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 FACIL: 50-261 H. B. Robinson Plant, Unit 2, Carolina Power and Light 05000261
 AUTH. NAME: UTLEY, E. E. AUTHOR AFFILIATION: Carolina Power & Light Co.
 RECIP. NAME: DENTON, H. R. RECIPIENT AFFILIATION: Office of Nuclear Reactor Regulation, Director

SUBJECT: Forwards project plan for resolving pressurized thermal shock issue. Independent consultant will review & assess overall program.

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NRR/DSI DIR		1	1	NRR/DSI/RSB		1	1
NRR/DST DIR		1	1	NRR/DST/GIB		1	1
REG FILE	05	1	1	RES/DET		1	1
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Carolina Power & Light Company
DEC 07 1982

Mr. Harold R. Denton, Director
Office of Nuclear Reactor Regulation
United States Nuclear Regulatory Commission
Washington, D.C. 20555

H. B. ROBINSON STEAM ELECTRIC PLANT, UNIT NO. 2
DOCKET NO. 50-261
LICENSE NO. DPR-23
PRESSURIZED THERMAL SHOCK

Dear Mr. Denton:

Attached please find Carolina Power & Light Company's (CP&L) Project Plan for resolving the Pressurized Thermal Shock Issue. As we have discussed with you and your staff, CP&L views the Pressurized Thermal Shock (PTS) issue very seriously and has undertaken a broad program to address and resolve the issue for H. B. Robinson. Carolina Power & Light Company believes that its program contains all actions which are reasonable and prudent at this time to achieve our goal of resolving the issue in the short term.

In the review of the attached plan, one must remember that CP&L initiated many of its programs some time ago. This represents an ongoing commitment to the resolution of the PTS issue. Starting in early 1981 Carolina Power & Light Company has been very active in all the Westinghouse Owners' Group activities which relate to this issue. On our own initiative CP&L undertook several engineering studies in 1981 to ascertain which short-term actions could be accomplished in the Cycle 9 reload (April 1982) to aid resolution of this issue. These actions included loading of the low leakage core, undertaking an enhanced inservice inspection (ISI) of the reactor vessel, and several actions to further quantify neutron fluence and material properties. Carolina Power & Light Company also began a plant-specific small-break loss of coolant analysis in cooperation with EPRI in January 1982 and made procedural and operator training improvements in May-June 1982. All of these actions were described to you and your staff in a meeting held May 6, 1982. Since May 1982, CP&L has undertaken additional programs including participation in the NRC's A-49 program, the commitment to heat the Refueling Water Storage Tank and examination of assumed flaw distributions in light of the recent ISI. The details of these program components are contained in the attached report. Although these actions were known individually by members of your staff, we presented a detailed briefing on this program to you and your staff on November 12, 1982. Since that meeting, we have formalized the components of this project under a single Project Manager who is Mr. Joe Sheppard.

Carolina Power & Light Company is committed to the resolution of Pressurized Thermal Shock for H. B. Robinson. In light of that commitment, CP&L is also committed to take the results of the various program components,

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especially the plant specific analyses, and resolve any concerns or problems raised. To aid in that effort and assure program adequacy, CP&L is in the process of retaining a consultant to act as a third party to review and assess our overall program. To that end, CP&L has engaged Mr. Benard C. Rusche to help identify and retain such a consultant. Carolina Power & Light Company will inform you of our final selection once that process is complete.

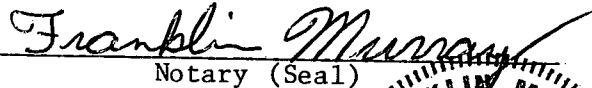
In conclusion, it should be apparent that CP&L has recognized the significance of the PTS issue from the beginning and has undertaken a broad program to resolve the issue in an orderly and timely fashion independent of any formal regulatory action. Mr. Sheppard and I are available at any time to address any questions that you have on our program. Additionally, CP&L intends to continue to provide the NRC staff with periodic updates of the progress of its program components and to answer any concerns expressed by the staff with respect to the program. As mentioned earlier, CP&L is committed to the resolution of the PTS issue as rapidly as possible and will take the steps necessary to accomplish that goal.

