Geoff Schwartz x6684

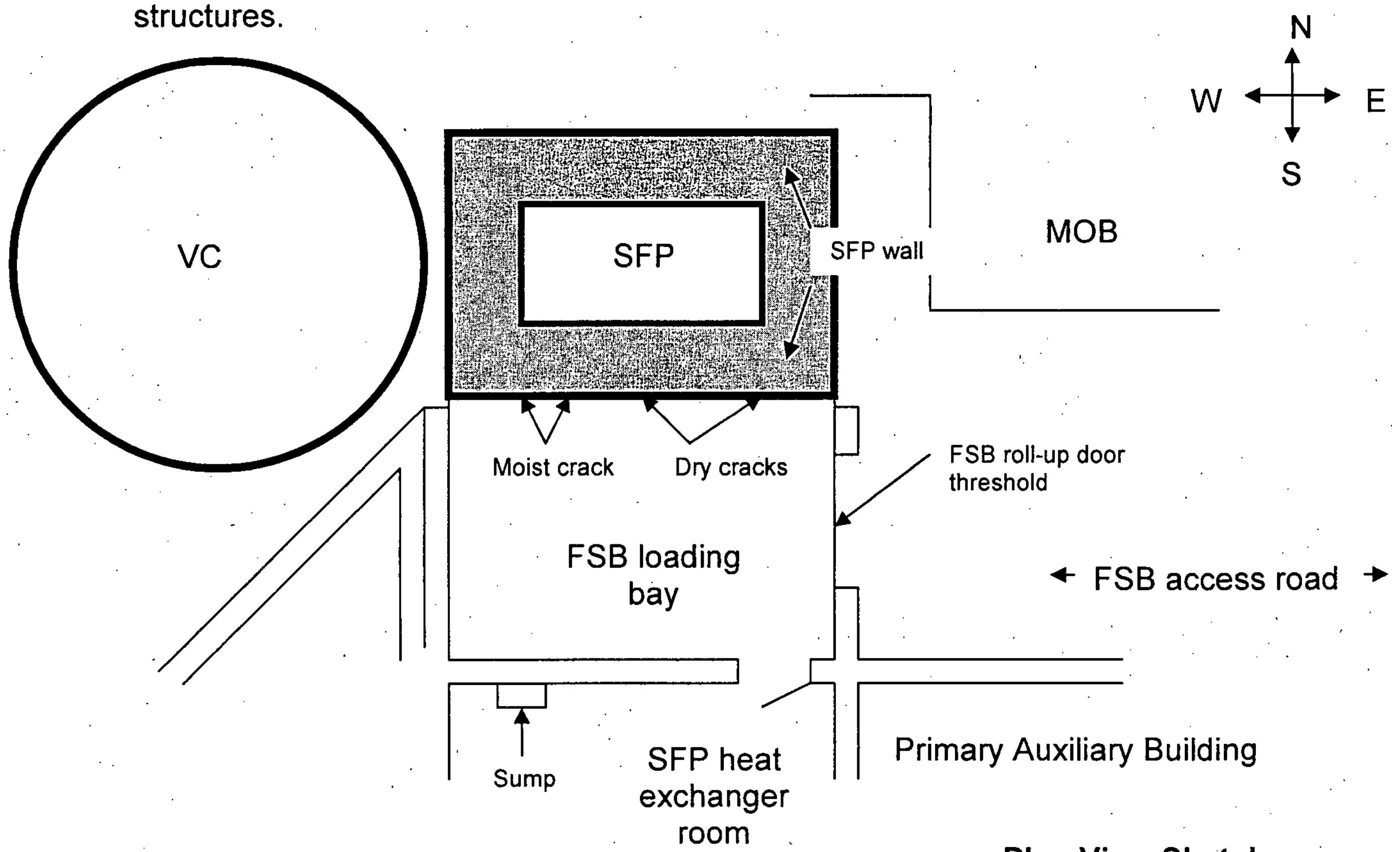
# Hairline Crack in IPEC Unit 2 Spent Fuel Pool South Wall

Revision 4, 9/15/05

**Note:** The discussion below up to the point of the Action Plan is a baseline technical discussion which will not be revised until the issue is resolved. Updates such as additional discoveries in the field and completion of Action Items are provided in the Action Plan section. **To go directly to the summary update and Action Plan, scroll to Page 6.**

## Location of issue

This paper discusses hairline concrete cracks, one of which is moist, discovered in the south wall of the IPEC Unit 2 Spent Fuel Pool (SFP), at an elevation of approximately 65 feet and above. The SFP is a seismically designed structure adjacent to Unit 2 Vapor Containment (VC) (to the west of the SFP), the Maintenance Outage Building (MOB) (to the north and east of the SFP), and the Fuel Storage Building (FSB) loading bay (to the south of the SFP). In order to meet seismic design requirements, the SFP is not supported by adjacent structures.




