EXHIBIT 8

NUCLEAR REGULATORY COMMISSION

Before the Atomic Safety and Licensing Board

In the Matter of	)	
	)	
CAROLINA POWER & LIGHT COMPANY	)	Docket No. 50-400-LA
	)	
(Shearon Harris Nuclear Power Plant)	)	ASLBP No. 99-762-02-LA

COUNTY OF WAKE	)	
	) ss:	
STATE OF NORTH CAROLINA	)	

AFFIDAVIT OF AHMAD A. MOCCARI, PH.D.

I, Ahmad Moccari, being duly sworn, do on oath depose and say:

1. I am a scientist specializing in corrosion. I have a Ph.D. in metallurgical engineering awarded by Ohio State University in 1974. I was an associate professor of materials science and engineering at Shiraz University in Iran from 1974 to 1979, and a Research Associate at Ohio State University's Fontana Corrosion Center from 1979 to 1982. At the Fontana Corrosion Center, I conducted research on the corrosion of various materials used in nuclear power plants, including Type 304 stainless steel. (Type 304 stainless steel is the material from which the piping in the spent fuel pool cooling and cleanup system ("SFPCCS") associated with Harris Nuclear Plant spent fuel pools C & D is made.) I am a member of the National Association of Corrosion Engineers and the American Society of Metals. I have been employed as a senior engineer by the Carolina Power & Light Company ("CP&L") since 1982. A copy of

my curriculum vitae is Attachment A to this affidavit. My business address is Carolina Power & Light Company, Harris Energy and Environmental Center, 3932 New Hill-Holleman Road, New Hill, North Carolina 27562.

2. While working for CP&L, I have carried out corrosion studies, failure analyses, and material identifications. I have analyzed both metallurgical and mechanical failures, as well as failures resulting from environmental factors. I have evaluated methods of controlling corrosion and scaling in water-cooled equipment, evaluated corrosion inhibitors, and evaluated methods of detecting bacteria in the field and in the laboratory. Some years ago, I was responsible for the evaluation of the cause of pitting corrosion in stainless steel piping at another of CP&L's nuclear plants. I determined that the cause of the pitting in a service water system pipe was an aggressive attack of an iron oxidizing bacteria. (In that case the source of the water in the service water system was lake water.) I was able to simulate the environment in the pit to assist in the choice of material for sleeving the damaged piping and eventually replacing sections of the piping.

3. In May of this year, I tested water samples from the SFPCCS piping associated with Harris Nuclear Plant spent fuel pools C and D. Those tests confirmed that there are no bacteria in the piping that might cause microbiologically influenced corrosion ("MIC"). These test results were expected because the high purity water (borated, demineralized) water in the piping effectively precludes such bacteria.

4. After the water in the SFPCCS piping was drained, the interior condition of the piping was inspected using a video camera mounted on a pipe crawler. I have reviewed the videotapes from that inspection. Those tapes show that the condition of the piping is very good. There are only a few areas of discoloration resulting from some deposits near some welds that

might indicate some slight corrosion that, at worst, would have no significant impact on the structural integrity or expected life of the piping.

5. I have tested the deposits removed from the piping. The deposits are almost entirely iron oxides, not the corrosion products associated with corrosion of Type 304 stainless steel.

6. In this affidavit I report (1) the results of tests that I performed in May 1999 to determine whether nuisance bacteria were present in the water samples from the SFPCCS piping; (2) my observations and conclusions regarding the condition of this piping, based on my review of videotapes from a video camera inspection of the internals of the SFPCCS piping embedded in the concrete walls and floor of spent fuel pools C and D; and (3) the results of the tests I conducted to characterize the microbiological nature of the localized, reddish-brown deposits on field weld 2-SF-144-FW-517 in the SFPCCS piping. I attach a copy of the report I prepared on the water samples (Technical Report 99-90, dated May 12, 1999) as Attachment B and a copy of the report I prepared on the condition of the SFPCCS piping (Technical Report 99-179, dated December 16, 1999) as Attachment C. The information in Attachment B and Attachment C is true and correct to the best of my information and belief.

