UNITED STATES OF AMERICA
NUCLEAR REGULATORY COMMISISON
Before the
ATOMIC SAFETY AND LICENSING BOARD

In the matter of	)	
	)	
CAROLINA POWER & LIGHT COMPANY	)	Docket No. 50-400
	)	
(Harris Nuclear Plant)	)	January 4, 2000

DECLARATION OF DAVID A. LOCHBAUM IN SUPPORT OF ORANGE COUNTY'S SUMMARY AND SWORN SUBMISSION REGARDING CONTENTION TC-2 (INADEQUATE QUALITY ASSURANCE

I, David A. Lochbaum, make the following declaration:

1. My name is David A. Lochbaum. I reside in the state of Maryland. I am employed by the Union of Concerned Scientists as its nuclear safety engineer. I have been so employed since October 1996. I have the following responsibilities: a) direct and coordinate UCS's nuclear safety program; b) monitor developments in nuclear industry to assess and respond to impact; c) serve as technical authority and spokesperson on nuclear issues; and d) initiate legal action to correct safety problems.

2. I am a graduate of the University of Tennessee with a bachelor of science in nuclear engineering. I have worked in the field of nuclear engineering since June of 1979. My seventeen years of employment experience in the nuclear industry are described in more detail in my resume, which is attached as Exhibit A to the Declaration that I submitted in support of Orange County's Supplemental Petition to Intervene (April 5, 1999).

3. I have reviewed the December 23, 1998, license amendment application filed by Carolina Power and Light (CP&L) for an amendment to Facility Operating License No. NPF-63, which seeks permission to activate spent fuel storage pools C and D at the Shearon Harris nuclear power plant. I have also reviewed the NRC's Federal Register notice for the proposed license amendment, the Final Safety Analysis Report for the Shearon Harris Nuclear Power Plant, and various correspondence and technical documents relating to the proposed license amendment. I am familiar with NRC regulations and regulatory practice.

3. I participated in the preparation of Orange County's contentions regarding the proposed license amendment. Following admission of Contention TC-3, Inadequate Quality Assurance, I was principally responsible for evaluating whether CP&L's License Amendment Application conforms to the requirements of Appendix B to 10 C.F.R. Part 50.

4. In making my evaluation, I conducted an extensive review of documents related to quality assurance at Harris and in general, including CP&L licensing documents, correspondence between CP&L and the NRC Staff, and studies prepared by CP&L and its consultants. I also participated in preparing for depositions of CP&L and NRC Staff witnesses regarding contention TC-3, and in reviewing the deposition testimony of these witnesses. In addition, I was deposed by both CP&L and the NRC Staff.

5. I am responsible for all of the technical factual assertions contained in Orange County's Detailed Summary Of Facts, Data And Arguments On Which Orange County Intends To Rely At Oral Argument To Demonstrate The Existence Of A Genuine And Substantial Dispute Of Fact With The Licensee Regarding The Proposed Expansion Of Spent Fuel Storage Capacity At The Harris Nuclear Power Plant, With Respect To Quality Assurance Issues, submitted to the Licensing Board on January 4, 2000 (hereinafter "Summary"). As I have attested in signing the Summary, the technical factual assertions therein are true and correct to the best of my knowledge, and all expressions of technical opinion therein are based on my best professional judgment.

I declare, under penalty of perjury, that the foregoing is true and correct.

I declare under penalty of perjury that the foregoing facts are true and correct to the best of my knowledge, and the foregoing opinions are based as my best professional judgement.

Executed January 4, 2000

David A. Lochbaum

CONTENTION TC-3: EXHIBIT 2

Letter from Donna B. Alexander, CP&L, to U.S. NRC (April 30, 1999), Re: Response to NRC RAI

CP&L

Carolina Power & Light Company
Harris Nuclear Plant
P.O. Box 165
New Hill NC 27562

APR 30 1999

SERIAL: HNP-99-069

United States Nuclear Regulatory Commission
ATTENTION: Document Control Desk
Washington, DC 20555

SHEARON HARRIS NUCLEAR POWER PLANT
DOCKET NO. 50-400/LICENSE NO. NPF-63
RESPONSE TO NRC REQUEST FOR ADDITIONAL INFORMATION REGARDING THE ALTERNATIVE PLAN FOR SPENT FUEL POOL COOLING AND CLEANUP SYSTEM PIPING

Dear Sir or Madam:

By letter dated March 24, 1999, the NRC requested additional information regarding the Harris Nuclear Plant (HNP) license amendment request to place spent fuel pools 'C' and 'D' in service. Enclosure 8 of the HNP license amendment request (ref. SERIAL: HNP-98-188, dated December 23, 1998) provided a detailed description of the proposed alternatives to demonstrate compliance with ASME B&PV Code requirements for spent fuel pool cooling and cleanup system piping in accordance with 10 CFR 50.55a(a)(3)(i). The NRC has determined that additional information is required to complete the review of the proposed alternative piping plan. Enclosed is the HNP response to the NRC request for additional information. The enclosed information is provided as a supplement to our December 23, 1998 submittal and does not change our initial determination that the proposed license amendment represents a no significant hazards consideration.

Please refer any questions regarding the enclosed information to Mr. Steven Edwards at (919) 362-2498.

Sincerely,

Donna B. Alexander

Donna B. Alexander
Manager, Regulatory Affairs
Harris Nuclear Plant

KWS/kws

Enclosures

PENGAD-Bayonne, N.J.
DEPOSITION EXHIBIT
OC
No. 9

c:

Mr. J. B. Brady, NRC Senior Resident Inspector (w/ Enclosure 1)
Mr. Mel Fry, N.C. DEHNR (w/ Enclosure 1)
Mr. R. J. Laufer, NRC Project Manager (w/ all Enclosures)
Mr. L. A. Reyes, NRC Regional Administrator (w/ Enclosure 1)

CONTENTION TC-3: EXHIBIT 2a

Enclosure 1 to 4/30/99 RAI Response
(Response to RAI)

SHEARON HARRIS NUCLEAR POWER PLANT
DOCKET NO. 50-400/LICENSE NO. NPF-63
RESPONSE TO NRC REQUEST FOR ADDITIONAL INFORMATION REGARDING THE ALTERNATIVE PLAN FOR SPENT FUEL POOL COOLING AND CLEANUP SYSTEM PIPING

I. Existing Piping System

A. Detailed description of the proposed change:

Requested Item I.A.1

Provide isometric drawings (isometrics) showing all piping and piping systems within the scope of the proposed alternatives; i.e., for fuel pool cooling and cleanup system (FPCCS) and component cooling water system (CCWS) piping. Provide Isometric drawings to be used for continuance of design and construction without an N-Stamp.

Response to Requested Item I.A.1

Copies of the original construction isometrics are provided in Enclosure 2 and have been marked up to show:

- installed piping (in scope of the Alternative Plan)
- embedded piping
- class boundaries, including safety vs. non-safety related
- location and identification of field welds

In addition, please note that these isometrics include the following information:

- material requirements for piping and fittings
- pipe spool numbers (traceable to vendor data packages)
- location of hanger attachment lug welds

These markups were based upon detailed field walk downs of the current system configuration. Documented verification of these details will be provided by the system turnover / certification process used to implement this activity (ref. responses to RAI items II.2 & 3). Piping outside of Code boundaries is identified on these isometrics only for the purpose of depicting continuity.

Requested Item I.A.2

Provide weld matrixes that list all the welds (each weld should be uniquely identified and traceable to I.A.1 above) within the scope of the alternatives.

Response to Requested Item I.A.2

A matrix is provided in Enclosure 3 for each of the field welds in the scope of the Code related piping discussed in I.A.1. For clarity, in-scope field welds are defined herein as that set of field welds which meet all of the following criteria:

(1) is installed in the ASME Section III Class 3 boundaries of the Component Cooling Water or Spent Fuel Pool Cooling Systems
(2) was installed during original plant construction,
(3) Code required field installation records are no longer available
(4) is consistent with the design of the system as it will be completed
(5) is in the "large-bore" piping on the main system flow path. Instrument lines, vents and drains, branch connections to other systems, etc., are not included.

Requested Item I.A.3

(i) In the matrixes or isometrics, identify the piping material (ASME / ASTM Specification), weld material (ASME / ASTM Specification), the existence of all required material documentation, and any specific missing documentation. (ii) Identify each missing document for each weld. (iii) Identify the method(s) used for reconciliation of each type of missing document. (e.g., missing Certified Material Test Report reconstructed with complete chemical analysis run on shavings taken from the material). (iv) For the sampling and testing methods used for reconciliation, identify references used for guidance. (i.e., NRC DG-1070, ASME, or EPRI). Explain any differences between the sampling / testing methods and the selected referenced guidance. (v) For chemical analysis, identify sample size and chemical analysis (mean and standard deviation for each element) for each analyzing technique.

Response to Requested Item I.A.3

(i) The weld matrix (Enclosure 3) includes a listing of weld material based on a review of applicable Weld Procedure Specifications (WPS) and Weld Data Reports (WDR) for comparable piping. Note that piping material requirements are included in the isometrics provided in response to requested item I.A.1. All Code piping in the scope of the Alternative Plan has been supplied by an NPT Stamp holder and vendor documentation for this material is on hand. This accounts for material certification for all of the piping within the scope of the Alternative Plan and the large majority of the welds in that piping. The outstanding material certification issue to be addressed herein is that associated with welding materials for a relatively small group of field installed welds on the large bore (12" and up) Code piping. During construction, filler metal traceability was accomplished by recording the material heat number on the WDR. The WDR was incorporated into the piping installation package, and typically became the only source of this information to be forwarded to document control. Since the WDRs for these field welds are not on hand, the traceability of filler metal cannot be established.

(ii) The WDR was used to provide the installation record for field welds. Generally, these reports are no longer on hand for the subject welds.

(iii) The WDR contained information pertaining to weld attributes, including identification of the items being welded, specification of the WPS to be used, welder identification, filler metal material identification, NDE requirements, and signature documentation (including that of the ANI) that all required attributes were satisfactorily performed and verified as complete. Reconciliation of missing information is presented in the weld matrix discussed in response to requested item I.B.4.

(iv) The sample size chosen for verifying filler metal composition of accessible (i.e., non-embedded) field welds is 100%. All of the accessible field welds (including welds for hanger lugs) in the large bore stainless steel Spent Fuel Pool Cooling System piping subject to the Alternative Plan have been evaluated for material composition using a Metorex X-Met Alloy Analyzer. Additionally, three of these stainless steel welds have been subject to laboratory analysis of chip samples to verify chemical composition. All three of the large bore carbon steel field welds in the CCW System subject to the Alternative Plan will be evaluated by laboratory analysis of chip samples since the alloy analyzer does not lend itself to reliable evaluation of this material. The use of these specific methods for determination of base metal is provided in the Corporate Welding Manual, Procedure NW-16. Chemical analysis was and will continue to be performed by a reputable and recognized laboratory (NSL Analytical Services, Inc of Cleveland, Ohio for completed analyses) to traceable standards. Since some blending of filler metal and base metal may have occurred with the field welds in question, the results of the filler metal analysis is being evaluated by CP&L's Materials Services Section - Metallurgy Unit (See Enclosure 4 for analysis of SFP field welds).

(v) Relative to physical sample size, Corporate Welding Manual Procedure NW-16 calls for the removal of about 5 grams of material for this type of analysis. The precise weight of the sample taken was not recorded, but was sufficient to facilitate the testing for which results are provided herein. Relative to the number of welds subject to chemical analysis, three of the field welds in the stainless steel Spent Fuel Pool Cooling piping were subject to composition analysis by both the alloy analyzer and chemical analysis of chip samples. Note that the purpose of subjecting these three welds to chemical analysis was not to provide inference to the entire population, but rather to demonstrate consistency with the alloy analyzer. Since the alloy analyzer does not lend itself to reliable composition analysis with carbon steels, all three CCW field welds will also be subject to laboratory analysis for material composition. The accuracy of the chemical analysis method for each element is listed in the laboratory test report. The laboratory analysis report from the three stainless steel samples already completed is included in Enclosure 4.

Requested Item 1.A.4

In the matrixes or on the isometrics, identify inaccessible non-embedded welds and embedded welds (all other welds should be accessible).

Response to Requested Item I.A.4

The isometrics are marked up to show which field welds are embedded and thereby inaccessible (Enclosure 2). All field welds which are not embedded are externally accessible.

Requested Item I.A.5

On the isometrics, indicate the specific location of each weld listed in I.A.2 and identify the boundaries of the systems that are considered safety related. Identify all non-safety related items that appear on the isometrics.

Response to Requested Item I.A.5

The isometrics are marked up accordingly (Enclosure 2).

Requested Item I.A.6

(i) Identify in the matrixes, or on the isometrics, the welds that will be or have been inspected or re-inspected that have Code documentation, welds that have been inspected that do not have Code documentation, and welds that will be or have been inspected or re-inspected not to Code. (ii) For the welds that will be or have been inspected or re-inspected but not to Code, describe the inspection technique, acceptance criteria, and documentation. (iii) Identify the edition and addenda of ASME Code that will be or has been used for the above inspections and re-inspections.

Response to Requested Item I.A.6

(i) Code documentation for welds performed by the piping vendor are included in the vendor data packages. As noted in the Alternative Plan (Enclosure 8 to HNP-98-188, dated 12/23/98), this accounts for approximately 160 of the roughly 200 welds in the large bore Spent Fuel Pool Cooling piping. Based on available evidence, all of the 40 piping field welds and the 12 hanger attachment pad welds were inspected to Code requirements, but generally do not have the Code required documentation available.

Documentation which is on hand for these field welds is listed on the matrix prepared in response to requested item I.A.2. (Enclosure 3).

(ii & iii) The accessible field welds within the scope of the Alternative Plan have been re-inspected using original surface examination criteria from ASME Section III, 1974 - winter 1976 Addenda, ND-5000. A portion of the inaccessible (embedded) field welds will be subjected to internal inspections using a high resolution, remotely operated video camera mounted on a pipe crawler. Details of these camera inspections, including inspection technique and acceptance criteria, are provided in response to requested items III.3 & III.4.

Requested Item I.A.7

Identify any non safety related items installed during the original construction which will be upgraded to safety related status by this amendment; e.g., will any of the non-safety-related ANSI B31.1 piping (Enclosure 8, page 7 of the submittal) be upgraded?

Response to Requested Item I.A.7

No such items installed during original construction will be upgraded for use in a Code application in support of this activity. No B31.1 piping will be upgraded for use in a Code or safety-related application. The turnover of piping and equipment within the scope of this activity will include a review of all Code items and documentation by the ANI to ensure that each item has the appropriate certification.

Requested Item I.A.8

Identify any commercial grade items requiring dedication installed during the original construction. For these items, is documentation of the dedication program available for review? Are the dedication packages for items available for review?

Response to Requested Item I.A.8

No commercial grade items were installed during the original construction which will now be used inside Code boundaries. The turnover of piping and equipment within the scope of this activity will include a review of all Code items and documentation by the ANI to ensure that each item has the appropriate certification.

Requested Item I.A.9

Identify any commercial grade items requiring dedication that will be used to complete construction.

Response to Requested Item I.A.9

No commercial grade items will be dedicated for use in a Code application by this activity. The turnover of piping and equipment within the scope of this activity will include a review of all Code items and documentation by the ANI to ensure that each item has the appropriate certification.

Requested Item I.A.10

(i) Was the piping system constructed in accordance with a 10CFR50 Appendix B Program? (ii) Is the construction Appendix B program documentation available for review? (iii) If construction was performed under a different program, identify the program. Is this program documentation available for review?

Response to Requested Item I.A.10

(i) The overall quality assurance program used by Carolina Power & Light Company for the design and construction of the Harris Nuclear Power Plant is described in the Shearon Harris PSAR. PSAR Section 1.8 states that "The Carolina Power & Light Company Quality Assurance Program for the engineering and construction of the Shearon Harris Nuclear Power Plant (SHNPP), which includes the quality assurance programs for both Ebasco and Westinghouse by reference, is structured with regard to safety-related equipment in accordance with the eighteen criteria of Appendix B to 10CFR50. In addition, the subject Program is structured in accordance with ANSI N45.2 and thereby Regulatory Guide 1.28 . . . ". The PSAR further states that the "Shearon Harris Nuclear Power Plant Quality Assurance Plan" was replaced by the "CP&L Corporate Quality Assurance Program" on April 1, 1974, and provides a cross reference on how the subject plan met the criteria of 10 CFR50 Appendix B.

(ii & iii) Certain aspects of Shearon Harris Nuclear Power Plant construction were subject to QA requirements beyond those outlined in the CP&L Corporate QA Manual. Since CP&L was not only the Owner, but also the constructor, installer, and a fabricator for Code items in the Shearon Harris Nuclear Power Plant, a separate QA Program was developed, reviewed, approved and implemented specifically to obtain the required ASME N, NA, and NPT Certificates of Authorization. ASME Code Section III, Subsection NA-4133.2 requires that an applicant for a Certificate of Authorization develop a QA program and implementing procedure specific to the proposed scope of work, and that "the applicant shall request the Society to review this procedure and Program prior to the issuance of a Certificate of Authorization." For construction of SHNPP, CP&L met this requirement by the formalization of its "ASME Quality Assurance Manual", intended to meet the criteria in Section III, Subsection NA-4100 of the

Code. All Code work by CP&L during the Construction of the Shearon Harris Nuclear Power Plant was performed to the requirements of this QA program manual. A copy of the ASME Quality Assurance Manual is provided in Enclosure 5.

Requested Item I.A.11

(i) Are the work control procedures and hold point sign-off documents from the original construction available for review? (ii) If these documents are required by Code, what documents are missing?

Response to Requested Item I.A.11

(i) Work control procedures and hold point sign-off documents from the construction era are available for review.

(ii) With the exception of the aforementioned WDRs and associated weld process control issues (including NDE) discussed in response to item I.B.4, CP&L has not identified any missing documents requiring consideration under the Alternative Plan.

Requested Item I.A.12

(i) Provide a list of qualified weld procedure specifications (WPS) used, and their procedure qualification records (PQRs). (ii) For welds missing welder identification, how will weld integrity be established.

Response to Requested Item I.A.12

(i) The welding procedures available for welding during the original construction of the piping in question were identified based on a review of available WPS in the welding manual at that time. A copy of these WPS and their PQRs are provided in Enclosure 6.

(ii) CP&L has located welder identification markings at each accessible field weld in the scope of the Alternative Plan. These Code required welder symbols can be traced back to the welder responsible for each such weld, and from there, qualification records on file can be used to establish that each welder was appropriately qualified.

These markings are not accessible on embedded welds. However, alternate QC records have been located which identify the welders for three of these fifteen welds, and numerous programmatic and procedural assurances existed to ensure that welds were made using qualified welders and weld procedures. For embedded welds, internal camera inspections (as described in response to RAI Items III.2, 3 & 4) will be used to augment programmatic and procedural assurances relative to the quality of these welds.

In addition, since the Spent Fuel Pool Cooling piping nozzles exit into the pools below the water level, the portions of the Spent Fuel Pool Cooling System piping attached to the spent fuel pools (including the embedded piping) are flooded as well. Beyond internal camera inspections, water chemistry in these legs of piping will be analyzed to ensure that Microbiologically Induced Corrosion or other corrosion mechanisms have not resulted in degradation of the integrity of field welds or piping.

B. Applicable Regulations for Welds and Piping Systems Within the Scope of the Proposed Alternatives

Requested Item I.B.1

1. Identify the edition and addenda of Code and any Code cases that were used for original construction of the welds and piping systems. If not the same for all the welds, identify the Code requirements for each weld or group of welds.

Response to Requested Item I.B.1

Piping was installed to ASME Section III, 1974 Edition, Winter 1976 Addenda. The PSAR and current FSAR provide the CP&L position on conformance to the requirements of Reg. Guides 1.84 and 1.85 relative to use of Code cases. A review of the N-5 Code Data Report associated with turnover of Unit 1 SFP piping identifies two Code cases used at some point in its construction; it is reasonable to assume that these same Code cases may have been used on the corresponding Unit 2 piping and equipment. These Code cases are:

N-240	"Hydrostatic Testing of Open Ended Piping, Section III, Division 1"
N-275	"Repair of Welds, Section III, Division 1"

Likewise, a review of the Unit 1 CCW N-5 Code Data Report shows these Code cases in association with its construction:

N-275	"Repair of Welds, Section III, Division 1"
N-224	"Use of ASTM A500 Gr. B and ASTM A501 Structural Tubing for Section III, Class 2, 3 and MC"
N-224-1	"Use of ASTM A500 Gr. B and ASTM A501 Structural Tubing for Section III, Class 2, 3 and MC"
N-282	"Nameplates for Valves, Section III, Division 1, Class 1, 2 and 3 Construction"
N-127	"Alternative Rules for Examination of Welds in Piping, Section III, Class 1 and 2 Construction"

Requested Item I.B.2

Identify the edition and addenda of Code and code cases that will be used to complete construction of the piping systems. Identify any exceptions to Code requirements and justifications for these exceptions.

Response to Requested Item I.B.2

Construction will be completed to ASME Section III, 1974 Ed, Winter 1976 Addenda. Code Case N-240 will be used to exempt formal requirements for hydro testing of the embedded piping connected to the atmospheric spent fuel pools due to the lack of accessibility. The need to invoke other specific Code cases has not been identified. Use of any such Code case would be consistent with CP&L's position regarding conformance with Reg. Guides 1.84 and 1.85. Relative to exceptions to Code requirements, CP&L does not take any such exceptions beyond those specifically identified and addressed by this Alternative Plan.

Requested Item I.B.3

Identify the edition and addenda of Code and code cases that were or will be used for repair and replacement of welds and piping.

Response to Requested Item I.B.3

No repair or replacement activities have been performed on the Code piping subject to the Alternative Plan. Future repair and replacement activities (after completion of construction and turnover) will be governed by the site Section XI Repair and Replacement program.

Requested Item I.B.4

Provide a matrix (See I.A.2) that identifies the specific paragraph in Code that is applicable to missing weld documents. Identify documentation deficiencies for each weld. Identify any exceptions to Code requirements. Provide alternatives and justifications for these exceptions.

Response to Requested Item I.B.4

A matrix has been provided in Enclosure 7 for Code requirements pertaining to missing weld documents. Additional information relative to specific welds is provided in Enclosure 3. Alternatives and justifications are identified in Enclosure 2 and discussed elsewhere in the Alternative Plan and this RAI response.

Requested Item I.B.5

Identify the ASME requirements, including administrative requirements, that were completed prior to stoppage of the original construction of the piping systems. Is documentation of these completed requirements available for review? What ASME data reports were filed and what were their filing dates?

Response to Requested Item I.B.5

None of the piping or equipment in question had completed the system certification process and received an N-Stamp. Generally, requirements which were met are consistent with the status of construction at the time work was halted. For instance, embedded piping had been installed, inspected and tested prior to pouring concrete, but accessible piping immediately adjacent was still under construction. The availability of records for the construction varies. Generally, records generated by site construction during the installation of the subject piping is not on hand. However, records generated as a result of QC oversight (NCRs, DDRs, audits, etc) are on hand and retrievable. Notably, hydro test records are also generally available for that portion of construction that proceeded to the extent of hydro testing, including embedded Spent Fuel Pool Cooling System piping. Hydro test documentation, including verification of weld documentation, is available for all but 2 of the 15 embedded field welds. The remaining 2 are included in the liner leak test boundary and would have been procedurally required to be verified as complete, but were not specifically included in the leak test as inspection items. (See Enclosure 3 for identification of records available, and Enclosure 8 for the hydro test records specifically discussed herein.) No partial data reports were filed on the subject piping systems. Manufacturer's Code data reports from NPT suppliers are available in document control for the subject piping, as are warehouse receipt inspection records. These records will be subject to review by the ANI as part of the system turnover process.

Requested Item I.B.6

Identify ASME survey inspections conducted prior to stoppage of the original construction of the piping systems. Provide documentation for representative internal / external audits conducted during the peak construction periods for the welds in question (1978 - 1979), particularly in the areas of work control, welding, material traceability and records.

Response to Requested Item I.B.6

There are no documented ASME survey inspections on hand specific to the construction of the piping systems in question. There were, of course, ASME surveys associated with CP&L obtaining and maintaining its N, NA and NPT Certificates of Authorization. This was originally accomplished by an interim letter of authorization in July, 1978 allowing CP&L to commence Code work. A follow up survey on the effectiveness of the program was conducted in July of the following year, with additional audits occurring in 1982 and 1985, in accordance with Code requirements.

Information pertaining to audits and inspections performed by parties other than the ASME is provided in response to requested item I.B.7, below. Also, note that the majority of construction for the welds in question occurred during the '81 - '83 time frame, as attested to by QC records and other documents associated with this construction.

Requested Item I.B.7

Identify third party inspections conducted prior to stoppage of the original construction of the piping systems. Provide a representative sample of documentation for these inspections.

Response to Requested Item I.B.7

A number of ANI inspections specifically associated with the construction of the Unit 2 & 3 SFP Cooling piping are documented in the form of QA surveillance records, hydro test records and other types of records which would have been subject to ANI review. Generally, the ANI inspection records which cannot be retrieved are those associated with WDRs and pipe spool packages. Records for which ANI inspections / reviews are documented are identified in Enclosure 3.

In addition, Corporate QA / QC, which operated independently of the site construction program, provided both quality inspections of work activities and audits on construction activities. Records for which QC inspections are documented are identified in Enclosure 3, and representative samples of QA audits of the construction program are provided in Enclosure 9. Finally, the NRC performed regular inspections of construction activities, with follow-up activities being initiated as needed for issues identified and tracked to satisfactory closure.

Requested Item I.B.8

With regard to piping system components / services performed by others, provide documented validations of these vendors services. Provide the documentation of the audits of the supplier of prefabricated piping.

Response to Requested Item I.B.8

A review has been conducted which identifies that Code data reports are on hand for pipe spools and components inside Code boundaries. The turnover process for completion and activation of this portion of the plant will include a review of these documents by the ANI. CP&L intends to replace any piping or equipment provided by an outside supplier for which appropriate Code records cannot be located. Audit records of the supplier of prefabricated piping and a representative sample of a piping vendor data package are included in Enclosure 10.

II. Completion of Piping System (General)

Requested Item II.1

(i) Identify the differences between HNP's proposed construction program to complete the SFP C and D and the original construction program under HNP's N certificate. (ii) How will these differences be reconciled?

Response to Requested Item II.1

(i) CP&L proposes to complete construction per the design requirements of the original construction Code. CP&L is requesting that exception be allowed under 10CFR50.55a.(a)(3)(i) to certain QA requirements generally found in Section III, Subsection NA and associated with having certificates of authorization for construction and installation of Code items, and to requirements regarding N-Stamping of the completed systems.

(ii) CP&L proposes to reconcile the differences between the original program and the program to be used for completion by providing comparable assurances, tests, inspections and reviews as needed to assure an acceptable level of quality and safety in accordance with 10CFR50.55a.(a)(3)(i). It is CP&L's intention to complete construction using the current Corporate Appendix B QA Program, augmented by supplemental QA requirements to ensure that the intent of Code requirements are adequately addressed. (See response to requested items III.14, 15 & 16).

Requested Item II.2

Will data packages be prepared?

Response to Requested Item II.2

Yes. CP&L is implementing a turnover plan which closely emulates that associated with the N-Stamping process, including preparation of Section III style data packages and third party (ANI) review.

Requested Item II.3

What third party verification is planned?

Response to Requested Item II.3

The Hartford Steam Boiler Insurance and Inspection Co. has been in discussions with CP&L throughout the development of the Alternative Plan. The role that Hartford will play in the certification / turnover process is very similar to that which would be followed in an N-stamping process. It is intended that the ANI will review work packages, participate in field inspections, participate in resolution of field discrepancies and non-conformances, and conduct a final review and certification process much like that done for the preparation of an N-5 data report for each affected system within Code boundaries. Details of this process are contained in a set of "Supplemental QA Requirements" developed for this activity (See response to III.14). A copy of the generic data report to be used for installation of Code items is provided in Enclosure 11.

III. Specific Comments on Submitted Information

Requested Item III.1

(i) What was the basis for selecting the four externally accessible field welds for internal examination? (ii) Identify these welds in the matrix provided in response to I.A.2 above.

Response to Requested Item III.1

(i) Field welds were generally used to join long sections of prefabricated piping, and so were (are) not typically accessible for internal examination with the naked eye. The four field welds in question join the strainer nozzles to the piping, and were identified by a field walk down as being those field welds which could be accessed without specialized pipe crawling / camera equipment. One of these welds is only a few feet away from an open pipe end, lending itself well to visual examination with the assistance of an examination mirror. The other three field welds were subject to a more limited inspection by inserting a boroscope through nearby pressure taps. Note that a more detailed internal examination of these welds will be performed and formally documented when the strainers are disassembled, using the same internal inspection criteria as developed for the remote camera inspection discussed in III.2, 3, 4 & 5 below.

(ii) These welds are identified on the matrix (Enclosure 2) as 2SF-37-FW-441, 2SF-36-FW-449, 2-SF- 36-FW-450 & 2-SF-38-FW-451 .

Requested Item III.2

With reference to the "substantial portion of the embedded piping and field welds", identify these welds in the matrix provided in response I.A.2

Response to Requested Item III.2

These welds have been identified on Enclosure 3 as requested.

Requested Item III.3

Provide a summary of the inspection procedure used for remote inspection of embedded welds.

Response to Requested Item III.3

The procedure will use a pipe crawler mounted camera to perform a detailed inspection of the interior surfaces of embedded field welds. The procedure will include demonstration of camera resolution capability to at least 1/32" wire, and performance demonstration of inspector's ability to discern and disposition flaws of the nature which might be expected to be encountered. The inspection procedure will be developed and approved by a Level III inspector under the Corporate NDE Program. Inspections will be performed by an appropriately qualified Level II inspector.

Requested Item III.4

With reference to the remote inspection of the embedded welds, identify the critical characteristics that will be verified and the acceptance criteria to be used.

Response to Requested Item III.4

The inspection will specifically include examination of field welds for the following:

No cracks
No lack of Fusion (LOF)
No lack of Penetration (LOP)
No oxidation ("Sugaring")
No undercut greater than 1/32 inch
No reinforcement ("Push Through") greater than 1/16 inch
No Concavity ("Suck Back") greater than 1/32 inch
No porosity greater than 1/16 inch
No inclusions

Generalized inspections will be performed on the piping interior for indications of arc strikes, foreign material, high / low, mishandling indications, etc,. Any such indications shall be noted and characterized during the inspection and evaluated by Engineering if necessary.

In addition, since the Spent Fuel Pool Cooling piping nozzles exit into the pools below the water level, the portions of the Spent Fuel Pool Cooling System piping attached to the spent fuel pools (including the embedded piping) are flooded as well. The inspection procedure will also include criteria and instructions to conclusively ascertain if

Microbiologically Induced Corrosion or other corrosion mechanisms have resulted in degradation of this piping.

Data Recording - The following information will be recorded for each inspection:

1. The inspection will be recorded on videotape in a manner which will facilitate future review and evaluation.

2. Indication location (circumferential, side of weld, etc.), length, and depth (where applicable) shall be documented and recorded on tape.

References - The following references were used to establish this criteria:

ASME Section III, ND-4424 Winter 76 Addenda
ANSI B31.1 Paragraph 136.4.2, 1980 Edition
Corporate Welding Manual NGGM-PM-0003, NW-02, NW-06

Requested Item III.5

Provide results of remote inspection with any identified discrepancies

Response to Requested Item III.5

Camera inspections are currently planned for late May or early June of 1999. Results will be provided upon completion of this activity.

Requested Item III.6

Provide a completed weld data report, representative of those that were discarded. Identify the critical characteristics and explain how, in lieu of records, each will be validated.

Response to Requested Item III.6

A sample WDR is provided in Enclosure 12. Note that this is a WDR for one of the 15 embedded field welds, extracted from a DDR (Deficiency Disposition Report) in which a QA inspector questioned the identity of the adjacent pipe spool. Code required attributes recorded on the WDR are identified and reconciled in Enclosure 6.

Requested Item III.7

With reference to the procurement specification (SS-021, Purchasing Welding Materials for Permanent Plant Construction), did other specifications for other filler materials exist?

What assurances are provided that these other filler materials were not used for the embedded piping.

Response to Requested Item III.7

SS-021 is the site spec for procurement of filler material used in the SHNPP Construction Program and referenced in the Work Procedures which implemented this program. SS-021 is the specification for filler material specifically invoked by Code work procedures; no substitutes were identified or allowed. Research has not identified any other specification for this purpose in association with construction of SHNPP. Being a fairly new plant, CP&L still employs many of the weld engineers and craft personnel associated with the original construction effort. Numerous interviews of these personnel consistently provide the same conclusion; that filler material purchased by CP&L for use in Code work in construction of SHNPP was procured to this specification.

Requested Item III.8

Provide any updates / supplements to the Alternative Plan as they become available.

Response to Requested Item III.8

These will be provided as requested.

Requested Item III.9

With reference to the "large percentage of embedded field welds" that will be inspected, identify these welds on the matrix provided. Provide technical justification for not inspecting the remaining welds.

Response to Requested Item III.9

The matrix has been marked up as requested. The "large percentage of embedded field welds" referred to are those which CP&L has a high level of confidence can be accessed with available pipe crawling equipment based on a walk down with the vendor for pipe crawler / camera services. The enclosed weld matrix (Enclosure 3) specifically identifies the base scope of field welds which are targeted for inspection. Currently, 6 of the 15 embedded field welds are included, which notably includes both of the field welds for which hydro test records are not available.

Assurance of quality for any embedded field welds which are not subject to remote camera inspection is provided by conformance to the requirements of QA Program(s) and implementation procedures which existed at the time of construction along with the body of evidence which directly support adherence to those requirements. This evidence includes: uniform application of QA requirements for the entire site construction program, (including the completed and licensed Unit 1 facility), surveys, inspections, and audits verifying the effectiveness of QA program requirements, construction records which are on hand that attest to quality of construction, and re-performance of Code required inspections on accessible field welds in these same lines with no rejectable indications identified.

Requested Item III.10

(i) Explain what is meant by the statement that internal examination of the embedded welds provides a measure of quality assurance beyond Code requirements. (ii) What additional physical or material attributes will be verified?

Response to Requested Item III.10

(i) This statement is simply intended to identify that many of these welds would have been inaccessible for routine internal inspection at the time of construction (due to distance from an open pipe end), and since no Code requirements existed to do so, would not have been subject to an internal visual examination. Given this, internal camera inspections represent an activity above and beyond that which would have been required under the original construction program.
(ii) See response to requested items III.3 & 4.

Requested Item III.11

The submittal refers to opinions by Bechtel and Hartford concerning the benefits in accordance with an N certificate program. Are these opinions documented and available for review?

Response to Requested Item III.11

Hartford's endorsement of the Alternative Plan is provided in Enclosure 13. Note that this letter is authored by Dr. Richard E. Feigel, Vice President of Hartford Steam Boiler Inspection and Insurance Co. and Chairman of the ASME Council on Codes and Standards. Bechtel's endorsement of this plan is implicit in that they, as the design A/E, have fully reviewed and incorporated the Alternative Plan into the design change packages for this activity.

Requested Item III.12

Provide a copy of the site ASME Section III QA program used during original construction.

Response to Requested Item III.12

A copy of the ASME Section III QA Program manual is provided in Enclosure 5.

Requested Item III.13

(i) Provide a copy of the Corporate QA program that will be used to complete construction. (ii) (Provide a list of implementing quality control procedures for welder qualification, weld procedures, inspections, documentation, etc).

Response to Requested Item III.13

(i) A copy of the current Corporate QA Program Manual is provided in Enclosure 14. Note that this program manual is used with FSAR Section 17 to define the overall corporate QA program.
(ii) All welding will be accomplished in accordance with the Corporate Welding Manual, which conforms to the requirements of Section IX with regard to welder qualification, weld procedures and process control. NDE will be performed in accordance with the Corporate NDE Manual. The site Mechanical Modification Procedures (MMPs) are those procedures which will primarily be used to control work control processes. The list of MMPs most applicable to this activity and the index from the Corporate Welding and NDE Manuals are provided in Enclosure 15.

Requested Item III.14

Provide a copy of the supplemental quality assurance requirements developed to augment the Corporate QA Program, which was based on a review of the approved Construction QA Program at the time of construction versus the existing Corporate QA Program.

Response to Requested Item III.14

Supplemental QA Requirements are provided in Enclosure 16.

Requested Item III.15

Provide documentation of the referenced comparison of approved ASME Section III Construction QA Program Manual with the effective Corporate 10CFR50 Appendix B QA Program.

Response to Requested Item III.15

Documentation of the referenced comparison is provided in Enclosure 17.

Requested Item III.16

Provide documentation of the supplemental quality assurance requirements that have been developed specifically for the purpose of addressing differences between ASME Section III quality assurance requirements and the Corporate 10CFR50 Appendix B QA Program.

Response to Requested Item III.16

The ASME Section III QA Manual discussed in response to requested items III.14 and III.15 above is the document which was reviewed by the ASME and singularly credited for assuring compliance with Section III requirements in order to authorize CP&L to perform N, NA and NPT stamp activities. The overall corporate QA program may have shared procedures, facilities, etc. with this program, but was not directly relied upon to assure compliance with Section III during the construction effort. Given this, the Supplemental QA Requirements provided in response to requested item III.14 and the QA manual comparison provided in response to item requested item III.15 provide the documentation requested in this item as well.

CONTENTION TC-3: EXHIBIT 2b

CP&L ASME Quality Assurance
Manual (For Construction)
(Rev. 9, 1985)
(Excerpts)

(Enclosure 5 to 4/30/99 RAI Response)

CP&L

Carolina Power & Light Company

ASME
QUALITY ASSURANCE MANUAL

SHEARON HARRIS NUCLEAR POWER PLANT
POST OFFICE BOX 101
WAKE COUNTY, NEW HILL, NORTH CAROLINA

Recommended by: ______________________ 6/12/85
Manager - Corporate Quality Assurance Department

Recommended by: ______________________ 6/13/85
Vice President - Nuclear Engineering and Licensing Department

Recommended by: ______________________ 6/12/85
Vice President - Nuclear Plant Construction Department

Recommended by: R.A. Watson 6/12/85
Vice President - Harris Nuclear Project Department

Recommended by: ______________________ 6-12-85
Senior Vice President - Nuclear Generation

Approval by: ______________________ 6-20-85
Senior/Executive Vice President
Power Supply and Engineering & Construction

Original: May 24, 1978
Second Edition, Rev. 0 - April 27, 1982
Second Edition, Rev. 1 - January 20, 1983
Second Edition, Rev. 2 - April 27, 1983
Second Edition, Rev. 3 - April 29, 1983
Second Edition, Rev. 4 - August 8, 1983
Second Edition, Rev. 5 - September 23, 1983
Second Edition, Rev. 6 - October 21, 1983
Second Edition, Rev. 7 - January 12, 1984
Second Edition, Rev. 8 - February 29, 1984
Second Edition, Rev. 9 - July 3, 1984
Second Edition, Rev. 10 - October 17, 19
Second Edition, Rev. 11 - March 21, 198
Second Edition, Rev. 12 - April 24, 198
Second Edition, Rev. 13 - June 24, 1985
Second Edition, Rev. 14 - November 25,

Second Edition
Rev. 4

Policy Statement

It is the policy of the Carolina Power & Light Company to engineer, construct, and operate nuclear power plants without jeopardy to public health and safety. Measures shall be set forth and documented for quality assurance which encompass those responsibilities within CP&L and those responsibilities delegated to companies supporting the engineering, construction and start-up of nuclear power plant projects. These documented measures comprise the CP&L ASME Quality Assurance Manual and shall be strictly adhered to. This Manual provides quality measures for assuring nuclear safety for long-term power production; engineering design requirements and objectives are achieved in construction of new facilities; and plant functional capability is maintained in operating plants. These measures assure compliance with the quality requirements of ASME Boiler and Pressure Vessel Code, Section III, Division 1, Nuclear Power Plant Components and applicable Federal, State and local regulations and codes.

I take full and complete responsibility for the program described in this CP&L ASME Quality Assurance Manual. I have assigned the responsibility for its implementation as documented and approved herein for the Engineering, Construction and Start-Up portions of this program to the Senior Vice President - Nuclear Generation, and to the Manager - Corporate Quality Assurance Department.

The Senior Vice President in charge of Nuclear Generation has assigned the responsibility for implementation of his portion of this program to the Vice President - Harris Nuclear Project, and to the Vice President - Nuclear Plant Construction and the Vice President - Nuclear Engineering and Licensing who shall have stop-work authority within their department's responsibility for work determined to be out of compliance with this program.

The Manager - Corporate Quality Assurance Department, in the implementation of his portion of this program, has delegated to the Manager - Quality Assurance/Quality Control Harris Plant and the Manager - Quality Assurance Services, the authority to stop any work determined to be out of compliance with applicable sections of the ASME Code and this program.

The Manager - Corporate Quality Assurance Department has the responsibility for implementing the Corporate quality assurance audit program for the engineering, construction and start-up of nuclear power plants.

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

5.0 STORAGE AND PROCESS CONTROL

5.1 Storage

The Discipline Managers/Manager Project Administration are responsible for issue of procedures for storage control of Code items to prevent damage, deterioration or loss. When necessary special coverings, special equipment, and special protective environments such as, inert gas atmosphere, specific moisture content levels, and temperature levels shall be specified and provided in storage procedures.

5.1.1 The Director - QA/QC is responsible for surveillance of storage areas containing Code items in accordance with Harris Plant QA/QC Section procedures to assure that items are properly controlled and protected. Nonconformances shall be identified and dispositioned in accordance with Section 10.0.

6

CONTENTION TC-3: EXHIBIT 2c

Present CP&L Corporate (Appendix B)
Quality Assurance Manual
(Excerpts)

(Enclosure 14 to CP&L 4/30/99 RAI Response)

Present Corporate (Appendix B) Quality Assurance Manual

CP&L

NGG PROGRAM MANUAL

Title: Quality Assurance Program Manual		
Lead Department: PERFORMANCE EVALUATION & REGULATORY AFFAIRS		
NGG Program Manual Number: NGGM-PM-0007	Revision Number: Rev. 1	Effective Date: July 10, 1998

Revision 1:

Sections 19.0 and 20.0 were combined into Section 19.0 to provide more detailed requirements in establishing the Graded Approach to Quality for Software. The procedures implementing the requirements of these Sections will become effective August 18, 1998, after training has been presented on the implementing procedures and the changes to the QA Program Manual. Therefore the changes to this manual will also have an effective date of August 18, 1998. In addition, Section 3.4.2 was revised to correct an error in performing design verification, and Enclosure 1, CP&L Quality Assurance Program Policy, was added to ensure that the Quality Assurance Program Policy on the Intranet is appropriately controlled.

Approved By:

C S Hinnant
Senior Vice President and Chief Nuclear Officer

7-7-98
Date

1.0 INTRODUCTION

1.1 CP&L QUALITY ASSURANCE (QA) PROGRAM - SCOPE

This manual amplifies the CP&L committed 10CFR50 Appendix B Quality Assurance Program (QAP) requirements described in (U)FSAR Section 17.3 and establishes measures for assuring that organizations performing **safety-related** activities perform their responsibilities in a manner which results in safe nuclear power production. This manual also establishes the QA programs for the non-safety related areas of RW-Q, FP-Q, and **Quality Class B**. Additional QA requirements imposed on individual plants by regulations and commitments shall be considered a part of the QAP. Other QA programs are established in this manual to comply with requirements, either required by regulators, or determined to assist the company implement structured programs beneficial to the operation of the nuclear plants.

The guidance provided in this manual is not all inclusive. It is intended to be used in conjunction with Sections 1.8 and 17.3 of the (U)FSARs to develop procedures that implement the CP&L Quality Assurance Program.

1.2 SCOPE OF APPLICATION

The measures described in this manual have been written to comply with the Quality Assurance requirements of certain regulatory documents identified in Sections 1.8 and 17.3 of the (U)FSARs. The applicable regulatory commitments are identified in each section.

The manual is arranged in functional sections to facilitate its use and includes additionally Appendix I which cross-references functional subjects with the applicable criteria of 10CFR50, Appendix B, and Appendix II which contains QA program regulatory guide references.

A list or system identifying items to which Sections 1.0 through 19.0 apply shall be maintained at each nuclear plant or work location. The responsibility for maintaining this list or system shall be identified in procedures or interface documents.

1.2.1 Sections 1.0 through 14.0--Scope of Application

For compliance with 10CFR50, Appendix B, and 10CFR72 the provisions of Sections l.0 through 14.0 shall be applied to activities associated with **safety-related** materials, equipment, and **services**.

1.2.2 Section 15.0--Scope of Application

This section identifies measures for compliance with the QAP requirements for fire protection systems, components, parts, and administrative programs.

that source-inspected items are marked, labeled, and traceable to documentation packages and that documentation packages include records required by procurement documents, as a minimum. Any inspections or tests required per Section 5.3.3 which are not performed during source inspection shall be performed by appropriately qualified personnel upon receipt of the item(s) by CP&L.

5.3.6 Measures shall be taken to assure that items, including those subdivided, are properly identified from the time of receipt to the point of installation. Identification markings shall be applied in a manner that will not affect the function of the item.

5.3.7 The required identification and status markings shall be retained with the items or records traceable to the items. The identification of each item shall be included in the record of assembly or installation. For uninstalled items in work areas, status indicators such as markings, tags, or notations on work control documents shall be applied to show the latest status.

5.3.8 When items or required documentation for the items do not conform to requirements, the items shall be identified as nonconforming. Nonconforming items will be identified and controlled until proper disposition is made.

5.3.9 A receipt inspection documentation package shall be prepared and will include or reference for **traceability** the procurement documents, receipt inspection report, special inspection reports, certifications, plant-generated documents, and contractor-furnished documents. The documentation package shall be retained as QA Records.

5.4 CONDITIONAL RELEASE OF NONCONFORMING ITEMS

5.4.1 A **conditional release** may be initiated to permit progression of work involving a nonconforming item awaiting resolution. The request shall contain the necessary justification and limitations prior to review and approval.

5.4.2 If reasonable control and **traceability** can be maintained, a **conditional release** may be issued to permit limited use, installation, or testing of an item. The item shall be clearly tagged or otherwise traceable to show the status and the permitted actions.

5.5 MATERIAL STORAGE AND RELEASE

5.5.1 Items shall be stored in designated storage areas. Identification tags or marks and the inspection status shall be retained on items or on records which are traceable to the items. Release of accepted items shall be controlled to prevent damage, deterioration, or unauthorized storage and release.

5.5.2 Nonconforming items shall be segregated and stored in a designated storage area, when practical, to await disposition. When it is not practical to segregate nonconforming items, they shall remain tagged and held in storage areas until properly dispositioned.

5.5.3 Items shall be controlled to assure that they are properly dispositioned at the end of their specified shelf life or qualification period.

5.5.4 The appropriate handling equipment shall be provided and controlled to assure safe and adequate handling. Designated equipment shall be periodically inspected and tested to criteria established in procedures.

5.6 STORAGE INSPECTION PROGRAM

5.6.1 Inspection shall be maintained over items in storage areas. This program shall include:

5.6.1.1 Periodic inspections to assure that items are properly controlled, maintained, and protected. Inspections shall be documented.

5.6.1.2 The identification and control of nonconforming items until proper disposition is made.

6.0 PROCEDURES AND DRAWINGS

6.1 SCOPE

This section establishes requirements for preparation, review, approval, and control of procedures and drawings for **activities affecting quality.**

6.2 RESPONSIBILITY

Each organization performing **activities affecting quality** is responsible for ensuring this section is properly implemented in their area of responsibility.

6.3 REGULATORY COMMITMENTS

This section utilized in conjunction with Regulatory Guide 1.33 and American National Standards Institute N18.7 as committed in Sections 1.8 and 17.3 of the (U)FSAR, establishes the requirements essential to comply with the associated portions of 10CFR50 Appendix B.

6.4 PROCEDURES AND DRAWINGS

6.4.1 Appropriate procedures shall be developed for the preparation, review, approval, and issue of procedures and drawings.

6.4.2 The accomplishment of **activities affecting quality** shall be in accordance with approved procedures and/or drawings which are appropriate to the circumstances.

CONTENTION TC-3: EXHIBIT 2.d.

