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12/14/83

app #95

UNITED STATES OF AMERICA
NUCLEAR REGULATORY COMMISSION

BEFORE THE ATOMIC SAFETY AND LICENSING BOARD

In the Matter of	)		
	)		
DUKE POWER COMPANY, et al.	)	Docket Nos.	50-413
	)		50-414
(Catawba Nuclear Station,	)		
Units 1 and 2)	)		

TESTIMONY OF C. L. RAY, R. L. WILLIAMS, & L. R. BARNES, R. C. GAMBERG, J. E. CAVENDAR, A. W. ROY, J. C. SHROPSHIRE, J. N. UNDERWOOD AND E. A. INGRAM REGARDING THE BOARD QUESTION CONCERNING THE CONTAINMENT SPRAY SYSTEM

Q. PLEASE STATE YOUR NAMES, BUSINESS ADDRESSES, AND PROFESSIONAL QUALIFICATIONS.

A. Mr. Ray: My name is Clarence L. Ray, Jr. By business address is Duke Power Company, P.O. Box 33189, Charlotte, N.C. 28242. I am currently employed by Duke Power Company as a Principal Engineer in the Mechanical/Nuclear Division of the Design Engineering Department. In this position I am responsible for managing the section responsible for piping analysis and pipe support design for the Catawba Nuclear Station. A copy of my professional qualifications is attached (Attachment A).

Mr. Williams: My name is Royce L. Williams. My business address is P.O. Box 33189, Charlotte, N.C. 28242. I am currently employed by Duke Power Company as an Analytical Engineer II in the Mechanical/Nuclear Division of the Design Engineering Department. In this position I am responsible for the preparation of the Piping Material Procurement and Piping Installation Specifications for our Nuclear Stations.

Mr. Gamberg: My name is Robert C. Gamberg. My business address is Duke Power Company, P.O. Box 33189, Charlotte, N.C. 28242. I am currently employed by Duke Power Company as a Design Engineer I in the Mechanical/Nuclear Division of the Design Engineer Department. In this position I am responsible for the design of various mechanical fluid systems for Catawba Nuclear Station. A copy of my professional qualifications is attached (Attachment C).

Mr. Ingram: My name is Eulys Albert Ingram. My business address is Catawba Nuclear Station, P.O. Box 223, Clover, S.C. 29710. I am currently employed by Duke Power Company in the Construction Department as Power House Mechanic. In this position my duties are to fabricate and erect piping according to the requirements of the ASME code and the requirements established by Duke Power Company's Quality Control unit. A copy of my professional qualifications is attached (Attachment D).

Mr. Barnes: My name is L. R. Barnes. My business address is Catawba Nuclear Station, P.O. Box 223, Clover, S.C. 29710. I am currently employed by Duke Power Company in the Construction Department as Planning and Control Manager. In this position I am responsible for construction planning and cost control or Catawba Nuclear Station. A copy of my professional qualifications is attached (Attachment F).

Mr. Cavender: My name is John E. Cavender. My business address is Duke Power Company, P.O. Box 33189, Charlotte, N.C. 28242. I am currently employed by Duke Power Company in the Quality Assurance

Department as Nondestructive Examination Examiner (NDE) Level III. In this position I am responsible for training and qualification of NDE personnel, the development and approval of NDE procedures, and periodic review of NDE records. I also perform periodic reviews of the qualification NDE personnel. A copy of my professional qualifications is attached (Attachment F).

Mr. Roy: My name is Alfred W. Roy. My business address is Duke Power Company, P.O. Box 33189, Charlotte, N.C. 28242. I am currently employed by Duke Power company as a Quality Assurance Supervisor in the Vendors Division of the Quality Assurance Department. In this position I am responsible for surveys, audits and surveillance for piping and materials suppliers and manufacturers. A copy of my professional qualifications is attached (Attachment G).

Mr. Shropshire: My name is J. C. Shropshire. My business address is Catawba Nuclear Station, P. O. Box 223, Clover, S.C. 29710. My current position is Quality Assurance Engineer in the Quality Assurance Department. I am responsible for the mechanical, welding, and NDE quality assurance group. A copy of my professional qualifications is attached (Attachment H).

Mr. Underwood: My name is Joseph N. Underwood. My business address is P.O. Box 33189, Charlotte, N.C. 28242. I am currently employed by Duke Power company as a supervising Design Engineer in the Mechanical/Nuclear Division of the Design Engineering Department. In this position I am responsible for supervising a group which performs

stress analysis on piping systems for the Catawba Nuclear Station. A copy of my professional qualifications is attached (Attachment I).

Q. WHAT IS THE PURPOSE OF THIS TESTIMONY?

A. This testimony is designed to respond to the Board's question that assuming the concerns of In Camera Witness #1 regarding out-of-roundness, wall thickness, fit-ups, and stress induced by pipe bending in the Unit 1 containment spray system are "well founded," how would "the functional use and structural integrity of that system be affected under adverse conditions? What corrective action, if any, would be required for the safe operation of the plant?" Tr. 482.

Q. PLEASE DESCRIBE THE PURPOSE, COMPONENTS AND IMPORTANT CHARACTERISTICS OF THE CONTAINMENT SPRAY SYSTEM?

A. The Containment Spray System is a very low pressure system designed to reduce containment pressure in the event of a loss of reactor coolant accident. The system accomplishes this by spraying relatively cool water into the containment atmosphere, condensing any steam that might be present in upper containment and cooling the air in upper containment. Inside the annulus and containment building this system consists of six spray rings each with its own header which connects the ring to a water source in the auxiliary building. Four of the rings are supplied by the two containment spray pumps (two rings connected to each pump). The remaining two rings are connected to the residual heat removal system (each is connected to a different train of the residual heat removal system). Piping in this portion of the system is 8" in diameter with short sections of smaller diameter pipe used for test connections and

attachment of the spray nozzles to the rings. Contrary to In Camera Witness #1's allegations, none of the system is located in the pipe chase. RCG.

Q. AT THE HEART OF THE BOARD'S QUESTION IS THE ASSUMPTION THAT THE WITNESSES CONCERNS REGARDING OUT-OF-ROUNDNESS, WALL THICKNESS, FIT-UPS AND STRESS INDUCED BY BENDING PIPES ("COLD SPRINGING") ARE WELL FOUNDED. ARE THESE CONCERNS WELL FOUNDED?