Analysis of Water Samples

7. In May of this year I was asked to analyze seven water samples — one taken from each of the drain valves at the low points in seven SFPCCS piping lines. I was asked, in particular, to determine whether nuisance bacteria were present in the seven water samples that could potentially cause MIC (microbiologically influenced corrosion) in the piping. These low points are where any bacteria or sediment would most likely be found. I first performed standard laboratory analyses to determine the presence and aggressivity of sulfate-reducing bacteria,

slime-forming bacteria, iron-related bacteria, and heterotrophic aerobic bacteria and then prepared a report on the results of my analyses. (Attachment B.)

8. My analyses indicated that no nuisance bacteria capable of causing MIC were present in any of the seven water samples. Bacteria levels of any kind were low. The levels of sulfur reducing bacteria ranged from under 1,000 cells per milliliter (or below the lowest level that the test I used could detect) to 100,000 cells per milliliter (which is generally considered low). These results were expected because the piping had been flooded with borated, demineralized water for as long as ten years. This borated, demineralized water would not be either a source for bacteria or an environment conducive to sustaining bacteria capable of causing MIC. In fact, flushing with demineralized water and filling a pipe that had been subject to MIC with demineralized water would be a recommended action to lower the bacteria counts and consequently arrest MIC. Furthermore, if MIC were a problem in the SFPCCS piping, leaks from pinholes should have developed in the piping many years ago. I understand that no such leaks have been detected in the accessible piping where leaks would have been very obvious. The accessible piping has been inspected on the outside and in some places on the inside diameter and no leaks have been detected.

9. Levels of other impurities that could potentially cause corrosion inside the piping were also very low. I have reviewed plant records that show the chemical analysis of the water that remained in the piping for a number of years and it measured very low concentrations of chloride, fluoride and sulfate and measured low conductivity.

10. In short, analysis of water samples indicated that there should be no significant corrosion inside the piping.

Videotapes of SFPCCS Piping

11. In September of this year, over several days and for a total time of between twelve and fifteen hours, I reviewed videotapes of the inside of all the SFPCCS piping embedded in the concrete walls and floor of spent fuel pools C and D. After the water had been drained from the piping, a small video camera mounted on a wheeled carriage was maneuvered through the piping. The video camera was able to take high quality pictures of everything on the inside of the SFPCCS piping – longitudinal welds, circumferential welds, and the piping's inside surfaces. The camera work was very professional. The light clearly illuminated the surfaces examined. Areas of interest were inspected from a number of different angles as the camera moved back and forth over the same surface. I was able to inspect the piping and welds easily. The videotapes emphasized the welds in the embedded sections of the piping, both longitudinal (from the original fabrication of the piping) and circumferential (where lengths of piping are connected), but the videotapes showed the interior surface between circumferential welds as the camera moved through the piping. I looked for any surface irregularity, any indication of corrosion. The images were very clear. I could even see machine marks left from the time the pipe was manufactured. I could see some yellowish-white surface film in some areas of the piping which appears to be, and most likely is composed of, boric acid crystals from the borated, demineralized water that has leaked into the piping from the spent fuel pools. I examined every one of the 15 field welds in the embedded sections of the piping. In all of them, I saw only one indication, which appeared to be a pinhole. The condition of the inside of the piping was very good. There were, however, some reddish-brown deposits or areas of staining near some welds. These localized deposits and staining might conceivably have been indications of corrosion at or adjacent to the welds.

Characterization of Surface Deposits in the SFPCCS Piping

12. Field Weld 517 in the SFPCCS piping showed three spots with reddish-brown deposits potentially indicating corrosion. During the initial remote visual inspection of this field weld, however, it was impossible to make out any surface discontinuities at these locations because the deposits obscured the surface of the metal. After the deposits were removed at two locations (with high-pressure water), the metal surface of the piping appeared intact. Some of the deposits were still present at the third location, making it impossible to judge conclusively whether or not there may be a surface discontinuity (such as a pit, pinhole or crack) under the remaining deposit. Some of these deposits were scraped off for analysis to determine whether bacteria that cause MIC were present. I reviewed the videotape that showed the deposit sample being removed from Field Weld 517. As described in more detail in my technical report attached as Attachment C, I conducted three bacteria detection tests on this sample.

13. First, I used a Rapidchek™ II Kit to determine the level of sulfate-reducing bacteria (if any) in the sample. The Rapidchek test showed no detectable levels of sulfate-reducing bacteria.

