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Geoff Schwartz x6684

Hairline Crack in IPEC Unit 2 Spent Fuel Pool South Wall

9/8/05

Ex. 4

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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

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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 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 six times less than the concentration in the SFP, and the ratios of Cesium-134 and 137 indicate the activity is about six 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,

   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

      (Unit 3 has such a leak detection system). The Unit 2

      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

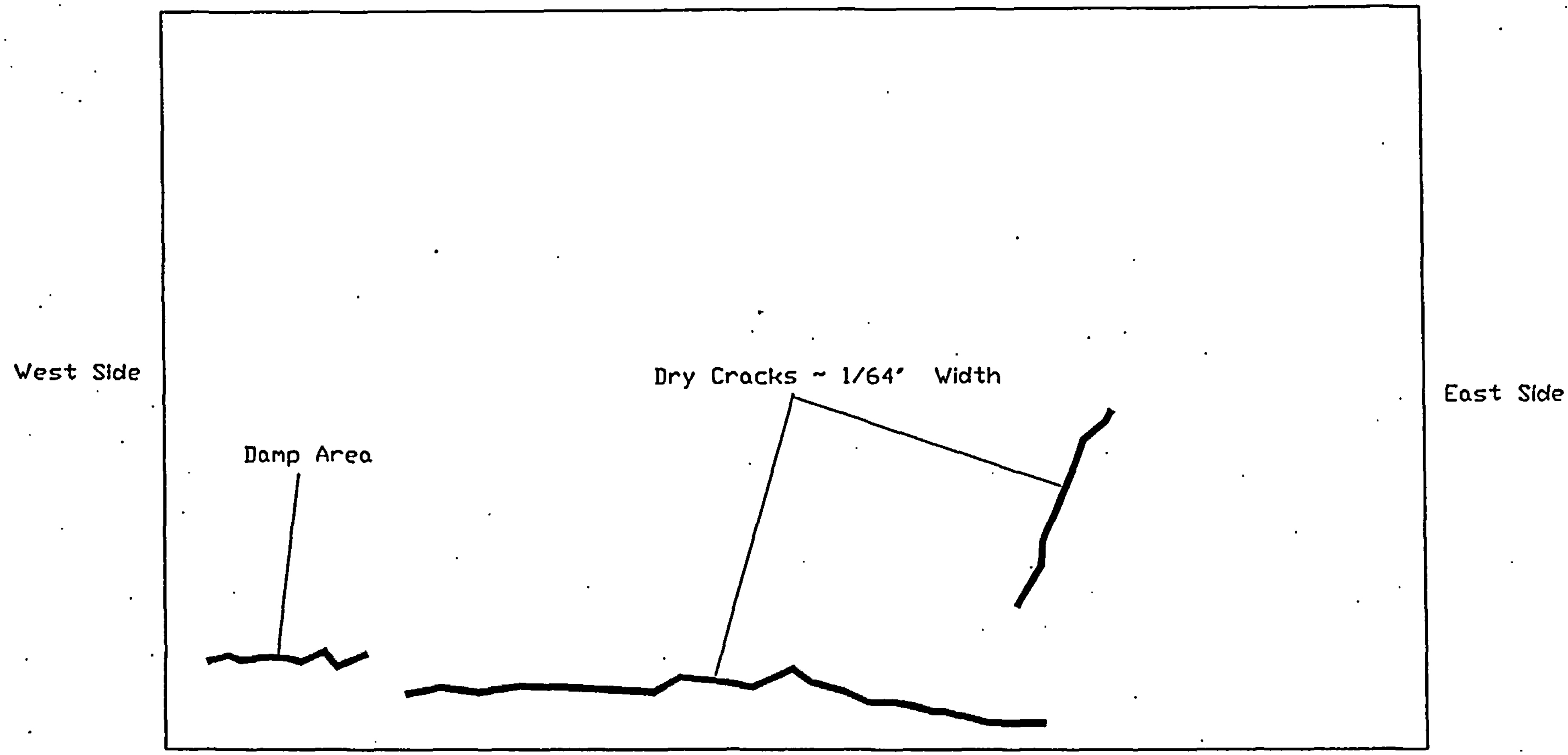
The following actions are being implemented to aid in determining the source of moisture, potential amount and extent of related soil contamination, conclusions, and remediation/repair plan and schedule.

