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UNITED STATES OF AMERICA NUCLEAR REGULATORY COMMISSION

BEFORE THE ATOMIC SAFETY AND LICENSING BOARD

Docket Nos.	50-4980L 50-4990L	
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TESTIMONY ON BEHALF OF HOUSTON LIGHTING & POWER COMPANY, ET AL.

OF

MR. ALBERT D. FRALEY, JR. MR. GORDON R. PURDY MR. ROBERT A. CARVEL

ON

THE CONCRETE RESTART PROGRAM



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UNITED STATES OF AMERICA NUCLEAR REGULATORY COMMISSION

BEFORE THE ATOMIC SAFETY AND LICENSING BOARD

In the Matter of:	5
HOUSTON LIGHTING & POWER COMPANY, <u>ET AL</u> .	<pre>9 Docket Nos. 50-4980L 9 50-4990L 6</pre>
(South Texas Project, Units 1 & 2)	\$ \$

TESTIMONY CF ALBERT D. FRALEY, JR. GORDON R. PURDY, AND ROBERT'A. CARVEL ON THE CONCRETE RESTART PROGRAM

Q. 1 Please state your names.

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A. 1 Albert D. Fraley, Jr., (ADF), Gordon R. Purdy (GRP) and Robert A. Carvel (RAC).

Q. 2 By whom are you employed?

A. 2 (ADF, GRP): Brown & Root, Inc. (B&R).

(RAC): Houston Lighting & Power Company (HL&P).

Q. 3 Describe your current position and responsibilities.

A. 3 (ADF): I am Assistant Project Manager, Construction for B&R at the South Texas Project (STP). I am responsible for managing the Construction Engineering group, cost, scheduling, planning and all other construction activities at the STP Site, where I report to B&R Construction Manager.

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(GRP): I am the Quality Engineering (QE) Manager for the B&R Power Group. I am responsible for the management and direction of QE personnel at the STP site where I report to the B&R Project QA Manager for STP.

(RAC): I am the Project QA Supervisor - Civil/ Structural for HL&P at the STP Site. My group provides programmatic and technical direction in the formulation and implementation of B&R's QA/QC program for Civil/Structural activities. We conduct implementation reviews to ensure compliance with project quality requirements. We follow up on nonconformance reports (NCR's) to ensure timely and effective corrective action, and we review all dispositioned NCR's for technical and QA/QC adequacy and feasibility. We also review and approve the QA/QC programs of potential suppliers and sub-contractors and we serve as the contact group for NRC personnel inspecting civil/structural activities.

Q. 4 Please summarize your professional qualifications and experience.

A. 4 (ADF): I have nineteen years of experience working for B&R in various areas of construction in nuclear and fossil power plants and other heavy industry projects. I started, in 1962, as an apprentice carpenter and carpenter's helper in three construction projects: the International Paper Company paper mill in Evadale, Texas; the U.S.I. Chemicals plant in

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Deer Park, Texas; and the McPherson fossil power plant in McPherson, Kansas. Starting in 1964, I became a carpenter foreman for four projects: the Giddings Power Station Unit #2 (fossil fired) in Bastrop, Texas; the Pan American Petroleum Company petroleum and sulphur plant in Edgewood, Texas; the Premier Fertilizers fertilizer plant in Pasadena, Texas; and the Elmendorf Power Plant (fossil fired) in San Antonio, Texas. In the Giddings and Elmendorf projects I also worked as a "rodbuster" (a person engaged in erecting reinforcing steel in concrete structures) and also worked in concrete placements. Starting in 1965, I worked in the construction of the Nekgosa-Edwards Paper Company paper mill in Ashdown, Arkansas. In that job I was responsible for supervising the placement of concrete, the erection of rebar, and the carpentry work in the ground floor and all the offsite structures of the mill. In 1966, I was put in charge of all carpentry work, form design and temporary construction at the Gulf States Utilities Company's Willis Power Plant, Unit #1 (fossil fired), Willis, Texas. In 1967, I was appointed General Foreman in charge of all civil construction activities relating to the machine room building and all the offsite structures, including all architectural work, excavation, structural steel erection, reinforcing steel, concrete carpentry work, and painting, at the Boise Southern Paper Mill in De Ridder, Louisiana.