14. Second, I used an Easicult™ S culture tube to confirm the results of the Rapidchek test. This culture tube provides an environment that fosters the growth of any sulfate-reducing bacteria in the sample, resulting in the formation of black iron sulfide. If sulfate-reducing bacteria are present, either part or all of the culture tube will turn black, depending on the amount of bacteria present in the sample. After five days (the culturing time recommended by Easicult's manufacturer's), there was no blackening at all, confirming that no sulfate-reducing bacteria were present.

15. Third, I used a BART™ kit — which involves culturing for up to two weeks — to determine whether any bacteria present were aggressive enough to cause MIC. (Not all bacteria are aggressive enough to cause corrosion.) Tests with the BART kits further confirmed that no bacteria capable of causing material degradation due to MIC were present in the deposit sample from the SFPCCS piping.

16. Finally (as described in detail in Attachment C), I used a scanning electron microscope with an energy dispersive x-ray spectrometer attachment to determine the elemental composition of the reddish-brown material from the SFPCCS piping. A x-ray diffractometer was then used to identify the chemical compounds present. The scanning electron microscope/energy dispersive spectrometer showed that the reddish-brown material consists primarily of iron and oxygen (most likely iron oxide) with lesser and varying amounts of silicon, aluminum, carbon, calcium, chromium, nickel, sodium, magnesium, nickel, potassium, zinc, and chlorine. X-ray diffraction analysis of the deposit sample showed this sample to consist primarily of iron oxide (a mixture of hematite (α-Fe_2O_3) and lepidocrocite (FeOOH)) and possibly graphite. It is not clear exactly what chemical compounds these other elements compose. The patterns revealed by the x-ray diffraction did not match any of the published patterns for aluminum silicates or calcium-aluminum silicates. Apart from the iron oxides, however, the deposits appear to be largely particulate in structure, including small fragments of what appears to be stainless steel. The presence of these particulates and small metallic fragments suggests that the deposits do not reflect corrosion of the piping at the welds. Rather, the weld itself appears to have acted as a site at which crud has simply accumulated. This is what would be expected where corrosion-resistant stainless steel has been exposed to demineralized water at relatively low temperatures.

17. Based on the observations of the other spots where the reddish-brown deposit was removed, analysis of the deposits, and the condition of the remainder of the piping and field welds, it is unlikely that any defect would be found at Field Weld 517. In any event, a pit or small crack would have no effect on the piping's structural integrity. The deposits and staining near some welds in the SFPCCS piping clearly could not have been the result of active MIC because the bacteria required to cause MIC could not be detected either in the water that was in the piping or in the deposits.

18. Because measured concentrations of chloride, fluoride, and sulfate in the water are very low and temperatures are below 200°F, no other form of corrosion of the stainless steel would be expected other than MIC. The appearance of the welds I examined supports this general conclusion.

19. A small linear indication was observed near field Weld 515 (2-SF-144-FW-515) that seems to extend out from the circumferential seam weld. There is no known degradation mechanism that could have caused this stainless steel piping to crack. The possibilities are intergranular stress-corrosion cracking (IGSCC), transgranular stress-corrosion cracking (TGSCC), and corrosion fatigue (cracking caused by simultaneous presence of cyclic stress and a corrosive environment). IGSCC and TGSCC crack stainless steel only where three conditions are met: (1) tensile stress, (2) a specific corrosive environment and (3) a susceptible material. Only one of the three (high stresses) even hypothetically could exist in the SFPCCS piping. The environment of borated, demineralized water with very low impurities (such as chloride, fluoride, and sulfur) and low electrical conductivity to which the piping is exposed is not corrosive enough, and the near-ambient temperature is much too low. IGSCC are TGSCC both impossible under these conditions. Corrosion fatigue is not possible either because the line

is embedded in 4 to 6 feet of concrete and can not be subjected to cyclic loading. The linear indication appears to be a manufacturing artifact, not corrosion.

20. Field Weld 516 (2-SF-144-FW-516) shows four locations where corrosion halos/rust streaks appear on or near the weld. However, no pitting or pinholes are associated with these discolored/streaked areas. Corrosion halos and rust streaks have no effect on the structural integrity of the piping. They are no cause for concern. Field Weld 516 appears to show some small areas where the consumable insert in the weld did not completely melt. Close inspection of the consumable insert, however, revealed that the insert was completely fused on its edges. No crevices appear that would provide a potential site for crevice corrosion.

