IR 546049 Assignment 02

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Reference: A/R A2152754 Eval 06

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Engineering Response
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This evaluation is being prepared as a technical eval in accordance with procedure CC-AA-309-101, rev 7, and will be submitted to document control for retention. The evaluation resolves concerns identified under IR 546049.

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1.0 SCOPE

Evaluate the current acceptability of the Oyster Creek drywell shell below elevation 10'-3" considering the standing water found in the Bay #5 inspection trench and the moisture identified in the Bay #17 inspection trenches. This evaluation will demonstrate that adequate margin exists in the drywell shell to support plant start-up through the next plant operating cycle. Additionally, the as-found conditions will be demonstrated to not adversely impact current design or licensing bases requirements. The inspection trenches are located inside the drywell.

This evaluation will include:

- Results from drywell shell non-destructive examination (NDE) inspections
- Chemistry analysis of the water samples taken from the drywell sump, the sub-pile room (room below the reactor vessel) drainage trough and the Bay #5 trench
- The water migration tracer test results
- The drywell shell corrosion evaluation
- Visual inspection of drywell sump 1-8

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2.0 EVALUATION

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2.1 Background

In 1980, Oyster Creek Generating Station observed water coming from the sand bed region drains. Investigation conducted between 1980 and 1986 determined the source of water was from the reactor cavity during refueling outages. Ultrasonic Testing (UT) thickness measurements taken in 1986 confirmed that the drywell shell was thinner than expected and that wall thinning in the sand bed region was greater than locations above the sand bed.

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As a result of the 1986 UT readings, a program was initiated to obtain detailed measurements in order to determine the extent and characterization of the thinning. Measurements were taken from inside the drywell and around its perimeter, in accessible locations corresponding to the sand bed region.

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To determine the vertical profile of wall thinning within the sand bed region (the bottom elevation of the sand bed region is 8'-11.25", the top elevation of the sand bed region is

12'-3"), two trenches were excavated in elevation 10'-3" concrete floor slab inside the drywell in 1986. One trench is located in Bay #5 and the other in Bay #17. The approximate bottom elevation of the trenches is 8'-9" and 9'-3" respectively. The basis for selecting the two bays is that Bay #5 exhibited less wall thinning, while Bay #17 experienced greater wall thinning. Following the specified inspections/examinations the exposed steel in the trenches was prepped and coated, and the trenches were filled with an easily removable material, (Dow Corning 3-6548 silicone RTV foam topped with a protective sealing layer of promatic low density silicone elastomer), to the height of the 10'-3 floor slab surface.

In 1988 the sand bed drains were cleared to allow for proper drainage of the sand bed region.

Additional UT thickness measurements taken in 1987, 1988, and 1989 showed that corrosion in the sand bed region continued to occur despite removal of water from the region. Furthermore, the cathodic protection system installed in two bays was not effective in arresting corrosion. Thus, removal of the sand was pursued, as the potential solution for mitigating corrosion in the sand bed region. Actions to remove the sand were initiated in 1988.

Again in 1991 UT measurements were obtained and evaluated as documented in Calculation C-1302-187-5300-021.

In 1992 sand was completely removed for the sand bed region. The external surface of the shell was cleaned in preparation for coating. The multi-layered epoxy coating of the shell, in the sand bed region, was completed in January 1993.

Numerous detailed inspections of the drywell have been performed since 1980. The engineering documentation associated with these inspections indicated evidence of water in the Bay #5 and #17 trenches during inspections during the 12R outage and the 15R outage (Sept 1994). The 1998 structural monitoring walkdown documented no water at the trenches. The documentation and the engineering evaluation for these findings are included as attachment 7.1.

2.2 1R21 Findings

The 1R21 outage scope included removal of the filler material and NDE inspection of the drywell shell in the Bay #5 and #17 trenches. This is the first time since 1988 that the filler material has been removed.

Removal of the filler material during 1R21 revealed water in the trenches. Specifically approximately 5" depth of standing water was found in the Bay #5 trench, and dampness was noted in the Bay #17 trench. The approximate elevation of the top of the water in the Bay #5 trench (elevation 9'-2"), is near the bottom of the Bay #17 trench (approximate elevation 9'-3").

The standing water was removed from the Bay #5 trench via a wet-vac. Following the initial removal, additional water was observed entering the trench. The water level returned to its initial 5" depth. On-going dewatering via the wet-vac was initiated and continued until the water level was lowered to the bottom of the trench. The entire dewatering process removed at least 25 gallons of water from the Bay #5 trench. (see attached "Oyster Creek Trench Pump Out Schedule" for a summary of actions. See section 7.2 of this eval)

No water was removed from the Bay #17 trench since this area was damp only with no standing water found. The bottom of this trench is approximately at the same height as the top of the water level found in trench #5.

2.3 Additional Actions

The following actions, associated with the identification and evaluation of the water found in the elevation 10'-3" concrete slab, were initiated:

- Performed a detailed drawing review to identify potential sources of the water in the trenches
- Obtained water samples and sent to lab for detailed analysis
- Performed an engineering field walkdown of the drywell interior at 10'-3" elevation to identify potential water in-leakage paths and water system leaks
- Added a tracer element to water in the sub-pile room drainage trough to determine if trough leakage was a potential source of the Bay #5 trench water
- Removed additional concrete from the bottom of the Bay #5 trench and performed additional UT exams to determine any potential impact to the drywell shell
- Initiated an engineering analysis to evaluate impact of the water on the drywell shell integrity
- Initiated field repairs and modifications to mitigate/minimize future water intrusion into the elev 10'-3" concrete slab. (ECR 06-00879)

2.4 Identification of Potential Water Sources

The detailed drawing review confirmed that the only water bearing commodities in the drywell basement slab (elev 10'-3" and 10'-9") are the drywell sump 1-8, the sub-pile room drainage trough, and the trough-to-sump drain pipes. A preliminary field inspection of these commodities indicated potential leakage points in the trough, and at the trough-to-sump drainpipes. The elevation of these potential leakage points was above the 5" water level in the Bay #5 trench. External sources of water were ruled out based on the visual and UT examinations performed in the sandbed region of the drywell shell. See section 5.0 for a list of the drawings reviewed.

Other potential water sources were also determined based on the field walkdowns. Sources such as equipment leakage/condensation that either fell to the floor or washed down the inside of the drywell shell and traveled to the basement concrete-to-wall joint were identified.

2.5 Water Samples

A series of water samples were obtained from the drywell sump, the sub-pile room drainage trough, and Bay #5 trench. The initial water samples taken from the Bay #5 trench, upon discovery of the water, were performed by the Oyster Creek chemistry personnel. The ph of these initial samples were greater than 10.5. These initial samples provided the earliest and most accurate pH indication of the water in contact with the drywell shell at the time of discovery. Comparisons were also made with other above floor water sources such as the RBCCW, Condensate and Feedwater systems. (For a complete listing of water samples used see the Section 7.3 attached report.) These samples were taken to assist in determining sources of the water in the Bay #5 trench, and the possible migration path of the water. Water samples were obtained from the Bay #5 trench and the sub-pile room trough and were sent to an off-site lab for analysis. OC and corporate chemistry personnel then evaluated the lab results. As part of this evaluation, a list of the water systems in the drywell was compiled. A matrix was developed defining the chemical composition of the potential water sources. The chemistry evaluation compared the lab results with the potential sources in order to identify/eliminate any contributing systems.

The evaluation concludes, "The source(s) of water in the trench cannot be conclusively determined from chemistry analysis. We can conclude that it is not the result of CCW leakage as there is no evidence of closed cooling water corrosion inhibitor in the trench. Furthermore, it is not the direct result of recent reactor coolant leakage because there are no short-lived radionuclides in the trench samples. It is also unlikely that the source of water is due to an external source. The radionuclides present in the trench water are indicative of CRD water that has been allowed to decay such that only longer-lived radionuclides are present in the trench samples. The difference between the radionuclides present in the trough and the trench is due to the tortuous path the water takes migrating from the trough to the trench. Migration of water from the trough to the trench has a relatively long transit time as evidenced by the fact that there are no short-lived radionuclides in the trench. The two samples containing dye indicate that water is migrating, albeit slowly, from the trough where the fluorescein solution was added on Monday, October 23, to the trench. Therefore, the most probable source of water in the Bay 5 trench is Control Rod Drive water."
See the attached chemistry evaluation, section 7.3 of this eval, for complete details.

2.6 Field Walkdowns

Engineering and maintenance personnel performed numerous field walkdowns and inspections. These inspections looked at the concrete surfaces at elevation 10'-3", the sub-pile room floor, the sub-pile room drainage trough, and the upper visible area of the drywell sump pit 1-8. These inspections:

- Confirmed, through the 2006 structural monitoring walkdown that the elev 10'-3 floor slab concrete outside of the sub pile room was in generally good condition.

- Did not identify any defects in the sump 1-8 liner plate when viewed from above, and during a detailed visual exam, (See section 2.7.2 for visual examination of the sump pit 1-8).
- Identified several defects, (i.e. cracks and voids) at the interface of the drainage trough and its drainpipes to the 1-8 sump.
- Identified a glass object embedded in a void at the bottom of the drainage trough near the discharge pipes to the sump. This condition was confirmed to be a direct water entry path into the drywell elevation 10'-3"/10'-9" concrete slab. This condition is believed to have existed since the original plant construction. It is unknown if the associated void has degraded since that time.
- Confirmed that no caulk or other sealant material currently exists at the curb-to-drywell shell interface at elev 10'-3".

(Note: the 2006 drywell maintenance rule structural monitoring walkdown write-up is attached for information, section 7.6)

2.7 Water Migration

Potential migration paths identified from the drawing reviews and field walkdowns were investigated. It was determined that water migration could occur during plant operation or during outage periods. See the attached sketches in section 7.8 for the drywell elevation 10'-3" configuration. The credible paths investigated included:

- Water/condensation washing down the inside face of the drywell shell and into the unsealed circumferential gap between the shell and the elev 10'-3" slab
- Water migration through degraded surfaces of the elevation 10'-3" and 10'-9" floor slabs
- Leakage from the drywell sump 1-8
- Leakage from the sub-pile room drainage trough/drain into the concrete and through sub surface cracks or between concrete pour layers
- Water migration from water on the elevation 10'-3" slab
- Any combinations of the above pathways

Based on the drawing review and the field inspections, engineering concluded that leakage from the sub-pile room drainage trough/drain appeared to be a highly likely source of the trench water.

To confirm this hypothesis, a tracer test plan was developed and implemented, (see attachment 7.4, tracer test plan, for more information.). The test commenced 10/23/06 at approximately 04:30 and continued throughout the day. Based on the scheduled control rod drive (CRD) exchange, which would cause water to enter the sub-pile room, the drainage trough drainpipe plugs were removed on 10/23/06 at approximately 21:20. (see the attachment 7.2, "Oyster Creek Trench Pump Out Schedule" for a summary of the actions.) At the time of the drain plug removal, approximately 15 gallons of water was lost from the trough, but no tracer element had been identified in the Bay #5 trench. This was not unexpected, since the water migration rate through concrete is small and the slab had been "de-watered" to the bottom of the Bay #5 trench. Monitoring of the Bay #5 trench continued for the next several days.

On 10/25/06 at approximately 08:00, a small amount of water was observed in the Bay #5 trench. Inspection of the water with a black light provided initial confirmation that tracer element was present in the water. A sample was extracted and confirmatory testing was performed in the hot lab. This testing confirmed the presence of the tracer element in the sample.

The 10/25/06 positive identification of tracer element in the Bay #5 trench confirms that some, if not all, of the water that migrated to the Bay #5 trench is from the sub-pile room drainage trough and associated drains. Engineering continues to consider the drywell-to-concrete curb interface as another credible water entry path based on the observations of water dripping down the wall during early outage walkdowns, and the gap at the concrete-to-shell interface.

As noted in the maintenance rule structural monitoring walkdowns, (attachment 7.6), discussed above, the structural inspection of the elevation 10'-3"/10'-9" floor slab surface condition was in generally good condition. The as-found condition is not conducive to significant water intrusion.

2.8 Engineering Evaluation of the Drywell Shell Steel Corrosion

An engineering evaluation was prepared by an independent structural engineering and corrosion expert from Structural Integrity Associates (SIA). The evaluation reviewed the impact of the as-found water on the continued integrity of the drywell shell. The engineering evaluation utilized the results of the above discussed water chemical analysis and NDE examinations. The engineering evaluation concluded: These measured water chemistry values, plus the lack of any indications of rebar degradation, suggest that the protective passive film established during concrete installation at the embedded steel/concrete interface is still intact and significant corrosion of the drywell steel would not be anticipated as long as this benign environment is maintained. Therefore, since the concrete environment complies with the EPRI concrete structure guidelines, corrosion would not be considered "an applicable aging mechanism for nuclear power plant concrete structures and structural members" at Oyster Creek. More specifically, the results of this engineering evaluation indicate that no significant corrosion of the inside surface of drywell steel shell would be anticipated for the following reasons:

- The concrete floor water inside the drywell is characterized by corrosion-inhibiting high pH with low impurity levels that are significantly below the EPRI embedded steel guidelines action level recommendations. Therefore, drywell steel integrity can be maintained indefinitely as long as the high pH and low impurity levels in the water at the concrete-to-drywell shell interface are maintained.
- Any subsequent water (such as reactor coolant) entering the concrete floor-to-drywell shell interface will increase in pH due to its migration through and

contact with the concrete. This will reduce its corrosivity compared to neutral pH.

- The corrosion of drywell steel surfaces in contact with water at the concrete floor-to-drywell shell interface is expected to occur only during outages when oxygen is present. Corrosion during operation is expected to be almost nil since the drywell operates inerted and no oxygen is present to drive the corrosion reaction. During outages, shell corrosion losses in the interface are expected to be small since the exposure time is very limited and the water pH is expected to be relatively high.
- The expected low corrosion losses in the concrete-to-drywell shell interface have been confirmed by examinations of steel surfaces in the trenches, which have revealed only superficial corrosion of the drywell shell.

Therefore, the water identified in contact with the inside surface of the drywell steel has not been and is not, an engineering concern for the structural integrity of the drywell as long as the environmental conditions (e.g., pH and water purity) are maintained.
The SIA engineering evaluation is included as attachment 7.5.

In addition to the review performed by SIA, a review of the 10CFR50 Appendix J, Type A testing results was performed to confirm that the area of the shell encased in concrete is not breached. Attachment 7.0 was prepared to evaluate this configuration. The last type A test was performed successfully in November 2000.

2.9 NDE Inspections

2.9.1 UT Examinations
The scope of the 1R21 outage included numerous NDE exams of the drywell shell. Additional drywell shell NDE exams were also performed as a result of the water found in the Bay #5 and #17 trenches. The results of these NDE exams were reviewed and evaluated by engineering in technical evaluation A/R A2152754 eval 09. that tech eval concludes: The plates exposed by the two trenches exhibit signs of material loss. It is concluded that all the material loss occurred between 1986 and 1992. Assumed corrosion rates for this mechanism between 1986 and 1994 are consistent with as found measured corrosion rates previously established for these bays for this period in time.

Additional concrete was removed from Bay 5 trench and UT readings taken on the newly exposed 6 inches of drywell shell below the previous 1986 and 2006 readings. This newly excavated area represents shell thicknesses of the embedded region (on both sides) of the vessel in Bay 5 of sandbed region. The average Drywell shell thickness measured was 1.113 inches and the minimum reading was 1.052 inches. The UT Data Sheet is Attachment 7 of a/r a2152754 eval 09. The shell thickness in this area meets the general uniform thickness criteria of .736 inches with considerable margin. This area will be used to repeat these UT measurements in 1R22.

Evaluation of the NDE examination results at and below the elevation 10'3" concrete slab concludes that the drywell shell has sufficient thickness to withstand all design requirements.

2.9.2 Visual Inspection of Drywell Sump 1-8

A visual inspection was performed on the drywell sump 1-8. the inspection was performed to confirm the stainless steel sump liner remains structurally adequate and leak tight. The inspection looked for pitting, corrosion, cracks, and other defects. The visual inspection confirmed the liner remains structurally adequate and leak tight. The inspection results are included in attachment 7.7.

2.10 Field Repairs/Rework

ECR 06-00879 has been developed to mitigate the introduction of water into and/or below the drywell elevation 10'-3" slab through inspections, repairs, and rework of associated components during 1R21. Specifically the ECR implements the following actions:

- Clean and inspect the sub-pile room drainage trough.
- Verify drainage trough is properly sloped to the sump
- Repair/re-surface the trough and discharge points as required to return the trough to its design intent
- Clean and dewater the drywell sump 1-8 to verify integrity.
- Perform visual inspection of the drywell sump 1-8
- Repair significant leak paths, if any, in the drywell sump 1-8, as required (Note: as documented in section 2.9.2. above, the sump did not require any repairs.)
- Clean and prep the top surface of the elevation 10'-3" slab curb at the drywell shell interface.
- Seal the joint at the curb-to-drywell shell interface with approved caulking material
- Excavate additional concrete at the base of the Bay #5 trench to provide sufficient space for new UT exams of the shell below the current trench bottom
- Perform UT exams at additional drywell shell locations at the newly exposed portions of the drywell shell
- Caulk the concrete-to-shell interface in the Bay #5 and #17 trenches

2.11 Drywell Leakage Monitoring

In addition to the above described actions implemented during 1R21, on-line procedures minimize potential water available for water migration below the elevation 10'-3"/10'9" floor slab. Plant operating procedures require on-line monitoring of known and unidentified drywell leakage. This process maintains the drywell leakage to an acceptable amount, and provides a rapid indication of significant drywell leakage during plant operation.

2.12 Structural Adequacy of the Elevation 10'-3" Concrete Slab

The fill slab is reinforced concrete placed in the bottom of the drywell vessel up to El. 10'-3" to provide a working base for supporting the reactor pedestal and other loads from the internal structures and equipment. The fill slab transfers all imposed loads to the drywell vessel foundation through direct bearing only, (Ref., Section 3.8.3.1.1 of the UFSAR). Typically, cracking of concrete elements within reasonable limits will not affect the structural capacity of concrete members provided the overall integrity of the element remains intact. Given the structural configuration of the fill slab as confined by the steel shell and exterior drywell support and that the primary load transfer mechanism is by direct bearing, nominal cracking in the slab will not affect its load carrying capacity. The concrete material removed from the Bay #5 and Bay #17 trenches has no impact on the drywell shell analysis.
.The original concrete fill inside the drywell was specified to have a minimum compressive strength of 3000 psi at 28 days. The concrete was placed in three (3) layers with specific requirements for strength and time between pours, (Reference: Drawing BR 4059-2 sheet 2 of 3).

From a structural standpoint, the presence of water in cracks or porosities will not impact the strength of the fill slab. It should be noted that the Bay #5 and Bay #17 trenches were excavated in areas that are completely outside the concrete bearing area required to support the reactor vessel pedestal.

The concrete slab is inspected each outage as part of the Maintenance Rule Structural Monitoring Program. The Maintenance Rule Structural Monitoring walkdowns to date have reported the concrete surface sound, with no spalling or cracking that would indicate reinforcing steel corrosion in the slab.