A. No. We have conducted a detailed investigation and analyses of these concerns and they are totally without merit. The factors supporting our determination include the following:

1. Out-of-Roundness:

The procurement documents associated with piping for the containment spray system required that the 8" pipe be supplied in conformance with, among other things, Paragraph 2.1 of ASME II material specification SA-312 which invokes ASTM specification A-530. Paragraph 12.1 of A-530 establishes ovality limits for the piping. In providing this piping, the vendor, through his QA program furnished to Duke a Certified Materials Test Report which certified that the imposed requirements, including those associated with ovality, have been met. It should be noted that several sections of the 8" SA-312 piping material were sent to a fabrication shop to be formed into long radius bends for the 6 ring headers and other bends in the systems. As required by the purchase order, the fabricator, through his quality assurance program, provided to Duke

the Supplier Quality Assurance Certifications which certified that the bends met the requirements of ASME III. ASME III NC-3642 and NC-4223.2 require that after bending, the difference between maximum and minimum diameters shall not exceed 8% of the average diameter before bending, or in this case approximately 0.64". LRB, RLW.

The piping manufacturers and fabricators conducted appropriate inspections and audits of their manufacturing and fabrication processes and provided written certifications to Duke Power which stated that piping supplied met Code and specification requirements which includes ovality limits. These vendor QA programs have been periodically audited by Duke Power Company and no significant deviations in this regard were noted. AWR.

In addition to vendor audits and surveillance, upon receipt of this piping Duke Power conducts a separate receipt inspection which includes a review of the vendor certification that code requirements have been met. Further, prior to use of the piping a QA cleanliness inspection, QA fit-up inspection and several QA welding inspections are conducted on the piping. QA inspectors are trained to be very conservative and critical in their inspections, and if there were excessive ovality, it would have been detected at least in some of these additional inspections. In addition to all these inspections, QA conducts periodic surveillance on the material and audits processes ongoing in the plant. In sum, the numerous inspections on the piping conducted by trained Duke QA inspectors provide reasonable

assurance that any excessive ovality in the piping would have been detected. Significantly, despite all of these inspections we know of no reported incident of ovality problems concerning piping used for the Containment Spray System. JCS, LRB.

Accordingly, it's our determination that there is reasonable assurance that there were no deficiencies regarding out-of-roundness of piping used in the Catawba Unit 1 Containment Spray System. JCS, LRB, RLW, AWR.

It should be noted however, that in observing authorized modifications on piping to bring the ends from an <u>acceptable</u> out-of-roundess condition to a more perfectly round condition for welding, In Camera Witness #1 may have incorrectly assumed that the out-of-roundness was beyond acceptable limits. Methods specified in ASME III NC-4231 of improving acceptable ovality conditions include use of bars, jacks and clamps. Discussions with cognizant personnel on the job revealed that indeed these methods were used to adjust acceptable ovality of the ends of the Containment Spray System piping in order to achieve an acceptable fit-up for welding. LRB, EAI.

2. <u>Minimum Wall Thickness</u>:

The piping used in the Unit 1 Containment Spray System is 8" Schedule 40 piping with a nominal wall thickness of .322" and a minimum observed wall thickness of .250". The stress analysis performed and used in final design/construction work on the system

assumed use of a Schedule 20 pipe which has a nominal thickness of .250" (minimum thickness of .219"). This design analysis demonstrated that there was significant wall thickness margin in the system. For grinding to result in a wall thickness problem, the grinding would have to result in a reduction of wall thickness from the nominal thickness of .322" (or for a worst case situation from the minimum observed thickness of .250") to below .219". RLW, CLR.

The probability of excessive grinding which would result in such a defect which was not noted and reported by the grinder and corrected is very remote. Further, the visual inspections required by QA coupled with the 100% radiography of all welds on this system would have assured that any such excessive grinding defect would have been identified and corrected. In sum, there is reasonable assurance that if there were grinding induced defects on the Containment Spray System which could conceivably have resulted in a minimum wall thickness problem such defects would have been so large that they would have been easily detected by the grinder or in normal QA visual or radiography inspections. JEC, EAI, JCS.

3. <u>Fit-Up Inspections</u>:

In Camera Witness #1's testimony alleges that in the installation of an 8" schedule 40 stainless steel 45° elbow fitting between two sections of pipe which were already in place in the Unit 1 Containment Spray System, a fit-up inspection did not occur. A review of the records indicates that the welds he is referring to are weld joints 1NS125-4

and 1NS75-14. A review of the weld record form M-4A indicates that joint 1NS125-4 was originally fit-up and inspected on 7/17/80. A 7/22/80 note on form F-9B for this weld indicates that on 7/17/80 the elbow fitting was modified from 45° to 44°-27'. While it may have appeared that a fit-up inspection was not conducted due to the date of the note on the F-9B form, the work described was actually performed on 7/17/80 and noted as such on the F-9B form. Therefore, the inspection performed on 7/17/80 included all work performed on the fit-up of the joint. LRB, JCS.

In any event, weld record form M-4A for weld 1NS125-4 further states that because of unacceptable lack of penetration discovered by radiography, the entire weld was cut out on 8/25/80 and remade. All subsequent inspections, welding and NDE steps on the weld record appear proper, and the weld radiographs were accepted by Duke on 9/23/80 and by the Authorized Nuclear Inspector on 9/24/80. In addition, the weld joint was hydrostatically tested to 300 psig on 8/28/83. LRB, JCS.

In short, it is clear that the fit-up of this weld, while potentially confusing for a helper such as the witness, did receive an adequate fit-up inspection. In any event, as previously stated this weld was cut out and replaced clearly in conformance with requirements. LRB, JCS.

Discussions with fitters, foremen and others associated with this erection, as well as a review of records regarding this system provides no indication whatsoever that any fit-up inspections were missed. LRB, EAI.

Accordingly, it is our determination that this assumption is clearly not well founded. JCS, LRB, EAI.

4. Cold Springing:
At the outset it should be noted that Catawba specifications and procedures clearly state that cold springing is not authorized on piping systems except under controlled conditions, e.g., any force in excess of moderate hand pressure to achieve alignment must be applied and checked as required by specific procedures. Responsible construction personnel are well trained on these restrictions. LRB, CLR, EAI.