**Plan View Sketch**
**Not to Scale**

The top of the SFP base slab is at an elevation of 54 feet 7 inches. The SFP has a horizontal construction joint at elevation 75 feet, and the top of the pool wall is at elevation of 95 feet. In addition to the above sketch, an elevation sketch and photograph of the moist crack are attached as separate documents.

**Background**

IPEC is in the process of implementing dry cask storage capability for Unit 2. This requires that the Fuel Storage Building (FSB) loading bay floor be removed and replaced with a significantly more substantial structure. The original floor has been removed, and excavation of soil and rock in the loading bay is in progress. During removal of loose soil and rocks in the north area of the loading bay (along the SFP south wall), approximately horizontal cracks were exposed at an elevation of approximately 65 feet, and an approximately vertical crack above. The cracks are very narrow (less than 1/64-inch wide). One of the cracks, on the west side of the south SFP wall, has moisture in and near it.

**SFP wall structure**

In the area of the crack, the SFP wall is 4 feet thick, heavily reinforced concrete. The inside of the SFP is lined with ¼-inch stainless steel plate anchored to the concrete, so that the plate and concrete are in contact and the interface area between the plate and concrete is very narrow. The cracks have been visually inspected by an IPEC civil/structural engineer, and the IPEC Supervisor of Civil/Mechanical Engineering. The condition is typical of cracking due to shrinkage during post-construction concrete curing. The moisture in and around one of the cracks is very slight, essentially a film which is not dripping or beading. The moisture has been analyzed and found to contain trace amounts of Cesium 134 and 137, Cobalt-60, and Boron. The Boron concentration is about 6 to 15 times less than the concentration in the SFP, and the ratio of Cesium-134 to 137 indicate the activity is about 6 to 10 years old. The crack has calcium stains emanating from it, as is expected when moisture leaches through concrete, and no visual evidence of steel corrosion products (rust). Due to the thickness of the SFP wall, amount of steel reinforcement, and lack of evidence that the small amounts of moisture and boron have caused corrosion of the reinforcing rods, there is reasonable assurance that the SFP wall is structurally sound and capable of performing it's intended function.

**Potential sources of moisture**

The moisture in and around the crack could be from one or a combination of several sources.

1. A leak, either active or in the past, through the SFP stainless steel liner, allowing pool water to enter the narrow space between the liner and the concrete, and leach through the wall into the crack.

    a. The Unit 2 SFP does not have a leak detection system. Usually such a system consists of a drain path fro a void space between the pool wall and the stainless steel pool liner (Unit 3 has such a leak detection system). The Unit 2 stainless steel liner is attached directly to the concrete wall. An active leak, depending on it's age and volume, could be determined when it develops by a change in frequency of pool water make-up and/or a change in pool boron concentration. A discussion with Unit 2 licensed operators indicated the frequency of make-up has not changed, other than that expected due to seasonal changes in pool water evaporation rate, and as a separate attachment to this paper, a trend graph of boron concentration in Unit 2 SFP is attached indicating no unexpected/unexplained loss of boron. However, due to the lack of a leak detection system, and the large volume of pool water normally lost due to evaporation, a small liner leak could go undetected.

b. Based on isotopic ratios and radionuclide type, the existence of radionuclides such as Cesium and Tritium in the moisture could provide an indicator of whether there is an active leak, or whether the moisture source could have been from a since-repaired liner leak. Soil and moisture samples are being collected and will be sent to a laboratory for analysis which can detect the presence of Tritium.

2. Contamination of the soil in the FSB loading bay, above and adjacent to the moist crack, and subsequent entry of contaminated liquid into the crack due to hydraulic pressure from the loading bay side.

**Historical information**

1. In the northeast area of the SFP stainless steel liner at about the 89 foot level, a small hole occurred during a 1990 pool re-racking project. The damage was discovered in 1992 when boron powder was found on the SFP east exterior wall. During subsequent radiological recovery and repair of the hole, outside soil adjacent to the SFP east wall was found to contain Antimony-124 and 125, and Cesium-137. Approximately 100 55-gallon barrels of soil, down to a depth of eight feet below grade (72 foot level) required remediation. The leakage through the hole in the pool liner was estimated to have been 20-30 gallons per day, which was unnoticed due to the much large volume of normal evaporative loss from the pool.

2. The original loading bay floor had a drain system (see attached elevation sketch), above and adjacent to the area of the moist crack, which was piped through the wall separating the FSB loading bay and SFP heat exchanger room to a sump in the heat exchanger room. When the floor was removed in 2004 for the dry cask storage modifications, the drain pipe was found to be cracked, and the wall penetration through which the drain

pipe was installed was found to be unsealed. Discussions with personnel who were working at Unit 2 at the time indicated that in years past, the level in the sump rose above the drain pipe penetration. This, along with the cracked pipe, resulted in contamination of the soil beneath the floor. Contamination of this soil, primarily in the northwest area of the loading bay, was found and remediated during excavation in 2004 and 2005 for the dry cask storage project.