Yours very truly,



E. E. Utley
Executive Vice President
Power Supply and
Engineering & Construction

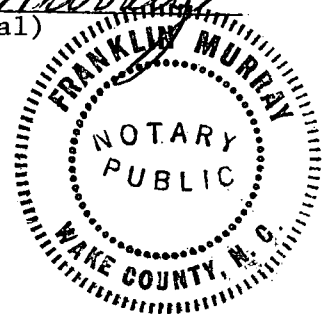
Sworn to and subscribed before me this 7th day of December, 1982.


Notary (Seal)

My commission expires: OCT 04 1986

EEU/pgp (5819C1T5)
Attachment

cc: Commissioner J. F. Ahearne (NRC)
Commissioner J. K. Asseltine (NRC)
Commissioner V. Gilinsky (NRC)
Mr. J. P. O'Reilly (NRC-RII)
Commissioner N. J. Palladino (NRC)
Mr. G. Requa (NRC)
Commissioner T. M. Roberts (NRC)
Mr. Steve Weise (NRC-HBR)
Mr. Roy Woods



CP&L PROJECT PLAN TO ADDRESS
PRESSURIZED THERMAL SHOCK

CP&L PROJECT PLAN TO ADDRESS
PRESSURIZED THERMAL SHOCK

Executive Summary

Carolina Power & Light Company (CP&L) is dedicated to the resolution of the Pressurized Thermal Shock (PTS) issue. Carolina Power & Light Company, therefore, has developed an integrated plan to address the issue. The program elements include:

- 1) Low Leakage Core Loading - Loaded for the present cycle and planned for follow on cycles. Designed in 9/81 and loaded in 4/82. Achieves an average flux reduction of 50%.
- 2) Plant Specific Analyses:
 - NSAC Study of H. B. Robinson Small Break LOCA - Started 1/82, Complete 3/83
 - A-49 - CP&L Commitment 7/82, Kickoff 11/82, Complete 5/84
 - Others - as necessary to resolve issues raised above
- 3) Plant Modifications:
 - Heating of RWST - Installed by start of next cycle
 - Others - Investigations underway concerning additional system modifications, and/or potential shielding of critical welds
- 4) Surveillance Capsules:
 - Capsule T removed 4/82 - Results in 1/83
 - Two other capsules moved into lead positions
 - Special dosimetry installed
- 5) Inservice Inspection (ISI):
 - Ten-year ISI - No flaws including the beltline
 - Near Surface - No flaws including the beltline
 - Review of assumed flaw distribution against the above results
- 6) Procedures & Training:
 - Procedures modified to reflect PTS prior to this cycle
 - Enhanced Procedure Set (NUREG 0737, Item I.C.1)
 - Complete prior to next cycle
 - All operators trained and examined with respect to PTS prior to this cycle.
 - PTS included into initial operator training and integrated into operator retraining program.
- 7) Material Properties Research for the H. B. Robinson Vessel
 - Underway with EPRI and Westinghouse
 - Contingency procedures being developed to sample vessel welds

8) Other Efforts:

- Westinghouse Owners' Group
- AIF
- Fundamental Research

This program is designed to provide results and allow time for making any necessary changes prior to the H. B. Robinson Plant reaching the NRC Generic PTS Screening Criteria.

Carolina Power & Light Company believes that the above program represents all prudent and reasonable actions necessary to address the PTS issue.

Introduction & Background

Carolina Power & Light Company (CP&L) is dedicated to the safe and reliable operation of its nuclear power plants and to provide reliable, cost effective electrical power to its customers. Both objectives are in the best interest of both CP&L's customers and stockholders. Consistent with these objectives is CP&L's dedication to the resolution of the Pressurized Thermal Shock (PTS) issue.

Carolina Power & Light Company has been intimately involved in the PTS issue since early 1981 when the issue came to light. Carolina Power & Light Company has devoted considerable manpower and resources in the ensuing 18 months. Carolina Power & Light Company's involvement has taken the form of active participation in the Westinghouse Owners' Group (WOG), the researching and development of plant specific data, enhanced inservice inspection and surveillance programs, improved training and procedures, and the loading of a low leakage core at the start of the present cycle. Additionally, CP&L is pursuing two plant specific analyses for H. B. Robinson and will heat the Refueling Water Storage Tank prior to the start of the next cycle. Finally, CP&L has under consideration other program elements including evaluation of transients not covered by the plant specific analyses underway and potentially third party review of our total approach.