Further, quality assurance personnel rigidly enforce these procedures during surveillance audits and scheduled fit-up and welding inspections. If during any such inspection or surveillance it appeared that there was attempt to use uncontrolled cold springing, the inspector would have reported the violation (moderate hand pressure to achieve alignment is authorized), there were no reported cases of cold springing or attempts to use cold springing on this system. JCS, EAI.

Indeed, the method used to erect the containment spray system was such that the only closure weld (i.e., welding to a fixed location from a fixed pipe - the basic condition which must be present for cold springing) where cold springing would be practical was in the system ring headers located in the top of the dome. The fact that there was no cold springing in the ring headers, was demonstrated when a short section of pipe was cut out of each spray ring header after closure of the header and in no case did the pipe spring out of alignment indicating a cold springing condition. CLR, EAI.

Discussions with many of the fitters and foremen associated with erection of the system reflect that there was no cold springing on this system. EAI.

In short, the lack of any QA/QC reports of cold springing coupled with the erection process and discussions with personnel responsible for and knowledgeable about the erection of this system provides reasonable assurance that there was no cold springing of this system. JCS, CLR, LRB, EAI.

Q. IN RESPONSE TO THE BOARD'S QUESTION, EVEN ASSUMING THE ASSUMPTIONS OF THE WITNESS REGARDING OUT-OF-ROUNDNESS, MINIMUM WALL THICKNESS, FIT-UPS AND PIPE BENDING ARE WELL FOUNDED, WOULD THIS HAVE ADVERSELY AFFECTED THE FUNCTIONAL USE OR STRUCTURAL INTEGRITY OF THE SYSTEM SO AS TO CALL INTO QUESTION THE SAFE OPERATION OF THE PLANT?

A. No. We have conducted a detailed investigation and analyses of these issues and determined that even assuming that the concerns are well

founded (which as noted above is not valid), there would be virtually no impact on the system capability or structural integrity. The bases for this determination include the following:

1. Out-of-Roundness:

The witness states that any pipe which was out-of-round in the first instance was eventually always made round prior to fit-up and welding by "mash[ing] it on the sides." Tr. 72. As previously stated, the ASME code also allows out of roundness present in the pipe to be corrected by use of force when aligning sections of pipe for welding. LRB.

Correction of ovality by force (e.g., "mashing") would induce either a cold set in the pipe wall or secondary stresses in the pipe wall. Any cold set induced in the pipe wall by correcting ovality (even excessive ovality) would have no effect on the primary stress levels in the pipe. Any secondary stresses induced by correcting ovality (even excessive ovality) would be reduced by the heat of welding; and any remaining locked in secondary stresses would have no effect on the ability of the pipe to perform its intended function. In sum, correcting an ovality deficiency by the use of force would have no adverse impact on the system. CLR, JNU.

2. Wall Thickness:

As previously stated, even assuming that a grinding defect occurred which could conceivably result in a wall thickness problem, the analysis on this system used schedule 20 pipe (nominal wall thickness of .250") instead of the schedule 40 pipe installed (nominal wall

thickness of .322") so that the depth of the defect adversely impacting the system would have to be so great that it would be readily detected in either the visual or radiographic inspections. Upon identification, it would be corrected. Thus, minimum wall thickness concerns as raised by the witness here would have no adverse impact on the system. (It should be noted that the witness himself stated that he did not know if grinding violated minimum wall thickness. (Tr. 76.)) CLR, JCS, JEC.

3. Fit-Ups:

As previously stated, a review of the records indicates that the alleged missed fit-up inspection occurred on a weld that was subsequently cut out and replaced. Accordingly, the witness' concern regarding the fit-up of this weld would have no impact on the Containment Spray System.

However, assuming that other welds somehow missed fit-up inspections (even though all QA weld record forms M-4A have been initialed and dated reflecting the inaccuracy of this assumption), each pipe weld in the containment spray system is required to have a full volumetric examination by radiography. This examination assured that full fusion of each section of pipe joined was achieved, regardless of any fit-up problems which may have been missed. JCS, JEC.

The only other concern related to fit-up would be a surface irregularity at the weld caused by misalignment of the pipe sections

being joined. The potential for this surface irregularity was already accounted for in the stress analysis by the conservative practice of applying a stress intensification factor at the weld of 1.8 which is, as required by the ASME Code, when fit-up is not maintained to close tolerance. This stress intensification factor is a multiplier applied to the calculated stress at the weld joint to account for any surface irregularity due to misalignments which are greater than 10% of the pipe thickness in magnitude. CLR, JNU.

In short, any missed fit-up inspection of a weld in the system would have no adverse impact on the system. JCS, JEC, CLR, JNU.

4. Cold Springing:

As previously stated, the erection process of the Unit 1 Containment Spray System was such that the possibility of cold springing in the system is extremely remote.

However, we have analyzed the potential impact of cold springing piping into position in order to make closure welds. This analysis consisted of a generic review of how the cold springing would affect the stress/strain characteristics of the pipe, and how it would affect the existing stress levels in the pipe as calculated by the piping analysis of the Containment Spray System. The analysis demonstrated that the deflection used for cold springing the pipe into position result in secondary stresses which are termed self-limiting. Self-limiting means that the stresses are developed due to a finite deflection, e.g., a deflection of 3" - 4". Therefore, the

strain in the pipe is limited. Stresses below the yield stress of the pipe will be retained in the pipe, are relieved by any subsequent plastic action, and will not adversely impact the system. At any time if a combination of this secondary stress and stresses due to design loads reach the yield stress of the pipe, then these self limiting stresses are relieved without adversely effecting the pipe. For this reason, the ASME code does not require that secondary stresses be combined with stresses due to faulted loads. In short, cold springing of piping as described by the witness (i.e., 3" - 4") in the Unit 1 Containment Spray System would have no adverse impact on the system. CLR, JNU.

To provide an indication of the stress levels which would be generated by such cold springing, a computer analysis was performed on a 4" cold springing of the smallest (and thus worst case) ring header in the system. A ring header was chosen for this analysis because, as previously stated, based on the erection process the only closure welds on the system where it would have been practical to use cold springing occurred in the ring headers. CLR, JNU.

