Appendix A

Code Summary

CASMO-2

CASMO-2 is a multi-group two-dimensional transport theory code for burnup calculations on BWR and PWR assemblies. This code has been developed by Studsvick Energiteknik AB and supported by EPRI.

CHART

CHART prepares cross section tables in HARMONY format from cross section data produced by CASMO-2. CHART reduces significantly the tedious task of hand transferring values from CASMO-2 printout to macroscopic and microscopic tables in card image HARMONY format. Two, three, and four group cross section data may be obtained with one-dimensional HARMONY interpolating tables.

COMETHE-III-J

The COMETHE code calculates fuel pin thermal and mechanical behavior as a function of burnup. This code was developed by Belgo Nucleaire and licensed in this country by the S. M. Stoller Corp. EPRI is sponsoring the distribution and further development of this code for the utilities. The code does all the calculations described for TAFY and includes a relocation and cracking model to determine fuel-clad interaction forces.

CORE

CORE (Codes for Operating Reactor Evaluation) is a package of computer routines for the off-line evaluation of reactor performance. CORE uses as input: detailed reactor physics data, isotopics, and thermal-hydraulics data. Calculated values are: F_Q, $F^N_{\Delta H}$, assembly burnups, isotopics, reactivity, and core thermal-hydraulics information.

DELAY

DELAY calculates core averaged delayed neutron fractions for six energy groups, core averaged decay constants for six energy groups, core averaged delayed neutron fraction with and without importance factor, estimated prompt neutron

lifetime, and reactivity versus period. Input consists primarily of isotopic fission fractions versus burnup and enrichment from PDQØ7 calculations.

EPRI-CELL

EPRI-CELL computes the space, energy and burnup dependence of the neutron spectrum within cylindrical cells of Light Water Reactor fuel rods. Its primary output consists of broad group, microscopic, exposure dependent cross sections for subsequent use in multidimensional diffusion theory depletion analysis. EPRI-CELL utilizes three industry accepted subcodes; GAM-1, THERMOS, and CINDER.

EPRI-CPM

EPRI-CPM is a multi-group two-dimensional collision probability code for burnup calculations on BWR and PWR assemblies. The code handles a geometry consisting of cylindrical fuel rods of varying composition in a square pitch array with allowance for fuel rods loaded with gadolinium, burnable absorber rods, cluster control rods, in-core instrument channels, water gaps, boron steel curtains and cruciform control rods in the regions separating fuel assemblies.

EPRI-FIT

EPRI-FIT is a program which processes the PDQØ7 integral file and calculates and edits values needed by the EPRI-NODE code. EPRI-FIT greatly reduces the hand calculation time needed to extract these values from the PDQØ7 printout and improves the quality assurance. A data file under the local name of COLOR is written which contains the EPRI-FIT edited data and is used as input to the SUPERLINK program.

EPRI-NODE

EPRI-NODE is a multi-dimensional nodal code derived from to FLARE. The EPRI-NODE program computes the core effective multiplication factor, the three-dimensional core power distribution, core coolant flow and temperature distribution, and fuel exposure distribution. The program includes the effects of partially inserted full-length control rods, part-length rods, and up to 13

different fuel assembly types with different enrichments and burnable absorber shim loadings. EPRI-NODE has a capacity to represent the core with 32 axial nodes for each fuel assembly and 30x30 nodes in the XY plane.

The program iterates to account for the interaction between power distribution and core nuclear properties which depend on coolant flow and coolant temperature distributions, fuel temperature distribution and xenon distribution. The program computes the time dependence of xenon following changes in power level and/or changes in power distribution. The program permits fuel shuffling from one location to another and fresh fuel insertion for burnup cycle calculations. Individual steps can by stacked for either xenon transient or fuel cycle burnup calculations.

EPRI-NUPUNCHER

NUPUNCHER prepares cross section tables in HARMONY format from cross section data produced by EPRI-CELL and placed on the ECDATA file. NUPUNCHER reduces significantly the tedious task of hand transferring values from the EPRI-CELL printout to macroscopic and microscopic tables in card image HARMONY format. Two, three and four group cross section data may be obtained with one-dimensional HARMONY interpolating tables.

EPRI-PDQØ7 MODIFICATIONS

PDQØ7 is the industry accepted multi-group one, two, or three-dimensional diffusion depletion code. EPRI-ARMP uses PDQØ7/Version II with minor modifications to allow options for improved removal treatment, peak power editing, and re-editing.

EPRI-SHUFFLE

The EPRI-SHUFFLE program will read a PDQØ7 concentration file, make certain modifications to this file, and write a new updated concentration file. This procedure is accomplished by defining "assembly regions" in the program input. Assembly regions are square arrays of mesh points containing depletable nuclide concentrations and superimposed on the original PDQØ7 geometry. These assembly

regions are then used to describe the movement of existing nuclide concentrations by translation, reflection and/or rotation. In addition, new fuel concentrations can replace spent fuel concentrations in selected assembly regions described in the program's input.

EPRI-SUPERLINK

SUPERLINK accesses data on the files produced by EPRI-FIT and, together with relevant input information for file management and for data processing control, produces polynomial coefficients for use in EPRI-NODE.

MULTIFIT

MULTIFIT reads EPRI-CELL cross section files and generates HARMONY cross sections and g-factors. Both HARMONY masks and function tables can include the effects of up to three independent variables. MULTIFIT can perform almost all of the functions of EPRI-NUPUNCHER.

PDQØ7

See EPRI-PDQØ7 Modifications.

NODE UTILITY CODE (NUC)

The NUC program is a package of subroutines that performs any necessary utility function to EPRI-NODE files. The major subroutines are:

I. FILE - this mode lists, merges, purges, adds, rearranges, edits, etc. the NODE cases on one or more history files.

II. FLEX - this mode takes an existing file, expands or collapses it to a new problem size, and then stores it on a new disk.

III. COPY - this mode copies a given history file from disk storage (working file) to magnetic tape storage (permanent backup file) and vice versa.

IV. MARGINS - this mode performs those operations which are necessary to calculate CFM, DNB, LOCA, and $F_{\Delta H}$ margins from an input history file(s). It also plots the results in the form of a "fly speck" graph.

TACO2

TACO2 conservatively predicts fuel pin temperature and fuel pin pressure. It includes models for fuel densification, fuel swelling, fuel restructuring, gas release, cladding creep, and gap closure.

VIPRE

VIPRE is a transient and steady state open channel thermal hydraulic code that considers energy mixing between channels and is used to calculate flow distribution among individual channels in an assembly or a cluster of fuel pins. It calculates flow, pressure drop, coolant parameters up the channel, and DNBR.

TACO

TACO conservatively predicts fuel pin temperature and fuel pin pressure. It includes models for fuel densification, fuel swelling, fuel restructuring, gas release, cladding creep, and gap closure.