Therefore, the concrete floor slab integrity is maintained and the presence of water in the inspection trenches has no detrimental impact on the drywell internal concrete's structural design function.

3.0 <u>CONCLUSION</u>

3.1 Based on the detailed drawing reviews, field inspections, chemical analysis, and monitoring, the source of a portion of the water in the Bay #5 trench is confirmed to have originated from the degraded areas in the sub-pile room drainage trough drain. There still remains a potential leak path from the unsealed area between the drywell shell and the concrete curb at elevation 10'-3". Based on the drywell elevation 10'-3" construction details and the relative bottom elevation of the Bay #5 and Bay #17 trenches, the source of the Bay #5 water is also likely to be the source of the dampness noted in the Bay #17 trench. water or moisture may continue to exist below the drywell interior elevation 10'-3" floor slab.

3.2 The attached SIA engineering evaluation indicates that no significant corrosion of the inside surface of drywell steel shell occurs as long as the current environmental conditions inside the drywell are maintained for the following reasons:

- The water at the concrete floor-to-drywell shell interface inside the drywell is characterized by corrosion-inhibiting high pH with low impurity levels that are significantly below the EPRI embedded steel guidelines action level recommendations. Therefore, drywell steel integrity can be maintained indefinitely as long as the high pH and low impurity levels in the water at the concrete floor-to-drywell shell interface is maintained.
- Any subsequent water (such as reactor coolant) entering the concrete floor-to-drywell shell interface will increase in pH due to its migration through and contact with the concrete. This will reduce its corrosivity compared to neutral pH.
- The corrosion of drywell steel surfaces in contact with water at the concrete floor-to-drywell shell interface is expected to occur only during outages when oxygen is present. Corrosion during operation is expected to be almost nil since the drywell operates inerted and no oxygen is present to drive the corrosion reaction. During outages, shell corrosion losses in the interface are expected to be small since the exposure time is very limited and the water pH is expected to be relatively high.
- The expected low corrosion losses in the concrete-to-drywell shell interface have been confirmed by examinations of steel surfaces in the trenches, which have revealed only superficial corrosion of the drywell shell.
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- Therefore, the water identified in contact with the inside surface of the drywell steel has not been and is not, an engineering concern for the structural integrity of the drywell as long as the environmental conditions (e.g., pH and water purity) are maintained.

3.3 The evaluation of the NDE examination results at and below the elev 10'-3" concrete slab concluded that the drywell shell has sufficient thickness to withstand all design requirements.

3.4 ECR 06-00879 has been generated to implement a series of actions to mitigate further water intrusion into and below the drywell elevation 10'-3" concrete slab. These actions will greatly reduce or eliminate future water migration below the surface of the elevation 10'-3"/10'-9" concrete slab.

3.5 Overall Conclusion

Significant engineering, maintenance, and NDE effort was employed during the 1R21 outage to address the cause, source, and impact of the standing water in the Bay #5 inspection trench and the dampness in the Bay #17 inspection trench at drywell elevation 10'-3". The investigations concluded that the likely entry point for the water was a deteriorated connection at the sub-pile room drainage trough drainpipes, at the void in the bottom of the sub-pile room drainage trough, and at the unsealed gap at the elev 10'-3" concrete slab curb and the interior surface of the drywell shell. A design change was implemented to remediate these entry paths. In addition, detailed inspections confirmed the structural adequacy of the drywell sump. NDE exams confirmed that the drywell shell thickness maintains adequate margin by exceeding the required minimum wall thickness. The SIA engineering report established that the drywell shell structural integrity is not impacted by continued water in the drywell elevation 10'-3" concrete. Therefore it is concluded that the drywell structural integrity is maintained and the drywell continues to meet all of its design bases requirements until the next scheduled refueling outage at which time additional inspections will be performed.

4.0 RECOMMENDATIONS

4.1 Perform UT and visual examinations of the drywell shell in the Bay #5 and #17 trenches (interior shell surface) and the sand bed region inspection points below the as-found Bay #5 trench water level (exterior shell surface) in the next refueling outage to confirm that the conclusions of this evaluation remains valid. See action tracking item IR 546049, assignment 06.

4.2 Include the sub-pile room drainage trough and the drywell shell-to-concrete curb caulk in the structural monitoring program. Inspection should be performed each refueling outage. The inspections will be part of ER-OC-450. Reference ECR 06-00879, and ER-OC-450

5.0 REFERENCES

IR 546049
Cc-AA-309-101, rev 7
Dwg 3e-153-02-001, rev 7
Dwg 3e-153-02-009, rev 4
Dwg BR 2134, rev 8
Dwg BR 2135, rev 8
Dwg BR 2145, rev 12
Dwg BR 2146, rev 14
Dwg BR 2184, rev 7
Dwg BR 2186, rev 9
Dwg BR 4049, rev 7
Dwg BR 4050, rev 2
Dwg BR 4058, rev 2
Dwg BR 4059, sheet 1, rev 1
Dwg BR 4059, sheet 2, rev 2
Dwg BR 4070, sheet 1, rev 4
Dwg BR 4070, sheet 2, rev 3
Dwg BR 3136, rev 15
Dwg 9-0971, sheet 11, rev 2 (CB&I)
UFSAR Section 3.8
Calculation C-1302-187-5300-021.

6.0 REVIEWS

This eval has been prepared as a technical evaluation in accordance with procedure CC-AA-309-101. Based on a review of CC-AA-102, this eval has no procedure, program, or other documentation impacts.

Based on a review of HU-AA-1212, a risk rank of 2 was assigned to this product, and the appropriate pre-job brief was performed. This evaluation shall receive an independent review, and an independent third party review.

7.0 ATTACHMENTS

7.1 Plant Structure Walkdown/Monitoring Reports, (20 pages). Attachment includes: Report dated 03/26/97 for walkdown performed in 1996 (contains letter describing conditions found in 1994); Report dated 11/12/98 for walkdown performed in 1998.

7.2 Oyster Creek Trench Pump Out Schedule (3 pages)

7.3 OC Drywell Chemistry Sample Results and Analysis, rev 6. (13 pages) Attachment also includes embedded file (BWXT Report "Examination of Water Samples From Oyster Creek, rev 0, dated 10/22/06) (32 pages)

7.4 Tracer Test Plan, rev 2 (3 pages)

7.5 Structural Integrity Associates, Inc. "Corrosion Evaluation of the Oyster Creek Drywell Shell Steel – ECR 06-00879", dated 11/02/06 (11 pages)

7.6 2006 Drywell Maintenance Rule Structural Monitoring Walkdown Write-up (20 pages) Attachment includes #R2091380-01-01, and #R2091380-01-02

7.7 GE Visual Examination Report #21R-158 - Sump 1-8 Visual Inspection (3 pages)

7.8 Simplified sketches (5 pages)

7.9 Evaluation of the Ability of Type A Integrated Leak Rate Test to Detect Through Wall Breach in the Concrete Encased Area of the Drywell Shell, 10/31/06 (5 pages)

7.10 MPR Associates Letter, "Third Party Independent Review of Oyster Creek Drywell Water Evaluation, dated 11/03/06 (3 pages)

Preparer: DP Knepper - PEDM

Independent Reviewer Comments:
An independent review of this document was performed in accordance with CC-AA-309-101. I performed a detailed review of the inputs, attachments and reference documents, with emphasis being applied to evaluations performed or referenced in Section 2.0. I performed a walkdown of the concrete slab and verified that the concrete slab is in good

condition. I provided comments to the preparer and all comments have been satisfactory resolved. I agree with the conclusion that the structural integrity of the containment shell is not impacted by continued water in the drywell Elevation 10'-3" concrete slab, or its adjacent interface with the containment shell.

Independent review Performed by Dan Fiorello, Corporate Design Engineering

Independent Third Party Reviewer:
ITPR was performed by MPR Associates. The documentation of this review is included as Attachment 7.10 of this eval.

Manager Comments:
The preparer and multiple reviewers of this technical evaluation had the appropriate knowledge and experience and are qualified to perform this task. The Independent Third Party Review (ITPR) was performed by MPR who was selected as a subject matter expert based on their expertise and industry experience on this topic. This document has been rigorously challenged and addresses the adequacy of the as-found water conditions and potential impacts to demonstrate the drywell vessel maintains its design and licensing bases requirements to support restart from 1R21.

The ITPR has been completed and comments adequately resolved as documented in Attachment 10.

Manager Approval: F.H. Ray 11/3/2006

Attachment 7.1

Plant Structure Walkdown /Monitoring Reports

A) Report dated 03/26/97 for walkdown performed in 1996 and contains letter describing condition found in 1994
B) Report dated 11/12/98 for walkdown performed in 1998

(20 Pages)

GPU NUCLEAR	OYSTER CREEK NUCLEAR GENERATING STATION PROCEDURE	Number 125.6
Title: Building Structure Monitoring Plan		Revision No. 0

ATTACHMENT 125.6-1

PLANT STRUCTURE WALKDOWN/MONITORING REPORT

SYSTEM: PART OF THE Rx Bldg (153) DATE 03/28/97 TIME

LOCATION: INSIDE THE DRYWELL

WALKDOWN ENGINEER SIGNATURE: T.H. CHANG / [signature]

MANAGER OF THE WALKDOWN ENGINEER SIGNATURE: [signature] For Tom Quintenz 4/2/97

OTHERS ON WALKDOWN:

Inspection Items	Yes	No	N/A	Location	Descriptions
1 Major Concrete Crack	☐	☒	☐		
2 Spalling or Scaling Concrete	☐	☒	☐		
3 Rebar Exposure	☐	☒	☐		
4 Rebar Corrosion	☐	☒	☐		
5 Water Intrusion	☐	☒	☐		
6 Water Stain	☒	☐	☐	} Various Location	See Note (2)
7 Rust Stain	☒	☐	☐		
8 Disintegrating Concrete	☐	☒	☐		
9 Structural Settlement	☐	☒	☐		
10 Distorted Structural Member	☐	☒	☐		
11 Noticeable Block Wall Defect	☐	☐	☒		
12 Noticeable Structural Steel Defect	☐	☒	☐		

CONDITION/PROBLEMS NOTED DURING WALKDOWN AND ACTIONS INITIATED

Notes:

(1) The only concrete inside the drywell can be visually examined are on the El. 10' floor & the reactor vessel supporting pedestal.

(2) There were few water stain & rust stain at various location inside the drywell. These minor stains were judged to be caused from the water in the Rx cavity leaking to the drywell during some outages before. However, there was no leakage found during this walk down.

(3) For other details, see the attached report and pictures.

16R STRUCTURAL WALKDOWN REPORT
INSIDE THE DRYWELL

1. **GENERAL STATEMENT**

As required per plant Procedure 125.6, a walkdown was performed in the morning of September 22, 1996 by Tom Quintenz and T.H. Chang inside the Drywell. This walkdown is to provide visual inspection to the structural elements at that area in accordance with the NRC's New Maintenance Rule. The accessible locations from El. 82' on top of the biological shield wall to platforms at El. 46' and 25', to El. 10' concrete floor and under the Reactor vessel were inspected.

2. **SCOPE**

2.1 **El. 82' on Top of Biological Shield Wall**

- The general appearance of the Reactor vessel stabilizers, the star truss that connects the biological shield wall to the Drywell steel liner, and the surface condition of the Drywell, the steel platform underneath the Reactor cavity which was flooded during this inspection.
- General condition of the pipe supports and duct supports.

2.2 **El. 46' Grating Platform**

- The general condition of the platform structure.
- The platform steel beams and beam connections, if visible.
- The surface condition of Drywell liner.
- The supports for Drywell cooling fans.
- The general condition of the pipe/equipment supports.

2.3 **El. 23' Grating Platform**

- Same as for El. 46' platform except there are no Drywell cooling fans on El. 23'.

2.4 **Concrete Floor at El. 10'**

- The Drywell surface condition.
- The concrete floor surface condition.
- The ring corbel that supports the Reactor vessel looking up from underneath the vessel.

3. **RESULTS AND CONCLUSIONS**

Some of these conditions were documented in the attached pictures. There are no obvious structural deficiencies found during this walkdown except the following:

3.1 Any temporary, heavy laydown load shall be placed on top of the steel beam, particularly the radial beams where the structural strength is greater. Due to the very tight space condition, some of the steel plates removed from the pipe penetration were laid on the grating. This condition was inspected, and no sign of structural failure nor excessive displacement at this location was found.

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ATTACH PG 4

16R STRUCTURAL WALKDOWN REPORT
INSIDE THE DRYWELL

3.2 On El. 10', at the sand bed region where the concrete curb protects the Drywell liner, there are two locations where concrete curbs were removed about one foot long. The two locations are near the drain tank and near the ladder. GPUN performed UT to monitor the Drywell liner corrosion condition at the sand bed region at those two locations. During this walkdown, floor water accumulation at those two locations was identified. The possible impact to the Drywell liner due to the water has been addressed by Sam Saha (Memo 5340-95-002, January 3, 1995).

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ATTACH PAGE 5

GPU Nuclear

Memorandum

Subject:	INSPECTION OF DRYWELL COATING AND CONCRETE TRENCHES @ EL: 10'-3", OC	Date:	January 3, 1995
From:	S. K. Saha - Engineer, Engineering and Design	Location:	Morris Corp. Center [redacted]
To:	Distribution		

On September 29, 1994 the writer, along with Bill Quinlan, made an entry into the drywell to inspect and observe coating condition on the inside surfaces of drywell shell from elevation 10'-3" to elevation 53'. As a part of the same effort, an inspection of two trenches at elevation 10'-3" in Bays 5 and 17, excavated and filled during 11R outage, was also performed. The results of this inspection are detailed below:

<u>Drywell Coating</u>:

The inside surface of the drywell shell between elevations 10'-3" to 94'-1" is coated with CarboZinc 11 coating, manufactured by Carboline Company. During construction, the individual shell plates were precoated in the shop with CarboZinc 11 over an abrasive blasted surface (SSPC-SP5/SP6) to a dry film thickness (DFT) of 3-6 mils except 2 to 3 inches of the edges which were masked off for field welding (Ref 1). During field erection, the individual drywell shell plates were welded to form the pressure boundary. The weld crowns were ground flush and touched up (probably by brush) with CarboZinc 11 (Ref. 1). During the last 25 years of plant operation, various system modifications/repairs have required removal of this coating for welding and/or fitting. Upon completion of repair/modification, CarbonZinc 11 was reapplied by brush over a SP-3 (power brush cleaned) <u>or</u> SP-11 (power tool cleaned) surface.

The walkdown inspection was carried out from the platforms located inside drywell at elevations 10'-3", 23'-6" and 46'-1". The visual inspection did not reveal any coating distress such as blisters, disbonding, chalking, spalling, etc. Some fading of luster and accumulation of dust were seen on the coating surface which was expected considering the coating type and its age. The coating showed good adhesion to the drywell shell when tapped with a 2"x4" wooden bar. In short, nothing was observed on the coating to change any technical basis of its failure mode during LOCA or to cause strainer blockage, as evaluated under Reference 2.

<u>Concrete Trenches</u>:

During 11R, two trenches were dug where the concrete floor meets the drywell shell ((Figure 1) to evaluate shell thickness and to remove plug samples in Bays 5 and 17. After evaluation and repair, the shell was spray coated in the trench areas, filled up with Dow Corning 3-6548 Silicone RTV Foam and sealed at the top by pouring a protective sealing layer of Promatec Low Density Silicone Elastoner. It was evident after a 12R inspection of the area, that water was seeping into the trenches. Probable sources of water may be (a): various component (e.g. valve) leakages, (b): spills from drain

IR 546049-02 ATTACHMENT 7.1
ATTACH Pg. 6

tanks, and (c): excess water from outage activities (e.g. CRD changes). In April, 1994, the trench areas were visually inspected again when a walkdown was conducted to check fixed point radiation monitors during a forced outage. The areas were totally dry (Figures 2 and 3).

To evaluate corrosion potential of trench water on the drywell shell, it was decided to collect water samples from the trench areas during 15R outage and analyze for pH, conductivity and halogen content as specified in Reference 3. The writer found the trench areas wet/moist during 9/29/94 drywell walkdown but no water accumulation was seen (Figures 4 and 5). When the elastomeric filler/sealer was vigorously tapped with a 2"x6" wooden bar, water was seen spewing out of the joint connecting elastomeric filler/sealer to the drywell shell (Figures 6 and 7). However, the amount of water was inadequate in quantity for the planned analysis and no sampling was performed. A band of rust 1 to 1.5" wide was seen on the drywell shell above sealer shell interface indicating the level of water accumulation on the concrete floor. No visually observed localized corrosion attack was seen in the rusted band and the depth of oxide layer was visually estimated to be in 2-3 mils range.

The above observation indicates that (a): Prometec LDSE is no longer acting as a seal to prevent intrusion of surface water, and (b): Dow Corning RTV foam is retaining the water reaching the trenches. It is likely that the subject areas dry out rapidly once the reactor starts but nonetheless, water reaching the trenches do remain in contact with concrete and drywell shell until it dries out. Concerns have been expressed on long and short term effect of this water intrusion on drywell shell corrosion. The writer's evaluation of the subject concerns are summarized below:

- Although no water sample analysis was performed, it is believed that such analyses would have shown low corrosion potential for the drywell shell in trench areas because of:

a) expected high pH value of trench water due to contact with concrete. The pH of a saturated $Ca(OH)_2$ solution is about 12.5. At such high pH value and in the presence of moisture and oxygen (outage condition), carbon steel shell will be passivated by formation of thin γ-FeOOH oxide film. When oxygen is depleted and concrete is dry (plant operation), this film may be disrupted but still amount of corrosion will be very low (Ref. 4).

b) low contaminants leaching out of (1)-RTV foam (Ref. 5), (2) LDSE sealer (Ref. 6), and (3)-concrete. The leach rate should not increase corrosion potential of the trapped water by any substantial margin.

c) nitrogen inerting of drywell during plant operation. Nitrogen blanket will keep the shell corrosion to a very low level.

Therefore, the writer does not expect any significant shell corrosion from infrequent trapping and drying of moisture under filler/sealer and shell interface at the subject trenches.

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Technically, the condition of the subject trenches is not desirable. In addition to collecting water, they also trap various contaminants including radioactive particles. Rectification of the situation will require either prevention of water from reaching the trenches or removal of existing filler materials and resealing the trenches with proven material(s). Any such rectification will involve significant exposure of radiation to work personnel. The conceptual estimate for this job is 10-15 Person-REM based upon similar work in 12R (Ref. 7). Therefore, desirability of rectification work must be evaluated against practicality of high Person-REM exposure before any final decision is made.

Please feel free to call me at extension 7684 if you have any questions on the evaluation.