This analysis was performed assuming that a 4 inch offset at the closure weld was corrected by springing the pipe into alignment prior to welding. The results of this analysis showed that the combined stresses under this condition fully satisfy ASME Code requirements. CLR, JNU.

being joined. The potential for this surface irregularity was already accounted for in the stress analysis by the conservative practice of time if a combination of this secondary stress and stresses due to design loads reach the yield stress of the pipe, then these self limiting stresses are relieved without adversely effecting the pipe. For this reason, the ASME code does not require that secondary stresses be combined with stresses due to faulted loads. In short, cold springing of piping as described by the witness (i.e., 3" - 4") in the Unit 1 Containment Spray System would have no adverse impact on the system. CLR, JNU.

To provide an indication of the stress levels which would be generated by such cold springing, a computer analysis was performed on a 4" cold springing of the smallest (and thus worst case) ring header in the system. A ring header was chosen for this analysis because, as previously stated, based on the erection process the only closure welds on the system where it would have been practical to use cold springing occurred in the ring headers. CLR, JNU.

This analysis was performed assuming that a 4 inch offset at the closure weld was corrected by springing the pipe into alignment prior to welding. The results of this analysis showed that the combined stresses under this condition fully satisfy ASME Code requirements. CLR, JNU.

Q. EVEN ASSUMING THAT ALL THE WITNESS' CONCERNS ARE WELL FOUNDED, AND HYPOTHETICALLY ASSUMING THAT SOME TYPE OF ADVERSE IMPACT COULD SOMEHOW RESULT IN A SUBSTANTIAL DEGRADATION OF THE CONTAINMENT SPRAY SYSTEM, WOULD THE SYSTEM STILL BE ABLE TO PERFORM ITS INTENDED FUNCTION?

A. The containment spray system contains two independent, redundant trains of pumps, spray rings and headers, either of which can supply 100% of the cooling required to perform system function. A break in one of the rings (or supply headers) connected to the containment spray pumps could, at worst, result in effectively losing spray from that ring and degrading spray flow in the other ring connected with the same pump. However, assuming no spray from either of these two rings, the remaining two rings supplied by the redundant pump are capable of meeting required spray flow to assure system function. If the break were to occur in one of the rings connected to the residual heat removal system, the other ring would be operable and would provide adequate spray. In short, even hypothesizing a significant degradation of the Containment Spray System based on assumptions and gross speculations which, as previously noted, are totally without merit, the system can continue to perform its intended function. RCG.

Q. ASSUMING THAT THE CONCERNS OF THE WITNESS ARE WELL FOUNDED, THE LICENSING BOARD QUESTION FURTHER INQUIRED AS TO WHAT CORRECTIVE ACTIONS, IF ANY, WOULD BE REQUIRED FOR SAFE OPERATION OF THE PLANT.

A. From the foregoing, the witness' concerns regarding out-of-roundness, pipe bending, minimum wall thickness and fit-ups are totally without

merit, and, in any event, would have no adverse impact on the Unit 1 Containment Spray System's structural integrity or capability to perform its intended function. Accordingly, no corrective action is needed for safe operation of the plant.

CLARENCE L. RAY, JR.

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Charlotte, NC 28212
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(704) 373-6209 (office)
Age: 36 Height: 6' - 0" Weight: 195 lbs.

FORMAL EDUCATION: Old Dominion University: BSCE 1970

PROFESSIONAL ACTIVITIES:

Registered Professional Engineer - North Carolina
Registered Professional Engineer - South Carolina
American Society of Civil Engineers - Member
American Society of Mechanical Engineers - Member
ASME, Committee on Cranes for Nuclear Facilities- Main Committee Member and Structural Subcommittee-Member.
ASME, BPVC, Section III, Working Group on Component Supports - Member

ADDITIONAL TRAINING:

Foundation Engineering Seminar - UNCC
ACI Code Seminar - NCSU
Structural Design Seminar - Lincoln Electric Co.
Management Development Program - Duke Power Co.
Advanced Management Development Program - Duke Power Co.
Effective Management Training Program - Duke Power Co.

WORK EXPERIENCE:

FROM	TO	TITLE	PROGRAM	COMPANY
1/82	Present	Principal Engineer	Catawba Nuclear Station	Duke Power

In charge of section responsible for all piping analysis, piping support design, pipe rupture restraint design, seismic supports for HVAC ducts, and mechanical equipment support design. Analysis and designs performed in accordance with ASME Section III, ANSI B30.1 and AISC specifications. Duties include accountability for manpower and expenditure budgets; interfacing with other Departments, Divisions and Sections; NRC interface on technical items and licensing; development and maintenance of design and erection specifications and procedures; administration of out-of-house contracts; and general personnel management. Manage 260 engineers and 70 other.

FROM	TO	TITLE	PROGRAM	COMPANY
11/79	12/81	Senior Engineer	Catawba Nuclear Station	Duke Power

In charge of design group and analysis group (beginning 6/81) responsible for all piping analysis, piping support design, pipe rupture restraint design, seismic supports for HVAC ducts, and mechanical equipment support design. Analysis and designs performed in accordance with ASME Section III, ANSI B30.1 and AISC specifications. Duties include accountability for manpower and expenditure budgets; interfacing with other Departments, Divisions and Sections; NRC interface on technical items and licensing; development and maintenance of design and erection specifications and procedures; administration of out-of-house contracts; and general personnel management. Manage 190 engineers and 60 other.

FROM	TO	TITLE	PROGRAM	COMPANY
6/77	10/79	Design Engineer	McGuire, Catawba & Cherokee Nuclear Stations	Duke Power

In charge of group responsible for structural steel design for all stations, support of electrical cable tray at McGuire, Catawba and Cherokee Nuclear Stations, and the specification and technical evaluation for the purchase of all cranes and hoists for these nuclear stations. Duties included the establishing of design requirements, approval of calculations and drawings, accountability for schedule and manpower requirements, interfacing with other Departments, Divisions, and Sections, interfacing with vendors and with the NRC. Supervised 16 engineers.

FROM	TO	TITLE	PROGRAM	COMPANY
1/75	5/77	Assistant Design Engineer	McGuire & Catawba Nuclear Stations	Duke Power

Had lead responsibility for all major structural steel design for Catawba Nuclear Station. Also performed miscellaneous design work on McGuire Nuclear Station. Duties included the preparation of engineering calculations and design sketches, writing specifications, making cost estimates, checking design drawings and calculations, and directing designers in preparing drawings. In addition to major building structural steel design, assignments included the design of a 404 ft. railroad bridge and a 252 ft. highway bridge.