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In February, 1970, I was made Assistant Building Superintendent for construction of the Carolina Power & Light Co.'s Brunswick Units 1 and 2 nuclear power plants in Southport, North Carolina. At Brunswick, I was originally in charge of all aspects of the construction of the diesel generator buildings and all offsite work, as well as all the switchyard, bridges, and railroad trestle construction. While at Brunswick, I was promoted in 1974 to Building Superintendent in charge of all civil construction on the project. I began working in the STP project as Building Superintendent in September 1975, being directly in charge of all civil construction at STP. In 1979, I was promoted to Area Manager in charge of all construction (electrical, mechanical and civil) in the Reactor Containment Buildings for Units 1 and 2 at STP. In 1980, I was promoted to Project General Superintendent and placed in charge of all construction on the site. On March 1, 1981, I was appointed to my current position as Assistant Project Manager, Construction.

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(GRP): Prior to joining B&R, I spent twenty-one years working in the nuclear power industry, eighteen of which were spent in the United States Naval Nuclear Power Program. I worked primarily in the area of construction, operation and maintenance of nuclear power plants. I also spent approximately one year with Bechtel Power Corporation as a mechanical Quality Control (QC) Engineer.

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(RAC): I received a B.S. degree in Civil Engineering from Cornell University in 1973. Before joining HL&P in June 1980, I had worked for Stone & Webster Engineering Corporation for approximately seven years. During this period, I spent five years in various civil quality control positions at four nuclear power plants and one petrochemcial plant. For the last year before joining HL&P, I was responsible for supervising all Quality Engineering activities for the Civil/Structural and Mechanical disciplines at the River Bend Nuclear Power Plant.

Q. 5 What is the purpose of your testimony?

A. 5 (ADF, GRP, RAC): The purpose of our testimony is to describe the program that has been implemented to resume complex concrete placements at STP and the respective roles of each of our organizations in the program.

Q. 6 Please summarize your recent involvement with the placement of concrete at STP.

A. 6 (ADF): In August 1980, I was assigned, together with John Ruud of B&R QA, as coordinator of the complex concrete restart activities at STP, an assignment which I have carried out to date and in which I expect to continue until normal complex concrete placement operations are resumed.

(GRP): In May 1980 I was assigned the responsibility of QE Manager for STP. As such, I am directly responsible for the Civil QE Discipline and its participation in both the concrete restart program and the normal concrete placement activities.

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(RAC): I have had responsibility for HL&P's QA program for concrete activities since June 1980.

Q. 7 Mr. Fraley and Mr. Carvel, when was concrete construction stopped at STP and why?

A. 7 (ADF, RAC): On December 21, 1979, a meeting was held between HL&P officers and the Director of Region IV of the NRC. At the meeting, the Director informed HL&P of noncompliances identified relative to concrete placement activities. On that same date, HL&P verbally instructed B&R not to place any safety related concrete until certain aspects of the site QC control program were resolved.

Q. 8 Once work was stopped, what actions were taken by HL&P and B&R to respond to the problems cited by the NRC that led to the decision to stop work?

A. 8 (ADF, RAC). On December 28, 1979, as described in the testimony of Mr. Of the and Mr. Frazar, HL&P proposed to the NRC a "Nine Point Action Plan" to address the problems identified by the NRC. With the presentation of this plan, HL&P asked, and obtained authorization from NRC, to resume placement of safety-related non-complex concrete at STP. Such work was resumed on December 31, 1979. Complex safety-related placements were to remain suspended until authorization to proceed with them was given by HL&P.