3. From 2003 through 2005, various activities associated with the dry cask storage project in the area above and adjacent to the crack required the use of water as a dust-inhibiting and cooling measure, which was allowed to drain into the FSB loading bay soil. These activities included core-boring, saw cutting of the original loading bay floor, and excavation, Six core-bore samples, to a depth of greater than 20 feet, were taken in the FSB loading bay (four cores), and FSB access roadway (2 cores) in 2003 during the dry cask storage engineering study activities.

**Industry operating experience**

In September 2002 the Salem nuclear plant found evidence of contaminated water leaking through a wall and onto the floor of the auxiliary building. This leak was found as a follow-up to unexpected shoe contaminations. There were other leaks through walls and penetrations that appeared to be originating from the Unit 1 SFP. It was determined that the tell-tale drains for the SFP were plugged with debris, so there was a build up of hydrostatic pressure between the liner and concrete wall. This caused the leakage to find alternative through-wall paths. When these drains were cleaned, the leakage flowed to a collection system, essentially terminating the through wall leakage. The pool leakage was then identified via the drain system. This pool leakage occurred for an indeterminate time.

Salem conducted sampling and analysis of the environment surrounding Unit 1 FSB, in a phased approach, to identify potential release of the water outside the building confines. On February 6, 2003, Salem found tritium (H-3) contamination in close proximity to the Unit 1 FSB. By now the tell-tale drains were functioning, so the through wall leakage had stopped. Salem reviewed other spills that could have contributed to the tritium contamination.

Salem performed test core borings in various site locations and initially identified five areas with varying tritium contamination levels. 37 well locations were installed around the site to better characterize the extent of contamination, and 30 of the areas found some tritium contamination. There were no locations that found tritium in unrestricted-access areas

## Action Plan

The following actions (see next page) are being implemented to aid in determining the source of moisture, potential amount and extent of related soil contamination, conclusions, and remediation/repair plan and schedule.

1. The IPEC Manager of Dry Cask Storage (G. Schwartz, x6684) has overall responsibility for executing this plan, updating it, and keeping senior management, NRC, and Unit 2 Shift Manager informed daily. The IPEC Director of Special Projects (D. Mayer, x5521, who has responsibility for Health Physics Department) will assist.
2. (Manager of Dry Cask Storage) Issue Condition Report and submit Operability Evaluation information to Shift Manager; develop and issue ODMI. **CR-IP2-2005-03557 included Operability Evaluation). ODMI issued.**
3. (Radiological Waste Department) Take radiological samples at damp crack, and take dirt samples from where excavation material was placed. **Complete, see discussions below.**
4. (Civil-structural Engineering) Determine rebar location in relation to cracks, using a rebar detection device. **Completed 9-7-05. Rebar is about 4 inches directly behind and parallel to cracks.**
5. (Radiological Waste Department/Civil-structural Engineering) Hand-drill (small diameter bit) several inches into the SFP wall in the area of the moist crack and analyze drill-bit finds for contamination. **Completed 9-7-05. Finds appeared to be damp in first several inches of depth, then appeared to be dry. Results:**

| Sample of Hole Drilled in North FSB Wall | pH | Co-60 uCi/gm | Cs-134uCi/gm | Cs-137 uCi/gm | Iron ppm | Boron ppm |
|---|---|---|---|---|---|---|
| Base line | 11.74 | ND | ND | ND | 96 | 159 |
| First 2" (0-2") of crack | 10.7 | 8.31E-05 | 2.65E-05 | 1.65E-03 | 628 | 72 |
| Second 2" (2-4") of crack | 11.46 | 4.04E-05 | 1.39E-05 | 8.46E-04 | 640 | 56 |
| Third 2" (4-6") of crack | 11.75 | 1.02E-05 | ND | 1.27E-04 | 3285 | 28 |
| Fourth 2" (6-8") of crack | 11.79 | ND | ND | 1.75E-05 | 60 | 226 |