21. Field Weld 519 (2-SF-143-FW-519) appears to have rust streaks/stains and yellowish-white deposits (most likely boric acid crystals) which have obscured a good portion of the weld root. One pit-like indication initially appeared to be associated with one of the rust streaks and with a halo. Upon close inspection from a number of different angles as the camera moved back and forth, however, I concluded that this is not a pit or other defect at all. It is most likely the start and stop of the weld which has acted as a nucleation site for crud to accumulate.

22. In sum, analysis of water samples from the SFPCCS piping indicates that corrosion should not have occurred in the piping. Absence of bacteria in the deposits found at or near some welds confirms that microbiologically influenced corrosion — the only form of corrosion that could possibly have occurred under the conditions in the piping — did not occur. And close examination of the welds that show some possible indications of corrosion largely confirms that corrosion has not occurred at those locations. Deposits found there appear to be crud that has simply collected there. In any event, if there is any actual corrosion at those

locations, it is so minor and so superficial that it can have no significant effect on the structural integrity of the piping.

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

Executed on December 22, 1999.

Ahmad A. Moccari

Ahmad A. Moccari

Subscribed and sworn to before me this
22nd day of December, 1999.

Lisa M. Randall

Lisa M. Randall -(Notary Public - Wake Co.)

My commission expires 6-7-2003

LISA M. RANDALL NOTARY PUBLIC WAKE COUNTY, N.C.

RESUME

NAME:	Ahmad Alexander Moccari
BUSINESS ADDRESS:	Carolina Power & Light Company Harris Energy and Environmental Center 3932 New Hill-Holleman Rd. New Hill, NC 27562
PHONE:	(919)362-3438
EDUCATION:	Ph.D. The Ohio State University Columbus, Ohio, September 1974, Metallurgical Engineering (corrosion)
	M.S. University of Miami, Coral Gables, Florida, January 1970, Mechanical Engineering
	B.S. (Honors) Tehran Institute of Technology, Tehran, Iran, June 1964, Welding Engineering

JOB EXPERIENCE:

Dec. 1982 until present

Senior Engineer, Carolina Power & Light Company, Harris E&E Center, New Hill, NC

Performed corrosion studies, failure analysis, and material identification for Nuclear Plants, Fossil Plants, Hydro Plants, Transmission, and Legal Department. Failure analysis activities included metallurgical, mechanical, and environmentally-induced failure. Corrosion evaluation activities included control of corrosion and scaling problems in water-cooled equipment, corrosion inhibitor evaluations, bacteria detection in the field and in the laboratory, field failure analysis of steam drum, and the development and evaluation of surface modification that has eliminated the sticking problem of safety relief valves for BWR nuclear power plants (patent pending).

1979-1982

Research Associate, Fontana Corrosion Center, Ohio State University, Columbus, Ohio

JOB EXPERIENCE:
(CONTINUED)

Conducted research on the stress-corrosion cracking and corrosion fatigue of turbine blade and disc alloys in simulated steam turbine environments at room and high temperatures. Other research carried out during this period included studies of the effect of flow rate on the corrosion behavior of 90/10 Cu-Ni alloy (condenser tube material) in NaCl solution by using A.C. impedance, small-amplitude cyclic voltammetry and Tafel extrapolation methods; electrochemical screening of organic and inorganic inhibitors for the corrosion of disc alloy in concentrated sodium hydroxide solution; and corrosion fatigue crack propagation rate of Inconel 600 and Type 304 stainless steel in simulated PWR primary environments.

1974-79 — Associate Professor, Shiraz University, Materials Science, and Engineering Department, Shiraz, Iran

Taught undergraduate courses in corrosion, physical metallurgy, mechanical metallurgy, thermodynamics, and welding. Other responsibilities included being Dean of students of the Engineering School and Director of the Material Science and Engineering Department.

1970-74 — Graduate Research Associate, Department of Metallurgical Engineering, Ohio State University, Columbus, Ohio

Carried out research on the corrosion fatigue of Type 304 stainless steel in NaCl + H_2SO_4 solutions at room temperature and the wear study of metallic and plastic implants in simulated body environment.
Professor in charge: R. W. Staehle

1968-70 — Graduate Research Assistant, Department of Mechanical Engineering, University of Miami, Coral Gables, Florida

Studied the effect of vacuum on the creep-rupture behavior of Type 316 stainless steel.
Professor in charge: B. King

MEMBERSHIPS:

1 - The National Association of Corrosion Engineers (NACE International)
2 - American Society of Metals (ASM International)

AHMAD A. MOCCARI, Ph.D.