Q. 9 What is the difference between complex and noncomplex concrete placements?

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A. 9 (ADF, RAC): The decision to classify a placement as "complex" is arrived at jointly by Construction Engineering, Construction Supervision and QA. Factors involved in the decision are the rebar density and configuration; the quantity and size of embedments; and the pour volume, geometry and location. All placements in the Reactor Containment Building shell walls are classified as complex.

Q. 10 Was action taken to implement the items in the Nine Point Action Plan relating to concrete placements?

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A. 10 (ADF, RAC): Yes. On January 25, and February 28, 1980, HL&P wrote to the Director of I&E's Region IV describing the actions taken by B&R and HL&P to respond to the items in the Nine Point Action Plan. As stated in those letters, the Nine Point Action Plan was fully implemented as of the end of February 1980.

Q. 11 Were complex concrete placements restarted once the response to the Nine Point Action Plan was completed?

A. 11 (ADF, RAC): No. On April 30, 1980, the I&E Director issued an Order to Show Cause requiring HL&P to show cause why safety-related construction activities at STP, including complex concrete placements, should not be stopped and/or remain stopped until certain actions were taken. In its response of July 28, 1980 to the Order to Show Cause, HL&P committed to taking a number of steps, beyond those already implemented in the area of complex concrete placements. These commitments included:

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 Revision and reissuance of concrete placement procedures.

2. Training of personnel in the revised procedures.

3. Review by Construction, Engineering and QA management of the results of the Concrete Special Task Force investigation of the Unit 1 Reactor Containment Building for impact on existing procedures and methods; and performance of modifications in these procedures and methods as necessary.

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4. Assignment of a complex pour coordinator from B&R Construction to oversee complex concrete placement operations until such time as Construction management determined that performance was satisfactory.

5. Assignment of a complex pour coordinator from B&R QA to oversee concrete placement inspection activity until QA management determined that B&R QC performance was satisfactory.

6. Verification of the availability of qualified Pittsburgh Testing Laboratory concrete testing personnel.

7. Reconfirmation of the qualification and certification of QC inspection personnel.

8. Review of the concrete supplier's quality program to assure there were no unresolved quality program deficiencies.

9. Reverification of the availability of adequate concrete placement equipment and personnel.

 Resumption of complex concrete placement on a limited basis.

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 Review of the quality of the placement and documentation of the work for conformance with requirements.

12. After the processes described in the above items had been completed, expansion of the complex concrete placement program into other areas as additional B&R personnel were qualified.

Q. 13 What actions were taken to implement the July 28, 1980, commitments?

A. 13 (ADF, RAC): B&R had primary responsibility for developing the complex concrete restart program embodied in these commitments. Some of the actions included in the July 28, 1980 response (such as the revision of the concrete placement procedures) were well under way at the time the formal commitment to the NRC was made. In addition to rewriting the concrete construction procedures, HL&P and B&R took a number of other steps to insure that future complex concrete placements would be conducted fully in accordance with those commitments and with the revis d procedures. First of all, a Complex Restart Review Committee, which Mr. Fraley chairs, was organized to oversee the restart program. In addition, the Project instituted a simulated complex concrete pour program; reevaluated the Construction organization so that people with strong backgrounds in relevant areas would be assigned to those areas; instituted a zero defect program; conducted the training program on the revised concrete procedures in such a way as to assure consistent

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interpretation of the procedure by the various affected organizations; gave QC Inspectors the authority to stop work if there are any doubts that the work meets acceptance criteria; and established individual personnel qualification and training files, as well as reviewing the qualifications of subcontractor personnel. Most importantly, we devised a demonstration program of seven complex placements to test out the new procedure and to confirm that complex placements can be resumed at STP.

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(RAC): In addition to participating in the procedure revision process itself, HL&P reviewed the final product to assure that it complied with all commitments and addressed all areas of concern. We also provided programmatic direction to B&R personnel engaged in the revision effort.