S. K. Saha
Extension 7684

/kw

Attachments
(Figures 1 thru 7)

Distribution:
- J. D. Abramovici - Mechanical Components Manager
- J. J. Colitz - Director, Engineering and Design
- W. M. Connor - Manager, Nuclr Matrls/Chem Engineering
- W. J. Cooper - Manager Rad Engineering, OC
- R. F. Croll - Engineer, Engineering and Design
- D. K. Croneberger - Director Special Projects
- D. H. Reppert - Tech Analyst, Rad Engineering, OC
- [redacted] - Tech Function Site Director, OC
- S. L. Schwartz - Engineer, Systems Engineering, OC
- C. R. Tracy - Engrg Projects Director (OC)

IR 546049-02 ATTACHMENT 7.7
ATTACH PAGE 8

DLS JRS

REFERENCES:

1. GPUNC Technical Data Report No. 503 - "Drywell Coating Evaluation"

2. GPUNC Safety Evaluation SE-328245-001 - "Drywell Shell Coating Touch Up"

3. GPUNC Specification - SP-1302-32-035 - "Inspection and Minor Repair of Coating on Concrete and Drywell Shell Surfaces in the Sandbed Region"

4. ASM Handbook - Volume 13 "Corrosion" - 9th Edition - Chapter "Corrosion in Structures" - Page 1301

5. Dow Corning Product Information Bulletin on 6548 Silicone RTV foam

6. Personal Communication with Glenn Kruse of Promatec on Reg. Guide 1.36 Test on Promatec LDSE materials.

7. GPUNC Memo 5340-95-001 - "Drywell Floor Trench Repair" from R. F. Croll to S. K. Saha

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ATTACH PAGE 9

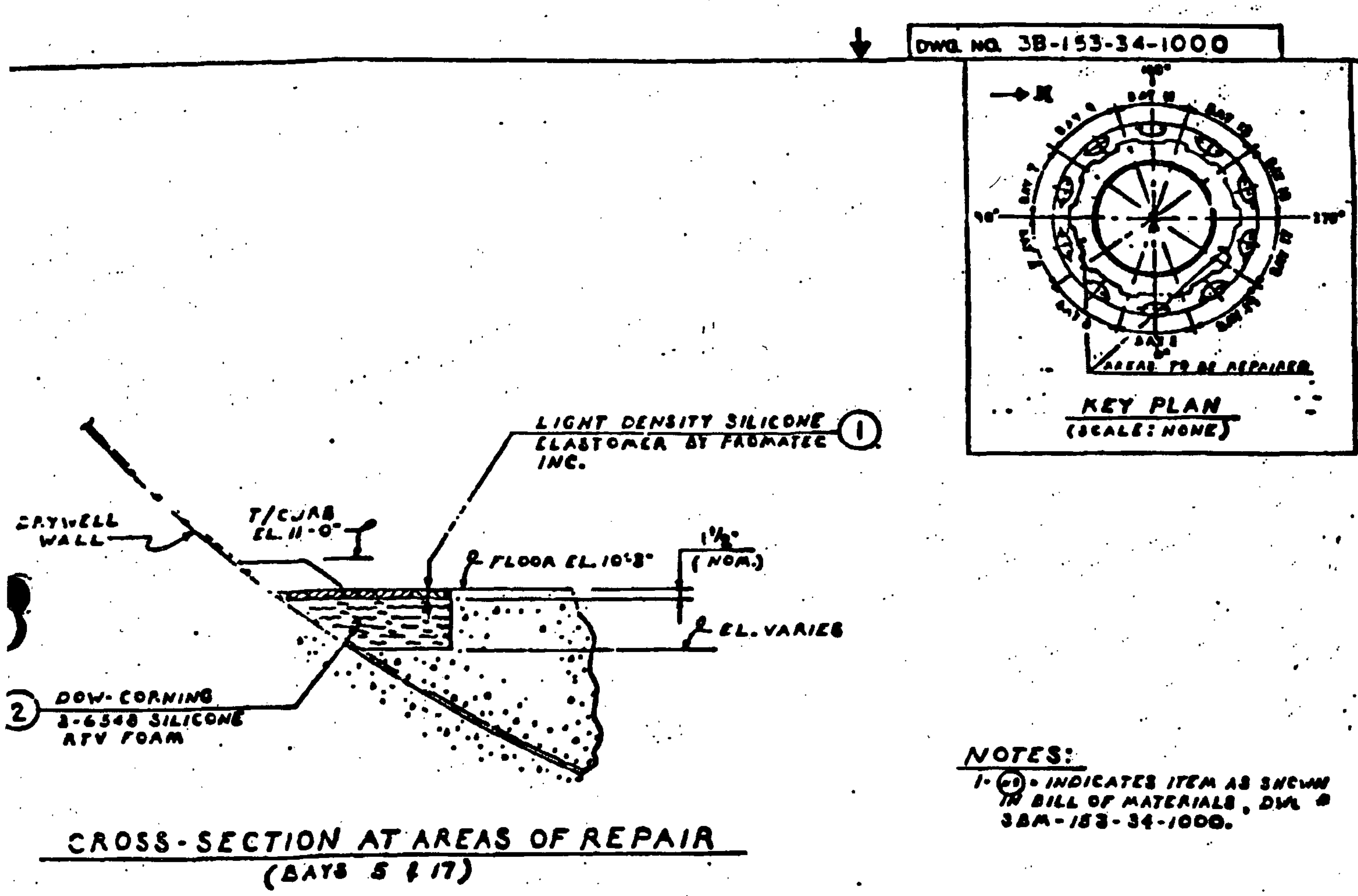

Figure 1: A cross section of excavated drywell concrete trench @ Elev. 10'-3"

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ATTACHMENT 7.1
ATTACH PAGE 10

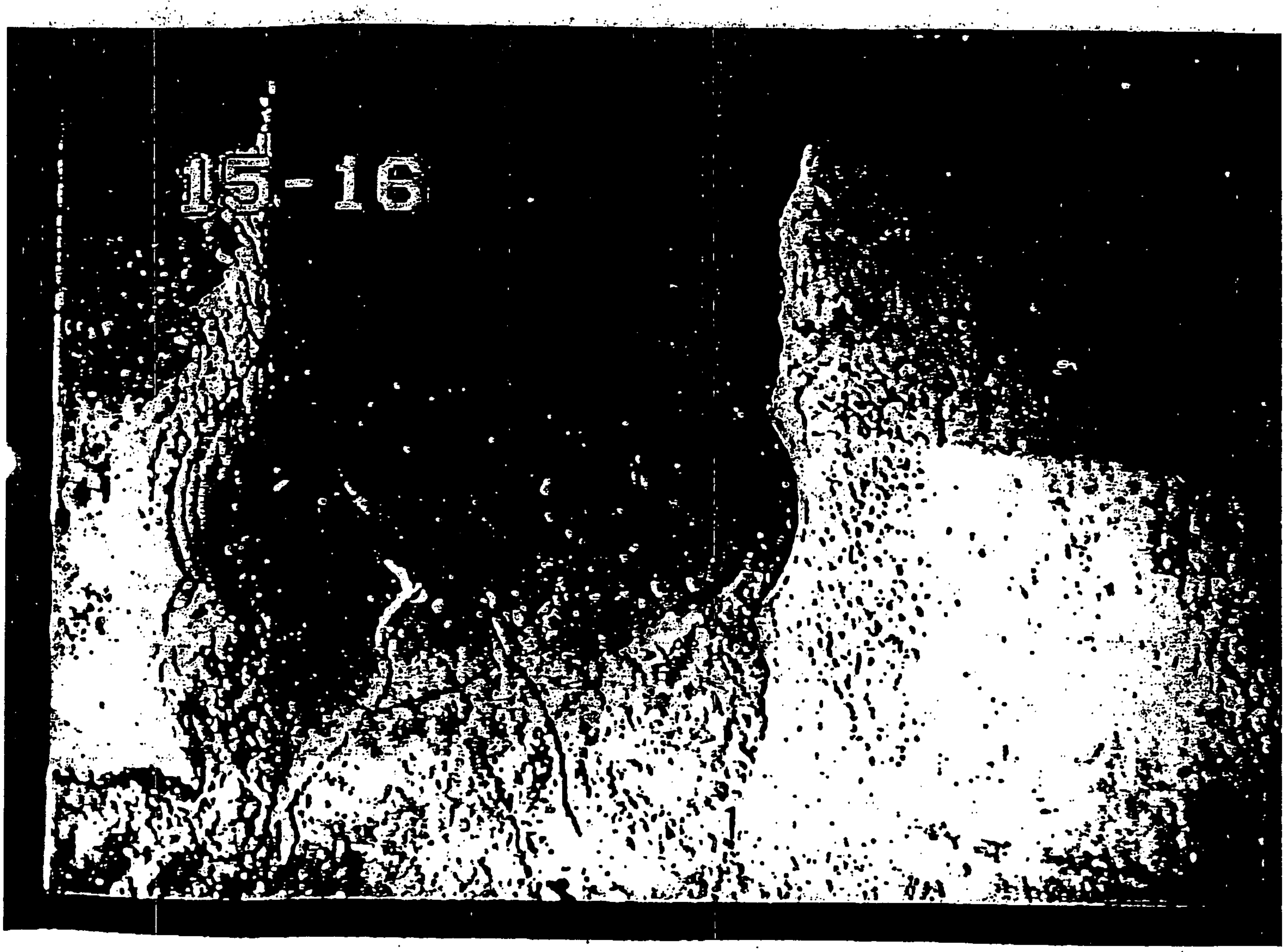
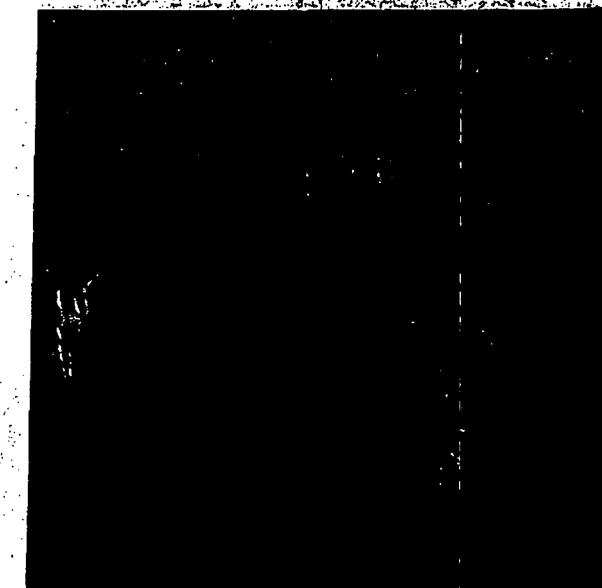


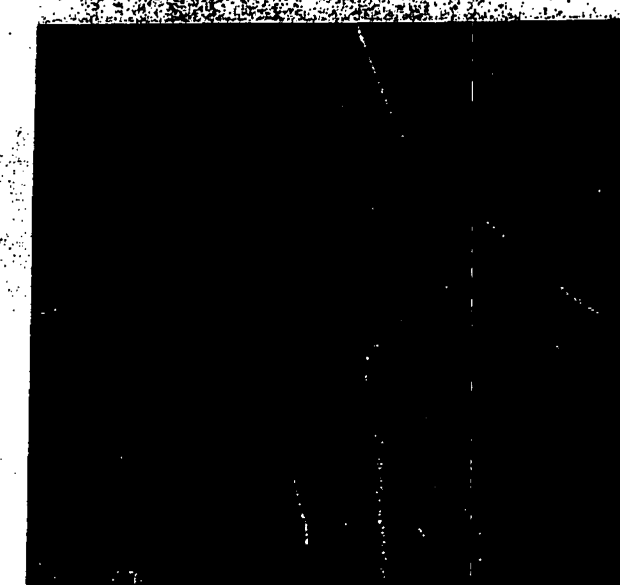
Figure 2: Repaired concrete trench area in Bay 5 during April '94 walkdown showing the area totally dry. Note crack at the sealer - concrete-shell interface.

Figure 4: Bay 5 trench repair area showing signs of wetness and moisture during September '94 walkdown

Figure 5: Same as Figure 4 but in Bay 17



9/22/96
TYPICAL RX VESSEL STABILIZER SUPPORT ON TOP OF BIOLOGICAL SHIELD WALL @ EL. 82'. THESE STABILIZERS ARE IN GOOD SHAPE.



TYPICAL BRACKET SUPPORT FOR THE RX CAVITY LOOKING FROM TOP OF BIOLOGICAL SHIELD WALL. THESE BRACKETS ARE IN GOOD SHAPE. 9/22/96

16R DRYWELL WALK-DOWN

IR 546049-02 ATTACHMENT 7

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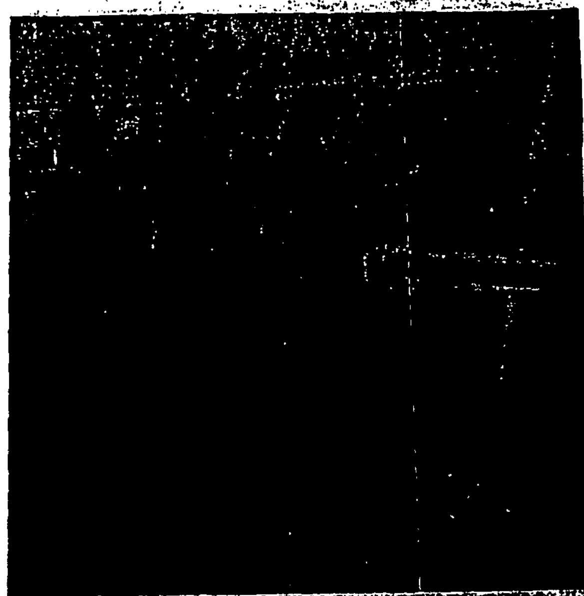
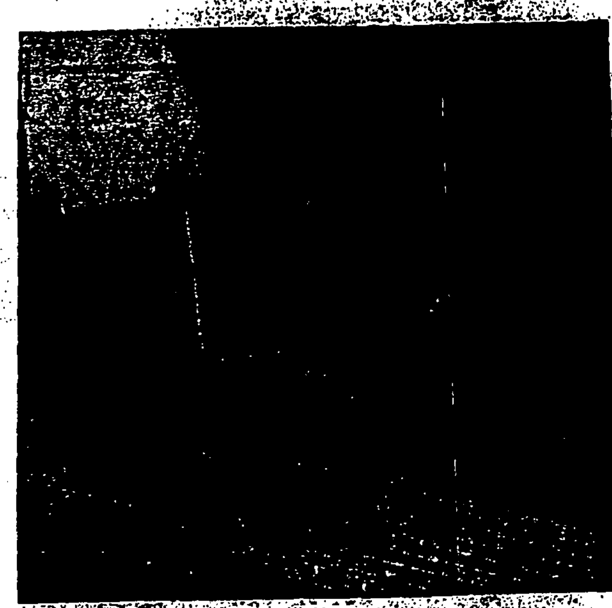


RADIAL BEAM SUPPORT ON THE DRYWELL SIDE LOOKS IN GOOD CONDITION. 9/22/96 (EL.46')

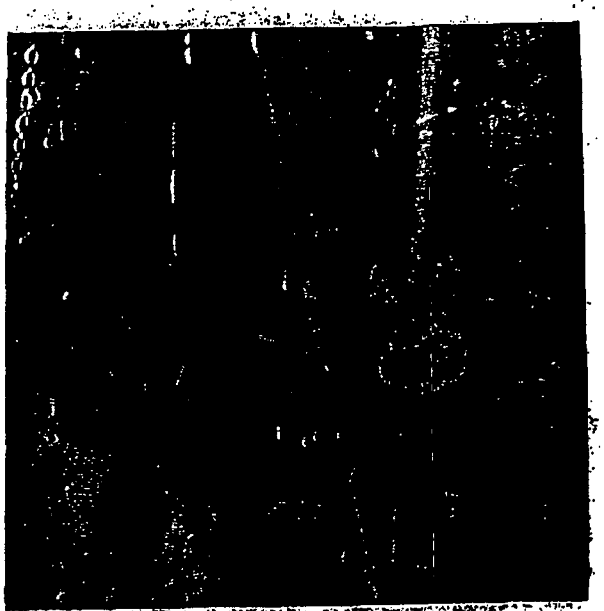


STEEL PLATES LAYING ON THE EL46' GRATING. DUE TO THE SPACE TIGHTNESS THESE PLATES WERE NOT ON TOP OF BEAMS. 9/22/96

16R PRYNELL WALK-DOWN

IR 546049 -02 - ATTACHMENT 7.1

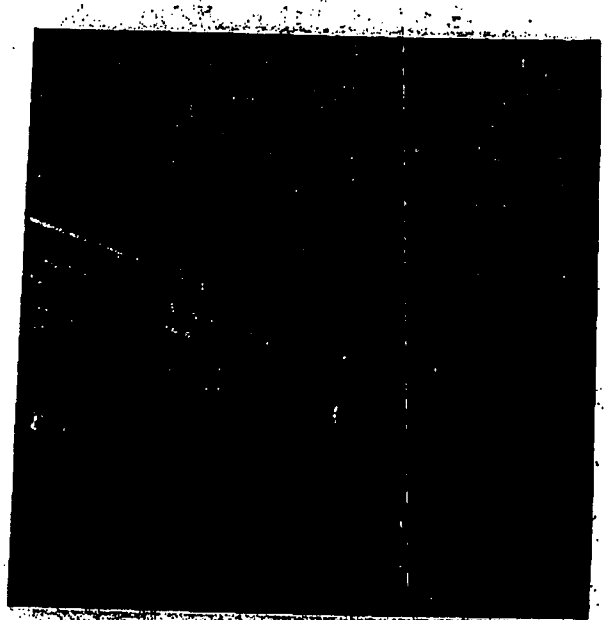
ATTACH PAGE 14



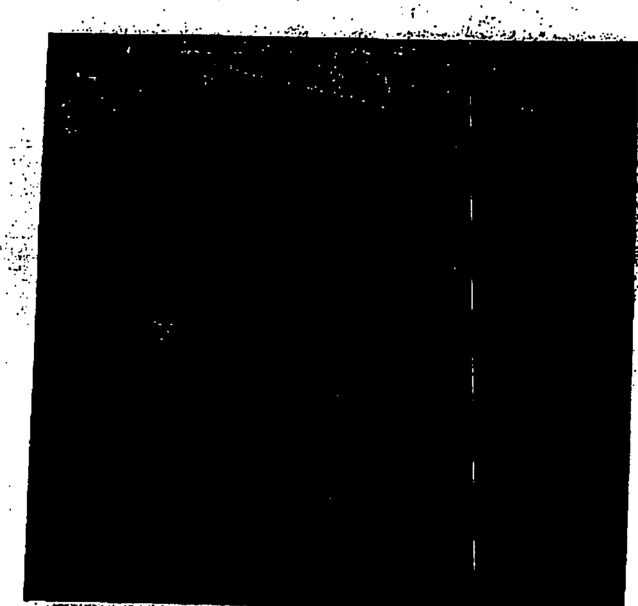
ONE TYPICAL [illegible] ON EL 46' SHOWS THE CROWDEDNESS OF THAT AREA. 9/22/96

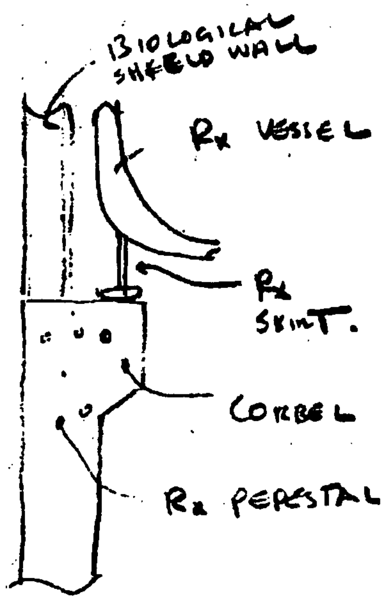
TYPICAL PLATFORM SUPPORT @ THE BIOLOGICAL SHIELD WALL SIDE FOR EL. 46'. THEY ARE IN GOOD SHAPE

