UNITED STATES
NUCLEAR REGULATORY COMMISSION
WASHINGTON, D. C. 20555

NOV 12 1980

MEMORANDUM FOR: W. V. Johnston, Chief, Core Performance Branch, DSI

FROM: Lambros Lois, Reactor Physics Section, Core Performance Branch, DSI

THRU: D. Fieno, Section Leader, Reactor Physics Section, CPB, DSI

SUBJECT: ARMP, USER'S MEETING REPORT

A two-day meeting (Oct. 28-29, 1980) was held in Dallas, Texas to discuss utility, EPRI and their contractor's progress and experience in the ARMP system of codes. This was the seventh semiannual meeting held for and by ARMP users. The meetings are organized by EPRI and this particular one has been hosted by "Texas Utilities Services, Inc." The meeting was attended by about 55 users; the agenda is in Attachment 1.

I found the meeting very useful in spite of a few disappointing presentations. Of particular interest were the presentations which are related to our current review effort and the work we sponsor at BNL, for example:

a. the presentation by Richard Cheng of Middle South Utilities discussed the ANO-1, -2 physics topical;

b. the presentation of D. VerPlanck of Yankee Atomic Electric Co. on BWR modeling (under contract to EPRI) and

c. the presentation of G. Lanning of the Nebraska Public Power Co. on the COPHIN implementation.

BNL was represented in the meeting by D. Cokinos and L. Eisenhart.

A brief abstract of each of the presentations is given in Attachment 2. Attachments 3-15 contain the material distributed by the speakers which includes more detailed information on each presentation.

Lambros Lois

Lambros Lois
Reactor Physics Section
Core Performance Branch
Division of Systems Integration

Attachments:
As stated

ATTACHMENT 2

Brief Description of the Presentation in the
Seventh ARMP Semiannual User's Meeting

1. BWR Modeling, Part I - Dave VerPlanck, Yankee Atomic

   The work presented by VerPlanck has been commissioned by EPRI and is an extensive comparison of PDQ and CASMO, SIMULATE results. Extensive use was made of Vermont Yankee measurements of the earlier loadings. The calculations indicated that very good agreement can be obtained if thermal leakage correction factors and albedo corrections for corner assemblies are applied. Extensive comparisons are shown in Attachment 3.

2. The SPEAR Code - T. Oldberg, EPRI

   The SPEAR code aims to optimize the operation of BWRs and minimize the estimated 3.1% capacity factor loss due to fuel ramp rate restrictions. This is to be accomplished by applying statistical decision theory. The speaker claimed that $160 million can be earned each year if the results of the SPEAR code are applied by the utilities. The code is based on results and theory presented in the report EPRI NP-1378, "SPEAR Fuel Reliability Code System." A copy of this report is available at the undersigner's desk. The final version of the code will be available to the utilities in early 1981. The viewgraphs of this presentation are shown in Attachment 4.

3. Transient Analysis Using the RAMONA Code - Lars Moberg, Scandpower for Carolina Power and Light

   This presentation dealt with the application of the RAMONA-III code to BWR transients. The RAMONA-III code uses a 3-dimensional nodal model (PRESTO) based on a 2-group time-dependent diffusion equations with 6 delayed groups. The thermal-hydraulics are based on non-equilibrium thermodynamics using the integrated momentum approach. The fuel thermodynamics and heat transfer uses radial heat conduction through fuel pellets, gap and cladding. The rest of the plant is represented by appropriate boundary conditions. The results of the application showed excellent agreement with experimental measurements. The RAMONA-III code can handle 3-dimensional dependent problems as, for example, rod drop transients which would be difficult to handle otherwise. The viewgraphs of this presentation are in Attachment 5.

4. Power Shape Monitoring System γ-Scan Verification of BWR Albedo Boundary Conditions and Spectrum Correction Factors - T. Ancona, NAI

   The purpose of this work was to determine boundary conditions which could improve BWR representation. It was found that beyond the proper value of the albedo one must use the proper value of the "spectrum correction factor." Power distribution and control rod worth improved significantly. The work is not completed yet and no handouts were circulated.

5. Physics Topical ANO-1, -2 - Richard Cheng, Middle South Utilities

   A brief description of the physics topical report which has been submitted to the NRC for review was discussed. The viewgraphs were pages of the report. It was stated that due to the delay caused by the (well publicized) clams

in the cooling water, refueling will not take place until June 1981. The cover letter on the topical requested review to accommodate an April 1981 refueling.

6. COPHIN Implementation Experience - Gene Lanning, Nebraska Public Power

The purpose of the COPHIN code is to interface PDQ to CPM and/or the CASMO programs. This program will automate microscopic depletion updating. The running of the program uses very little CPU time but greatly facilitates running PDQ by preparing the input automatically. Control rods have to be input manually. The COPHIN code has been received by BNL and will be implemented. The presentation handout is shown as Attachment 6.

7. Monticello Supporting Calculations - Cliff Bonneau, Northern States Power Co.

Many older experimental data have been analyzed with the ARMP system codes. The purpose was to update the computational capabilities for future predictive refueling calculations.

8. IBM and CDC Versions of Predictor-Corrector in PDQ - George Poetschat, GRP Consulting, Inc.

The purpose of the predictor-corrector technique applied to PDQ is to cut down on the running time by improving on the convergence, lowering the number of iterations. The results showed that the number of iterations can be cut by a factor of 3-5, but the computation time savings are not as big due to increased calculations per iteration. A brief description is given in Attachment 7.