Enclosure 16 to 4/30/99 RAI Response (Supplemental Quality Assurance Requirements for the Design Change Packages Associated with Completion of the Units 2 & 3 Spent Fuel Cooling System)

16

Supplemental Quality Assurance Requirements for the Design Change Packages Associated with Completion of the Units 2 & 3 Spent Fuel Pool Cooling System

SUPPLEMENTAL QA REQUIREMENTS

The following is a set of supplemental QA requirements developed for the implementation and turnover of Code items associated with the completion and activation of the Unit 2 & 3 Spent Fuel Pools at Harris Nuclear Plant. This document will be incorporated directly into the "Design Requirements" section of the design change packages for the pertinent modifications, and then by specific instructions in the appropriate sections (installation, testing, turnover, etc) as necessary to ensure that its requirements are implemented.

1.0 GENERAL

1.1 Scope

This document defines the set of QA requirements which will be used to govern the engineering, construction and startup of the Section III, Class 3 portions of the Spent Fuel Pool Facilities originally intended to service HNP Units 2 & 3. This portion of the plant was partially installed during original plant construction, but was suspended subsequent to cancellation of these units. The development of a supplement specific to this scope is necessitated by the following concerns:

- The original N-certificate associated with this program has long since been discontinued, and no partial turnover was conducted for the partially installed piping and equipment.
- The field construction documentation packages for partially installed piping have been discarded and are no longer available

As a result of the above, it is not possible to complete these systems in full compliance with Section III utilizing the previously installed piping and equipment. Since the N stamping process is the prescribed method for demonstrating quality assurance in construction activities, it is necessary to define a suitable alternate program which will ensure that the requisite level of quality exists upon completion and turnover. Generally, the corporate Nuclear Generation Group's Quality Assurance Manual is of suitable rigor to accomplish this. However, the program defined in the corporate QA manual was developed to comply with 10CFR50 Appendix B as it concerns operating plants, and was not intended to specifically conform to the requirements of Section III. For example, the corporate QA program outlines condition reporting requirements which govern field activities and meets the requirements of Appendix B in this regard. However, this program does not integrate involvement of the ANI in documenting adverse conditions, nor does it require the ANI to participate in the closeout of adverse condition reports. In addition, the current site procedures pertaining to field activities are generally oriented towards meeting the requirements of Section XI for inservice inspection, rather than Section III.

To address this issue, a set of QA requirements have been developed and are presented herein to supplement the corporate Appendix B QA Program. Generally, these requirements were the result of a review of the current corporate Appendix B Quality Assurance Program against the requirements of the approved ASME Section III QA

Manual utilized for construction of the Harris Nuclear Plant. These requirements are not intended to delete or revise any requirements in the corporate QA manual, but rather are to provide additional criteria in supplement of the existing program. These criteria will be implemented in one of the following manners:

Revision of site procedures: Since this supplement is not intended to contradict approved site procedures, this might be necessary to reconcile conflicts between the Supplemental QA Requirements and that of existing site procedures.

Incorporation through the work control process: When criteria are stipulated that are not already reflected in site procedures, it may be more suitable to add these through work planning and specific instructions in the work package. The requirements for additional involvement of the ANI would be an example of this.

Procedure revisions will be reflected by markups and inclusion on the Document Update Form (DUF), while work package implementation will be accomplished by specific instruction in the appropriate section of the modification package (implementation, testing, etc.).

1.2 Responsibilities

General - Programmatic responsibilities for implementation of the Corporate Appendix B program, including the site's Section XI Repair and Replacement Program, are as defined in the Corporate Quality Assurance Program Manual and supporting documents, including site procedures. The involvement of site organizations as pertains to the implementation of these supplemental requirements will be subject to their review and approval during the modification approval process.

AIA (ANI) - The Authorized Inspection Agency is responsible for providing the support necessary for implementation of the supplemental requirements described in this ESR. Acceptance of these requirements will be based upon NRC review and approval of the 10CFR50.55a Alternative Plan. Formal AIA endorsement of these supplemental requirements from a programmatic perspective will accomplished by review and approval of the modification packages which incorporate them.

Modification Engineer - The Modification Engineer for the affected ESR is responsible for implementing the requirements found herein in the most appropriate manner. This would include either revision of site procedures or through direct incorporation into the modification package, as described above.

Modification Responsible Engineer - This supplement pertains only to modification activities completing construction of the spent fuel cooling systems originally intended to service Units 2 & 3. As such, the ultimate responsibility for adherence for this rests with the RE for these modifications. Since this supplement will be incorporated into the modification packages, the RE is responsible for ensuring that the modification package contains sufficient instructions and guidance to implement it as written.

2.0 DESIGN AND DOCUMENT CONTROL

2.1 Design Control

Design Control over the modification design is directed and coordinated by CP&L in accordance with corporate and site procedures governing the modification process and design activities by outside organizations. This process results in rigorous design review process (including independent design verification) by the A/E and detailed owner's reviews by CP&L engineering personnel.

This supplement pertains only to modification activities completing construction of the spent fuel cooling systems originally intended to service Units 2 & 3. Generally, it is intended that completion of this portion of the plant will be governed by the same revisions of the Code that were utilized for original design and construction. To that end, the applicable version of the Code associated with a particular aspect of construction, and the boundaries of that applicability shall be clearly defined as design inputs in the modification packages. Later versions of the Code may be used only with reconciliation of any differences between it and the Code that was utilized for original design and construction.

2.2 Design Specifications

2.2.1 Design specifications will be prepared for all Code stamped items, in accordance with corporate and site procedures, and will be subject to the following requirements:

- The specification shall clearly delineate Code classification and boundaries and the pertinent code revision associated with the item.
- The specification shall address Code requirements for data reports, including any that may pertain to transmittal to enforcement authorities.
- The specification shall fully conform to Section III design requirements.
- The design specification shall be certified to be correct, complete, and in compliance with the code by one or more Registered Professional Engineers competent in the applicable field of design of components and related nuclear power plant requirements. It is noted that some of site's existing design specifications date back to the construction era, but may have been revised since the plant began operation. In these instances, it is acceptable to use previous certified revisions of design specifications, so long as a reconciliation of any subsequent revisions is performed to assess design impact and integration into the current the Appendix B Program.

2.3 Design Control

2.3.1 Design control shall be as directed in the corporate QA program as implemented by corporate and site procedures.

2.3.2 Design of Code stamped items shall conform to the version of the Code which would have been utilized during original plant construction. Later versions can be utilized only with documented reconciliation. Design criteria of Section III, Subsection ND shall apply to all Class III piping, equipment and components.

2.3.3 Subsequent revision to the affected modification packages shall also be subject to the supplemental requirements defined herein through completion of construction and the turnover process.

2.3.4 This supplement is "frozen" as it is incorporated into the 10CFR50.55a Alternative Plan and approved by the NRC. Design changes and modification revision packages shall not delete or revise the content or applicability of these supplemental requirements, in whole or part, without NRC approval.

2.4 Applicability of existing site procedures

2.4.1 It is appropriate to use the site Section XI Repair and Replacement as a guide for integration of site procedures with the construction of Code related items. Generally, existing site procedures shall apply as if the Code portions of construction were being performed as a Section XI Repair and Replacement activity. However, where this supplement contradicts existing procedure or program requirements, the requirements in this supplement shall take precedent and the affected procedure or program be revised as appropriate.

2.4.2 Welding, including weld procedures, welder qualification, weld material control, use and control of welder ID symbols and preparation of Weld Data Reports, will be done using the Corporate Welding Manual as invoked and implemented through site procedures.

2.4.3 The ANI shall have the opportunity to review procedures, including those for welding and QC, which will be utilized for Code related construction activities during the review of work packages prior to field issuance. Likewise, any revisions to these procedures which is intended to be utilized in the work package subsequent to the initial ANI review shall also be identified to the ANI for his review prior to its use.

2.5 Document Control

2.5.1 Document Control will be as currently defined in the corporate Appendix B QA program for quality related activities and implemented through site procedures.

2.6 Identification of ASME code Documents

2.6.1 Purchase requisitions, purchase orders, procedures and other documents generated and / or used at the site for fabrication and installation of Code items shall be identified as "ASME Section III".

3.0 PROCUREMENT

3.1 General

3.1.1 The A/E may provide input into the procurement process, however, all procurement will be performed by CP&L under its existing Appendix B Quality Assurance Program and implemented by corporate and site procedures.

3.1.2 Procurement of all code stamped items will be accomplished using approved design specifications certified by a Registered Professional Engineer competent in nuclear power plant design.

3.2 Service Contracts

3.2.1 Service Contracts intended to obtain services associated with the engineering or construction of piping and equipment affected by this supplement shall be subject to all the rules and requirements of this supplement.

3.3 Code Stamped Items

3.3.1 It is intended to complete construction to the version of the Code to which the system was originally designed and specified, which governed construction of the existing portion of piping and equipment installed during initial plant construction. The applicable version of the code associated with a particular aspect of procurement or construction and the boundaries of that applicability shall be clearly defined in the modification package. Code stamped items shall be clearly identified as such in the modification BOM or the Equipment Commissioning List. Code stamped items shall be specified and procured so as to fully comply with Code requirements, including the use of qualified suppliers with appropriate Code certification, and shall be stamped in accordance with code requirements.

The BOM or the Equipment Commissioning List shall, as a minimum, contain the following information regarding Code stamped items:

Commercial information which sets forth items, quantities, terms, conditions, etc. as appropriate, as well as the approved Design Specification(s) which defines the engineering and quality requirements.

3.3.2 Any exceptions to the Design Specifications taken by the supplier with regard to a Code stamped item shall be reconciled by revision to the affected Design

Specification prior to proceeding with procurement. Any such revision to the Design Specifications would be prepared, reviewed and approved as set forth for the original specification.

3.4 Qualification of Suppliers

3.4.1 Qualification of Suppliers of materials and services shall be accomplished in accordance with the existing CP&L Appendix B Program in accordance with approved plant procedures. All suppliers must be verified as being on the approved supplier's list for the scope of supply and holding active certification from the ASME for any Code items being procured.

4.0 RECEIVING INSPECTION

4.1 Code stamped items

Inspection, examination and acceptance of Code items shall be accomplished in accordance with corporate and site procedures. Receipt activities shall be documented in the form of a Receipt Inspection Report (RIR). Items accepted shall be appropriately tagged / labeled.

Nonconformances noted during receipt inspection shall be reported via Condition Report (nonconformance) initiation, and the affected items placed on hold or rejected. When the vendor's data package is missing or deficient, the item will be placed on hold pending the delivery of the missing information or resolution of the deficiency.

When conditions warrant, Conditional Release requests may be granted to permit progression of work involving a nonconforming item awaiting resolution. When this occurs, it will be processed and approved in accordance with existing site procedures. The ANI will be provided with the closure documentation for any conditional releases affecting Code stamped items or Code related construction.

5.0 STORAGE AND PROCESS CONTROL

5.1 Storage

Storage requirements for Code stamped items will be clearly identified in the Design Specification. Storage control through manufacture and shipment will be governed by the procurement process.

5.2 Equipment Commissioning Plan

5.2.1. General

This section prescribes the methodology which will be followed in commissioning previously installed equipment in support of completing and activating the C & D Spent Fuel Pools. The subject equipment was installed during the original site construction effort for Unit 2 & 3 fuel storage and handling activities, and was spared in place when these units were cancelled. This equipment was never incorporated into the operating unit nor has it been formally maintained under controlled storage conditions since that time. Note that the equipment in question (including Code related equipment) was procured to applicable design and quality assurance requirements, and this plan does not take exception to any of these requirements. Rather this plan prescribes a set of criteria which will ensure that the equipment in question will meet the applicable requirements of Appendix B and is capable of performing its intended function in the completed design.

5.2.2 Field Walkdown / Scope Development

Scope development is accomplished by performing a detailed field walkdown and comparing the modification design to the field condition. The entire list of previously installed equipment (both Code and non-Code related) which is anticipated to be used in the completed design will be compiled to comprise the scope of the Equipment Commissioning Plan. Note that this plan is not limited to mechanical equipment, and will include civil (pipe supports, penetrations), I&C (instrument racks, instrumentation, tubing) and electrical (cables, conduit, cable trays, equipment ground connections) as well. Each item in scope will be identified and individually dispositioned in the modification package.

5.2.3 Document Review / Retrieval

A document retrieval and review process will be included in the matrix of commissioning requirements to ensure that required quality assurance information is on hand. Generally, equipment commissioning matrix documentation requirements will be consistent with that of the original procurement effort. In particular, all Code documentation requirements (including Code data reports) must be satisfied for Code items. Records required for commissioning fall into one of two categories, which are discussed as follows:

(a) Procurement Documentation
This documentation pertains to the information which was originally used to procure the equipment in question and the vendor quality packages which were supplied with the item in response. These records are required to establish traceability and verify that required vendor quality assurance documentation and

quality releases are on file. Generally, this information is available in the Receipt Inspection Report (RIR) generated at the time the item was received. It is not acceptable to assume that the necessary information must have been received and is in order by virtue of its being installed in the field under control of the construction program, as it would have been possible to have issued the item to the field with a conditional release with outstanding quality related issues pending. All Code equipment must have traceability to the Code Data Report(s) for its construction.

(b) Field generated records
Construction records must be reviewed to ascertain to what extent the existing field condition was documented as being complete and satisfactory. Generally, this information exists in the equipment installation packages and has been maintained in document control for the major pieces of equipment in question. Once the equipment installation records have been retrieved, these must be compared against the field condition to verify that the installation as accepted has not been subsequently altered. Previous construction activities can be accepted for use in the modification implementation effort to the extent that required installation documentation exists and is verified to conform to the field condition.

In the event that records are found to be missing or deficient, an assessment is performed to determine what installation can be accepted by virtue of retest or re-inspection, or by use of alternate methods of verification. Alternately, the implications of the documentation deficiency can be evaluated to determine the potential impact to quality. Any such evaluation used to accept field conditions in the absence of required information must be formally documented and subject to design review as appropriate. Except as specifically provided in the 10CFR50.55a Alternative Plan for records of field installation of piping, this equipment commissioning plan is not intended to take exception to Code requirements pertaining to equipment installation or documentation requirements. Given this single exception, an evaluation of a deficiency is not allowed to stand in lieu of installation records which are deemed to be specifically required by Section III of the ASME B&PV Code.

5.2.4 Development of examinations, tests and acceptance criteria

The Equipment Commissioning Matrix shall specify any additional activities necessary to ensure the requisite level of quality assurance in light of the lack of formal controls on storage and handling since this equipment was initially installed. Development of these activities will include the following:

- Field verification of equipment identification against procurement documentation. In the case of Code related equipment, traceability will be established to the Code Data Report(s) and National Board Registration.
- Physical inspections, testing, etc., as required to verify that lack of controlled storage conditions and regular maintenance has not caused any condition affecting

quality. Commissioning criteria shall include consideration of corrosion, fouling, aging, radiation exposure, etc. For Code requirements, any degradation identified would be assessed in terms of Code requirements, with acceptability based on demonstrated compliance with those requirements.

- Physical inspections and considerations necessary to ensure that plant activities since construction have not resulted in any condition potentially adverse to quality (scavenging of parts, introduction of foreign material, damage from personnel and equipment traffic, etc). For Code equipment and piping, these criteria will specifically consider Code required attributes, with acceptability based on full Code compliance.

5.2.5 Repair of Deficiencies

Repair of any deficiencies shall be done in accordance with approved procedures. Since Code items in the scope of this equipment commissioning plan are supplied as completed Section III components from the vendor under that vendor's NPT Stamp Program, repairs to these items meet the definition of "Repairs" in ASME Section XI and shall be accomplished under the site's Section XI Repair and Replacement Program.

5.2.6 ANI Involvement

Code stamped equipment and related commissioning requirements will be specifically identified as such in the modification package in order to facilitate the system certification process. Provisions shall be made to ensure that any work packages generated to commission Code equipment are made available for ANI review subsequent to work completion.

5.2.7 Revising or Altering the Equipment Commissioning Plan

Generally, this equipment commissioning plan does not take exception to Code or quality requirements, but rather prescribes a dedication process which will ensure that all such requirements are met in light of the lack of storage control for the equipment it addresses. The sole exception is with regard to field installation records for Code related piping, which are no longer available and are the subject of a 10CFR50.55a Alternative Plan currently under review by the NRC. Acceptance of the field installation of this piping is contingent upon approval of this Alternative Plan by the NRC, and revising the Equipment Commissioning Plan with regard to piping acceptability may require prior notification of the NRC. Otherwise, this plan does not take exception from design or quality requirements (including ASME Code requirements), and authorization for its use and any revisions to it are provided under 10CFR50.59.

5.3 Process Control

Process control sheets are utilized to establish measures to ensure that processes, including welding and heat treating, are controlled in accordance with the Code and are accomplished by qualified personnel using qualified procedures. Generally, process control sheets for Code related construction activities will be as provided for under the site's procedures. Additional process control sheets are found in the Corporate Welding Manual and Corporate NDE Manual, as invoked and implemented by site and corporate procedures.

The ANI will review process control sheets for code related construction activities before they are issued to the field for construction. The ANI will have the opportunity to add any inspection hold points deemed necessary at this time. All process control sheets for Code related construction activities will be reviewed and accepted by the ANI subsequent to completion of field activities.

The hydrostatic test pressure used for pressure testing shall be required to meet Section III requirements, as opposed to those specified in Section XI. The process control sheets for hydrostatic testing shall reflect the more stringent test criteria.

Nonconforming field conditions will be controlled by site work process control and condition reporting procedures. The ANI will be notified of any condition reports initiated against code related construction activities, and will verify any such items are resolved prior to signing off the process control sheets for final acceptance.

Identification tags or markings shall be retained on each code item. When it is necessary to cut or transfer an item during code related construction, material identification shall be transferred to the affected piece prior to cutting. This activity shall be witnessed by QC and appropriately documented in the work package.

5.4 Modification Implementation Procedures

5.4.1 Modification procedures are being utilized for code construction (in the context of this ESR) will be those presently existing for use with the site's Section XI Repair and Replacement Program, subject to the supplemental requirements prescribed herein.

5.5 Start-up Procedures

5.5.1 Detailed start-up procedures will be developed and included in the affected modification package. Review of start-up procedures, including QC review, will be documented by review and signature approval as part of the modification approval process.

6.0 WELDING CONTROL

6.1 General

Welding activities associated with Code construction, including welding procedure qualification, weld materials procurement and control, welding equipment control, qualification of welders, weld process control and post weld heat treatment activities shall be controlled in accordance with the Corporate Welding Manual by the Plant Welding Engineer and the Plant Operating Manual. Welding may be performed by Contractors provided that the contractor is fully qualified to CP&L's welding program for the specific welding or welding related activity being performed.

Contractor's not qualified to and working under CP&L's Corporate Welding Program may only be used for Code welding activities for which they maintain their own program having the appropriate ASME certification. In this case, a service contract must be provided which authorizes the Contractor to invoke his program for the subject scope of work.

Work packages involving welding activities associated with Code construction will be reviewed by QC and the ANI prior to field issuance to ensure that appropriate hold points are included. Weld Data Reports shall be generated for any such welds per the Corporate Welding Program, and hold point inspections shall be accepted by QC and the ANI by signature and date on the WDR.

7.0 CONTROL OF EQUIPMENT, TOOLS, GAUGES AND INSTRUMENTS

7.1 General

Equipment, tools, gauges and instruments specified for calibration control shall be identified, stored, calibrated, and maintained in accordance with site procedures. Calibrations and adjustments shall be accomplished at prescribed intervals and against certified standards having known valid relationships to national standards. If no national standard exists, the equipment manufacturer's recommended standard shall be used. Recalibration shall be performed any time the accuracy of an instrument is suspect.

Traceability shall be maintained between the instrument and equipment or item being tested. The instrument identification number shall be recorded on the appropriate process control documentation. In the event an instrument is found to be out of calibration, a Condition Report must be initiated and an evaluation shall be performed to identify and disposition any suspect inspections, examinations, and test results.

8.0 INSPECTION, TESTS and NONDESTRUCTIVE EXAMINATION (NDE)

8.1 General

NDE activities associated with Code construction, including NDE procedures, qualification of personnel and control of inspection and test equipment shall be accomplished as provided in the Corporate NDE Manual. NDE procedures and acceptance criteria are provided in the Corporate NDE Manual for both original construction code and Section XI requirements. NDE shall be performed on all Code related construction activities in these modifications consistent with Section III requirements, and all such NDE shall utilize Section III acceptance criteria.

8.1.1 Process Control

Inspection, test and examination requirements shall be defined in the work packages and documented on appropriate process control sheets. These packages will be reviewed by the QC and ANI prior to field issuance. Work will not progress past established QC and ANI hold points until the hold point is accepted by signature and date by the QC inspector or ANI.

8.1.2 ANI Review and Approval of NDE Documentation

Records of inspections, tests and examinations containing QC and ANI hold points will not be considered completed until all such hold points are satisfied and the ANI has completed his inspection and signed and dated the process control sheets.

9.0 CODE DATA REPORT AND CERTIFICATION

9.1 General

The piping systems completed under these modifications will not be eligible for N stamping due to issues pertaining to the discontinuance of the original construction program and missing documentation. However, these systems will undergo a certification process similar to N stamping. Installation of Code piping, equipment and components will be documented on an ASME Section III data report "equivalent form". This form will be comparable to an NIS-2 form associated with Section XI repair / replacement activities, and PLP-605 can be used as a guideline for its completion. All work packages for installation of Code equipment shall be clearly identified as such, and provided to the ANI for review prior to field issuance and again upon completion of work activities. Completed and approved documentation pertaining to Code related construction, including field generated records and vendor data packages, shall be compiled in packages pending the review of the ANI for system turnover.

The ANI will review the documentation and certify completeness and conformance with the requirements of the corporate Appendix B Manual and these supplemental requirements prior to system turnover. Since these supplemental requirements will be implemented either by procedure revision or modification instruction, this certification will be accomplished by verifying that all Code related activities were conducted and documented in accordance with site procedures and the requirements of the modification package. The specific list of items reviewed to determine completeness and conformance will be provided as an attachment to this certification. Similar to the N-5, this listing will constitute the boundaries of the completed construction which would have normally been N-stamped.

The completed certification of the affected piping, equipment and components will be included in the modification documentation package as a permanent QA record.

10.0 NONCONFORMANCE AND CORRECTIVE ACTION

10.1 Nonconformance and corrective actions will be addressed within corporate and site procedures, including those associated with procurement, work control and condition reporting. Satisfactory resolution of any non-conformances or adverse conditions associated with code stamped items or code related construction activities will be verifiable by the ANI and all other responsible parties prior to turnover.

11.0 RECORDS CONTROL AND RETENTION

11.1 Records control and retention will be as directed by site work control and document control procedures, except as related to the ANI's role in certification as described herein.

12.0 AUTHORIZED NUCLEAR INSPECTOR

12.1 The services of an AIA shall be used as described herein. It is noted that a qualified ANI would be necessary for Section III construction activities, while an ANII is involved when performing repair and replacement activities under Section XI. Since elements of both are associated with this modification, dual qualification will be required for the AIA's site representative involved with this modification. Signoffs for this individual will reflect this dual qualification (ANI / ANII).

13.0 REVIEW, CONTROL AND REVISION OF SUPPLEMENTAL QA REQUIREMENTS

13.1 These supplemental requirements as incorporated into the modification design and approved therein will become part of a 10CFR50.55a Alternative Plan and therein subject to NRC review and acceptance. Since NRC acceptance for the alternative plan represents the authorization for these supplemental QA requirements, revision to these requirements can only be accomplished by submittal and review of the NRC as a revision to the Alternative Plan. Exceptions would be allowed only for revision to items which comply with all Code and Regulatory requirements and are provided for completeness and clarity (see Equipment Commissioning Plan), or administrative or clerical changes which do not affect technical requirements.

CONTENTION TC-3: EXHIBIT 3

Letter from Donna B. Alexander, CP&L to U.S. NRC
(October 29, 1999) re: Response to RAI

CP&L

Carolina Power & Light Company
Harris Nuclear Plant
PO Box 165
New Hill NC 27562

OCT 29 1999

SERIAL: HNP-99-172

United States Nuclear Regulatory Commission
ATTENTION: Document Control Desk
Washington, DC 20555

SHEARON HARRIS NUCLEAR POWER PLANT
DOCKET NO. 50-400/LICENSE NO. NPF-63
RESPONSE TO NRC REQUEST FOR ADDITIONAL INFORMATION REGARDING THE ALTERNATIVE PLAN FOR SPENT FUEL POOLS C & D COOLING AND CLEANUP SYSTEM PIPING

Dear Sir or Madam:

By letter HNP-98-188, dated December 23, 1998, Carolina Power & Light Company (CP&L) submitted a license amendment request to increase fuel storage capacity at the Harris Nuclear Plant (HNP) by placing spent fuel pools C & D in service. The U. S. Nuclear Regulatory Commission (NRC) issued letters dated March 24, 1999, April 29, 1999, June 16, 1999, and August 5, 1999 requesting additional information regarding our license amendment application. HNP letters HNP-99-069, dated April 30, 1999, HNP-99-094, dated June 14, 1999, HNP-99-112, dated July 23, 1999, and HNP-99-129, dated September 3, 1999 provided our respective responses.

By letter dated September 20, 1999, the NRC issued a fifth request for additional information (RAI) regarding our license amendment application to place spent fuel pools C & D in service. The September 20, 1999 NRC RAI specifically requests additional information on the proposed alternative plan to demonstrate compliance with ASME Code requirements for the cooling and cleanup system piping in accordance with 10 CFR 50.55a(a)(3)(i). The Enclosures to this letter provide the HNP response to the NRC staff's September 20, 1999 RAI.

The enclosed information is provided as supplement to our December 23, 1998 amendment request and does not change our initial determination that the proposed license amendment represents a no significant hazards consideration.

Please refer any questions regarding the enclosed information to Mr. Steven Edwards at (919) 362-2498.

Sincerely,

Donna B. Alexander
Manager, Regulatory Affairs
Harris Nuclear Plant

KWS/kws

Enclosures:

1. HNP Responses to NRC Request For Additional Information (RAI)
2. Technical Report: HNP - Material Identification of Chips from Carbon Steel Welds Associated with the Spent Fuel Pool Activation Project (1 page total)
3. Chemistry Sample Data Sheets (2 sheets total)
4. QCI-19.1, Revision 1, entitled "Preparation & Submittal of Weld Data Report, Repair Weld Data Report, Tank Fabrication Weld Record & Seismic I Weld Data Report" (25 pages total)

c: Mr. J. B. Brady, NRC Senior Resident Inspector (w/ Enclosure 1)
Mr. Mel Fry, N.C. DEHNR (w/ Enclosure 1)
Mr. R. J. Laufer, NRC Project Manager (w/ all Enclosures)
Mr. L. A. Reyes, NRC Regional Administrator - Region II (w/ Enclosure 1)

bc: (all w/ Enclosure 1)

Mr. K. B. Altman
Mr. G. E. Attarian
Mr. R. H. Bazemore
Mr. C. L. Burton
Mr. S. R. Carr
Mr. J. R. Caves
Mr. H. K. Chernoff (RNP)
Mr. B. H. Clark
Mr. W. F. Conway
Mr. G. W. Davis
Mr. W. J. Dorman (BNP)
Mr. R. S. Edwards
Mr. R. J. Field
Mr. K. N. Harris

Ms. L. N. Hartz
Mr. W J. Hindman
Mr. C. S. Hinnant
Mr. W. D. Johnson
Mr. G. J. Kline
Mr. B. A. Kruse
Ms. T. A. Head (PE&RAS File)
Mr. R. D. Martin
Mr. T. C. Morton
Mr. J. H. O'Neill, Jr.
Mr. J. S. Scarola
Mr. J. M. Taylor
Nuclear Records
Harris Licensing File
Files: H-X-0511
H-X-0642

CONTENTION TC-3: EXHIBIT 3.a

Enclosure 1 to 10/30/99 RAI (RAI Response)

SHEARON HARRIS NUCLEAR POWER PLANT
DOCKET NO. 50-400/LICENSE NO. NPF-63
RESPONSE TO NRC REQUEST FOR ADDITIONAL INFORMATION REGARDING THE ALTERNATIVE PLAN FOR SPENT FUEL POOL COOLING AND CLEANUP SYSTEM PIPING

Requested Information Item 1:

Explain how the Metorex X-Met 880 Alloy Analyzer discriminates between the different standards that you used in your analysis described in Enclosure 3, "Metallurgy Unit Report for Spent Fuel Pool Weld Metal Composition analysis," of your April 30, 1999, RAI response. What are the chemical element ranges associated with the different standards that you used? What determines a match on a particular standard? What chemical elements are not included in the "Match" determination and how are these elements reconciled?

Response 1:

Background:

The primary objective of the field alloy analysis was to confirm with reasonable assurance that the as-deposited weld material for the spent fuel pool piping field welds is an austenitic stainless steel material compatible with Type 304 stainless steel piping material. The chemical composition of the stainless steel filler materials are specified in ASME Section II, Part C, SFA-5.4 / 5.9. The elements controlled under this specification for stainless steel filler materials are: carbon, chromium, nickel, molybdenum, columbium plus tantalum, manganese, silicon, phosphorus, sulfur, nitrogen, and copper.

The Alloy Analyzer was used in a comparison / identification mode. In the comparison / identification mode, the unknown is compared to reference materials which are input by a specific measurement technique and stored in a memory location of the instrument. This method of analysis was selected to provide reasonable assurance that the chemical compositions of analyzed field welds are consistent with an austenitic stainless steel having a chromium content in the range of 18 to 24 weight percent and a nickel content in the range of 8 to 14 weight percent.

> ***Explain how the Metorex X-Met 880 Alloy Analyzer discriminates between the different standards that you used in your analysis described in Enclosure 4, "Metallurgy Unit Report for Spent Fuel Pool Weld Metal Composition Analysis," of your April 30, 1999, RAI response.***

The Metorex X-Met 880 Alloy Analyzer utilizes a Cadmium-109 isotopic source to excite the analyzed material and measure the secondary radiation produced by the source excitation. This instrument can detect elements that range between and include chromium and molybdenum on the periodic chart of the elements. (The elements between and including terbium and uranium are also detected by this instrument with a cadmium source.)

The instrument was configured to detect six specific elements using the following pure element standards: (1) chromium, (2) manganese, (3) iron, (4) nickel, (5) copper, and (6) molybdenum. Iron was selected because austenitic stainless steels are considered to be iron-based alloys; chromium, nickel, and molybdenum were selected because they are primary alloying elements; manganese was selected because it is a secondary alloying element; and copper was selected because it is a potential "tramp" (i.e., unwanted) element in this material that is detectable by this instrument. A backscatter standard was used to determine the background spectrum. The pure element standards and the backscatter standard were supplied with the instrument by the manufacturer. A series of comparison standards were loaded into the instrument for this analysis. These standards included: (1) Type 304 stainless steel, (2) Type 309 stainless steel, (3) Type 310 stainless steel, (4) Type 316 stainless steel, and (5) NIST SRM 1154a. These four secondary standards and one National Institute of Standards and Technology (NIST) Standard Reference Material (SRM) were used because: (1) the instrument was used in a comparison mode, and (2) none of the SRMs available from NIST have compositions consistent with either Type 304, Type 308, or Type 309 stainless steels. NIST SRM 1155 (Type 316 stainless steel) and NIST SRM C1287 (Type 310 stainless steel - modified) were used also, as independent reference checks of the instrument during the field analysis.

In the comparison / identification mode, the unknown is compared to reference materials which are input by a specific measurement technique and stored in a memory location of the instrument. The alloy analyzer has a multi-channel analyzer (MCA) having 256 micro channels. These micro channels represent a specific X-ray energy range (e.g., Channel 1 - 1 to 2 eV, Channel 2 - 2 to 3 eV, etc.). Each element has an average value for its excitation X-ray energy and, in practice, the actual response has a Gaussian distribution. Each pure element has a range, or window, consisting of several micro channels based on the full width at half maximum value of the Gaussian distribution. Therefore, counts detected in an element window are due to a detectable and measurable concentration of this element. The pure element standards and the austenitic stainless steel standards have different compositions. The response of the instrument varies with the concentration of a given element in a standard. The counts obtained for a standard by this instrument are proportional to the elemental concentration(s). Each standard will have a unique pattern (or "fingerprint") of counts in the selected element windows based on its chemical composition. The instrument discriminates between standards and unknowns based on the similarity of the instrument response (or counts detected) to the element windows for the stored standards.

What are the chemical element ranges associated with the different standards that you used?

The chemical element ranges for the standards used are shown below in Table 1. The NIST SRM (1154a) that was used to set-up the Alloy Analyzer has a chemical composition that is not within the chemical composition range for any standard UNS stainless steel alloy. However, the nickel and chromium contents of the NIST 1154a standard are similar to the nickel content of the Type 309 comparison standard and the chromium content of the Type 304 comparison standard, respectively. The remaining detectable elements in these three comparison standards are comparable and cannot be used to accurately differentiate between the various unknowns.

TABLE 1

Chemical Element Ranges for Standards Used to Set-up the Metorex Alloy Analyzer

Standard	Composition, Weight Percent					
	Chromium	Manganese	Iron	Nickel	Copper	Molybdenum
Type 304	**18.28**	1.48	bal.	8.13	0.19	0.17
Type 309	22.60	1.63	bal.	**13.81**	--	--
Type 310	24.87	1.94	bal.	19.72	0.11	0.16
Type 316	16.74	1.44	bal.	10.07	0.11	2.06
NIST 1154a	**19.31**	1.44	bal.	**13.08**	0.44	0.068
Chemical Element Ranges for Standards Used to Check the Alloy Analyzer						
NIST C1287	23.98	1.66	bal.	21.16	0.58	0.46
NIST 1155	18.45	1.63	bal.	12.18	0.169	2.38

The tolerances for the chemical element ranges for the secondary standards (nominal Type 304, Type 309, Type 310, and Type 316 stainless steels) are not known. These secondary standards were provided with mill test reports for their chemical compositions, but the precise accuracy of these standards is not known because they are not certified as traceable to primary reference standards. However, the applicable ASTM standards for these alloys permit a major alloying element range of between 1 and 2.5 weight percent (e.g., carbon content - 0.08 weight percent maximum; silicon content - 1.00 weight percent maximum; nickel content - 8.00 to 10.50 weight percent maximum; etc.) without the applicable product analysis tolerances that depend upon the specific element and its relative concentration.

What determines a match on a particular standard?

During a test, the Alloy Analyzer detects, measures, and compares the counts obtained for the specified elements in the unknown to those for the standards that have been loaded into the instrument (the specified elements are those that were loaded as pure element standards during the instrument set-up). The X-ray energy detection range for each of the specified elements is pre-set in the instrument and is based on physical constants related to the energy difference between electron shells in atomic structures. The number of counts in each pure element range is measured and compared to the counts for these elements in the known comparison standards. The difference in counts between the unknown and the comparison standards is measured. The instrument is configured with three thresholds (or limits) for the difference in counts between the closest standard and the unknown. The least amount of difference between a comparison standard and the unknown is indicated by "GOOD MATCH." If there are differences between the unknown and standard that do not meet the "GOOD MATCH" criteria, but the unknown is similar to one or more standards, the alloy analyzer will indicate "POSSIBLE MATCH." If the difference in counts is too large, the instrument will indicate "NO GOOD MATCH."

What chemical elements are not included in the "Match" determination and how are these elements reconciled?

The primary objective of the field alloy analysis was to confirm with reasonable assurance that the as-deposited weld material was an austenitic stainless steel material compatible with the Type 304 stainless steel piping material. The chemical compositions of stainless steel filler materials are specified in ASME Section II, Part C, SFA-5.4 / 5.9. The elements controlled under this specification for stainless steel filler materials are: carbon, chromium, nickel, molybdenum, columbium plus tantalum, manganese, silicon, phosphorous, sulfur, nitrogen, and copper.

The alloy analyzer was set up to detect the primary alloying elements: chromium, nickel, and molybdenum. In addition, the alloy analyzer was also set up to detect the secondary alloying element manganese, the tramp element copper, and the alloy base iron. The remaining elements addressed in the specification, but not detected by the alloy analyzer, are: carbon, columbium plus tantalum, silicon, phosphorous, sulfur, and nitrogen. None of these elements are capable of being detected with the Metorex Alloy Analyzer using a Cadmium-109 source either due to their relative concentration or their X-ray excitation energy. These secondary alloying elements, while important to the weldability characteristics of the filler material, are not as important to the performance of the weld in service with regard to strength and corrosion resistance.

Samples of three spent fuel pool cooling piping field welds were obtained by plant personnel and submitted to an external commercial laboratory for chemical analysis. The elements that were not determined by field analysis and those that were used in the identification mode of the field welds were measured by this laboratory and are shown in Table 2. Laboratory analysis of this representative sample substantiates the results of the field analysis and provides additional assurance that the chemical compositions of spent fuel pool field welds are satisfactory.

TABLE 2

NSL Chemical Analysis Results			
Identification	**2-SF-36-FW-450**	**2-SF-38-FW-451**	**2-SF-71-FW-329**
Alloy Analyzer Results	304 SS Possible	NIST 1154a Possible	NIST 1154a Possible
NSL Chemical Analysis Results			
Carbon	0.13	0.10	0.064
Niobium	< 0.05	< 0.05	< 0.05
Chromium	20.08	20.11	19.06
Copper	0.054	0.10	0.093
Manganese	1.46	1.39	0.79
Molybdenum	0.12	0.10	0.085
Nickel	9.30	9.24	9.63
Phosphorus	0.021	0.021	0.026
Sulfur	0.007	0.005	0.013
Silicon	0.37	0.39	0.25
Titanium	< 0.01	0.011	< 0.01

In summary, the alloy analyzer was set up to confirm with reasonable assurance that the as-deposited weld material for the spent fuel pool piping field welds is an austenitic stainless steel material compatible with the reported Type 304 stainless steel piping material and the chemical composition requirements specified in ASME Section II, Part C, SFA-5.4 / 5.9. The programmatic and procedural controls which existed at the time of construction, augmented by the testing and analysis effort described above, provide reasonable assurance that the weld material for the spent fuel pool piping field welds is the proper weld material and will perform satisfactorily in service.

<u>Requested Information Item 2:</u>

Provide assurance that the ferrite numbers are acceptable for A-No. 8 weld wire (ND-2433) used in welds with missing weld wire documentation.

<u>Response 2:</u>

Ferrite numbers have been measured for 18 of the 19 accessible field welds remaining in the scope of the Alternative Plan (one field weld is located underneath a grating which could not be removed at the time the measurements were taken). The results of this work show mean ferrite numbers ranging from approximately 4 to 9 FN. SFA 5.9, Section A4.12 states that the ferrite potential for 308, 308L, and 347 is approximately 10 FN, but notes that the ferrite content may vary by +/- 7 FN or more around these midpoints and still be within the limits of the chemical specification. Furthermore, Section A4.13 also states that the ferrite potential of a filler metal is usually modified downward in the deposit due to changes in the chemical composition caused by the welding process and technique used.

Ferrite is know to be beneficial in reducing the tendency for cracking or fissuring in weld metals; however, it is not critical, particularly under the mild service conditions associated with the spent fuel pool cooling system. Assurance that the ferrite numbers are acceptable is demonstrated by the following: (1) the measured ferrite numbers are reasonably consistent with those expected for the type of filler material used, (2) all of the exposed field welds in the scope of the Alternative Plan have successfully completed a liquid penetrant examination which noted no evidence of cracks or fissures, (3) a strict materials control program governed issuance and control of weld materials, and (4) there is no evidence that incorrect or uncontrolled filler material might have been used.

Requested Information Item 3:

Explain the chemical analysis in the Table associated with PQR 6(c), dated 11/15/84, page 2 of 2, laboratory test No. 9-2-149 described in Enclosure 6, "Lab Test Reports," of your April 30, 1999, RAI response. What row(s) are associated with the base material, weld, and standard(s)? What criteria was used to determine acceptability?

Response 3:

Welding Procedure Specification (WPS) 8B2, Revision 16 is supported by four Procedure Qualification Records (PQRs). The original procedure qualification test, as documented on PQR 6, was performed in 1976. The procedure qualification test coupon for this test was prepared from 10 inch schedule 40 pipe, which has a wall thickness of 0.365 inches. This test coupon thickness supports a qualified base metal thickness range of 3/16 (0.1875) inches to 0.730 inches. In 1981, an additional procedure qualification test, as documented in PQR 6(A), was performed to support the extended thickness range of 3/16 inches to 8 inches. This new qualified range was achieved by welding a 1.5 inch thick weld test coupon. In 1982, another procedure qualification test was performed, as documented in PQR 6(B), to expand the thickness range qualified to include a base material thickness as thin as 0.049 inches. This extended range was achieved by welding a 0.049 inch wall thickness test coupon. In 1984, the final procedure qualification test, as documented in PQR 6(C), was performed to extend the qualified thickness range to include materials as thin as 0.031 inches. This new thickness range was achieved by welding a weld test coupon with a thickness of 0.031 inches.

The portion of WPS 8B2, Revision 16 that was used to fabricate the fuel pool piping, based on base metal thickness range, is supported by PQR 6 and PQR 6(A). The fuel pool piping has a nominal wall thickness of 3/8 (0.375) inches, which is within the qualified base metal thickness range of 3/16 (0.1875) inches to 0.730 inches for PQR 6 and 3/16 (0.1875) inches to 8 inches for PQR 6(A).

Relative to the chemical analysis in the Table associated with PQR 6(c), dated 11/15/84, page 2 of 2, laboratory test No. 9-2-149, referenced WPS 8B2 addresses welding of a SA240 TP 304 test coupon with a thickness of 0.031 inch. The documented mechanical test results reference two test specimens having a thickness of 0.031 inch (E&E Laboratory Test Number 9-2-149, specimen numbers 699 and 700). PQR 6(c) references an Arcos welding filler material, which according to the Certified Material Test Reports (CMTRs) attached to PQR 6(c) is Type 316 stainless steel filler material.

A definitive explanation for all of the entries on the data sheet in question, page 2 of 2 of the chemical analysis results, can not be provided due to insufficient documentation. However, based on the documentation supporting the procedure qualification test for PQR 6 (C), Metallurgy Unit test records and anecdotal information, it appears that Harris Welding Engineering personnel requested the E&E Laboratories to perform mechanical testing and chemical analyses for a completed welding procedure qualification coupon performed using 0.031 inch thick Type 316 stainless steel base material. It is believed that the chemical analysis requested was to be performed on a sample of the material taken from the item that was to be welded in production and which provided the impetus to perform the additional weld procedure qualification. This is supported by the fact that chips of the supplied material were provided to the Analytical Chemistry Laboratory on November 12, 1984 (sampled on November 9, 1984) while the PQR is dated November 15, 1984. This indicates that the chemical analysis was performed prior to the welding of the procedure qualification test coupon and should not be considered a part of the procedure qualification test.

Requested Information Item 4:

For the piping and welds examined internally, provide a discussion of the examination results. What inspection criteria is used for evaluating the piping and welds for corrosion and fouling? Describe the corrosion and fouling inspection procedure and inspection personnel qualification process. For the embedded welds not examined internally, describe what is preventing their examination. Discuss why the decision not to inspect all of the embedded welds will result in an acceptable level of quality and safety.

Response 4:

An initial visual inspection of the embedded piping and welds was completed using a pneumatically-powered crawler carrying a high resolution camera. This crawler employed two sets of pneumatic cylinders which expanded and contracted in coordination with a single cylinder between them to produce an “inch worm” effect. Inspections of four of the eight embedded spent fuel pool cooling lines were performed using this crawler, including six embedded field welds. Camera resolution was excellent and the visual inspection of the lines was thorough. This arrangement proved unsuitable, however, for longer lines having multiple elbows, and a decision was made to investigate other possible methods of inspecting the balance of embedded piping. An arrangement was eventually selected which used flexible fiberglass rods to manually drive a camera on rollers through the pipe. A second inspection effort, only recently completed, used this crawler to successfully inspect all 9 of the remaining embedded field welds and associated piping.

The remainder of this response will focus on the initial inspection of four SFP cooling lines and six embedded welds. The results of the inspection of the remaining lines and nine embedded welds is still in the review process. Our preliminary evaluation is that the results of the second visual inspection are consistent with those of the first inspection and demonstrate that the piping and welds have not measurably degraded and are acceptable for their intended purpose.

The pneumatically-powered crawler provided a stable base from which to successfully complete a visual examination of the piping and welds which could be reached using this equipment. Each inspection was preceded by a resolution check wherein the camera was required to discern a 1.0 mil wire at the appropriate focal length, and the level of detail provided of the internal pipe surfaces was excellent. These inspections were conducted in accordance with Special Plant Procedure SPP-0312T, which provided specific acceptance criteria, as well as qualification requirements for the equipment and inspectors. The inspection included welds on four of the eight embedded cooling lines connected to Spent Fuel Pools C & D. All of the lines inspected were 12 inch, schedule 40 stainless steel (304) piping.

The initial inspection included the following field welds:

Field Weld Number	Piping Function
2-SF-8-FW-65	C SFP Cooling Supply
2-SF-8-FW-66	C SFP Cooling Supply
2-SF-143-FW-512	D SFP Cooling Supply
2-SF-144-FW-515	D SFP Cooling Supply
2-SF-144-FW-516	D SFP Cooling Supply
2-SF-159-FW-408	D SFP Cooling Supply

In accordance with the acceptance criteria in Special Plant Procedure SPP-0312T, welds which can be accepted without further evaluation must be completely free of the following defects:

- no Cracks
- no Lack of Fusion
- no Lack of Penetration
- no Oxidation
- no Undercut greater than 1/32"
- no Reinforcement ("Push Through") greater than 1/16"
- no Concavity (Suck Back") greater than 1/32"
- no Porosity greater than 1/16"
- no Inclusions

In addition, any indications not included in the above list of weld attributes but potentially pertinent to the condition of the piping and welds were required by the inspection procedure to be reviewed and formally evaluated by Harris Nuclear Plant Engineering staff. Such indications would include arc strikes, foreign material, evidence of mishandling, pipe mismatch, pitting, and evidence of corrosion.

The inspection procedure requires that personnel performing visual examinations be CP&L Visual Weld Examiners, certified in accordance with the Corporate NDE Manual. In addition, they are required to have successfully completed the CP&L training course on remote camera equipment and/or have demonstrated their capability to utilize the equipment to the satisfaction of the NDE VT Level III. Vendor personnel operating the closed circuit television system were not required to be certified visual weld examiners, but were required to be familiar with their equipment and proficient in its use.

Generally, the inspection results were good. It is noted that the welds in question were not subject to volumetric examination, and were sufficiently far from the open end of the pipe at the time of welding that an internal visual examination would not have been performed at the time of welding. Relative to the inspection criteria pertaining to weld attributes provided above, five of the six field welds were accepted based on the qualified examiner's review of the camera inspection video. A single weld, 2-SF-144-FW-516, was identified as having areas where portions of a consumable insert could be discerned. This weld, which exists in the horizontal piping on the supply line to SFP D, had several locations where a consumable insert had been utilized but was not fully consumed. Generally, these locations were limited to several very small areas where a small portion of the insert could be discerned, but included one area about 1.5 inches long where a continuous portion of the insert could be seen.

The presence of a small amount of unconsumed insert is not considered to be an indication of an unqualified welder, inadequate procedures, or inappropriate materials. The small amount of unconsumed insert is a relatively insignificant imperfection which is not unusual on field welds such as 2-SF-144-FW-516, which was only subject to surface examination and does not lend itself to internal visual examination. ASME Section III, Subsection ND design rules recognize the potential for imperfections of this nature in welds not subject to volumetric examination, and require that a reduction in joint efficiency be assumed for butt welds which are subject to surface examination only (ref. ND-3552.2).

The root pass associated with the indication of unconsumed insert is backed up by multiple weld passes, any one of which would be adequate to establish a leak tight pressure boundary under these conditions. Hydrostatic test records show that field weld 2-SF-FW-144-516 successfully completed hydrostatic testing at 32 psi during construction prior to the line being embedded, and that this test was witnessed by both QC and the ANI. Procedures and processes at the time required that both these field welds were subject to multiple inspections and documentation reviews during construction. Given this, and considering that this weld was subject to multiple inspections at the time of construction, it is highly unlikely that the indications noted on field weld 2-SF-144-FW-516 extend into the root pass, let alone the multiple passes that followed it.