9/22/96



SOME RUST MARKS INDICATE LEAKAGE OCCURRED SOMETIME AGO. THESE RUSTS ARE JUDGED TO BE MINOR AND DO NOT AFFECT THE STRUCTURAL STRENGTH. 9/22/96





CONCRETE RING BRACKET (CORBEL) TO SUPPORT THE Rx VESSEL. IT LOOKS IN SOUND CONDITION FROM EL.10' INSIDE THE CRD ROOM UNDER THE Rx VESSEL. 9/22/96

IR 546049-02 ATTACHMENT 7.1

10/13/06 07:36:30

ATTACH PAGE 16

GPU NUCLEAR

OYSTER CREEK NUCLEAR GENERATING STATION PROCEDURE	Number 125.6
Title Building Structure Monitoring Plan	Revision No. 0

ATTACHMENT 125.6-1

PLANT STRUCTURE WALKDOWN/MONITORING REPORT

SYSTEM: PORTION OF REACTOR BUILDING (153) DATE 11/12/98 TIME

LOCATION: INSIDE THE DRYWELL

WALKDOWN ENGINEER SIGNATURE: T.H. CHANG / [signature]

MANAGER OF THE WALKDOWN ENGINEER SIGNATURE: [signature]

OTHERS ON WALKDOWN:

Inspection Items	Yes	No	N/A	Location	Descriptions
1 Major Concrete Crack	☐	☒	☐		
2 Spalling or Scaling Concrete	☐	☒	☐		
3 Rebar Exposure	☐	☒	☐		
4 Rebar Corrosion	☐	☒	☐		
5 Water Intrusion	☐	☒	☐		
6 Water Stain	☐	☐	☒		
7 Rust Stain	☐	☐	☒		
8 Disintegrating Concrete	☐	☒	☐		
9 Structural Settlement	☐	☒	☐		
10 Distorted Structural Member	☐	☒	☐		
11 Noticeable Block Wall Defect	☐	☐	☒		
12 Noticeable Structural Steel Defect	☐	☒	☐		

CONDITION/PROBLEMS NOTED DURING WALKDOWN AND ACTIONS INITIATED

SEE NEXT PAGE FOR DETAILS

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ATTACH PAGE 17

Nov 6, 1998

17 R Structural Walk-down Report
Inside the drywell

Background:

Under the requirement of "The structural monitoring plan", GPUN shall perform a structural inspection inside the drywell during every re-fueling outage. The scope of the inspection is to visually examine the condition of the supporting frames, the connections, the surface of the drywell, the general out-look of the pipe and equipment supports, the concrete condition at elevation 10'. To some extent, the temporary loading condition including the rigging, the radiation shielding, the location of the temporary equipment loading on the existing structural elements are also inspected.

During this inspection on September 30, 1998, the engineer used the 16R walk-down report and compared to the current condition. The engineer went through elevation 46', 23' and 10' but not elevation 82' on top of the biological shield wall due to the access unavailability at the time of this inspection. Since there was no activity on el. 82', the engineer believed that inspection to that location was not important. The star truss and the reactor vessel stabilizers are massive and therefore a development of unaware structural defect is not likely to happen on elevation 82'.

Results of the 17R inspection:

(1) The surface of the drywell looked in good material condition. There was no sign of corrosion, crack or other structural defects.
(2) The radial beams and the secondary beams for the platforms are in good shape. The engineer also checked few bolted connections and found no evidence of 'structural defect or failure'.
(3) The engineer did not observe any temporary over load that may fail the existing structural elements.
(4) On elevation 10', the engineer inspected the reactor pedestal from the room underneath the Rx vessel, and the floor condition. They were all in good condition. The two cutout areas at the curb were dry although standing water at few locations was presented at the time of this inspection.

As a result of this 17R walk-down, the engineer concluded that the structural adequacy inside the drywell was ensured.

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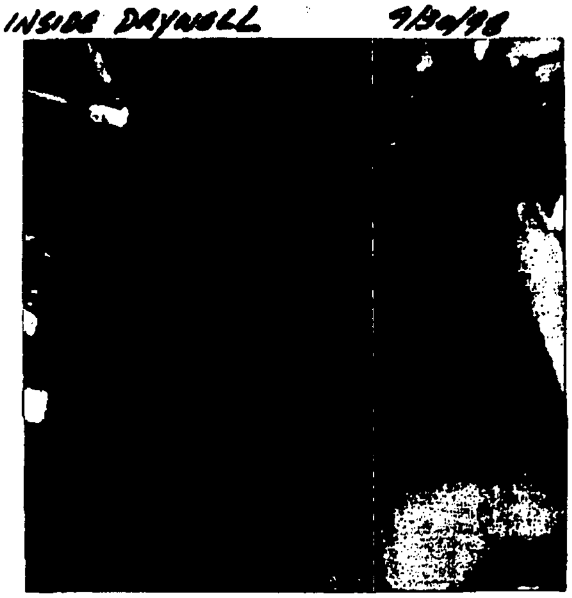
INSIDE DRYWELL EL.10' 9/30/98

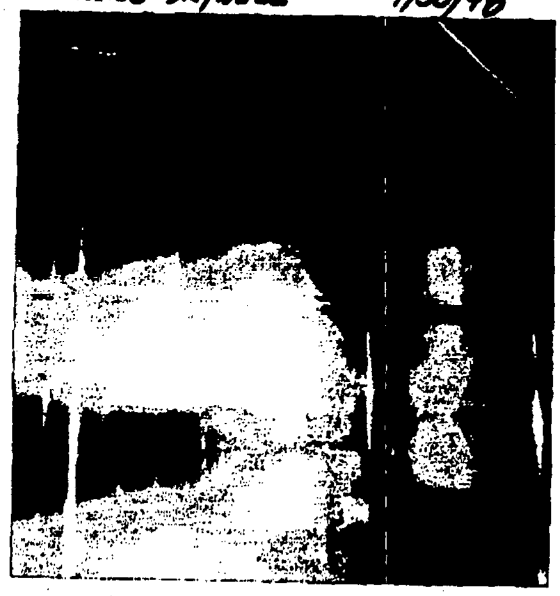
THE CURB CUT-OUT IS DRY. NO SIGN OF MATERIAL DETERIORATION TAKES PLACE.

INSIDE DRYWELL 9/30/98



LOOKING UP FROM EL. 23' TO THE INNER PLATFORM SUPPORT. THERE IS RUST ON THE BEAM, BUT NO HARM TO THE STRUCTURAL INTEGRITY IS SEEN.

INSIDE DRYWELL 9/30/98



EL.46' TYPICAL RADSHIELD BLANKETS WRAPPED AROUND THE CIRC. WATER PIPES.

INSIDE DRYWELL 9/30/98

EL.46' THE PLATFORM OUTER HANGER SUPPORT LOOKS IN GOOD CONDITION.

INSIDE DRYWELL 9/30/98

REACTOR PEDESTAL LOOKING UP FROM EL.10' UNDER THE RX VESSEL. THE CONCRETE STRUCTURE IS IN GOOD CONDITION.

INSIDE DRYWELL EL.10' 9/30/98

SOME WATER ON THE FLOOR

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ATTACHMENT 7.2
ATTACH PAGE 1 of 3

Attachment 7.2

Oyster Creek Trench Pump Out Schedule
(~~one~~ 3 page~~s~~)

DPK 11/3/06

IR 546049-02
ATTACHMENT 7.2
ATTACH PAGE 2

OYSTER CREEK TRENCH PUMP OUT

Date	Time	Trench Level (Top of Floor to Water Level)	A Trough Level	B Trough Level	C Trough Level	D Trough Level	Vacuum Running in Trench	Level of Water in Vacuum Container	1-8 Sump Water Level	Notes
10/21/2006	10:45						No		24" down from top of sump	
10/21/2006	11:55									Manually drained 1-8 Sump, Sump inspected, no obvious holes, debris in corners
10/21/2006	12:00	1' - 6 1/8 "					No		0" - 1/4"	Vacuum Pump Off, only input 200 ml/min
10/21/2006	16:40	1' - 6 1/2 "					No		8"	Vacuum Pump Off
10/21/2006	16:45	No Water					Yes		8"	Started Vacuum Pump
10/21/2006	17:15	No Water					No	2 1/2"		
10/21/2006	21:51	1' - 6 1/2 "	Dry	1/16 "	1/2 "	Dry	No		Not Measured	Vacuum hose disconnected, water not being removed
10/21/2006	22:30	1' - 6 1/2 "					Yes	2 5/8" before emptying	Not Measured	Vacuum container emptied, vacuum restarted
10/22/2006	2:15	Dry/No Water	Dry	1/16"	2"	1/16"	Yes	1 1/4" before emptying	13"	Time noted on stop watch resulting in 1 1/4" level in vacuum container was 3 hours, 23 minutes
10/22/2006	2:30	Water visible in lowest point					No			With vacuum pump off for 15 minutes, water was observed; however, rate at which water was entering trench has slowed. Vacuum pump restarted after this observation.
10/22/2006	10:32	Dry/No Water	Dry	1/2"	1"	1/4"	Yes	3" did not empty	19"	With vacuum pump off for 16 minutes, 1 drop of water was observed; new hose to 1-8 Sump added for CRD drives, no flow. Flow from 2 1/2 pipe still about 200ml.
10/22/2006	13:15	Dry/No Water	Dry	1/2"	7/8"	1/4"	Yes	3" did not empty	21.5"	Under vessel work (pulling tubes) is getting water in the area.
10/23/2006	4:30	Dry/No Water	3"	3.5"	4"	3 1/4"	Yes	3" did not empty	36"	Dye added to trough
10/23/2006	9:40	Dry/No Water	2 1/2"	2 3/4"	3"	2 1/2"	Yes	Did not look	No dye in sump	Vacuum ran all night long, is not turned off. No sign of dye migration.

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ATTACHMENT 7.2
ATTCH PAGE 3 OF 3

10/23/2006	12:09	Dry/No Water	2"	2 3/4"	3 1/4"	2 1/2"	No	Did not look	31"	No sign of dye in sump or trench
10/23/2006	16:45	Dry/No Water	1 7/8"	2 5/8"	3"	2 1/2"	NO	3" did not empty	32 1/2"	Dye visible past pipe plug in quad a and in sump.
10/23/2006	21:20	Dry/No Water	2"	2 1/2"	3"	2 1/2"	No	3" did not empty	Looked at pipe plugs with no conclusion	Removed pipe plugs, flushed trough.

Attachment 7.3

Chemistry Analysis Report

Includes printout of embedded file containing BWXT report

(45 Pages)

OC Drywell Chemistry Sample Results and Analysis Rev 6

Background

In 1986 two trenches were excavated in Bays # 5 and 17 at elevation 10' 3" of the Drywell to allow access to the interior surface of the Drywell shell in order to perform ultrasonic testing measurements and to collect core samples. At the time, the exterior of the Drywell shell at that elevation was inaccessible because it was filled with sand.

During a planned inspection during 1R21 standing water was observed in the Bay # 5 trench. No standing water was observed in the Bay # 17 trench. An initial sample of approximately two liters of that standing water was obtained on October 18, 2006 at 02:50 to determine if the source of water could be determined by on-site analysis. The on-site analysis of this initial sample was an isotopic analysis only versus chemical analysis. The concrete above the surface of the water was dry. After removing two liters of water from the Drywell Bay #5 trench and lowering its level, the water returned to its initial level. Subsequent discussions identified that additional analyses would be required in order to identify the source of water in the trench.

On October 19, 2006 at 02:05, both the Drywell Bay #5 trench and a 1-8 Drywell Sump local sample (Sample #6 or BWXT RACL #0610012-06) were obtained. These samples were counted on-site for isotopic analysis. The following night shift, October 20, 2006 at 00:20, the Drywell Bay # 5 trench (Sample #4 or BWXT RACL #0610012-04) and the Drywell trough (Sample #2 or BWXT RACL #0610012-02) were sampled at 00:20 for off-site analysis by GPL Laboratories. On-site analysis of these samples consisted of chlorides, sulfates, isotopic activity, pH, conductivity and molybdate. Due to the high activity levels of these samples, two of these samples were decanted to prepare for shipment at a lower dose rate. This was challenged internally and the decision was made to ship those same samples out again without decanting in a smaller volume to ensure a representative sample for all analysis.

Later on October 20, 2006 at 18:20 samples were obtained from the Drywell Bay # 5 Trench (Sample #3 or BWXT RACL #0610012-03) and the Drywell trough (Sample #1 or BWXT RACL #0610012-01), later at 19:15 a sample of Drywell Control Rod Drive (CRD) leak (Sample #5 or BWXT RACL

#0610012-05) also was obtained for analysis. It was determined that off-site analysis for elemental analysis that could not be performed at Oyster Creek would also be required for these samples. These three samples were combined with the new aliquots from the three previously shipped samples so that no interlaboratory bias would be seen in the data.

Therefore, six sets of two samples each were sent to BWXT labs on October 21, 2006 for analysis. The report of that analysis is found in Attachment 1. All samples for analysis by BWXT were prepared by one chemist to reduce the chance of error and no decanting was performed. It is for those reasons that only the BWXT samples should be used for outside vendor data analysis.

Summary of Data

Constituents	Date Time	RACL Chain-of-Custody	pH	pH	Isotopes	Tritium	Iron	Copper	Zinc	Nickel
Units	XX/XX/XX YY:YY		none	none	uCi/mL	uCi/mL	ug/L	ug/L	ug/L	ug/L
Samples										
Reactor Water (Base)	Numerous Dates, See Notes				Mn-54: 2.23e-4 Co-58: 5.91e-5 Fe-59: 1.01e-4 Co-60: 9.07e-5 Zn-65: 2.04e-5 Mo-99: 2.82e-5 Cs-137: none	1.11E-02	0.874	0.072	1.87	0.08
Condensate (Base)	Numerous Dates, See Notes				Mn-54: 1.17e-7		29.928	0.142	0.084	<0.032
Feedwater (Base)	Numerous Dates, See Notes						3.46	0.016	0.44	0.017
Reactor Bldg Closed Cooling Water (Base)	9/6/2006 9:00:00 AM, See Notes		9.52		Co-60: 4.09e-6 Cs-134: 8.25e-7 Cs-137: 1.28e-5		245	28		
Turbine Bldg Closed Cooling Water (Base)	9/5/2006 9:00:00 AM, See Notes		9.49		Cs-137: 2.32E-06		79	221		

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ATTACHMENT #7.3
ATTACH PAGE 4

Constituents	Date Time	Cobalt	Conductivity	Sulfates	Nitrates	Chlorides	Calcium	Potassium	Fluoride	Magnesium	Chromium
Units	XX/XX/XX YY:YY	ug/L	uS/cm	ug/L	ug/L	ug/L			ug/L		
Samples											
Reactor Water (Base)	Numerous Dates, See Notes		0.061	0.5-1.1		0.1					
Condensate (Base)	Numerous Dates, See Notes	<0.528	0.063	<0.2	<0.3	<0.4					
Feedwater (Base)	Numerous Dates, See Notes		0.053								
Reactor Bldg Closed Cooling Water (Base)	9/6/2006 9:00:00 AM, See Notes		600	1000		900			< 5000		
Turbine Bldg Closed Cooling Water (Base)	9/5/2006 9:00:00 AM, See Notes		1030	2930		1360			< 5000		

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ATTACHMENT 7.3
ATTACH PAGE 5

Constituents	Date Time	Molybdate	Sulfur	Trace Elements	Notes
Units	XX/XX/XX YY:YY	mg/L			
Samples					
Reactor Water (Base)	Numerous Dates, See Notes				Nickel, Copper, Iron, Zinc data is the average of 5 September samples. Chlorides and Sulfates data is for October. Isotopic & conductivity data from September 15, 2006. Tritium Data from October 13, 2006.
Condensate (Base)	Numerous Dates, See Notes				Cobalt, Copper, Iron, Nickel, Zinc data is the average of 5 October samples. Sulfates, Nitrates, Chlorides data is the average of the last 4 samples. Isotopic & Conductivity Data from 9/12/06.
Feedwater (Base)	Numerous Dates, See Notes				Copper, Iron, Nickel & Zinc data is the September average for these samples. Conductivity Data from 9/12/06.
Reactor Bldg Closed Cooling Water (Base)	9/6/2006 9:00:00 AM, See Notes	371		Benzotriazole: 39	All data from 9/6/06 sample except Total Gamma is from 10/18/06 sample.
Turbine Bldg Closed Cooling Water (Base)	9/5/2006 9:00:00 AM, See Notes	389		Benzotriazole: 29	All data from 9/5/06 sample except Total Gamma is from 10/20/06 sample.

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Constituents	Date Time	RACL Chain-of-Custody	pH	pH	Isotopes	Tritium	Iron	Copper	Zinc	Nickel
Units	XX/XX/XX YY:YY	BWXT Assigned	BWXT @ 21.2 deg C	Oyster Creek	pCi/mL	pCi/mL	ug/L	ug/L	ug/L	ug/L
Sample #1 - Drywell Trough	10/20/06 18:20	0610012-01	7.02	7.50	Mn-54: 9.74e+0 Co-60: 3.98e+0 Cs-137: 3.00e+0	1.93E+03	2900	38.2	571	29.2
Sample #2 - Drywell Trough	10/20/06 00:20	0610012-02	7.43	7.95	Mn-54: 7.97e+2 Co-58: 1.91e+1 Co-60: 4.11e+3 Zn-65: 1.48e+2 Cs-137: 3.07e+1	7.95E+03	41500	426	7350	231
Sample #3 - Drywell Bay # 5 trench	10/20/06 18:20	0610012-03	8.40	9.30	Co-60: 2.60e+0 Cs-137: 1.66e+1	5.51E+03	1720	43.2	136	13.2
Sample #4 - Drywell Bay # 5 trench	10/20/06 00:20	0610012-04	10.21	10.35	Cs-137: 1.64e+1	5.63E+03	1600	49.3	235	12.3
Sample #5 - Drywell CRD Leak	10/20/06 19:15	0610012-05	6.35	6.19	Mn-54: 6.55e+1 Co-58: 5.56e+0 Co-60: 2.84e+1 Zn-65: 3.18e+1	7.47E+03	244	10.7	348	17.8
Sample #6 - Drywell 1-8 Sump	10/19/06 2:55	0610012-06	7.34	7.62	Mn-54: 1.17e+2 Co-58: 2.15e+1 Fe-59: 4.45e+0 Co-60: 6.19e+1 Zn-65: 1.60e+1 Mo-99: 1.97e+0 Cs-137: 1.06e+1	4.85E+03	199	597	749	2.9

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Constituents	Date Time	RACL Chain-of-Custody	Cobalt	Conductivity	Sulfates	Nitrates	Chlorides	Calcium	Potassium	Fluoride
Units	XX/XX/XX YY:YY	BWXT Assigned	ug/L	uS/cm	ug/L	ug/L	ug/L	ug/L	ug/L	
Sample #1 - Drywell trough	10/20/06 18:20	0610012-01	3.0	150	19900		3200	4530	494	
Sample #2 - Drywell trough	10/20/06 00:20	0610012-02	33.3	104	15000	3500	< 2000	15700	1780	
Sample #3 - Drywell Bay # 5 trench	10/20/06 18:20	0610012-03	not detected	656	230,000		14600	83500	29400	
Sample #4 - Drywell Bay # 5 trench	10/20/06 00:20	0610012-04	1.9	672	228,000		13600	96600	29800	
Sample #5 - Drywell CRD Leak	10/20/06 19:15	0610012-05	0.339	6.32	6700		700	not detected	111	
Sample #6 - Drywell 1-8 Sump	10/19/06 2:55	0610012-06	0.178	151	171,000		16,300	1780	534	

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Constituents	Date Time	RACL Chain-of-Custody	Magnesium	Chromium	Molybdate	Sulfur	Notes
Units	XX/XX/XX YY:YY	BWXT Assigned			mg/L	ug/L	
Sample #1 - Drywell trough	10/20/06 18:20	0610012-01				not detected	
Sample #2 - Drywell trough	10/20/06 00:20	0610012-02			< 15	2850	
Sample #3 - Drywell Bay # 5 trench	10/20/06 18:20	0610012-03				41700	
Sample #4 - Drywell Bay # 5 trench	10/20/06 00:20	0610012-04			< 15	42700	
Sample #5 - Drywell CRD Leak	10/20/06 19:15	0610012-05				not detected	
Sample #6 - Drywell 1-8 Sump	10/19/06 2:55	0610012-06				1460	

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Analysis of Spreadsheet Data

Chemistry was asked to determine the source of water in the Drywell Bay #5 trench. Following is an analysis of in-house and vendor laboratory data.