1. The IPEC Manager of Dry Cask Storage (G. Schwartz, x6684) has overall responsibility for executing this plan, updating it, and keeping senior management and the NRC informed. The IPEC Director of Special Projects (D. Mayer, x5521, who has responsibility for Health Physics Department) will assist.
2. (Civil-structural Engineering) Determine rebar location in relation to cracks, using a rebar detection device. **Completed 9-7-05. Rebar is [ ] to cracks.** Ex. 4
3. (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 were damp in first several inches of depth, then dry. Cesium-134 and 137 and Cobalt-60 were found, declining from highest to lowest concentration as depth increased.**
4. (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.**
5. (Chemistry Department) Sample the soil beneath the area of the crack for H-3. **Sample collected, sending to off-site laboratory requesting rapid turn-around. Results expected by 9-21-05 or earlier.**
6. (Chemistry Department) Scrape material from an unaffected area of the SFP wall and test for boron content. **Using dry finds from drilling (see above). Results expected 9-8-05.**
7. (Civil/structural Engineering) Determine the typical level of boron in clean concrete. **Attempted, no information located as of 9-7-05.**
8. (Civil/structural Engineering) Determine expected corrosion rates for steel reinforcing rods subjected to an environment containing boron. **Ongoing. 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 9-8-05**
9. (Licensing Department) Gather historical written records on SFP stainless steel liner damage and SFP sump overflows. **Liner damage information recovered. Search for sump historical information ongoing.**
10. (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. A 4-inch diameter core, [ ] is planned to be taken 9-8-05 in the area of the moist crack.** Ex. 4
11. (Chemistry Department) Determine if a Unit 2 Spent Fuel Pool Integrity Evaluation from Tritium Measurement, was performed, similar to that performed for Unit 3. **Search ongoing (evaluation requires several months – such an evaluation was performed for Unit 3 and used to conclude the liner has no leaks).**

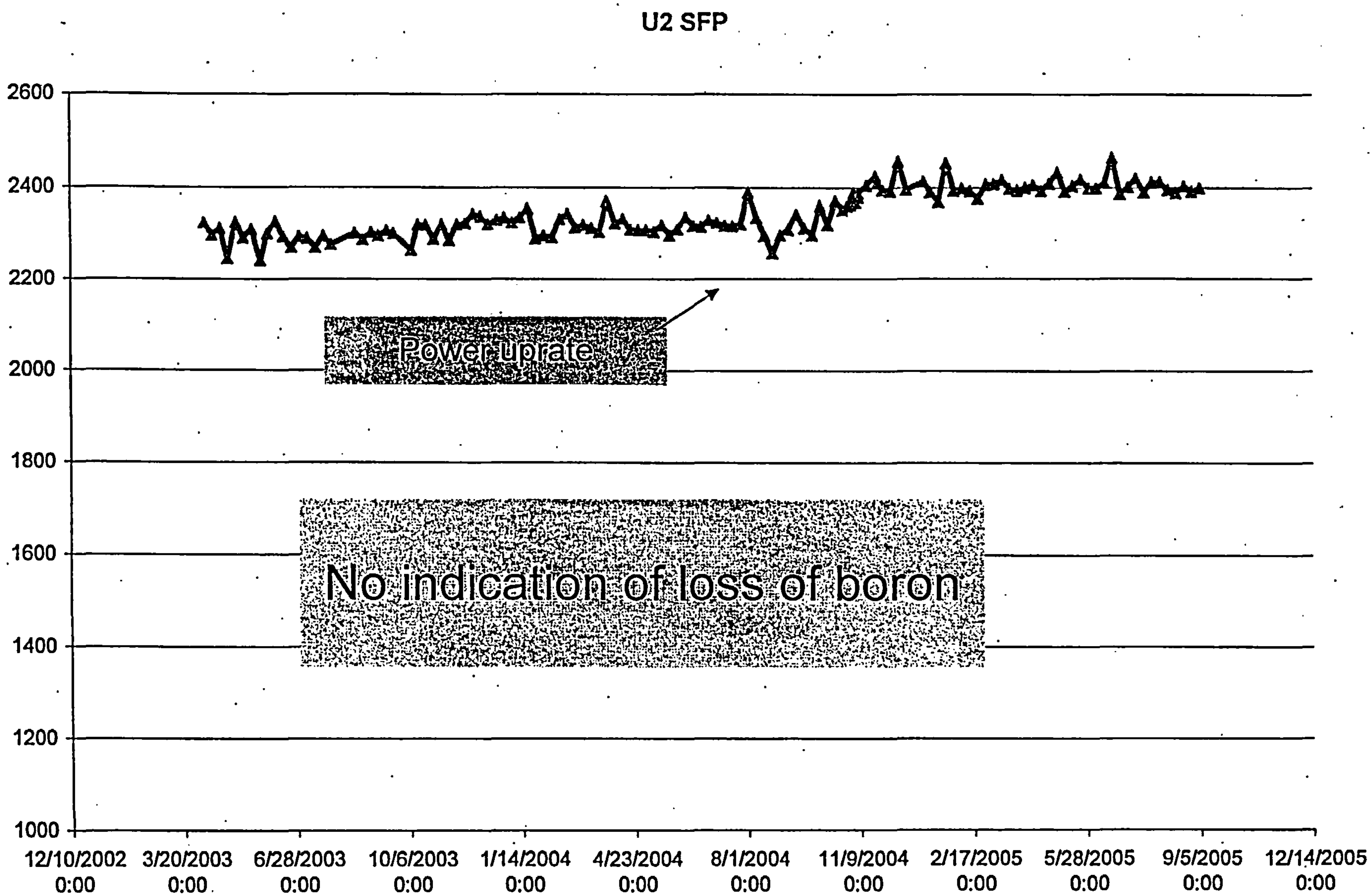
12. (Dry Cask Storage Manager) Issue final version of this paper with conclusions and physical actions (as deemed necessary, such as repairs, test core bores, etc.) and schedule. **Target 9-23-05.**