Carolina Power & Light Company fully realizes the safety and economic implications inherent with the PTS issue. With those implications in mind, CP&L is dedicated to the successful resolution of the PTS issue. Carolina Power & Light Company's efforts toward that resolution are described in the following discussion of CP&L's Project Plan to Address Pressurized Thermal Shock.

Program Components

Low Leakage Core Loading

CP&L designed a low leakage core loading pattern in September, 1981 and installed it April, 1982 during the refueling for the current cycle. Follow on cores will also incorporate low leakage loading patterns.

The low leakage pattern is achieved by placing twice- and thrice-burned fuel on the periphery of the core. This pattern reduces the peak flux at the vessel wall by approximately 50 percent.

In order to quantify the flux reduction achieved by the new core loading, CP&L installed a special dosimetry capsule and flux wires during the last refueling. These will be removed and analyzed following this cycle.

CP&L has done preliminary studies of methods to further reduce neutron flux. To date those studies have shown significant penalties for flux reductions greater than 50%. These penalties are in the form of increased peaking factors, decreases in margins to thermal limits, shortened cycle length and deratings of the unit. For example, to achieve a 75% flux reduction would shorten cycle length by approximately 30 effective full power days and derate the core by 15-30%. Replacement power costs would range from 15 to 30 million dollars per cycle. This represents a significant cost to the Company and its customers and must be carefully weighed against any benefits gained.

Plant Specific Analysis

Carolina Power & Light Company has participated actively in the generic efforts with regard to PTS. In connection with those efforts, a great deal of plant specific data were generated. Additionally, CP&L has provided plant specific information concerning vessel materials, irradiation, procedures, training, and transients in several submittals to the NRC.

In addition to participation in the generic efforts, CP&L has undertaken two H. B. Robinson specific analyses:

- 1) In January 1982, CP&L entered a joint program with EPRI/NSAC to perform a plant specific analysis of H. B. Robinson with respect to a postulated Small Break Loss of Coolant Accident (SBLOCA). The SBLOCA is potentially the limiting transient for H. B. Robinson from a PTS viewpoint due to the potential for stagnation of loop flows. At the time the study was commissioned, several studies, including extensive Owners' Group work, pointed to the SBLOCA as the limiting transient for H. B. Robinson. Follow on work has continued to point to the SBLOCA as limiting. The SBLOCA analysis is utilizing H. B. Robinson geometries, weld chemistry and fluence data. The analysis is a linking of four computer codes to 1) develop the transient, 2) analyze mixing in the downcomer, 3) analyze thermal stresses, and 4) analyze stress intensities against predetermined criteria.

The thermal hydraulic transient is being determined by a H. B. Robinson specific RETRAN model developed and validated by CP&L. Thermal mixing is being determined by the 3D mixing code COMMIX. Thermal stresses are being analyzed using the 3D stress code ABAQUS. Finally the code PTS-1 is being used to calculate stress intensities and to perform the fracture mechanics evaluation. These analyses will be best estimate calculations.

This project is expected to produce a realistic analysis of the Small Break LOCA as it relates to H. B. Robinson. The results of this project will give CP&L an early review of the potential consequences of this transient for H. B. Robinson and allow the early review of any appropriate modifications or changes. A final report based on this transient is expected in March, 1983.

CP&L intends to continue this program by analyzing additional overcooling transients which in our view are potentially limiting for H. B. Robinson. In addition, the RETRAN model developed in this program will be made available to ORNL for their use in the A-49 study.

- 2) In July 1982, CP&L agreed to participate with the NRC in a plant specific analysis of H. B. Robinson under the auspices of Generic Safety Issue A-49. The effort with regard to A-49 commenced on November 9, 1982. A final report is expected in May, 1984. The A-49 analysis will examine a large number of potential PTS initiators for H. B. Robinson and explore in detail those initiators which are of high enough probability and produce a significant enough cooldown to be of concern. It is CP&L's intention to be a full participant in the development of this analysis. CP&L is committed to take the results of the A-49 analysis and to utilize the tools developed in both the NSAC and A-49 efforts to analyze and resolve whatever problems are identified by these programs.