1. The Reactor Building and Turbine Building Closed Cooling Water (CCW) systems at Oyster Creek are treated with a molybdate solution (~375 ppm). The absence of molybdate (< 15 ppm) in the Drywell samples indicates there is no leakage of CCW into these samples. (Note: One cannot measure a zero value for a parameter. There is a Lower Limit of Quantification. For molybdate, that value is < 15 ppm.) This result indicates there is no significant leak from the CCW system to the trough or the trench.

2. The tritium data from the six samples range from 1.95E+3 to 7.95E+3 pCi/mL. Since the tritium level is higher in the trough than the trench, there is no direct rapid communication between the trough and trench.

3. Between 00:20 and 18:20 on October 25, 2005 chloride and sulfate concentrations in the trough decreased. This indicates that impurity concentrations in the trough were diluted most likely from the CRD leakage during the time period between samples because the water in the trough did not have time to pick up impurities. During the same time period, there was no dilution in the trench.

4. Between the two time periods of 00:20 and 18:20 the water in the trough is diluted while the water in the trench is relatively constant as indicated by the relatively constant values for chloride, sulfate, calcium and potassium in the two trench samples. This conclusion is also based upon copper, zinc and nickel data. This also supports the findings in No. 2 and 3 above that there is no free flow of water between the trough and the trench during that 18-hour time period.

5. The first sample taken from the trough showed the presence of short-lived radionuclides as well as a peak at 511 keV. The presence of short-lived radionuclides and a 511 keV peak in the trough sample and their absence in the trench samples indicates that the trough water is fresher and the trench water is "older." The 511 keV peak is due likely to fluorine-18 that has a 1.8-hour half-life. The trench samples are four orders of magnitude lower in activity than the trough samples. This indicates the water in the trench is not refreshed with short-lived radionuclides, as is the water in the trough. This is also consistent with No. 2 above in terms of lack of direct rapid communication from the trough to the trench.

6. The pH values are consistent with other chemistry values. Elevated pH in the trench is the result of high levels of calcium that the water picked up as a result of it being in contact with concrete for a longer time. Calcium in water

raises its pH. The first sample taken from the Bay 5 trench on October 19 had a pH of 10.72. This elevated pH is consistent with water being in contact with concrete for a relatively long time.

7. Low iron in the trench sample indicates there is minimal carbon steel corrosion in the vicinity of the trench.

8. On October 23, 2006 at 0438 sodium fluorescein dye was added to the trough. At approximately 09:00 on October 25, water was spotted in the Drywell Bay 5 trench. The ≈ 30 mL of sample had Mn-54, Co-60 and Cs-137 present along with fluorescein.

   A second sample, consisting of 100 mL of water obtained October 26, also showed Mn-54, Co-60 and Cs-137. It too was positive for fluorescein but was more dilute than the previous day's sample. These two results indicate that water is migrating, albeit slowly, from the trough where the fluorescein solution was added on Monday, October 23, to the trench.

CONCLUSION

The source(s) of water in the trench cannot be conclusively determined from chemistry analysis. We can conclude that it is not the result of CCW leakage as there is no evidence of closed cooling water corrosion inhibitor in the trench. Furthermore, it is not the direct result of recent reactor coolant leakage because there are no short-lived radionuclides in the trench samples. It is also unlikely that the source of water is due to an external source.

The radionuclides present in the trench water are indicative of CRD water that has been allowed to decay such that only longer-lived radionuclides are present in the trench samples. The difference between the radionuclides present in the trough and the trench is due to the tortuous path the water takes migrating from the trough to the trench. Migration of water from the trough to the trench has a relatively long transit time as evidenced by the fact that there are no short-lived radionuclides in the trench. The two samples containing dye indicate that water is migrating, albeit slowly, from the trough where the fluorescein solution was added on Monday, October 23, to the trench. Therefore, the most probable source of water in the Bay 5 trench is Control Rod Drive water.

Preparer/Reviewers:

Michael Ford   Oyster Creek
Robert Artz   Oyster Creek

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Scott Giacobbe	EXELON Power Labs
John Diletto	EXELON Power Labs
Tom Wait	EXELON Power Labs
David Morey	EXELON Corporate Chemistry

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ATTACHMENTS

Attachment 1- BWXT Examination of Water Samples from Oyster Creek

Oyster Creek
Report.pdf

Attachment 2- Michelle Mura (Amergen) e-mail to Rick Devault (BWXT) dated October 21, 11:23 pm

Oyster Creek water samples - Message (Rich Text)

File Edit View Insert Format Tools Actions Help

Reply | Reply to All | Forward

From: Mura, Michelle   Sent: Sat 10/21/2006 11:23 PM
To: 'rfdevault@bwxt.com'
Cc: O'Rourke, John P.; Artz, Robert J; Ford, Michael; Pruslowski, Marcia; Birkmire, Leanne K.
Subject: Oyster Creek water samples

Per proposal number RACL-0657 section 2.4 ICP Analysis, the elements that can be eliminated from the list to be analyzed per the project team (J. ORourke) are tin, barium, cadmium, silver, arsenic, mercury, selenium, and vanadium. I will verify with the team the need for chloride, fluoride, and sulfate. I understand that these analyses would not be able to be performed until next week. Thank you

Michelle R. Mura
Oyster Creek Generating Station
Plant Primary Chemist
phone 609-971-4070
pager 609-615-1692

Start | 11:16 PM

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BWXT Services, Inc.

To: John Diletto, Exelon Power Laboratory

From: Kevin Hour, BWXT Services, Inc.

Date: October 22, 2006

Re: Examination of Water Samples from Oyster Creek

Ref: Rev. 0

Introduction

Per Exelon Power Lab's request, BWXT Services (BWXS), Inc. Lynchburg Technology Center (LTC) was to provide expedited service to analyze two water samples from the Oyster Creek Nuclear Power Station. This work scope was authorized under Exelon Power Labs Purchase Order 00059971-00001, authorization 2006100258, dated October 20, 2006. This work was designated safety-related and was conducted in accordance with Radioisotope and Analytical Chemistry Laboratory (RACL) Quality Assurance Plan.

BWXS received the shipment around 7:00 pm on October 21 and the LTC HP released the specimens to RACL personnel around 8:00 pm. Upon opening of the two packages, RACL personnel found a total of six plastic bags and each one of them had a unique description and identification. Inside each bag, there were two 125 ml plastic containers (one is preserved and one is not). Since this was not consistent with purchase order specifications, RACL personnel contacted the reactor site people. Michelle Mura, a chemist at Oyster Creek, confirmed for us that all six samples needed to be analyzed. Based on this instruction, RACL personnel proceeded with the preparation. Further discrepancies between the purchase order and the BWXS proposal were identified; both sides discussed and reached the following conclusion (documented in an email from Michelle Mura to Rick Devault, dated October 21 11:23pm).

1. The following elements are removed from the list of elements to be analyzed: tin, barium, cadmium, silver, arsenic, mercury, selenium, and vanadium.
2. Per the Purchase Order, chloride, fluoride, and sulfate are to be analyzed. BWXS did not mobilize a qualified analyst to perform this task as BWXS did not include this task in its proposal. Either the analysis is to be performed at Oyster Creek or BWXS will perform the analysis in the coming week.

BWXS management decided to proceed with the agreed upon statement of work and will submit revised proposal later to Exelon Power Labs to revise its Purchase Order.

Methods and Test Results

Specimen Identification and Traceability

Six specimens were received and their identifications are summarized as follow:

Oyster Creek Identification	RACL Chain-of-Custody
Dry Well Trough (10/20/06 18:20)	0610012-01
Dry Well Trough (10/20/06 00:20)	0610012-02
Dry Well Hole#5 Bay (10/20/06 18:20)	0610012-03
Dry Well Hole #5 Bay (10/20/06 00:20)	0610012-04
Dry Well CRD Leak (10/20/06 19:15)	0610012-05
Dry Well 1-8 Pump (10/19/06 02:55)	0610012-06

For each specimen, there were two 125 ml plastic containers (one was preserved with nitric acid and designated as "A" sample and one was not and designated as "B" sample). An aliquot of specimen was taken from these bottles for various analyses and specimen identification was written on the bottle or vial to preserve the specimen traceability.

pH Measurement

pH measurement was conducted in accordance with LTC Technical Procedure TP-312, Rev. 11 "Measurements of pH in Soil and Water Based on SW846 Methods: 9040B (Water) and 9045C (Soil/Waste). Unpreserved specimens show pH ranging from 6.35 to 10.21 and preserved specimens (with nitric acid) are verified to have pH below 2. Detailed results are shown in Appendix A.

Gamma Scan

Due to the limited amount of material received, only 20 cc of specimen was used for gamma scan. All six non-preserved specimens were prepared in accordance with LTC Technical Procedure TP-398, Rev. 8 "Sample Dissolution, Actinide Separations and Gamma Spectroscopy Preparation. All six specimens were counted in accordance with LTC Technical Procedure TP-852, Rev. 2 "QC Operations, Calibration and Sample Counting Procedure for the Genie 2000 Counting System" for 1 hour. Cobalt-60, manganese-54 and cesium-137 are the main isotopes identified in the specimens. Detailed results are shown in Appendix B.

ICP/MS

Per the discussion with customer, the unpreserved specimens were used for calcium and potassium analysis and the preserved specimens were analyzed for the remaining metals. All specimens were prepared in accordance with LTC Technical Procedure TP-1474, Rev. 1 "Microwave Assisted Acid Digestion of Aqueous Samples, Sediments, Sludge, Soils & Oil Extracts (SW 846 3015, 3051)". Analysis was performed in accordance with LTC Technical Procedure TP-873, Rev. 1 "Inductively Coupled Plasma-Mass Spectrometry SW846-6020A". Detailed results are shown in Appendix C.

Tritium Analysis

An aliquot was taken from each of the six unpreserved specimens for tritium analysis. Specimens were prepared in accordance with LTC Technical Procedure TP-642, Rev. 3 "Analysis of Tritium Samples" and counting was conducted in accordance with LTC Technical Procedure TP-619, Rev. 2C "General Counting Procedure for the Model 2550TR/LL Liquid Scintillation Counting System". Detailed results are shown in Appendix D.

Independent Review and QA Review

All data were subjected to an independent technical review. Additionally, the Laboratory QA Manager performed a review of the project and concluded that it was performed in accordance with customer's purchase order requirement except for those discrepancies documented in the Introduction section of this report. A certificate of conformance is shown in Appendix E.

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Memo Hour to Diletto
Examination of Water Samples from Oyster Creek
October 22, 2006

Summary

pH measurement, gamma scan, elemental analysis, and tritium analyses were conducted on six water specimens removed from the Oyster Creek Nuclear Power Station. If further information regarding this data report is required, please contact any of the following personnel.

Kevin Y. Hour (434)-426-6881
Kevin Bull (434) 426-6124
Virginia Gibson (434) 369-6258

R. F. DeVault, 10/22/06
Rick Devault
Project Engineer

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Memo Hour to Diletto
Examination of Water Samples from Oyster Creek
October 22, 2006

Appendix A

pH Measurements

TP-312-4 12/02 SMJ 10/21/06 TP312 R11B

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LOGBOOK #: LB763

pH Worksheet

9040B/9045C/Method 150.1 Rev. 3-83

pH Meter ID: 1-2004-0017 Instr. Serial No. 017033

Temp. Compensated: (Yes) / No Thermometer ID: 1-2005-0003 Balance ID: —

Analysis Date/Time: 10/22/06 0230 Calibration Due Date: 3-3-07 Calibration Due Date: —

Buffer	MFG	Lot #	Date Exp.	Slope	pH Value	Temp.
4	FISHER	050180-24	1/07	100.8	4.03	21.2°C
7	FISHER	050993-24	3/07	100.8	7.00	21.2°C
10	FISHER	050767-24	3/07	100.8	9.99	21.2°C
7 Rerun (1CV)	FISHER	050993-24	3/07	100.8	7.00	21.2°C

Sample ID	Temperature °C	pH Value	% Moisture <20% (Y/N) (If "Y", 9045C)	Mass of Sample	Vol. Water
QC 5D27001	21.2°C	8.69	NA	NA	NA
0610012-01B	↓	7.02	↓	↓	↓
0610012-02B	↓	7.43	↓	↓	↓
0610012-03B	↓	8.40	↓	↓	↓
0610012-04B	↓	10.21	↓	↓	↓
0610012-05B	↓	6.35	↓	↓	↓
0610012-06B	↓	7.34	↓	↓	↓
0610012-06B Dup	↓	7.38	↓	↓	↓
Buffer 4	↓	4.03	↓	↓	↓
—	—	—	—	—	—
Chk Buffer (CCV)					
Final Buffer (CCV)	21.2°C	7.00	—	—	—

(Duplicate 1 in 20 samples required)

QC True Value 8.70 Range 8.44-8.95 Date Rec. 10/19/04 Exp. 1/31/08

Element Batch ID

Notes: manual pH calibration performed with p1=7.00 and p2 = 10.00. Read Buffer 4 as sample SMJ 10/22/06 SMJ

Performed by: Sharlene Johnson Date/Time: 10/22/06 0300

Reviewed by: R. F. DeVault Date: 10/22/06

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Appendix B

Gamma Scan Results

BWXT Services, Inc. Gamma Data Report for Oyster Creek
SDG 0610012

10/22/2006

Customer Sample ID	NELS Sample ID	Analysis Method	Analyte	Result	2 Sigma Uncertainty	MDA	Units (1)	Preparation Date	Analysis Date
Dry Well Trough 10/20/06 18:20	0610012-01	EPA901.1	Mn-54	9.74E+00	1.34E+00	9.97E-01	pCi/mL	10/21/06	10/22/06
Dry Well Trough 10/20/06 18:20	0610012-01	EPA901.1	Co-58	MDA	NA	1.03E+00	pCi/mL	10/21/06	10/22/06
Dry Well Trough 10/20/06 18:20	0610012-01	EPA901.1	Fe-59	MDA	NA	1.56E+00	pCi/mL	10/21/06	10/22/06
Dry Well Trough 10/20/06 18:20	0610012-01	EPA901.1	Co-60	3.98E+00	9.46E-01	9.24E-01	pCi/mL	10/21/06	10/22/06
Dry Well Trough 10/20/06 18:20	0610012-01	EPA901.1	Zn-65	MDA	NA	2.53E+00	pCi/mL	10/21/06	10/22/06
Dry Well Trough 10/20/06 18:20	0610012-01	EPA901.1	Mo-99	MDA	NA	6.43E-01	pCi/mL	10/21/06	10/22/06
Dry Well Trough 10/20/06 18:20	0610012-01	EPA901.1	Cs-137	3.00E+00	7.00E-01	8.01E-01	pCi/mL	10/21/06	10/22/06
Dry Well Trough 10/20/06 00:20	0610012-02	EPA901.1	Mn-54	7.97E+02	6.20E+01	1.23E+01	pCi/mL	10/21/06	10/22/06
Dry Well Trough 10/20/06 00:20	0610012-02	EPA901.1	Co-58	1.91E+01	7.20E+00	1.15E+01	pCi/mL	10/21/06	10/22/06
Dry Well Trough 10/20/06 00:20	0610012-02	EPA901.1	Fe-59	MDA	NA	2.69E+01	pCi/mL	10/21/06	10/22/06
Dry Well Trough 10/20/06 00:20	0610012-02	EPA901.1	Co-60	4.11E+03	1.32E+02	9.81E+00	pCi/mL	10/21/06	10/22/06
Dry Well Trough 10/20/06 00:20	0610012-02	EPA901.1	Zn-65	1.48E+02	2.14E+01	3.19E+01	pCi/mL	10/21/06	10/22/06
Dry Well Trough 10/20/06 00:20	0610012-02	EPA901.1	Mo-99	MDA	NA	4.38E+00	pCi/mL	10/21/06	10/22/06
Dry Well Trough 10/20/06 00:20	0610012-02	EPA901.1	Cs-137	3.07E+01	5.32E+00	7.73E+00	pCi/mL	10/21/06	10/22/06
Dry Well Hole #5 Bay 10/20/06 18:20	0610012-03	EPA901.1	Mn-54	MDA	NA	8.93E-01	pCi/mL	10/21/06	10/22/06
Dry Well Hole #5 Bay 10/20/06 18:20	0610012-03	EPA901.1	Co-58	MDA	NA	7.17E-01	pCi/mL	10/21/06	10/22/06
Dry Well Hole #5 Bay 10/20/06 18:20	0610012-03	EPA901.1	Fe-59	MDA	NA	1.38E+00	pCi/mL	10/21/06	10/22/06
Dry Well Hole #5 Bay 10/20/06 18:20	0610012-03	EPA901.1	Co-60	2.60E+00	7.06E-01	7.03E-01	pCi/mL	10/21/06	10/22/06
Dry Well Hole #5 Bay 10/20/06 18:20	0610012-03	EPA901.1	Zn-65	MDA	NA	1.78E+00	pCi/mL	10/21/06	10/22/06
Dry Well Hole #5 Bay 10/20/06 18:20	0610012-03	EPA901.1	Mo-99	MDA	NA	8.08E-01	pCi/mL	10/21/06	10/22/06
Dry Well Hole #5 Bay 10/20/06 18:20	0610012-03	EPA901.1	Cs-137	1.66E+01	1.47E+00	9.87E-01	pCi/mL	10/21/06	10/22/06
Dry Well Hole #5 Bay 10/20/06 00:20	0610012-04	EPA901.1	Mn-54	MDA	NA	9.92E-01	pCi/mL	10/21/06	10/22/06
Dry Well Hole #5 Bay 10/20/06 00:20	0610012-04	EPA901.1	Co-58	MDA	NA	9.98E-01	pCi/mL	10/21/06	10/22/06
Dry Well Hole #5 Bay 10/20/06 00:20	0610012-04	EPA901.1	Fe-59	MDA	NA	1.71E+00	pCi/mL	10/21/06	10/22/06
Dry Well Hole #5 Bay 10/20/06 00:20	0610012-04	EPA901.1	CO-60	MDA	NA	2.04E+00	pCi/mL	10/21/06	10/22/06
Dry Well Hole #5 Bay 10/20/06 00:20	0610012-04	EPA901.1	Zn-65	MDA	NA	2.02E+00	pCi/mL	10/21/06	10/22/06