Since field weld 2-SF-144-FW-516 is on a line which connects directly to atmospheric spent fuel pools, hydraulic pressure at the welds is limited to static head and a small amount of friction losses. (The effect of velocity head would be sufficiently small as to be negligible, but would actually tend to reduce the effective pressure.) At the location of field weld 2-SF-144-FW-516, static head due to the elevation difference is approximately 286 - 277.5 = 8.5 feet. Piping friction losses per 100 ft for 12 inch steel piping is only about 3 feet at 4000 gpm, so even considering the effect of elbows in the line, the 55 foot length of piping between this field weld and SFP C would only contribute another few feet for a total head of about 10 feet (i.e., less than 5 psi).

Operation of the SFP cooling and cleanup system for the C & D pools will be at a relatively low temperature and very low pressure. Accordingly, the minimum wall thickness needed to retain this pressure over a localized area of reduced wall is only a very small percentage of the 0.375 inch wall thickness in this piping. The piping in the vicinity of field weld 2-SF-FW-516 is completely embedded in concrete, located approximately at the center of a six foot thick, seismically-designed wall. As such, this piping is not subject to externally induced movement or stresses. Since the SFP cooling and cleanup system operates at a relatively low temperature with little variation, thermally induced stresses and thermal cycling are not of appreciable concern. Given the lack of externally induced stresses or thermal cycling, the small pieces of unconsumed insert will not initiate a crack or otherwise propagate a piping failure.

Based on all of the above considerations, the indications of an unconsumed insert identified on field weld 2-SF-144-FW-516 are acceptable, and no rework or repair to the weld is required.

Videotapes of the first six embedded field welds and associated piping to be visually inspected have been reviewed by CP&L engineering and metallurgical personnel. Aside from localized occurrences of loosely adhering surface film (principally boron deposits from boric acid added to the water), the videotape provides clear evidence that the piping was free from fouling or foreign materials. Where necessary, deposits were removed with pressurized water before the visual inspection. It is the consensus of the reviewers that the condition of the piping and welds is very good. Several inconsequential stains and small pits were noted, indicating that a small amount of minor corrosion may have occurred at some time in the past. Videotapes of all 15 embedded field welds and associated piping have been forwarded to corrosion experts both within CP&L and in the industry.

Requested Information Item 5:

What are the chemical analyses for steel welds 2-CC-3-FW-207, 2-CC-3-FW-208, and 2-CC-3-FW-209?

Response 5:

Chemical analyses for the carbon steel chips have been completed and are provided as Enclosure 2 to this RAI response. The results of these analyses substantiate that the filler material used for these welds is generally consistent with chemical composition requirements found in SFA 5.1 for ER70S-6 and SFA 5.18 for E7018.

Requested Information Item 6:

Describe the paper trail that identifies a specific weld material to a specific weld on the isometric drawings, i.e., show that the weld material being verified with the Metorex X-Met 880 was specified for that location. Identify missing documentation that breaks the paper trial, if any.

Response 6:

The weld metal to be used on a given weld was prescribed by the Weld Procedure Specification. The Weld Data Report (WDR) documented the Weld Procedure Specification to be used, as well as the AWS Classification of filler material. For the field welds for which WDRs are no longer available, it is not possible to directly document the Weld Procedure Specification and filler metal that was used. However, since the vendor data sheets are available on the pipe spools, a review has been done of the Weld Procedure Specifications available at that time and which would have been applicable for this type piping, material, and end prep. These Weld Procedure Specifications were provided to the NRC as Enclosure 6 to HNP-99-069, dated April 30, 1999, the HNP response to the March 24, 1999 NRC RAI on the Alternative Plan.

The pipe spools utilized in the HNP spent fuel pool cooling system are Type 304 stainless steel, a P-8 material. The Weld Procedure Specifications for P-8 to P-8 piping welds such as these in the spent fuel pool cooling system would have used filler metals conforming to SFA No. 5.4 / 5.9, including ER308, ER308L, ER316, ER316L and ER347. For Type 304 to Type 304 piping, ER308 would have typically been specified on the WDR. Given that some chemical changes in composition will be caused by the welding process and that blending of the base metal and filler metal would occur, the Metorex X-Met 880 testing is not intended to confirm the that chemical composition conforms to chemical composition requirements for each element, but rather to assure that weldments are sound by substantiating that the filler metal used was compatible with the piping material and generally consistent with composition requirements of the Weld Procedure Specification. Additional details on the use of the Alloy Analyzer to evaluate filler metal is provided in the HNP response to Requested Information Item 1 above.

Requested Information Item 7:

Discuss the chemical analysis and any other analysis performed on the water in the fuel pool cooling and cleanup system (FPCCS) and component cooling water system (CCWS) for spent fuel pools (SFPs) C and D. Where did the water come from? Discuss any differences between the chemical analysis and the original water source. Provide the staff with a representative analysis of the water.

Response 7:

A review of plant documentation substantiates that the embedded lines connected to SFPs C & D had water in them on two separate occasions during the construction process. Water samples were collected from seven of the eight lines associated with the embedded piping. * Analysis results of those water samples substantiate that the water in these lines originated from the spent fuel pools. Specifically, chloride and fluoride concentrations were very low, and generally consistent with specifications for spent fuel pool chemistry. Sulfate levels and conductivity, while not typically analyzed for spent fuel pool chemistry, were also very low and consistent with high purity water. The water samples also showed low levels of tritium, at a concentration similar to that of the spent fuel pools. Enclosure 3 to this RAI response provides a representative analysis of water samples taken from both the C and D SFP piping.

Initially, these lines were filled with water for hydrostatic testing prior to pouring concrete. Potential sources of hydrotest water included potable water and lake water, although procedures did require that the piping be drained and vented subsequent to test completion. Since these lines could not be isolated from their respective fuel pool liners, they would have been filled again in support of pool liner leak testing. The procedure for liner leak testing required test water to have a chloride content of no more than 100 ppm, which effectively precluded the use of either potable water or lake water for this evolution. Furthermore, procedures required the pools to be drained after testing, then rinsed with distilled or demineralized water. Subsequent to liner leak testing, there was no reason to introduce water into the pools again until they were filled and put into service (1989 - 1990 time frame). Several of these lines were drained one additional time in 1995 - 1996, when drain valves were added to the exposed portions of several of the embedded lines. Since that time, these lines refilled with water from the spent fuel pools. The water samples that were collected and analyzed, as discussed above, were samples of water that leaked past "plumbers plugs" in the pool nozzles since this last evolution.

* One of the eight lines has no drain line with an isolation valve for taking water samples, and was not represented in the initial set of water samples.

Requested Information Item 8:

In Enclosure 8, "Hydrotest Records for Embedded Spent Fuel Pool Cooling Piping and Field Welds," of your April 30, 1999, RAI response, you provided signed hydrostatic test reports for 13 embedded welds. Starting with the signed hydrostatic test report, back track through procedures and program requirements to the point where the missing document(s) were verified as being complete. In other words, identify the specific procedural and program controls requiring verification of completion of the missing documentation (manufacturing/fabrication records, weld data records, updated isometric drawings, and inspections) starting backward from the hydrostatic test report.

Response 8:

Construction procedure WP-115, "Pressure Testing of Pressure Piping (Nuclear Safety Related)," governed the hydrostatic testing of the embedded lines connected to HNP SFPs C and D. This procedure specifically required, prior to hydrotesting, the Mechanical QA Specialist verify that:

1) all required piping documentation is complete, and
2) all required weld documentation is complete.

Reference to piping and weld documentation is found in WP-102, "Installation of Piping." Specific requirements found in this document include:

1) that each weld joint for Code piping receive a WDR, and that these WDRs receive a QA and ANI inspection.
2) that weld procedures utilized be qualified in accordance with MP-01, "Qualification of Weld Procedures."
3) that welders and welding operators be qualified in accordance with MP-02, "Procedure for Qualifying Welders and Weld Operators."
4) that welds be stamped in accordance with MP-05, "Stamping of Weldments."
5) that weld material be controlled in accordance with MP-03, "Welding Material Control."

Generally, items 2 - 5 above ensure that Code welds were performed to appropriate procedures in the plant's Section IX weld program. Relative to item 1, WP-102 provided reference to CQC-19, "Weld Control" which again required that all Code welds received a WDR, and referenced procedure CQI-19.1, "Preparation & Submittal of Weld Data Report & Repair Weld Data Report," for detailed instructions on the use of WDRs. As prescribed by this procedure, the WDR included essentially all of the required attributes and documentation for welds within Code boundaries. Enclosure 4 provides a copy of CQI 19.1 at a revision level existing at or about the time most of the welds in question were made. Similarly, WP-102 contained requirements for layout and dimensional tolerances, as well as references to appropriate procedures for other piping installation processes, such as performance of cold pulls and torqueing of flanged connections. Therefore, in order to satisfy the prerequisites of procedure WP-115, the Mechanical QA Specialist would be required to verify that all the WDRs and RWDRs were complete and approved, dimensional and tolerance inspections had been completed, and all other piping installation processes had been completed and appropriately documented.

Requested Information Item 9:

Identify the concrete pouring procedure that requires checking for the welder symbol and a successful hydrostatic test before pouring.

Response 9:

Since embedding a line in concrete represented a point at which piping was no longer accessible for inspections, rework, etc., procedural controls were established to ensure that all required work activities had been completed and that documentation was in order prior to authorizing concrete placement. Procedure WP-05, "Concrete Placement", included a pre-placement requirement for a craft superintendent sign-off on the concrete placement report to signify completion of the craft's installation and superintendent inspection thereof. This procedure required that this sign-off be made by all craft superintendents, as a safeguard against omissions, whether or not they had material in a particular placement. Subsequently, procedure WP-05 required that the Construction Inspection Unit (QC) be notified when the installation was complete and ready for pre-placement inspection.

Procedure TP-24, "Mechanical Pipe Installation Inspection" provided requirements for the Construction Inspection Unit relative to inspection of piping, and included separate sections on embedded piping inspection. This procedure specifically required the CI inspector to inspect the installation and documentation prior to concrete placement. The CI inspector was required to verify the specific installation attributes:

1) that piping installation was performed in accordance with design drawings and documents, notably including verification of pipe spool identification
2) that piping was free from physical damage, and had no missing parts, and
3) that all piping leak tests were complete and documented.

It can be seen that procedures associated with concrete placement did provide assurance that piping embedded in concrete was the correct piping and was correctly installed. Furthermore, since the hydro-test was generally the final milestone for completion of a pipe segment, verification that all piping leak tests were complete and documented provided assurance that all test and inspection requirements were met. Procedures WP-05 and TP-24 do not specifically require a verification of the welder symbol. Rather, this assurance is provided by the review of weld documentation prior to hydro-testing, as well as the programmatic controls in CQC-19 and related procedures discussed above.

Requested Information Item 10:

Describe how the liner leak tests support weld integrity for welds 2-SF-8-FW-65 and 2-SF-8-FW-66 (Enclosure 3 of your response to NRCs RAI). For these two welds, back track through procedures and program requirements to the point where the missing documents were verified as being completed.

Response 10:

Leak testing of the liner was accomplished under procedure TP-057, "Hydrostatic Testing of Fuel Pool Liners." This procedure provided specific steps to be completed prior to performance of the liner leak test. The procedure required that Engineering prepare the test package, including identification of all boundaries and all isolation points to be utilized. For the north spent fuel pool liner hydrostatic test, the documented test boundaries included the piping runs containing 2-SF-8-FW-65 and 2-SF-8-FW-66.

Subsequent to preparation of the test package, QC was required to complete the "Prerequisites" section of the test form. Similar to the discussion of piping hydro-test procedures provided in the response to Requested Information Item 8 above, these prerequisites included a line item for the QC Inspector to verify "all weld documentation complete." Although the test procedure was specifically concerned with inspection of the liners, this verification would have necessarily extended to the entire pressurized boundary to ensure that no external leakage occurred, that partially completed welds were not overstressed, etc.

Although hydrostatic test packages have not been located at this time for welds 2-SF-8-FW-65 and 2-SF-8-FW-66, plant documentation does support that this hydrostatic test was done. For example, QA Deficiency and Disposition Report (DDR) 794 was initiated to assess hydrostatic test requirements for the plate rings reinforcing the piping to pool nozzle connections. The resolution to this DDR acknowledged that the pipe spools adjacent to these welds had been subject to hydrostatic testing, even going so far as to include the dates of test performance. Four of the ten spools listed are included in the scope of the SFP C and D embedded piping, and two of these spools are in the line in which welds 2-SF-8-FW-65 and 2-SF-8-FW-66 are located. The other two spools referenced are on isometric drawing 2-SF-159, and are specifically included in a hydrostatic test package for which records have been located (provided previously to the NRC as Enclosure 7 to HNP-99-069, dated April 30, 1999). Comparison of the dates listed on DDR 794 against those associated with piping on isometric drawing 2-SF-159 verify that the test dates on these documents are in agreement.

Therefore, even though hydrostatic test records specifically listing welds 2-SF-8-FW-65 and 2-SF-8-FW-66 as inspection items have not been located, it can be established with a high level of confidence that these welds were hydro-statically tested, and that documentation associated with these welds was reviewed and verified as being complete.

Requested Information Item 11:

Describe precautions that were taken to protect system components (e.g., pumps, valves, heat exchangers, piping) from deleterious environmental effects during layup. Describe the layed up condition of the partially completed piping system and how this was determined. How would these layup conditions be different if it was known that SFPs C and D would be put in service later?

Response 11:

The location of system components (e.g., pumps, valves, heat exchangers, piping), the 236' elevation area of the Fuel Handling Building, is fully enclosed and serviced by a safety related HVAC system. This area is also the location of the operating Unit 1 spent fuel pool cooling pumps and heat exchangers, and is completely suitable for the long term storage of piping and equipment. It was anticipated that at some time it would be necessary to place C and D pools into service, and consideration was given to specific requirements for equipment protection. The spent fuel pool cooling pump motors were removed and placed in controlled storage conditions with heaters energized and shafts periodically rotated. The spent fuel pool heat exchangers were capped to preclude introduction of foreign material, and provided with a nitrogen blanket on the shell (CCW) side to prevent moisture and other contaminants from inducing corrosion. Spent Fuel Pool Cooling piping not connected to the spent fuel pools, which had never been wetted and was not connected to any active water systems, also received Foreign Material Exclusion (FME) type covers. Notably, the spent fuel pool cooling pumps and strainers were protected by FME covers on adjacent piping.

Through conversations with cognizant personnel, it is known that when it became necessary to fill the C and D spent fuel pools, the exposed ends of the connected spent fuel pool piping were fitted with leak tight covers and flooded as well. At some point, "plumber's plugs" were fitted in the C and D spent fuel pool cooling nozzles, although it is not clear whether these plugs were installed before or after the lines were flooded by the spent fuel pools. The primary purpose of these plugs was not for equipment protection but instead for ALARA considerations, i.e., to preclude collection of radioactive material in the piping.

Requested Information Item 12:

Why was visual inspection rather than ultrasonic inspection chosen to examine the integrity of the embedded welds?

Response 12:

Examination requirements for the embedded spent fuel pool cooling piping at the time of construction consisted of a surface visual and liquid penetrant examination of the piping OD, consistent with design rules and NDE requirements in ASME Section III, Subsection ND. Numerous programmatic and documentation assurances exist to confirm that these required inspections were indeed completed. In reviewing options for inspection of embedded piping and associated welds under the Alternative Plan, the objective was to implement an inspection program which: (1) provided yet another measure of assurance of construction quality, (2) provided a means to inspect as much of the overall scope as possible, (3) allowed for inspection of not only discrete areas of interest (ie., field welds), but also for qualitative assessment of overall piping condition, including corrosion and fouling, and (4) had a high level of probability to produce meaningful results with existing, proven technology. These criteria are individually discussed as follows:

1) Provides additional measure of assurance of construction quality

A detailed inspection of the interior of the piping with a high resolution camera provides a means to discern and assess numerous attributes pertaining to construction quality, including fit-up and alignment, adequacy of purge, and fusion of the root pass. These attributes, while readily examined with the use of a remote camera, do not lend themselves to detection and evaluation through ultrasonic examination.

2) Provides a means to inspect as much of the overall scope as possible

Camera inspection provides a means to see as much of the overall inspection scope (piping interior surfaces) as possible, as well as focus on specific areas of interest. A number of vendors offer inspection services of piping using remote cameras and a variety of propulsion methods, providing the best probability of inspecting as much of the piping as possible. Using real time feedback, direct camera operators can move relatively quickly over long runs of piping which can be readily observed as clean and in good condition; however, considerable time is spent in adjusting focus, lighting and other parameters to provide a detailed examination of specific areas of interest. Although ultrasonic techniques are commonly used to detect wall thinning in steam piping, this process requires that the entire surface to be examined be mapped, with each grid location receiving an ultrasonic examination. Clearly, the lack of access in the embedded piping precludes the use of a similar technique to assess the overall condition of the embedded piping.

3) Allows for inspection of overall piping condition, but also macroscopic examination for fouling, corrosion, etc.

Camera inspection is the only viable means to identify and assess numerous attributes which pertain to the suitability of piping for service, including surface corrosion, fouling, foreign objects in the line, etc. Visual inspection with a high resolution camera can also detect visual evidence of corrosion (stains, discoloration) even when no loss of material or other degradation is obvious.

(4) Provide a high level of probability of producing meaningful results with existing, proven technology

While not deemed appropriate to evaluate macroscopic examination of piping quality for the reasons discussed above, CP&L has investigated the feasibility of using ultrasonic examination to disposition discrete, localized indications. The obstacles associated with remotely performing ultrasonic examinations of these 12 inch embedded lines are considerable, and include:

- Piping runs approaching 100 feet long
- Piping runs including 4 or more elbows
- Both horizontal and vertical runs
- Since pools are full, inspections must be done from the exposed piping end, meaning that all vertical runs are upward
- The weld joints themselves are irregular to the extent a direct beam method could not be used. In addition, these butt welds utilized consumable inserts with an end prep having a counterbore approximately ¾ inch from the weld joint. This configuration complicates the use of angle beam ultrasonic methods
- The piping surface must be clean and smooth, such that boron crystals or any other film or material which are in the area to be inspected must be removed.
- A means must be devised to inject couplant in the area to be inspected
- The technique must provide a means to precisely locate and control the detector transducers, which would invariably require the use of a remote camera

The device would need to be capable of propelling a camera, UT transducers, and all attendant cabling through long pipe sections with numerous elbows and risers to the location of interest, identify and focus on the indication to be examined, clean it as necessary, inject couplant on the area where the transducer will be placed, then precisely locate the transducer at that point, adjusting it as necessary to provide a good signal. Even then, since the back (outside) surface of the weld joints is irregular, it is not certain that the results will allow an accurate interpretation of the condition of the piping. In summary, while several vendors have expressed an interest in working on a cost and materials basis to provide the propulsion, robotics, and equipment necessary to perform ultrasonic examination of the embedded piping, none have been identified with the proven experience necessary to provide repeatable, reliable results under similar conditions.

Requested Information Item 13:

Describe the post modification testing to be performed to ensure that the system(s) will satisfy all design requirements. Include description of hydro-tests to verify the integrity of the system pressure boundaries, flushing to ensure unobstructed flow through the system components, and pre-operational functional testing under design flow/heat loads.

Response 13:

Post modification testing will include the following:

1) System Hydrostatic testing conforming to Section III requirements will be performed on the completed system. With the exception of embedded piping, components inside Code boundaries will be included in this test effort, including pumps, heat exchangers and strainers. In a previous HNP response to the NRC RAI on the Alternative Plan (ref. HNP-99-069, dated April 30, 1999), CP&L stated that Code Case N-240 would be used to exempt formal requirements for hydro-testing of the embedded piping connected to the atmospheric spent fuel pools. CP&L is continuing to investigate methods to provide additional assurance of the quality of embedded piping and field welds, including consideration of pressure testing. The final disposition of hydrostatic testing of embedded spent fuel pool piping will be provided to the NRC as part of the follow-up report on embedded piping and welds as discussed in the response to Requested Information Item 4 above.

2) A flush procedure will be developed which ensures that piping and components inside Code boundaries are free from fouling and debris which might affect system performance, reliability or spent fuel integrity.

3) Pre-operational testing will include a flow balance and verification which ensures that design flow requirements are met for the Spent Fuel Pool Cooling and Component Cooling Water systems, as well as those heat loads which rely on CCW (such as RHR) and heat sinks downstream of CCW (ESW, UHS). Given the lack of a heat load which would facilitate the performance of a meaningful heat duty test of the Spent Fuel Pool Cooling System, no such test will be performed. Moreover, at the 1.0 Mbtu / hr maximum heat load associated with this license amendment request, performance of such a test would not be viable even at the proposed licensed limit. Although the C and D spent fuel pool cooling heat exchangers were installed in the Fuel Handling Building nearly 20 years ago, they have never been placed into service and, from a design perspective, are still new. Moreover, these heat exchangers were layed up with a nitrogen blanket on the shell side, protecting it from moisture and corrosion. A pre-service inspection of the tubesheets and tubes has been performed on these heat exchangers to ensure that no foreign material or corrosion exists which might obstruct flow or otherwise reduce performance.

CONTENTION TC-3: EXHIBIT 3.b

Enclosure 3 to RAI Response (Chemistry Sample Data Sheets)

ENCLOSURE 3 to SERIAL: HNP-99-172

SHEARON HARRIS NUCLEAR POWER PLANT
DOCKET NO. 50-400/LICENSE NO. NPF-63
RESPONSE TO NRC REQUEST FOR ADDITIONAL INFORMATION REGARDING THE ALTERNATIVE PLAN FOR SPENT FUEL POOLS C & D COOLING AND CLEANUP SYSTEM PIPING

Chemistry Sample Data Sheets from HNP Procedure CRC-001

(2 sheets total)

CHEMISTRY SAMPLE DATA SHEET

SAMPLE PT SPENT FUEL POOL 'C' - 2SF-213		
SAMPLE COLLECTOR JERRY BOLEY	OP MODE I	DATE 4-27-99

SAMPLE TIME	PARAMETER	LIMITS	RESULTS	ANALYST
0930	F		13.1 ppb	LLB/MSJ
↓	Cl		28.2 ppb	↓
	SO4		424 ppb	
	pH		5.33	
	KTOT		25.4	

Comments

Reviewed By: Terry Thompson Date 4-29-99

CONTENTION TC-3: EXHIBIT 4

ESR # 96-00266, Rev. 0 re: Evaluate Unit 2 & # SFP Cooling Embedded Piping

ShawPittman

A Law Partnership Including Professional Corporations

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December 23, 1999

BY HAND DELIVERY

Diane Curran, Esq.
Harmon, Curran, Spielberg & Eisenberg, L.L.P.
1726 M Street, N.W., Suite 600
Washington, D.C. 20036

Dear Diane:

Enclosed is a copy of the Engineering Services Report (ESR) that dispositions all indications from the video inspection of the spent fuel pool clean-up system piping. This ESR includes Rev 2 of the Structural Integrity Associates, Inc. report.

Sincerely yours,

John H. O'Neill, Jr.

Enclosure

Document #: 872204 v.1

Form 1a	ENGINEERING DISPOSITION		
ESR # 99-00266 Rev # 0	WR/JO #	Other Documents (CR, OEF, etc.)	
Plant/Unit HNP 0	Primary System Number & Name 7110 SPENT FUEL POOL COOLING SYSTEM		☐ Multiple Systems Affected
Title Evaluate Unit 2 &3 SFP Cooling Embedded Piping		Originator/Phone LANE, ROBERT J /362-2859	
Due Date - -			

********** CAUTION **********

THIS PRODUCT TYPE SHALL NOT BE USED TO CHANGE OR ESTABLISH NEW DESIGN INPUTS, BASES, ASSUMPTIONS, PARAMETERS OR CHANGE CRITERIA. THE USE OF THIS PRODUCT IS RESTRICTED TO THE LIMITS AND BOUNDS ESTABLISHED IN THE RESPONSE. CONTACT ENGINEERING IF ADDITIONAL USES ARE ANTICIPATED.

REQUEST:

See attached

RESPONSE:

See attached

Engineering Review: Edison L. Morales (signature) Edison L. Morales 12/21/99

Reviewed by: (signature) 12/20/99
ANI

APPROVALS

Responsible Engineer	ROBERT J LANE	(signature) 12/20/99
Responsible Supervisor	(Print Name, Sign, Date) R. Steven Edwards	(signature) 12/21/99

Form 1 **ENGINEERING SERVICE REQUEST**

ESR #	Rev #	Title
99-00266	0	Evaluate Unit 2 &3 SFP Cooling Embedded Piping

Request:

Evaluate the results of internal inspections of embedded Unit 2 & 3 SFP Cooling System piping. These inspections are being performed in support of the SFP Activation Project, in support of the 10CFR50.55a Alternative Plan. The inspection results and evaluation of those results will be provided to the NRC per their request during the review of that submittal.

Response:

An evaluation of the embedded piping and field welds has been performed as requested. This evaluation assessed initial quality of construction, the effect of extended lay up since construction, and the present suitability for service. Independent expert opinions both inside and outside the company were used in the development of this evaluation. These are documented as attachments to the ESR package. This evaluation is being completed to provide the information discussed above to the NRC for their review in support of an ongoing license amendment request. 10CFR50.59 does not apply.

1.0 List of Effective Pages

Page No.	Rev.
1	0
2	0
3	0
4	0
5	0
6	0
7	0
8	0
9	0
10	0
11	0
12	0
13	0
Attachment 1 (15 pp.)	0
Attachment 2	effective pages listed in attachment
Attachment 3 (5 pp.)	

2.0 Table of Contents

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List of Effective Pages	1
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Evaluation	3
Conclusion	12

<u>Attachments</u>

Attachment 1	Inspection Data Sheets
Attachment 2	Evaluation of Embedded Welds in Spent Fuel Piping at Harris Nuclear Plant, by Mr. George Licina of Structural Integrity Associates
Attachment 3	Harris E&EC Center Material Services Section Metallurgy Services Technical Report 99-179

3.0 EVALUATION

3.1 Scope

License Amendment Request HNP-98-188 associated with the activation of Harris Spent Fuel Pools "C" and "D" includes a 10CFR50.55a Alternative Plan for completion of construction of these facilities. The scope of this alternative plan includes embedded portions of the spent fuel pool cooling piping runs connecting to the spent fuel pools. Piping isometric packages associated with the construction of this piping are no longer available, and since the piping is embedded in concrete, a number of Code required attributes can no longer be directly verified. In addition, this piping has been in wet lay up for as long as ten years, with no formal program for controlling lay up conditions. To address these conditions, CP&L has embarked on a test and inspection effort to verify the as-constructed quality of this embedded piping and evaluate its present suitability for service. The test and inspection program discussed above specifically included remote camera inspections of internal surfaces of embedded field welds and piping. The special procedure written to direct this inspection incorporated a procedural requirement that any recordable indications be addressed by engineering via ESR. The purpose of this ESR is to document any such recordable indications, and provide a disposition to each relative to its implications on "as-constructed" quality and present suitability for service of this piping.

3.2 References

3.2.1 Special Plant Procedure SPP-0312T
3.2.2 Isometric drawings 2-SF-1, 8, 30, 34, 143, 144, 149, 151,159
3.2.3 Vendor Data Packages for Isos 2-SF-1, 8, 30, 34, 143, 144, 149, 151,159
3.2.4 ASME Section III, Subsection ND, '74 Edition with addenda through Winter '76 addenda
3.2.5 License Amendment Request HNP-98-188
3.2.6 ASME Section III, Subsection ND, '71 Edition through Summer '73 addenda

3.3 Design Inputs

3.3.1 The Fuel Handling Building (FHB) has two storage facilities with a common cask unloading pool. Each facility consists of a new fuel pool, a spent fuel pool, interconnecting transfer canals, and a spent fuel pool cooling and cleanup system (Fuel Pool Cooling). The south end pools contain new and spent fuel and have a functional cooling and cleanup system. The north end pools contain water, but the cooling and cleanup system is not functional, as the piping is not complete and blanked off. The north end systems are being made functional, and the embedded spent fuel pool cooling piping connected to these spent fuel pools is being evaluated in this ESR.

3.3.2 Given that certain construction records are no longer available, a 10CFR50.55a Alternative Plan has been submitted to the NRC for the acceptance of previously installed piping, particularly that of embedded piping for which Code required attributes can no longer be reestablished. CP&L has performed remote camera inspections of this embedded piping in order to establish the quality of its construction as well as its suitability for the intended service. CP&L has committed to provide the results of those inspections and its disposition on embedded piping to the NRC.

3.3.3 The Fuel Pool Cooling piping is seismic category 1 and designed to ASME B&PV Code, Section III, Class 3 requirements, 1971 edition through summer 1973 addenda. Rules for construction were in accordance with the 1974 edition with addenda through winter 1976.

3.3.4 The suction line to the Fuel Pool Cooling pump penetrates the fuel pool wall approximately 18 feet above the fuel assemblies which precludes uncovering the fuel assemblies as a result of a postulated suction line rupture. From this location the piping is routed through reinforced concrete along the side and under the spent fuel pools to open areas of Fuel Handling Building 236' elevation.

3.3.5 Safety related portions of the Fuel Pool Cooling System have the following design temperature and pressure ratings: Temperature - 200°F, Pressure - 150 psig

3.3.6 Spent Fuel Pool Cooling piping is constructed of 300 series stainless steel in accordance with construction specifications. The specific manufacturing specifications for this piping are as listed on the vendor's manufacturing record sheets.

3.4 Disposition

3.4.1 Scope of Inspections

All of the fifteen embedded field welds and associated Fuel Pool Cooling System piping runs were inspected using a high resolution camera fitted to a pipe crawler. These inspections were conducted in accordance with Special

Plant Procedure SPP-0312T, which provided specific acceptance criteria, as well as qualification requirements for the equipment and inspectors. The inspection included welds on six of the eight embedded cooling lines connected to spent fuel pools "C" and "D". The remaining two lines have only approximately 6 feet of embedded pipe each, with no embedded shop or field welds. All of the lines inspected were 12" schedule 40 stainless steel (304) piping.

The inspection specifically included the following welds:

Field Weld Number	Piping Function
2-SF-1-FW-1	D SFP Cooling Return
2-SF-1-FW-2	D SFP Cooling Return
2-SF-1-FW-4	D SFP Cooling Return
2-SF-1-FW-5	D SFP Cooling Return
2-SF-8-FW-65	C SFP Cooling Supply
2-SF-8-FW-66	C SFP Cooling Supply
2-SF-143-FW-512	D SFP Cooling Supply
2-SF-143-FW-513	D SFP Cooling Supply
2-SF-143-FW-514	D SFP Cooling Supply
2-SF-144-FW-515	D SFP Cooling Supply
2-SF-144-FW-516	D SFP Cooling Supply
2-SF-144-FW-517	D SFP Cooling Supply
2-SF-149-FW-408	D SFP Cooling Supply
2-SF-159-FW-518	D SFP Cooling Return
2-SF-159-FW-519	D SFP Cooling Return

Per the acceptance criteria in SPP-0312T, welds which could be accepted without further evaluation must be completely free of the following defects:

- Cracks
- Lack of Fusion
- Lack of Penetration
- Oxidation
- Undercut greater than 1/32"
- Reinforcement ("Push Through") greater than 1/16"
- Concavity (Suck Back") greater than 1/32"
- Porosity greater than 1/16"
- Inclusions

The scope of inspection also included the Fuel Pool Cooling piping associated with the embedded field welds, including shop welds, seam welds and condition of the piping itself.

Generally, the inspection results were very good. It is noted that the welds in question were not subject to volumetric examination, and were sufficiently far from the open end of the pipe at the time of welding that an internal visual examination would not have been performed. Some general discoloration of the weld and portions of the internal surfaces of piping was noted, as well as a number of minor surface indications. The following is a summary of the results of these inspections as interpreted and recorded by the QC inspector working to the inspection procedure, categorized by type of indication. In addition, a small linear indication was noted in the piping seam weld of the spool above 2-SF-144-FW-515. While this does not appear to be associated with the construction of the field weld itself and was not recorded on the examination data sheet, it does not meet the acceptance criteria of the procedure and so is also being added to the list of items being evaluated herein. The Examination Data Sheet for all fifteen welds are included as Attachment 1 to this evaluation.

3.4.2 Incidence of Weld Inserts Not Fully Consumed

(ref. 2-SF-1-FW-1, 2-SF-1-FW-4, 2-SF-1-FW-5, 2-SF-143-FW-513, 2-SF-144-FW-517, 2-SF-143-FW-514, 2-SF-144-FW-516)

The typical field weld joint of the Fuel Pool Cooling piping incorporated a consumable insert, with the ends of the pipe spools being prepped at the vendor facility for use with this configuration. By design, the root pass of the weld would consume the insert while fusing both ends of the pipe together. A number of field welds had locations where small portions of the insert could be discerned, indicating that it was not fully consumed by the root pass. Generally, these incidences of unconsumed insert were limited to several very small areas where a small portion of the insert could be discerned. The most significant indication of unconsumed insert was observed on 2-SF-144-FW-516, which exists in the horizontal piping on the supply line to the "D" SFP. This weld had several locations where a consumable insert had been utilized but was not fully melted by the root pass, including one area about 1.5" long where a continuous portion of the insert could be discerned. Notably, to the extent that could be discerned by closely reviewing multiple camera angles, inspection of these areas of unconsumed insert indicates that these pieces of insert material are completely fused around the edges.

The "C" and "D" Fuel Pool Cooling lines operates at a low temperature, and based strictly on pressure temperature considerations the minimum wall thickness needed to retain this pressure over a localized area of reduced wall is only about 0.011", or about 3% of the .375" nominal wall thickness in this piping. The piping in the vicinity of these field welds is completely embedded in reinforced concrete, approximately in the center of a six foot thick seismic wall. As such, this piping is not subject to externally induced movement or stresses. Since the Fuel Pool Cooling System operates at a low temperature with little variation, thermal induced stresses and thermal cycling are not of appreciable concern. Given the lack of externally induced stresses, or thermal cycling, there is no reason to expect the indication to initiate a crack or otherwise propagate itself.

It follows from the above discussion that the consideration of stresses for this field weld is limited to residual stresses from construction and that induced by internal pressure. Since 2-SF-144-FW-516 resides on a line connecting directly to atmospheric spent fuel pools, hydraulic pressure at the welds is limited to static head and a small amount of friction losses. (The effect of velocity head would be sufficiently small as to be negligible, but would actually tend to reduce the effective pressure.) For 2-SF-144-FW-516, static head due to the elevation difference is approximately 286 - 277.5 = 8.5 feet. Piping losses per 100 ft for 12" steel piping is only about 3 feet at 4000 gpm, so even considering the effect of elbows in the line, the 55 foot piping run between this field weld and the "C" SFP would only contribute another few feet for a total head of about 10 feet (less than 5 psi).

The observation that the pieces of unconsumed insert are actually fused around the edges is notable in that this discounts the potential existence of rejectable linear indications or crack-like conditions. This is significant in that crack-like conditions could act to intensify stress as well as provide nucleation sites for corrosion. Even so, analyses performed by Structural Integrity Associates (Attachment 2) show that, based on conservative stress considerations, the allowable flaw size for such an indication would be quite large, in fact, many times the length of any of the pieces of unconsumed insert observed in the embedded field welds. The potential for corrosion at these sites has also been considered, and is fully addressed elsewhere in this evaluation.

The root pass associated with these welds is backed up by multiple weld passes, any one of which would be adequate to establish a leak tight pressure boundary under these conditions. The line in question has been flooded for a number of years, with no evidence of leakage or dampness where the piping exits the concrete or elsewhere on the wall in the vicinity of this piping. In addition, hydrostatic test records are on hand for all of the welds having incidence of unconsumed insert, showing that these successfully completed hydrostatic testing at or above 32 psi during construction prior to the line being embedded, with this test being witnessed by both QC and the Authorized Nuclear Inspector (ANI). Procedures and processes at the time required that these field welds be subject to multiple inspections and documentation reviews during construction. Finally, given that these pieces of unconsumed insert are actually fused around their periphery, this condition is not considered to extend through the root pass on these welds, let alone the multiple passes that are behind them.

It is concluded that the incidence of unconsumed weld insert identified by camera inspection of the embedded field welds do not challenge piping integrity or otherwise affect its suitability for the intended service. Further, these are not gross defects which would indicate unqualified welders, inadequate procedures or inappropriate materials, but relatively insignificant imperfections which are to some degree expected on field welds such as 2-SF-144-FW-516 which was only subject to surface examination and does not lend itself to internal visual examination. ASME Section III, Subsection ND design rules for vessels specifically recognize the potential for imperfections in welds which are not subject to volumetric examination, and provide compensation when necessary by a reduction in joint efficiency based on the type and extent of NDE performed. (ref. ND-3552.1,2). While these considerations regarding joint efficiency do not directly apply to the embedded Fuel Pool Cooling piping, it is evident that the Code acknowledges that some incidence of minor imperfections will exist in welds of this nature which are not volumetrically examined, and that Code design rules take this into consideration. Based on these considerations and the additional discussion in Attachment 2 pertaining to structural integrity, the indications of incomplete fusion identified on these embedded field welds are deemed acceptable with no rework / repair.

3.4.3 Incidence of Stains / Deposits

(ref. 2-SF-1-FW-1, 2-SF-1-FW-2, 2-SF-8-FW-65, 2-SF-8-FW-66, 2-SF-149-FW-408, 2-SF-143-FW-512, 2-SF-143-FW-513, 2-SF-144-FW-515, 2-SF-144-FW-517, 2-SF-159-FW-518, 2-SF-159-FW-519)

Stains and / or deposits observed on the interior of the embedded piping are divided into two categories. These are (1) light surface films existing over areas of the piping and welds, ranging in color from white to reddish - brown, and (2) stains and / or deposits occurring directly in the area of the field weld itself, and thereby associated specifically with conditions at that weld. These indications are assessed herein for their implications on the potential for corrosion attack on the embedded piping.

The generalized film that appeared on certain areas of piping could be further broken down into two categories. First, there were areas of white to tan deposits where boron crystals formed as the borated water on the interior surfaces of the piping evaporated as it was drained. In many instances camera inspections clearly showed the crystalline structure of this material. Second, a reddish-brown film could be observed in some areas. This material was lightly adhering, and was easily washed off where necessary to facilitate camera inspection of the Fuel Pool Cooling piping and welds. This reddish-brown material is very similar in appearance to the iron oxide which is introduced to the spent fuel pools by way of spent fuel transshipment. Chemical analysis of this material confirms that it is indeed primarily composed of iron oxide, as described in the analysis from the HE&EC Metallurgy Unit (Attachment 3). Neither the boron deposits or the reddish-brown deposits results from, contributes to, or is otherwise associated with corrosion or degradation in this piping. This material will be removed from the line during piping flushing prior to turnover, and will be of no consequence to the eventual operation of the system.

These indications observed on the welds themselves ranged from small, localized stains and discolorations to localized deposits of reddish brown material. An extensive effort has been completed to assess the cause of these indications, determine extent of condition, and evaluate whether they pose any liability to the integrity of the spent fuel pool cooling piping and the safe and reliable operation of the system. This effort included the following tests, inspections and analyses:

3.4.3.1 Analysis of lay up water in the embedded lines

A review of plant documentation substantiates that the embedded lines connected to Spent Fuel Pools "C" & "D" had water in them on two separate occasions during the construction process. Initially, these lines were filled with water for hydrostatic testing (hydrotest) prior to pouring concrete. Potential sources of hydrotest water included potable water and lake water, although procedures did require that the piping be drained and vented subsequent to test completion. Since these lines could not be isolated from their respective fuel pool liners, they would have been filled again in support of pool liner leak testing. The procedure for liner leak testing required that test water have a chloride content of no more than 100 ppm, which effectively precluded the use of potable water and lake water for this evolution. Further, procedures required that subsequent to testing, the pools be drained, then rinsed with distilled or demineralized water. After completion of liner leak testing, there was no reason to introduce water into the pools again until they were filled and put into service (1989 - 1990 time frame). The lines connected to "C" pool were drained one additional time in 1995 - 1996, when drain valves were added to the exposed portions of piping. Since that time these lines have refilled with water from the spent fuel pools. The water samples that were collected and analyzed as discussed above were of water that leaked past "plumbers plugs" in the pool nozzles subsequent to initial pool filling or since the addition of drain valves, as applicable.

The water which has been sitting in these lines under extended layup conditions was recently subject to chemical and microbiological analysis. Water samples were collected from seven of the eight lines associated with the embedded piping at drain valves located at the low points of the piping. Analyses of the water samples substantiate that the water in these lines originated from the spent fuel pools. Specifically, chloride and fluoride concentrations were very low, and generally consistent with specifications for spent fuel pool chemistry. Sulfate levels and conductivity, while not typically analyzed for spent fuel pool chemistry, were also very low and consistent with high purity water. The water samples also showed low levels of tritium, at a concentration similar to that of spent fuel pools "C" and "D". This test effort also determined that the water in these lines had low levels of microbiological activity. The results of this testing discount the potential for chemically or microbiologically induced corrosion to have occurred during extended layup.

3.4.3.2 Chemical and microbiological analysis of deposits on embedded field welds

Inspection of FW-517 found three locations having a localized deposit of reddish-brown material at the field weld. Samples of this material were removed by fitting the head of the inspection camera with an arm and swab, and using pan and tilt manipulations to collect material directly from the locations of interest. This material was subject to microbiological testing for the presence of bacteria associated with MIC, as well as chemical analysis to determine its makeup. The results of this effort, described in Attachment 3, provided negative results relative to the presence of aggressive bacteria which are associated with MIC. An elemental analysis of the deposit material was performed using a Scanning Electron Microscope. This determined that the material was predominantly composed of iron oxide consistent with material introduced into the spent fuel pools by transshipment.

3.4.3.3 Expert Review of Visual Examination of Videotapes

In addition to CP&L plant engineering, weld engineering and the site ANI, the videotaped examinations of embedded field welds have been reviewed by Dr. Ahmad Moccari, CP&L's foremost corrosion specialist. Also, Mr. George Licina, a leading industry authority on corrosion in power plant systems, was requested to perform an independent expert review and reviewed all of the videotaped inspections as part of that expert review. The results of these reviews are provided in Attachments 2 (Licina) & 3 (Moccari). Based on the observations of these experts, it can be concluded that

- The as constructed quality of the piping was good
- The piping has been exposed to very benign environmental conditions.
- Localized corrosion is the most likely form of degradation, but even localized corrosion (including MIC) is very improbable
- Even based on worst case postulated conditions, no loss of piping structural integrity is associated with these indications.
- Extended wet lay up does not appear to have degraded the piping, such that it remains suited for its intended service.

It is concluded that the incidence of stains / deposits identified on these embedded field welds is deemed acceptable with no rework / repair.

3.4.4 <u>Incidence of linear indication in the base metal</u>

(ref. 2-SF-144-FW-515)

A small linear indication (approximately ½" long) was observed extending out of the seam weld on the pipe spool above 2-FW-144-FW-515 and into the counter-bored region adjacent to this weld. This indication does not appear to originate in the field weld itself, nor does it have the appearance of being corrosion related. The corrosion mechanisms which could possibly cause cracking in the Type 304 Stainless Steel spent fuel pool cooling lines are very unlikely due to a lack of the aggressive conditions (chemistry, stress and temperature) which might initiate them. Further, the line is not exposed to cyclical loading or thermal variations, which might induce fatigue cracking.

Since the linear indication appears to originate in the seam weld itself, other possibilities for its initiation are associated with the manufacture of the pipe spool. Low ferrite content has been associated with cracking of stainless steel weldments. A review of the Certified Material Test Reports in the vendor data package for the pipe spool of interest show that the piping base metal was required to have a minimum ferrite content of 5%. The ferrite content of the weld wire itself was measured by several methods, with calculated ferrite at 9%, and measured ferrite ranging from 5 to 10. These values are considered typical of what would be expected based on material specification requirements. Another possibility is that the indication is a small inclusion in the seam weld, which was exposed by the machining process. Manufacturing records show that this seam weld was subject to 100% RT. Although it is unlikely that an RT would have missed this indication during manufacture of the piping, it it is far less likely that an RT would have missed such an indication if it extended significantly beyond the visible indication observed in the examination of 2-SF-144-FW-515.

At this point the specific cause for the linear indication in the seam weld above 2-SF-144-FW-515 cannot be conclusively determined. What can be said is that an external visual and liquid penetrant examination was completed of this field weld after its construction, and that the indication of interest would have been identified if it extended to the exterior surface of the piping. Subsequently, this field weld was subjected to and successfully completed hydrostatic testing and additional close visual inspection prior to the concrete pour. These examinations and tests provide conclusive evidence that the crack is not through wall and will not result in leakage.

Structural Integrity Associates was asked to provide an expert independent evaluation of the implications of the indication on the structural integrity of the piping. Their conclusion, based on critical flaw size analysis and consideration of the potential mechanisms for crack propagation, is that the indication does not challenge piping integrity, nor is there any reason to suspect that the indication might propagate beyond its existing condition (See Attachment 2). Based on these considerations, the linear indication noted on 2-SF-144-FW-515 is deemed acceptable with no rework / repair.

3.4.5 Condition of Balance of Piping

The videotaped inspection also allowed an assessment of the overall condition of the embedded spent fuel pool piping. It could readily be observed that the piping was without noticeable construction anomalies such as mismatch or other fitup problems. There was no evidence of mishandling, such as dents or ovality, or of corrosion which might be evident of contamination or sensitization during handling and construction. Field welds and shop welds were all found to be in the expected location based upon isometric drawings and vendor manufacturing records. The camera inspection confirmed that the quality of construction was good, and provided no evidence to support that the piping was not in compliance with construction requirements.

The balance of piping does contain a number of shop welds associated with fabrication of the pipe spools, as well as the longitudinal seam weld made by the piping manufacturer. Code required documentation is on hand for the materials and construction of these welds, and given the greater control over heat input and other parameters in a shop and manufacturing environments, it is reasonable to assume that conditions at these welds would be as good as or better than those of the field welds described above. Additional observations regarding the balance of piping are provided in both Attachments 2 & 3.

4.0 CONCLUSIONS

Based on the preceding evaluation, it can be concluded that the original quality of construction of embedded spent fuel pool piping in the scope of this evaluation was constructed to the requisite level of quality in accordance with its Construction Code. Subsequently, it was subjected to extended layup, which did not result in any substantial degradation of the piping or welds. It was also noted that the stainless steel piping and welds are conservatively designed for system pressures far in excess of the maximum pressure of the embedded Fuel Pool Cooling System piping, which connects directly to the atmospheric fuel pools. It can be concluded that the Fuel Pool Cooling piping in its present condition is completely suitable for its intended service in support of activation of the "C" and "D" spent fuel pools.

Remote Visual Examination
Data Sheet

Sheet 1 of 1

System: SPENT FUEL POOL COOLING

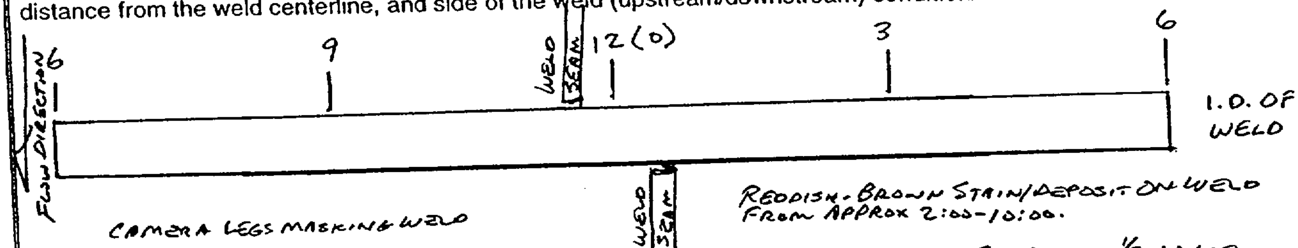
WR/JO Number: 99-AGQI1

Component ID (Weld Number) 2-SF-159-FW-519
LINE 3SF12-171SB-2+3

Reference "0" Location: BETWEEN PIPE WELD SEAMS
TDC of Weld N/A   North Side of Weld N/A

Recordable Condition Present	Yes	No	Comments
Cracks		✓	
Lack of Fusion		✓	
Lack of Penetration		✓	
Oxidation	✓		
Undercut Greater Than 1/32"		✓	
Reinforcement Greater Than 1/16"		✓	
Concavity Greater Than 1/32"		✓	
Porosity Greater Than 1/16"		✓	
Inclusion		✓	
Arc Strikes		✓	
Mishandling		✓	
Foreign Material		✓	
Pipe ID Mismatch		✓	
Pitting		✓	
MIC		✓	
Other	✓		SEE BELOW

Comments/Notes:
Note: If recordable condition/indication is noted, record the following information: length/width, circumferential location, distance from the weld centerline, and side of the weld (upstream/downstream) condition/indication is located on.