6. (Radiological Waste Department) Place a plastic covering over the moist cracks to attempt to capture of a sufficient volume of liquid for radiochemistry analysis. **Collected 12 mL sample 9/12-13/05. Contained low levels of Cs-137 and Co-60. Contained approximately 1265 ppm Boron and approximately .02 micro-c/mL H-3. This indicates the moisture is from the pool.**
7. (Chemistry Department) Sample the soil beneath the area of the crack for H-3. **Sample collected, sent off-site to laboratory for Tritium analysis. Results received 913/05, indicating low level H-3 near (within a foot) of the wall, decreasing within 2-3 feet to nearly undetectable.**
8. (Chemistry Department) Scrape material from an unaffected area of the SFP wall and test for boron content. **Used dry finds from drilling, low-level Boron detected (less than 400 ppm).**
9. (Civil/structural Engineering) Determine the typical level of boron in clean concrete. **Attempted, no information available.**
10. (Civil/structural Engineering) Determine expected corrosion rates for steel reinforcing rods subjected to an environment containing boron. **See #11 and #19 below.**
11. (Licensing Department) Gather historical written records on SFP stainless steel liner damage and SFP sump overflows. Some **Liner damage information recovered, including Calculation CGX-00006 (Structural Evaluation of Unit 2 Fuel Pool Wall) and Technical Report ME-3802 (Evaluation of Spent Fuel Pool Walls - IP2 NPP). These are considered**

**bounding for the current situation in terms of wall and rebar structural integrity. No information on sump overflows (other than tribal knowledge) has been recovered.**

12. (Civil/structural Engineering) Arrange a ground-penetrating radar (GPR) inspection (or other methodology) of the crack to *determine (if possible) crack depth.* ***GPR determined not feasible. Two 4-inch diameter cores, 4 inches in depth (just*** **up to rebar), were taken 9-8-05 in the area of the moist crack. One appeared to be dry on 9-8-05 and it is presumed this was affected by boring bit heating. 24 hours later on 9-9-05 it was damp. The rebar exhibits normal surface oxidation. Visual inspection on 9/12/05 to 9/15/05 appears to indicate moisture is lessening.**
13. (Chemistry Department) Determine if a Unit 2 Spent Fuel Pool Integrity Evaluation from Tritium Measurement, was performed, similar to that performed for Unit 3. **Not performed for Unit 2. TBD whether to perform this, as it requires a lengthy period of data collection.**
14. (Radiological Waste and Chemistry Departments) Gather radiological results of test core borings accomplished for dry cask storage inside FSB loading bay (4) and in FSB loading bay access road in 2003. **Completed. Low-level surface contamination was found consisting of Cs-134, Cs-137, Co-58 and Co-60.**
15. (Manager of Dry Cask Storage) Bring in expert structural engineer from ABS Consulting with past experience in SFP leakage. **Arrived 9/12/05, performing calculation of seepage rate discussed in #19 below.**
16. Conduct Challenge Meeting with IPEC management. **Completed 9/12/05.**
17. Contact JAF to obtain input based upon recent experience with leaking Spent Fuel Pool liner. **Conference call conducted with JAF 9/13/05. Discussed conditions and status of IPEC issue, and draft ODMI. No additional recommended actions were suggested, however valuable information was learned – JAF had an active pool liner leak earlier this year, but the leakage has appeared to cease on it's own, potentially indicative of a pinhole forming then being closed by some debris, or by the leak path (crack in concrete) being closed in some manner.**
18. Inspect other accessible exterior areas of SFP wall. **Other accessible areas in addition to the south wall include the west wall in the pipe penetration space ("Pipe Pen"), the west wall in between the FSB, VC and PAB, and the east wall outside adjacent to the MOB (where the 1990-92 leak was discovered). The east wall has no evidence of a problem subsequent to the 1990-92 leak. The west wall in the Pipe Pen has some cracking and dry white streaking with no evidence of moisture. The white material will be sampled for radiochemistry by 9/16/05. The west wall in between the FSB, VC and PAB has some shrinkage cracking but no evidence of moisture.**
19. (Manager of Dry Cask Storage) Issue final version of this paper with conclusions and recommendations for physical actions (as deemed necessary, such as repairs, test wells, etc.) and schedule. This will include a calculation of seepage rate of pool water through the wall, and characterizations of environmental impact and structural impact, as well as a schedule for implementation of recommended physical actions. **Target 9-23-05.**

**Summary as of 9/13/05**

Due to the thickness of the SFP wall, amount of steel reinforcement, small volume of moisture and boron impingement on the reinforcing rods, there is reasonable assurance that the SFP wall is structurally sound and capable of performing it's intended function. This is additionally supported by the bounding calculation and study referred to above.

The data collected so far appears to indicate a pinhole in the SFP liner. Location and whether the leak path is active is undetermined. As *indicate in #19 above, a final version of this paper with conclusions and recommendations for physical actions* (as deemed necessary, such as inspections/repairs, test wells, etc.) is targeted to be completed next week. This will include a calculation of seepage rate of pool water through the wall, and characterizations of environmental impact and structural impact, as well as a schedule for implementation of recommended physical actions

Attachments (See Rev.1 issue of this paper dated 9/9/05)

Elevation sketches (2)
Moist crack photograph
Unit 2 SFP Boron graph
Core bores photograph
Draft ODMI