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BWXT Services, Inc. Gamma Data Report for Oyster Creek
SDG 0610012

10/22/2006

Customer Sample ID	NELS Sample ID	Analysis Method	Analyte	Result	2 Sigma Uncertainty	MDA	Units [1]	Preparation Date	Analysis Date
Dry Well Hole #5 Bay 10/20/06 00:20	0610012-04	EPA901.1	Mo-99	MDA	NA	9.04E-01	pCi/mL	10/21/06	10/22/06
Dry Well Hole #5 Bay 10/20/06 00:20	0610012-04	EPA901.1	Cs-137	1.64E+01	1.42E+00	7.93E-01	pCi/mL	10/21/06	10/22/06
Dry Well CRD Leak 10/20/06 19:15	0610012-05	EPA901.1	Mn-54	6.55E+01	5.66E+00	1.63E+00	pCi/mL	10/21/06	10/22/06
Dry Well CRD Leak 10/20/06 19:15	0610012-05	EPA901.1	Co-58	5.56E+00	1.10E+00	1.26E+00	pCi/mL	10/21/06	10/22/06
Dry Well CRD Leak 10/20/06 19:15	0610012-05	EPA901.1	Fe-59	MDA	NA	2.55E+00	pCi/mL	10/21/06	10/22/06
Dry Well CRD Leak 10/20/06 19:15	0610012-05	EPA901.1	Co-60	2.84E+01	2.28E+00	1.13E+00	pCi/mL	10/21/06	10/22/06
Dry Well CRD Leak 10/20/06 19:15	0610012-05	EPA901.1	Zn-65	3.18E+01	3.78E+00	3.59E+00	pCi/mL	10/21/06	10/22/06
Dry Well CRD Leak 10/20/06 19:15	0610012-05	EPA901.1	Mo-99	MDA	NA	7.99E-01	pCi/mL	10/21/06	10/22/06
Dry Well CRD Leak 10/20/06 19:15	0610012-05	EPA901.1	Cs-137	MDA	NA	1.77E+00	pCi/mL	10/21/06	10/22/06
Dry Well 1-8 Sump 10/19/06 02:55	0610012-06	EPA901.1	Mn-54	1.17E+02	1.03E+01	1.82E+00	pCi/mL	10/21/06	10/22/06
Dry Well 1-8 Sump 10/19/06 02:55	0610012-06	EPA901.1	Co-58	2.15E+01	2.46E+00	2.09E+00	pCi/mL	10/21/06	10/22/06
Dry Well 1-8 Sump 10/19/06 02:55	0610012-06	EPA901.1	Fe-59	4.45E+00	2.74E+00	4.34E+00	pCi/mL	10/21/06	10/22/06
Dry Well 1-8 Sump 10/19/06 02:55	0610012-06	EPA901.1	Co-60	6.19E+01	4.14E+00	1.24E+00	pCi/mL	10/21/06	10/22/06
Dry Well 1-8 Sump 10/19/06 02:55	0610012-06	EPA901.1	Zn-65	1.60E+01	3.20E+00	4.14E+00	pCi/mL	10/21/06	10/22/06
Dry Well 1-8 Sump 10/19/06 02:55	0610012-06	EPA901.1	Mo-99	1.97E+00	1.07E+00	1.70E+00	pCi/mL	10/21/06	10/22/06
Dry Well 1-8 Sump 10/19/06 02:55	0610012-06	EPA901.1	Cs-137	1.06E+01	1.73E+00	2.34E+00	pCi/mL	10/21/06	10/22/06

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Appendix C

ICP-MS Results

INORGANIC ANALYSIS DATA PACKAGE

Client: Exelon -Oyster Creek Site **SDG No.:** 0610012 **Method Type:** 3015/6020A

Sample ID: 0610012-01A D1 **Client ID:** Dry Well Trough 18:20

Matrix: WATER **Date Received:** **Level:** LOW

% Solids: **Sample Wt/Vol:** 45.0 **Final Vol:** 50.0

Prep Batch ID: 841-21 **Prep Date:** 10/22/2006

Analyte	CAS No.	Concentration	Units	C	Qual	M	DL	Dil	Analytical Date	Analytical Time
Lithium	7439-93-2	84.4	ug/L	U		MS	84.4	10.00	10/22/2006	03:20:59
Boron	7440-42-8	39.0	ug/L	B		MS	4.0	10.00	10/22/2006	03:20:59
Sodium	7440-23-5	3040	ug/L			MS	33.2	10.00	10/22/2006	03:20:59
Magnesium	7439-95-4	1430	ug/L			MS	6.0	10.00	10/22/2006	03:20:59
Aluminum	7429-90-5	456	ug/L			MS	7.5	10.00	10/22/2006	03:20:59
Silica	7440-21-3	999	ug/L			MS	11.1	10.00	10/22/2006	03:20:59
Phosphorus	7723-14-0	89.5	ug/L	B		MS	11.1	10.00	10/22/2006	03:20:59
Potassium	7440-09-7	521	ug/L			MS	10.2	10.00	10/22/2006	03:20:59
Calcium	7440-70-2	3860	ug/L			MS	376	10.00	10/22/2006	03:20:59
Titanium	7440-32-6	38.2	ug/L	B		MS	1.0	10.00	10/22/2006	03:20:59
Chromium	7440-47-3	15.2	ug/L			MS	0.611	10.00	10/22/2006	03:20:59
Iron	7439-89-6	2900	ug/L			MS	19.2	10.00	10/22/2006	03:20:59
Manganese	7439-96-5	37.7	ug/L			MS	0.911	10.00	10/22/2006	03:20:59
Cobalt	7440-48-4	3.0	ug/L	B		MS	0.233	10.00	10/22/2006	03:20:59
Nickel	7440-02-0	29.2	ug/L	B		MS	3.2	10.00	10/22/2006	03:20:59
Copper	7440-50-8	38.2	ug/L	B		MS	1.7	10.00	10/22/2006	03:20:59
Zinc	7440-66-6	571	ug/L			MS	92.1	10.00	10/22/2006	03:20:59
Strontium	7440-24-6	45.1	ug/L	B		MS	2.5	10.00	10/22/2006	03:20:59
Zirconium	7440-67-7	1.2	ug/L	B		MS	0.222	10.00	10/22/2006	03:20:59
Molybdenum	7439-98-7	1580	ug/L			MS	2.0	10.00	10/22/2006	03:20:59
Tin	7440-31-5	1.4	ug/L	B		MS	0.158	10.00	10/22/2006	03:20:59
Antimony	7440-36-0	1.5	ug/L	B		MS	0.267	10.00	10/22/2006	03:20:59
Barium	7440-39-3	8.7	ug/L	B		MS	0.878	10.00	10/22/2006	03:20:59
RPD Tungsten	7440-33-7	11.1	ug/L	U		MS	11.1	10.00	10/22/2006	03:20:59
Lead	7439-92-1	115	ug/L			MS	0.967	10.00	10/22/2006	03:20:59

Qualifier Descriptions:
- U - Non-Detected Concentration
- B - Concentration is between MDL and CRDL
- N - Associated Matrix Spike is outside percent recovery quality control criteria
- * - Associated Duplicate is outside relative percent difference quality control criteria
- E - Associated Serial Dilution is outside percent difference quality control criteria

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INORGANIC ANALYSIS DATA PACKAGE

Client: Exelon -Oyster Creek Site **SDG No.:** 0610012 **Method Type:** 3015/6020A

Sample ID: 0610012-02A **Client ID:** Dry Well Trough 00:20

Matrix: WATER **Date Received:** **Level:** LOW

% Solids: **Sample Wt/Vol:** 45.0 **Final Vol:** 50.0

Prep Batch ID: 841-21 **Prep Date:** 10/22/2006

Analyte	CAS No.	Concentration	Units	C	Qual	M	DL	Dil	Analytical Date	Analytical Time
Lithium	7439-93-2	42.2	ug/L	U		MS	42.2	5.00	10/22/2006	04:19:33
Boron	7440-42-8	121	ug/L			MS	2.0	5.00	10/22/2006	04:19:33
Sodium	7440-23-5	8890	ug/L			MS	16.6	5.00	10/22/2006	04:19:33
Magnesium	7439-95-4	7490	ug/L			MS	3.0	5.00	10/22/2006	04:19:33
Aluminum	7429-90-5	5580	ug/L			MS	3.7	5.00	10/22/2006	04:19:33
Silica	7440-21-3	10600	ug/L			MS	22.2	20.00	10/22/2006	05:06:25
Phosphorus	7723-14-0	746	ug/L			MS	5.6	5.00	10/22/2006	04:19:33
Potassium	7440-09-7	1710	ug/L			MS	5.1	5.00	10/22/2006	04:19:33
Calcium	7440-70-2	13500	ug/L			MS	188	5.00	10/22/2006	04:19:33
Titanium	7440-32-6	529	ug/L			MS	0.500	5.00	10/22/2006	04:19:33
Chromium	7440-47-3	226	ug/L			MS	0.306	5.00	10/22/2006	04:19:33
Iron	7439-89-6	41500	ug/L			MS	9.6	5.00	10/22/2006	04:19:33
Manganese	7439-96-5	497	ug/L			MS	0.456	5.00	10/22/2006	04:19:33
Cobalt	7440-48-4	33.3	ug/L	B		MS	0.117	5.00	10/22/2006	04:19:33
Nickel	7440-02-0	231	ug/L			MS	1.6	5.00	10/22/2006	04:19:33
Copper	7440-50-8	426	ug/L			MS	0.872	5.00	10/22/2006	04:19:33
Zinc	7440-66-6	7350	ug/L			MS	184	20.00	10/22/2006	05:06:25
Strontium	7440-24-6	160	ug/L			MS	1.3	5.00	10/22/2006	04:19:33
Zirconium	7440-67-7	17.6	ug/L	B		MS	0.111	5.00	10/22/2006	04:19:33
Molybdenum	7439-98-7	5030	ug/L			MS	1.0	5.00	10/22/2006	04:19:33
Tin	7440-31-5	9.7	ug/L	B		MS	0.079	5.00	10/22/2006	04:19:33
Antimony	7440-36-0	6.1	ug/L	B		MS	0.133	5.00	10/22/2006	04:19:33
Barium	7440-39-3	73.7	ug/L			MS	0.439	5.00	10/22/2006	04:19:33
RFD Tungsten	7440-33-7	7.1	ug/L	B		MS	5.6	5.00	10/22/2006	04:19:33
Lead	7439-92-1	1530	ug/L			MS	0.483	5.00	10/22/2006	04:19:33

Qualifier Descriptions:
U - Non-Detected Concentration
B - Concentration is between MDL and CRDL
N - Associated Matrix Spike is outside percent recovery quality control criteria
* - Associated Duplicate is outside relative percent difference quality control criteria
E - Associated Serial Dilution is outside percent difference quality control criteria

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INORGANIC ANALYSIS DATA PACKAGE

Client: Exelon -Oyster Creek Site **SDG No.:** 0610012 **Method Type:** 3015/6020A

Sample ID: 0610012-03A **Client ID:** Dry Well Hole #5 Bay 18:20

Matrix: WATER **Date Received:** **Level:** LOW

% Solids: **Sample Wt/Vol:** 45.0 **Final Vol:** 50.0

Prep Batch ID: 841-21 **Prep Date:** 10/22/2006

Analyte	CAS No.	Concentration	Units	C	Qual	M	DL	Dil	Analytical Date	Analytical Time
Lithium	7439-93-2	42.2	ug/L	U		MS	42.2	5.00	10/22/2006	04:23:42
Boron	7440-42-8	578	ug/L			MS	2.0	5.00	10/22/2006	04:23:42
Sodium	7440-23-5	52500	ug/L			MS	16.6	5.00	10/22/2006	04:23:42
Magnesium	7439-95-4	580	ug/L			MS	3.0	5.00	10/22/2006	04:23:42
Aluminum	7429-90-5	119	ug/L			MS	3.7	5.00	10/22/2006	04:23:42
Silica	7440-21-3	9380	ug/L			MS	22.2	20.00	10/22/2006	05:10:25
Phosphorus	7723-14-0	98.1	ug/L			MS	5.6	5.00	10/22/2006	04:23:42
Potassium	7440-09-7	26200	ug/L			MS	5.1	5.00	10/22/2006	04:23:42
Calcium	7440-70-2	73000	ug/L			MS	188	5.00	10/22/2006	04:23:42
Titanium	7440-32-6	0.500	ug/L	U		MS	0.500	5.00	10/22/2006	04:23:42
Chromium	7440-47-3	12.7	ug/L			MS	0.306	5.00	10/22/2006	04:23:42
Iron	7439-89-6	1720	ug/L			MS	9.6	5.00	10/22/2006	04:23:42
Manganese	7439-96-5	53.6	ug/L			MS	0.456	5.00	10/22/2006	04:23:42
Cobalt	7440-48-4	0.117	ug/L	U		MS	0.117	5.00	10/22/2006	04:23:42
Nickel	7440-02-0	13.2	ug/L	B		MS	1.6	5.00	10/22/2006	04:23:42
Copper	7440-50-8	43.2	ug/L	B		MS	0.872	5.00	10/22/2006	04:23:42
Zinc	7440-66-6	136	ug/L			MS	46.1	5.00	10/22/2006	04:23:42
Strontium	7440-24-6	2470	ug/L			MS	1.3	5.00	10/22/2006	04:23:42
Zirconium	7440-67-7	1.0	ug/L	B		MS	0.111	5.00	10/22/2006	04:23:42
Molybdenum	7439-98-7	1960	ug/L			MS	1.0	5.00	10/22/2006	04:23:42
Tin	7440-31-5	2.2	ug/L	B		MS	0.079	5.00	10/22/2006	04:23:42
Antimony	7440-36-0	6.0	ug/L	B		MS	0.133	5.00	10/22/2006	04:23:42
Barium	7440-39-3	16.0	ug/L	B		MS	0.439	5.00	10/22/2006	04:23:42
Tungsten (RFD)	7440-33-7	5.6	ug/L	U		MS	5.6	5.00	10/22/2006	04:23:42
Lead	7439-92-1	24.8	ug/L	B		MS	0.483	5.00	10/22/2006	04:23:42

Qualifier Descriptions:
U - Non-Detected Concentration
B - Concentration is between MDL and CRDL
N - Associated Matrix Spike is outside percent recovery quality control criteria
*** - Associated Duplicate is outside relative percent difference quality control criteria**
E - Associated Serial Dilution is outside percent difference quality control criteria

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INORGANIC ANALYSIS DATA PACKAGE

Client: Exelon -Oyster Creek Site **SDG No.:** 0610012 **Method Type:** 3015/6020A

Sample ID: 0610012-04A **Client ID:** Dry Well Hole #5 Bay 00:20

Matrix: WATER **Date Received:** **Level:** LOW

% Solids: **Sample Wt/Vol:** 45.0 **Final Vol:** 50.0

Prep Batch ID: 841-21 **Prep Date:** 10/22/2006

Analyte	CAS No.	Concentration	Units	C	Qual	M	DL	Dil	Analytical Date	Analytical Time
Lithium	7439-93-2	42.9	ug/L	B		MS	42.2	5.00	10/22/2006	04:28:07
Boron	7440-42-8	557	ug/L			MS	2.0	5.00	10/22/2006	04:28:07
Sodium	7440-23-5	51300	ug/L			MS	16.6	5.00	10/22/2006	04:28:07
Magnesium	7439-95-4	564	ug/L			MS	3.0	5.00	10/22/2006	04:28:07
Aluminum	7429-90-5	199	ug/L			MS	3.7	5.00	10/22/2006	04:28:07
Silica	7440-21-3	12900	ug/L			MS	22.2	20.00	10/22/2006	05:14:36
Phosphorus	7723-14-0	105	ug/L			MS	5.6	5.00	10/22/2006	04:28:07
Potassium	7440-09-7	26300	ug/L			MS	5.1	5.00	10/22/2006	04:28:07
Calcium	7440-70-2	85300	ug/L			MS	188	5.00	10/22/2006	04:28:07
Titanium	7440-32-6	2.2	ug/L	B		MS	0.500	5.00	10/22/2006	04:28:07
Chromium	7440-47-3	24.6	ug/L			MS	0.306	5.00	10/22/2006	04:28:07
Iron	7439-89-6	1600	ug/L			MS	9.6	5.00	10/22/2006	04:28:07
Manganese	7439-96-5	34.6	ug/L			MS	0.456	5.00	10/22/2006	04:28:07
Cobalt	7440-48-4	1.9	ug/L	B		MS	0.117	5.00	10/22/2006	04:28:07
Nickel	7440-02-0	12.3	ug/L	B		MS	1.6	5.00	10/22/2006	04:28:07
Copper	7440-50-8	49.3	ug/L	B		MS	0.872	5.00	10/22/2006	04:28:07
Zinc	7440-66-6	235	ug/L			MS	46.1	5.00	10/22/2006	04:28:07
Strontium	7440-24-6	2730	ug/L			MS	1.3	5.00	10/22/2006	04:28:07
Zirconium	7440-67-7	0.528	ug/L	B		MS	0.111	5.00	10/22/2006	04:28:07
Molybdenum	7439-98-7	1890	ug/L			MS	1.0	5.00	10/22/2006	04:28:07
Tin	7440-31-5	2.4	ug/L	B		MS	0.079	5.00	10/22/2006	04:28:07
Antimony	7440-36-0	5.7	ug/L	B		MS	0.133	5.00	10/22/2006	04:28:07
Barium	7440-39-3	15.4	ug/L	B		MS	0.439	5.00	10/22/2006	04:28:07
RFB Tungsten	7440-33-7	5.6	ug/L	U		MS	5.6	5.00	10/22/2006	04:28:07
Lead	7439-92-1	36.0	ug/L	B		MS	0.483	5.00	10/22/2006	04:28:07

Qualifier Descriptions:
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- E - Associated Serial Dilution is outside percent difference quality control criteria

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INORGANIC ANALYSIS DATA PACKAGE

Client: Exelon -Oyster Creek Site **SDG No.:** 0610012 **Method Type:** 3015/6020A