Q. 14 Please describe the process by which the concrete placement procedures were revised and reissued.

A. 14 (ADF, RAC): The reevaluation and rewriting of the STP concrete procedures was a multidisciplinary undertaking by B&R and HL&P. In April 1980, at the direction of the B&R Project General Manager, Construction Engineering established a detailed plan for the rewrite effort. Under the plan, Construction Engineering reviewed the existing concrete procedures in the light of significant input from the construction crafts, and proposed a number of changes to the procedures, which changes were then reviewed and commented upon by QA/QC personnel, including Quality Engineers. B&R and HL&P Construction Engineers

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then prepared a redraft of the procedures, which was reviewed by the Design Engineers, as well as the Training Department. After final meetings by Construction, QC and Design Engineering, final revisions were agreed upon and the new procedures were approved by all affected B&R disciplines and HL&P Construction and QA.

(GRP): The Civil QE and QC disciplines have been intimately involved in the formulation and implementation of the complex concrete restart program from the time the task was initially defined. During development of the new procedure covering all aspects of concrete activities, QE assured the proper translation of engineering design requirements into the procedure including all *pplicable* inspection acceptance and rejection criteria. QE and QC working together assured that the inspection requirements were clearly identified in the new procedure, that the requirements conveyed clear direction for field implementation and that the required quality inspection reports provided objective evidence of all activities which required quality documentation.

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QE actively participated in the extensive training program prior to the implementation of the new concrete procedure. This included participating in the training presentations to Construction and Engineering, performing training for field QC inspection personnel, participating in the pre-planning phase of the simulated dry-runs and participating in the pre-planning

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and performance of the trial placements conducted on non-complex concrete placements.

Q. 15 What areas were given special attention in your review?

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A. 15 (ADF, RAC): We focused our attention on the following areas in the procedures: providing greater continuity and clarity; eliminating references to codes and standards outside the procedures; improving documentation flow; eliminating conflicting directives where they existed; providing additional information where required; more clearly defining hold points; clarifying responsibility assignments; and increasing input from affected craft, QC, and engineering personnel.

Q. 16 Have craft personnel been trained in the revised procedure?

A. 16 (ADF): The procedure reexamination and revision effort resulted in a comprehensive single procedure, Concrete Construction Procedure CCP-25, which was approved in July 1980. It replaced and incorporated Concrete Construction Procedures CCP-3, 4, 6, 8, 11, 12 and 19. Training on CCP-25 began in July 1980. Training was in three phases: classroom instruction, videotaped instruction on the basics of the procedures, and controlled "hands on" field training administered to affected personnel in QC and Engineering and to Construction personnel working on concrete, rebar and carpentry. Individual training files have been established for concrete consolidation personnel

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documenting that all training steps have been met for each individual. In addition, as provided in the new procedure, B&R has established a 90-day cycle for retraining all concrete consolidation personnel.

(GRP): QE actively participated in the extensive training program prior to the implementation of the new concrete procedure. This included participating in the training presentations to Construction and Engineering, performing training for field QC inspection personnel, participating in the pre-planning phase of the simulated dry-runs and participating in the preplanning and performance of the trial placements conducted on non-complex concrete placements.

(RAC): HL&P has monitored B&R's retraining to assure that changes were adequately explained to CC Inspectors and the accept/reject criteria were fully understood. In addition, we have monitored the generic B&R quarterly refresher training sessions.

Q. 17 Panel, how do the new concrete procedures address the problem area; found to exist in its predecessors?

A. 17 (Panel): Lack of clarity problems have been solved by simplifying words, definitions, forms and document flow where possible, and by giving great weight to the input from construction craft personnel and their supervisors, who will be the people utilizing the procedure in the field. The need to refer to other sources has been eliminated by placing all

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required information in the procedure so that it "stands alone" without need for outside reference material. Documentation flow problems have been dealt with by combining all concrete procedures into one. The lack of sufficient information as to what the procedure requires has been remedied by spelling out "inspection checklists" that tell construction personnel what they are responsible for at each inspection checkpoint. Inspection hold points at which QC review and verification are to take place have been more clearly defined. Further, the new procedures expand and clarify the QC Inspectors' stop work authority. The procedures also outline what to do in the event that interpretation questions arise due to conflicting requirements in drawings, specifications and procedures.