DRAWING NOT TO SCALE

Examiner: [signature]   Date: 11-4-99

APPROVALS

Spent Fuel Pool RE*: [signature] Robert J. Lee   Date: 12/20/99
ANII: [signature]   Date: 12-20-99

* SFP RE Coordinator review required if recordable conditions are noted.

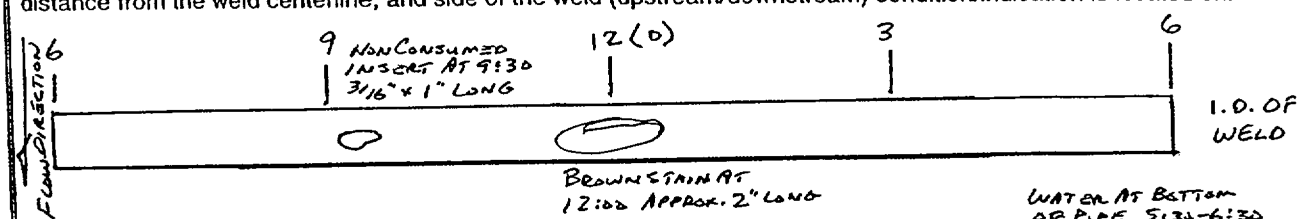
QA RECORD

Remote Visual Examination
Data Sheet

Sheet 1 of 1

System: SPENT FUEL POOL COOLING			WR/JO Number: 99-AGQI1
Component ID / (Weld Number) 2-SF-1-FW-1 LINE 3SF12-1715B-2+3			Reference "0" Location: TDC of Weld ☒ North Side of Weld ☐
Recordable Condition Present	Yes	No	Comments
Cracks		✓	
Lack of Fusion		✓	
Lack of Penetration		✓	
Oxidation	✓		
Undercut Greater Than 1/32"		✓	
Reinforcement Greater Than 1/16"		✓	
Concavity Greater Than 1/32"		✓	
Porosity Greater Than 1/16"		✓	
Inclusion		✓	
Arc Strikes		✓	
Mishandling		✓	
Foreign Material		✓	
Pipe ID Mismatch		✓	
Pitting		✓	
MIC		✓	
Other	✓		SEE BELOW

Comments/Notes:
Note: If recordable condition/indication is noted, record the following information: length/width, circumferential location, distance from the weld centerline, and side of the weld (upstream/downstream) condition/indication is located on.



DRAWING NOT TO SCALE APPARENT OXIDATION FROM APPROX. 12:30-5:00

Examiner: [signature] Date: 11-4-99

APPROVALS

Spent Fuel Pool RE*: [signature] / Robert J. Law Date: 12/20/99

ANII: [signature] Date: 12/20/99

* SFP RE Coordinator review required if recordable conditions are noted.

QA RECORD

ESR 99-00266, Rev. 0, Att. 1, P. 7

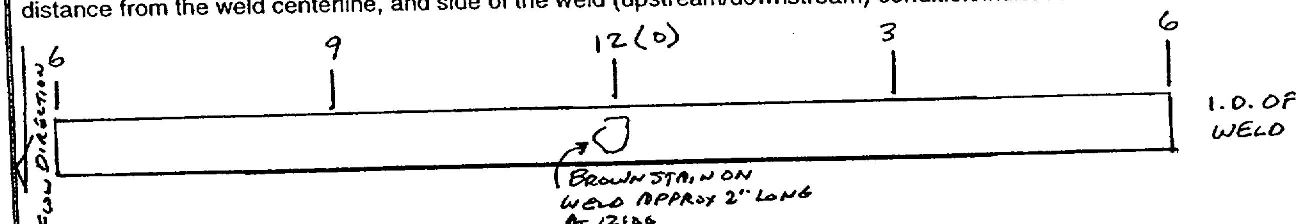
Remote Visual Examination
Data Sheet

Sheet 1 of 1

System: SPENT FUEL POOL COOLING	WR/JO Number: 99-AGQI1	
Component ID / (Weld Number) 2-SF-1-FW-2 LINE 3SF12-1715B-2+3	Reference "0" Location: TDC of Weld ☒	North Side of Weld ☐

Recordable Condition Present	Yes	No	Comments
Cracks		✓	
Lack of Fusion		✓	
Lack of Penetration		✓	
Oxidation		✓	
Undercut Greater Than 1/32"		✓	
Reinforcement Greater Than 1/16"		✓	
Concavity Greater Than 1/32"		✓	
Porosity Greater Than 1/16"		✓	
Inclusion		✓	
Arc Strikes		✓	
Mishandling		✓	
Foreign Material		✓	
Pipe ID Mismatch		✓	
Pitting		✓	
MIC		✓	
Other	✓		SEE BELOW

Comments/Notes:
Note: If recordable condition/indication is noted, record the following information: length/width, circumferential location, distance from the weld centerline, and side of the weld (upstream/downstream) condition/indication is located on.



DRAWING NOT TO SCALE

CAMERA LEG MASKING WELD AT 6:30, 12:00, AND 5:00

Examiner: [signature] Date: 11-4-99

APPROVALS

Spent Fuel Pool RE*: Robert J. L... / [signature] Date: 12/21/99

ANII: [signature] Date: 12/20/99

* SFP RE Coordinator review required if recordable conditions are noted.

QA RECORD

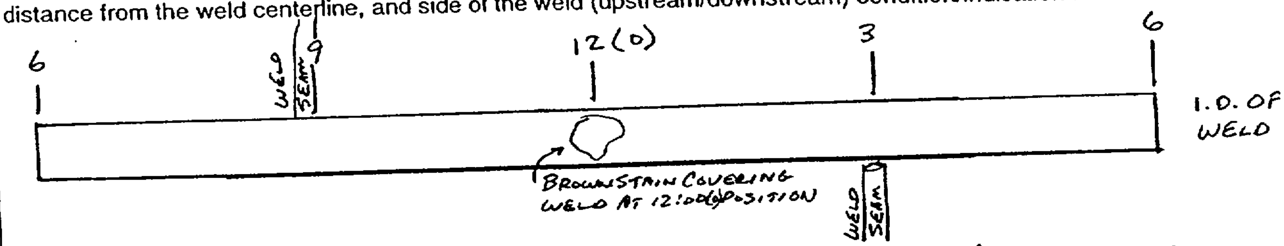
Remote Visual Examination Data Sheet

Sheet 1 of 1

System: SPENT FUEL POOL COOLING	WR/JO Number: 99-AGQI1
Component ID (Weld Number) 2-SF-159-FW-518 LINE 3SF12-174SA-2+3	Reference "0" Location: TDC of Weld ☐ North Side of Weld ☒

Recordable Condition Present	Yes	No	Comments
Cracks		✓	
Lack of Fusion		✓	
Lack of Penetration		✓	
Oxidation	✓		
Undercut Greater Than 1/32"		✓	
Reinforcement Greater Than 1/16"		✓	
Concavity Greater Than 1/32"		✓	
Porosity Greater Than 1/16"		✓	
Inclusion		✓	
Arc Strikes		✓	
Mishandling		✓	
Foreign Material		✓	
Pipe ID Mismatch		✓	
Pitting		✓	
MIC		✓	
Other	✓	✓	SEE BELOW

Comments/Notes:
Note: If recordable condition/indication is noted, record the following information: length/width, circumferential location, distance from the weld centerline, and side of the weld (upstream/downstream) condition/indication is located on.



DRAWING NOT TO SCALE   OXIDATION WAS APPARENT ON WELD FROM APPROX. 12:00-8:00

Examiner: [signature]   Date: 11-4-99

APPROVALS

Spent Fuel Pool RE*: Robert J. [signature]   Date: 12/20/99

ANII: [signature]   Date: 12/20/99

* SFP RE Coordinator review required if recordable conditions are noted.

QA RECORD

ESR 99-00266, Rev. 0, Att. 1, p. 5

Remote Visual Examination
Data Sheet

Sheet 1 of 1

System: SPENT FUEL POOL COOLING

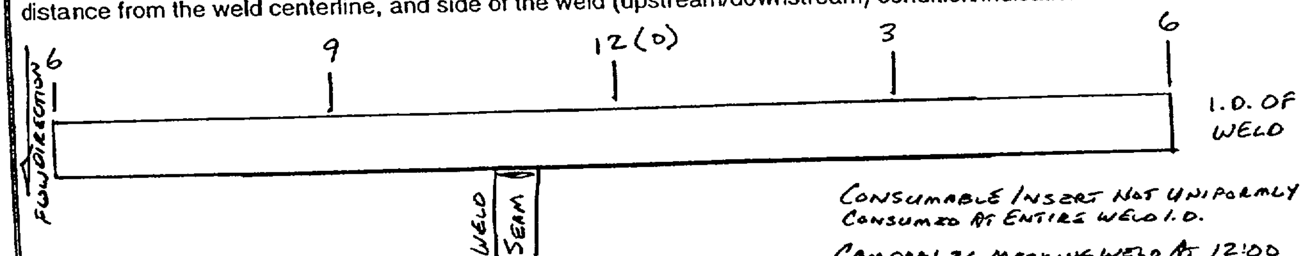
WR/JO Number: 99-AGQI1

Component ID (Weld Number) 2-SF-1-FW-4
LINE 3SF12-174SA-2+3

Reference "0" Location: TDC of Weld ☒ North Side of Weld ☐

Recordable Condition Present	Yes	No	Comments
Cracks		✓	
Lack of Fusion		✓	
Lack of Penetration		✓	
Oxidation		✓	
Undercut Greater Than 1/32"		✓	
Reinforcement Greater Than 1/16"		✓	
Concavity Greater Than 1/32"		✓	
Porosity Greater Than 1/16"		✓	
Inclusion		✓	
Arc Strikes		✓	
Mishandling		✓	
Foreign Material		✓	
Pipe ID Mismatch		✓	
Pitting		✓	
MIC		✓	
Other	✓		SEE BELOW

Comments/Notes:
Note: If recordable condition/indication is noted, record the following information: length/width, circumferential location, distance from the weld centerline, and side of the weld (upstream/downstream) condition/indication is located on.



Examiner: [signature] Date: 11-4-99

APPROVALS

Spent Fuel Pool RE*: Robert J. [signature] Date: 12/20/99

ANII: [signature] Date: 12/20/99

* SFP RE Coordinator review required if recordable conditions are noted.

QA RECORD

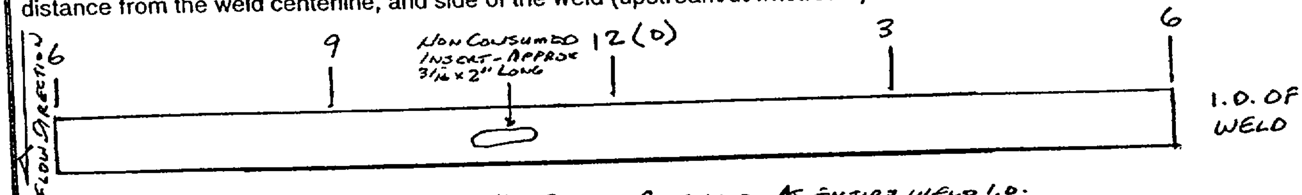
Remote Visual Examination
Data Sheet

Sheet 1 of 1

System: SPENT FUEL POOL COOLING	WR/JO Number: 99-AGQI1
Component ID / (Weld Number) 2-SF-1-FW-3 LINE 3SF12-174SA-2+3	Reference "0" Location: TDC of Weld ☒ North Side of Weld ☐

Recordable Condition Present	Yes	No	Comments
Cracks		✓	
Lack of Fusion		✓	
Lack of Penetration		✓	
Oxidation		✓	
Undercut Greater Than 1/32"		✓	
Reinforcement Greater Than 1/16"		✓	
Concavity Greater Than 1/32"		✓	
Porosity Greater Than 1/16"		✓	
Inclusion		✓	
Arc Strikes		✓	
Mishandling		✓	
Foreign Material		✓	
Pipe ID Mismatch		✓	
Pitting		✓	
MIC		✓	
Other	✓		SEE BELOW

Comments/Notes:
Note: If recordable condition/indication is noted, record the following information: length/width, circumferential location, distance from the weld centerline, and side of the weld (upstream/downstream) condition/indication is located on.



CONSUMABLE INSERT WASN'T UNIFORMLY CONSUMED AT ENTIRE WELD I.D.

DRAWING NOT TO SCALE — CAMERA LEGS MASKING WELD AT 12:00, 5:00, AND 7:00

Examiner: [signature] Date: 11-4-99

APPROVALS

Spent Fuel Pool RE*: Robert J. Lau / [signature] Date: 12/21/99

ANII: [signature] Date: 12/20/99

* SFP RE Coordinator review required if recordable conditions are noted.

QA RECORD

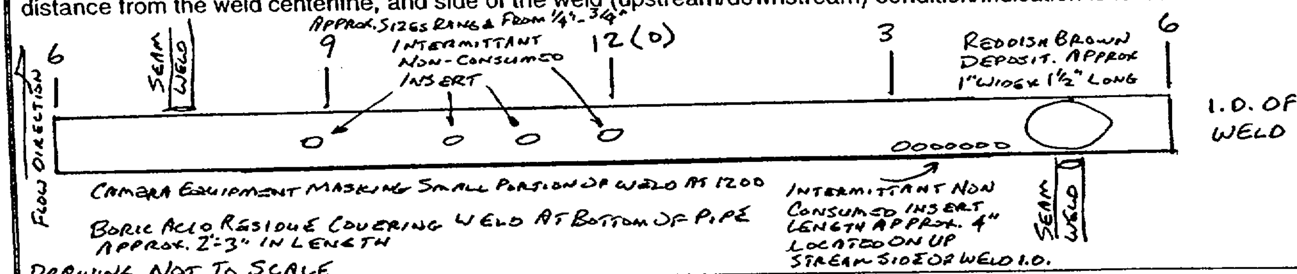
ESR 99-00266, Rev. 0, Att 1, P. 7

Remote Visual Examination
Data Sheet

Sheet 1 of 1

System: SPENT FUEL POOL COOLING			WR/JO Number: 99-AGQI1
Component ID (Weld Number) 2-SF-193-FW-513 LINE 3SF12-179SA-2-3			Reference "0" Location: TDC of Weld ☒ North Side of Weld ☐
Recordable Condition Present	**Yes**	**No**	**Comments**
Cracks		✓	
Lack of Fusion		✓	
Lack of Penetration		✓	
Oxidation		✓	
Undercut Greater Than 1/32"		✓	
Reinforcement Greater Than 1/16"		✓	
Concavity Greater Than 1/32"		✓	
Porosity Greater Than 1/16"		✓	
Inclusion		✓	
Arc Strikes		✓	
Mishandling		✓	
Foreign Material		✓	
Pipe ID Mismatch		✓	
Pitting		✓	
MIC		✓	
Other	✓		SEE BELOW

Comments/Notes:
Note: If recordable condition/indication is noted, record the following information: length/width, circumferential location, distance from the weld centerline, and side of the weld (upstream/downstream) condition/indication is located on.



Examiner: Gary O. [signature] Date: 11-2-99

APPROVALS

Spent Fuel Pool RE*: Robert J. [signature] Date: 12/20/99

ANII: [signature] Date: 12/20/99

* SFP RE Coordinator review required if recordable conditions are noted.

QA RECORD

ESR 99-00266, Rev 0, Att. 1, P. 8

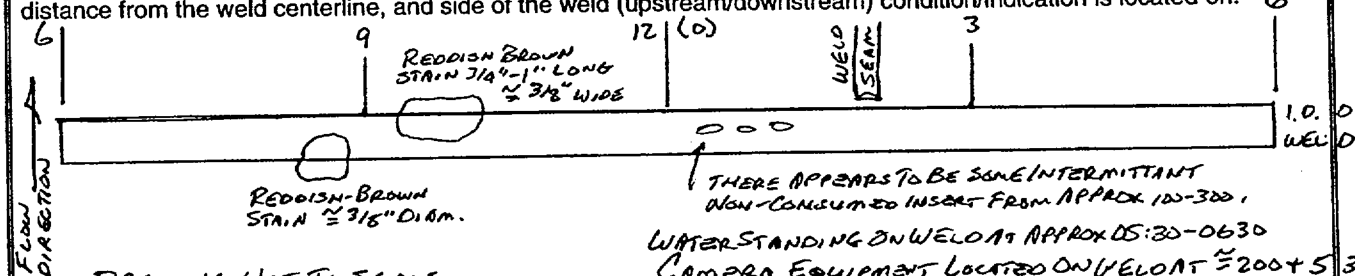
Remote Visual Examination
Data Sheet

Sheet 1 of 1

System: SF Pool Cooling	WR/JO Number: 99-AIQF1
Component ID (Weld Number) 2SF-144-FW-517 Line 3SF12-17658-2-3	Reference "0" Location: TDC of Weld ☒ North Side of Weld ☐

Recordable Condition Present	Yes	No	Comments
Cracks		✓	
Lack of Fusion		✓	
Lack of Penetration		✓	
Oxidation		✓	
Undercut Greater Than 1/32"		✓	
Reinforcement Greater Than 1/16"		✓	
Concavity Greater Than 1/32"		✓	
Porosity Greater Than 1/16"		✓	
Inclusion		✓	
Arc Strikes		✓	
Mishandling		✓	
Foreign Material		✓	
Pipe ID Mismatch		✓	
Pitting		✓	
MIC		✓	
Other	✓		See Below

Comments/Notes:
Note: If recordable condition/indication is noted, record the following information: length/width, circumferential location, distance from the weld centerline, and side of the weld (upstream/downstream) condition/indication is located on.



Examiner: *[signature]* Date: 12-20-99

APPROVALS

Spent Fuel Pool RE*: *[signature]* Date: 12/20/99
ANII: *[signature]* Date: 12/20/99

* SFP RE Coordinator review required if recordable conditions are noted.

QA RECORD

ESR 99-00266, Rev. 0, Att. 1, P. 9

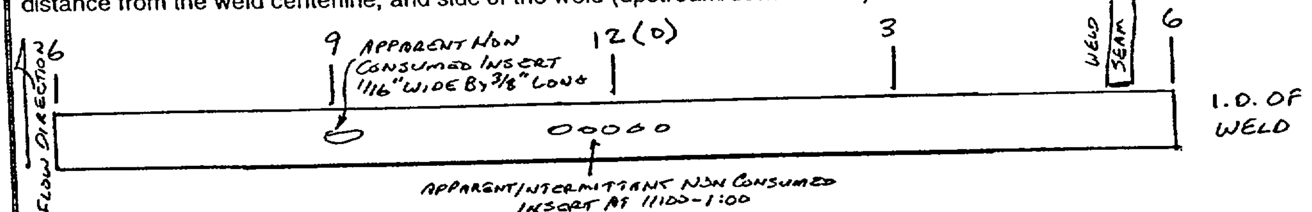
Remote Visual Examination Data Sheet

Sheet 1 of 1

System: SPENT FUEL POOL COOLING	WR/JO Number: 99-AGQI1
Component ID / (Weld Number) 2-SF-143-FW-514 LINE 3SF12-179SA-2-3	Reference "0" Location: TDC of Weld ☒ North Side of Weld ☐

Recordable Condition Present	Yes	No	Comments
Cracks		✓	
Lack of Fusion		✓	
Lack of Penetration		✓	
Oxidation		✓	
Undercut Greater Than 1/32"		✓	
Reinforcement Greater Than 1/16"		✓	
Concavity Greater Than 1/32"		✓	
Porosity Greater Than 1/16"		✓	
Inclusion		✓	
Arc Strikes		✓	
Mishandling		✓	
Foreign Material		✓	
Pipe ID Mismatch		✓	
Pitting		✓	
MIC		✓	
Other	✓		SEE BELOW

Comments/Notes:
Note: If recordable condition/indication is noted, record the following information: length/width, circumferential location, distance from the weld centerline, and side of the weld (upstream/downstream) condition/indication is located on.



DRAWING NOT TO SCALE WATER STANDING IN BOTTOM OF PIPE CAMERA EQUIP. MOSKING WELD @ 2:00

Examiner: [signature] Date: 11-3-99

APPROVALS

Spent Fuel Pool RE*: Robert S. [signature] / [signature] Date: 12/20/99

ANII: [signature] Date: 12/20/99

* SFP RE Coordinator review required if recordable conditions are noted.

QA RECORD

Remote Visual Examination
Data Sheet

Sheet 1 of 1

System: SPENT FUEL POOL COOLING	WR/JO Number: 99-ADUP1
Component ID / Weld Number: 2-SF-149-FW-408	Reference "0" Location: SEAM WELD DOWNSTREAM TDC of Weld N/A North Side of Weld N/A

Recordable Condition Present	Yes	No	Comments
Cracks		✓	
Lack of Fusion		✓	
Lack of Penetration		✓	
Oxidation		✓	
Undercut Greater Than 1/32"		✓	
Reinforcement Greater Than 1/16"		✓	
Concavity Greater Than 1/32"		✓	
Porosity Greater Than 1/16"		✓	
Inclusion		✓	
Arc Strikes		✓	
Mishandling		✓	
Foreign Material		✓	
Pipe ID Mismatch		✓	
Pitting		✓	
MIC		✓	
Other		✓	

Comments/Notes:
Note: If recordable condition/indication is noted, record the following information: length/width, circumferential location, distance from the weld centerline, and side of the weld (upstream/downstream) condition/indication is located on.

DISCOLORATION OBSERVED ON WELDS

Examiner: [signature] Date: 7-15-99

APPROVALS

Spent Fuel Pool RE*: [signature] Date: 7/21/99

ANII: [signature] Date: 7/21/99

* SFP RE Coordinator review required if recordable conditions are noted.

QA RECORD

Remote Visual Examination
Data Sheet

Sheet 1 of 1

System: SPENT FUEL POOL COOLING	WR/JO Number: 99-ADUP1
Component ID / Weld Number: 2-SF-144-FW-515	Reference "0" Location: SEAM WELD DOWNSTREAM TDC of Weld N/A North Side of Weld N/A

Recordable Condition Present	Yes	No	Comments
Cracks		✓	
Lack of Fusion		✓	
Lack of Penetration		✓	
Oxidation		✓	
Undercut Greater Than 1/32"		✓	
Reinforcement Greater Than 1/16"		✓	
Concavity Greater Than 1/32"		✓	
Porosity Greater Than 1/16"		✓	
Inclusion		✓	
Arc Strikes		✓	
Mishandling		✓	
Foreign Material		✓	
Pipe ID Mismatch		✓	
Pitting		✓	
MIC		✓	
Other		✓	

Comments/Notes:
Note: If recordable condition/indication is noted, record the following information: length/width, circumferential location, distance from the weld centerline, and side of the weld (upstream/downstream) condition/indication is located on.

DISCOLORATION OBSERVED ON WELD

Examiner: [signature] Date: 7-15-99

APPROVALS

Spent Fuel Pool RE*: [signature] Date: 7/21/99

ANII: [signature] Date: 7-21-99

* SFP RE Coordinator review required if recordable conditions are noted.

QA RECORD

Remote Visual Examination
Data Sheet

Sheet 1 of 1

System: SPENT FUEL POOL COOLING	WR/JO Number: 99-AOUP1
Component ID / Weld Number: 2-SF-144-FW-516	Reference "0" Location: SEAM WELD DOWNSTREAM TDC of Weld N/A North Side of Weld N/A

Recordable Condition Present	Yes	No	Comments
Cracks		✓	
Lack of Fusion		✓	
Lack of Penetration		✓	
Oxidation		✓	
Undercut Greater Than 1/32"		✓	
Reinforcement Greater Than 1/16"		✓	
Concavity Greater Than 1/32"		✓	
Porosity Greater Than 1/16"		✓	
Inclusion		✓	
Arc Strikes		✓	
Mishandling		✓	
Foreign Material		✓	
Pipe ID Mismatch		✓	
Pitting		✓	
MIC		✓	
Other	* ✓		

Comments/Notes:
Note: If recordable condition/indication is noted, record the following information: length/width, circumferential location, distance from the weld centerline, and side of the weld (upstream/downstream) condition/indication is located on.

* UNCONSUMED INSERT WAS OBSERVED AT VARIOUS LOCATIONS ON THE CIRCUMFERENCE OF THE WELD I.D. INSERT LENGTHS VARIED FROM APPROXIMATELY 1/8" TO 1½" IN LENGTH.

Examiner: [signature] Date: 7-15-99

APPROVALS

Spent Fuel Pool RE*: [signature] Date: 7/21/99
ANII: [signature] Date: 7-21-99

* SFP RE Coordinator review required if recordable conditions are noted.

QA RECORD

Remote Visual Examination
Data Sheet

Sheet 1 of 1

System: SPENT FUEL POOL COOLING	WR/JO Number: 99-AEHH2
Component ID / Weld Number: 2-SF-8-FW-65	Reference "0" Location: SEAM WELD UPSTREAM TDC of Weld N/A North Side of Weld N/A

Recordable Condition Present	Yes	No	Comments
Cracks		✓	
Lack of Fusion		✓	
Lack of Penetration		✓	
Oxidation		✓	
Undercut Greater Than 1/32"		✓	
Reinforcement Greater Than 1/16"		✓	
Concavity Greater Than 1/32"		✓	
Porosity Greater Than 1/16"		✓	
Inclusion		✓	
Arc Strikes		✓	
Mishandling		✓	
Foreign Material		✓	
Pipe ID Mismatch		✓	
Pitting		✓	
MIC		✓	
Other		✓	

Comments/Notes:
Note: If recordable condition/indication is noted, record the following information: length/width, circumferential location, distance from the weld centerline, and side of the weld (upstream/downstream) condition/indication is located on.

DISCOLORATION OBSERVED ON WELD

Examiner: Gary O. Law Date: 7-15-99

APPROVALS

Spent Fuel Pool RE*: Robert J. [illegible] Date: 7/21/99
ANII: [illegible] Date: 7-21-99

* SFP RE Coordinator review required if recordable conditions are noted.

QA RECORD

ESR 99-00266, Rev. 0, Att. 1, P. 14

Remote Visual Examination
Data Sheet

Sheet 1 of 1

System: SPENT FUEL POOL COOLING	WR/JO Number: 99-A0UN2
Component ID / Weld Number: 2-SF-8-FW-66	Reference "0" Location: SEAM WELD DOWNSTREAM TDC of Weld N/A North Side of Weld N/A

Recordable Condition Present	Yes	No	Comments
Cracks		✓	
Lack of Fusion		✓	
Lack of Penetration		✓	
Oxidation		✓	
Undercut Greater Than 1/32"		✓	
Reinforcement Greater Than 1/16"		✓	
Concavity Greater Than 1/32"		✓	
Porosity Greater Than 1/16"		✓	
Inclusion		✓	
Arc Strikes		✓	
Mishandling		✓	
Foreign Material		✓	
Pipe ID Mismatch		✓	
Pitting		✓	
MIC		✓	
Other		✓	

Comments/Notes:
Note: If recordable condition/indication is noted, record the following information: length/width, circumferential location, distance from the weld centerline, and side of the weld (upstream/downstream) condition/indication is located on.

DISCOLORATION OBSERVED ON WELD.

Examiner: [signature] Date: 7-15-99

APPROVALS

Spent Fuel Pool RE*: [signature] Date: 7/21/99
ANII: [signature] Date: 7-21-99

* SFP RE Coordinator review required if recordable conditions are noted.

QA RECORD

ESR 99-00266, Rev.0, Att.1, P.15

Remote Visual Examination
Data Sheet

Sheet 1 of 1

System: SF	WR/JO Number: 99-ADUP3
Component ID / Weld Number: 2SF-143 FW-512	Reference "0" Location: Long Seam Weld TDC of Weld N/A North Side of Weld N/A

Recordable Condition Present	Yes	No	Comments
Cracks		✓	
Lack of Fusion		✓	
Lack of Penetration		✓	
Oxidation		✓	
Undercut Greater Than 1/32"		✓	
Reinforcement Greater Than 1/16"		✓	
Concavity Greater Than 1/32"		✓	
Porosity Greater Than 1/16"		✓	
Inclusion		✓	
Arc Strikes		✓	
Mishandling		✓	
Foreign Material		✓	
Pipe ID Mismatch		✓	
Pitting		✓	
MIC		✓	
Other		✓	

Comments/Notes:
Note: If recordable condition/indication is noted, record the following information: length/width, circumferential location, distance from the weld centerline, and side of the weld (upstream/downstream) condition/indication is located on.

Discoloration of weld

Examiner: [signature] Date: 7-14-99

APPROVALS

Spent Fuel Pool RE*: [signature] Date: 7/21/99
ANII: [signature] Date: 7-21-99

* SFP RE Coordinator review required if recordable conditions are noted.

QA RECORD

ESR 99-00266
Att. 2, Rev. 0

Report No.: SIR-99-127
Revision No.: 2
Project No.: CPL-52Q
File No.: CPL-52Q-401
December 1999

Evaluation of Embedded Welds in Spent Fuel Piping at Harris Nuclear Plant

Prepared for:

Carolina Power & Light Company
New Hill, NC

Prepared by:

Structural Integrity Associates, Inc.
San Jose, CA

Prepared by: G. J. Licina   Date: 12-17-99

Reviewed by: [signature] for M. E. Sauby   Date: 12/17/99

Approved by: G. J. Licina   Date: 12-17-99

Structural Integrity Associates, Inc.

ESR 99-00266, Rev. 0, Att. 2

REVISION CONTROL SHEET

Document Number: SIR-99-127

Title: Evaluation of Embedded Welds in Spent Fuel Piping at Harris Nuclear Plant

Client: Carolina Power & Light Company

SI Project Number: CPL-52

Section	Pages	Revision	Date	Comments
1.0	1-1 – 1-2	0	12/7/99	Initial Issue
2.0	2-1 – 2-3			
3.0	3-1			
4.0	4-1 – 4-7			
5.0	5-1 – 5-11			
6.0	6-1 – 6-3			
7.0	7-1			
1.0	1-2	1		Incorporates results of additional examinations
4.0	4-1			
5.0	5-1, 5-3, 5-4, 5-8 – 5-11			
6.0	6-2			
1.0	1-2	2		Minor clarification, addition of allowable flaw size calculation
2.0	2-1, 2-2			
4.0	4-1			
5.0	5-3, 5-4			
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1.0 INTRODUCTION

Carolina Power & Light Company (CP&L) requested Structural Integrity Associates, Inc. (SI) to evaluate the structural integrity and suitability for service of the embedded stainless steel piping, including 15 field welds, in the Spent Fuel Pool Cooling and Cleanup System for Harris Nuclear Plant (HNP) spent fuel pools C and D. The Spent Fuel Pool Piping (SFP Piping) was constructed in the early 1980s, but was never installed and has not been operational. CP&L is now commissioning C and D SFP Piping in support of activating the C and D spent fuel pools.

This report provides a review of all of the materials transmitted to SI (Table 1-1) to provide an independent, expert opinion regarding the quality of construction and suitability for purpose of the SFP Piping. This review was primarily focused on the 15 embedded field welds, described on CP&L isometric drawings 2-SF-149, -144, -143, -151, -159, -1, and –8, but also considered the overall condition of the balance of the piping.

The quality of construction assessment was focused on the as-installed structural integrity of the SFP Piping, as described by the quality records provided for this review and from the videotapes of the remote visual inspections performed during 1999. The suitability for service included an assessment of the structural integrity of the SFP Piping in its present condition, including any potential degradation that the SFP Piping has experienced since initial installation, and projections of any further degradation that stainless steel piping in that condition would possibly experience for the duration of the SFP Piping's service life.

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Table 1-1

Materials Provided by CP&L

1. Vendor Data Packages for the following segments:

2-SF-149	2-SF-151	2-SF-30
2-SF-144	2-SF-1	2-SF-34
2-SF-143	2-SF-8	2-SF-159

2. Requested sections of the RAI submittal labeled "Enclosure 6 to Serial HNP-99-069" (includes CP&L weld procedures and PQRs, and DDRs).

3. Videotapes:
   "Weld Hydrolasing"
   "1999 CTS Power Services 1st Visit, 6/99 – Non Clear "C" Pipe"
   "Weld Cleaning 2-SF-8-FW-65 & 66"
   "Visual Inspections of Welds: WR/JO 99, ADUP1, 2-SF-149-FW-408, 2-SF-144-FW-515, 2-SF-144-FW-516, July 7, 1999"
   "6-24-99, 99-ADUNZ WR/JO, Weld 2-SF-8-FW-66 I.D "
   "Visual Inspection of Weld: 2-SF-143-FW-512, July 8, 1999"
   "Visual Inspection of Weld: 2-SF-8-FW-66, 2-SF-8-FW-65, CTS Power Services"
   "CP&L Tape 1" (2-SF-143-FW-513, FW-514; 2-SF-144-FW-517)
   "CP&L Tape 2" (2-SF-1-FW-5, FW-4, FW-1, FW-2; 2-SF-159-FW-518, FW-519)
   "SFP "D" Reinspection 2-SF-144-FW517"

4. Hydrostatic Test Records for the following segments:

2-SF-143	2-SF-159	
2-SF-149	2-SF-34	2-SF-1
2-SF-151	2-SF-144	2-SF-30

5. "Harris Nuclear Plant – Bacteria Detection in Water from the C and D Spent Fuel Pool Cooling Lines", Metallurgy Services Technical Report 99-90.

6. Isometric Drawings:

2-SF-149	2-SF-159	2-SF-1
2-SF-144	2-SF-151	2-SF-30
2-SF-143	2-SF-8	2-SF-34

7. Chemistry Sample Data Sheets –Spent Fuel Pool Drains (7), 4-27-99

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2.0 BACKGROUND

Initial communications with CP&L indicated that the SFP Piping in question is embedded in concrete and is therefore not accessible for external examination or radiographic examination. However, the majority of the piping in the Spent Fuel Pool Cooling and Cleanup System is exposed and is accessible. Per CP&L, all of the stainless steel piping, embedded or exposed, was installed under the CP&L ASME N Certificate construction program which existed at the time of construction, and was spared in place when construction of HNP Units 2 & 3 was canceled.

The stainless steel SFP Piping consists of 150 psi class piping spools, 12" or 16" STD (0.375" wall), welded Type 304 stainless steel pipe, with both seamless and welded fittings, prefabricated by an authorized supplier. Vendor data records (Table 1-1, Item 1) for those spools were reviewed. Those records show that the longitudinal seam welds for the pipe itself were made by the gas tungsten arc welding (GTAW) and submerged arc welding (SAW) processes, and were radiographed and examined by liquid penetrant techniques. Pipe spool welds done by the fabricator were examined visually and by liquid penetrant testing (PT). These spools were joined by field welds made by CP&L or its contractors or assembled by flanged connections. Consistent with the piping's Code of Construction (designed to Section III, Class 3, 1971-73; constructed to 1974-76), volumetric inspection was not required for the field welds. All of the embedded field welds are in 12" lines.

Some of the records associated with the installation and field welding of the piping were discarded, including the weld data reports for the embedded field welds. All of the SFP Piping received a hydrostatic test. The hydrostatic test procedure included a review of all weld data records and a sign-off that those records were complete. The hydrostatic test procedure also required that all welded joints be visible for inspection, that the piping be pressurized to a minimum of 1.25 times the system design pressure, held at that pressure for a minimum of ten minutes, and that the piping be examined for leakage over 360° at all joints and at all regions of stress while the piping was at pressure. The examination was also witnessed by the independent authorized nuclear inspector (ANI).

Service conditions for this embedded SFP Piping will be, and have been, very mild. The rated pressure of the stainless steel SFP Piping is 150 psi; however, as noted by CP&L, the maximum service pressure, which defined the system design pressure for hydrostatic testing is only about 25 psi. The maximum service pressure is so low because the Cooling and Cleanup System takes its suction on, and discharges into, the spent fuel pool, which is open to atmospheric pressure in the Spent Fuel Handling Building. Typical operating pressure will be less than 10 psi (limited by the static head at the lowest point); design temperature is less than 200°F; and service stresses from either pressure or supports are very low. The SFP Piping experiences no high fluid velocities, and the service environment is a well controlled, benign water chemistry (borated demineralized spent fuel pool water).

Following hydrostatic testing in late 1979 (Field Welds 2-SF-1-FW-1, -2, -4, and -5) or 1981/1982 (all of the other embedded Field Welds), CP&L indicated that the SFP Piping was drained and vented, but there are no records to indicate that the piping was either rinsed or dried. No water has been introduced into the SFP Piping by in-leakage from other systems, because none of the embedded piping is connected to any other systems. Per CP&L, piping was left unconnected to other systems (e.g., Closed Cooling Water, CCW) and openings were covered with Foreign Material Exclusion covers (plywood covers prior to1989; welded-on metal covers after spent fuel pools A and B were filled). The first filling of any of the "A" and "B" spent fuel pools occurred in 1989. Later, spent fuel pools C and D were also filled to ensure that there was no drain-down event from interconnected pools A and B. Over the years, this SFP Piping has filled with water from spent fuel pools C and D, that has leaked past "plumbers plugs" installed at the pool nozzles. This leakage from the spent fuel pools to the spared-in-place SFP Piping could have begun as early as 1989 or 1990. For the purposes of this analysis, the maximum time of flooding, approximately 10 years, will be assumed for conservatism. Although the piping has been filled for a number of years with spent fuel pool borated demineralized water, no formal lay-up program has ever been implemented for the embedded SFP Piping connected to spent fuel pools C and D. The phrase "wet lay-up" will be used to describe the flooded conditions that the piping has experienced since 1989, at the earliest.

Remote visual examination of fifteen embedded field welds (2-SF-8-FW-65 and –66; 2-SF-144-FW-515, -516, and –517; 2-SF-149-FW-408; 2-SF-143-FW-512, –513, and –514; 2-SF-159-FW-518, and –519; 2-SF-1-FW-1, –2, -4, and -5) and the piping in six of the eight lines was done by a CP&L contractor using a high resolution camera mounted to a pipe crawler following draining of those lines. Those videotapes were reviewed as a part of this project. In addition, CP&L has collected and analyzed water samples from seven of the lines for water chemistry and from seven lines to characterize the microbiological nature of the water.

3.0 OBJECTIVES

The primary objective of this project was to provide an independent, expert opinion on the structural integrity and suitability for purpose of the subject SFP Piping.

This assessment includes:

- A determination of the structural integrity of the welds as installed,
- An assessment of the present condition of the SFP Piping based upon any damage that has ensued during the roughly 10 years of wet lay-up,
- Suitability for service of the SFP Piping in the benign spent fuel pool water environment, and
- Specific recommendations on any other actions that should be performed to substantiate the quality of the SFP Piping.

4.0 APPROACH

4.1 Initial Quality

The first step in this assessment involved a detailed review of the available data, listed in Table 1-1. Materials that were reviewed included:

- Piping layout information
- Specified materials of construction, including weld metals
- Actual materials of construction (or verification that the specified materials were used throughout)
- Welding procedure specification(s) for shop and field welds
- Procedure Qualification Records for shop and field welds
- Visual and PT inspection records for shop welds
- Hydrotest results
- Videotapes of the remote visual examinations of fifteen field welds in the installed SFP Piping.

4.2 Degradation Since Construction

All potentially applicable degradation mechanisms were considered. The probability for each of those mechanisms to have degraded the piping during the extended wet lay-up was evaluated against the best estimate of the conditions to which the piping was actually exposed, considering:

- All loadings
- Nominal temperature, pressure, and water chemistry conditions
- Hydrotest water chemistry, and draining or drying procedures that might have been implemented following hydrotest
- Time of immersion since initial flooding (conservatively assumed to be approximately 10 years, the time between the initial fill of spent fuel pools and the drying done for the remote visual examination)
- Verification of the exposure conditions based upon temperature, pressure, and water chemistry data from monitoring or other surveillance of the lines (water chemistry, microbiological characterization)

- Detailed review of the videotapes from the remote visual examination of fifteen of the field welds performed in 1999.

All potentially operative degradation mechanisms were considered for the SFP Piping by comparing the degradation mechanisms and the operating conditions that are associated with them to the normal operating conditions for the piping (low flow or stagnant controlled purity water at ambient temperature) plus off-normal conditions, which for the SFP Piping are no different. Those degradation mechanisms are listed in Tables 4-1 and 4-2. Both tables are from compilations of all of the potentially operative degradation mechanisms for nuclear power plant components used in either ASME Code Case N-560 [1] evaluations or the EPRI Methodology for Risk-Informed Inservice Inspection [2]. This assessment has conservatively assumed that piping residual stresses were tensile stresses at the piping inside diameter and equal to the material's yield strength. Fit up and welding can produce residual stresses that can reach the yield strength before plastic deformation relaxes them.

Table 4-1

Degradation Mechanisms and Attributes in Code Case N-560 [1]

	Mechanism	Attributes	Susceptible Regions
1	Thermal Fatigue i. Thermal Shock ii. Stratification iii. Striping	Intermittent Cold Water Injection (i, ii, iii) Low Flow, Little Fluid Mixing (ii. Iii) Notch-Like Stress Risers (ii, iii) Very Frequent Cycling (ii, iii) Unstable Turbulence Penetration into Stagnant Lines (ii, iii) Bypass leakage in valves with large ΔTs (ii, iii)	Nozzles, branch pipe connections, safe ends, welds, HAZ, and base metal regions of high stress concentration
2	Flow Accelerated Corrosion	Turbulent Flow at Sharp Radius Elbows and Tees Proximity to Pumps, Valves and Orifices Material Chromium Content Fluid pH Oxygen Temperature	
3	Erosion-Cavitation	Severe Discontinuities in Flow Path Proximity to Pump, Throttle Valve, Reducing Valve or Flow Orifice	Fittings, welds, and HAZ
4	Corrosion i. General Corrosion ii. Crevice Corrosion iii. Pitting iv. MIC	Aggressive Environment (i, iii) Oxidizing Environment (ii, iii) Material (i, iv) Temperature (i, iv) Contaminants (sulfur species, chlorides, etc.) (ii) Crevice Condition (ii) Stagnant Region (ii) Low Flow (iii) Lay up (iv)	Base metal, welds, and HAZ
5	Stress Corrosion Cracking i. IGSCC ii. TGSCC iii. PWSCC	Susceptible Material (i) Oxidizing Environment (i, ii) Stress (residual, applied) (i, ii) Initiating Contaminants (sulfur species, chlorides, etc.) (I) (aqueous halides or concentrated caustic) (ii) Temperature (i, ii) Strain Rate (environmentally assisted cracking) (i, ii) Fabrication Practice (e.g., weld ID grinding, cold work (i) Notch-like Stress Risers	Austenitic stainless steel welds and HAZ (i) Mill-annealed Alloy 600 nozzle welds and HAZ without stress relief (iii)
6	Water Hammer [Note (1)]	Potential for Fluid Voiding and Relief Valve Discharge	

NOTE:
(1) Water hammer is a rare, severe loading condition as opposed to a degradation mechanism, but its potential at a location, in conjunction with one or more of the listed degradation mechanisms, could be cause for a higher examination zone ranking.

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Table 4-2

Degradation Mechanism Criteria and Susceptible Regions (from [2])

Degradation Mechanism		Criteria	Susceptible Regions
TF	TASCS	–NPS > 1 inch, and –pipe segment has a slope < 45° from horizontal (includes elbow or tee into a vertical pipe), and –potential exists for low flow in a pipe section connected to a component allowing mixing of hot and cold fluids, or potential exists for leakage flow past a valve (i.e., in-leakage, out-leakage, cross-leakage) allowing mixing of hot and cold fluids, or potential exists for convection heating in dead-ended pipe sections connected to a source of hot fluid, or potential exists for two phase (steam/water) flow, or potential exists for turbulent penetration into a relatively colder branch pipe connected to header piping containing hot fluid with turbulent flow, and –calculated or measured $\Delta T > 50$°F, and –Richardson number > 4.0	Nozzles, branch pipe connections, safe ends, welds, heat affected zones (HAZs), base metal, and regions of stress concentration
	TT	–operating temperature > 270°F for stainless steel, or operating temperature > 220°F for carbon steel, and –potential for relatively rapid temperature changes including cold fluid injection into hot pipe segment, or hot fluid injection into cold pipe segment, and – $\vert\Delta T\vert > 200$°F for stainless steel, or $\vert\Delta T\vert > 150$°F for carbon steel, or $\vert\Delta T\vert > \Delta T$ allowable (applicable to both stainless and carbon)	

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Table 4-2. Degradation Mechanism Criteria and Susceptible Regions (Cont.)

Degradation Mechanism		Criteria	Susceptible Regions
SCC	IGSCC (BWR)	–evaluated in accordance with existing plant IGSCC program per NRC Generic Letter 88-01	Welds and HAZs
	IGSCC (PWR)	– austenitic stainless steel (carbon content ≥ 0.035%), and –operating temperature > 200°F, and –tensile stress (including residual stress) is present, and –oxygen or oxidizing species are present <u>OR</u> –operating temperature < 200°F, the attributes above apply, and –initiating contaminants (e.g., thiosulfate, fluoride or chloride) are also required to be present	
	TGSCC	– austenitic stainless steel, and –operating temperature > 150°F, and –tensile stress (including residual stress) is present, and –halides (e.g., fluoride or chloride) are present, and –oxygen or oxidizing species are present	Base metal, welds, and HAZs

Table 4-2. Degradation Mechanism Criteria and Susceptible Regions (Cont.)

Degradation Mechanism		Criteria	Susceptible Regions
SCC (cont.)	ECSCC	– austenitic stainless steel, and –operating temperature > 150°F, and –tensile stress is present, and –an outside piping surface is within five diameters of a probable leak path (e.g., valve stems) and is covered with non-metallic insulation that is not in compliance with Reg. Guide 1.36, or –an outside piping surface is exposed to wetting from concentrated chloride-bearing environments (i.e., sea water, brackish water, or brine)	Base metal, welds, and HAZs
	PWSCC	–piping material is Inconel (Alloy 600), and –exposed to primary water at T > 560°F, and –the material is mill-annealed and cold worked, or cold worked and welded without stress relief	Nozzles, welds, and HAZs without stress relief
LC	MIC	–operating temperature < 150°F, and –low or intermittent flow, and –pH < 10, and –presence/intrusion of organic material (e.g., Raw Water System), or –water source is not treated with biocides	Fittings, welds, HAZs, base metal, dissimilar metal joints (for example, welds and flanges), and regions containing crevices
	PIT	–potential exists for low flow, and –oxygen or oxidizing species are present, and –initiating contaminants (e.g., fluoride or chloride) are present	
	CC	–crevice condition exists (i.e., thermal sleeves), and –operating temperature > 150°F, and –oxygen or oxidizing species are present	

Table 4-2. Degradation Mechanism Criteria and Susceptible Regions (Concluded)

Degradation Mechanism		Criteria	Susceptible Regions
FS	E-C	–cavitation source, and –operating temperature < 250°F, and –flow present > 100 hrs./yr., and –velocity > 30 ft./sec., and –$(P_d - P_v) / \Delta P < 5$	Fittings, welds, HAZs, and base metal within 5D of source
	FAC	–evaluated In accordance with existing plant FAC program	per plant FAC program

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5.0 RESULTS

5.1 Initial Quality

This piping was constructed (to the extent that construction was completed) under the HNP ASME QA program. All procedures and plant construction were subject to frequent internal and external audits. This same QA program was used to successfully complete and license HNP Unit 1. While much of the documentation for the fifteen embedded field welds was unavailable, the QA program did require procedures for material controls, material handling and welding procedures and qualifications, completion of weld data reports (note that hydrotest procedures required a sign-off of the completion of all weld data reports), specific QC inspections, and ANI third party review. Construction of the subject SFP Piping without those controls would have required a total breakdown of that QA program.

The presence of Deficiency Disposition Reports (DDRs) pertaining to embedded field welds (Table 1-1; Item 2) provides a clear indication that the QA program was indeed applied to the field welds. For example, Field Weld 2-SF-149-FW-408 required a DDR since an ANI hold point was bypassed on final inspection. Similarly, a DDR was written for 2-SF-144-FW-517 (arc strikes found).

