 to 3 sec.
7. Status: The REPP code is in productive use at Pacific Northwest Laboratory.
8. Machine Requirements: Approximately 51K words of directly addressable core storage are required for the program.
9. Programming Language Used: The program is written in FORTRAN-IV.
10. Operating System: CSCX.
11. Program Information: There are 13 routines in the REPP code. There are no overlay links. The source deck of the program consists of approximately 4000 cards.
12. Material Available: The REPP code is available through the Argonne Code Center.
13. *Acknowledgment*: This work is based on work performed under U.S. Atomic Energy Commission Contract AT(45-1)-1830.
14. *References*:

R. M. HIATT and C. BROMLEY, Jr., "REPP: A Thermal Hydraulic Design Code for Water-Cooled Reactors," BNWL-1013, Pacific Northwest Laboratory (1969).

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