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Q. 18 Mr. Fraley, please describe how the seven initial complex concrete placements in the restart program were selected.

A. 18 (ADF): The seven initial complex concrete placements were chosen so that they would provide as broad a spectrum of complex placements as possible. The placements chosen represented each of the main types of complex placements, and contained every obstacle to placing concrete that is likely to be encountered. Four of them were placements featuring high rebar congestion, a large number of embedments, difficult placement configurations, and the need for uncommon placement techniques. Another of the placements had highly congested

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rebar, a wall and a slab being placed together monolithically, and a requirement for the use of grout in conjunction with concrete to reach areas for which there was difficulty assuring that concrete could flow uniformly. Another placement was a typical shell wall placement, and also required the use of grout. The last placement was a typical dome pour, utilizing a large amount of grout together with concrete, and requiring pumping over 130 feet vertically and then over 400 feet horizontally.

Q. 19 Mr. Fraley and Mr. Carvel, what actions were taken in preparation for making these seven initial complex placements?

A. 19 (ADF): In addition to those undertaken to implement the commitments made in response to the Order to Show Cause, the following actions were taken in preparation for making the seven initial complex statements in the concrete restart program. The Review Committee for Safety Related Complex Pours, which includes Mr. Carvel and me, conducted a review of past complex placements, identifying potential areas of improvement and making appropriate recommendations. Construction and QC personnel were trained in the use of the new concrete procedures, and quarterly refresher courses on procedures and QC requirements were offered. Finally, nine non-complex placements were made following the procedures applicable to complex ones in order to simulate complex placement conditions. Our

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evaluation of these pours showed them to be entirely satisfactory.

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(RAC:) Prior to initiating the restart program, B&R conducted nine non-complex pours as if they were complex in order to familiarize all personnel with the procedural and documentation requirements for safety-related complex pours. HL&P QA personnel attended the pre and post-placement meetings and had personnel present for the entire duration of all of these pours. All documentation relating to these pours was reviewed and found in compliance with the new procedures.

With regard to implementing the restart program, HL&P QA personnel participated in all pre- and post-placement meetings for the safety-related, complex pours. A minimum of two HL&P QC Inspectors and one HL&P QA Specialist were present on each pour to monitor the performance of the B&R and PTL Inspectors. The documentation for these pours has been reviewed for compliance with Project requirements.

We also conducted an implementation review in conjunction with the first restart program placement. The implementation review was an in-depth examination of the pour to verify adherence to procedures, specifications, codes, standards and licensing commitments and to assess the effectiveness of the implementation. Our review indicated that all aspects of the performance and

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documentation of this first restart pour were accomplished in strict accordance with Project procedures.

Q. 20 Were there any further conditions set by the NRC to its authorization of the seven initial complex placements?

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A. 20 (ADF, RAC): Yes. On October 2, 1980, HL&P requested NRC's clearance to perform the seven initial complex placements. The NRC requested that certain actions be taken prior to commencing the placement of complex concrete. They included establishing management systems and special procedures to control the work on the seven placements; training personnel in those procedures and ensuring that adequate staffing existed to perform and to manage the placement activities; completing corrective action for previously identified deficiencies relating to concrete placements; utilizing concrete correlation testing in lieu of taking samples at the pump line discharge; and completing the yearly inspection and evaluation by the National Bureau of Standards Cement and Concrete Reference Laboratory of the concrete testing facilities maintained at the STP site by Pittsburgh Testing Laboratory.

Q. 21 Were all of these conditions satisfied?

A. 21 (ADF, RAC): Yes. The NRC acknowledged on January 13, 1981 that all conditions and been satisfied and released the seven complex placements for performance.