Finally, it has become apparent recently to CP&L that NRR's Division of Safety Technology has significant concerns related to the scope, schedule and inclusiveness of the Office of Nuclear Regulatory Research's A-49 program. CP&L was assured in Mr. D. G. Eisenhower's letter of October 25, 1982 that the A-49 analysis would be used to satisfy plant specific requirements. CP&L is, therefore, committed to assuring that the A-49 schedule and scope are sufficient to address the Staff concerns or to performing additional analyses to address those concerns. It would be CP&L's desire to conduct a series of technical meetings with NRR's Division of Safety Technology and the Office of Nuclear Regulatory Research in the short term to define those concerns and to propose methods to address them. CP&L views this to be an evolutionary process and is willing to work very closely with the staff to finalize the efforts necessary to constitute a Plant Specific PTS Analysis acceptable to the Staff.

Evaluation of Plant Modifications

Carolina Power & Light Company has performed preliminary engineering studies of several potential plant modifications with respect to the PTS issue. As mentioned before, as a result of these studies a low leakage core has been installed. Additionally, CP&L has either already investigated or is making preliminary studies of heating the Refueling Water Storage Tank (RWST); installing improved instrumentation; obtaining samples of vessel welds; modification of such systems as a Safety Injection, Auxiliary Feedwater and Pressure Control; shielding of critical welds and in-place annealing. As discussed below, based on this work CP&L is committed to heating of the RWST prior to the start of the next cycle. Other potential modifications require the completion of plant specific analysis such as the NSAC and A-49 efforts. Upon completion of these plant specific analyses, CP&L will make any additional modifications which are appropriate.

Based on information gained to date, CP&L is proceeding with the necessary design in order to heat the RWST prior to the start of the next cycle. Although final values have not been set, it is anticipated that the RWST would be maintained greater than 80°F. Preliminary information indicates that significant margin can be gained with respect to the SBLOCA with this modification while not affecting ECCS Analysis.

Carolina Power & Light Company is committed to reviewing and studying other potential plant modifications as more information becomes available from plant specific analyses.

Surveillance Capsules

As described in CP&L's submittal of January 25, 1982, two surveillance capsules had been removed and analyzed prior to Cycle 9. During the refueling for Cycle 9, an additional capsule (Capsule T) was removed. A final report on this capsule is expected in December, 1982.

In addition to the removal of Capsule T, CP&L also repositioned two additional capsules during the last refueling. Those capsules were removed from lag positions and placed into lead positions. Although a revised schedule for removal of those capsules has not been finalized, the repositioning of these capsules will place CP&L in a better position for evaluating the effects of neutron fluence on vessel materials.

Inservice Inspection

During the refueling for Cycle 9, CP&L conducted the ten-year Inservice Inspection of the H. B. Robinson reactor vessel. During that inspection the following examinations were conducted:

<u>Weld</u>	<u>Full Volumetric</u>	<u>Near Surface (R.G. 1.150)</u>
Upper Circumferential Weld	5%	100%
Middle Circumferential Weld	100%	100%
Middle Longitudinal Welds	100%	5 - 10%

These examinations were in excess of any code requirements and any CP&L commitments to the NRC. It should be noted that the critical weld for H. B. Robinson for PTS received a 100 percent full volumetric and a 100 percent near surface examination. No reportable indications were found. A final report on the inspection will be ready in early 1983. CP&L is also examining what potential credit can be taken for these inspections with respect to the flaw distribution assumed in PTS transient analysis.

Procedures & Training Programs

As mentioned previously, CP&L has been an active participant in the Westinghouse Owner's Group (WOG) PTS efforts. Following TMI, CP&L instituted the Safety Injection Termination Criteria recommended by the WOG and approved by the NRC. After further review of that criteria with respect to PTS, H. B. Robinson's procedures were modified and enhanced to reflect changes suggested by the WOG. These changes were described in CP&L's submittal of May 4, 1982. These changes are considered to be adequate for the interim until NUREG 0737 Item I.C.1 can be completed.