FROM	TO	TITLE	PROGRAM	COMPANY
11/72	12/74	Associate Engineer	McGuire & Catawba Nuclear Stations	Duke Power

Worked on the design of McGuire and Catawba Nuclear Station structural steel. Duties included the preparation of engineering calculations and design sketches, writing specifications, making cost estimates, checking design drawings and calculations, and directing designers in the preparation of drawings.

FROM	TO	TITLE	PROGRAM	COMPANY
6/70	10/72	Junior Engineer	Belews Creek Steam Station	Duke Power

Performed fundamental engineering work including engineering calculations, design sketches, writing specifications, cost estimates and checking drawings. Primary assignment was design of structural steel for Belews Creek Steam Station. Involved in all aspects of steel design including building steel, platforms, design of and support for coal handling equipment.

Attachment B

RESUME

ROYCE LEE WILLIAMS

PERSONAL: Home Address: 6531 Foxmeade Lane
Charlotte, North Carolina 28215

Telephone: (704) 536-4504 (Home)
(704) 373-4221 (Work)

Age: 46 Height: 5' - 11" Weight: 195 lbs.

FORMAL EDUCATION: North Carolina State University - BS Engineering Physics 1961

ADDITIONAL TRAINING: Supervision & Management Courses - Duke Power Company
Miscellaneous Seminars on Welding, NDE and Code Requirements

PERSONAL INVOLVEMENT: Registered Professional Engineer - N.C. 8010

Member - ASME, AWS
Member - ASME B & PV Code Section I
Member - ASME B & PV Code Section I Subgroups on General Requirements and Piping
Member - ASME B31.1 Code for Power Piping
Member - ANSI B36.10 Committee on Welded and Seamless Wrought Steel Pipe

WORK EXPERIENCE:

FROM	TO	TITLE	PROGRAM	COMPANY
9/73	Present	Analytical Engineer II	McGuire, Catawba and Cherokee Nuclear Stations	Duke Power

In charge of Sub-group responsible for preparation of specifications for the procurement and installation of piping materials for ASME Section III and B31.1 applications. Responsible for contract administration and engineering coordination on these items. Resolve non-conforming item reports relating to piping material and Code problems. Act as coordinator with other Groups, Departments, and Divisions on Code questions pertaining to materials, fabrication, examination and testing. Supervised two-to-four Engineers and a Technical Assistant.

FROM	TO	TITLE	PROGRAM	COMPANY
8/71	8/73	Project Engineer	Various Power Plants	ITT Grinnell Industrial Piping, Kernersville North Carolina

Responsible for engineering work in connection with prefabricated piping. Supervised preparation of orders for special materials and shop spool sketches. Coordinated engineering and scheduling and acted as liason with Architect Engineers. Supervised an Engineer and two Draftsmen.

FROM	TO	TITLE	PROGRAM	COMPANY
6/67	8/71	Department Engineer	Various Power and Process Piping Jobs	ITT Grinnell Industrial Piping Division Charlotte, North Carolina

Responsible for estimating and ordering materials for power and process piping work. Heavily involved in the ordering of materials for a 3-Unit Nuclear Power Plant. Supervised an Engineer and three-to-four Draftsmen.

FROM	TO	TITLE	PROGRAM	COMPANY
6/61	6/67	Piping Engineer	Various Power and Process Piping Jobs	ITT Grinnell Industrial Piping Division Various Locations

Involved in estimating and material ordering. Acted as liason with owners and Architect Engineers in the office and on the job site. Approximately 1 1/2 years construction time on process and power piping work.

FROM	TO	TITLE	PROGRAM	COMPANY
12/57	9/59	Draftsman	Various Power and Process Piping Jobs	ITT Grinnell Industrial Piping Division Charlotte, North Carolina

Involved in general drafting, material take-off and field surveys for heating, power and process piping work.

ROBERT C. GAMBERG

PERSONAL: Home Address: 1720 Wensley Dr.
Charlotte, N. C. 28210

Telephone: (704) 373-8575 (Office)
(704) 553-2290 (Home)

Age: 30 Height: 6' 0" Weight: 180

FORMAL EDUCATION: University of Virginia: BSNE 1975

ADDITIONAL TRAINING:
Fisher Control Valve Seminar - Charlotte, N. C.
Consolidated Safety & Relief Valve Seminar - Charlotte, N. C.
Pump Seminar - Duke Power Co.
Heat Exchanger Seminar - Duke Power Co.
Professional Development Program - Duke Power Co.
Supervisory Development Program - Duke Power Co.
Fluid Mechanics Seminar - Duke Power Co.

WORK EXPERIENCE:

FROM	TO	TITLE	DEPARTMENT	COMPANY
10/81	Present	Design Engineer I	Design Engineering	Duke Power Co.

Work group leader of 4-6 engineers responsible for the mechanical fluid system design of 25 fluid systems on Catawba Nuclear Station. Responsibilities include formulation of design criteria, determination of equipment design parameters, preparation of system design calculations, flow diagrams, system descriptions, review of vendor drawings, & plant licensing, trouble shooting & start up support. Currently supervise 4 engineers.

FROM	TO	TITLE	DEPARTMENT	COMPANY
6/75	10.81	Design Engineer I Assistant Design Engineer Engineer Associate Engineer Assistant	Catawba Nuclear Station	Duke Power Co.

Design responsibility for various fluid systems on Catawba Nuclear Station. Duties are similar to those listed above.

RESUME

Eulys A Ingram

PERSONAL:

Home Address: 17 Hillcrest Drive
York, S C 27945
Telephone: (803) 684-3099 (Home)
(803) 831-1512 (Work)

FORMAL EDUCATION: Seminole High School - 1958

ADDITIONAL TRAINING: None

WORK EXPERIENCE:

FROM	TO	TITLE	PROGRAM	COMPANY
6-17-80	Present	Powerhouse Mechanic	Catawba Nuclear Station	Duke Power

Install piping according to Design and by the instructions of crew foreman, Kreg Myers. Duties are to fabricate and erect piping according to the regulations of ASME boiler and pressure vessel codes and by the codes established by Duke Power Company's Quality Control Unit.