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Q. 22 Mr. Carvel, have there been any changes in the HL&P QA program for Civil/Structural activities which accompanied the formulation of the restart program?

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A. 22 (RAC): Yes. We have become more involved in the planning and analysis of complex pours as reflected by our participation in the pre- and post-placement meetings. HL&P also increased its involvement through the creation of a QC arm which provides Inspectors in addition to those from QA.

Notwithstanding our increased involvement in complex pours, HL&P QA has generally decreased its participation in the day-to-day aspects of B&R's QA/QC program and redirected its attention to spotting problems as they develop. We now monitor the programmatic aspects of the E&R program, rather than the daily results of the program. A Project Trending Program was developed by HL&P to aid in identifying recurring nonconformances so that root causes may be addressed. This program is independent of the B&R NCR trending program.

This additional effort by HL&P QA has been made possible by a significant expansion in the number of professional personnel on the staff. There are six professionals at present and we are still recruiting for an additional two places. We also have increased significantly the total years of nuclear experience of our staff through hiring experienced, highly qualified individuals. Our staff now has 34 man-years nuclear experience as compared to 13 man-years prior to November 1979.

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A formal training program has been established for the HL&P QA staff. The training needs of each individual are assessed yearly and quarterly by the supervisors and specific training is assigned as it becomes available. Each person receives the technical training required for his or her specialty and governal QA and STP program training. The technical training is provided primarily by specialized institutes to which we send selected individuals.

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Q. 23 Please describe the results of the complex placements made since the NRC's release.

A. 23 (ADF, RAC): The seven complex placements have now been completed, all successfully and in accordance with the Concrete Restart Program and applicable procedures. While some minor problems were experienced during the course of two of the placements, they were of the usual type encountered during complex concrete placements (for instance, plugged slick lines, an insignificant rock pocket observed upon form removal, vibrator breakdown), they were resolved expeditiously, and the quality of the placements was maintained. The satisfactory completion of these placements demonstrates the adequacy and effectiveness of the procedures controlling the complex concrete work and the adequacy of the training of the personnel performing the work.

Q. 24 Is a "rock pocket" the same as a void?

A. 24 (ADF, RAC) No. A "void" is an area within the placement that was never filled with concrete. A void

indicates that some condition or set of conditions prevented the concrete from reaching that specific location. In contrast, a "rock pocket" is an area that was filled with concrete initially but solidified without the mortar binding the aggregate.

Q. 25 Does the occurrence of this rock pocket indicate a programmatic problem?

A. 25 (GRP, RAC) No. The area involved was small and while B&R attempts to prevent all such occurrences, it is not unusual to occasionally have a rock pocket appear when forms are removed. We doubt that there is anything QC could have checked to prevent this rock pocket from occurring. It is important to remember that concrete placement is not an exact science. Even the best procedures, followed exactly, will not always produce perfect concrete.

Q. 26 Mr. Fraley, is there a plan for further complex ; concrete construction at STP?

A. 26 (ADF): Yes. B&R has formulated a plan for fourteen (14) additional complex placements in the reactor containments buildings. HL&P concurred in the plan and submitted it for NRC approval. On April 16, 1981, the NRC approved the placement of all but three dome placements on Unit 1 and requested additional information on the three remaining placements.

Q. 27 Panel, are you confident that the current concrete program will enable B&R and HL&P to continue producing high quality concrete?

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A. 27 (Panel): Yes, most definitely. As evidenced by the Task Force investigation, the concrete placed prior to the I&E Investigation 79-19 was high quality concrete. Since then, we have strengthened the program. The new procedures work well, are understood by the implementing personnel and have produced high quality concrete during the limited restart program. We suspect that further improvements can and will be made as we gain more experience. The key point is that HL&P & B&R have in place good concrete procedures and a QA/QC program that will detect any deficiencies, assure that they are corrected and take appropriate action to prevent or minimize recurrence.

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