In the absence of weld documentation packages for the field welds, the signed-off hydrotest records provide the only formal documentation that "all weld data records (are) complete". Those packages were provided for field welds 2-SF-149-FW-408; 2-SF143-FW-512, -513, and -514; 2-SF-144-FW-515, -516, and-517; 2-SF-159-FW-518, and –519; 2-SF-1-FW-1, -2, -4, and -5. No hydrotest packages were supplied for field welds FW-65 and –66.

The weld procedures that were reviewed as a part of this project were CP&L procedures that were in place at the time the field welds in the SFP Piping were made. Those procedures included welds in the variety of P-8 materials (per ASME Code Section IX) that would be used in nuclear construction, including the Type 304 stainless steel used for the SFP Piping. The controls on welding processes (GTAW and Shielded Metal Arc Welding, SMAW), heat inputs, purge and shielding gas, and other parameters required to make high quality welds in nuclear construction were typical of those that have been reviewed by Structural Integrity Associates for other plants, including welds for Class 1 systems. The weld procedure packages that were reviewed (Table 1-1, Item 2) also included Procedure Qualification Records that demonstrated that the weld procedures produced sounds welds with satisfactory mechanical properties.

Ebasco Services performed a calculation on the minimum piping wall thickness, t_{min}, that was required to retain the design pressures in the Spent Fuel Pool Cooling and Cleanup System, assuming a maximum allowable stress, SE, of 17,800 psi due to internal pressure [3]. That calculation, verified by Structural Integrity Associates showed that for 16" stainless steel pipe, t_{min} = 0.011" for a design service pressure of 25 psi (joint efficiency = 100%). For 12" pipe and a joint efficiency of 80%, the maximum for butt welds not subjected to volumetric examination, the calculated t_{min} was also equal to 0.011" for a design service pressure of 25 psi. The pipe's 0.375" nominal thickness is therefore approximately 30 times the required minimum thickness for the design service pressure.

The minimum wall thickness was also calculated for 150% of the 150 psi design rating of the 12" stainless steel piping, or 225 psi. The calculated t_{min} for that pressure (nine times the 25 psi design service pressure) was 0.080"; about one-fifth of the actual pipe thickness of 0.375". At a joint efficiency of 80% and pressure of 225 psi, t_{min} = 0.100". Those calculations apply to the exposed pipe. The results will be conservative for the SFP Piping embedded in concrete since the presence of the concrete effectively reinforces the pipe.

Although the fabrication requirements for the SFP Piping field welds did not require examination of the ID of pipe welds by visual or enhanced methods (such as PT), detailed visual examination results of the fifteen embedded field welds were provided by CP&L, from remote visual inspections performed during the Summer and Fall of 1999, to assess the present condition of those welds.

These visual examinations demonstrated that, in general, the piping and welds in the embedded SFP Piping were in good condition. However, there were some areas on some welds where the consumable insert was not completely consumed and some areas on most of the welds where the profile was less than ideal. The condition of a non-consumed insert was most pronounced on 2-SF-144-FW-516. Some small linear indications were observed (e.g., 2-SF-8-FW-65, 2-SF-144-FW-515 and FW-517, and 2-SF-159-FW-518) which appeared to be related to incomplete fusion. No areas were visible from the ID that would suggest that the reduction in thickness approached t_{min}. The fact that all welds passed a hydrostatic test (i.e., no visible leakage from a 360° examination) at a pressure in excess of 125% of the 25 psi system design pressure, for a minimum of ten minutes, provides a further verification of the initial quality and structural integrity of the welds.

At the ID, the appearance of the tie-in at the edges of all of the Field Welds that were examined is good to excellent. There are some weld areas, generally scattered around the circumference, where the consumable insert was not completely consumed or where the weld profile was less than ideal; not surprising for closure welds. FW-516, the worst weld in this regard, had the largest intermittent areas of incomplete consumption of its consumable insert but still exhibited complete fusion at the edges. Since there has been no volumetric examination of these welds, the overall structural integrity of the weld is assumed to be controlled by the subsurface condition resulting from small areas of the consumable insert not having been completely consumed. In the absence of a volumetric examination, that structural integrity evaluation must revert to the calculation of the required minimum thickness for the design or operating pressure, including a reduced joint efficiency. The design codes include provisions for a joint efficiency less than 100% for conditions such as these. The successful hydrotest results provide a verification that thickness exceeded t_{min} throughout FW-516 and the other welds at the time of the hydrotest, despite the non-consumed areas.

Several broad and apparently shallow linear indications were noted for 2-SF-144-FW-515. Those indications were always at the edge of the consumable insert. Similar indications were also apparent in the longitudinal seam of one of the adjacent pipes. That longitudinal seam had passed visual examination and PT as a part of its inspection following shop fabrication. No pitting or crevice corrosion were observed in the shallow linear indications in either the longitudinal seam or in field weld FW-515.

A calculation of the allowable flaw length was performed for an axial flaw, as set forth in ASME Code, Section XI, Appendix C. A through-wall flaw was conservatively assumed. For a maximum pressure of 25 psi (hoop stress = 425 psi), a total flaw length of 102 inches was determined. That means that for the 25 psi internal pressure loading, the pipe would retain its structural integrity for all axial flaws less than 102 inches. Clearly this flaw is many times greater than the observed indication near field weld FW-515.

No evidence of overheating or excessive heat tint was detected.

5.2 Degradation Since Construction

A review of all of the potentially operative degradation mechanisms listed in Table 4-1 and 4-2 identified that the only potentially operative degradation mechanisms for the SFP Piping are associated with corrosion. The flows, vibrations, and thermal conditions associated with the operation of the SFP piping, including up to ten years of wet lay-up, are far less than the conditions that can produce flow accelerated corrosion, or vibrational or thermal fatigue.

The potentially operative corrosion mechanisms include transgranular stress corrosion cracking (TGSCC), intergranular stress corrosion cracking (IGSCC), localized corrosion, and microbiologically influenced corrosion (MIC). No other corrosion mechanisms were considered to have been potentially operative for the extended lay-up conditions experienced by this piping. Other corrosion mechanisms, such as flow accelerated corrosion (FAC), are not considered operative due to the materials of construction (stainless steel), operating conditions (little or no flow; no temperatures in excess of typical ambient), and nominal environment (no caustic, raw water, or other damaging chemical species have been introduced to this piping).

The spent fuel pool cooling heat exchangers are cooled by the high purity component cooling water (CCW) system, which operates at a higher pressure than the SFP cooling water. Hence, any leakage would be from the CCW system into the SFP cooling water. Even this design condition is of no consequence for the embedded SFP Piping, since construction did not progress to the extent that any of the embedded piping was ever connected to the heat exchangers.

The SFP Piping has in effect been exposed to an extended wet lay-up with high purity water (albeit an inadvertent lay-up since no formal lay-up program was ever implemented for the lines connected to the spent fuel pools). As noted previously, over time, the piping has filled with water from the spent fuel pools which leaked past "plumbers plugs" installed at the pool nozzles, possibly beginning as early as 1989 when the "A" and "B" pools were first filled. No water has been introduced by in-leakage from other systems, because none of the embedded piping is connected to any other systems.

No regular sampling has been performed of the water in the SFP Piping. However, chemistry samples were collected from each of seven lines associated with the embedded piping (2-SF-74, -75, -212, -213, -214, -215, and –49) on 4-27-99 (Table 1-1, Item 7). Those results showed that chloride, fluoride, sulfate, and conductivity levels were very low (maximum values: chloride = 70.5 ppb; fluoride = 166 ppb; sulfate = 1027 ppb; conductivity = 103 μS/cm). Those chloride and fluoride concentrations are consistent with the specifications for spent fuel pool chemistry. Sulfate and conductivity levels are also consistent with those of a high purity water. The water samples also showed low levels of tritium; at a concentration similar to that of Spent Fuel Pool "C". The visual examinations also revealed a white crystalline substance near the bottom of some lines. That material looked very similar to boric acid crystals that form when borated water, as from the fuel pool, dries out on surfaces.

Seven water samples, from the "C" and "D" SFP Piping drains were also collected and evaluated by CP&L to provide some insight regarding the presence of active MIC bacteria in the lines (Table 1-1, Item 5). The water samples were analyzed using RapidChek™ II kits for sulfate reducing bacteria (SRB) and Hach Corporation BART™ kits for slime formers, iron related bacteria, and heterotrophic bacteria. The RapidChek tests indicated that the number of SRB was somewhere between the lower detection limit of 1000 cells/ml and 100,000 cells/ml. No slime formers, iron bacteria, or heterotrophic aerobes were detected with the BART kits. Those results are in dramatic contrast to typical bacterial counts for raw waters, providing further verification that the water in the lines was water of controlled chemistry; not untreated cooling water.

In low energy piping, the potentially operative degradation mechanisms will produce either tight cracks (TGSCC or IGSCC) or pinhole leaks (localized corrosion and MIC). For these low pressure lines, the only manifestations of those degradations will be very small leaks, of the order of a few drops per minute. In the absence of significant pressure loadings, which are absent in these lines, or significant seismic loadings, even the cracks produced by TGSCC or IGSCC would have no effect on structural integrity of the lines. Even significant pitting (i.e., over a large fraction of the circumference) confined to a narrow band, as can occur with severe MIC degradation of a weld, does not degrade the structural integrity of stainless steel weldments due to the very high toughness of those welds.

5.2.1 IGSCC

There is an extremely low probability of occurrence of IGSCC in stainless steel in the conditions and environment of the SFP Piping. While the very conservative assumption that residual stress is equal to the yield strength produces stresses sufficient to initiate and grow cracks, the controlled purity environment is not sufficiently aggressive to initiate or propagate cracks. For IGSCC driven by oxidizing conditions, the spent fuel pool temperature is far too low to produce IGSCC. Other aggressive and potential IGSCC-inducing species like thiosulfate are not present in the controlled purity environment nor is there a path that would introduce such species to the spent fuel pool environment. For example, IGSCC requires the presence of a significantly higher operating temperature (minimum of 200°F) or the presence of very aggressive chemical species such as caustic or thiosulfate.

5.2.2 TGSCC

Similarly, there is an extremely low probability of occurrence of TGSCC. As for IGSCC, the controlled purity environment is not sufficiently aggressive for either initiation or growth, even with the conservative assumption of residual stresses equal to the yield strength; a stress that would be sufficient to initiate and grow cracks if an appropriate environment were present. Chlorides are very low, limited to the levels permitted in the spent fuel pool environment (<100 ppb) or from chlorides that may have been introduced during the hydrotest (of the order of 50 to

100 ppm), with the residual chlorides subsequently diluted from the system by the spent fuel pool water.

Further, the spent fuel piping does not have any connection to coolers or other piping that can cause raw water to leak into the spent fuel pool environment.

5.2.3 Localized Corrosion

Pitting or crevice corrosion are also unlikely degradation mechanisms. The only environmental source over the long term is the very innocuous, controlled purity, spent fuel pool water. While the environment in this piping is not monitored, the spent fuel pool environment is checked by periodic water samples. All samples that have been collected from this piping, seven sample locations at one time point, as much as 10 years after initial wet-out, have confirmed that the environment inside the piping is consistent with the spent fuel pool water. The visual examinations also suggested that boric acid crystals were present in some of the lines

The chemical influence of the hydrotest water is limited by the total amount of chlorides, fluorides, and other potentially aggressive species in that water. Subsequent filling of the lines with high purity water would eliminate virtually all of those effects. The 1999 water samples have confirmed that no additional sources of water-borne chemical impurities were introduced. Dry-out and subsequent re-flooding or nearly complete dry-out of low spots would produce the most aggressive chemistry. Those locations would be expected at drains, precisely where samples were collected.

5.2.4 MIC

MIC is more likely than the other forms of localized corrosion since a minuscule population of microorganisms can grow to a diverse population of millions of microorganisms, limited only by the available nutrients. Source terms for microorganisms are hydrotest water, the spent fuel pool water, and potential intrusions of raw water from coolers. The latter item is not considered to be viable since the SFP Piping has effectively been isolated from all the coolers (more correctly, it was never connected).

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Most often, MIC will produce closed, "ink bottle" shaped pits (Figure 5-1), characterized by tiny entrance holes and exit holes (if the pit goes through-wall) with a much larger area of metal loss beneath the surface. Because of the very small openings to the pit at the ID and OD, leak rates are extremely small. In stainless steels, MIC pits are far more common at weldments, either in the weld metal itself, in the heat affected zone, or beneath the heat tint. In a worst case scenario, pits in a single weld could produce a significant area of metal loss along the length of the weld such that the effective length of the flaw is large.

CP&L Test Procedure TP-30 [4] required all hydrotest water to meet Westinghouse spec PS292722. Procedure WP-115 [5] permitted hydrotests using lake water or potable water (but still water per Westinghouse spec PS292722 for piping in Westinghouse's scope of supply). The majority of the hydrotest results that were received for the embedded piping evaluated in this report were performed in accordance with WP-115.

The monitoring of the water that has been done (one data point, consisting of seven samples collected in 1999) has shown very low counts of microbial species associated with MIC. While water samples are not the best method for verifying that there is no biofilm on piping surfaces, the water sampling plus visual inspection (both ID and OD) provides a reliable indicator that MIC has not produced any leakage or accelerated corrosion in the piping

It is recognized that MIC can occur in high purity waters, in nuclear plants in systems that are nominally high purity, but that have been contaminated during initial hydrotest or during operation [8, 9]. It is also well known that water samples provide a poor representation of the biofilms on surfaces that cause MIC. The water samples that have been collected and analyzed for bacteria associated with MIC do show that the purity of the water is still very good. More importantly, no evidence of large mounds of organic materials that are typically associated with MIC was present in any of the lines that were examined in the as-found condition. All of those welds and the surrounding pipe work that were examined by the remote visual examination have been very clean, even prior to hydrolasing.

No corrosion nodules or other indications that a localized corrosion phenomenon such as MIC has occurred during the wet lay-up were revealed by the detailed remote visual inspections for all but one of the welds. A few welds exhibited some evidence of minor corrosion; limited to minor staining on those welds, except for 2-SF-144-FW-517. A very few minor discolored areas, indicative of small pits that may or may not be active any longer, were observed on those welds that exhibited evidence of corrosion. None of those indications suggests the presence of any defects that would compromise the structural integrity of these lines. No crack-like defects were noted in any of the weldments.

The remote visual examination of 2-SF-144-FW-517 revealed three apparent pits, each defined by a reddish-brown deposit. Two of those indications were located in one short section at about the 3 o'clock position; the other at about 9 o'clock.

The reddish-brown deposits and apparent entrance holes in the weld metal of 2-SF-144-FW-517 could be due to MIC, or could be from another source. In either case, the depth and morphology of the metal loss through the thickness cannot be determined from the remote visual examination of the as-found pipe. The visual examination also cannot provide a determination of whether pitting is active or not, or provide information on the source of the pitting. A definitive determination of the root cause for these small pits would require careful microbiological and chemical sampling of the deposits and the pit interior to augment the visual examination of the as-found condition, then a similarly detailed examination of the area following removal of the deposits to better characterize the pit morphology.

An additional characterization of these deposits and apparent pits was performed by CP&L and reviewed as a part of this analysis. The additional activities included mechanical removal of the deposits, two water washes of the deposits to provide an improved visual inspection, and chemical analysis of the materials that were removed. Remote visual inspection was done during or following all of the cleaning procedures.

The first remote visual examination showed the mechanical removal of the deposits by a small tool attached to the pipe crawler. The deposits were removed very easily. The material was soft and muddy with a very definite reddish-brown color. The total quantity of deposits was very small; estimated to be of the order of milligrams. The first washing of the weld removed very little additional deposit. The reddish-brown discoloration was still obvious and the location of the areas of deposit were still three dimensional. The outer portion of the corrosion nodules had been removed mechanically and during the first pressure wash. Where the two apparent pits were located, one or two features that looked like very small entrance holes were observed at the periphery of the former corrosion nodules. One was located along the centerline of the weld root. The other pit nearby exhibited two locations that may also have been entrance holes into the underlying weld material, however, those features were not as distinct.

Following the second water washing, the appearance of the two apparent pit locations barely changed at all. There, the weldment was still discolored with a reddish-brown stain and the two affected areas still appeared to be covered with a layer of an iron-based corrosion product. The single corrosion nodule located approximately 180° away from those two nodules was still discolored, but the deposited corrosion product had been removed more completely and no definite pits of the weld metal or base metal were obvious.

CP&L performed chemical analyses of solid and liquid samples removed from the locations on FW-517 described above. Liquid samples were collected from the first water washing of FW-517 and piping several feet upstream and downstream of the field weld. That fluid was collected at the nearest access point, approximately 70 feet away. The CP&L analysis included examination in the scanning electron microscope (SEM) with an energy dispersive spectrometer (EDS) attachment to determine the approximate elemental composition of the samples. X-ray diffraction (XRD), which permits a determination of the compounds present from the presence of their unique diffraction characteristics, was performed on deposits filtered from the liquid sample. All of the samples characterized by EDS were primarily iron and oxygen, with minor amounts of chromium and silicon. No other significant peaks were detected. The XRD analysis showed that the filtered solids consisted almost entirely of hematite (α-Fe_2O_3) and lepidocrocite ($FeOOH$).

Corrosion pits, even the closed, tunneling pits in weld metal that are often associated with MIC of stainless steel, would have no consequence on structural integrity. MIC **can** produce pinhole leaks, however, even a severe MIC condition does not impact the structural integrity of stainless steel welds, as demonstrated both by calculation [6] and confirmed by experiment [7]. As demonstrated in References 6 and 7, a distribution of much larger pits in a more severely stressed stainless steel weld had no effect on load carrying capability.

The presence of the reddish-brown deposits and apparent small pits in FW-517 is not considered to be a condition that jeopardizes the structural integrity of the SFP Piping at all.

The most powerful evidence that all welds, including the embedded welds, are structurally sound is that there have been no pinhole leaks reported for any of the exposed piping. If MIC or other localized corrosion mechanisms were operative now or had produced a problem during the 10 year period that these lines have been wet, one or more pinhole leaks might be anticipated. All of the exposed piping has been subject to external visual examination by both CP&L engineering and QC. All of the exposed field welds have been satisfactorily reexamined, both visually and by liquid penetrant testing (PT). No leakage has ever been seen in any of the exposed piping. It is noted that not all of the exposed SFP piping is connected to the embedded piping, but a significant portion of it is. CP&L has estimated that a comparable volume of exposed piping is actually connected to and communicates with the embedded piping, and has been subject to the same flooded conditions.

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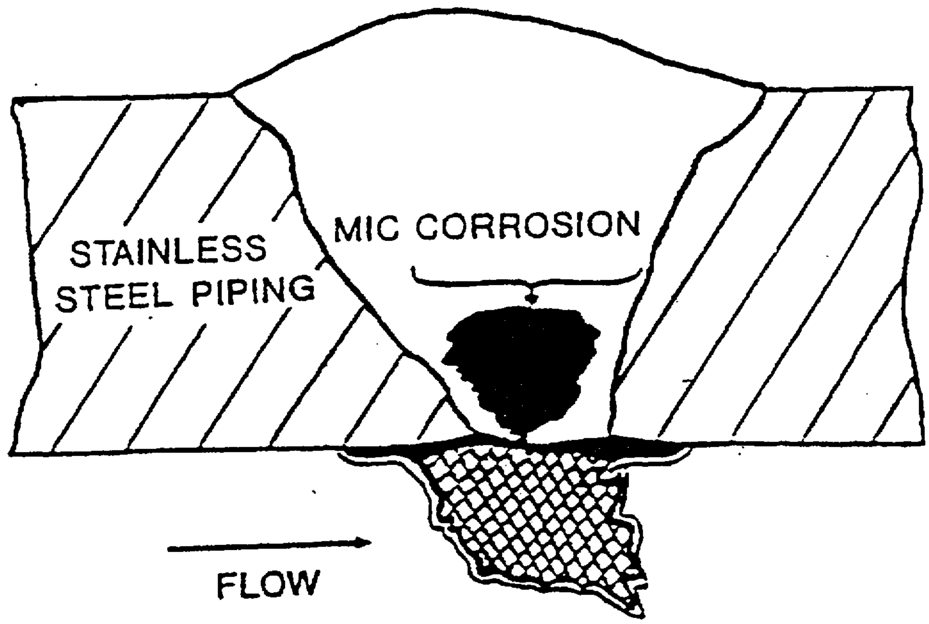

Figure 5-1. Closed Pit, Typical of MIC in Stainless Steel Piping Welds (from [7])

6.0 CONCLUSIONS

6.1 Initial Quality

The fabrication records for all of the spools in this scope were reviewed. Objective evidence was located to confirm that all components and all shop welds were of good quality.

This piping was constructed under the plant's ASME QA program; a program that was used to successfully complete and license HNP Unit 1, and which definitely appeared to have been solidly in place during the construction of all of the SFP Piping, as evidenced by QA records from that era.

No documentation was provided on the as-installed condition of field welds, except for those field welds for which hydrotest records are in hand (i.e., 2-SF-149-FW-408; 2-SF-143-FW -512,-513, and –514; 2-SF-159-FW–518, and -519; 2-SF-144-FW-515, -516, and -517; 2-SF-1-FW-1, -2, -4, and -5). For each of those welds, the hydrotest record did contain a sign-off that the weld data reports were complete, along with the successful results of the hydrotest itself, including the 360 degree visual inspection of each weld under pressure, done while the now embedded welds were still accessible.

Detailed visual examination results of embedded field welds were provided by CP&L from remote visual inspections performed for the utility during the Summer and Fall of 1999. Those inspections were used as a part of this evaluation.

The as-installed structural integrity of all of the field welds evaluated in this project (i.e., 2-SF-149-FW-408; 2-SF-143-FW-512, -513, and –514; 2-SF-159-FW–518, and -519; 2-SF-144-FW-515, -516, and -517; 2-SF-1-FW-1, -2, -4, and -5; 2-SF-8-FW-65 and, -66) was considered acceptable based upon the materials provided. The successful completion of the hydrostatic test and the detailed remote visual examination (following 10 years of exposure to a wet lay-up with high purity water) provided a conclusive demonstration of the quality of the initial welds.

6.2 Present Condition

The review of the detailed visual examinations for 2-SF-8-FW-65 and –66; 2-SF-144-FW-515, -516, and –517; 2-SF-149-FW-408; 2-SF-143-FW-512, -513, and –514; 2-SF-1-FW-1, -2, -4, and –5; and 2-SF-159-FW-518 and -519 also demonstrated that those welds were in a condition that would be very comparable to that of as-installed piping. The 10 years of wet lay-up does not appear to have degraded the structural integrity of the welds at all.

6.3 Suitability for Service as Spent Fuel Pool Piping

The assessment of the suitability for service of this SFP Piping was based upon all of the items listed above – records review and remote visual inspection.

The SFP Piping is exposed to very benign conditions. Localized corrosion, which could produce pinhole leaks, is the most likely form of degradation. None of the forms of localized corrosion, including MIC, is considered very likely at all.

No pinhole leaks have been detected in any of the exposed piping to date.

Pinholes will have no effect on structural integrity in any event.

The videotapes from the detailed remote visual examination are for six lines in a total population of eight (which include the fifteen field welds). Conclusions drawn from them assume that they are representative of the population. Per CP&L, there are no field welds in the remaining two lines.

The overall condition of the welds, including the appearance of the tie-in at the edges of the consumable insert, is good to excellent. There are some areas, generally scattered around the circumference, where the consumable insert was not completely consumed (e.g., 2-SF-144-FW-516) or where the weld profile was less than ideal. The very small thickness required to withstand design service pressure and the successful hydrotest results provide a verification that these welds are suitable for the SFP Piping's service conditions despite the non-consumed areas or imperfect profile.

The plant's best method to control degradation is to continue to keep these lines isolated from potential sources of contaminants and to assure that the only environment that the lines experience is controlled purity water. Periodic visual examination of exposed piping for the presence leaks can provide continued additional assurance of the integrity of the SFP Piping population.

ESR 99-00266, Rev. 0, Att. 2

7.0 REFERENCES

1. "Alternative Examination Requirements for Class 1, Category B-J Piping Welds, Section XI, Division 1," ASME Code Case N-560, August 9, 1996.

2. "Revised Risk-Informed Inservice Inspection Evaluation Procedure," EPRI Report No. TR-112657 Final Report, April 1999.

3. "Minimum Wall Thickness Calculation for Spent Fuel Pool Cooling and Clean-up," Ebasco Services Incorporated Calculation CAR-6418-312, Rev. 0, 2-13-84.

4. "Hydrostatic Testing of Buried or Embedded Pressure Piping (Nuclear Safety Related)," Carolina Power & Light Company, Shearon Harris Nuclear Power Plant, Technical Procedure TP-30, Rev. 0, 1978.

5. "Hydrostatic Testing of Buried or Embedded Pressure Piping (Nuclear Safety Related)," Carolina Power & Light Company, Shearon Harris Nuclear Power Plant, Work Procedure WP-115, Rev. 3, 1982.

6. A. F. Deardorff, J.F. Copeland, A.B. Poole, L.C. Rinaca, "Evaluation of Structural Stability and Leakage From Pits Produced By MIC In Stainless Steel Service Water Lines," CORROSION/89, Paper No. 514, NACE, 1989.

7. W.A. Pavinich, L.C. Rinaca, P.V. Guthrie, D.M. Hewette, "Four-Point Bend Testing of MIC-Damaged Piping," Proceedings: EPRI Service Water System Reliability Improvement Seminar, EPRI, 1988.

8. G.J. Licina, "Sourcebook for Microbiologically Influenced Corrosion," EPRI NP-5580, 1988.

9. G.J. Licina, "Detection and Control of Microbiologically Influenced Corrosion – An Extension of the Sourcebook for Microbiologically Influenced Corrosion," EPRI NP-6518-D, 1990.

ESR 99-00266
ATTACHMENT 3
Rev. 0

CAROLINA POWER & LIGHT COMPANY
MATERIAL SERVICES SECTION
METALLURGY SERVICES

TECHNICAL REPORT

To: Mr. Steve Edwards

Investigators:
Danny Brinkley
Ahmad Moccari *Ahmad Moccari*

Distribution:
Mr. Robert Lane/HNP
File/Metallurgy Services

Project Number: 99-179
Date: December 16, 1999
Reviewed by: *Kevin E. Johnston*

Approved by: *[signature]* 12/16/99
Supervisor, Metallurgy Services

SUBJECT: **Harris Nuclear Plant - Bacteria Detection in a Deposit Sample and Chemical Analysis of Reddish-Brown Material from the C&D Spent Fuel Pool Cooling Lines**

INTRODUCTION:

The objectives of this project were: (1) to determine if nuisance bacteria that could potentially cause microbiologically influenced corrosion (MIC) are present in the deposit sample from a field weld (2-SF-144-FW-517); (2) to perform chemical analysis of a sample of the reddish-brown material in the C&D spent fuel pool cooling lines, and (3) to provide a review of videotapes of the remote visual examination of the Harris Nuclear Plant (HNP) spent fuel pool cooling piping and field welds. Regarding these examinations, Field Welds 515, 516, 517, and 519 were particularly noted as being of interest to HNP engineering personnel and the NRC, and are specifically addressed herein.

LABORATORY EXAMINATION AND RESULTS:

1. Characterization of the Microbiological Nature of the Deposits

One smear pad containing some deposits scraped from Field Weld 517 from the C&D spent fuel pool cooling line was received for bacterial characterization. Review of the videotape of the remote visual inspection of Field Weld 517 showed the deposit sample being removed directly from the location(s) of interest.

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The as-received pad was rinsed with nano-pure demineralized water. The majority of the deposit appeared to have been removed from the pad by this rinsing and resulted in about 100 milliliters of reddish-brown solution with some suspended particulate.

The presence/absence of sulfate-reducing bacteria (SRB) in about 10 milliliters of the rinsed water was then evaluated using a Rapidchek™ II Kit, a "sulfate-reducing bacteria kit". The bacterial counts were found to be less than 1000 cells per milliliter which is the lower detectable level of this kit. The Rapidchek II Kit for detecting SRB is a commonly used kit in the field and provides a qualitative result in a short time. This kit provides a simple "presence/absence" test capable of indicating the population size of the SRB bacteria present in a water sample but it does not provide any information on the activity/aggressivity of the bacteria.

In order to confirm the results obtained from using the Rapidchek II kit, the presence and aggressivity of sulfate-reducing bacteria were investigated using an Easicult™ S culture tube. The growth of sulfate-reducing bacteria in the Easicult S culture tube results in the formation of black iron sulfide. The blackening may begin at any location in the tube and, depending on the degree of aggressivity, eventually either a portion of or the entire culture tube may become black. No blackening was observed after culturing for 5 days (the culturing time per the manufacturer's recommendation) indicating that the rinsed water was not infected with sulfate-reducing bacteria.

In addition, the presence and aggressivity of slime-forming bacteria, iron-related bacteria, and heterotrophic aerobic bacteria were evaluated using appropriate BART™ kits. These evaluations involve culturing and observation for up to about two weeks to determine any bacterial activity and growth. The results of the BART kits' analyses indicated that no nuisance bacteria capable of causing material degradation due to microbiological influenced corrosion (MIC) were present in the deposit sample from the C&D spent fuel pool cooling lines. As a controlled test, one kit of each kind was used to characterize bacteria in the nano-pure demineralized water. The results of these tests were negative.

It should be noted that the presence of microbiologically influenced corrosion (MIC) and halogen associated localized corrosion are not considered likely in the Harris Nuclear Plant C&D spent fuel pool cooling lines given that the piping is filled with a relatively low conductivity borated demineralized water with very low measured concentrations of chloride, fluoride, and sulfate. Furthermore, since these lines have been reportedly flooded for an extended period of time (up to ten years), the existence of microbial activity in an aggressive form would be expected to have been evidenced by this time in the form of material degradation which most likely would be visible by external leakage in accessible piping. The outside diameter surfaces of the accessible piping that have been exposed to the same water for the same number of years have been inspected by plant personnel and no incidents of leaking/weeping have been reported.

2. Chemical Analysis of the Reddish-Brown Material in the Spent Fuel Cooling Lines

Two fluid samples were received by Health Physics/Dosimetry personnel at the Harris Energy & Environmental Center. The sample that was the most discolored of the two was shaken and a portion of this sample was filtered using a 0.45-micron Millipore filter membrane. The first filter clogged, so a second filter was used.

The two filter samples were visually examined. Portions of the most heavily loaded filter were selected, excised, and prepared for analyses using an energy dispersive x-ray spectrometer (EDS) attachment to a scanning electron microscope (SEM) for elemental identification and a x-ray diffractometer (XRD) for chemical compound identification.

The SEM/EDS system is capable of detecting and analyzing x-rays emitted from elements having atomic numbers greater than or equal to that of beryllium. Typically, this instrumentation can detect the higher atomic elements (sodium and above on the Periodic Table) when present in concentrations of about 0.1 weight percent or greater. The detection limits for lower atomic number elements, such as oxygen and carbon, are probably at least an order of magnitude larger (e.g., > 1 weight percent) depending upon the sample matrix. The samples were imaged using a combination of secondary and backscattered electron detectors. The secondary electron images are very sensitive to surface features and topography. The intensity of the backscattered electron images is proportional to the average atomic number of the area being excited by the electron beam (e.g., lead is brighter than iron, and iron is brighter than carbon). The x-ray diffraction (XRD) system provides information that permits the identification of the crystal structure of an unknown material.

The SEM imaging showed the samples to consist of a mixture of materials. Some of the particles had a higher average atomic number than did other portions of the particulate. The chemical composition of the bulk sample was found to be primarily iron and oxygen with lesser and varying concentrations of silicon, aluminum, carbon, calcium, chromium, nickel, sodium, magnesium, nickel, potassium, zinc, and chlorine. Some small metallic fragments were observed in the sample that had compositions consistent with austenitic stainless steel. Carbon-rich, aluminum-rich, silicon-oxygen-calcium-aluminum-rich, silicon-rich, and chromium-rich particles were present in the sample. Some rod-like fibers were also present in the sample.

XRD analysis of the filtered deposit on a Millipore filter membrane showed this sample to consist primarily of iron oxides (a mixture of hematite - α-Fe_2O_3 and lepidocrocite - FeOOH) and possibly graphite. The obtained XRD pattern did not match any of the published patterns for aluminum silicates or calcium-aluminum silicates.

In summary, the majority of the filtered deposits from the fluid samples were identified to consist of iron oxide in the form of hematite (α-Fe_2O_3) and lepidocrocite (FeOOH). Lesser amounts of graphite and other types of particulate were present in the sample.

3. Review of the Videotape of the Remote Visual Examination of Embedded Spent Fuel Pool Cooling Piping and Field Welds

Reviewing the videotapes of the remote visual inspection of the 15 field welds (reviewing was performed at several times for a period of 12 to 15 hours) of the embedded C&D spent fuel cooling and cleanup system piping after the water had been drained revealed that the camera work was very professional. High quality images were obtained of the inside of the spent fuel piping showing very clearly the longitudinal welds, circumferential welds, and the inside surfaces of the piping. Some halos/rust streaks were observed indicating minor corrosion at the weld(s) or adjacent to the welds. Some predominantly yellowish-white deposits were also observed in the line which are most likely boric acid crystals. These surface anomalies appear to be superficial with no discernable pin hole(s) or crack-like defect(s) associated with them and are very highly unlikely to be detrimental to the structural integrity of the piping. The following discussion will address the specific field welds of concern.

Field Weld 515 (2-SF-144-FW-515)

A small linear indication extending out of the circumferential seam weld on the piping of FW-515 was observed. This indication is not associated with the field weld and does not have the appearance of being corrosion related. The degradation mechanisms that potentially could cause cracking in the spent fuel line which is fabricated from Type 304 stainless steel are intergranular stress-corrosion cracking (IGSCC), trangranular stress-corrosion cracking (TGSCC), and corrosion fatigue. The piping is exposed to an environment consisting of borated demineralized water with very low impurities (such as chloride, fluoride, and sulfur) and relatively low conductivity. This environment is not sufficiently corrosive and the operating temperature is not high enough for either IGSCC or TGSCC to be possible. Corrosion fatigue is also not considered possible either because the line is embedded in 4 to 6 feet of concrete and can not be subjected to cyclic loading. The visible indication appears to be a manufacturing artifact in the longitudinal seam weld and not associated with the construction of the field weld itself.

Field Weld 516 (2-SF-144-FW-516)

Four locations with corrosion halos/rust streaks were noted on or adjacent to FW-516. In addition to this streaking, some small areas were also observed where the consumable insert had not completely fused. No pitting or pin holes were associated with these discolored/streaked areas and they do not appear to be of concern relative to the piping integrity. Closer inspection of the consumable insert revealed that the insert was fused on its edges.

Field Weld 517 (2-SF-144-FW-517)

During the initial videotape review of the remote visual inspection of this field weld, three small locations with some rust-colored deposit buildup were observed. One area was located at approximately the 3 o'clock position and two areas were observed adjacent to each other at the 9 o'clock positions. No pitting or pin holes were visible at either of these locations due to the presence of the deposits. After removing some of the deposits for bacteria characterization, no visible pitting, pin hole, or crack-like defects on the piping underneath the deposits at the 3 o'clock position and at one of the two spots at the 9 o'clock position were observed. Some loosely scattered deposits and some discoloration were, however, noted at these two locations. The scattered deposits were removed after further hydrolazing and the inside diameter surface of piping appeared free of surface discontinuities at those locations. Some of the deposits were still present at one of the spots at the 9 o'clock position. Consequently, a conclusion about whether or not surface discontinuity was present at this location could not be made. However, based on observation of the other two spots and the remainder of the piping and field welds, it is very highly unlikely that any surface discontinuities would be found at this spot which would be detrimental in any way to the piping integrity.

Field Weld 519 (2-SF-143-FW-519)

This field weld appears to have more rust streaks/stains and more yellowish-white deposits (most likely boric acid crystals) which have obscured a good portion of the weld root. One pit-like indication appeared to have been associated with one of the rust streaks. A halo (circular discoloration with a yellowish-brown, reddish-brown, and black stain) is also associated with the pit-like indication. However, upon close inspection from a number of different angles as the camera moved back and forth it was concluded that this did not appear to be a pit or similar defect, but rather the start and stop of the weld which has acted as a nucleation site for crud to accumulate.

CONTENTION TC-3: EXHIBIT 5

IE Information Notice No. 85-56, Inadequate Environment Control for Components and Systems in Extended Storage or Layup (July 15, 1985)

SSINS No. : 6835
IN 85-56

UNITED STATES
NUCLEAR REGULATORY COMMISSION
OFFICE OF INSPECTION AND ENFORCEMENT
WASHINGTON, D.C. 20555

July 15, 1985

IE INFORMATION NOTICE NO. 85-56: INADEQUATE ENVIRONMENT CONTROL FOR COMPONENTS AND SYSTEMS IN EXTENDED STORAGE OR LAYUP

Addressees:

All nuclear power reactor facilities holding an operating license (OL) or a construction permit (CP).

Purpose:

This information notice is being provided to alert addressees to problems which can occur if equipment is improperly stored or laid up during construction or extended plant outages. Addressees also are reminded that programs for proper storage and preservation of materials and components are required by NRC regulations (10 CFR 50, Appendix B), even though not specifically addressed as license conditions. It is expected that recipients will review the information for applicability to their facilities and consider actions, if appropriate, to preclude a similar problem occurring at their facilities. However, suggestions contained in this information notice do not constitute NRC requirements; therefore, no specific action or written response is required.

Description of Circumstances:

Licensee event reports, 10 CFR 50.55(e) reports, and NRC inspection reports contain many instances where materials and components have been seriously degraded due to improper storage, protection, or lay up, both at facilities under construction and facilities with operating licenses. A number of representative examples are described in the following paragraphs.

A recent NRC inspection at Nine Mile Point Unit 2 disclosed that the cooling water heat exchanger for the high pressure core spray diesel generator had water standing irk the tube side of the unit. The heat exchanger had been delivered to the site and had been "stored in place" in 1977, but was not yet in service. The source of the water is unknown, but it has been hypothesized that the heat exchanger had been inadequately drained after a manufacturer's hydro-test in 1976. The site construction organization had no program for inspection or surveillance of equipment in storage. Significant corrosion damage was observed on the copper alloy tubes and the carbon steel tube sheets and water boxes.

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Corrosion damage similar to that described above was found during an NRC inspection at Hope Creek. In that instance, the two heat exchangers were supplied for the engine cooling system for the plant emergency diesel generators. The heat exchangers had been received onsite sometime before, and stored in place. They had not yet been placed in service.

In November 1984 the licensee for H. B. Robinson Unit 2 notified the NRC that, while preparing for restart after a 10 month outage, numerous pinhole leaks had been detected in the stainless steel service water piping. Further examination of the piping disclosed other corrosion pits that had not penetrated through the wall. Temporary repairs were accomplished by the use of about 800 welded sleeves. The licensee has submitted plans for future complete replacement of the affected pipe. The corrosion has been attributed to microbiological growth in the stagnant water that was in the system during the extended outage. Proper layup of the system could have precluded damage. IE Information Notice 85-30 provides additional information on this phenomenon.

At Palo Verde, the licensee reported in June 1984 that corrosion attack had been found on internal surfaces of two Unit 2 auxiliary feedwater pumps. The pumps had not been operated. In December 1984, the licensee reported that the corrosion had been caused by contaminated water inadvertently left in the pumps after prestartup flushing of the system.

Discussion:

The cases cited above are a small sample of the wide variety of instances where improper storage or layup has resulted in significant damage and extended plant outages. Many of the events are related to balance-of-plant equipment and are not reportable to the NRC. They do, however, often cause extended outages. The Robinson service water piping damage extended the plant outage for 4 months, and additional down time will be required in the future to install the replacement pipe.

At Palo Verde, it required extensive work and 6 months time to finally resolve that the pumps were still serviceable.

10 CFR 50.34(a)(7) requires that each applicant for a construction permit shall provide a description of the quality assurance program to be applied to the construction of the facility, in accordance with the requirements of 10 CFR 50, Appendix B. 10 CFR 50.34(b)(6)(ii) requires a description of how the requirements of Appendix B will be satisfied during the operation of each nuclear power facility. Among the requirements of Appendix B, Criterion XIII addresses storage, cleaning, and preservation of materials and equipment.

No specific action or written response to this information notice is required. If you need additional information about this matter, please contact the Regional Administrator of the appropriate NRC regional office or this office.

Edward L. Jordan Director
Division of Emergency Preparedness
and Engineering Response
Office of Inspection and Enforcement

Technical Contact: J. B. Henderson, IE
492-9654

Attachment: List of Recently Issued IE Information Notices

CONTENTION TC-3: EXHIBIT 6

NRC IE Information Notice No. 85-30, Microbiologically Induced Corrosion of Containment Service Water system (April 19, 1985)

SSINS No.: 6835
IN 85-30

UNITED STATES
NUCLEAR REGULATORY COMMISSION
OFFICE OF INSPECTION AND ENFORCEMENT
WASHINGTON, D.C. 20555

April 19, 1985

IE INFORMATION NOTICE NO. 85-30: MICROBIOLOGICALLY INDUCED CORROSION OF CONTAINMENT SERVICE WATER SYSTEM

Addressees:

All holders of a nuclear power reactor operating license (OL) or construction permit (CP).

Purpose:

This information notice is provided to alert recipients of significant corrosion pitting due to microbiologically induced corrosion identified in stainless steel piping sections of a service water system after an extended plant outage. It is expected that recipients will review the information for applicability to their facilities and consider actions, if appropriate, to preclude similar problems occurring at their facilities. However, suggestions contained in this information notice do not constitute NRC requirements; therefore, no specific action or written response is required.

Description of Circumstances:

On January 26, 1984, H. B. Robinson Unit 2 was shut down and remained shut down throughout the year to replace the lower assemblies of the steam generator and perform other maintenance work.

On November 19, 1984, Carolina Power and Light Company (CP&L) reported that minor pinhole leaks were found in the heat affected zones of circumferential welds joining 6-inch diameter, Schedule 10, 304 stainless steel piping that provides service water to the four containment chilling units. Visual inspection of the entire system revealed minor leakage at a total of 54 weld joints, 32 inside and 22 outside containment. Further radiographic examination revealed evidence of localized corrosion pitting on the inside surface at many other austenitic piping weld joints of the system. Numerous sleeve assemblies were required to restore integrity of the welds degraded by the corrosion attack.

Discussion:

The licensee's investigation determined that the root cause of the problem was the result of microbiologically induced corrosion (MIC). This is representative of several similar incidents reported in construction and operating plants in past years. A very recent example may be a large number of leaking welds in

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IN 85-30

the Essential Spray Pond Piping system at Palo Verde Unit 2. The licensee's evaluation is currently underway, but their preliminary conclusion is the problem is caused by MIC.

MIC is a form of corrosive action that occurs as a direct, or indirect, result of living organisms in contact with the materials of construction. Microorganisms have been observed in a variety of environments including soils, sediment, natural fresh water (e.g., wells, rivers, lakes), brackish and sea water, as well as oil and other natural petroleum products. Many species may form synergistic cross feeding support systems with other bacteria, fungi, algaes and the like to enhance survival under the most adverse conditions. They have been known to tolerate a wide-range of temperatures (-10 to 90<deg>C), pH values of 0 to 10.5, oxygen concentrations from zero to almost 100 percent O2 and extreme hydrostatic pressure. There are six different classifications of microorganisms containing over 30 species that can be a problem, depending on the geographic location and the environmental conditions.

The metabolic processes of organisms are sustained by chemical reactions. These processes can significantly influence the corrosion behavior of materials by (1) destruction of protective surface films, (2) creating corrosive deposits, and/or (3) altering anodic and cathodic reactions depending on the environment and organism(s) involved.

Several general methods for inhibiting MIC have been employed with varied degrees of success in recirculation systems. Among these methods were an application of protective coatings in conjunction with cathodic protection, corrosion inhibitors, or water chemical treatment such as periodic shock chlorination. However, it is important to correctly diagnose the presence of MIC and the organisms involved before attempting such corrective measures to ensure that no products are formed that themselves have a detrimental effect on the materials. Moreover, if water chemical treatment is used, it is important to ensure that residual chemical levels are maintained within the permissible range of applicable EPA requirements.

Where the above measures are not practical, it has been observed that relatively rapid fluid flow tends to prevent attachment of organisms whereas low flow rates or stagnant conditions favor biofouling and concentration cell corrosion. Thus, cleaning and dry lay up, or periodic recirculation flushing, during extended outages to mitigate know biological activity would appear to be prudent alternatives.

No specific action or written response is required by this information notice. If you have any questions about this matter, please contact the Regional Administrator of the appropriate NRC regional office or the technical contact listed below.

Edward L. Jordan, Director
Division of Emergency Preparedness
and Engineering Response
Office of Inspection and Enforcement

Technical Contact: William J. Collins, IE
(301) 492-9630

Attachment: List of Recently Issued IE Information Notices

CONTENTION TC-3: EXHIBIT 7

NRC Information Notice No. 94-38, Results of a special NRC Inspection at Dresden Nuclear Power Station Following a Rupture of Service Water Inside Containment (May 267, 1994)

UNITED STATES
NUCLEAR REGULATORY COMMISSION
OFFICE OF NUCLEAR REACTOR REGULATION AND
OFFICE OF NUCLEAR MATERIALS SAFETY AND SAFEGUARDS
WASHINGTON, D.C. 20555

May 27, 1994

NRC INFORMATION NOTICE 94-38: RESULTS OF A SPECIAL NRC INSPECTION AT DRESDEN NUCLEAR POWER STATION UNIT 1 FOLLOWING A RUPTURE OF SERVICE WATER INSIDE CONTAINMENT

Addressees

All holders of operating licenses or construction permits for nuclear power reactors and all fuel cycle and materials licensees authorized to possess spent fuel.

Purpose

The U.S. Nuclear Regulatory Commission (NRC) is issuing this information notice to inform addressees of the results of a special NRC inspection at Dresden Nuclear Power Station Unit 1 (Dresden 1) after a rupture of the service water system occurred inside the containment. It is expected that recipients will review the information for applicability to their facilities and consider actions, as appropriate to avoid similar problems. However, suggestions contained in this information notice are not NRC requirements; therefore, no specific action or written response is required.

Description of Circumstances

Dresden 1, one of three boiling-water reactors at the Dresden site near Morris, Illinois, was licensed for operation on September 28, 1959, and was permanently shut down October 31, 1978. On January 25, 1994, the licensee for Dresden 1 discovered approximately 200 m [55,000 gallons] of service water in the basement of the unheated Unit 1 containment. The water originated from a rupture of the service water system piping inside the containment that had been caused by freeze damage to the system. The NRC dispatched a team of inspectors from the Offices of Nuclear Reactor Regulation (NRR), Nuclear Material Safety and Safeguards (NMSS), and Region III to conduct a special inspection of the circumstances surrounding the event. The results of this special inspection are contained in NRC Inspection Report No. 50-010/94001, issued on April 15, 1994.

The licensee investigated the circumstances further and found that there was a potential for a portion of the spent fuel pool (SFP) system inside the containment to fail and result in a partial draindown of the SFP containing 660 spent fuel assemblies. The licensee implemented several specific actions to guard against further damage from freezing and appointed an investigation team headed by a corporate official to investigate the status of Dresden 1.

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The NRC issued NRC Bulletin 94-01, "Potential Fuel Pool Draindown Caused by Inadequate Maintenance Practices at Dresden Unit 1," April 14, 1994, to request that action addressees specified in the bulletin take actions to ensure that the quality of the SFP coolant, and the cooling and shielding for fuel or equipment stored in the SFP is not compromised and that all necessary structures and support systems are maintained and are not degraded. The bulletin also indicated that the NRC staff is reviewing the need to request actions related to siphon or drainage paths at older operating power plants and certain fuel cycle facilities.

Discussion

The NRC inspection team evaluated the circumstances of the event and the findings of the licensee investigation. Based on these reviews, and as noted in NRC Bulletin 94-01, the following conditions existed at Dresden 1:

Heating had not been provided to the Dresden 1 containment for the 1989/1990 and subsequent heating seasons. The lack of heating inside the containment under more severe weather conditions could potentially have resulted in the freezing and rupture of the fuel transfer tube. Failure of the fuel transfer tube could have drained the SFP to several feet below the top of the stored fuel assemblies. The loss of water shielding would have created onsite personnel hazards from the high radiation fields.