FROM	TO	TITLE	PROGRAM	COMPANY
6-77	6-80	Self-Employed	Co. President	Ingram Plumbing & Heating

Installed industrial and residential piping which included steam systems for cotton mills, commercial laundry mats and dry cleaning establishments. Install gas piping for service stations and Bosice Cascade Company. Licensed in the state of North Carolina. # PH 6402

FROM	TO	TITLE	PROGRAM	COMPANY
11-75	6-77	Pipe Foreman		Scholl Incorporated Rockingham, N C

Supervisor and instructed a crew of 12 craftsmen in the installation of miscellaneous industrial piping. Duties also included the installation of heating and air conditioning in residential areas.

FROM	TO	TITLE	PROGRAM	COMPANY
3-70	11-75	Foreman		Tri City Inc. Rockingham, N C

Supervised crew of craftsmen in the installation of commercial fire protection, plumbing and heating. Also storm drains and other related piping. Later, was superintendent during the construction of Tri City Shopping Center with the responsibilities of the installation of all piping, heating and air conditioning, electrical work, and fire protection.

FROM	TO	TITLE	PROGRAM	COMPANY
3-60	3-70	District Installation Manager		Sears Roebuck Greensboro, N C

Service and installation of household goods until 3-67 then moved up to District Installation Manager over 22 stores. Responsible for the installation of household goods including garages, fencing, appliances, and etc. sold by the 22 stores. Also instructed classes in the installation of the above mentioned items.

WORK
EXPERIENCE: (Cont'd)

FROM	TO	TITLE	PROGRAM	COMPANY
11-58	3-60			Rock Hill Printing & Finishing Co. Rock Hill, S C

Operated a set of finishing frames which set the width of cloth.

RESUME

LARRY RONALD BARNES

PERSONAL: Home Address: 306 Belwood Drive
Belmont, N.C. 28012

Telephone: (704) 825-5533 (Home)
(803) 831-1512 Ext. 273 (Office)

Age: 37 Height: 5'10" Weight: 175 lbs.

FORMAL ECUCATION: Auburn University: BIE 1967

ADDITIONAL TRAINING:
- Nuclear Power Officer Training - U S Navy
- Advanced Management Development - Duke Power
- Effective Management Program - Harbridge House
- Enhancing Project Management Skills - Project Management Institute
- ASME Boiler & Pressure Vessel Code Section III - Ohio State Univ.

PROFESSIONAL INVOLVEMENT:
- Registered Professional Engineer - NC 6867 SC 5699
- Member - ASME, AACE, ANS (local)
- Commander - U S Naval Reserve

WORK EXPERIENCE:

FROM	TO	TITLE	PROGRAM	COMPANY
10/81	Present	Planning & Control Manager	Catawba Nuclear Station	Duke Power

Directing the activities of 70 engineers, technicians, and clerks to provide estimating, long and short range construction planning, budget preparation, cost and schedule performance monitoring, and reporting. Provide direct support personnel in a matrix organization to the Unit 1 and Unit 2 general superintendents to maximize planning timeliness and effectiveness. Direct planning activities for Unit 2 construction testing and preoperational checkout activities.

FROM	TO	TITLE	PROGRAM	COMPANY
1/81	10/81	Support/ Restraint Mgr.	Catawba Nuclear Station	Duke Power

Direct the activities of 85 engineers, technicians, and clerks to provide technical direction and administrative support for the fabrication, installation, and rework of piping supports and restraints to meet requirements of ASME section III subsection NF. Developed and implemented procedures for document control, production control and tracking, process control, material control, constructability review, technical problem resolution, and completion verification. Restructured and staffed organization and trained personnel to maximize production during a period of complete redesign of all supports/restraints.

FROM	TO	TITLE	PROGRAM	COMPANY
1/79	12/80	Construction Services Manager	Multiple Power-Plants	Duke Power

Directed the activities of the 50 member Construction Services Division. Provided general office staff support to the Vice President, Construction and to

five construction sites with a total department workforce peak of 7000. Developed and coordinated multiple-site systems for planning, scheduling, budgeting, cost control, material control, equipment maintenance and management, industrial engineering, and future project planning. Represented company on Electric Utility Cost Group, Southeastern Electric Exchange Construction Committee, and Project Management Institute forum on powerplant construction.

3/76	12/78	Construction QA Manager	Multiple Powerplants	Duke Power

Directed operations of the Construction Division of the Quality Assurance Department to perform all quality assurance activities related to the construction of seven pressurized water reactor electric powerplants. Played key role in ASME implementation survey resulting in renewal of corporate N, NPT, and NA authorizations. Served as principal contact for NRC inspectors for the construction phase. Administrative supervision of 50 quality assurance personnel and functional direction of approximately 240 inspection personnel.

10/75	3/76	Mechanical Engineer	Barton Nuclear Station	Alabama Power

Planned and scheduled mechanical construction activities for Alan R. Barton Nuclear Plant, a four unit boiling water reactor power plant. Project cancelled prior to beginning construction.

5/74	10/75	Senior QA Engineer	McGuire Nuclear Station	Duke Power

As a member of a special task force, helped define a corporate reorganization resulting in an independent Quality Assurance Department. Rewrote the quality assurance program to reassign and add responsibilities under the new organization for acceptance by the AEC and ASME. Presented the new QA program to an ASME manual survey team for Owner's Certificate, NPT, and NA authorization. Recruited and trained a 22 person construction project QA staff to perform all QA functions on site. Implemented the new QA program and within 6 months successfully underwent an ASME implementation survey resulting in the issue of an Owner's Certificate, NPT, and NA authorizations from ASME. Underwent recurrent AEC inspections without being cited for any violations.

1/72	4/74	Assistant/Assoc. Field Engineer	Oconee Nuclear Station	Duke Power

Provided technical direction to craftsmen, inspectors, and technicians for piping material traceability, weld record traceability, and installation of piping supports and insulation. Performed overall QA review function for site activities.

12/67	12/71	Naval Officer	Nuclear Submarine Force	U S Navy

Served as communications, sonar, reactor control, and refueling officer aboard a fleet ballistic missile submarine. Qualified as Engineering Officer of the Watch, Officer of the Deck, and Qualified in submarines.