In conjunction with NUREG 0737 Item I.C.1, CP&L is engaged in a overall upgrading of all H. B. Robinson Emergency Procedures. This program, which is currently underway, will combine the WOG Procedure Guidelines with a flow path format developed at CP&L's Brunswick Plant. As part of this enhancement, a specific procedure with regard to Reactor Vessel Integrity will be integrated into the overall procedure set. This overall effort will be completed prior to startup from the next refueling outage.

Training

In March, 1982, CP&L conducted PTS awareness training for H. B. Robinson Reactor Operations. Following an audit conducted by the NRC in April 1982, CP&L committed to conduct a more extensive PTS training program for all operators, Shift Technical Advisors (STA) and selected members of management. This program was documented in CP&L's submittal of May 4, 1982 and described in a meeting with the NRC on May 6, 1982.

The program described in the May 4, 1982 submittal consisted of both classroom and simulator training. The classroom session consisted of two days of training on fracture mechanics, transients and accidents, case histories, emergency procedures and an examination. The simulator session consisted of 6 to 8 hours of exercises including a review of PTS bases, exercises on three key PTS events, oral examinations and evaluations. All participants were required to receive a score of 80 or higher on an examination administered upon the completion of training. All Reactor Operators and STAs completed this program prior to startup for Cycle 9. Copies of the programs lesson plans were provided to the NRC. Additionally, this information is now included in initial training for reactor operators and has been integrated into the annual retraining program.

Finally, the WOG is presently compiling a generic PTS training package. Upon completion of that package, CP&L will examine it for material to include in the CP&L program.

Material Properties Research

Carolina Power & Light Company is working with Westinghouse and EPRI to better define the material properties of the H. B. Robinson reactor vessel. The previously mentioned efforts with regard to fluence measurement and surveillance capsules are part of this task. Additionally, extensive efforts are underway to research all available records to better define initial vessel properties. To date, there is strong evidence that actual concentrations of impurities in the critical welds are much less than that previously assumed. These results have the potential for affecting in a very beneficial way the resolution of the PTS issue for H. B. Robinson.

Carolina Power & Light Company is also developing on a contingency basis potential methods for actually sampling the Robinson vessel welds of interest. These efforts are all in the very preliminary stages.

Finally, CP&L is continuing to review flux calculations for the Robinson vessel. CP&L believes that the use of plant specific power distribution information and the use of plant specific material number densities in a realistic way will reduce predicted vessel fluence an additional 20 - 30%. Although CP&L has based its program schedule on the results of NRC fluence calculations, this review is intended to further demonstrate that adequate time is available to resolve the PTS issue for H. B. Robinson prior to reaching the generic screening criteria.

Other Efforts

In addition to the efforts discussed previously, CP&L is supporting efforts in other areas connected with PTS. These areas include:

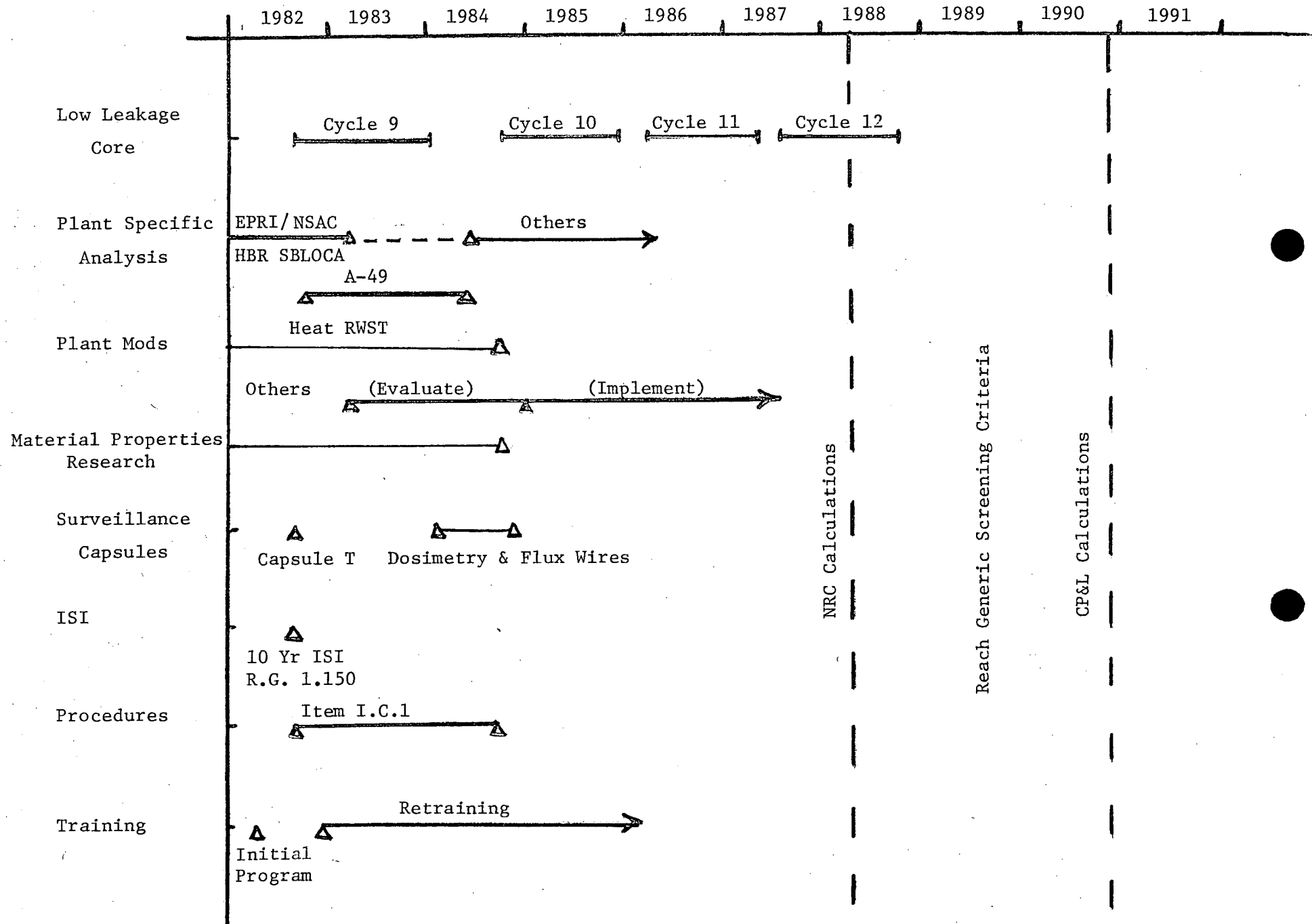
- 1) Active support and participation in Westinghouse Owners' Group ongoing activities. These activities include additional studies of flow stagnation and a review of Reactor Coolant Pump trip criteria in addition to the ongoing procedures and generic PTS activities.
- 2) Active participation on the AIF Reactor Vessel Integrity Subcommittee.
- 3) Encouragement of additional EPRI research including fundamental research into the saturation effects of radiation damage.

As other projects or activities develop which CP&L feels will contribute to the resolution of the PTS issue, CP&L will review them and support them as appropriate.