The water quality in the SFP was poor. The original cleanup and cooling system was shut down in 1983; by 1987 the water quality had degraded to the point that an influx of microorganisms had developed. Concerned that the microorganisms might cause microbiologically induced corrosion, the licensee installed a temporary system to clean up the pool. The temporary system proved to be incapable of restoring the water quality to an acceptable level. Licensee records show that the conductivity in the pool exceeded the technical specification limit of 10 mho per centimeter by about a factor of two. Also, the licensee estimated that approximately 90 stored fuel bundles had leaking fuel pins resulting in elevated concentrations of cesium-137 of about 370 Becquerels/ml [1 x 10-2 Ci/ml].

A number of obsolete piping lines from the original pool cleanup and cooling system remained in the SFP and were potential siphon paths that could reduce the pool level.

Because the SFP gate was not installed it could not have prevented a draindown of the pool if the fuel transfer pool or tunnel had emptied. The NRC inspectors noted that the gaskets and steel mating surfaces for the spent fuel gate had been exposed to adverse biological, chemical, and radiological conditions that may have affected their ability to seal had the gate been installed.

The licensee had no SFP leak detection or water inventory program. The observed cracks in the unlined concrete pool indicated a potential for pool leakage.

The following additional information was not included in NRC Bulletin 94-01:

Service water to Unit 1 had been isolated on January 24, 1994 because of a rupture of service water piping in the off-gas filter building. Had the service water not been isolated, the leakage into the Unit 1 containment would have been greater and may have challenged containment integrity. A number of other pressurized water lines were isolated outside of the Unit 1 containment but the valves were not locked out or red tagged to provide positive control. These lines could have flooded the containment if opened and a rupture occurred inside the containment.

An inspection of the SFP transfer tunnel by a remotely-controlled submersible camera found cracks in the concrete floor of the tunnel that could be pathways for SFP water leakage.

A number of discrepancies in licensee actions with respect to docketed decommissioning plan submittals were found. These included (1) failure to appoint a project manager for the Unit 1 decommissioning activities, (2) failure to have systems operable that were stated to be operable including a system for containment heating, (3) failure to implement a commitment to install an Eberline Model SPING 3A air monitor in the fuel storage building, (4) failure to have service water and certain other systems drained or properly laid up so as not to be challenged by temperature extremes, and (5) failure to maintain ventilation exhaust flow rates in the containment sphere and the fuel storage building.

In addition to the above conditions the NRC inspectors also noted the following programmatic inadequacies:

The site audit and quality verification program focused on the operating reactors at Units 2 and 3. Because of the emphasis on the operating reactors, audits and safety evaluations for the site were not rigorously implemented for Unit 1 or did not include the Dresden 1 systems and programs.

The licensee could not provide any safety evaluation performed to support the decision to terminate heating of the Unit 1 containment.

The inspection team concluded that the layup of the plant and storage of spent fuel at Dresden 1 was not well managed or maintained for a period of years and that weaknesses existed in the site quality audit and inspection programs. Further, safety reviews of changes to Dresden 1 systems such as termination of heating and ventilation for the containment were apparently not performed or not adequately reviewed to determine the safety consequences of the changes. Interviews with personnel at the Dresden site (which includes two operating units in addition to Dresden 1) showed that, in part, the weaknesses identified above were based on an incorrect belief that Dresden 1 could not cause a serious safety problem because it was permanently shut down. This belief resulted in audits and safety evaluations that were not rigorously implemented or that did not include the Dresden 1 systems and programs. However, as noted above, significant safety considerations did exist.

This information notice requires no specific action or written response. If you have any questions about the information in this notice, please contact one of the persons listed below or the appropriate NRC project manager.

/s/'d by JTGreeves/for /s/'d by AEChaffee/for

Malcolm R. Knapp, DirectorBrian K. Grimes, Director
Division of Waste Management Division of Operating Reactor Support
Office of Nuclear Material SafetyOffice of Nuclear Reactor Regulation
and Safeguards

Technical contacts: James McCormick-Barger, RIII
(708) 829-9872

Richard Dudley, NRR
(301) 504-1116

Larry Bell, NMSS
(301) 504-2171

Attachments:
1. List of Recently Issued NRC Information Notices
2. List of Recently Issued NMSS Information Notices

CONTENTION TC-3: EXHIBIT 8

Letter from Kerry D. Landis, NRC, to James Scarola, CP&L, re: NRC Inspection Report No. 50-400/99-12 (December 28, 1999)

UNITED STATES
NUCLEAR REGULATORY COMMISSION
REGION II
SAM NUNN ATLANTA FEDERAL CENTER
61 FORSYTH STREET, SW. SUITE 23T85
ATLANTA, GEORGIA 30303-8931

December 28, 1999

Carolina Power & Light Company
ATTN: Mr. James Scarola
Vice President - Harris Plant
Shearon Harris Nuclear Power Plant
P. O. Box 165, Mail Code: Zone 1
New Hill, NC 27562-0165

SUBJECT: NRC INSPECTION REPORT NO. 50-400/99-12

Dear Mr. Scarola:

This refers to the inspection conducted on November 15 - 19, 1999, at your Harris facility. This was a special team inspection covering activities related to the planned expansion of the Shearon Harris spent fuel pool. The objectives of this inspection were to assess the implementation of the construction quality assurance program in construction of the C and D spent fuel pools, evaluate the alternate weld inspection program, and evaluate the plans for commissioning of the equipment for the C and D spent fuel pools (SFP).

The inspection found that CP&L had a comprehensive program to control, inspect, and document welding at the time of original plant construction in accordance with Section III of the ASME Boiler and Pressure Vessel Code, and NRC requirements. The inspection also found that the alternate weld inspection program was adequate to provide assurance that the welds for which documentation was missing, met design requirements. The program for commissioning of the C and D SFP equipment will be examined in an inspection tentatively planned for January 24 - 28, 2000. No violations of NRC requirements were identified during the inspection.

In accordance with 10 CFR 2.790 of the NRC's "Rules of Practice," a copy of this letter and its enclosures will be placed in the NRC Public Document Room.

Sincerely,

Kerry D. Landis, Chief
Engineering Branch
Division of Reactor Safety

Docket No. 50-400
License No. NPF-63

Enclosure: NRC Inspection Report

cc w/encl: (See page 2)

cc w/encl:

cc w/encl:
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Performance Evaluation and
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(cc w/encl cont'd - See page 3)

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Board of County Commissioners
of Chatham County
Electronic Mail Distribution

U. S. NUCLEAR REGULATORY COMMISSION

REGION II

Docket Nos.: 50-400

License Nos.: NPF-63

Report Nos.: 50-400/99-12

Licensee: Carolina Power & Light Company (CP&L)

Facility: Shearon Harris Nuclear Power Plant, Unit 1

Location: 5413 Shearon Harris Road
New Hill, NC 27562

Dates: November 15 - 19, 1999

Team Leader: J. Lenahan, Senior Reactor Inspector
Engineering Branch
Division of Reactor Safety

Inspectors: B. Crowley, Senior Reactor Inspector
K. Heck, Quality Assurance Engineer, NRR
D. Naujock, Materials Engineer, NRR

Approved By: Kerry D. Landis, Chief
Engineering Branch
Division of Reactor Safety

SUMMARY OF FINDINGS

Shearon Harris Nuclear Power Plant
NRC Inspection Report 50-400/99-12

The fuel pool cooling systems are described in Section 9.1.3 of the licensee's Updated Final Safety Analysis Report (UFSAR). The design basis for pools A and B, which support the operation of Unit 1, is identical to that for pools C and D. Because these pools are located in a single building and major system components needed to be installed during the early phase of construction, procurement and installation of the major system components for all four spent fuel pools was performed concurrently, in the late 1970s and early 1980s. In a letter dated December 23, 1998, the licensee requested an amendment to the Shearon Harris facility operating licensee to place spent fuel pools (SFP) C and D in service to increase the onsite spent fuel storage capacity. The licensee is currently operating and storing fuel in the A and B SFP. The majority of the C and D SFP were completed prior to 1982 during plant construction.

During preparation of the plans for completion of the C and D SPF, the licensee discovered that documentation for 52 welds on ASME Class III piping had been inadvertently destroyed. The 52 welds were 40 piping welds and 12 welded attachments for pipe hangers (lugs). The 40 piping welds included 15 spent fuel system welds which are embedded in concrete, 22 accessible spent fuel system welds, and 3 accessible component cooling system welds. Three of the accessible spent fuel system welds were subsequently removed and replaced with new welds, resulting in 37 piping welds with missing records. The most significant missing documents were the weld data reports (WDRs) for each of the welds. In order to demonstrate the weld quality for the welds with missing documentation, the licensee developed and implemented an alternative inspection program.

This special inspection included a review of the construction quality assurance (QA) and quality control (QC) program; the original construction QA/QC records; the licensee's alternative inspection program for welds with missing QA/QC records; the engineering service requests prepared to complete the C and D SFP; a walkdown inspection of the accessible C and D SPF components; and the licensee's program for commissioning of the C and D SFP. The inspectors used Temporary Instruction (TI) 2515/143 for guidance during this inspection.

The inspection found that the licensee had a comprehensive program to control, inspect, and document welding at the time of original construction in accordance with Section III of the ASME Boiler and Pressure Vessel Code, and NRC requirements. The inspection also found that the licensee's alternative weld inspection program was adequate to provide assurance that the welds for which documentation was missing, met design requirements. The licensee's program for commissioning of the C and D SFP equipment should ensure that existing equipment meets design requirements and will perform its design function. An Inspector Followup Item (IFI) was opened to inspect implementation of the equipment commissioning process. No violations were identified.

REPORT DETAILS

1. REVIEW OF THE LICENSEE'S CONSTRUCTION QUALITY ASSURANCE PROGRAM

1.1 Review of Quality Assurance and Quality Control Procedures

Inspection Scope

The inspectors reviewed Quality Assurance (QA) and Quality Control (QC) procedures that implemented the QA program requirements during construction.

Observations and Findings

The inspectors reviewed the licensee's ASME Quality Assurance Manual for the Construction of the Shearon Harris Nuclear Power Plant transmitted to NRC by letter dated dated April 30, 1999. This Manual described the quality assurance program that implemented the quality assurance requirements of ASME Boiler and Pressure Vessel Code, Section III, Division 1, Nuclear Power Plant Components, and applicable Federal, State and local regulations and codes. The Manual was applicable to fabrication and construction of ASME components which include the A, B, C and D spent fuel pools.

The inspectors reviewed the implementing QA and QC procedures listed below which controlled activities relating to weld quality. The procedures revisions were applicable to the time during 1979-1981 when the major weld activity for construction of the spent fuel pools occurred. Procedures reviewed were as follows:

Number, Revision	Title
CQA-1, Rev. 5	Personnel Training and Qualification
CQA-2, Rev. 0	QA Document Control
CQA-4, Rev. 5	QA Records
CQA-8, Rev. 3	Material Issue Surveillance
CQA-12, Rev. 0	Mechanical Equipment Installation Monitoring
CQA-14, Rev. 0	Application and Control of "N" Type Symbol Stamps
CQA-15, Rev. 0	Assignment and Control of National Board Serial Numbers
CQA-16, Rev. 0	Preparation and Submittal of ASME Code Data Reports
CQA-18, Rev. 0	Control of Site Fabrication/Modification of Piping Subassemblies
CQA-20, Rev. 0	Surveillance of Contractor Welding and Related Activities
CQA-22, Rev. 0	Welding Activity Monitoring
CQA-24, Rev. 0	Procurement Control
CQA-28, Rev. 0	QA Surveillance
CQA Appendix A	Quality Assurance Forms
CQC-2, Rev. 3	Nonconformance Control
CQC-4, Rev. 3	Procurement Control

CQC-6, Rev. 0	Receiving Inspection
CQC-8, Rev. 3	Storage Control
CQC-10, Rev. 0	Cleanness Control
CQC-12, Rev. 0	Mechanical Equipment Installation Control
CQC-13, Rev. 0	Concrete Control
CQC-19, Rev. 0	Weld Control
CQC-20, Rev. 0	Post-Weld Heat Treatment Control
CQC-22, Rev. 3	Hydrostatic Test Inspection
CQC-23, Rev. 0	Systems Turnover

The procedures were consistent with the CP&L QA program, established by the ASME QA Manual and NRC requirements, and defined specific process requirements in sufficient detail to provide for QA/QC control of welding activities.

A detailed review was performed for procedures CQC-19, Weld Control; CQC-22, Hydrostatic Test Requirements; and CQC-13, Concrete Control. This review was directed toward determining an alternate method to ascertain the quality of the field welds for which certain records were missing. These procedures are described below.

Weld Control

CQC-19 assigned the Welding QA/QC Specialist the responsibility for: review and verification of data and designated hold points in the Weld Data Reports (WDRs); ensuring completed WDRs for code welds were forwarded to the Authorized Nuclear Inspector (ANI) for review; supervising the QC Inspectors in the performance of weld inspections; and monitoring activities related to welding. QC inspection personnel were trained and qualified in accordance with CQA-1. The SFP field welds, which were ASME Code Class 3 welds, were documented on a WDR , reviewed and approved by the Welding QA/QC Specialist, and reviewed for acceptance by the ANI. The ANI performed an independent third party review. The responsibilities of the Welding QA/QC Specialist and QA inspection personnel were sufficiently defined to provide reasonable assurance that the quality of the completed field welds were in compliance with applicable ASME Code requirements. After the documentation of a field weld was determined to be acceptable, pertinent documents were assembled and the package was transmitted to QA Records in accordance with CQA-4.

Hydrostatic Test Inspection

CQC-22 established the requirements for performing hydrostatic test inspections to ensure that hydrostatic tests were performed in accordance with approved procedures and specifications. The Mechanical QA Specialist was responsible for verifying that the documentation for the piping was completed prior to performance of the hydrostatic test. This included verification that field welds within the scope of a hydrostatic test had been satisfactorily completed, inspected, and accepted. The Mechanical QA Specialist was also responsible for performance of the leak inspection during hydrostatic testing. QC inspection personnel also witnessed the test. The responsibilities of the Mechanical QA Specialist and QC inspection personnel were sufficiently defined to provide assurance that the quality of hydrostatic testing was in compliance with applicable procedures and specifications. After the documentation for a hydrostatic test had been accepted by the ANI, the pertinent documents were assembled and reviewed by the Mechanical QA Specialist, who verified that manufacturing/fabrication records for components within the boundaries of the test had been received and accepted and that there were no open nonconformances on any of the components.

Concrete Placement

CQC-13 and Construction Procedure WP-05, Concrete Placement, established the requirements for assuring all work activities in the area affected by a concrete pour were completed prior to placement of concrete. A prerequisite to placement of concrete was the completion of a Concrete Placement Report, which signified that all activities in the affected area had been satisfactorily completed such that access to the area to be covered with concrete was no longer required. When specific crafts completed their work, the appropriate Craft Superintendent signed off the Concrete Placement Report, signifying that a particular activity, such as mechanical, electrical, cadwelds, nondestructive examination, or cleanup, was complete and ready for the concrete pour. This sign-off was required by all Craft Superintendents, whether or not they had work in the particular placement, as a safeguard against omissions. After sign-off by the Craft Superintendents, Field Engineering signed the Concrete Placement Report, verifying that required design attributes, such as the correct location and anchoring of embedded conduit, grounding, inserts, sleeves, piping, and plumbing, were complete and correct. When all the crafts had completed their work, the Construction Inspector signed the report, signifying that all work had been inspected and approved. Subsequently, Quality Control and Quality Assurance signed the report signifying that all of their oversight activities were completed and that the items to be embedded in the concrete were in compliance with applicable requirements. Finally, after all required disciplines, QA, Construction Inspector and design approval sign-offs were completed, the Area Superintendent authorized concrete placement activities to proceed. The completed Concrete Placement Report was transmitted to QA Records in accordance with CQA-4.

Conclusions

The QA/QC procedures in effect at the time of construction of the SFP provided comprehensive control of welding and other construction activities. The procedures provided holdpoints to assure welding was completed in accordance with ASME and NRC requirements prior to proceeding beyond a point wherein any nonconformances could be resolved. These included a detailed review of weld documentation to assure the welds were completed in accordance with technical requirements, and that the welds were inspected and tested prior to being subjected to a hydostatic pressure test. For welds which were to be embedded in concrete, completion of the Concrete Placement Report provided an additional holdpoint to assure the welds were satisfactory prior to placement of concrete. The ANI provided an independent third party review of the ASME welding program.

1.2 Review of Welding Process Control Procedures

Inspection Scope

The inspectors reviewed original construction welding process control procedures, which were in effect at the time the existing Fuel Pools "C" and "D" equipment and piping were installed, as detailed below.

Observations and Findings

The welding control procedures listed below were reviewed to verify that a quality assurance program was in place at the time of installation of Fuel Pools "C" and "D" piping to ensure that pipe welding was accomplished in accordance with applicable Code requirements. The procedure revisions were those applicable when the welding activities for the fuel pools were in progress. Procedures reviewed were as follows:

MP-01, Revisions 3, 5, 6, and 7, Qualifying of Welding Procedures

MP-02, Revision 4, Procedure for Qualifying Welders and Welding Operators

MP-03, Revisions 1, 3, and 4, Welding Material Control

MP-06, Revisions 3, 4, and 5, General Welding Procedure for Carbon Steel Weldments

MP-07, Revisions 3 and 4, General Welding Procedure for Stainless Steel Nickel Base and Nonferrous Weldments

MP-09, Revisions 1, 9, and 10, Welding Equipment Control

MP-10, Revisions 2 and 3, Repair of Base Materials and Weldments

MP-11, Revisions 3, 4, and 5, Training and Qualification of Metallurgical/Welding Engineering and Support Personnel

MP-12, Revisions 1, 2, and 3, Control of Special Welding Materials for BOP and Welding Material for Non-Permanent Plant

MP-13, Revisions 1 and 2, Welder Qualification for Areas of Limited Accessibility

The procedures provided detailed control for all aspects of the welding process, including qualification of procedures and welders, control of welding materials, control of welding variables, and quality documentation for each weld.

Conclusions

At the time of original construction of the existing fuel pool cooling system piping, a comprehensive welding program was in place to control and document pipe welding in accordance with Section III of the ASME Boiler and Pressure Vessel Code.

2. REVIEW OF CONSTRUCTION QA/QC RECORDS

2.1 Review of Hydrostatic Test Reports

Inspection Scope

The inspectors reviewed the records documenting the results of hydrostatic testing performed on the piping welds embedded in the C and D fuel pool concrete.

Observations and Findings

The inspectors reviewed the records which documented completion of hydrostatic testing in accordance with WP-115 and the licensee's quality assurance program. Records examined were for the following C and D fuel pool embedded piping welds numbers : 2-SF-1-FW-1, -2, -4, & -5; 2-SF-149-408; 2-SF-143-512, 513, & -514; 2-SF-144-FW-515, -516, & -517; and 2-SF-159-FW-518 & -519. These records were documented on CP&L form QA-26, pages one and two of two, Hydrostatic Test Records. Information on the data sheets included the hydrostatic test boundaries (welds tested), the piping design pressure, test pressure, the test medium and test temperature, test data, and the test results. The test prerequisites required that the mechanical QA specialist verify that all required piping documentation was completed, and that all required weld documentation was completed. The inspectors verified that the hydrostatic test records specified that all weld records were completed, and that the welds were accepted by the quality assurance group prior to start of the hydrostatic test. The inspectors also verified that the records had been signed by the ANI. The hydrostatic test records for the above welds showed that all welds were tested to a minimum of 25 percent above design pressure and that all welds met the test acceptance criteria. The licensee did not retain copies of the form QA-26 for embedded weld numbers 2-SF-8-FW-65 & -66. However, in response to questions during construction regarding hydrostatic testing of the welds attaching the liner plate to the piping spool pieces, the licensee initiated Deficiency and Disposition Report (DDR) 794. Resolution of this DDR included documentation of the dates various welds were hydrostatically tested. The dates the welds for piping spool pieces were hydrostatically tested (July 19, 1979 and July 24, 1979) were listed in the DDR response. These included weld numbers 2-SF-8-FW-65 & 66. The inspectors concluded that the documentation for DDR-794 provided evidence that weld numbers 2-SF-8-FW-65 & 66 were subjected to hydrostatic testing in accordance with WP-115 and the licensee's quality assurance program.

Conclusions

The hydrostatic test records documented that the embedded welds were subjected to hydrostatic testing, and met the test acceptance criteria. The records also provided evidence that the welds were completed, inspected and documented in accordance with the licensee's quality assurance program. The hydrostatic test records provide evidence that the WDRs were reviewed prior to performance of the hydrostatic tests.

2.2 Review of Concrete Placement Reports

Inspection Scope

The inspectors reviewed the concrete placement records for spent fuel pools C and D which documented that all work and preparations for the concrete placements were completed and that all required inspections had been completed prior to placement of concrete.

Observation and Findings

Prior to placement of concrete, a concrete placement report was completed to document that all work activities have been completed in a particular area (slab, column, wall, etc) and that the concrete placement could proceed. The inspectors reviewed drawing numbers SK A-G-0126, South Fuel Pool Area of FHB Isometric, and SK A-G-0125, FHB Isometric North Fuel Pool Units 2 & 3, to determine the concrete placement numbers which contained the embedded piping for the C and D fuel pool cooling system. This review showed that the piping had been installed in the following C & D fuel pool placement numbers; wall placements W-255-7, W-261-7, -7A, -9, -10, and -11, W-281-10, -16, -17, and -18, and slab placements SL-246-3 and SL-246-4. The inspectors reviewed the placement report for the above listed placement numbers and verified that the placement reports had been properly completed and signed prior to placement of concrete. The inspectors verified that the mechanical embed/piping had been signed in accordance with CP&L procedure WP-05. The acceptance criteria noted on the placement reports for mechanical embed/piping was CP&L procedure WP-102, Installation of Piping. Procedure WP-102 required that a verification be performed to assure that all piping was installed as per the design drawings. Additional requirements referenced by procedure WP-102 were that hydrostatic testing of piping to be embedded in concrete was to be completed in accordance with CP&L procedure WP-115, Hydrostatic Testing of Buried or Embedded Piping.

Conclusions

The concrete placement reports provide evidence that the piping embedded in the concrete was inspected and tested in accordance with the requirements of the licensee's construction quality assurance program prior to concrete placement. These requirements included verification that the welding was completed in accordance with applicable procedures, and that documentation such as WDRs were completed and reviewed prior to the concrete placement.

2.3 Review of ASME Documentation

Inspection Scope

The inspectors reviewed completed documentation required by the ASME Boiler and Pressure Vessel Code for the fuel pool cooling systems.

Observation and Findings

10 CFR 50.55, "Codes and standards," requires that systems and components of pressurized water-cooled nuclear reactors meet certain requirements of the ASME Boiler and Pressure Vessel Code. The fuel pool cooling systems for for SFP A, B, C, and D are classified as ASME Code Section III, Division 1, Class 3 systems. The applicable edition of the ASME code is Section III, 1974, Winter 1976 Addenda.

Subsection NA of Section III addresses "General Requirements"; Subsection ND addresses requirements for "Class 3 Components". Subsection NA-8420, "Report Form for Field Installation," required that installation welds be verified on Data Form N-5, which includes attestation of the quality of the weld process and specification data for the weld filler material. The weld process was witnessed at several specified check points by a Quality Assurance inspector; the Authorized Nuclear Inspector had the option to witness any check point and verified the completed weld data report prior to closure.

The licensee's amendment request, submitted by letter dated December 23, 1998, states that certain records, notably piping isometric packages for field installation of the completion portion of SFP C and D, were inadvertently discarded. Subsection NA-8416, "Piping Systems" of the Code requires completion of N-5 forms for each piping system, which includes weld data records attesting to the quality of the weld process and weld material certification. Because these records have been lost, the SPF C and D cannot be certified as an N-stamp system.

Since piping welds for SFP A and B were completed during the same time frame as those for SFP C and D, and by the same group of welders, it is reasonable to expect similar quality of the N-5 data packages for both units. Therefore, the N-5 package for Pools A and B were examined. The N-5 forms were included as part of the N-3 package, which was submitted upon completion of Unit 1 to the ASME National Board, the enforcement authority having jurisdiction. The N-3 form listed the components including interconnecting welds and the data reports for a facility. The summary N-3 package for Unit 1 was examined by the inspectors.

Subsection NA-8400 identifies the reporting requirements for various components, including valves and pumps, parts and appurtenances, pipe subassemblies, and piping systems. Only the reporting requirements for 49 field welds cannot be met. The inspectors randomly selected data packages for two C and D SFP components: a pump (2B-SB) and a strainer (3-SF-53-5A-2). The data package for the pump included a Certificate of Compliance, a Manufacturer's Data Report (NPV-1), material certification, hydrostatic test reports, performance test reports, welding ticket records, dimensional inspection records, a cross-sectional drawing, and an as-built drawing. The data package for the strainer included an ASME Code data report, a Certificate of

Conformance, liquid penetrate reports, a product quality control check list, material test reports, an inspection and test report, dimensional inspection records, and sequence traveler.

Conclusions

The ASME N-3 and N-5 data packages for Unit 1 and the ASME data packages for two SPF C and D components reviewed by the inspectors were determined to be complete and satisfactory and provided an indication that the licensee documented construction of the SFP in accordance with ASME requirements.

2.4 Review of Audits of ASME QA Program Implementation

Inspection Scope

The inspectors randomly selected an audit of ASME QA program implementation for review.

Observations and Findings

CP&L corporate audits were conducted of the ASME QA Program Implemented at Shearon Harris. The inspectors retrieved a listing of these audits from the licensee's data base and noted that eight such audits had been conducted during the period from March 19, 1979 through February 19, 1982. From these audits, the inspectors randomly selected audit QAA/170-6 for review. QAA/170-6 was conducted at the Shearon Harris site on September 21-29, 1981. The inspectors reviewed the audit checklist, the audit report containing the findings and concerns, the memoranda describing the corrective actions for each identified deficiency, and the QA closure documentation. The audit report concluded that the Shearon Harris Construction, Nuclear Plant Engineering, and QA Program adequately met ASME code requirements except for eleven findings and sixteen concerns. The identified deficiencies were typically associated with procedural and training requirements and indicative of careful review by the auditors. The inspectors reviewed the corrective actions and found them reasonable and appropriate. All corrective actions were implemented and determined to be satisfactory by the licensee'sQuality Assurance organization within four months following the audit.

Conclusions

The audit report showed that the licensee's QA program implemented the ASME program and NRC requirements during construction.

2.5 Review of Vendor ASME QA Program Implementation

Inspection Scope

The inspectors reviewed an audit of a vendor supplying Code equipment for compliance with ASME requirements.

Observations and Findings

The inspectors reviewed CP&L corporate audit QAA/702-1, conducted at the fabrication facility of Southwest Fabricating & Welding Company, Inc., a supplier of piping spool pieces for the four spent fuel pools at Shearon Harris. The audit was conducted on May 22-23, 1974, in order to appraise the the manufacturing facility and quality assurance program to adherence to purchase order requirements, including applicable Articles of Section III of the ASME Boiler and Pressure Vessel Code and the requirements of 10 CFR 50, Appendix B, "Quality Assurance for Nuclear Power Plants." The audit report concluded that the vendor's quality system, as defined in its QA Manual was adequate to meet the intent of the requirements imposed by the purchase order. The audit report identified six findings requiring corrective action. The inspectors reviewed the audit checklist and the audit report containing the findings. The inspector also reviewed the corrective actions taken by the vendor and the QA closure documentation. Based on this review, the inspectors determined that the deficiencies were relatively minor and administrative in nature and that the corrective actions were appropriate. All actions were determined to be satisfactory by the CP&L Quality Assurance organization within three months of the audit with exception of an issue related to training and qualification of audit personnel. This issue was held open pending resolution of a related draft ANSI standard and closed satisfactorily in December, 1974.

Conclusions

The vendor audit report showed that the licensee's QA program implemented the ASME program and NRC requirements for performance of vendors during construction.

2.6 Review of QA/QC Related Reports

Inspection Scope

The inspectors reviewed a random sample of QA/QC related reports to assess the effectiveness of the site QA/QC program in identifying and resolving problems associated with SFP welding activities.

Observations and Findings

Reports documenting results of QA/QC activities were reviewed by the inspectors to assess the effectiveness of the QA/QC program. The reports selected for review covered the period when welding activities were in progress on the piping from 1979 to 1982. The records reviewed include Deficiency and Disposition Reports (DDRs), Nonconformance Reports (NCRs), and QA/QC monitoring and surveillance reports. DDRs for ASME Code components required the ANI to review, approve and sign the final disposition as acceptable. The following DDRs, which are listed in general categories assigned by the inspectors, were reviewed:

Category	DDR

Arc Strike	869, 877, 895, 945
Stamping	888, 889, 914, 945
Holdpoint	829, 1009
Hydrostatic Test	783, 794

The identified deficiencies were clearly identified on the DDR and disposition of the deficiencies were appropriate. Concurrence with the disposition by the ANI and report closure by Quality Assurance was completed for all DDRs reviewed.

Nonconformances (NCRs) were less significant infractions of the QA program requirements (i.e., were less serious than DDRs). The following NCRs were reviewed and listed in general categories assigned by the inspectors.

Category	NCR
Arc Strike	WP-206
Stamping	W-027, W-096, W-103
Holdpoint	W-207
Welder Requirement	WP-111, W-028
Weld Status Report	WP-278

Documentation of the nonconforming condition was clear and corrective actions were appropriate. The final disposition for each NCR was verified by the responsible QA Specialist.

For completeness of review, the inspectors arbitrarily selected a sample of QA/QC reports which documented monitoring and surveillance of weld activities. These covered areas which included material control, welding equipment, welder training and qualification, review of WDRs for accuracy and completeness, and compliance with weld procedures. The following QA/QC activity reports were reviewed and determined to be typical and expected for oversight of welding activities.

> WP62, WS79, WP56, W29, W86, W116, W124, W143, W199, W200, W285, W297, W322, W361, W365, W402, W429, W434, W456, W461, W462, W469, W475, QA8, QA81, WS80, QA146, QA150, QA169, QA215, QA294, QA359, QA424, QA368, QA376, QA509, QA548, QASRC83116, QA550, QA551, QA586, QA587, QA588, QA703, QA777, W509, W507, W506, W503, W767, W756, W750, QA16, QA254, QASRC187, QASRC822660, QA199, W630, W560, W554, W544, W519, W518, QA385, W8257, W225.

Conclusions

Based on review of the above DDRs, NCRs, and reports documenting QC/QA activities, the inspectors concluded that inspection personnel actively monitored welding activities and processes for compliance with ASME Code and QA Program requirements. Deficiencies were accurately reported, corrective actions promptly taken, and appropriately resolved. All corrective action documents reviewed were in compliance with the licensee's QA program and NRC requirements.

3. SFP C AND D DESIGN CHANGES

Inspection Scope

The inspectors reviewed the design changes prepared by licensee engineers to complete the C and D spent fuel pools.

Observations and Findings

The licensee implements design changes in accordance with CP&L procedure EGR-NGGC-0005, Engineering Service Requests (ESR). This procedure implements the design control program required by 10 CFR 50, Appendix B. The licensee prepared the following ESRs to complete the C and D spent fuel pools:

- ESR 95-00425, Study Effort to Support Fuel Pool in Service Date.

- ESR 99-00218, CCW Tie In to Heat Exchangers for North Pools

The inspectors reviewed the ESRs. ESR 99-00218 was prepared for connecting the C and D spent fuel pool heat exchangers to the Unit 1 component cooling water system. During the inspection, the licensee was in the process of installing piping and pipe supports required for the tie-in of the CCW system to the SFP C and D heat exchangers. The final tie in will not be completed unless NRC approval is received for the fuel pool expansion. ESR 95-00425 was prepared to complete the C and D SFP piping, complete installation of equipment (pump motors, strainers, etc.), perform system pre-operational and startup testing, and revise existing plant procedures to incorporate the C and D SFP into the Unit 1 operating plant.

The inspectors reviewed the 10 CFR 50.59 safety evaluation, design inputs, design evaluations, assumptions, and references, design verification documentation, and installation drawings and instructions. The inspectors noted that the details for commissioning of the existing equipment were incomplete. The licensee initiated ESR 99-00416 to control the commissioning process. This is discussed in the Section below. The requirements and procedures for preoperational and startup testing were also incomplete. Discussions with licensee engineers disclosed that these procedures will be developed following those used for startup of Unit 1 (SFP A and B). The 10 CFR 50.59 evaluation concluded that this project involved an unreviewed safety question which required NRC approval prior to completion and startup.

Conclusions

The ESRs were technically adequate and generally met regulatory requirements.

4. EQUIPMENT COMMISSIONING

Inspection Scope

The inspectors examined the licensee's maintenance and lay-up actions for the installed Fuel Pool "C" and "D" piping and equipment. In addition, plans for additional activities to ensure that equipment will meet all applicable requirements and be capable of performing its intended function were reviewed.

Observations and Findings

A significant portion of the Fuel Pool Cooling System and Component Cooling Water System piping and components for Fuel Pools "C" and "D" were installed during original construction in the late 1970s and early 1980s. As documented in section 26.5.0 of Engineering Service Request (ESR) Design Specification 95-00425, Revision 0, the equipment was never incorporated into the operating unit and has not been formally maintained under controlled storage since that time. The equipment was procured and installed to applicable quality assurance requirements. However, since the installed equipment has been stored in-place without a formal storage and lay-up program, the licensee plans to implement an equipment commissioning or dedication process to ensure that the equipment will meet the applicable requirements and is capable of performing its intended function in the completed design. In accordance with ESR 95-00425, which had not been approved and issued at the time of the inspection, a Matrix of Commissioning Requirements is to be developed, which will define the requirements, including any additional inspections and testing, for each component. At the time of the inspection, a preliminary matrix had been developed as part of ESR 95-00425 and ESR 99-00416 had been initiated to further detail and manage the commissioning process. Although plans and some of the details for the process were included in ESR 95-00425, most of the details for each individual component were still being developed to be included in ESR 99-00416. Based on discussions with responsible licensee personnel and review of ESR 95-00425, the commissioning process will consist of the following activities:

Scope Development

To develop the scope for the commissioning process, a field walkdown of the installed equipment (mechanical, civil, instrumentation and control, and electrical) will be performed to compare the installed equipment with the completed modification design and each item in scope will be identified and individually dispositioned as part of ESR 99-00416.

Document Review

Quality documentation will be retrieved and reviewed to ensure that required quality assurance information is available, complete and acceptable. The verified records will include original procurement and field installation records. The equipment installation records will be compared with field conditions to ensure that the installation as accepted has not been altered. If records are missing or deficient, an assessment will be performed to determine what can be accepted by virtue of retest or re-inspection, or by use of alternate methods of verification.

Test and Acceptance Criteria

The Equipment Commissioning Matrix will specify additional activities needed to ensure the required level of quality assurance because of the lack of formal storage and lay-up program since original equipment installation. These activities will include:

Field verification of equipment identification against procurement documentation with establishment of traceability to Code Data Reports for code related equipment.

Physical inspections and testing as required to verify that lack of controlled storage conditions and regular maintenance has not caused any condition (corrosion, aging, etc.) adverse to quality.

Physical inspections and considerations necessary to ensure that plant activities since construction have not resulted in any conditions adverse to quality (scavenging of parts, introduction of foreign material, damage from personnel and equipment traffic, etc.).

Although the equipment commissioning details for individual equipment had not been finalized, some work had already been accomplished. The inspectors reviewed the following work requests (WRs) that had been issued:

WR 98-AGAR1 - Disassemble and Inspect Valve 1CC-512
WR 98-AFJA1 - Inspect Train A Spent Fuel Cooling Heat Exchanger
WR 98-AFJE1 - Inspect Train B Spent Fuel Cooling Heat Exchanger
WR 98-AFJF1- Disassemble and Inspect Train A Spent Fuel Cooling System Strainer
WR 98-AFJH1- Disassemble and Inspect Train B Spent Fuel Cooling System Strainer
WR 98-AFIY1- Disassemble and Inspect Spent Fuel Pool Cooling Pump 2A
WR 98-AFIZ1- Disassemble and Inspect Spent Fuel Pool Cooling Pump 2B

Disassembly and inspection had been completed for WRs 98-AGAR1, 98-AFJA1, 98-AFJE1, 98-AFJH1. The other 3 WRs had not yet been worked. For inspection of the Heat Exchangers, the WRs only covered removing the end covers and inspecting the tube side of the Heat Exchangers. The WRs indicated that a nitrogen purge had been maintained on the shell side of the heat exchangers. However, further investigation revealed that the use of the nitrogen purge had not been implemented until late 1991. In May of 1988, WRs 88-AMYH1 (Train A) and 88-AMYI1 (Train B) were issued to provide a nitrogen purge on the shell side of the Heat Exchangers. The WRs documented that the shell side of the Heat Exchangers had been open to the Fuel Building atmosphere. There was no indication how long the heat exchangers had been open. The 1988 WRs installing the purge were not worked until December 1991. Also, additional WRs documented a number of problems with low nitrogen purge on Train B Heat Exchanger in 1993. Based on the documented history of lack of control of the atmosphere on the shell side of the Heat Exchangers, the Inspectors questioned whether additional evaluations of the Heat Exchangers were needed. In response, the licensee indicated that further evaluations of the shell side of the Heat Exchangers will be performed as part of the commissioning process under ESR 99-00416.

The inspectors walked down and observed the general condition of the installed piping and equipment. Even though the equipment had not been maintained under a formal program, the equipment and piping appeared to be well preserved. The inspectors also examined spent fuel pool cooling pump motors "A" and "B", which have been stored and maintained in the warehouse since procurement at the time of construction. These were found to be in good condition with the motor space heaters energized. Evidence of control of storage of the pumps, including records of periodic pump shaft rotation, maintenance of heat on motors, and megger testing, were reviewed. Preventative maintenance of these parameters had been maintained in accordance with licensee Material Evaluation Procedure ME 000261.03.

The inspectors inspected three welds, weld numbers 2-CC-3-FW-207, 2-CC-3-FW-208, and 2-CC-3-FW-209 for misalignment and concluded that there was no noticeable misalignment.

The inspectors reviewed the re-inspection records for installed welds and piping as discussed below.

Based on the above reviews, the inspectors concluded that the planned equipment commissioning process should ensure that existing equipment will meet requirements and will perform its design function. However, since the details of tests and inspections to be performed for individual equipment items had not been completed, Inspector Followup Item (IFI) 50-400/99-12-01, Review of Final Equipment Commissioning Details, was opened to track further inspection after more details are available.

Conclusions

Although details of the commissioning inspections had not been finalized for each individual piece of equipment, a detailed plan had been drafted and if properly implemented should ensure that existing equipment meets requirements and will perform its intended function. An IFI was opened to track further inspection of the equipment commissioning process after more details of the tests and inspections to be performed for individual equipment items are available. The equipment commissioning WRs reviewed were considered appropriate to ensure that equipment is acceptable to place in service. Based on the documented history of lack of control of the atmosphere on the shell side of the Spent Fuel Pool Cooling Heat Exchangers, the inspectors concluded that additional evaluations of the heat exchangers were needed.

5. ALTERNATE INSPECTION PROGRAM

5.1 Review of Weld Records

Inspection Scope

The inspectors reviewed the Spent Fuel Cooling System and Component Cooling System weld and weld inspection records as detailed below.

Observations and Conclusions

The licensee re-inspected all existing accessible Fuel Pool "C" and "D" Spent Fuel Pool Cooling System (SFPCS) and supporting Component Cooling Water System (CCWS) pipe and pipe attachment field welds. The welds were visually (VT) and liquid penetrant (PT) inspected. In addition, vibro-tooled welder symbol identifications were taken from each weld surface and welder qualification verified by review of records. The re-inspections and the welder symbols were documented on new Weld Data Reports (WDRs). The inspectors reviewed the new WDRs, the NDE qualification records for the current re-inspections and the original construction welder qualification records for these welds. All records were retrievable and found to be in order.

In addition to review of the re-inspection records for the accessible welds, records consisting of WDRs, welder qualification records, weld QC inspector records, NDE examiner qualification records, welding procedure specifications (WPSs), and procedure qualification records (PQRs) were reviewed for the below listed Unit 1 SFPCS piping welds. These Unit 1 (SFP A and B) welds were constructed using the same welding QC program at approximately the some time period as that used for the cooling system piping welds for Fuel Pools "C" and "D".

F1-236-1-SF-10-FW-60
F1-236-1-SF-2-FW-9
F1-236-1-SF-10-FW-58
F1-236-1-SF-2-FW-8
F1-236-1-SF-10-FW-59
F1-236-1-SF-2-FW-6
F1-236-1-SF-2-FW-7

These original Unit 1 (SFP A and B) construction records were retrievable, legible, and complete. The records provided objective evidence that a detailed welding quality control program was in place and followed during original construction.

Conclusions

All records reviewed were retrievable and in order. The original Unit 1 construction records provided good assurance that the SFP C and D welding was accomplished and documented in accordance with the approved welding quality assurance program in effect at that time.

5.2 Welding Material

Inspection Scope

The inspectors reviewed the welding procedure specifications and the records for the filler metal (materials) used for welding the SFPCS and CCWS piping.

Observations and Findings

SFP A & B Filler Metal

The inspectors randomly selected embedded SFPCS welds from isometrics drawings, 1-SF-2 and 1-SF-10 from SFP A and B for review. The WDRs for these welds were reviewed by the inspectors. From the WDRs, the inspectors randomly selected the certified material test reports (CMTRs) for filler and insert metals and reviewed the chemical test records. Based on the records reviewed, the inspectors concluded that the materials used for the embedded welds were type 308 filler metal, type 308 consumable inserts, and type 304 base material (piping materials).

The inspectors reviewed Weld Procedure Specification (WPS)1BA3 for the material used for welding the pipes in the component cooling water system. The WPS listed the pipe material as P-1, Grade 1 (Appendix D to Section XI of the ASME Code) and weld filler metals as E70S-6 and E7018. For procedure qualification, WPS 1BA3 referenced Procedure Qualification Report (PQR) 15. The inspectors reviewed PQR 15 and CMTRs of the material used for the qualifications.

Product Check Chemistries

The inspectors compared the chemistries from CMTRs with the stainless steel product check chemistries submitted to NRC in a letter dated April 30, 1999, Subject: Response to NRC Request for Additional Information Regarding The Alternative Plan for SFPCS Piping, and the chemical analyses from PQR 15 that were used for qualifying the carbon steel weld procedure specification 1BA3 with product check chemistries submitted to NRC in a letter dated June 14, 1999. The comparisons showed carbon analyses for the product checked consistently above the filler metal values for SFP A & B and values recorded in the PQR. The inspectors questioned the licensee regarding possible carbon contamination with the product check chemistries.

In search of the contamination, the inspectors examined the sampled surface on weld 2-CC-3-209. The sample had been removed from the center of the weld crown. The weld and surrounding pipe were clean and free of foreign matter. Next, the inspectors reviewed the technique used for sampling. The sampling technique is in Appendix A to Procedure NW-16, Revision 1, "Identification of Base Metals for Welding Applications," dated January 6, 1998. The sampling technique uses a rotary carbide deburring tool which removes material with a grinding action. Licensee engineers suspected that the deburring tool was a possible source of the carbon contamination. The licensee made test samples by taking known material and seeding it with metal flakes broken from the teeth of the deburring tool. The tests showed that for samples seeded with 5 and 10 weight percent from the deburring tool, the carbon analyses increased by .03 and .08 weigh percent, respectively. The tests showed that the carbide deburring tool was a possible source of carbon contamination.

Alloy Comparator

During the inspection, the inspectors witnessed a demonstration of the test method used to develop the acceptance criteria for the test data submitted to NRC in the April 30, 1999 letter. For the testing, the licensee utilized the Metorex X-Met 880 electronic unit, CP&L Control No. MLCE-132 which was operated by CP&L's plant metallurgist. The inspectors reviewed the following: Operating Instruction Manual 3881 432-4VE; and operating procedure: MCP-NGGC-0101, Revision 1, Test Method 4, dated March 26, 1999. For developing an acceptance criteria, the metallurgist setup the X-Met using the same calibration and reference standards that were used for the previous testing. For calibration, pure standards for Fe, Cr, Ni, Cu, Mo, and a backscatter sample were run and stored in the X-Met. For reference alloys, stainless steel standards for type 304, 309, 310, 316, and NIST C1154a were run and stored in the X-Met reference library.

For the development of the acceptance criteria, 12 different standards were used. Each standard was run 10 times producing an average set of chemical values. In the comparison mode, the X-Met compared each test against the standards stored in the reference library. If the test matched or was close to a match with a reference standard, the X-Met displayed the reference standard followed by the term: good, possible, or good/possible. If a test did not come close to any reference standard, the X-Met displayed "no good match." The reference standards, test standards, type of match displayed for that standard, and the Cr, Ni, Mo, Mn, and Cu from the certified analysis reports for the standards are shown in Table 1 in the Appendix. The data showed that the X-Met comparison mode can discriminate stainless steel types and chemical extremes within a stainless steel type. Based on the testing performed on the accessible field welds and Table 1, the licensee's metallurgist tentatively established the acceptance criteria for field welds as two test displays showing a good or possible match and no test displays showing no good match.

Conclusions

The SFPCS piping and CCW piping was welded using the correct materials. The X-Met and chemical analysis provided identification of stainless steel and carbon steel materials.

5.3 Water Quality

Inspection scope

The inspectors reviewed the C & D SFP pipe welds exposed internally to hydrostatic pressure test water and/or the spent fuel pool water.

Observations and Findings

The inspectors reviewed drawings and hydrostatic test records to identify the C & D SFP welds that were exposed internally to hydrostatic pressure test water or spent fuel pool water, to determine the length of time that these welds were exposed to that water. Of the 52 welds identified in CP&L's letter dated April 30, 1999, pipe welds 2-SF-1-FW-3, 2-SF-1-FW-6, and 2-SF-36-FW-448 were replaced by new welds, and 12 are hanger-to-pipe welds. Of the remaining 37 pipe welds with missing documentation, the inspectors identified 15 welds exposed to hydrostatic test water, 22 welds exposed to the fuel pool liner leak test water, and the same 22 welds exposed to the current fuel pool water conditions.

Hydrostatic test water quality was specified in CP&L Procedure WP-115, Revision 0, "Hydrostatic Testing of Buried or Embedded Pressure Piping," dated September 19, 1979. WP-115 specified that potable or lake water was to be used for hydrostatic testing. After testing, the procedure required that the pipes must be drained. However, the procedure did not specify a time limit for draining of the piping/system. The inspectors were unable to determine from documentation when the piping was drained. However, logic dictates that the pipes were drained before the licensee performed the fuel pool liner leak testing (hydrostatic test).

Hydrostatic test water quality for fuel pool liners was identified in CP&L Procedure TP-57, "Hydrostatic Test of Fuel Pool Liners," dated May 17, 1983. TP-57 required that that the fuel pool be leak tested for a 24 hour period using unchlorinated site water. The procedure defined unchlorinated water as site water with a chloride content not exceeding 100 parts per million (ppm). After the test, the procedure required that the test water was pumped out of the SFP and that the pool was rinsed with demineralized or distilled water. Attachment A to TP-57 for SFP D showed that the pool was filled June 11, 1985 with water containing less than 1 ppm chlorides and that the rinse was completed on November 1, 1985. For SFP C, the records showed that the pool was filled May 7, 1985 with water containing less than 1.5 ppm chlorides and that the rinse was completed on November 4, 1985.

Discussions with licensee engineers disclosed that SFPs C & D were filled with SFP quality water around 1989 and have been full ever since. The gates between SPF A and B and C and D were opened at various times which resulted in the water mixing between the pools. During April 1999, the licensee obtained water samples from the low points in seven of eight pipe lines connected to SFP C & D. These samples were analyzed for impurities. The results are tabulated in Table 2 in the Appendix. The inspectors compared the sample results to the administrative limits for A & B SFP and data for a primary system cold shut down that is published in NUREG CR-5116, Survey of PWR Water Chemistry, February 1989. Based on the data reviewed, the water quality in SFP C & D was similar to the water quality in SFP A and B.