Publications

1. "Effects of Vacuum on the Creep-Rupture Behavior of Type 316 Stainless Steel," MS Thesis, University of Miami, Coral Gables, Florida, January(1970)

2. "Corrosion Fatigue of Type 304 Stainless Steel in H_2SO_4/NaCl Solution at 25°C,"Ph.D. Dissertation, University Microfilms, Ann Arbor, Michigan (1975).

3. "Studies on the Oxidation and Spalling Resistance of Austenitic Stainless Steels," with S.I. Ali, British Corrosion Journal, Second Issue (1979).

4. "Effect of Chloride and H_2S on the Oxidation Resistance of Various Stainless Steels," with S.I. Ali, British Corrosion Journal, Third Issue (1979).

5. "An Investigation of Stress Corrosion Cracking of MgAZ61 Alloy in 3.5% NaCl + 2% K_2CrO_4 Aqueous Solution at Room Temperature," with C.R. Shastry, Z. Werkstofftech, 10, 119-123 (1979).

6. "Inhibition of Stress Corrosion Cracking of Type 403 Stainless Steel Steam Turbine Blade,"with B. Bavarian and D.D. Macdonald, Corrosion, Vol. 38, No. 2, February (1982).

7. "Effect of Silicate and Phosphate on the Corrosion Fatigue Crack Growth Rate in Type 403 Stainless Steel in Concentrated Sodium Chloride and Sodium Hydroxide Solutions," with Wen-Ta Tsai and D.D. Macdonald, Corrosion, Vol. 39, No. 1, January (1983).

8. "Development of Controlled Hydrodynamic Techniques for Corrosion Testing," with T.Y. Chen, and D.D. Macdonald, MTI Publication No. T-3

9. "Stress Corrosion Cracking of ASTM A-470 Turbine Disc Steel in LP Steam Turbine Environments,"with S. Somuah, P. Chung, A. Boating, S. Smialowska, H. Gailey, and D.D. Macdonald, Proceedings of the International Symposium on Environmental Degradation of Materials in Nuclear Power Systems held in Myrtle Beach, NC, August (1983).

10. "Effect of Potential on the Corrosion Fatigue Crack Growth Rate in Type 304 Stainless Steel in Sodium Sulfate Solution at 250°C,"with Wen-Ta Tsai, S. Smialowska, and D.D. Macdonald, Corrosion, Vol, 40, No. 11, November (1984).

11. "Electrochemical Screening of Organic and Inorganic Inhibitors for the Corrosion of ASTM A-470 Steel in Concentrated Sodium Hydroxide Solutions," with D.D. Macdonald, Corrosion, Vol. 41, No. 5, May (1985).

12. " Evaluation of Aluminum Alloy Anodes for Aluminum/Air Batteries," with D.D. Macdonald, K.H. Lee, and D. Harrington, Corrosion, Vol. 44, No. 9, 1988.

13. " Development of Controlled Hydrodynamic Techniques for Corrosion Testing," with T.Y. Chin and D.D. Macdonald, Corrosion, Vol. 48, No. 3, March (1992).

14. "Evaluation of Corrosion Inhibitors for Component Cooling Water Systems," with D.B. Alexander, Corrosion, Vol. 49, No. 11, November (1993).

15. "Corrosion Inhibitor Evaluation for Materials Used in Closed Cooling Water Systems," Materials Performances, Vol. 38, No. 9, September (1999)

CAROLINA POWER & LIGHT COMPANY
MATERIAL SERVICES SECTION
METALLURGY SERVICES

TECHNICAL REPORT

To: Mr. Steve Edwards

Project Number: 99-90
Date: May 12, 1999
Reviewed by:

Investigators:
Ahmad A. Moccari

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

Approved by: R. J. Block
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.

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[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.

CAROLINA POWER & LIGHT COMPANY
MATERIAL SERVICES SECTION
METALLURGY SERVICES

TECHNICAL REPORT

To: Mr. Steve Edwards	**Project Number:** 99-179
	Date: December 16, 1999
Investigators:	**Reviewed by:**
Danny Brinkley	KEVIN E JOHNSTON
Ahmad Moccari	
Distribution:	**Approved by:** 12/16/99
Mr. Robert Lane/HNP	
File/Metallurgy Services	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.

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.