26251 (8-81)

Form N_E-B	Revision 1

DUKE POWER COMPANY
CERTIFICATION OF NONDESTRUCTIVE EXAMINATION PERSONNEL

Name	Method
John E Cavender	Radiography

Level	Limitations (If Any) (If None So State)
III	None

Education and experience Background

See Attached Resume

ON THE JOB TRAINING		PROJECT/SENIOR QA ENGINEER		EYE EXAMINATION
Date Started	Date Completed			
N/A	N/A	N/A	Date	JAEGER (J-1) 11/20/81 Date

CLASSROOM TRAINING	Name of Course	Hours	Date Completed
	N/A		

Additional Required Qualifications

Basic NDE Examination Score is 97 - this grade is not included in the composite grade

Required Length of on the Job Training N/A

Examinations:

General Grade	98	x 0.3	38.2
Specific Grade	95	x 0.3	28.5
Practical Grade	100	x 0.4	30.0
Composite Grade			97.7

NDE PROCEDURES QUALIFIED TO:

All RT

LEVEL III EXAMINER: N/A DATE:

☐ CERTIFICATION
☒ RECERTIFICATION

CERTIFIED BY: [signature]

Corporate Quality Assurance Manager, ~~Administrative Services~~

CERTIFICATION PERIOD:

From	To
9-29-82	9-29-85

ANNUAL EVALUATION ... 9/29/83

RESUME OF JOHN E CAVENDER

FOR CERTIFICATION AS LEVEL III IN RADIOGRAPHIC TESTING

Graduated South High School, Knoxville, Tennessee June, 1954
Enlisted in U S Navy, June, 1954
Associate Degree in Mechanical Engineering, Central Piedmont Community College Charlotte, NC June, 1982
Class C - Industrial Radiography School, May, 1963 120 hours, San Diego, California

Class C - Nondestructive Testing of Metals School July, 1964 12 weeks. Certified as Inspector for Radiography to NAVSHIPS 250-1500-1 (Nuclear) and NAVSHIPS 9922 (Conventional).

1964 to 1966 Supervisor of Radiographers U S S Bryce Canyon (AD36), reviewed all work requests, determined RT procedures and techniques required to accomplish requested Inspection in accordance with specifications, interpreted results of all RT inspections.

1966 to 1968 Supervisor of Radiographers, U S S Shenandoah (AD26) initial planning, setting up and qualifying the Radiography Lab to the requirements of NAVSHIPS 250-1500-1 and NAVSHIPS 9922. Reviewed all work requests, determined RT procedures and techniques to be used, performed radiography of all welder Qualifications tests. Evaluated and interpreted results of all RT performed, also performed evaluation and interpretation of radiography for other activities.

1969 to 1970 Supervisor of Radiographers, U S S H.W. Gilmore (AS16) assigned personnel work requests, determined RT techniques and procedures to be used, certified as Examiner for RT to NAVSHIPS requirements, updated procedures and techniques, trained and qualified personnel as RT operators and Inspectors. Reviewed all Radiographs prior to final acceptance.

1970 to 1971 Supervisor of Radiographers, U S S L.Y. Spear (AS36) trained and qualified personnel as RT operators and inspectors in accordance with NAVSHIPS requirements. Assigned personnel job tasks, determined RT techniques and procedures to be used. Wrote and qualified RT procedures to requirements of NAVSHIPS 250-1500-1. Reviewed all radiographs for final acceptance. Performed audits of other Radiographic facilities.

1971 to 1974 Assigned as Senior Radiographic Instructor, U S Navy Nondestructive Testing of Metals School, San Diege, California. Taught Radiography theory, method, techniques and acceptance to the requirements of NAVSHIPS 250-1500-1, NAVSHIPS 9922, and ASNT-TC-1A. Certified as RT examiner in accordance with NAVSHIPS 250-1500-1.

1974 to 1979 Performed training of Personnel in the Construction, Quality Assurance, Steam Production and Design Engineering Departments of Duke Power Company to requirements of ASME and SNT-TC-1A.

-C

1979 to 1981 Assigned as Supervisor of the QA Service Group, responsible for the QA/QC Inspector training program (NDE, Mechanical, Electrical, and Civil) and NDE Level III Examiner for the QA Department and provided NDE services to other Departments.

1981 to Present Assigned to the QA Technical Services Division as the Level III NDE and Welding. Responsibility for: providing NDE procedures for performing required examination; review of NDE & Welding inspectors annually; review all NDE and welding inspection training material; provide technical NDE services to other QA Divisions and Company Departments requiring information and assistance on NDE matters; and reviews vendor inspection records and aid in resolving problems related to vendor supplied materials.

The above statements are attested to be true based on documentation in company files. Accordingly, John E Cavender is recommended for certification as Level III Examiner Radiographic Testing.

Recommended W O Henry

W. O. Henry
Quality Assurance Manager, Technical Services

Certified Level III Radiographic Testing to the requirements of SNT-TC-1A for Duke Power Company, 422 South Church Street, Charlotte, NC 28242.

G. W. Grier, III
Corporate Quality Assurance Manager,
Duke Power Company

Date

PROFESSIONAL QUALIFICATIONS OF MR. A. W. ROY

TO BE PROVIDED.

RESUME

NAME: Joe C. Shropshire

PRESENT POSITION: QA Engineer
Catawba Project

PERSONAL DATA: Age - 39
Marries - Two children
Address - 1204 Dumbarton Road
Gastonia, NC 28054

EDUCATION:

Graduate of Drewry Mason High School, Ridgeway, VA 1962

Bachelor of Science in Civil Engineering from Virginia Polytechnic Institue, 1967

Graduate study in Civil Engineering at Virginia Polytechnic Institute in 1969-1970

Various technical courses and seminars.

Various Duke Power Company management training courses.

EXPERIENCE:

Virginia Department of Highways, Richmond, VA.

1967-68 Highway Engineer Trainee. During my training I worked as a bridge design engineer, materials engineer, hydraulics engineer, and construction field engineer. Was given responsible charge for several projects. Project experience included structural design, drainage studies, materials evaluation, and tunned construction.

Bluefield State College, Bluefield, WV

1968-69 Instructor. I was an Instructor of Civil Engineering Technology and was responsible for the quality and content of courses taught. Some courses taught were Structural Steel and Reinforced Concrete Design, Statics, Strength of Materials, Surveying.

Virginia Polytechnic Institute, Blacksburg, VA.

1969-70 Coordinator of Men's Residence Halls. I was responsible for the overall student management for two student dorms.