914-44...
917 414-2509

914-137 6607

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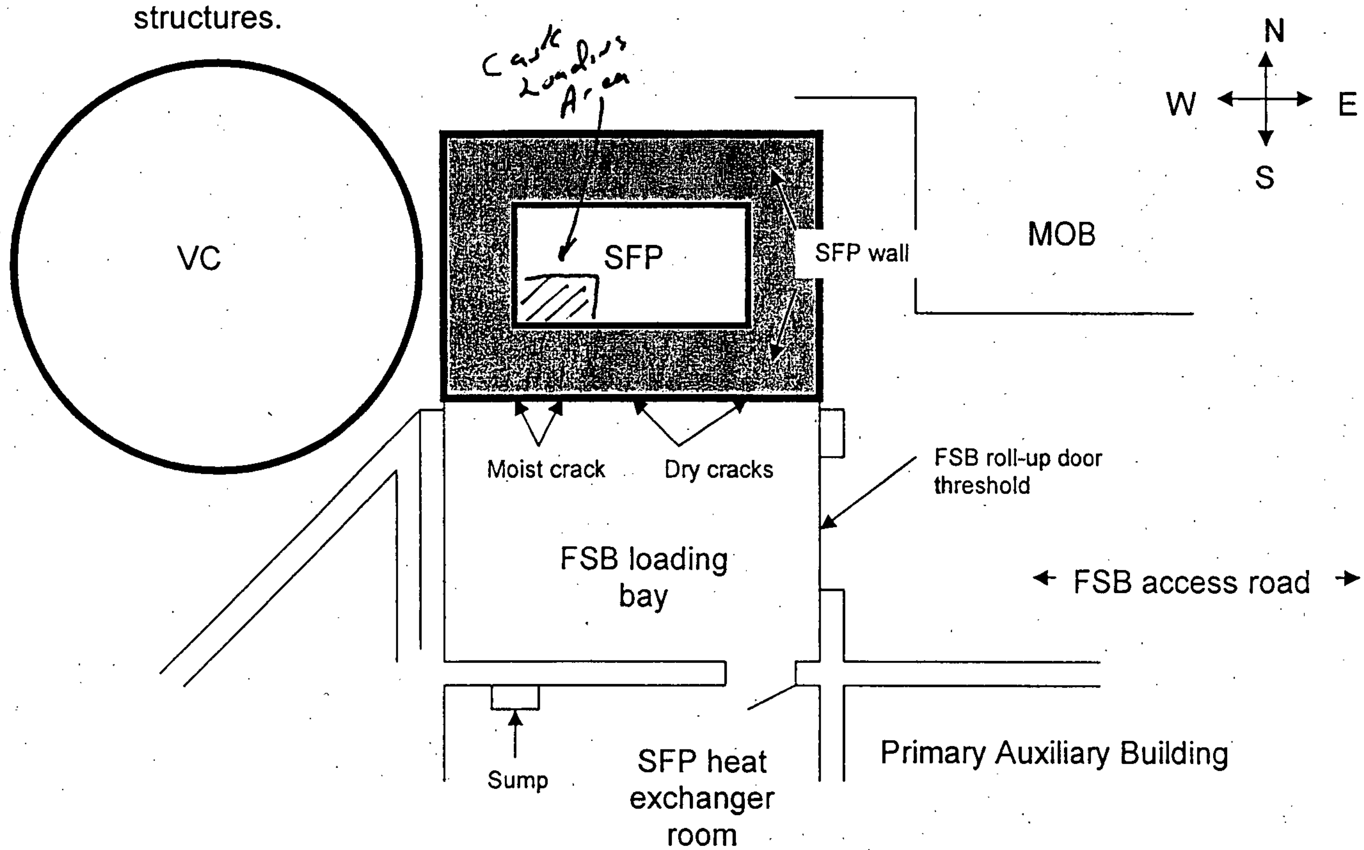
# Hairline Crack in IPEC Unit 2 Spent Fuel Pool South Wall

Revision 2, 9/12/05

## Location of issue

This paper discusses hairline concrete cracks, one of which is moist, discovered in the south wall of the IPEC Unit 2 Spent Fuel Pool (SFP), at an elevation of approximately 65 feet and above. The SFP is a seismically designed structure adjacent to Unit 2 Vapor Containment (VC) (to the west of the SFP), the Maintenance Outage Building (MOB) (to the north and east of the SFP), and the Fuel Storage Building (FSB) loading bay (to the south of the SFP). In order to meet seismic design requirements, the SFP is not supported by adjacent structures.




**Plan View Sketch**
**Not to Scale**

The top of the SFP base slab is at an elevation of 54 feet 7 inches. The SFP has a horizontal construction joint at elevation 75 feet, and the top of the pool wall is at elevation of 95 feet. In addition to the above sketch, an elevation sketch and photograph of the moist crack are attached as separate documents.