The pipe welds exposed to the potentially poorest water quality were the embedded welds. If corrosion or fouling were to occur, they would occur in the embedded welds first. The presence of corrosion or fouling would be visible from the interior of the piping. The visual inspection of the embedded welds performed by the licensee to examine the interior of the embedded piping is discussed below.

<u>Conclusions</u>

The pipe welds exposed to the potentially poorest water quality were the 15 embedded welds. The pipe welds remaining were exposed to treated water with very low impurities and similar to the water quality in SFP A and B. If corrosion or fouling were present in the SFP C and D piping, they would occur in the embedded welds first because of the type of water the embedded piping was exposed to.

5.4 Review of the Procedure for Remote Visual Inspection of Welds and Piping

Inspection Scope

The procedure used for remote visual inspection of embedded welds was examined for compliance with the CP&L Quality Assurance Program and NRC requirements.

Observations and Findings

The inspectors reviewed Temporary Procedure SPP-0312T, Temporary Procedure For Remote Visual Examination of Interior Welds and Surfaces of Embedded Unit 2 Spent Fuel Pool Cooling Piping for C and D Pools. The procedure provided instructions for performing remote visual examinations of interior welds and surfaces of embedded piping for the SFP C and D piping. The results of these examinations were used to determine whether the weld quality and interior surface conditions meet the acceptance criteria established in Paragraph 6.0 of the procedure. The acceptance criteria specified that welds were to be free of the following defects: cracks, lack of fusion, lack of penetration, oxidation ("sugaring"), undercut greater than 1/32 inch, reinforcement ("push through") exceeding 1/16 inch, concavity ("suck back") exceeding 1/32 inch, porosity greater than 1/16 inch, or inclusions. Any recordable indications of these defects were recorded on Attachment 1 of the procedure. Other indications such as arc strikes, foreign material, mishandling, pipe mismatch, pitting and microbiologically induced corrosion were also recorded on the attachment and were required to be evaluated by licensee engineers.

In addition to reviewing SPP-0312T, the following referenced documents were examined by the inspectors with respect to applicable requirements: (1) ASME Section III, 1974, Subsection ND-4424, Surfaces of Welds; NDEP-0606, Rev. 4, Remote Visual Examination; NDEP-601, Rev. 13, VT Visual Examination of Piping System and Component Welds at Nuclear Power Plants; and NDEP-A, Rev. 13, Nuclear NDE Procedures and Personnel Processes.

Both Revision 0 (approved 5/17/99) and Revision 1 (approved 9/9/99) of procedure SPP-0312T were reviewed. Revision 1 contained no change in the technical content or scope of work, but was made to reflect a new vendor and contract number. Based on review of the procedure and applicable references, the inspectors determined that the procedure prescribed prerequisites, precautions and limitations, and detail on special tools and equipment to adequately control the scope of the visual inspection activities. Technical, process-related, and administrative references were adequate and complete. The acceptance criteria were appropriately detailed such that conclusions as to the weld quality and interior surface conditions could be made by qualified inspection personnel. The remote inspection procedure was reviewed for adequacy prior to its use by a licensee NDE Level III inspector. The licensee's Level III NDE inspector was interviewed by the inspectors. The Level III certification records and training for this individual were also reviewed.

Conclusions

The procedure which specified the method for visual inspection of the embedded welds provided detailed instructions and acceptance criteria for inspecting and evaluating the embedded welds. The procedure complied with the licensee's QA program and NRC requirements.

5.5 Remote Visual Examination

Inspection Scope

The inspectors reviewed the videotape that recorded the remote visual examination and the analysis of the remote visual examination of embedded welds. The review included piping and other welds captured on videotape. The inspectors also reviewed the licensee's evaluations of the welds documented on Attachment 1 to SPP-0312T.

Observation and Findings

The licensee performed a remote enhanced visual examination of 15 embedded field welds from inside the stainless steel SFP C and D piping. Prior to performance of the remote video examinations of the embedded piping, three Level II NDE personnel were trained in the use of procedure SPP-0312T. These individuals demonstrated their proficiency with the use of this procedure to the ANI and the Level III NDE inspector. Attestations to the satisfactory completion of these activities were reviewed by the inspectors and determined to be satisfactory.

The visual examination was performed by sending a mobile video camera with focusing and magnifying capabilities through the piping to examine each embedded field weld. The video camera sent images of the weld to a television monitor and video recorder. The images on the monitor were viewed by the licensee's Level II qualified remote visual inspectors. The Level II's observations were documented on Attachment 1 to SPP-0312T, "Remote Visual Examination Data Sheets." Attachment 1 contained a check list for recordable condition of the weld. These recordable conditions are described in the acceptance criteria of SPP-0312T. Weld acceptability was determined by the qualified Level II visual examiner in accordance with the acceptance criteria specified in procedure SPP-0312T and approved by a qualified Level III NDE inspector and the ANI.

The inspectors reviewed eight videotapes recorded during the remote visual inspection and the completed SPP-0312T Attachment 1 for each embedded field weld. The videotapes reviewed were as follows: weld 2-SF-8-FW-65 prior to cleaning; the in-process cleaning of 2-SF-144-FW-516; and the 15 embedded field welds after cleaning. The videotapes also captured images of accessible welds 2-SF-150-412 and 2-SF-148-FW-382.

In the videotape made prior to cleaning, the inspectors observed laced material particles inside the pipes and on the field welds. These particles looked like a dusting of snow flakes. They were flat, very thin, interconnected, and conformed to the contour of the pipes, pipe seams, and field welds. The inspectors viewed the videotape showing removal of the particles from welds 2-

SF-144-FW-516. The particles were removed with a pressurized water flow directed toward the pipes, interior surfaces. When the particles were hit by the water stream, they were readily dispersed. After dispersing, the particles appeared to be suspended in the water.

Based on the videotapes of the cleaned field welds, the inspectors concurred with the observations of the licensee's NDE inspectors recorded on the Attachment 1 to SPP-0321T for each weld. The inspectors observed the images of vendor fabricated welds, pipe seam welds, and the piping itself as the video camera traveled to the different embedded field weld locations. These images showed no misalignment, unusual protrusions, blockages, or indentations in the pipe walls, pipe seams, vendor fabricated welds, and the two accessible field welds examined. In the videotapes made of the cleaned welds, the inspectors identified conditions in three welds that require further evaluations. These conditions were: (1) an insert segment with the letters 308L still visible on weld 2-SF-144-FW-516; (2) brown spots that were out of focus with the surface of the pipe on weld 2-SF-144-FW-517, and (3) heavy stains, oxides, and deposits on weld 2-SF-159-FW-519. Although not part of the weld inspection, the inspectors also observed and requested an evaluation of a condition adjacent to the longitudinal seam in the pipe just beyond weld 2-SF-144-FW-515. The condition appears to be a fine saw tooth line located parallel to the pipe seam and about half the seam thickness away. The length of the line was not determined. The licensee stated that they were evaluating these conditions which were identified on the SPP-0312T, Attachment 1.

The inspectors reviewed and found satisfactory work requests associated with preparation for remote video inspection, and the system closure following completion of the visual inspection. These were WR/JO 99-ADUN2, ADUP1, AEHH2, and AFEY1. Results of the visual examinations were recorded on a data sheet, marked as a QA Record, which was included in SSP-0312T as Attachment 1. The data sheet was reviewed by the inspectors and determined to provide adequate detail of the examination to determine whether the acceptance criteria had been met and to record any recordable conditions noted by the licensee's NDE inspector. Completed data sheets documenting examination of 15 interior welds and piping surfaces were examined and determined to contain sufficient detail as to the results of the inspection. The signature of the NDE Level II examiner on Attachment 1 was determined to be one of the three personnel who were trained and qualified in the use of this procedure.

The recordable conditions documented on the data sheet are required to be reviewed and approved by licensee engineers and subsequently be approved by an ANI. The licensee initiated ESR 99-00266 to evaluate the recordable conditions. The evaluations were being performed by an independent engineering consultant. At the time of the inspection, evaluation of the recordable conditions had not been completed.

The inspectors reviewed and discussed the videotape examination of weld 2-SF-144-FW-516 with a CP&L welding supervisor that worked as a welding engineer during the construction of the SFP. The videotape showed the section of a consumable insert in the weld with the lettering 308L still visible on the consumable insert. The welding supervisor stated that the type of consumable insert for this application is shaped like the cross section of an inverted mushroom. The stem of the insert forms the base of the joint between the pipes. The joint is hand welded using a gas shielded tungsten arc welding process. The process should consume the insert and adjacent pipe during the first weld pass. The supervisor stated that insufficient heat input may fuse the insert (mushroom) head to the weld puddle instead of melting the insert completely. After the first pass, subsequent passes were made with filler metal to form weld layers. The supervisor estimated that 5 layers of filler metal were necessary to weld 3/8-inch thick piping.

The inspectors requested that the licensee provide chemical analysis on the particulate that were dispersed during the pipe/weld cleaning process. This particulate appeared reddish brown in color, is easily disturbed, and is believed by the licensee to be the source of the pipe stain. The inspectors questioned the ANI regarding the particulate. The ANI stated that there he observed abundant amounts of reddish brown color on the video equipment, piping interior, and at the video equipment entry point during the inspection. The licensee radiologically analyzed by chemical elements the particulate in 1990 and again in 1996. They provided the analyses to the inspectors for review. The particulate is radioactive with the most abundant element by two orders of magnitude being iron, followed by one order of magnitude cobalt, and zero order of magnitude nickel.

Conclusions

The condition of the embedded welds and associated piping inside the C and D SFP piping are free of abnormal obstructions and deposits. However, the inspectors identified four conditions requiring further evaluations. The licensee is in the process of evaluating the data shown on SSP-312T, Attachment 1 that include these four conditions.

5.6 QA Programs for Special Inspections Associated with the Alternate Inspection Program

Inspection Scope

The inspectors reviewed the alternate inspection activities for compliance with quality assurance requirements.

Observations and Findings

Ongoing activities associated with the alternate inspection program for resolution of issues concerning activation of Pools "C" and "D" were reviewed. These activities include remote inspection of the inner surfaces and field welds for embedded piping, determination of water chemistry during the period of layup, and examination of weld material taken from accessible field welds.

Oversight and examination of the embedded piping was performed by qualified NDE Level II examiners, who demonstrated proficiency in the use of the procedure used for the inspection (SPP-0312T) to the satisfaction of a NDE Level III examiner. The demonstration was witnessed and an Authorized Nuclear Inspector concurred with the demonstration of this proficiency.

Water chemistry analysis was performed by the CP&L chemistry organization, in accordance with site and corporate quality assurance program requirements. Material analysis of the weld samples was performed by NSL Analytic Services, identified on the CP&L Approved Supplier List with Supplier Control No. 16; manual dated 6/30/99; reviewed by CP&L 11/4/99. The supplier was audited for compliance under the CP&L Commercial Grade Survey program on February 1-2, 1999.

Conclusions

Activities associated with special inspections related to activation of fuel pools C and D were performed in compliance with applicable quality assurance requirements.

6. AUTHORIZED NUCLEAR INSPECTOR

Inspection Scope

The inspectors interviewed the authorized nuclear inspector (ANI) to determine the involvement of the ANI with the WDR, hydrostatic tests, and remote visual examinations.

Observations and Findings

The inspectors interviewed the recently retired ANI (July 1, 1999) and current ANI. The retired ANI was involved in plant construction and reviewed WDRs during plant construction. The verification was performed in two stages. The first stage was the verification of field weld fabrication at randomly selected predetermined hold points and ASME Code required inspection points. When satisfied that ASME requirements were met, the ANI initialed the associated line entry on the WDR. The second stage was verification of the entire WDR. When satisfied that all the necessary entries for the specified field weld were complete, the ANI signed off the WDR.

When questioned by the Inspectors regarding the significance of the ANI signature on the hydrostatic test document, both ANIs stated that the signature meant that the hydrostatic test satisfied ASME Code requirements, and the signature on the hydrostatic test was independent of any ANI signatures on the WDRs.

The ANIs were questioned regarding the extent of their involvement with the remote visual examinations of the 15 embedded welds in the C & D SFPs. They stated they both observed the equipment demonstration and qualifications of the remote visual examiners. For the equipment demonstration, a video camera was mounted on a transporting device that moved through a mockup of the SFP piping. The mockup contained flaws similar to those described in the acceptance criteria of Procedure SSP-0312T. In the mockup demonstration, the video camera transmitted images to a television monitor as it was moved. By viewing the monitor, the licensee's remote visual examiner directed the equipment operator to the areas of interest. These images were analyzed by the examiner. The examiner had to determine if the images of interest were a flaw, the type of flaw, and the acceptability of the flaw. The successful detection of flaws in the mockup demonstrated the equipment and remote visual examiner's skills. Upon a successful demonstration, the remote visual examiner qualification was certified by the licensee and verified by the ANI. On June 30, 1999, both ANIs signed off on the qualifications of the three remote visual examiners.

The inspectors questioned the current ANI regarding his involvement with the reinspection of the accessible welds and remote video examination of the embedded welds. The ANI stated that he observed the reinspection of accessible welds, 2-SF-36-FW-450 and 2-SF-38-FW-451, and that he observed the remote video inspections of at least two of the embedded welds. The actual examinations of the other embedded welds were less extensively viewed. At the time of the inspection, the ANI was in the process of reviewing the videotapes and verifying the data recorded on the remote visual examination data sheets.

Conclusions

The ANIs performed an independent verification of ASME Code requirements on the WDR and hydrostatic test documentation. The verification is part of their duties that are required by the 1974 Edition (and later) of ANSI/ASME Code N626.0, "Qualifications and Duties for Authorized Nuclear Inspection," and the referenced edition and addenda of Section III of the ASME Code. The ANIs were actively involved with the demonstration of the remote visual examination equipment and the qualification of the personnel. The current ANI was actively involved with examination and videotaping of the embedded welds

7. NRC INSPECTIONS DURING THE CONSTRUCTION PHASE

The Inspectors reviewed NRC Inspection Reports which documented inspection of construction activities by NRC Region II Inspectors between 1978 and 1983. This was the period when the A, B, C, and D spent fuel pools were under construction. The inspection reports document more than 50 separate inspections for this period for items related to the welding program and/or piping installation. The majority of these inspections were performed by eight Region II Welding Specialist inspectors. Several violations dealing with the general subject of welding were identified in these reports. Most of these violations were relatively minor (Severity Level V and VI) and would not be cited under the current NRC reactor inspection program. These violations would typically be resolved through the licensee's corrective action program. The violations were typical of what one would expect for oversight of a large construction project and are not indicative of any programmatic weakness in the licensee's welding program.

MANAGEMENT MEETINGS

The Team Leader discussed the progress of the inspection with licensee representatives on a daily basis and presented the results to members of licensee management and staff at the conclusion of the Inspection on November 19, 1999. The licensee acknowledged the findings presented.

PARTIAL LIST OF PERSONS CONTACTED

Licensee

D. Alexander, Manager, Regulatory Affairs
B. Altman, Manager, Major Projects Section
E. Black, Level III NDE Examiner

G. Brovette, ANI
B. Clark, General Manager, Harris Plant
E. Dayton, ANI (Retired)
J. Eads, Supervisor, Licensing and Regulatory Programs
S. Edwards, SFP Activation Project Manager
G. Kline, Manager, Harris Engineering Support Services
J. Scarola, Vice President, Harris Plant
K. Shaw, Licensing Engineer, Major Projects Section
M. Wallace, Senior Analyst, Licensing
Daniel W. Brinkey III, CP&L Metallurgist
Charlie Griffith, CP&L Welding Supervisor

Other licensee employees contacted included engineering, maintenance and administrative personnel.

NRC:

R. Hagar, Resident Inspector
K. Landis, Chief, Engineering Branch, Division of Reactor Safety

INSPECTION PROCEDURE USED

TI 2515/143, Shearon Harris Spent Fuel Pool ("C" and "D") Expansion

ITEMS OPENED, CLOSED, AND DISCUSSED

Opened

50-400/99-12-01	IFI	Review of Final Equipment Commissioning Details

Closed

None

Discussed

None

APPENDIX 1

TABLES

Table 1

X-Met 880 Alloy Analyzer Data for Developing an Acceptance Criteria

Standard	Cr	Ni	Mo	Mn	Cu	Good/Possible Match: Alloy	No Good Match	Overall Rating
Type 304	18.28	8.13	0.17	1.48	0.19	7 / 3: Type304	----	Good
Type 309	22.60	13.81	---	1.63	---	9 / 1: Type309	----	Good
Type310	24.87	19.72	0.16	1.94	0.11	5 / 5: Type310	----	Good
Type 316	16.74	10.07	2.06	1.44	0.11	Not Analyzed	----	----
NIST C1154a	19.31	13.08	0.068	1.44	0.44	10 / 0: C1154a	----	Good
Standards Used to Check the Alloy Analyzer								
NIST 1267	24.14	0.29	---	0.315	---	0 / 0	10	No Match
NBS 1219	15.64	2.16	0.164	0.42	0.162	0 / 0	10	No Match
NBS C1289	12.12	4.13	0.82	0.35	0.205	0 / 0	10	No Match
BCS 331	15.20	6.26	---	0.78	---	0 / 0	10	No Match
NIST C1151a	22.59	7.25	0.79	2.37	0.385	0 / 0	10	No Match
NIST C1153a	16.70	8.76	0.24	0.544	0.226	0 / 9: Type304	1	Possible
NIST C1152a	17.76	10.86	0.44	0.95	0.097	0 / 4: Type304	6	No Match

NIST 1155	18.45	12.18	2.38	1.63	0.169	0 / 8: Type316	2	Possible
NIST C1287	23.98	21.16	0.46	1.66	0.58	0 / 8: Type310	2	Possible
NBS 1230	14.80	24.20	1.18	0.64	0.14	0 / 0	10	No Match
NBS C1288	19.55	29.30	2.83	0.83	3.72	0 / 0	10	No Match
NBS 1246	20.10	30.80	0.36	0.91	0.49	0 / 0	10	No Match

<u>Table 2</u>

Current Water Assay for C & D SFP Piping Systems, Administrative limits for A & B SFP, and NUREG CR-5116 Data for Primary Water in Cold Shut Down (ppb = parts per billion)

Identification	F (ppb)	Cl (ppb)	SO_4 (ppb)	pH
2-SF-75	57	29.5	1027	6.33
2-SF-74	29.3	62.7	682	5.82
2-SF-49	166	48	632	5.60
2-SF-215	11.7	26	321	5.55
2-SF-214	14.2	31.5	430	5.40
2-SF-212	120	70.5	676	6.74
2-SF-213	13.1	28.2	424	5.33
A & B SFP Admin. Limits (1)	<150	<150	----	----
Primary Water(2) Shut Down	<150	<150	----	----

(1) HNP Plant operating manual, Volume 5, Part 3, "SHNPP Environmental and Chemistry Sampling and Analysis Program," January 20, 1999.
(2) Shut down values above those indicated should be corrected before reaching full power operations.

CONTENTION TC-3: EXHIBIT 9

CP&L Technical Report 99-90, re: Harris Nuclear Plant – Bacteria Detection in Water from the C&D Spent Fuel Pool Cooling Lines

(18)

CAROLINA POWER & LIGHT COMPANY
MATERIAL SERVICES SECTION
METALLURGY SERVICES

TECHNICAL REPORT

To: Mr. Steve Edwards	**Project Number:** 99-90
	Date: May 12, 1999
Investigators: Ahmad A. Moccari	**Reviewed by:**
Distribution: Mr. Robert Lane/HNP; File/Metallurgy Services	**Approved by:** [signature] Supervisor, Metallurgy Services

SUBJECT: Harris Nuclear Plant - Bacteria Detection in Water from the C&D Spent Fuel Pool Cooling Lines

INTRODUCTION:

The objective of this project was to determine if nuisance bacteria are present in the water samples from the C&D spent fuel pool cooling lines from the Harris Nuclear Plant (HNP) that would potentially cause microbiologically influenced corrosion (MIC)[1].

LABORATORY EXAMINATION AND RESULTS:

Seven water samples labeled as "2SF-74 D Pool," "2SF-75 D Pool," "2SF-49 D Pool," "2SF-212 D Pool," "2SF-213 C Pool," "2SF-214," and "2SF-251 C Pool" were received for bacteria detection analysis. The presence of sulfate-reducing bacteria (SRB) in the as-received water samples were evaluated using a Rapidchek II Kit, a "sulfate-reducing bacteria kit". The bacterial counts were found to be in the range of less than 1000 cells per milliliter (the lower detectable level of this utilized kit) to 100,000 cells per milliliter. The Rapidchek II Kit for detecting SRB is a commonly used kit in the field and provides a qualitative result in a short time. This kit is a simple "presence/absence" test capable of indicating the population size of the SRB bacteria present in a water sample but it does not provide any information on the activity/aggressivity of the bacteria.

In order to confirm the results obtained from using the Rapidchek II kits, the presence and aggressivity of sulfate-reducing bacteria were investigated using SRB-Biological Activity Reaction Test (BART) kits. In addition, the presence and aggressivity of slime-forming bacteria, iron-related bacteria, and heterotrophic aerobic bacteria were evaluated using appropriate BART kits. These evaluations involve culturing and observation for up to about two weeks to determine any bacterial activity and growth. The results of BART kits analyses indicated that no nuisance bacteria capable of causing material degradation due to MIC were present in any of the seven water samples from the C&D spent fuel pool cooling lines.

It should be noted that the presence of microbiologically influenced corrosion (MIC) and halogen associated localized corrosion are not considered likely in the Harris Nuclear Plant C&D spent fuel pool cooling lines given that the piping is filled with demineralized water with measured very low concentrations of chloride, fluoride, and sulfate. Furthermore, since these lines have been reportedly flooded for an extended period of time, the existence of microbial activity in an aggressive form would be expected to have been evidenced by this time in the form of material degradation which most likely would be visible by external leakage. No such incidents have been reported by plant personnel.

[1] In the open literature various terminologies such as microbiologically induced corrosion, microbial-induced corrosion, biologically influenced corrosion, microbially influenced corrosion, etc. have been used to refer to this mechanism. Most currently it is referred to as Microbiologically Influenced Corrosion.

CONTENTION TC-3: EXHIBIT 10

Transcript of Deposition of Dr. Ahmad A. Moccari
(October 19, 1999) (excerpts)

ORIGINAL

UNITED STATES OF AMERICA
NUCLEAR REGULATORY COMMISSION
DOCKET NO. 50-400-LA
ASLBP NO. 99-762-02-LA

In the Matter of:)
)
CAROLINA POWER AND LIGHT COMPANY)
)
(Shearon Harris Nuclear Power Plant))
)
- - - - - - - - - - - - - - - - - - -

DEPOSITION

OF

AHMAD A. MOCCARI, PH.D.

At the Harris Energy and Environmental Center
3932 New Hill-Holleman Road
New Hill, North Carolina

October 19, 1999
9:00 a.m.

B. JORDAN & CO.
CERTIFIED VERBATIM REPORTERS
P.O. BOX 3372 CHAPEL HILL, NORTH CAROLINA 27515 (919) 929-6592

A P P E A R A N C E S

JOHN H. O'NEILL, JR., ESQ.
Shaw, Pittman, Potts & Trowbridge
2300 N Street, N.W.
Washington, D.C. 20037
(For the Applicant)

DIANE CURRAN, ESQ.
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(For the Intervenor)

SUSAN C. UTTAL, ESQ.
Senior Attorney
OWFN-15B18
U.S. Nuclear Regulatory Commission
Washington, D.C. 20555
(For the U.S. Nuclear Regulatory Commission)

Also Present

WILLIAM R. HOLLAWAY, PH.D., ESQ.

DR. GORDON THOMPSON

DAVID LOCHBAUM

DONALD G. NAJOCK

JOHN R. CAVES, P.E.

other material hanging across any of the welds?

A No.

Q Are you familiar with an internal e-mail that was written at CP&L that discussed such an observation?

A I'm not.

MS. CURRAN: I'm going to ask the reporter to mark as Exhibit 22 an e-mail memo from David Kunkel to Edwards, Steven; Lane, Robert; Shaw, Kevin, dated June 26, 1999.

(Whereupon, OC Deposition Exhibit No. 22 was marked for identification.)

Q Have you ever seen this document before?

A No.

Q Okay. Why don't you just read it for a minute?

A Okay.

(Witness reviews document.)

A Yes.

Q Do you know who David Kunkel is?

A No.

Q Did you observe anything similar to what he's describing in this memo?

A Not algae.

Q Did you see something else?

A Some surface film, but not algae. Algae need oxygen, they need sun. How can you see algae in a pipe that doesn't see sun?

Q Surface film. What causes surface film?

A A deposit from whatever is in the water.

Q I'm sorry. A deposit from--

A From whatever is in the water.

Q From water?

A Whatever is in the water. The cause was in the water.

Q Whatever is in the water.

A Uh-huh (affirmative).

Q Did you see that on many welds?

A No.

Q How many did you see it on?

A I cannot say exactly how many.

Q You saw it on a few?

A It depends on how you say a few. What's the number?

Q All right. Well, there's 15 of them.

A Yeah.

Q So--

A I don't know. I cannot put a number down that says two or three. I don't know.

Q Can pure water or demineralized water cause surface film?

A Pure water, demineralized water, no. But that's not what they have there.

Q But that's not--

A They have something else in the water. Boron. Boric acid, yes.

Q Boric acid can cause the film?

A It's boron solidified, precipitate, yes. Yes.

Q To your knowledge, was the piping cleaned prior to the camera inspection?

A I think some of them were cleaned, yes.

Q Some of them were cleaned.

A Yes.

Q Assuming that it had been cleaned, would that affect your evaluation of the video?

A No. Give you a better view of the surface. That's the best thing.

Q Was any chemical analysis performed of the surface film to verify that it was boron precipitate?

A I'm not aware of it, no.

Q I'd like to go back to your report, which is Exhibit 12--18. I'm sorry. At the end of your report, the third line up from the bottom, you say, "The existence of microbial activity in an aggressive form would be expected to have been evidenced by this time in the form of material degradation, which most likely would be visible by external leakage."

A Uh-huh (affirmative).

Q Where would this external leakage occur? If you were going to look for it, where would you look?

A If the pipe is visible outside, you look outside.

Q Oh, I see.

A Yes.

Q In other words, if the pipe is accessible--

A Sure.

Q --then you can see--

A You can look outside to see if there is any leakage.

Q So on the outside of the pipe you could machining the pipe.

Q Oh, I see.

A Yeah. If you can see those, it means that they are still there. There's no corrosion there. If there are machine marks there, it means that there is no corrosion there, yeah.

Q And you look for rust.

A Yes.

Q And you look for deposits.

A That's correct.

Q Is there anything else you look for?

A There's nothing else you look for.

Q When you look for MIC, what are the signs that MIC is present?

A The same thing you can see for rust, deposits.

Q Can you tell from the video camera inspection whether there's any pinhole leakage or high porosity of the pipe or the weld?

MR. O'NEILL: Objection. Compound. Do you want to take them one at a time?

MS. CURRAN: Okay.

Q When you look at the welds on the

videotape, can you see any pinhole leakage, using the camera?

A Yes. You can see.

Q Did you see that in the inspection?

A I saw one pinhole.

Q Where was it?

A It was adjacent to the weld.

Q What causes pinhole leaks?

A Chemical corrosion, MIC, or it could have been a defect. We don't know.

Q When you use the video camera to examine a weld, can high porosity or increased porosity be seen?

A I didn't look for that because I'm not a welding expert.

Q Increased porosity isn't an effect of MIC or corrosion?

A I don't think so.

Q And you looked at every weld when you looked at these videotapes.

A That's correct.

Q Did you see any weld defects in your examination?

A I'm not a weld expert. So I cannot say if

48	6	Insert “shows” after “tape”; delete “shows” after “pipe”	Clarification
48	7	Delete “shows”	Clarification
48	8	“inside the weld, ID,” to “the”	Clarification
48	13	Delete “, yes” after “drained”	Clarification
48	18	Delete “emphasize”	Clarification
48	19	“go” to “goes”; “put” to “puts”; delete “different” before “light”	Clarification
48	20	“angle” to “angles”	Clarification
48	24	Delete “But”; “you” to “can be”	Clarification
48	25	“see” to “seen”; “clear” to “clearly”; “Go” to “Goes”	Clarification
49	3	“go” to “goes”; “move” to “moves”	Clarification
55	13,14	Delete sentence “The cause was in the water.”	Clarification
56	12	Delete sentence “Boric acid, yes.”	Clarification
59	7,8	“It’s both. Sometimes localized, sometimes widespread.” to “It is generally localized.”	Accuracy
61	12	Delete “the pipe” before “inside”; insert “of” after “inside”	Clarification
61	14	Insert “all” before “--if”	Clarification
61	21	“pipe and the pipe I see the condition,” to “inside diameter surface of the piping”	Clarification
63	8	“the boron” to “was not obscured”	Clarification
63	12	“It’s” to “It”; insert “can be” before “very”; “you can see it.” to “seen.”; “And” to “When”	Clarification
63	13	“camera wheel” to “crawler”	Clarification

63	14	"wheel" to "device"	Clarification
63	15	"it" to "the deposit was"; delete ", the deposit" after "bit"	Clarification
63	22	Insert "crawler" before "wheel"; "wheel" to "wheels"; delete "was--they"	Clarification
63	24	Insert "crawler" after "the"	Clarification
64	3	Insert "crawler" after "the"	Clarification
64	4	Delete "Not because--"	Clarification
65	3	"the" to "signs of"	Clarification
65	21	Delete "if you see"; "mark" to "marks"	Clarification
67	7	Insert "or two" after "one"; "pinhole" to "pinholes."	Accuracy
67	25	"weld" to "welding"	Clarification
72	9	"Food." to "No food, they will not survive."	Clarification

CONTENTION TC-3: EXHIBIT 11

Structural Integrity Associates, Inc., Report No. SIR-99-127, Rev. 0, Evaluation of Embedded Welds in Spent Fuel Piping at Harris Nuclear Plant (December 7, 1999)

Report No.: SIR-99-127
Revision No.: 0
Project No.: CPL-52
File No.: CPL-52-401
December 1999

Evaluation of Embedded Welds in Spent Fuel Piping at Harris Nuclear Plant

Prepared for:

Carolina Power & Light Company
New Hill, NC

Prepared by:

Structural Integrity Associates, Inc.
San Jose, CA

Prepared by: G. J. Licina Date: 12-7-99

Reviewed by: M. E. Sauby Date: 12/7/99

Approved by: G. J. Licina Date: 12-7-99

REVISION CONTROL SHEET

Document Number: SIR-99-127

Title: Evaluation of Embedded Welds in Spent Fuel Piping at Harris Nuclear Plant

Client: Carolina Power & Light Company

SI Project Number: CPL-52

Section	Pages	Revision	Date	Comments
1.0	1-1 – 1-2	0	12/7/99	Initial Issue
2.0	2-1 – 2-3			
3.0	3-1			
4.0	4-1 – 4-7			
5.0	5-1 – 5-11			
6.0	6-1 – 6-3			
7.0	7-1			

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1.0 INTRODUCTION

Carolina Power & Light Company (CP&L) requested Structural Integrity Associates, Inc. (SI) to evaluate the structural integrity and suitability for service of the embedded stainless steel piping, including 15 field welds, in the Spent Fuel Pool Cooling and Cleanup System for Harris Nuclear Plant (HNP) spent fuel pools C and D. The Spent Fuel Pool Piping (SFP Piping) was constructed in the early 1980s, but was never installed and has not been operational. CP&L is now commissioning C and D SFP Piping in support of activating the C and D spent fuel pools.

This report provides a review of all of the materials transmitted to SI (Table 1-1) to provide an independent, expert opinion regarding the quality of construction and suitability for purpose of the SFP Piping. This review was primarily focused on the 15 embedded field welds, described on CP&L isometric drawings 2-SF-149, -144, -143, -151, -159, -1, and –8, but also considered the overall condition of the balance of the piping.

The quality of construction assessment was focused on the as-installed structural integrity of the SFP Piping, as described by the quality records provided for this review and from the videotapes of the remote visual inspections performed during 1999. The suitability for service included an assessment of the structural integrity of the SFP Piping in its present condition, including any potential degradation that the SFP Piping has experienced since initial installation, and projections of any further degradation that stainless steel piping in that condition would possibly experience for the duration of the SFP Piping's service life.

Table 1-1

Materials Provided by CP&L

1. Vendor Data Packages for the following segments:

2-SF-149	2-SF-151	2-SF-30
2-SF-144	2-SF-1	2-SF-34
2-SF-143	2-SF-8	2-SF-159

2. Requested sections of the RAI submittal labeled "Enclosure 6 to Serial HNP-99-069" (includes CP&L weld procedures and PQRs, and DDRs).

3. Videotapes:
   "Weld Hydrolasing"
   "1999 CTS Power Services 1st Visit, 6/99 – Non Clear "C" Pipe"
   "Weld Cleaning 2-SF-8-FW-65 & 66"
   "Visual Inspections of Welds: WR/JO 99, ADUP1, 2-SF-149-FW-408, 2-SF-144-FW-515, 2-SF-144-FW-516, July 7, 1999"
   "6-24-99, 99-ADUNZ WR/JO, Weld 2-SF-8-FW-66 I.D "
   "Visual Inspection of Weld: 2-SF-143-FW-512, July 8, 1999"
   "Visual Inspection of Weld: 2-SF-8-FW-66, 2-SF-8-FW-65, CTS Power Services"
   "CP&L Tape 1" (2-SF-143-FW-513, FW-514; 2-SF-144-FW-517)
   "CP&L Tape 2" (2-SF-1-FW-5, FW-4, FW-1, FW-2; 2-SF-159-FW-518, FW-519)

4. Hydrostatic Test Records for the following segments:

2-SF-143	2-SF-159	2-SF-143
2-SF-149	2-SF-34	2-SF-1
2-SF-151	2-SF-144	2-SF-30

5. "Harris Nuclear Plant – Bacteria Detection in Water from the C and D Spent Fuel Pool Cooling Lines", Metallurgy Services Technical Report 99-90.

6. Isometric Drawings:

2-SF-149	2-SF-159	2-SF-1
2-SF-144	2-SF-151	2-SF-30
2-SF-143	2-SF-8	2-SF-34
2-SF-159		

7. Chemistry Sample Data Sheets –Spent Fuel Pool Drains (7), 4-27-99

2.0 BACKGROUND

Initial communications with CP&L indicated that the SFP Piping in question is embedded in concrete and is therefore not accessible for external examination or radiographic examination. However, the majority of the piping in the Spent Fuel Pool Cooling and Cleanup System is exposed and is accessible. Per CP&L, all of the stainless steel piping, embedded or exposed, was installed under the CP&L ASME N Certificate construction program which existed at the time of construction, and was spared in place when construction of HNP Units 2 & 3 was canceled.

The stainless steel SFP Piping consists of 150 psi class piping spools, 12" or 16" STD (0.375") wall, welded Type 304 stainless steel pipe, with both seamless and welded fittings, prefabricated by an authorized supplier. Vendor data records (Table 1-1, Item 1) for those spools were reviewed. Those records show that the longitudinal seam welds for the pipe itself were made by the gas tungsten arc welding (GTAW) and submerged arc welding (SAW) processes, and were radiographed and examined by liquid penetrant techniques. Pipe spool welds done by the fabricator were examined visually and by liquid penetrant testing (PT). These spools were joined by field welds made by CP&L or its contractors or assembled by flanged connections. Consistent with the piping's Code of Construction (designed to Section III, Class 3, 1971-73; constructed to 1974-76), volumetric inspection was not required for the field welds. All of the embedded field welds are in 12" lines.

Some of the records associated with the installation and field welding of the piping were discarded, including the weld data reports for the embedded field welds. All of the SFP Piping received a hydrostatic test. The hydrostatic test procedure included a review of all weld data records and a sign-off that those records were complete. The hydrostatic test procedure also required that all welded joints be visible for inspection, that the piping be pressurized to a minimum of 1.25 times the design pressure, held at that pressure for a minimum of ten minutes, and that the piping be examined for leakage over 360° at all joints and at all regions of stress while the piping was at pressure. The examination was also witnessed by the independent authorized nuclear inspector (ANI).

Service conditions for this embedded SFP Piping will be, and have been, very mild. The design pressure of the stainless steel SFP Piping is 150 psi; however, as noted by CP&L, the maximum service pressure is only about 25 psi. The maximum service pressure is so low because the Cooling and Cleanup System takes its suction on, and discharges into, the spent fuel pool, which is open to atmospheric pressure in the Spent Fuel Handling Building. Typical operating pressure will be less than 10 psi (limited by the static head at the lowest point); design temperature is less than 200°F; and service stresses from either pressure or supports are very low. The SFP Piping experiences no high fluid velocities, and the service environment is a well controlled, benign water chemistry (borated demineralized spent fuel pool water).

Following hydrostatic testing in late 1979 (Field Welds 2-SF-1-FW-1, -2, -4, and -5) or 1981/1982 (all of the other embedded Field Welds), CP&L indicated that the SFP Piping was drained and vented, but there are no records to indicate that the piping was either rinsed or dried. No water has been introduced into the SFP Piping by in-leakage from other systems, because none of the embedded piping is connected to any other systems. Per CP&L, piping was left unconnected to other systems (e.g., Closed Cooling Water, CCW) and openings were covered with Foreign Material Exclusion covers (plywood covers prior to1989; welded-on metal covers after spent fuel pools A and B were filled). The first filling of any of the "A" and "B" spent fuel pools occurred in 1989. Later, spent fuel pools C and D were also filled to ensure that there was no drain-down event from interconnected pools A and B. Over the years, this SFP Piping has filled with water from spent fuel pools C and D, that has leaked past "plumbers plugs" installed at the pool nozzles. This leakage from the spent fuel pools to the spared-in-place SFP Piping could have begun as early as 1989 or 1990. For the purposes of this analysis, the maximum time of flooding, approximately 10 years, will be assumed for conservatism. Although the piping has been filled for a number of years with spent fuel pool borated demineralized water, no formal lay-up program has ever been implemented for the embedded SFP Piping connected to spent fuel pools C and D. The phrase "wet lay-up" will be used to describe the flooded conditions that the piping has experienced since 1989, at the earliest.

Remote visual examination of fifteen embedded field welds (2-SF-8-FW-65 and –66; 2-SF-144-FW-515, -516, and –517; 2-SF-149-FW-408; 2-SF-143-FW-512, –513, and –514; 2-SF-159-FW-518, and –519; 2-SF-1-FW-1, –2, -4, and -5) and the piping in six of the eight lines was done by a CP&L contractor using a high resolution camera mounted to a pipe crawler following draining of those lines. Those videotapes were reviewed as a part of this project. In addition, CP&L has collected and analyzed water samples from seven of the lines for water chemistry and from seven lines to characterize the microbiological nature of the water.

3.0 OBJECTIVES

The primary objective of this project was to provide an independent, expert opinion on the structural integrity and suitability for purpose of the subject SFP Piping.

This assessment includes:

- A determination of the structural integrity of the welds as installed,
- An assessment of the present condition of the SFP Piping based upon any damage that has ensued during the roughly 10 years of wet lay-up,
- Suitability for service of the SFP Piping in the benign spent fuel pool water environment, and
- Specific recommendations on any other actions that should be performed to substantiate the quality of the SFP Piping.

4.0 APPROACH

4.1 Initial Quality

The first step in this assessment involved a detailed review of the available data, listed in Table 1-1. Materials that were reviewed included:

- Piping layout information
- Specified materials of construction, including weld metals
- Actual materials of construction (or verification that the specified materials were used throughout)
- Welding procedure specification(s) for shop and field welds
- Procedure Qualification Records for shop and field welds
- Visual and PT inspection records for shop welds
- Hydrotest results
- Videotapes of the remote visual examinations of fifteen field welds in the installed SFP Piping.

4.2 Degradation Since Construction

All potentially applicable degradation mechanisms were considered. The probability for each of those mechanisms to have degraded the piping during the extended wet lay-up was evaluated against the best estimate of the conditions to which the piping was actually exposed, considering:

- All loadings
- Nominal temperature, pressure, and water chemistry conditions
- Hydrotest water chemistry, and draining or drying procedures that might have been implemented following hydrotest
- Time of immersion since initial flooding (conservatively assumed to be approximately 10 years, the time between the initial fill of spent fuel pools and the drying done for the remote visual examination)
- Verification of the exposure conditions based upon temperature, pressure, and water chemistry data from monitoring or other surveillance of the lines (water chemistry, microbiological characterization)

- Detailed review of the videotapes from the remote visual examination of fifteen of the field welds performed in 1999.

All potentially operative degradation mechanisms were considered for the SFP Piping by comparing the degradation mechanisms and the operating conditions that are associated with them to the normal operating conditions for the piping (low flow or stagnant controlled purity water at ambient temperature) plus off-normal conditions, which for the SFP Piping are no different. Those degradation mechanisms are listed in Tables 4-1 and 4-2. Both tables are from compilations of all of the potentially operative degradation mechanisms for nuclear power plant components used in either ASME Code Case N-560 [1] evaluations or the EPRI Methodology for Risk-Informed Inservice Inspection [2]. This assessment has conservatively assumed that piping residual stresses were tensile stresses at the piping inside diameter and equal to the material's yield strength. Fit up and welding can produce residual stresses that can reach the yield strength before plastic deformation relaxes them.

Table 4-1

Degradation Mechanisms and Attributes in Code Case N-560 [1]

	Mechanism	Attributes	Susceptible Regions
1	Thermal Fatigue i. Thermal Shock ii. Stratification iii. Striping	Intermittent Cold Water Injection (i, ii, iii) Low Flow, Little Fluid Mixing (ii. Iii) Notch-Like Stress Risers (ii, iii) Very Frequent Cycling (ii, iii) Unstable Turbulence Penetration into Stagnant Lines (ii, iii) Bypass leakage in valves with large ΔTs (ii, iii)	Nozzles, branch pipe connections, safe ends, welds, HAZ, and base metal regions of high stress concentration
2	Flow Accelerated Corrosion	Turbulent Flow at Sharp Radius Elbows and Tees Proximity to Pumps, Valves and Orifices Material Chromium Content Fluid pH Oxygen Temperature	
3	Erosion-Cavitation	Severe Discontinuities in Flow Path Proximity to Pump, Throttle Valve, Reducing Valve or Flow Orifice	Fittings, welds, and HAZ
4	Corrosion i. General Corrosion ii. Crevice Corrosion iii. Pitting iv. MIC	Aggressive Environment (i, iii) Oxidizing Environment (ii, iii) Material (i, iv) Temperature (i, iv) Contaminants (sulfur species, chlorides, etc.) (ii) Crevice Condition (ii) Stagnant Region (ii) Low Flow (iii) Lay up (iv)	Base metal, welds, and HAZ
5	Stress Corrosion Cracking i. IGSCC ii. TGSCC iii. PWSCC	Susceptible Material (i) Oxidizing Environment (i, ii) Stress (residual, applied) (i, ii) Initiating Contaminants (sulfur species, chlorides, etc.) (I) (aqueous halides or concentrated caustic) (ii) Temperature (i, ii) Strain Rate (environmentally assisted cracking) (i, ii) Fabrication Practice (e.g., weld ID grinding, cold work (i) Notch-like Stress Risers	Austenitic stainless steel welds and HAZ (i) Mill-annealed Alloy 600 nozzle welds and HAZ without stress relief (iii)
6	Water Hammer [Note (1)]	Potential for Fluid Voiding and Relief Valve Discharge	

NOTE:

(1) Water hammer is a rare, severe loading condition as opposed to a degradation mechanism, but its potential at a location, in conjunction with one or more of the listed degradation mechanisms, could be cause for a higher examination zone ranking.

Table 4-2

Degradation Mechanism Criteria and Susceptible Regions (from [2])

Degradation Mechanism		Criteria	Susceptible Regions
TF	TASCS	–NPS > 1 inch, and –pipe segment has a slope < 45° from horizontal (includes elbow or tee into a vertical pipe), and –potential exists for low flow in a pipe section connected to a component allowing mixing of hot and cold fluids, or potential exists for leakage flow past a valve (i.e., in-leakage, out-leakage, cross-leakage) allowing mixing of hot and cold fluids, or potential exists for convection heating in dead-ended pipe sections connected to a source of hot fluid, or potential exists for two phase (steam/water) flow, or potential exists for turbulent penetration into a relatively colder branch pipe connected to header piping containing hot fluid with turbulent flow, and –calculated or measured $\Delta T > 50°F$, and –Richardson number > 4.0	Nozzles, branch pipe connections, safe ends, welds, heat affected zones (HAZs), base metal, and regions of stress concentration
	TT	–operating temperature > 270°F for stainless steel, or operating temperature > 220°F for carbon steel, and –potential for relatively rapid temperature changes including cold fluid injection into hot pipe segment, or hot fluid injection into cold pipe segment, and –$\lvert \Delta T \rvert > 200°F$ for stainless steel, or $\lvert \Delta T \rvert > 150°F$ for carbon steel, or $\lvert \Delta T \rvert > \Delta T$ allowable (applicable to both stainless and carbon)	

Table 4-2. Degradation Mechanism Criteria and Susceptible Regions (Cont.)

Degradation Mechanism		Criteria	Susceptible Regions
SCC	IGSCC (BWR)	–evaluated in accordance with existing plant IGSCC program per NRC Generic Letter 88-01	Welds and HAZs
	IGSCC (PWR)	– austenitic stainless steel (carbon content ≥ 0.035%), and –operating temperature > 200°F, and –tensile stress (including residual stress) is present, and –oxygen or oxidizing species are present OR –operating temperature < 200°F, the attributes above apply, and –initiating contaminants (e.g., thiosulfate, fluoride or chloride) are also required to be present	
	TGSCC	– austenitic stainless steel, and –operating temperature > 150°F, and –tensile stress (including residual stress) is present, and –halides (e.g., fluoride or chloride) are present, and –oxygen or oxidizing species are present	Base metal, welds, and HAZs

Table 4-2. Degradation Mechanism Criteria and Susceptible Regions (Cont.)

Degradation Mechanism		Criteria	Susceptible Regions
SCC (cont.)	ECSCC	– austenitic stainless steel, and –operating temperature > 150°F, and –tensile stress is present, and –an outside piping surface is within five diameters of a probable leak path (e.g., valve stems) and is covered with non-metallic insulation that is not in compliance with Reg. Guide 1.36, or –an outside piping surface is exposed to wetting from concentrated chloride-bearing environments (i.e., sea water, brackish water, or brine)	Base metal, welds, and HAZs
	PWSCC	–piping material is Inconel (Alloy 600), and –exposed to primary water at T > 560°F, and –the material is mill-annealed and cold worked, or cold worked and welded without stress relief	Nozzles, welds, and HAZs without stress relief
LC	MIC	–operating temperature < 150°F, and –low or intermittent flow, and –pH < 10, and –presence/intrusion of organic material (e.g., Raw Water System), or –water source is not treated with biocides	Fittings, welds, HAZs, base metal, dissimilar metal joints (for example, welds and flanges), and regions containing crevices
	PIT	–potential exists for low flow, and –oxygen or oxidizing species are present, and –initiating contaminants (e.g., fluoride or chloride) are present	
	CC	–crevice condition exists (i.e., thermal sleeves), and –operating temperature > 150°F, and –oxygen or oxidizing species are present	

Table 4-2. Degradation Mechanism Criteria and Susceptible Regions (Concluded)

Degradation Mechanism		Criteria	Susceptible Regions
FS	E-C	–cavitation source, and –operating temperature < 250°F, and –flow present > 100 hrs./yr., and –velocity > 30 ft./sec., and –$(P_d - P_v) / \Delta P < 5$	Fittings, welds, HAZs, and base metal within 5D of source
	FAC	–evaluated In accordance with existing plant FAC program	per plant FAC program

5.0 RESULTS

5.1 Initial Quality

This piping was constructed (to the extent that construction was completed) under the HNP ASME QA program. All procedures and plant construction were subject to frequent internal and external audits. This same QA program was used to successfully complete and license HNP Unit 1. While much of the documentation for the fifteen embedded field welds was unavailable, the QA program did require procedures for material controls, material handling and welding procedures and qualifications, completion of weld data reports (note that hydrotest procedures required a sign-off of the completion of all weld data reports), specific QC inspections, and ANI third party review. Construction of the subject SFP Piping without those controls would have required a total breakdown of that QA program.