9. PWR Nodal Code Models and Improvements - Eddie Liang, Portland General Electric

The purpose of this work was to improve the NODE-P, a 3-dimensional nodal code. To this end, data from Trojan have been used along with PDQ comparisons. The areas where improvements have been affected include the source term, diffusion area or a function of exposure, the treatment of the albedo and others. A comparison of the improved NODE-P with direct instrument measurements at Trojan show good to excellent agreement. The handout which includes extensive PDQ and experiment comparisons is shown as Attachment 8.

10. BWR Modeling: Part II - Dave VerPlanck, Yankee Atomic Electric Co.

This is the second part of the presentation described in 1 above. An extensive description was given of the Vermont Yankee Cycles 1-5. The results showed that with the proper empirical factors, excellent agreement with experiment can be obtained. Tables of comparison are shown in Attachment 9.

11. McGuire PDQ Power Distribution - Quang Huyuh, Duke Power Co.

The purpose of this work was to calculate the depletion characteristics of McGuire 1 Cycle 1. This reactor is a Westinghouse PWR built by Duke Power Co. The main interest focused on the initial boron concentration and the power distribution as a function of burnup. The codes used were EPRI-CELL,

NUPUNCHER, EPRI-CPM and PDQ7. A difference of 30-70 ppm in critical boron concentration between this calculation and the vendor data was identified. No explanation was offered for the difference. The comparison and the main results of the calculations are shown in Attachment 10.

12. BWR Model Development at Carolina Power and Light - Paul Sieh, C.P. and L.

The purpose of this work is to prepare the C.P. and L. staff to perform cycle management analysis by 1982. To this end extensive benchmarking and analytic method error determination is done using the data available from the Brunswick plant operations. The analytical scheme constructed using existing codes and a limited number of comparisons are shown in Attachment 11.

13. SIMULATE Comparisons with 3-D PDQ - T. Ancona, NAI

This was a presentation of partial results of ongoing work of SIMULATE and PDQ comparisons. The tentative conclusion was that for good K_{eff} and power distribution prediction in BWRs, good values of the albedo and the spectral correction factor must be used. No written material was distributed.

14. PSEUDAX Development - Burt Rothleder, SAI

The objective of this work is to develop a code which will cut computation time in depletion calculations. To this end g factors are computed for cross section adjustment using HARMONY. Results up to now showed that the scheme does not work effectively. It was attributed to an EPRI-NODE-P misnormalization. No written material was distributed.

15. Comparison of SIMULATE, PRESTO and CDMT in Predicting Operational Data - Ron Lucier, Yankee Atomic Electric Co.

The purpose of this effort was to identify the source of differences in operational data from different codes. It was found that PRESTO contains errors. It was thought though that it is worth maintaining. No written material was distributed.

16. PDQ-8 and Other PDQ Developments - George Poetschat, GRP Consulting, Inc.

The PDQ-8 version has been released to the National Energy Software Center in 1979; however, it is not operational yet. The program is restricted to U. S. users. The manual has been completed; the code is written for the CDC 7600 and 6600. The PDQ-8 is based on a Bettis Atomic Power Laboratory report, WAPD-TM-1266, May 1978. Some of the main features of the new code are:

(a) Block depletion, to cut down running time;
(b) Skewed lines, for more accurate geometry description; and
(c) expanded edit capability.

A brief description of the program features are shown in Attachment 12.

17. CASMO-Based Signal to Power Calculations - Glen Horne, Duke Power Co.

The purpose of this work was to improve the signal to power conversion using the CASMO code for the Self-Powered Neutron Detectors used in Oconee. The signals of the detectors are adjusted for burnup, boron, etc., and it is intended to update the plant computer. The results were compared with the B&W results with excellent agreement. A more extensive description of the scheme and the comparisons are shown in Attachment 13.

18. BOL Comparisons of CPM and CASMO with Monte Carlo - Bill Moore, Washington Public Power

The Exxon XMC Monte Carlo code was used to evaluate the CPM and the CASMO codes both for BWR and PWR assemblies. The library of XMC is difficult to trace; the initial was from BNWL, but modifications have been effected. K_∞, epithermal multiplication, epithermal escape probabilities, thermal multiplications and power distributions are compared for Quad Cities fuel type 1a. Attachment 14 shows that the comparisons are very good. An ANS abstract has been published in June 1980 by Duane Tompson.

19. NORGE Modifications - Glen Correll, WPPSS

The purpose of the NORGE modifications was to enable treatment of Samarium microscopic cross sections, direct restart capability, exact values of $\bar{\nu}_f$ and κ_f and improved input and output formats. Comparisons of NORGE to SIMULATE are shown in Attachment 15.

MEETING SUMMARY DISTRIBUTION

CORE PERFORMANCE BRANCH

Central File	w/attachment 2	Principal Staff Participants
[redacted]	" "	L. Lois
NRR R/F	w/attachment 2	
CPB R/F	w/attachment 2	
H. Denton	no attachment	
E. Case	" "	
NRR-PPAS		
D. Ross	w/attachment 2	
L. Rubenstein	w/attachment 2	
W. Johnston	" "	
W. Butler	" "	
J. Stolz	" "	
P. Check	" "	
W. Kreger	" "	
D. Eisenhut	" "	
F. Schroeder	" "	
R. Vollmer	" "	
S. Hanauer	" "	
IE (3)	" "	
ACRS (16)	" "	
R. Meyer	" "	
L. Phillips	" "	
D. Fieno	With attachments	
Reactor Physics Section, CPB	w/attachment 2	