Wake Technical Institute, Raleigh, NC

1970-71 Instructor. I was an Instructor of Civil Engineering Technology and was responsible for course development, content and quality. Courses taught included Materials, Statics, Strength of Materials, Reinforced Concrete Design.

Bluefield State College, Bluefield, WV

1971-73 Administrative Assistant (Part time instructor in Technology). I was responsible for developing and writing grant proposals and coordinating federal funding, directed institutional research and served on the Board of Regents Committee for Institutional Research, numerous special projects. Was partially responsible for developing Mine Supervisory Training Program.

Virginia Department of Highways, Richmond, VA

1973-74 Highway Materials Engineer "A". I was assistant Head of Soils Lab and was responsible for soils testing and evaluation of test results; responsible for materials studies; responsible for development and evaluation of test procedures. Advised other department engineers on foundation location and design, slope design, subsidence problems, materials resources.

Spartanburg Technical College, Spartanburg, SC

1974-77 Department Head - Civil Engineering Technology. Responsible for the course content and quality of the Civil Engineering Technology program. Taught all courses in curriculum. Was responsible for department budget and maintenance and purchase of equipment.

Pittsburgh Testing Laboratory, Atlanta Office, Atlanta, GA

1977-78 District Manager and Engineer. The responsibility for managing the Atlanta Office and overseeing the engineering and testing activities was mine. The office offered general, and some specialized, engineering and testing services to architects, engineers, contractors, and manufacturers. Testing, QA services, materials research and engineering analysis were supervised by me.

Duke Power Company, Charlotte, NC

1978-79 Assistant QA Engineer. Assigned to QA-Engineering and Services. I was responsible for developing, coordinating, and training QC-Civil inspectors in structural steel, concrete, soils, and coatings.

1979-80 Associated QA Engineer. Assigned to the QA-Construction Division at the Catawba Nuclear Project as QA Engineer Mechanical, Welding, NDE. I am responsible for providing the supervision and direction for the implementation of the QA program in the areas of mechanical piping,

	equipment and systems testing, and welding and NDE.
1980-Present	QA Engineer. Assignment same as 1979-1980 except that during 1981-1982 I was also responsible for the implementation of the QA program for support/restraints.

PROFESSIONAL: Registered Professional Engineer in West Virginia (#6476)

Member of American Society of Civil Engineers (ASCE)

Member of National Society of Professional Engineers (NSPE)

RESUME

JOSEPH NORRIS UNDERWOOD

PERSONAL: Home Address: 6821 Old Post Road
Charlotte, NC 28212

Telephone: (704)537-5478 (home)
(704)373-8828 (office)

Age: 36 Height: 6'- 4" Weight: 190 lbs.

FORMAL EDUCATION: North Carolina State University, BSME 1969

PROFESSIONAL AFFILIATES: Registered Professional Engineer
North Carolina #7266; South Carolina #6232

Member - American Society of Mechanical Engineers

ADDITIONAL TRAINING: Miscellaneous Computer Program Usage Seminars (SUPERPIPE, PISOL, ANSYS) - Duke Power Company

Piping Analysis - Duke Power Company, EDS Nuclear, Inc., Teledyne

WORK EXPERIENCE:

FROM	TO	TITLE	PROGRAM	COMPANY
7/82	Present	Supervising Design Engineer	Catawba Nuclear Station	Duke Power

In charge of group performing ASME Class 1, 2, and 3 piping stress analysis for Catawba Nuclear Station. Responsible for developing criteria and procedures to insure all calculations meet ASME Section III and ANSI B31.1 Codes, Regulatory Guides and Company defined quality assurance guidelines. Scope includes the analysis of new piping systems, backfit analysis to meet the NRC's IE Bulletin 79-14, and the certification of systems for ASME Code stamping.

FROM	TO	TITLE	PROGRAM	COMPANY
5/79	7/82	Supervising Design Engineer	McGuire Nuclear Station	Duke Power

Similar piping analysis responsibilities as described above for the McGuire Nuclear Station, but only for ASME Class 2 and 3 systems. In addition, performed equipment qualification analysis and was responsible for contract administration of companies supplying

consulting services to Duke in the piping analysis and support/restraint design fields. Interface directly with management of consulting firms in resolving schedule problems and approving budgets, work scope and budget change requests. Developed reports to the NRC concerning adherence to codes and standards and interfaced with that group during audits. Provided input in developing station safety analysis report.

9/75	5/79	Assistant Design Engineer	Catawba Nuclear Station	Duke Power

Supervisor of a group of engineers performing piping analysis for the Catawba Nuclear Station. Responsible for interviewing prospective employees, training new engineers and providing general supervisory functions for the group. Determined analysis schedules supporting the design of piping systems and supports by other groups. Provided technical expertise to the group in interpreting codes, developing analysis criteria and procedures and solving major problems uncovered during the analysis phase. Developed sections of the station dynamic loads on piping and equipment.

6/72	9/75	Engineer Associate	Belews Creek Steam Station	Duke Power

Work Leader for a group performing piping analysis for the Belews Creek Fossil-fired Steam Station. Identified piping systems requiring analysis. Determined code requirements and developed analysis procedures to meet those requirements. Scheduled the work of a group of analysts to meet design and construction schedules and checked the analysis performed by the group. Interfaced with other design groups to optimize plant and equipment design. Helped author and review purchase specifications for equipment and piping components. Developed erection and cold pull procedures for high temperature (1000F) piping systems and directed field installation of these systems and their supports.

6/69	6/72	Engineer Assistant	Oconee Nuclear Station	Duke Power

Performed basic engineering calculations on piping components and systems for the Oconee Nuclear Station. Included static and dynamic analysis to determine thermal flexibility of piping and design loads on supports. Used hand calculations as well as state-of-the-art computer programs. Helped develop analysis techniques and verify that computer programs accounted for requirements defined in the ASME Section III Code for nuclear power components.

NUCLEAR REGULATORY COMMISSION

Docket No. 50-413 Official Exh. No. 95

In the matter of Catawba

Staff ______ IDENTIFIED ✓

Applicant ✓ RECEIVED ✓

Intervenor ______ REJECTED ______

Cont'g Off'r ______

Contractor ______ DATE 12/14/83

Other ______ Witness ______

Reporter Mary Simons