## Background

IPEC is in the process of implementing dry cask storage capability for Unit 2. This requires that the Fuel Storage Building (FSB) loading bay floor be removed and replaced with a significantly more substantial structure. The original floor has been removed, and excavation of soil and rock in the loading bay is in progress. During removal of loose soil and rocks in the north area of the loading bay (along the SFP south wall), approximately horizontal cracks were exposed at an elevation of approximately 65 feet, and an approximately vertical crack above. The cracks are very narrow (less than 1/64-inch wide). One of the cracks, on the west side of the south SFP wall, has moisture in and near it.

**SFP wall structure**

In the area of the crack, the SFP wall is 4 feet thick, heavily reinforced concrete. The inside of the SFP is lined with ¼-inch stainless steel plate anchored to the concrete, so that the plate and concrete are in contact and the interface area between the plate and concrete is very narrow. The cracks have been visually inspected by an IPEC civil/structural engineer, and the IPEC Supervisor of Civil/Mechanical Engineering. The condition is typical of cracking due to shrinkage during post-construction concrete curing. The moisture in and around one of the cracks is very slight, essentially a film which is not dripping or beading. The moisture has been analyzed and found to contain trace amounts of Cesium 134 and 137, Cobalt-60, and Boron. The Boron concentration is about 6 to 15 times less than the concentration in the SFP, and the ratio of Cesium-134 to 137 indicate the activity is about 6 to 10 years old. The crack has calcium stains emanating from it, as is expected when moisture leaches through concrete, and no visual evidence of steel corrosion products (rust). Due to the thickness of the SFP wall, amount of steel reinforcement, and lack of evidence that the small amounts of moisture and boron have caused corrosion of the reinforcing rods, there is reasonable assurance that the SFP wall is structurally sound and capable of performing it's intended function.

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b. Based on isotopic ratios and radionuclide type, the existence of radionuclides such as Cesium and Tritium in the moisture could provide an indicator of whether there is an active leak, or whether the moisture source could have been from a since-repaired liner leak. Soil and moisture samples are being collected and will be sent to a laboratory for analysis which can detect the presence of Tritium.

2. Contamination of the soil in the FSB loading bay, above and adjacent to the moist crack, and subsequent entry of contaminated liquid into the crack due to hydraulic pressure from the loading bay side.

**Historical information**

1. In the northeast area of the SFP stainless steel liner at about the 89 foot level, a small hole occurred during a 1990 pool re-racking project. The damage was discovered in 1992 when boron powder was found on the SFP east exterior wall. During subsequent radiological recovery and repair of the hole, outside soil adjacent to the SFP east wall was found to contain Antimony-124 and 125, and Cesium-137. Approximately 100 55-gallon barrels of soil, down to a depth of eight feet below grade (72 foot level) required remediation. The leakage through the hole in the pool liner was estimated to have been 20-30 gallons per day, which was unnoticed due to the much large volume of normal evaporative loss from the pool.

2. The original loading bay floor had a drain system (see attached elevation sketch), above and adjacent to the area of the moist crack, which was piped through the wall separating the FSB loading bay and SFP heat exchanger room to a sump in the heat exchanger room. When the floor was removed in 2004 for the dry cask storage modifications, the drain pipe was found to be cracked, and the wall penetration through which the drain pipe was installed was found to be unsealed. Discussions with personnel who were working at Unit 2 at the time indicated that in years past, the level in the sump rose above the drain pipe penetration. This, along with the cracked pipe, resulted in contamination of the soil beneath the floor. Contamination of this soil, primarily in the northwest area of the loading

bay, was found and remediated during excavation in 2004 and 2005 for the dry cask storage project.

3. From 2003 through 2005, various activities associated with the dry cask storage project in the area above and adjacent to the crack required the use of water as a dust-inhibiting and cooling measure, which was allowed to drain into the FSB loading bay soil. These activities included core-boring, saw cutting of the original loading bay floor, and excavation, Six core-bore samples, to a depth of greater than 20 feet, were taken in the FSB loading bay (four cores), and FSB access roadway (2 cores) in 2003 during the dry cask storage engineering study activities.

**Industry operating experience**

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**Action Plan**

The following actions are being implemented to aid in determining the source of moisture, potential amount and extent of related soil contamination, conclusions, and remediation/repair plan and schedule.