Sample ID: 0610012-05A D1 **Client ID:** Dry Well CRD Leak

Matrix: WATER **Date Received:** **Level:** LOW

% Solids: **Sample Wt/Vol:** 45.0 **Final Vol:** 50.0

Prep Batch ID: 841-21 **Prep Date:** 10/22/2006

Analyte	CAS No.	Concentration	Units	C	Qual	M	DL	Dil	Analytical Date	Analytical Time
Lithium	7439-93-2	42.2	ug/L	U		MS	42.2	5.00	10/22/2006	04:57:15
Boron	7440-42-8	13.4	ug/L	B		MS	2.0	5.00	10/22/2006	04:57:15
Sodium	7440-23-5	613	ug/L			MS	16.6	5.00	10/22/2006	04:57:15
Magnesium	7439-95-4	136	ug/L			MS	3.0	5.00	10/22/2006	04:57:15
Aluminum	7429-90-5	58.1	ug/L			MS	3.7	5.00	10/22/2006	04:57:15
Silica	7440-21-3	103	ug/L			MS	5.6	5.00	10/22/2006	04:57:15
Phosphorus	7723-14-0	44.1	ug/L	B		MS	5.6	5.00	10/22/2006	04:57:15
Potassium	7440-09-7	194	ug/L			MS	5.1	5.00	10/22/2006	04:57:15
Calcium	7440-70-2	333	ug/L			MS	188	5.00	10/22/2006	04:57:15
Titanium	7440-32-6	0.872	ug/L	B		MS	0.500	5.00	10/22/2006	04:57:15
Chromium	7440-47-3	2.6	ug/L	B		MS	0.306	5.00	10/22/2006	04:57:15
Iron	7439-89-6	244	ug/L			MS	9.6	5.00	10/22/2006	04:57:15
Manganese	7439-96-5	4.1	ug/L			MS	0.456	5.00	10/22/2006	04:57:15
Cobalt	7440-48-4	0.339	ug/L	B		MS	0.117	5.00	10/22/2006	04:57:15
Nickel	7440-02-0	17.8	ug/L	B		MS	1.6	5.00	10/22/2006	04:57:15
Copper	7440-50-8	10.7	ug/L	B		MS	0.872	5.00	10/22/2006	04:57:15
Zinc	7440-66-6	348	ug/L			MS	46.1	5.00	10/22/2006	04:57:15
Strontium	7440-24-6	1.8	ug/L	B		MS	1.3	5.00	10/22/2006	04:57:15
Zirconium	7440-67-7	0.467	ug/L	B		MS	0.111	5.00	10/22/2006	04:57:15
Molybdenum	7439-98-7	3.1	ug/L	B		MS	1.0	5.00	10/22/2006	04:57:15
Tin	7440-31-5	0.778	ug/L	B		MS	0.079	5.00	10/22/2006	04:57:15
Antimony	7440-36-0	1.4	ug/L	B		MS	0.133	5.00	10/22/2006	04:57:15
Barium	7440-39-3	3.2	ug/L	B		MS	0.439	5.00	10/22/2006	04:57:15
RFD Tungsten	7440-33-7	5.6	ug/L	U		MS	5.6	5.00	10/22/2006	04:57:15
Lead	7439-92-1	40.9	ug/L	B		MS	0.483	5.00	10/22/2006	04:57:15

Qualifier Descriptions:
- U - Non-Detected Concentration
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- E - Associated Serial Dilution is outside percent difference quality control criteria

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INORGANIC ANALYSIS DATA PACKAGE

Client: Exelon -Oyster Creek Site **SDG No.:** 0610012 **Method Type:** 3015/6020A

Sample ID: 0610012-06A **Client ID:** Dry Well 1-8 Sump

Matrix: WATER **Date Received:** **Level:** LOW

% Solids: **Sample Wt/Vol:** 45.0 **Final Vol:** 50.0

Prep Batch ID: 841-21 **Prep Date:** 10/22/2006

Analyte	CAS No.	Concentration	Units	C	Qual	M	DL	Dil	Analytical Date	Analytical Time
Lithium	7439-93-2	42.2	ug/L	U		MS	42.2	5.00	10/22/2006	05:01:17
Boron	7440-42-8	54.2	ug/L	B		MS	2.0	5.00	10/22/2006	05:01:17
Sodium	7440-23-5	29000	ug/L			MS	16.6	5.00	10/22/2006	05:01:17
Magnesium	7439-95-4	54.2	ug/L	B		MS	3.0	5.00	10/22/2006	05:01:17
Aluminum	7429-90-5	64.2	ug/L			MS	3.7	5.00	10/22/2006	05:01:17
Silica	7440-21-3	426	ug/L			MS	5.6	5.00	10/22/2006	05:01:17
Phosphorus	7723-14-0	24.5	ug/L	B		MS	5.6	5.00	10/22/2006	05:01:17
Potassium	7440-09-7	492	ug/L			MS	5.1	5.00	10/22/2006	05:01:17
Calcium	7440-70-2	1380	ug/L			MS	188	5.00	10/22/2006	05:01:17
Titanium	7440-32-6	0.500	ug/L	U		MS	0.500	5.00	10/22/2006	05:01:17
Chromium	7440-47-3	1.1	ug/L	B		MS	0.306	5.00	10/22/2006	05:01:17
Iron	7439-89-6	199	ug/L			MS	9.6	5.00	10/22/2006	05:01:17
Manganese	7439-96-5	35.5	ug/L			MS	0.456	5.00	10/22/2006	05:01:17
Cobalt	7440-48-4	0.178	ug/L	B		MS	0.117	5.00	10/22/2006	05:01:17
Nickel	7440-02-0	2.9	ug/L	B		MS	1.6	5.00	10/22/2006	05:01:17
Copper	7440-50-8	597	ug/L			MS	0.872	5.00	10/22/2006	05:01:17
Zinc	7440-66-6	749	ug/L			MS	46.1	5.00	10/22/2006	05:01:17
Strontium	7440-24-6	15.5	ug/L	B		MS	1.3	5.00	10/22/2006	05:01:17
Zirconium	7440-67-7	0.117	ug/L	B		MS	0.111	5.00	10/22/2006	05:01:17
Molybdenum	7439-98-7	38600	ug/L			MS	10.2	50.00	10/22/2006	05:19:05
Tin	7440-31-5	0.883	ug/L	B		MS	0.079	5.00	10/22/2006	05:01:17
Antimony	7440-36-0	0.894	ug/L	B		MS	0.133	5.00	10/22/2006	05:01:17
Barium	7440-39-3	1.5	ug/L	B		MS	0.439	5.00	10/22/2006	05:01:17
RPD Tungsten	7440-33-7	5.6	ug/L	B		MS	5.6	5.00	10/22/2006	05:01:17
Lead	7439-92-1	4.3	ug/L	B		MS	0.483	5.00	10/22/2006	05:01:17

Qualifier Descriptions:
U - Non-Detected Concentration
B - Concentration is between MDL and CRDL
N - Associated Matrix Spike is outside percent recovery quality control criteria
*** - Associated Duplicate is outside relative percent difference quality control criteria**
E - Associated Serial Dilution is outside percent difference quality control criteria

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INORGANIC ANALYSIS DATA PACKAGE

Client: Exelon -Oyster Creek Site **SDG No.:** 0610012 **Method Type:** 3015/6020A

Sample ID: 0610012-01B D1 **Client ID:** Dry Well Trough 18:20

Matrix: WATER **Date Received:** **Level:** LOW

% Solids: **Sample Wt/Vol:** 45.0 **Final Vol:** 50.0

Prep Batch ID: 841-22 **Prep Date:** 10/22/2006

Analyte	CAS No.	Concentration	Units	C	Qual	M	DL	Dil	Analytical Date	Analytical Time
Potassium	7440-09-7	494	ug/L			MS	25.6	25.00	10/22/2006	06:01:12
Calcium	7440-70-2	4530	ug/L			MS	939	25.00	10/22/2006	06:01:12

Comments:

Qualifier Descriptions:
- U - Non-Detected Concentration
- B - Concentration is between MDL and CRDL
- N - Associated Matrix Spike is outside percent recovery quality control criteria
- * - Associated Duplicate is outside relative percent difference quality control criteria
- E - Associated Serial Dilution is outside percent difference quality control criteria

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INORGANIC ANALYSIS DATA PACKAGE

Client: Exelon -Oyster Creek Site **SDG No.:** 0610012 **Method Type:** 3015/6020A

Sample ID: 0610012-02B D1 **Client ID:** Dry Well Trough 00:20

Matrix: WATER **Date Received:** **Level:** LOW

% Solids: **Sample Wt/Vol:** 45.0 **Final Vol:** 50.0

Prep Batch ID: 841-22 **Prep Date:** 10/22/2006

Analyte	CAS No.	Concentration	Units	C	Qual	M	DL	Dil	Analytical Date	Analytical Time
Potassium	7440-09-7	1780	ug/L			MS	25.6	25.00	10/22/2006	06:05:15
Calcium	7440-70-2	15700	ug/L			MS	939	25.00	10/22/2006	06:05:15

Comments:

Qualifier Descriptions:
- U - Non-Detected Concentration
- B - Concentration is between MDL and CRDL
- N - Associated Matrix Spike is outside percent recovery quality control criteria
- * - Associated Duplicate is outside relative percent difference quality control criteria
- E - Associated Serial Dilution is outside percent difference quality control criteria

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INORGANIC ANALYSIS DATA PACKAGE

Client: Exelon -Oyster Creek Site **SDG No.:** 0610012 **Method Type:** 3015/6020A

Sample ID: 0610012-03B D1 **Client ID:** Dry Well Hole #5 Bay 18:20

Matrix: WATER **Date Received:** **Level:** LOW

% Solids: **Sample Wt/Vol:** 45.0 **Final Vol:** 50.0

Prep Batch ID: 841-22 **Prep Date:** 10/22/2006

Analyte	CAS No.	Concentration	Units	C	Qual	M	DL	Dil	Analytical Date	Analytical Time
Potassium	7440-09-7	29400	ug/L			MS	25.6	25.00	10/22/2006	06:09:13
Calcium	7440-70-2	83500	ug/L			MS	939	25.00	10/22/2006	06:09:13

Comments:

Qualifier Descriptions:
- U - Non-Detected Concentration
- B - Concentration is between MDL and CRDL
- N - Associated Matrix Spike is outside percent recovery quality control criteria
- * - Associated Duplicate is outside relative percent difference quality control criteria
- E - Associated Serial Dilution is outside percent difference quality control criteria

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INORGANIC ANALYSIS DATA PACKAGE

Client: Exelon -Oyster Creek Site **SDG No.:** 0610012 **Method Type:** 3015/6020A

Sample ID: 0610012-04B D1 **Client ID:** Dry Well Hole #5 Bay 00:20

Matrix: WATER **Date Received:** **Level:** LOW

% Solids: **Sample Wt/Vol:** 45.0 **Final Vol:** 50.0

Prep Batch ID: 841-22 **Prep Date:** 10/22/2006

Analyte	CAS No.	Concentration	Units	C	Qual	M	DL	Dil	Analytical Date	Analytical Time
Potassium	7440-09-7	29800	ug/L			MS	25.6	25.00	10/22/2006	06:13:17
Calcium	7440-70-2	96600	ug/L			MS	939	25.00	10/22/2006	06:13:17

Comments:

Qualifier Descriptions:
U - Non-Detected Concentration
B - Concentration is between MDL and CRDL
N - Associated Matrix Spike is outside percent recovery quality control criteria
*** - Associated Duplicate is outside relative percent difference quality control criteria**
E - Associated Serial Dilution is outside percent difference quality control criteria

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INORGANIC ANALYSIS DATA PACKAGE

Client: Exelon -Oyster Creek Site **SDG No.:** 0610012 **Method Type:** 3015/6020A

Sample ID: 0610012-05B D1 **Client ID:** Dry Well CRD Leak

Matrix: WATER **Date Received:** **Level:** LOW

% Solids: **Sample Wt/Vol:** 45.0 **Final Vol:** 50.0

Prep Batch ID: 841-22 **Prep Date:** 10/22/2006

Analyte	CAS No.	Concentration	Units	C	Qual	M	DL	Dil	Analytical Date	Analytical Time
Potassium	7440-09-7	111	ug/L	B		MS	25.6	25.00	10/22/2006	06:21:31
Calcium	7440-70-2	939	ug/L	U		MS	939	25.00	10/22/2006	06:21:31

Comments:

Qualifier Descriptions:
U - Non-Detected Concentration
B - Concentration is between MDL and CRDL
N - Associated Matrix Spike is outside percent recovery quality control criteria
*** - Associated Duplicate is outside relative percent difference quality control criteria**
E - Associated Serial Dilution is outside percent difference quality control criteria

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INORGANIC ANALYSIS DATA PACKAGE

Client: Exelon -Oyster Creek Site **SDG No.:** 0610012 **Method Type:** 3015/6020A

Sample ID: 0610012-06B D1 **Client ID:** Dry Well 1-8 Sump

Matrix: WATER **Date Received:** **Level:** LOW

% Solids: **Sample Wt/Vol:** 45.0 **Final Vol:** 50.0

Prep Batch ID: 841-22 **Prep Date:** 10/22/2006

Analyte	CAS No.	Concentration	Units	C	Qual	M	DL	Dil	Analytical Date	Analytical Time
Potassium	7440-09-7	534	ug/L			MS	25.6	25.00	10/22/2006	06:17:33
Calcium	7440-70-2	1780	ug/L			MS	939	25.00	10/22/2006	06:17:33

Comments:

Qualifier Descriptions:
- U - Non-Detected Concentration
- B - Concentration is between MDL and CRDL
- N - Associated Matrix Spike is outside percent recovery quality control criteria
- * - Associated Duplicate is outside relative percent difference quality control criteria
- E - Associated Serial Dilution is outside percent difference quality control criteria

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INORGANIC ANALYSIS DATA PACKAGE

Client: Exelon -Oyster Creek Site **SDG No.:** 0610012 **Method Type:** 3015/6020A

Sample ID: 0610012-01A D1 **Client ID:** Dry Well Trough 18:20

Matrix: WATER **Date Received:** **Level:** LOW

% Solids: **Sample Wt/Vol:** 45.0 **Final Vol:** 50.0

Prep Batch ID: 841-21 **Prep Date:** 10/22/2006

Analyte	CAS No.	Concentration	Units	C	Qual	M	DL	Dil	Analytical Date	Analytical Time
Sulphur	7704-34-9	1110	ug/L	U		MS	1110	10.00	10/22/2006	09:23:51

Comments:

Qualifier Descriptions:
- **U - Non-Detected Concentration**
- **B - Concentration is between MDL and CRDL**
- **N - Associated Matrix Spike is outside percent recovery quality control criteria**
- *** - Associated Duplicate is outside relative percent difference quality control criteria**
- **E - Associated Serial Dilution is outside percent difference quality control criteria**

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INORGANIC ANALYSIS DATA PACKAGE

Client: Exelon -Oyster Creek Site **SDG No.:** 0610012 **Method Type:** 3015/6020A

Sample ID: 0610012-02A D1 **Client ID:** Dry Well Trough 00:20

Matrix: WATER **Date Received:** **Level:** LOW

% Solids: **Sample Wt/Vol:** 45.0 **Final Vol:** 50.0

Prep Batch ID: 841-21 **Prep Date:** 10/22/2006

Analyte	CAS No.	Concentration	Units	C	Qual	M	DL	Dil	Analytical Date	Analytical Time
Sulphur	7704-34-9	2850	ug/L			MS	556	5.00	10/22/2006	09:48:17

Comments:

Qualifier Descriptions:
U - Non-Detected Concentration
B - Concentration is between MDL and CRDL
N - Associated Matrix Spike is outside percent recovery quality control criteria
* - Associated Duplicate is outside relative percent difference quality control criteria
E - Associated Serial Dilution is outside percent difference quality control criteria

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INORGANIC ANALYSIS DATA PACKAGE

Client: Exelon -Oyster Creek Site **SDG No.:** 0610012 **Method Type:** 3015/6020A

Sample ID: 0610012-03A D3 **Client ID:** Dry Well Hole #5 Bay 18:20

Matrix: WATER **Date Received:** **Level:** LOW

% Solids: **Sample Wt/Vol:** 45.0 **Final Vol:** 50.0

Prep Batch ID: 841-21 **Prep Date:** 10/22/2006

Analyte	CAS No.	Concentration	Units	C	Qual	M	DL	Dil	Analytical Date	Analytical Time
Sulphur	7704-34-9	41700	ug/L			MS	11100	100.00	10/22/2006	10:00:35

Comments:

Qualifier Descriptions:
U - Non-Detected Concentration
B - Concentration is between MDL and CRDL
N - Associated Matrix Spike is outside percent recovery quality control criteria
*** - Associated Duplicate is outside relative percent difference quality control criteria**
E - Associated Serial Dilution is outside percent difference quality control criteria

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INORGANIC ANALYSIS DATA PACKAGE

Client: Exelon -Oyster Creek Site **SDG No.:** 0610012 **Method Type:** 3015/6020A

Sample ID: 0610012-04A D3 **Client ID:** Dry Well Hole #5 Bay 00:20

Matrix: WATER **Date Received:** **Level:** LOW

% Solids: **Sample Wt/Vol:** 45.0 **Final Vol:** 50.0

Prep Batch ID: 841-21 **Prep Date:** 10/22/2006

Analyte	CAS No.	Concentration	Units	C	Qual	M	DL	Dil	Analytical Date	Analytical Time
Sulphur	**7704-34-9**	**42700**	**ug/L**			**MS**	**11100**	**100.00**	**10/22/2006**	**10:04:39**

Comments:

Qualifier Descriptions:
U - Non-Detected Concentration
B - Concentration is between MDL and CRDL
N - Associated Matrix Spike is outside percent recovery quality control criteria
*** - Associated Duplicate is outside relative percent difference quality control criteria**
E - Associated Serial Dilution is outside percent difference quality control criteria

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INORGANIC ANALYSIS DATA PACKAGE

Client: Exelon -Oyster Creek Site **SDG No.:** 0610012 **Method Type:** 3015/6020A

Sample ID: 0610012-05A D1 **Client ID:** Dry Well CRD Leak

Matrix: WATER **Date Received:** **Level:** LOW

% Solids: **Sample Wt/Vol:** 45.0 **Final Vol:** 50.0

Prep Batch ID: 841-21 **Prep Date:** 10/22/2006

Analyte	CAS No.	Concentration	Units	C	Qual	M	DL	Dil	Analytical Date	Analytical Time
Sulphur	7704-34-9	556	ug/L	U		MS	556	5.00	10/22/2006	10:12:52

Comments:

Qualifier Descriptions:
U - Non-Detected Concentration
B - Concentration is between MDL and CRDL
N - Associated Matrix Spike is outside percent recovery quality control criteria
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E - Associated Serial Dilution is outside percent difference quality control criteria

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INORGANIC ANALYSIS DATA PACKAGE

Client: Exelon -Oyster Creek Site **SDG No.:** 0610012 **Method Type:** 3015/6020A

Sample ID: 0610012-06A D1 **Client ID:** Dry Well 1-8 Sump

Matrix: WATER **Date Received:** **Level:** LOW

% Solids: **Sample Wt/Vol:** 45.0 **Final Vol:** 50.0

Prep Batch ID: 841-21 **Prep Date:** 10/22/2006

Analyte	CAS No.	Concentration	Units	C	Qual	M	DL	Dil	Analytical Date	Analytical Time
Sulphur	7704-34-9	1460	ug/L			MS	556	5.00	10/22/2006	10:16:59

Comments:

Qualifier Descriptions:
U - Non-Detected Concentration
B - Concentration is between MDL and CRDL
N - Associated Matrix Spike is outside percent recovery quality control criteria
* - Associated Duplicate is outside relative percent difference quality control criteria
E - Associated Serial Dilution is outside percent difference quality control criteria

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Memo Hour to Diletto
Examination of Water Samples from Oyster Creek
October 22, 2006

Appendix D

Tritium Measurements

BWXT Services, Inc. Tritium Data Report for Oyster Creek
SDG 0610012

10/22/2006

Customer Sample ID	NELS Sample ID	Analysis Method	Analyte	Result	2 Sigma Uncertainty	MDA	Units [1]	Preparation Date	Analysis Date
Dry Well Trough 10/20/06 18:20	0610012-01	EPA 906.0	H-3	1.93E+03	1.76E+02	5.77E-01	pCi/mL	10/21/06	10/22/06
Dry Well Trough 10/20/06 00:20	0610012-02	EPA 906.0	H-3	7.95E+03	7.27E+02	5.77E-01	pCi/mL	10/21/06	10/22/06
Dry Well Hole #5 Bay 10/20/06 18:20	0610012-03	EPA 906.0	H-3	5.51E+03	5.04E+02	5.77E-01	pCi/mL	10/21/06	10/22/06
Dry Well Hole #5 Bay 10/20/06 00:20	0610012-04	EPA 906.0	H-3	5.63E+03	5.15E+02	5.77E-01	pCi/mL	10/21/06	10/22/06
Dry Well CRD Leak 10/20/06 19:15	0610012-05	EPA 906.0	H-3	7.47E+03	6.83E+02	5.77E-01	pCi/mL	10/21/06	10/22/06
Dry Well 1-8 Sump 10/19/06 02:55	0610012-06	EPA 906.0	H-3	4.85E+03	4.44E+02	5.77E-01	pCi/mL	10/21/06	10/22/06

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Appendix E

Certificate of Comformance

BWXT Services, Inc.
Lynchburg Technology Center

Quality Assurance
Certification of Conformance

BWXS Contract Charge No. S-1211-150

Exelon PowerLabs Purchase Order 00059971-00001, Authorization 2006100258

BWXT Services, Inc. hereby certifies that the item(s) or service(s) provided on this order are in accordance with the requirements of the above-specified Exelon PowerLabs purchase order, dated 10/20/06, and amendments summarized in BWXT Services, Inc. report to John Diletto from Kevin Hour, "Examination of Water Samples from Oyster Creek," dated 10/22/06. This project was conducted on 10/21/06-10/22/06 in accordance with the requirements of the BWXT Services, Inc., Radioisotope and Analytical Chemistry Laboratory QA Plan, Revision 0, dated 10/24/05, and applicable requirements of the Nuclear Materials and Inspection Services, Standard Practice QA Plan, Revision 7, dated 10/1/05, for the project titled "Examination of Water Samples from Oyster Creek."