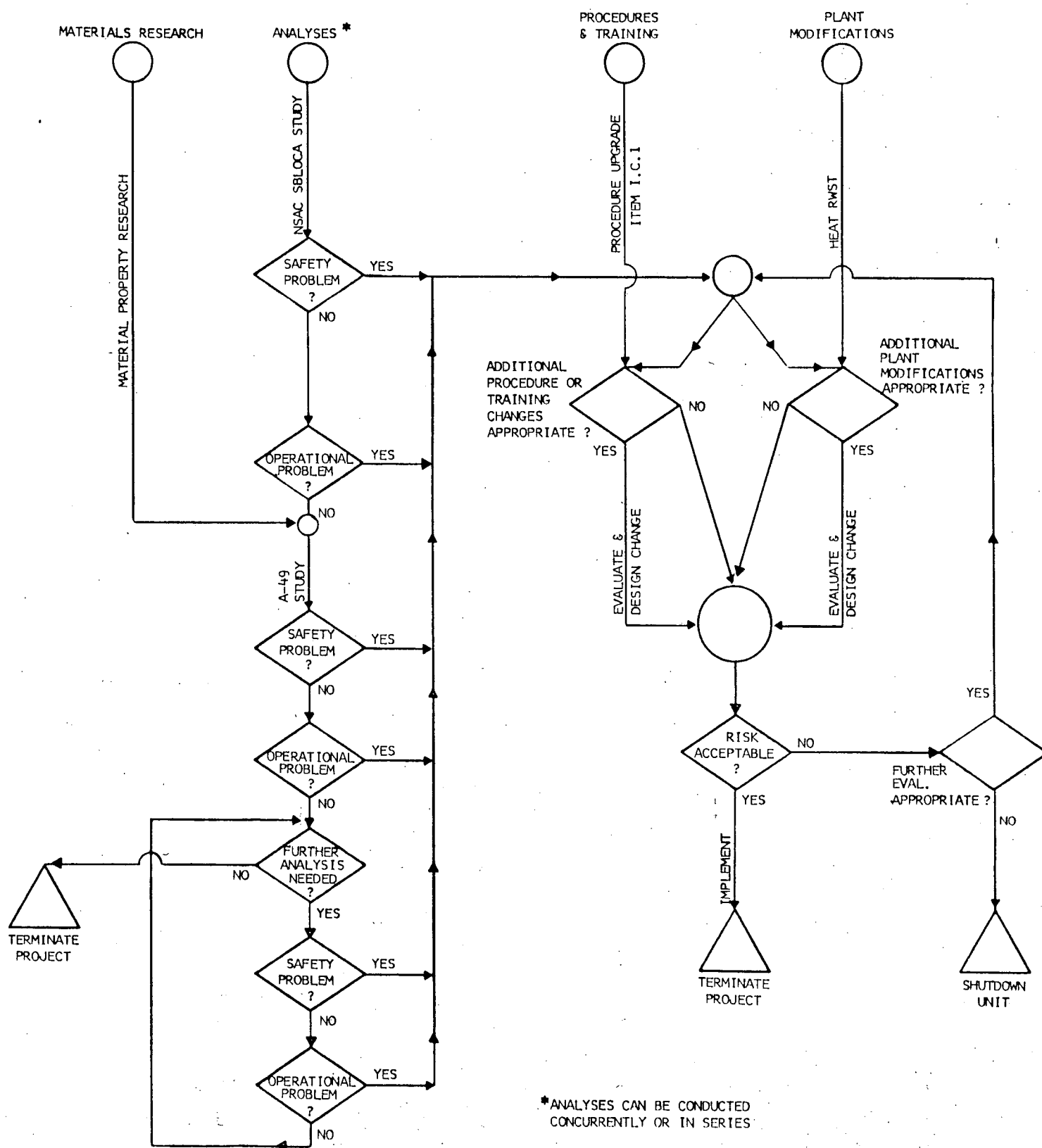
Schedule

The attached shows CP&L's anticipated schedule for the overall PTS Project Plan. The figure following the schedule shows the methodology CP&L will use to integrate the various components of its PTS Project Plan.

CP&L PTS PROGRAM



Decision Analysis for Pressurized Thermal Shock



Summary

Carolina Power & Light Company is dedicated to the resolution of the PTS issue. Although both CP&L and NRC's calculations show adequate time to address the issue before H. B. Robinson approaches the NRC Screening Criteria, CP&L has undertaken an extensive and integrated program to address the issue in the short term. That program includes:

- 1) Low leakage loading patterns
- 2) Plant Specific Analyses (NSAC & A-49 Studies)
- 3) Plant Modifications (Heating of the RWST)
- 4) Restructuring of Surveillance Capsules Positions and Schedules
- 5) Enhanced Inservice Inspection
- 6) Improved Procedures & Training
- 7) Material Properties Research
- 8) Support of Other Generic Efforts

In conclusion, CP&L fully appreciates the implications of the PTS issue and the safety economic risks inherent with it. Carolina Power & Light Company has, therefore, developed a program which it believes to contain all reasonable and prudent actions necessary to contribute to an expeditious resolution of the issue.

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