1. The IPEC Manager of Dry Cask Storage (G. Schwartz, x6684) has overall responsibility for executing this plan, updating it, and keeping senior management, NRC, and Unit 2 Shift Manager informed daily. The IPEC Director of Special Projects (D. Mayer, x5521, who has responsibility for Health Physics Department) will assist.
2. (Manager of Dry Cask Storage) Issue Condition Report and submit Operability Evaluation information to Shift Manager. **Complete. CR-IP2-2005-03557.**
3. (Manager of Dry Cask Storage) Prepare Operational Decision Making Issue (ODMI). **Target to issue ODMI 9/13/05**.
4. (Radiological Waste Department) Take radiological samples at damp crack, and take dirt smples from where excavation material was placed. **Results (ND = None Detected):**

| Sample Date-time | Location | Type | Co-60 uCi | Cs-134 uCi | Cs-137 uCi |
|---|---|---|---|---|---|
| 9/1/05 10:00 AM | N. Wall at leak | Large Area Smear | ND | 3.03E-07 | 1.92E-03 |
| 9/1/05 10:12 AM | N. Wall at leak | Large Area Smear | ND | 6.24E-04 | 4.64E-03 |
| 9/1/05 12:00 PM | N. Wall at leak | Large Area Smear | ND | ND | 1.68E-03 |
| 9/1/05 2:00 PM | N. Wall at leak | Scraping of wall | 2.22E-03 | 5.06E-03 | 8.07E-02 |
| 9/2/05 1:30 PM | N. Wall at leak | Large Area Smear | ND | ND | 1.17E-03 |
| 9/2/05 1:30 PM | N. Wall at leak | Large Area Smear | ND | ND | 1.17E-03 |
| 9/7/05 1:00 PM | 1 Outside MOB Dirt on Hill area | Dirt | ND | ND | 8.75E-08 |
| 9/7/05 1:00 PM | 2 Outside MOB Dirt on Hill area | Dirt | ND | ND | ND |
| 9/7/05 1:00 PM | 3 Outside MOB Dirt on Hill area | Dirt | ND | ND | 1.03E-07 |
| 9/7/05 1:00 PM | 4 Outside MOB Dirt on Hill area | Dirt | ND | ND | 5.61E-07 |
| 9/8/05 10:00 AM | 4 Re-sample Outside MOB Dirt on Hill area | Dirt | ND | ND | 2.18E-07 |

5. (Civil-structural Engineering) Determine rebar location in relation to cracks, using a rebar detection device. **Completed 9-7-05. Rebar is about 4 inches directly behind and parallel to cracks.**
6. (Radiological Waste Department/Civil-structural Engineering) Hand-drill (small diameter bit) several inches into the SFP wall in the area of the moist crack and analyze drill-bit finds for contamination. **Completed 9-7-05. Finds appeared to be damp in first several inches of depth, then appeared to be dry. Results:**

| Sample of Hole Drilled in North FSB Wall | pH | Co-60 uCi/gm | Cs-134uCi/gm | Cs-137 uCi/gm | Iron ppm | Boron ppm |
|---|---|---|---|---|---|---|
| Base line | 11.74 | ND | ND | ND | 96 | 159 |
| First 2" (0-2") of crack | 10.7 | 8.31E-05 | 2.65E-05 | 1.65E-03 | 628 | 72 |

| | | | | | | |
|---|---|---|---|---|---|---|
| Second 2" (2-4") of crack | 11.46 | 4.04E-05 | 1.39E-05 | 8.46E-04 | 640 | 56 |
| Third 2" (4-6") of crack | 11.75 | 1.02E-05 | ND | 1.27E-04 | 3285 | 28 |
| Fourth 2" (6-8") of crack | 11.79 | ND | ND | 1.75E-05 | 60 | 226 |

7. (Radiological Waste Department) Place a plastic covering over the moist crack to attempt to capture of a larger volume of liquid for radiochemistry analysis. **Plastic installed 9-7-05 and left in place 24 hours. Collected approximately 2 mL of liquid, which was insufficient for Tritium detection. Plastic reinstalled and left over weekend of 9/10 to 9/1105, with moisture collected still insufficient.**
8. (Chemistry Department) Sample the soil beneath the area of the crack for H-3. **Sample collected, sent off-site to laboratory for Tritium analysis 9/9/05 - results expected by 9/14/05 or earlier. Other analysis results:**

| Sample Date | Location | | Co-60 uCi/gm | Cs-134 uCi/gm | Cs-137 uCi/gm |
|---|---|---|---|---|---|
| 9/6/2005 | Against North Wall below Leak | Dirt | 1.05E-05 | 3.98E-06 | 2.92E-04 |
| 9/6/2005 | 1 ft from N. Wall Below Leak | Dirt | 1.15E-06 | ND | 1.61E-05 |
| 9/6/2005 | 2 ft from N. Wall Below Leak | Dirt | 2.42E-07 | ND | 5.07E-07 |
| 9/6/2005 | 3 ft from N. Wall Below Leak | Dirt | ND | ND | 1.19E-07 |
| 9/8/2005 | Against North Wall below Leak 1 ft depth | Dirt | 5.90E-06 | 3.54E-06 | 1.63E-04 |
| 9/8/2005 | 1 ft from N. Wall Below Leak 1 ft depth | Dirt | 1.19E-06 | 1.82E-07 | 1.09E-05 |
| 9/8/2005 | 2 ft from N. Wall Below Leak 1 ft depth | Dirt | ND | ND | 9.44E-08 |
| 9/8/2005 | Against North Wall below Leak 2 ft depth | Dirt | 1.38E-05 | 1.43E-05 | 6.00E-04 |
| 9/8/2005 | 2 ft from N. Wall Below Leak 2 ft depth | Dirt | ND | ND | ND |