The presence of Deficiency Disposition Reports (DDRs) pertaining to embedded field welds (Table 1-1; Item 2.) provides a clear indication that the QA program was indeed applied to the field welds. For example, Field Weld FW-408 required a DDR since an ANI hold point was bypassed on final inspection. Similarly, a DDR was written for FW-517 (arc strikes found).

In the absence of weld documentation packages for the field welds, the signed-off hydrotest records provide the only formal documentation that "all weld data records (are) complete". Those packages were provided for field welds FW-408, -512, -513, -514, -515, -516, -517, -518, and –519. No hydrotest packages were supplied for field welds FW-65 and –66.

The weld procedures that were reviewed as a part of this project were CP&L procedures that were in place at the time the field welds in the SFP Piping were made. Those procedures included welds in the variety of P-8 materials (per ASME Code Section IX) that would be used in nuclear construction, including the Type 304 stainless steel used for the SFP Piping. The controls on welding processes (GTAW and Shielded Metal Arc Welding, SMAW), heat inputs, purge and shielding gas, and other parameters required to make high quality welds in nuclear construction were typical of those that have been reviewed by Structural Integrity Associates for other plants, including welds for Class 1 systems. The weld procedure packages that were reviewed (Table 1-1, Item 2) also included Procedure Qualification Records that demonstrated that the weld procedures produced sounds welds with satisfactory mechanical properties.

Ebasco Services performed a calculation on the minimum piping wall thickness, t_{min}, that was required to retain the design pressures in the Spent Fuel Pool Cooling and Cleanup System, assuming a maximum allowable stress, SE, of 17,800 psi due to internal pressure [3]. That calculation, verified by Structural Integrity Associates showed that for 16" stainless steel pipe, t_{min} = 0.011" for a design service pressure of 25 psi (joint efficiency = 100%). For 12" pipe and a joint efficiency of 80%, the maximum for butt welds not subjected to volumetric examination, the calculated t_{min} was also equal to 0.011" for a design service pressure of 25 psi. The pipe's 0.375" nominal thickness is therefore approximately 30 times the required minimum thickness for the design service pressure.

The minimum wall thickness was also calculated for 150% of the 150 psi design rating of the 12" stainless steel piping, or 225 psi. The calculated t_{min} for that pressure (nine times the 25 psi design service pressure) was 0.080"; about one-fifth of the actual pipe thickness of 0.375". At a joint efficiency of 80% and pressure of 225 psi, t_{min} = 0.100". Those calculations apply to the exposed pipe. The results will be conservative for the SFP Piping embedded in concrete since the presence of the concrete effectively reinforces the pipe.

Although the fabrication requirements for the SFP Piping field welds did not require examination of the ID of pipe welds by visual or enhanced methods (such as PT), detailed visual examination results of the fifteen embedded field welds were provided by CP&L, from remote visual inspections performed during the Summer and Fall of 1999, to assess the present condition of those welds.

These visual examinations demonstrated that, in general, the piping and welds in the embedded SFP Piping were in good condition. However, there were some areas on some welds where the consumable insert was not completely consumed and some areas on most of the welds where the profile was less than ideal. The condition of a non-consumed insert was most pronounced on

FW-516. Some small linear indications were observed (e.g., FW-65, FW-515, FW-517, FW-518) which appeared to be related to incomplete fusion. No areas were visible from the ID that would suggest that the reduction in thickness approached t_{min}. The fact that all welds passed a hydrostatic test (i.e., no visible leakage from a 360° examination) at a pressure in excess of 125% of the design pressure, for a minimum of ten minutes, provides a further verification of the initial quality and structural integrity of the welds.

At the ID, the appearance of the tie-in at the edges of all of the Field Welds that were examined is good to excellent. There are some weld areas, generally scattered around the circumference, where the consumable insert was not completely consumed or where the weld profile was less than ideal; not surprising for closure welds. FW-516, the worst weld in this regard, had the largest intermittent areas of incomplete consumption of its consumable insert but still exhibited complete fusion at the edges. Since there has been no volumetric examination of these welds, the evaluation of the overall structural integrity of the weld, where the subsurface condition resulting from small areas of the consumable insert not having been completely consumed, must revert to the calculation of the required minimum thickness for the design or operating pressure (including a reduced joint efficiency; which is precisely why a joint efficiency less than 100% is employed). The successful hydrotest results provide a verification that thickness exceeded t_{min} throughout FW-516 and the other welds at the time of the hydrotest, despite the non-consumed areas.

Several broad and apparently shallow linear indications were noted for FW-515. Those indications were always at the edge of the consumable insert. Similar indications were also apparent in the longitudinal seam of one of the adjacent pipes. That longitudinal seam had passed visual examination and PT as a part of its inspection following shop fabrication. No pitting or crevice corrosion were observed in the shallow linear indications in either the longitudinal seam or in FW-515.

No evidence of overheating or excessive heat tint was detected.

5.2 Degradation Since Construction

A review of all of the potentially operative degradation mechanisms listed in Table 4-1 and 4-2 identified that the only potentially operative degradation mechanisms for the SFP Piping are associated with corrosion. The flows, vibrations, and thermal conditions associated with the operation of the SFP piping, including up to ten years of wet lay-up, are far less than the conditions that can produce flow accelerated corrosion, or vibrational or thermal fatigue.

The potentially operative corrosion mechanisms include transgranular stress corrosion cracking (TGSCC), intergranular stress corrosion cracking (IGSCC), localized corrosion, and microbiologically influenced corrosion (MIC). No other corrosion mechanisms were considered to have been potentially operative for the extended lay-up conditions experienced by this piping. Other corrosion mechanisms, such as flow accelerated corrosion (FAC), are not considered operative due to the materials of construction (stainless steel), operating conditions (little or no flow; no temperatures in excess of typical ambient), and nominal environment (no caustic, raw water, or other damaging chemical species have been introduced to this piping).

The spent fuel pool cooling heat exchangers are cooled by the high purity component cooling water (CCW) system, which operates at a higher pressure than the SFP cooling water. Hence, any leakage would be from the CCW system into the SFP cooling water. Even this design condition is of no consequence for the embedded SFP Piping, since construction did not progress to the extent that any of the embedded piping was ever connected to the heat exchangers.

The SFP Piping has in effect been exposed to an extended wet lay-up with high purity water (albeit an inadvertent lay-up since no formal lay-up program was ever implemented for the lines connected to the spent fuel pools). As noted previously, over time, the piping has filled with water from the spent fuel pools which leaked past "plumbers plugs" installed at the pool nozzles, possibly beginning as early as 1989 when the "A" and "B" pools were first filled. No water has been introduced by in-leakage from other systems, because none of the embedded piping is connected to any other systems.

No regular sampling has been performed of the water in the SFP Piping. However, chemistry samples were collected from each of seven lines associated with the embedded piping (2-SF-74, -75, -212, -213, -214, -215, and –49) on 4-27-99 (Table 1-1, Item 7). Those results showed that chloride, fluoride, sulfate, and conductivity levels were very low (maximum values: chloride = 70.5 ppb; fluoride = 166 ppb; sulfate = 1027 ppb; conductivity = 103 μS/cm). Those chloride and fluoride concentrations are consistent with the specifications for spent fuel pool chemistry. Sulfate and conductivity levels are also consistent with those of a high purity water. The water samples also showed low levels of tritium; at a concentration similar to that of Spent Fuel Pool "C". The visual examinations also revealed a white crystalline substance near the bottom of some lines. That material looked very similar to boric acid crystals that form when borated water, as from the fuel pool, dries out on surfaces.

Seven water samples, from the "C" and "D" SFP Piping drains were also collected and evaluated by CP&L to provide some insight regarding the presence of active MIC bacteria in the lines (Table 1-1, Item 5). The water samples were analyzed using RapidChek™ II kits for sulfate reducing bacteria (SRB) and Hach Corporation BART™ kits for slime formers, iron related bacteria, and heterotrophic bacteria. The RapidChek tests indicated that the number of SRB was somewhere between the lower detection limit of 1000 cells/ml and 100,000 cells/ml. No slime formers, iron bacteria, or heterotrophic aerobes were detected with the BART kits. Those results are in dramatic contrast to typical bacterial counts for raw waters, providing further verification that the water in the lines was water of controlled chemistry; not untreated cooling water.

In low energy piping, the potentially operative degradation mechanisms will produce either tight cracks (TGSCC or IGSCC) or pinhole leaks (localized corrosion and MIC). For these low pressure lines, the only manifestations of those degradations will be very small leaks, of the order of a few drops per minute. In the absence of significant pressure loadings, which are absent in these lines, or significant seismic loadings, even the cracks produced by TGSCC or IGSCC would have no effect on structural integrity of the lines. Even significant pitting (i.e., over a large fraction of the circumference) confined to a narrow band, as can occur with severe MIC degradation of a weld, does not degrade the structural integrity of stainless steel weldments due to the very high toughness of those welds.

5.2.1 IGSCC

There is an extremely low probability of occurrence of IGSCC in stainless steel in the conditions and environment of the SFP Piping. While the very conservative assumption that residual stress is equal to the yield strength produces stresses sufficient to initiate and grow cracks, the controlled purity environment is not sufficiently aggressive to initiate or propagate cracks. For IGSCC driven by oxidizing conditions, the spent fuel pool temperature is far too low to produce IGSCC. Other aggressive and potential IGSCC-inducing species like thiosulfate are not present in the controlled purity environment nor is there a path that would introduce such species to the spent fuel pool environment. For example, IGSCC requires the presence of a significantly higher operating temperature (minimum of 200°F) or the presence of very aggressive chemical species such as caustic or thiosulfate.

5.2.2 TGSCC

Similarly, there is an extremely low probability of occurrence of TGSCC. As for IGSCC, the controlled purity environment is not sufficiently aggressive for either initiation or growth, even with the conservative assumption of residual stresses equal to the yield strength; a stress that would be sufficient to initiate and grow cracks if an appropriate environment were present. Chlorides are very low, limited to the levels permitted in the spent fuel pool environment (<100 ppb) or from chlorides that may have been introduced during the hydrotest (of the order of 50 to 100 ppm), with the residual chlorides subsequently diluted from the system by the spent fuel pool water.

Further, the spent fuel piping does not have any connection to coolers or other piping that can cause raw water to leak into the spent fuel pool environment.

5.2.3 Localized Corrosion

Pitting or crevice corrosion are also unlikely degradation mechanisms. The only environmental source over the long term is the very innocuous, controlled purity, spent fuel pool water. While the environment in this piping is not monitored, the spent fuel pool environment is checked by periodic water samples. All samples that have been collected from this piping, seven sample locations at one time point, as much as 10 years after initial wet-out, have confirmed that the environment inside the piping is consistent with the spent fuel pool water. The visual examinations also suggested that boric acid crystals were present in some of the lines

The chemical influence of the hydrotest water is limited by the total amount of chlorides, fluorides, and other potentially aggressive species in that water. Subsequent filling of the lines with high purity water would eliminate virtually all of those effects. The 1999 water samples have confirmed that no additional sources of water-borne chemical impurities were introduced. Dry-out and subsequent re-flooding or nearly complete dry-out of low spots would produce the most aggressive chemistry. Those locations would be expected at drains, precisely where samples were collected.

5.2.4 MIC

MIC is more likely than the other forms of localized corrosion since a minuscule population of microorganisms can grow to a diverse population of millions of microorganisms, limited only by the available nutrients. Source terms for microorganisms are hydrotest water, the spent fuel pool water, and potential intrusions of raw water from coolers. The latter item is not considered to be viable since the SFP Piping has effectively been isolated from all the coolers (more correctly, it was never connected).

Most often, MIC will produce closed, "ink bottle" shaped pits (Figure 5-1), characterized by tiny entrance holes and exit holes (if the pit goes through-wall) with a much larger area of metal loss beneath the surface. Because of the very small openings to the pit at the ID and OD, leak rates are extremely small. In stainless steels, MIC pits are far more common at weldments, either in the weld metal itself, in the heat affected zone, or beneath the heat tint. In a worst case scenario, pits in a single weld could produce a significant area of metal loss along the length of the weld such that the effective length of the flaw is large.

CP&L Test Procedure TP-30 [4] required all hydrotest water to meet Westinghouse spec PS292722. Procedure WP-115 [5] permitted hydrotests using lake water or potable water (but still water per Westinghouse spec PS292722 for piping in Westinghouse's scope of supply). The majority of the hydrotest results that were received for the embedded piping evaluated in this report were performed in accordance with WP-115.

The monitoring of the water that has been done (one data point, consisting of seven samples collected in 1999) has shown very low counts of microbial species associated with MIC. While water samples are not the best method for verifying that there is no biofilm on piping surfaces, the water sampling plus visual inspection (both ID and OD) provides a reliable indicator that MIC has not produced any leakage or accelerated corrosion in the piping

It is recognized that MIC can occur in high purity waters, in nuclear plants in systems that are nominally high purity, but that have been contaminated during initial hydrotest or during operation [8, 9]. It is also well known that water samples provide a poor representation of the biofilms on surfaces that cause MIC. The water samples that have been collected and analyzed for bacteria associated with MIC do show that the purity of the water is still very good. More importantly, no evidence of large mounds of organic materials that are typically associated with MIC was present in any of the lines that were examined in the as-found condition. All of those welds and the surrounding pipe work that were examined by the remote visual examination have been very clean, even prior to hydrolasing.

No corrosion nodules or other indications that a localized corrosion phenomenon such as MIC has occurred during the wet lay-up were revealed by the detailed remote visual inspections for all but one of the welds. A few welds exhibited some evidence of minor corrosion; limited to minor staining on those welds, except for FW-517. A very few minor discolored areas, indicative of small pits that may or may not be active any longer, were observed on those welds that exhibited evidence of corrosion. None of those indications suggests the presence of any defects that would compromise the structural integrity of these lines. No crack-like defects were noted in any of the weldments.

The remote visual examination of FW-517 revealed three apparent pits, each defined by a reddish-brown deposit. Two of those indications were located in one short section near the bottom of the pipe; the other near the top.

The reddish-brown deposits and apparent entrance holes in the weld metal of FW-517 could be due to MIC, or could be from another source. In either case, the depth and morphology of the metal loss through the thickness cannot be determined from the remote visual examination of the as-found pipe. The visual examination also cannot provide a determination of whether pitting is active or not, or provide information on the source of the pitting. A definitive determination of the root cause for these small pits would require careful microbiological and chemical sampling of the deposits and the pit interior to augment the visual examination of the as-found condition, then a similarly detailed examination of the area following removal of the deposits to better characterize the pit morphology.

CP&L may choose to attempt to collect the additional information described above in order to define the root cause. However, the location of these small indications and the material's exposure history (numerous unknowns regarding time of first wet-out and possible contamination during remote visual examination and reflooding) will make sample collection and its interpretation difficult at best. The additional sampling and visual inspection may clearly define the depth and extent of the pits (both axially or circumferentially) and provide conclusive evidence of the source of the pitting. The sampling effort may show that the present chemical and microbiological nature of the deposits is inconclusive, a possible result of the difficulties of sampling or because of the age of the pits.

Corrosion pits, even the closed, tunneling pits in weld metal that are often associated with MIC of stainless steel, would have no consequence on structural integrity. MIC **can** produce pinhole leaks, however, even a severe MIC condition does not impact the structural integrity of stainless steel welds, as demonstrated both by calculation [6] and confirmed by experiment [7]. As demonstrated in References 6 and 7, a distribution of much larger pits in a more severely stressed stainless steel weld had no effect on load carrying capability.

The presence of the reddish-brown deposits and apparent small pits in FW-517 is not considered to be a condition that jeopardizes the structural integrity of the SFP Piping at all.

The most powerful evidence that all welds, including the embedded welds, are structurally sound is that there have been no pinhole leaks reported for any of the exposed piping. If MIC or other localized corrosion mechanisms were operative now or had produced a problem during the 10 year period that these lines have been wet, one or more pinhole leaks might be anticipated. All of the exposed piping has been subject to external visual examination by both CP&L engineering and QC. All of the exposed field welds have been satisfactorily reexamined, both visually and by liquid penetrant testing (PT). No leakage has ever been seen in any of the exposed piping. It is noted that not all of the exposed SFP piping is connected to the embedded piping, but a significant portion of it is. CP&L has estimated that a comparable volume of exposed piping is actually connected to and communicates with the embedded piping, and has been subject to the same flooded conditions.

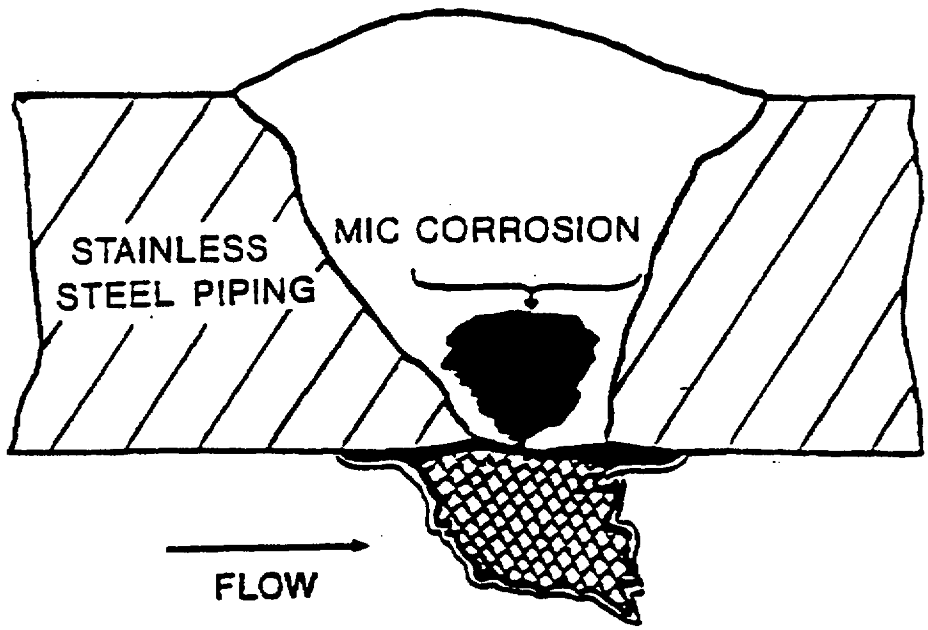

Figure 5-1. Closed Pit, Typical of MIC in Stainless Steel Piping Welds (from [7])

6.0 CONCLUSIONS

6.1 Initial Quality

The fabrication records for all of the spools in this scope were reviewed. Objective evidence was located to confirm that all components and all shop welds were of good quality.

This piping was constructed under the plant's ASME QA program; a program that was used to successfully complete and license HNP Unit 1, and which definitely appeared to have been solidly in place during the construction of all of the SFP Piping, as evidenced by QA records from that era.

No documentation was provided on the as-installed condition of field welds, except for those field welds for which hydrotest records are in hand (i.e., 2-SF-149-FW-408; 2-SF-143-FW-512, -513, and –514; 2-SF-159-FW–518, and -519; 2-SF-144-FW-515, -516, and-517; 2-SF-1-FW-1, -2, -4, and -5). For each of those welds, the hydrotest record did contain a sign-off that the weld data reports were complete, along with the successful results of the hydrotest itself, including the 360 degree visual inspection of each weld under pressure, done while the now embedded welds were still accessible.

Detailed visual examination results of embedded field welds were provided by CP&L from remote visual inspections performed for the utility during the Summer and Fall of 1999. Those inspections were used as a part of this evaluation.

The as-installed structural integrity of all of the field welds evaluated in this project (i.e., 2-SF-149-FW-408; 2-SF-143-FW-512, -513, and –514; 2-SF-159-FW–518, and -519; 2-SF-144-FW-515, -516, and-517; 2-SF-1-FW-1, -2, -4, and -5 ; 2-SF-8-FW-65 and, -66) was considered acceptable based upon the materials provided. The successful completion of the hydrostatic test and the detailed remote visual examination (following 10 years of exposure to a wet lay-up with high purity water) provided a conclusive demonstration of the quality of the initial welds.

6.2 Present Condition

The review of the detailed visual examinations for 2-SF-8-FW-65 and –66; 2-SF-144-FW-515, –516, and –517; 2-SF-149-FW-408; 2-SF-143-FW-512, -513, and –514; 2-SF-1-FW-1, -2, -4, and –5; and 2-SF-159-FW-518 and -519 also demonstrated that those welds were in a condition that would be very comparable to that of as-installed piping. The 10 years of wet lay-up does not appear to have degraded the structural integrity of the welds at all.

6.3 Suitability for Service as Spent Fuel Pool Piping.

The assessment of the suitability for service of this SFP Piping was based upon all of the items listed above – records review and remote visual inspection.

The SFP Piping is exposed to very benign conditions. Localized corrosion, which could produce pinhole leaks, is the most likely form of degradation. None of the forms of localized corrosion, including MIC, is considered very likely at all.

No pinhole leaks have been detected in any of the exposed piping to date.

Pinholes will have no effect on structural integrity in any event.

The videotapes from the detailed remote visual examination are for six lines in a total population of eight (which include the fifteen field welds). Conclusions drawn from them assume that they are representative of the population. Per CP&L, there are no field welds in the remaining two lines.

The overall condition of the welds, including the appearance of the tie-in at the edges of the consumable insert, is good to excellent. There are some areas, generally scattered around the circumference, where the consumable insert was not completely consumed (e.g., FW-516) or where the weld profile was less than ideal. The very small thickness required to withstand design service pressure and the successful hydrotest results provide a verification that these welds are suitable for the SFP Piping's service conditions despite the non-consumed areas or imperfect profile.

The plant's best method to control degradation is to continue to keep these lines isolated from potential sources of contaminants and to assure that the only environment that the lines experience is controlled purity water. Periodic visual examination of exposed piping for the presence leaks can provide continued additional assurance of the integrity of the SFP Piping population.

7.0 REFERENCES

1. "Alternative Examination Requirements for Class 1, Category B-J Piping Welds, Section XI, Division 1," ASME Code Case N-560, August 9, 1996.

2. "Revised Risk-Informed Inservice Inspection Evaluation Procedure," EPRI Report No. TR-112657 Final Report, April 1999.

3. "Minimum Wall Thickness Calculation for Spent Fuel Pool Cooling and Clean-up," Ebasco Services Incorporated Calculation CAR-6418-312, Rev. 0, 2-13-84.

4. "Hydrostatic Testing of Buried or Embedded Pressure Piping (Nuclear Safety Related)," Carolina Power & Light Company, Shearon Harris Nuclear Power Plant, Technical Procedure TP-30, Rev. 0, 1978.

5. "Hydrostatic Testing of Buried or Embedded Pressure Piping (Nuclear Safety Related)," Carolina Power & Light Company, Shearon Harris Nuclear Power Plant, Work Procedure WP-115, Rev. 3, 1982.

6. A. F. Deardorff, J.F. Copeland, A.B. Poole, L.C. Rinaca, "Evaluation of Structural Stability and Leakage From Pits Produced By MIC In Stainless Steel Service Water Lines," CORROSION/89, Paper No. 514, NACE, 1989.

7. W.A. Pavinich, L.C. Rinaca, P.V. Guthrie, D.M. Hewette, "Four-Point Bend Testing of MIC-Damaged Piping," Proceedings: EPRI Service Water System Reliability Improvement Seminar, EPRI, 1988.

8. G.J. Licina, "Sourcebook for Microbiologically Influenced Corrosion," EPRI NP-5580, 1988.

9. G.J. Licina, "Detection and Control of Microbiologically Influenced Corrosion – An Extension of the Sourcebook for Microbiologically Influenced Corrosion," EPRI NP-6518-D, 1990.

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CONTENTION TC-3: EXHIBIT 12

CP&L Special Plant Procedure SPP-0312T, Rev. 0

CAROLINA POWER & LIGHT COMPANY

SHEARON HARRIS NUCLEAR POWER PLANT

PLANT OPERATING MANUAL

VOLUME 4

PART 8

PROCEDURE TYPE: Special Plant Procedure

NUMBER: SPP-0312T

TITLE: Temporary Procedure For Remote Visual Examination Of Interior Welds And Surfaces Of Embedded Unit 2 Spent Fuel Pool Cooling Piping For "C" And "D" Pools. CTS Power Services Contract Number X0103269, Expires 12-31-99

REVISION 0

NOTE: This procedure has been screened per PLP-100 criteria and determined to be a Case III procedure. No additional management involvement is required.

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1.0 PURPOSE

The purpose of this procedure is to provide instructions for performing remote visual examinations of interior welds and surfaces of embedded piping for the Unit 2 Spent Fuel Pool (SFP) Cooling system. The results of these examinations will be used to determine if weld quality and interior surface conditions meet the acceptance criteria.

2.0 REFERENCES

1. CP&L Safety Manual.
2. MMM-011, Cleanliness, Housekeeping, Foreign Material Exclusion (FME) Classification and Work Practices.
3. NDEP-0606, Remote Visual Examination.
4. ASME Section III, ND-4424 Winter 76 Addenda
5. ANSI B31.1, Paragraph 136.4.2, 1980 Edition.
6. Corporate Welding Manual NGGM-PM-0003, NW-02 and NW-06.
7. NDEP-601, VT Visual Examination of Piping System and Component Welds at Nuclear Power Plants.
8. RMP-006, Quality Assurance/Vital Records Program.
9. OPS-NGGC-1301, Equipment Clearance.
10. R CP&L Letter Serial:HNP-99-069, dated 04-30-99.
11. R CP&L Letter Serial:HNP-98-188, dated 12-23-98.
12. EGR-NGGC-0005, Engineering Services Request.
13. NGGM-PM-0011, NDEP-A, Nuclear NDE Procedures and Personnel Processes.

3.0 PREREQUISITES

1. A clearance if necessary has been obtained per OPS-NGGC-1301.
2. All measuring and test equipment (M&TE) used to perform this procedure shall be within its current calibration cycle.
3. Scaffolding and/or temporary lighting have been installed, if necessary.
4. A Radiation Work Permit has been issued. ALARA job review and prejob briefings conducted as necessary.
5. Prior to and after each line inspection set-up, verify system resolution using a one mil diameter wire. Wire diameter shall be measured using calibrated equipment (i.e., micrometer). The system must be capable of resolving the one mil wire at the maximum and minimum distances and angles between the camera and inspection surface. If, during the inspection, distances or angles are used that are outside the previously verified parameters, the system shall be re-verified. The system verification shall be performed daily as a minimum.

4.0 PRECAUTIONS AND LIMITATIONS

4.1 Precautions

1. Comply with all applicable safety precautions outlined in the CP&L Safety Manual.
2. Ensure loose article control is maintained at all times when component covers are removed.

4.2 Limitations

1. If any discrepancies are encountered that cannot be resolved within the scope of this procedure, notify the appropriate Responsible Engineer or NDE Level III personnel.

2. Maintain accountability of materials and tools while performing remote visual examinations of SFP piping internals to satisfy the criteria of cleanliness and housekeeping per MMM-011 (Reference 2.2)

3. This procedure can be performed at any time providing the component being examined has been properly cleared, if required, per reference 2.9.

4. Vendor personnel operating the closed circuit television system need not be certified visual weld examiners. The television system operators shall display proficiency in performing their required functions.

5. Remote visual equipment used for examinations shall have resolution capability to discern a one-mil wire.

6. Personnel performing the visual examinations shall be CP&L certified Visual Weld Examiners. Certification shall be in accordance with reference 2.13. In addition, they shall have successfully completed the CP&L training course on remote camera equipment and/or have demonstrated their capability to utilize the equipment to the satisfaction of the NDE VT Level III, or designee.

5.0 SPECIAL TOOLS AND EQUIPMENT

1. CTS Power Services to provide closed circuit television system which includes: Internal Inspection Device, Camera-ELMO with Toshiba Power Pack or equivalent, Standard Color TV, Standard ½" VCR, 12-volt Power Pack for lighting, Videonics Video Titlemaker 2000, Javelin JV6000T flaw sizer, and head sets.

6.0 ACCEPTANCE CRITERIA

1. Accept/reject criteria as denoted below is applicable to the system/component being examined or those requirements provided by the appropriate engineering activity. A remote visual examination should be applicable to those attributes which determine the acceptability of the weld/surface being examined. An examination plan (checklist) of weld/surfaces to be inspected shall be prepared prior to the start of the examination. This is to ensure that none of the welds/surfaces to be examined are overlooked.

R 2. Acceptance Criteria for Embedded Spent Fuel Pool Piping.

Weld surfaces shall be free of the following defects:

- Cracks
- Lack of fusion
- Lack of penetration
- Oxidation ("Sugaring")
- Undercut greater than 1/32 inch
- Reinforcement ("Push Through") greater than 1/16 inch
- Concavity ("Suck Back") greater than 1/32 inch
- Porosity greater than 1/16 inch
- Inclusions

Note: Dimensions obtained should be accurate to within + or - 1/64 inch.

6.0 ACCEPTANCE CRITERIA (Continued)

3. Indication location (circumferential, side of weld i.e., upstream or downstream, etc.), length, and depth (where applicable) shall be documented on Attachment 1. Other indications, not referenced in paragraph 2 of this Acceptance Criteria, such as arc strikes, foreign material, mishandling, pipe mismatch, pitting, and MIC (microbiologically induced corrosion) shall also be recorded on Attachment 1 and evaluated by the Spent Fuel Pool Responsible Engineer (RE) as necessary. Evaluation will occur through the ESR process.

7.0 Documentation

1. Weld inspections shall be recorded and documented in accordance with Attachment 1 of this procedure. Examinations may also be recorded on video tape for future reference. Tape recordings should include voice overlay and proper labeling for the welds examined.

8.0 Records

1. Attachment 1 and tape recordings documented for each inspection are QA records

2. Weld documentation generated shall be turned over to Major Projects Section Document Control for inclusion in the approved work package for QA Records retention.

9.0 Attachments

Attachment 1 - Remote Visual Examination Data Sheet

Remote Visual Examination
Data Sheet

Sheet ____ of ____

System:			WR/JO Number:
Component ID / Weld Number:			Reference "0" Location: TDC of Weld ☐ North Side of Weld ☐
Recordable Condition Present	Yes	No	Comments
Cracks			
Lack of Fusion			
Lack of Penetration			
Oxidation			
Undercut Greater Than 1/32"			
Reinforcement Greater Than 1/16"			
Concavity Greater Than 1/32"			
Porosity Greater Than 1/16"			
Inclusion			
Arc Strikes			
Mishandling			
Foreign Material			
Pipe ID Mismatch			
Pitting			
MIC			
Other			

Comments/Notes:
Note: If recordable condition/indication is noted, record the following information: length/width, circumferential location, distance from the weld centerline, and side of the weld (upstream/downstream) condition/indication is located on.

Examiner: ____________________ Date: ____________________

APPROVALS

Spent Fuel Pool RE*: ____________________ Date: ____________________

ANII: ____________________ Date: ____________________

* SFP RE Coordinator review required if recordable conditions are noted.

QA RECORD

CONTENTION TC-3: EXHIBIT 13

Letter from Donna B. Alexander, CP&L, to US NRC
(October 15, 1999)

CP&L

Carolina Power & Light Company
Harris Nuclear Plant
PO Box 165
New Hill NC 27562

OCT 15 1999

SERIAL: HNP-99-156

United States Nuclear Regulatory Commission
ATTENTION: Document Control Desk
Washington, DC 20555

SHEARON HARRIS NUCLEAR POWER PLANT
DOCKET NO. 50-400/LICENSE NO. NPF-63
SUPPLEMENTAL INFORMATION REGARDING THE
LICENSE AMENDMENT REQUEST TO PLACE HNP
SPENT FUEL POOLS 'C' AND 'D' IN SERVICE

Dear Sir or Madam:

Enclosure 8 of the HNP license amendment request (ref. SERIAL: HNP-98-188, dated December 23, 1998) provided a detailed Alternative Plan for demonstrating compliance with ASME Boiler & Pressure Vessel Code requirements for spent fuel pool cooling and cleanup system piping in accordance with 10 CFR 50.55a(a)(3)(i). By letter dated March 24, 1999, the NRC issued a request for additional information (RAI) related to the Harris Nuclear Plant (HNP) license amendment request to place spent fuel pools C and D in service. The March 24, 1999 RAI included a request to identify each of the embedded field welds within the scope of the Alternative Plan. The HNP response (ref. SERIAL: HNP-99-069, dated April 30, 1999) provided a field weld matrix which identified the field welds to be inspected by using a high resolution remote video camera. The sample size was selected based on a feasibility walkdown with the camera vendor. CP&L has continued, however, to investigate alternative inspection methods with other vendors. Through these efforts with another vendor, CP&L has successfully performed a remote camera inspection of all 15 embedded field welds included within the scope of the Alternative Plan. In the course of the inspection, two field welds (2-SF-1-FW-3 and 2-SF-1-FW-6) which were not embedded in concrete, but within the scope of the Alternative Plan, were cut out to facilitate removal of piping to provide access for the camera inspections. An updated field weld matrix will be provided to reflect the removal of these two welds and the inspection of all 15 embedded field welds.

In addition, by letter dated April 29, 1999, the NRC issued an RAI related to the criticality control provisions in the HNP license amendment request. Item 1 of this RAI requested information regarding a postulated fresh fuel assembly misloading event. As a supplement to our June 14, 1999 response (ref. SERIAL: HNP-99-094) to requested item 1 of the RAI, we had our vendor, Holtec International, perform additional fuel assembly misloading analyses. The results of these analyses are included as an Enclosure to this letter. These analyses demonstrate that criticality will not occur as a result of the postulated misloading of a fresh fuel assembly in the spent fuel storage racks for HNP pools C and D.

This information is provided as a supplement to our December 23, 1998 license amendment request and does not change our initial determination that the proposed license amendment represents a no significant hazards consideration.

Please refer any questions regarding the enclosed information to Mr. Steven Edwards at (919) 362-2498.

Sincerely,

J.H. Eads for DBA

Donna B. Alexander
Manager, Regulatory Affairs
Harris Nuclear Plant

KWS/kws

Enclosure:

c: (all w/ Enclosure)

Mr. J. B. Brady, NRC Senior Resident Inspector
Mr. Mel Fry, N.C. DEHNR
Mr. R. J. Laufer, NRC Project Manager
Mr. L. A. Reyes, NRC Regional Administrator - Region II

Document Control Desk
SERIAL: HNP-99-156
Page 3

bc: (all w/ Enclosure)

Mr. K. B. Altman
Mr. G. E. Attarian
Mr. R. H. Bazemore
Mr. C. L. Burton
Mr. S. R. Carr
Mr. J. R. Caves
Mr. H. K. Chernoff (RNP)
Mr. B. H. Clark
Mr. W. F. Conway
Mr. G. W. Davis
Mr. M. J. Devoe
Mr. W. J. Dorman (BNP)
Mr. R. S. Edwards
Mr. R. J. Field
Mr. K. N. Harris
Ms. L. N. Hartz
Mr. W J. Hindman
Mr. C. S. Hinnant
Mr. W. D. Johnson
Mr. G. J. Kline
Mr. B. A. Kruse
Ms. T. A. Head (PE&RAS File)
Mr. R. D. Martin
Mr. T. C. Morton
Mr. J. H. O'Neill, Jr.
Mr. J. S. Scarola
Mr. J. M. Taylor
Nuclear Records
Harris Licensing File
Files: H-X-0511
H-X-0642

CONTENTION TC-3: EXHIBIT 14

CP&L ESR No. 95-00425, Rev. 0, Installation Section, Testing Requirements (excerpt, Section 12)

12.0 Testing Requirements

The Fuel Pool Cooling and Cleanup (FPCC) System, to support the activation of north fuel pools C and D, requires that a program be developed to identify the construction and/or system acceptance testing.

The FPCC System will be tested to verify compliance with the ESR design performance requirements, design basis document, and design drawing documents. These tests as listed herein will demonstrate that the FPCC System is meeting the specified performance and regulatory requirements. Prior to beginning testing all FPCC instrumentation installed by the ESR shall be calibrated.

The FPCC System consist of following sub-systems:

1) Cooling System
2) Cleanup System
3) Skimmer System

The Fuel Handling Building Filter Backwash System and Demineralized Water System, support systems to the FPCC System, have piping and components being activated by this ESR which will also require testing.

Supplemental QA requirements to be used to govern engineering, construction and startup of the ASME Section III, Class 3 portions of this modification are located in the Design Section of the ESR package under Design Input 26. The requirements relevant to construction and startup testing should be reviewed to assure that they are carried forward into the testing activities associated with this modification.

MODIFICATION & ACCEPTANCE TESTINGS

- **Weld Inspections of Piping System and Welded Attachments**

ASME Section III, Subsection ND-5200 will be followed to determine the types of weld examination required for new welds required to complete this modification. Refer to Section 13.0 for ANI review and certification requirements. The Alternative Plan submitted to the NRC must be reviewed for guidance and commitments regarding weld inspections performed on existing ASME Section III and B31.1 piping welds.

- **System Cleanliness and Flushing Test**

During the construction of FPCC modification, the system cleanliness shall be maintained in accordance with Maintenance Management Manual MMM-011, for Cleanliness Level B.

After the completion of FPCC system installation, a pre-operational system flushing will be performed to assure the proper cleanliness of the FPCC system.

A high level of cleanliness is required as evidenced by the following characteristics:

Corrosion-Resistant Alloys

1) The surface shall appear metal clean and free of organic films and contaminants when examined in accordance with para. 7.2.1 of ASTM A 380-78, practice for Cleaning and Descaling Stainless Steel Parts, Equipment, and Systems, except light deposits of atmospheric dust are permissible and shall show no evidence of deleterious contamination when subjected to the wipe test of para. 7.2.2 of ASTM A 380-78.

Summary for Cleanliness of the FPCCS:
Corrosion-resistant alloys

Surface Appearance – Metal Clean, but with temper films
Rust – 2 sq. in./1 sq. ft. (Scattered)
Paints or Preservatives – No requirement
Mill Scale – No requirement
Flushing Criteria – Free of contaminants such as sand, metal chips, weld slag, oil and discoloration.

SFPCC System filters and strainers shall be verified to be in working order and free of obstructions prior to release of the system for operation.

- **System Hydrostatic Testing in accordance with ASME Code**

After completion of the FPCC System's modifications, the hydrostatic testing will be performed in accordance with the ASME Code.

Post-Mod Testing

Piping segments in the FPCC System which have not been previously commissioned and, therefore, not subjected to hydrostatic leak testing shall be tested in accordance with the following requirements:

Boundaries for hydrotesting shall be consistent with sketches of the following flow diagrams in ESR Section 6.0:

- Drawing 2165-G-0307, Fuel Pools Cooling System Unit 2 (SK-9500425-M-2004)
- Drawing 2165-G-062, Fuel Pools Clean-up Systems (SK-9500425-M-2008)
- Drawing 2165-G-061, Fuel Pools Clean-up Systems (SK-9500425-M-2007)
- Drawing 2165-G-0847, Fuel Handling Building Filter Backwash System (SK-9500425-M-2010)
- Drawing 2165-G-0828, Spent Resin Transfer (SK-9500425-M-2012)
- Drawing 2165-G-0305, Fuel Pools Cooling System Unit 1 (SK-9500425-M-2001)
- Drawing 2165-G-049 S02, Potable & Demineralized Water Systems Unit 1 (SK-9500425-M-2013)

CONTENTION TC-3: EXHIBIT 15

Transcript of Deposition of R. Steven Edwards (October 19, 1999) (excerpts)

ORIGINAL

UNITED STATES OF AMERICA
NUCLEAR REGULATORY COMMISSION
DOCKET NO. 50-400-LA
ASLBP NO. 99-762-02-LA

In the Matter of:)
)
CAROLINA POWER AND LIGHT COMPANY)
)
(Shearon Harris Nuclear Power Plant))
)

- - - - - - - - - - - - - - - - - - -

DEPOSITION

OF

R. STEVEN EDWARDS

At the Harris Energy and Environmental Center
3932 New Hill-Holleman Road
New Hill, North Carolina

October 19, 1999
3:00 p.m.

B. JORDAN & CO.
CERTIFIED VERBATIM REPORTERS
P.O. BOX 3372 CHAPEL HILL, NORTH CAROLINA 27515 (919) 929-6592

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SUSAN C. UTTAL, ESQ.
Senior Attorney
OWFN-15B18
U.S. Nuclear Regulatory Commission
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(For the U.S. Nuclear Regulatory Commission)

Also Present

WILLIAM R. HOLLOWAY, PH.D., ESQ.

DR. GORDON THOMPSON

DAVID LOCHBAUM

DONALD G. NAJOCK

JOHN R. CAVES, P.E.

designates approval of the data collection.

Q Oh, I see. Is the procedure an approved procedure?

A Yes, it is.

Q Is this the procedure that was used in both the inspection conducted in July and September of this year?

A This is the procedure that was used in July of this year. We had to make--we changed vendors. Where this procedure references CTS Power Services, we had to make a revision to the procedure to use a different vendor.

Q But that's the only change to the procedure?

A Yes. It references the vendor that is performing the inspection. That would be on the cover sheet and then again on page 4 of six, item 5.1.

Q Would you turn to page 4, which contains the acceptance criteria in Section 6?

A Yes.

Q Is it correct that these acceptance criteria cover only inspection of welds and not piping?

A The intent of this--and if you look at item 2 there, it specifically includes the word "piping." And up at the top of the second page, item number 3, where we look specifically at things like mismatch, mishandling, arc strikes, pitting, corrosion, et cetera, those statements were included, specifically to make sure we were looking at piping and welds.

Q What is meant by the term "foreign material" in paragraph 3?

A Foreign material would be any item that you would not generally anticipate being there.

Q Would it include slime or any other kind of surficial coating?

A No. It would include things like debris, that sort of thing.

Q What are arc strikes?

A That's from the welding process where the welding rod would strike an area and leave a noticeable location.

Q If you look at Section 7--

A Yes.

Q --under "Documentation," it refers only to weld inspections, doesn't it?

A Yes, it does.

Q I'm going to ask you to look at Exhibit 20, which I think we've passed out.

A No.

Q We haven't? Okay.

I'd like to ask the court reporter to mark Exhibit 20, which is an engineering service request, ESR Number 99-00266, Revision 0, originator, Robert J. Lane, titled "Evaluate Units 2 and 3 SFP Cooling Embedded Piping."

(Whereupon, Deposition Exhibit No. 20 was marked for identification.)

(Witness reviews document.)

Q Are you familiar with this document?

A Yes.

Q Is this a draft document or a final document?

A This is a draft.

Q On the first page of this document--I guess it's the second page, page 1, page 2--under the word "request" it says that the request was to "evaluate the results of internal inspection of embedded Unit 2 and 3 SFP cooling system piping." Is that correct?

A Yes. That's what it says.

Q However, if we turn to the next page and we read the response, under both sections, "Scope Description" and "Evaluation," isn't it correct that the report refers to the examination of "6 of 15 embedded piping welds"?

A It does refer to six welds, yes.

Q So that it appears that the reviewer who wrote this report limited his or her evaluation to the condition of the welds.

A I'm not sure what you're asking.

Q Is this report limited to an evaluation of the welds?

A This particular evaluation, if you look back at the procedure, what it tells you is if you have recordable indications, then it's evaluated in an engineering evaluation by the responsible engineer.

So the purpose of this would be to evaluate any indications that the Level 2 NDE inspector would have identified here. So whatever indications he identified, then this evaluation would address those.

Q Well, under "response" in the paragraph entitled "Scope Description," wouldn't you think that scope description would describe what the reviewer set out to discuss?

A And again, this is a draft unreviewed document. I'm sure that would be one of the very first review comments that would come in when it's reviewed.

Q Has the ESR been issued in final form?

A No.

Q What remains to be done?

A Completing the evaluation.

Q What are the steps necessary to complete the evaluation?

A In this particular evaluation, as you noted, it only references the first six. It doesn't reference anything in the second nine as well as what other information that the engineer is waiting on.

I'd have to ask him directly what additional steps and activities he has to conduct to complete his evaluation and make it ready for formal review.

Q In the July inspection and the subsequent inspection, were any weld defects noted?

A This particular evaluation references an indication that was identified by the QC inspector on one of the welds, field weld 516. So it appears based on the way it's written there was one weld which had recordable indications. It doesn't necessarily mean it's a defect, just that something is recordable.

Q Does CP&L plan any follow-up to this?

A As stated in the procedure, any time there are recordable indications, they have to be evaluated and dispositioned.

Q How would they be evaluated?

A They would be evaluated through the engineering service request process.

Q Has CP&L made any decisions about what actions it would take, specific actions, to evaluate this further?

A Since this is a draft unreviewed document, that has not been completed.

Q Is CP&L contemplating any further examinations of the welds?

A I can't answer that question.

Q Why? Because you don't know?

A I know only what I'm contemplating. I can't speak for what anyone else is contemplating. So when you say "CP&L"--

Q All right. Well, please tell me what you're contemplating.

A I personally have no additional plans to do any more inspections.

Q When the welds were inspected, before they were inspected, were the welds cleaned?

A Initially what we did is we decided we would go in and do an as-found inspection to see whether or not the interior surface was conducive to getting a good quality inspection that the QC inspectors felt they could identify any indications.

Upon doing that on the first couple of welds, they decided with the surface film on the inside of the piping that it needed to be cleaned in order for them to get a good quality inspection.

Q How were they cleaned?

A With a hydro laser.

Q With a hydro laser?

A Yes.

Q What kind of a process is that?

A It's basically a high-pressure garden hose.

Q It sounds a lot fancier than that.

Was any chemical analysis performed of the surface film layer?

A Not to my knowledge.

MS. CURRAN: This is a good breaking point for me. Do you want to take a 10-minute break?

MR. O'NEILL: Sure.

(Whereupon, a brief recess was taken.)

Q Okay, Mr. Edwards. I'd like to go back in time to the construction phase and the point at which the piping for pools C and D was hydrotested. Do you know what quality water is used for a hydrotest?

A Off the top of my head--I'd have to go back and look at the hydro procedures to see what it allowed.

Q But CP&L has a procedure for what's permitted?

A Yes.

Q Are you aware of any record as to whether water used in the hydrotest was drained after the test was done?

A It would have been drained, because it was open on both ends subsequent to that.

Q How do you know?

A Well, because the piping that we're completing now is the portion that extends in the accessible area. So what was completed at that time would have been the piping that was embedded in order to support completion of the building and the spent fuel pools.

The later piping, which was not completed, is the piping then directly subsequent to that, which would connect up to the heat exchangers and the pumps. And that's still not in place.

Q So the pipes are plugged for the hydrotest, right?

A Yes.

Q But then the plugs are removed after the hydrotest?

A Yes. That's correct.

Q And that's a standard--

A Right.

Q --procedure.

A Yes. Generally, the plugs are used in multiple locations. So you don't have a specific plug for a specific location. You have specific-sized plugs. And remember, during the construction they're doing hundreds of hydros. So they would move from location to location.

Q Do you know for a fact that if the plugs were removed that all of the water used in the hydrotest would have been emptied from the pipes?

A I would expect it to, yes.

Q I'd like to go to Exhibit 9, which is CP&L's response to--their April 30, 1999, response to the NRC's request for additional information. I think you may already have a copy of that. But if you don't, could you get one from the court reporter?

A That's Number 19?

MR. O'NEILL: Nine.

Q Nine.

A I do not have 9.

(Witness reviews document.)

Q Are you familiar with this document?

A Yes.

Q Did you supervise the preparation of this document?

A Yes, I did.

Q Would you turn to page 3 and look at the bottom paragraph, number v, small Roman five?

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USNRC

UNITED STATES OF AMERICA
NUCLEAR REGULATORY COMMISSION
BEFORE THE ATOMIC SAFETY AND LICENSING BOARD '00 JAN -6 A9:41

In the Matter of	)	
	)	
CAROLINA POWER & LIGHT	)	Docket No. 50-400 -OLA
(Shearon Harris Nuclear	)	ASLBP No. 99-762-02-LA
Power Plant)	)	
	)	

CERTIFICATE OF SERVICE

I certify that on January 4, 2000, copies of the foregoing ORANGE COUNTY'S SUMMARY AND SWORN STATEMENT ETC. WITH RESPECT TO QUALITY ASSURANCE ISSUES and ORANGE COUNTY'S SUMMARY AND SWORN STATEMENT ETC. WITH RESPECT TO CRITICALITY ISSUES, including all appendices and exhibits (with the exception of videotapes, which could not be served by electronic mail) were served on the following by e-mail and/or first class mail as indicated below:

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