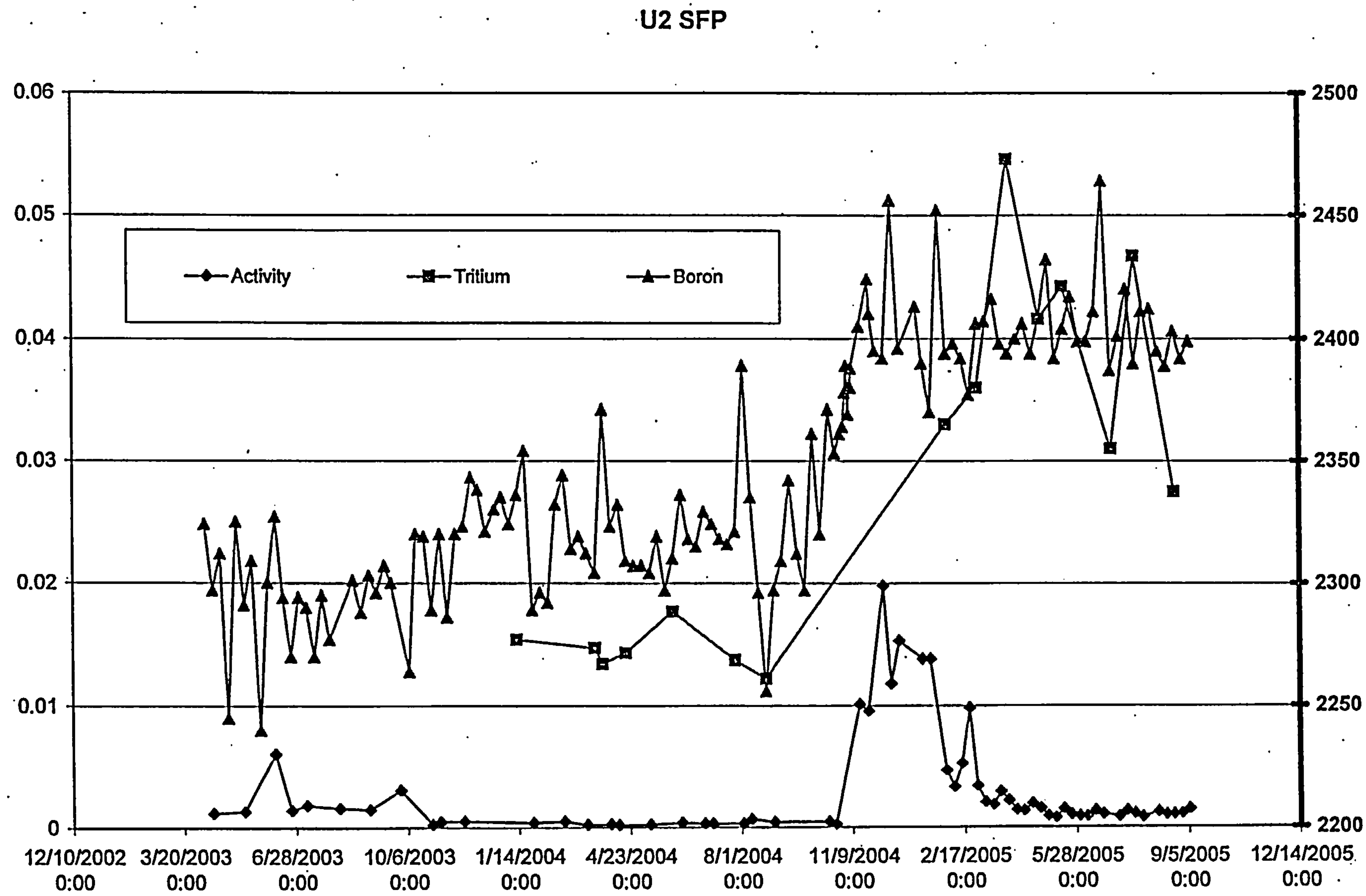
Attachments

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



Crack Map of South Wall Spent Fuel Pit
Looking North


U2 SFP
2600
2400
2200
2000
1800
1600
1400
1200
1000
12/10/2002 0:00
3/20/2003 0:00
6/28/2003 0:00
10/6/2003 0:00
1/14/2004 0:00
4/23/2004 0:00
8/1/2004 0:00
11/9/2004 0:00
2/17/2005 0:00
5/28/2005 0:00
9/5/2005 0:00
12/14/2005 0:00
Power uprate
No indication of loss of boron



U2 SFP
Activity
Tritium
Boron
0.06
0.05
0.04
0.03
0.02
0.01
0
2500
2450
2400
2350
2300
2250
2200
12/10/2002 0:00
3/20/2003 0:00
6/28/2003 0:00
10/6/2003 0:00
1/14/2004 0:00
4/23/2004 0:00
8/1/2004 0:00
11/9/2004 0:00
2/17/2005 0:00
5/28/2005 0:00
9/5/2005 0:00
12/14/2005 0:00