9. (Chemistry Department) Scrape material from an unaffected area of the SFP wall and test for boron content. **Used dry finds from drilling (see above table).**
10. (Civil/structural Engineering) Determine the typical level of boron in clean concrete. **Attempted, no information available.**
11. (Civil/structural Engineering) Determine expected corrosion rates for steel reinforcing rods subjected to an environment containing boron. **Calculation being performed using pH of SFP wall concrete based on samples taken, and using baseline results published in Florida Power & Light Test report P522-1471 of 1987 (Long-term Concrete Rebar**

**Test) regarding corrosion rates for rebar in a liquid-boron environment. Calculation targeted for completion 9-13-05. Similar calculation completed for SFP liner leak of 1990-92, determining no significant rebar degradation, has been recovered and is being reviewed.**

12. (Licensing Department) Gather historical written records on SFP stainless steel liner damage and SFP sump overflows. Some **Liner damage information recovered, search ongoing. L. Villani, Civil/Structural Engineering Supervisor (ConEd employee) at the time was consulted 9/12/05. Stated that boron formation on east exterior pool wall was significant ("stalagtites") and radiation on contact was significantly above background.**
13. (Civil/structural Engineering) Arrange a ground-penetrating radar (GPR) inspection (or other methodology) of the crack to determine (if possible) crack depth. **GPR determined not feasible. Two 4-inch diameter cores, 4 inches in depth (just up to rebar), were taken 9-8-05 in the area of the moist crack. One appeared to be dry on 9-8-05 and it is presumed this was affected by boring bit heating. 24 hours later on 9-9-05 it was damp. The rebar exhibits normal surface oxidation. Visual inspection on 9/12/05 appears to indicate moisture is lessening.**
14. (Chemistry Department) Determine if a Unit 2 Spent Fuel Pool Integrity Evaluation from Tritium Measurement, was performed, similar to that performed for Unit 3. **Not performed for Unit 2. TBD whether to perform this, as it requires a lengthy period of data collection.**
15. (Radiological Waste Department) Gather radiological results of test core borings accomplished for dry cask storage inside FSB loading bay (4) and in FSB loading bay access road in 2003. **Completed. Low-level surface contamination was found consisting of Cs-134, Cs-137, Co-58 and Co-60.**
16. (Manager of Dry Cask Storage) Bring in expert structural engineer from ABS Consulting with past experience in SFP leakage. **Arrived 9/12/05. Drafting calculation referred to above.**
17. (Manager of Dry Cask Storage) Issue final version of this paper with conclusions and physical actions (as deemed necessary, such as repairs, test wells, etc.) and schedule. **Target 9-23-05.**

<u>**Summary as of 9/12/05**</u>

Due to the thickness of the SFP wall, amount of steel reinforcement, and lack of evidence that the small amounts of moisture and boron have caused corrosion of the reinforcing rods, there is reasonable assurance that the SFP wall is structurally sound and capable of performing it's intended function.

The data collected so far is inconclusive. The next key event is results of Tritium testing.

Some soil and rock was removed 9/12/05 beneath the area of the moist crack for sampling purposes and another moist crack was observed below the first one. The upper (first) crack is at approximately 64.5 foot elevation and the second crack is approximately three feet below the first. The lower crack characteristics (hairline, roughly horizontal, length, moisture) observed is very similar to the upper crack. Visual inspection of the (upper) crack at 64.5 foot elevation indicates the amount of moisture, compared to last week, is declining. A plastic covering was placed over the crack on 9/9/05, and on 9/12/05 very little liquid was found in the plastic (not enough for meaningful radiochemistry analysis). A Challenge Meeting was held 9/12/05 and observed by a member of the

Resident's Office. The panel members were the General Manager of Plant Operations, Site Operations Manager, and Planning/Scheduling/Outage Manager. Representing the project team were the Manager of Dry Cask Storage and Supervisor of Radiological Engineering. Also present were the Director of Special Projects, and the Licensing Supervisor. Additional actions that will be taken based on this meeting include contacting JAF for OE on pool liner leakage, preparation of an ODMI, request for a fleet engineering call on 9/13, daily updates at the 8:30 morning meeting, and designation of a lead for this issue other than the Manager of Dry Cask Storage so that he can better focus on the overall project.

Attachments (See Rev.1 issue of this paper dated 9-9-05)

Elevation sketches (2)
Moist crack photograph
Unit 2 SFP Boron graph
Core bores photograph