10/22/06
Date

Don L. Hindman
Don L. Hindman.
Manager, Laboratory QA

Attachment 7.4

Tracer Test Plan

(~~2~~ 3 pages) DMF 11-3-06

DRYWELL WATER MITIGATION PROJECT
TRACER TEST, Rev. 2

Purpose

Establish required actions to implement the proposed tracer test

Background

Water has been identified in the Bay 5 and Bay 17 trenches in the Drywell, elevation 10'-3". The suspected source of the water is leakage from the Sub-pile Room drainage trough. To confirm/refute the suspected cause, tracer solution is to be added to the Sub-pile Room drainage trough while monitoring the Bay 5 and Bay 17 trench for the tracer element.

Implementation Process

1. **Prepare adequate tracer solution (Chemistry)**
2. **Identify all current water inputs to the trough (Engineering)**
3. **Re-direct water entering the trough directly to the sump to the extent possible (Operations)**
4. **Install temporary pipe plugs in the two 4 inch diameter trough discharge pipes. Plugs should be installed on the sump pit end of the pipes (PM/FIN).**
5. **Install temporary pipe plugs in the four 4 inch diameter drain pipes in the Sub-pile Room wall that input to the trough (PM/FIN).**
6. **Fill the trough with water to approximately 3 inch depth (approximately 50 gallons) (PM/FIN).**
7. **Disperse tracer solution (0.5 liter) into the trough. Dispersion should be as uniform as possible (PM/FIN).**
8. **Record date and time of tracer introduction and the depth of trough water at reference points A, B, C and D (PM/FIN).**
9. **Periodically monitor water in the trough for the duration of the test. If possible, station a vacuum or pump in the Sub-pile Room to remove water from the trough if the water depth reaches 6 inches. If water depth cannot be maintained at 6 inches or less due to inputs into the trough, remove the sump plug to release water into the sump to prevent the trough from overflowing. Note: If water level increases in the trough but is less than 6 inches, more tracer may be added to the trough as long as no water has entered the 1-8 sump from removal of any plugs – Contact Engineering at extension 4133 before adding more tracer.**
10. **Continue to monitor the trench at Bay 5 for water at the scheduled 4 hour interval.**
11. **Use black light, if necessary, to determine presence of tracer in the trench.**
12. **Record date and time of first observed tracer in the trench.**

13. At first observation of tracer and recording of date and time, the test is concluded. Demob may commence immediately.

Parts/Equipment

1. 0.5 liter of tracer solution. Solution available from Chemistry (Artz/Mura)
2. 6 – 4 inch diameter temporary pipe plugs
3. Water (approximately 50 gallons)
4. Black light for tracer detection in trench.

Prepared by: Knepper/O'Rourke
October 23, 2006, 0205 hours

Attachment 7.5

Structural Evaluation

Structural Integrity Associated, Inc report for the Corrosion Evaluation of the Oyster Creek Drywell Steel Shell

(Pages)

IR 546049-02
ATTACHMENT 7.7
ATTACH PAGE 2

Structural Integrity Associates, Inc.

3315 Almaden Expressway
Suite 24
San Jose, CA 95118-1557
Phone: 408-978-8200
Fax: 408-978-8964
www.structint.com
bgordon@structint.com

November 2, 2006
SIR-06-436, Rev. 1
BMG-06-016

Mr. Howard Ray
AmerGen Energy Company, LLC
Oyster Creek Generating Station
P. O. Box 388 Route 9S
Forked River, NJ 08731

Subject: Corrosion Evaluation of the Oyster Creek Drywell Shell Steel – ECR 06-00879

Dear Mr. Ray:

The results of this engineering evaluation indicate that no significant corrosion of the inside surface of drywell steel shell as long as the current environmental conditions inside the drywell are maintained for the following reasons:

1. The concrete floor pore water inside the drywell is characterized by corrosion-inhibiting high pH with low impurity levels that are significantly below the EPRI embedded steel guidelines action level recommendations. Therefore, drywell steel integrity can be maintained indefinitely as long as the high pH and low impurity levels in the concrete pore water are maintained.

2. Any subsequent water ingress into the concrete floor will also become high pH concrete pore water and will have the same corrosion inhibiting characteristics.

3. Corrosion of the steel shell that is not wetted by the concrete pore water will be mitigated by the inerting of the inside of the drywell with nitrogen during plant operation.

4. The only negligible corrosion that would occur during outages and briefly (hours) after the outage would be due to the dissolved oxygen in water that may have migrated into the two trenches, one each in Bays 5 and 17. Once the cathodic reactant dissolved oxygen is consumed in the brief corrosion reaction and/or effervesced from the water during heat up, however, corrosion even in these two locations will cease.

Therefore, the water identified in contact with the inside surface of the drywell steel has not been and is not, an engineering concern for the structural integrity of the drywell as long as the environmental conditions (e.g., pH and water purity) are maintained.

IR 546049 ASSIGN 02
ATTACHMENT 7.5
ATTACH PAGE 3

I thank you for the opportunity to provide this report to AmerGen and enjoyed visiting your site. If you have any questions on the content of this report please do not hesitate to contact me.

Very truly yours,

Barry M Gordon

Barry M. Gordon, P. E.
Associate

/nnn
Attachment
cc: M. Herrera, SI

IR 546049-02
ATTACHMENT 7.5
ATTACH PAGE 4

Corrosion Evaluation of the Oyster Creek Drywell Shell Steel – ECR 06-00879

Introduction

The degree that concrete pore water will provide corrosion protection for embedded steel depends on the chemical quality of the concrete, the quality of the water used for mixing the concrete, and the depth of concrete in contact with the steel. The permeability of the concrete is also an important factor affecting the embedded steel's corrosion propensities [1]. Low permeability concrete contains less water under a given exposure and is more likely to have high electrical resistance and, thus, will reduce the rate of the corrosion process of any steel in contact with the concrete. High quality concrete also resists the absorption of impurities and their migration to an embedded steel surface and provides a barrier to oxygen, the most common cathodic reactant in aqueous corrosion reactions. Finally, low water-to-cement ratios and adequate air entrainment increases the resistance to water penetration and will also mitigate corrosion [1].

Environmental Factors Affecting Corrosion in Concrete

When a freshly-mixed concrete is placed on steel, the mixing water contacting the steel surface forms hydrated calcium ferrite ($4CaO \bullet Fe_2O_3 \bullet 13H_2O$). This mixing water also reacts with steel and creates a thin layer of iron hydroxide [$Fe(OH)_2$] and calcium hydroxides [$Ca(OH)_2$]. The presence of abundant amount of calcium hydroxide and relatively small amounts of alkali elements, such as sodium and potassium, gives concrete pore solution a very high alkalinity with pH of 12 to 13.

This pH range is where steel (iron) is either thermodynamically "immune" to corrosion or where a protective passive film is thermodynamically stable on the steel surface regardless of the corrosion potential of the steel as affected by the dissolved oxygen content of the water, as illustrated in a pH – potential diagram or Pourbaix diagram, Figure 1 [2]. Although the pH of exposed concrete pore water may decrease, i.e., become more acidic, when exposed to air containing carbon dioxide (CO_2) due to carbonation, the pH of the water will still be sufficiently high to maintain a passive film on the steel surface. Therefore, steel in contact with low impurity concrete pore water will not suffer significant corrosion even if sufficient moisture and oxygen are available due to the spontaneous formation of this thin protective passive film [3]. Such corrosion resistance can be degraded if the alkaline concrete pore solution disappears (e.g. when large cracks reach the steel surface) or the ingress of detrimental species such as chloride (Cl^-), sulfate (SO_4^{-2}) or carbon dioxide (CO_2) can occur.

Corrosion of the steel surface in contact with concrete pore water typically occurs in two stages. The first initiation stage is characterized by aggressive species present in the surrounding medium, penetrating the concrete. The second stage starts when these aggressive species reach sufficient concentrations at the steel surface to degrade the passive film on the steel surface. Chloride and sulfate degrade passive films on most metals surfaces while carbon dioxide dissolved in water (carbonation) forms carbonic acid (H_2CO_3), which could lower the pH to a range where dissolution, i.e., corrosion, of steel can occur, Figure 1.

However, the corrosion of this steel is not significant if the concrete is not exposed to an aggressive environment as defined by the Electric Power Research Institute (EPRI). These guidelines suggest that an environment characterized by a pH <11.5 or chlorides >500 ppm or sulfate >1500 ppm can result in the degradation of embedded steel [1]. However, it should be noted that this pH corrosion "threshold" is clearly conservative since corrosion of steel (e.g., iron) can only thermodynamically occur when the pH <10, Figure 1, and actually remains kinetically insignificant until the pH is truly in the acidic range (e.g., pH <5.5) as noted in this EPRI evaluation [1]. It is important to note that the Pourbaix diagram only reflects a thermodynamic evaluation of corrosion reactions and implies nothing concerning the kinetics of the same corrosion reactions.

In the case of corrosion of steel rebar embedded in concrete, the non-passive corrosion film formed on the rebar steel surface has a volume of approximately three times the volume of the steel that has corroded. This results in a loss of bond between the embedded rebar and the concrete and leads to delamination and spalling of the concrete. Delamination and spalling would thus be indicators of the presence of an aggressive environment.

Oyster Creek Concrete-Drywell Shell Steel Evaluation

For the specific case of the Oyster Creek drywell shell in contact with the poured concrete floor inside the drywell, no gross degradation of the drywell shell appears to have occurred, which is completely consistent with the Pourbaix diagram. This conclusion is supported by: (1) the lack of visible significant corrosion on the drywell shell steel surfaces aside from superficial rusting of the steel in the trenches where the steel is no longer in contact with the concrete pore water; (2) the nominal ultrasonic testing (UT) thickness measurements taken by AmerGen during Oyster Creek's 2006 refueling outage; and (3) the lack of any indication of rebar degradation in the concrete inside the drywell.

This near lack of drywell steel corrosion on the interior drywell shell surface is most likely due to the very low concentrations of chloride (13.6 – 14.6 ppm) and sulfate (228 – 230 ppm) plus the high pH (8.40 – 10.21), despite carbonation, of the drywell trench water in Bay 5 as independently measured by BWX Technologies (BWXT) during the 2006 refueling outage, Table 1 [4]. Therefore, corrosion of the steel exposed in the trench that is in contact with good quality concrete pore water will be mitigated. Any corrosion of the trench steel not in contact with concrete pore water will be mitigated by the inerting of the drywell during operations, due to the lack of dissolved oxygen in the water in contact with the steel.

Some corrosion can occur on this exposed steel when the drywell is not inerted during outages and briefly (hours) after inerting as will be discussed in the next section. Again, this small amount of corrosion would be due to the dissolved oxygen in the trench water. Once the cathodic reactant dissolved oxygen is consumed in the brief corrosion reaction and/or effervesced from the water during heat up, corrosion will cease.

BWXT investigators suggest that the high pH and calcium content of the trench water indicates that this water has been in contact with the concrete over a significant period of time since the calcium concentration is significantly higher in the trench water (83.5 and 96.6 ppm) compared to the trough water (4.53 and 15.7 ppm), which is believed to be a source of the water in the trench [4].

Again, since these trench water chemistry values comply with the EPRI embedded steel guidelines action level recommendations for maintaining embedded steel integrity in concrete, the structural integrity of the embedded steel is assured as long as the corrosion mitigating concrete pore water chemistry is maintained [1].

Calculated Amount of Corrosion under Non-Inerted Conditions inside the Drywell

As an exercise, a calculation will be performed to determine how much additional corrosion could occur on a unit area of drywell surface prior to the inerting of the drywell, i.e., how much corrosion would occur in a closed, non-refreshed with oxygen, system. To accomplish this objective, several conservative, i.e., worst-case, assumptions will be made:

1. Assume the worst case temperature for the highest corrosion rate. The maximum temperature of the drywell was 140 °F (60 °C), which nearly coincides with the maximum corrosion rate for carbon steel in open systems, Figure 2. There is a linear increase in corrosion rate of carbon steel with temperature in a closed system from which oxygen cannot escape that corresponds with the increase in the oxygen diffusion coefficient. In an open system where dissolved oxygen can effervesce from the water such as the case with the drywell, the corrosion rate initially follows that for a closed system. However, the corrosion rate starts to rapidly decrease at approximately 158 °F (70 °C) due to the decrease in the solubility of the cathodic reactant oxygen in the water, which at that temperature becomes more significant than the increase in the oxygen diffusion coefficient [5].

2. Assume that the form of corrosion product formed on the drywell steel is non-adherent and non-protective Fe_2O_3, i.e., red rust.

3. Assume that one cubic centimeter (cm^3) of water contacts every square centimeter (cm^2) of drywell shell steel.

4. The water contacting the drywell steel is assumed to be pure water since pure water can retain the greatest amount of dissolved oxygen and there is no inhibiting effect of high pH. Note that the presence of impurities in the water will only affect the kinetics of the corrosion reaction, not the total amount of corrosion, which depends only on the quantity of the dissolved oxygen in the solution. Neither sulfate or chloride appear in the corrosion reactions in this system.

5. Assume that all the dissolved oxygen molecules in the water are not homogeneously distributed inside the unit volume of water, but are all biased and in contact with the drywell steel ready for cathodic reduction.

Corrosion Calculation

The following calculation determines the amount of steel that will be corroded if all the dissolved oxygen in the water reacts with the steel.

Calculation Data Inputs

Density of water at 140 °F (60 °C) = 0.983 g/cm^3 [6]

Weight of a unit volume (1 cm^3) of water at 140 °F (60 °C) = 0.983 g

Dissolved oxygen concentration in the water at 140 °F (60 °C) = 4.7 parts per million (ppm) [7]

Weight of dissolved oxygen in a unit volume of water = 4.7 x 10^{-6} x 0.983 g = 4.62 x 10^{-6} g

Moles of dissolved oxygen in a unit volume = 4.62 x 10^{-6} g/32 g/mole = 1.44 x 10^{-7} moles

Corrosion Calculation

Moles of iron corroded into Fe_2O_3 (red rust) per unit volume of water:

Since the "rusting reaction" is $4Fe + 3O_2 \rightarrow 2Fe_2O_3$, then 3 moles of dissolved oxygen form two moles of Fe_2O_3 rust

2/3 x 1.44 x 10^{-7} moles of dissolved oxygen = 9.6 x 10^{-8} moles of Fe_2O_3

Grams of iron corroded into Fe_2O_3 (red rust) per unit volume:

9.6 x 10^{-8} moles of Fe_2O_3 x 160 g/mole = 1.54 x 10^{-5} g of Fe_2O_3

Average Fe_2O_3 lost per cm^2 = 1.54 x 10^{-5} g/cm^2

Thickness of steel lost due to corrosion this corrosion would be:

1.54 x 10^{-5} g/cm^2/density of steel = 1.54 x 10^{-5} g/cm^2/7.85 g/cm^3 = 1.96 x 10^{-6} cm or ~ 0.02 µm = 0.0008 mils = 8 x 10^{-7} inches

Summary

These measured water chemistry values, plus the lack of any indications of rebar degradation, suggest that the protective passive film established during concrete installation at the embedded steel/concrete interface is still intact and significant corrosion of the drywell steel would not be anticipated as long as this benign environment is maintained. Therefore, since the concrete environment complies with the EPRI concrete structure guidelines, corrosion would not be considered "an applicable aging mechanism for nuclear power plant concrete structures and structural members" at Oyster Creek [1].

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ATTACH PAGE 8

More specifically, the results of this engineering evaluation indicate that no significant corrosion of the inside surface of drywell steel shell would be anticipated for the following reasons:

1. The concrete floor pore water inside the drywell is characterized by corrosion-inhibiting high pH with low impurity levels that are significantly below the EPRI embedded steel guidelines action level recommendations. Therefore, drywell steel integrity can be maintained indefinitely as long as the high pH and low impurity levels in the concrete pore water are maintained.

2. Any subsequent water ingress into the concrete floor will also become high pH concrete pore water and will have the same corrosion inhibiting characteristics.

3. Corrosion of the steel shell that is not wetted by the concrete pore water will be mitigated by the inerting of the inside of the drywell with nitrogen during plant operation.

4. The only negligible corrosion that would occur during outages and briefly (hours) after the outage would be due to the dissolved oxygen in water that may have migrated into the two trenches, one each in Bays 5 and 17. Once the cathodic reactant dissolved oxygen is consumed in the brief corrosion reaction and/or effervesced from the water during heat up, however, corrosion even in these two locations will cease.

Therefore, the water identified in contact with the inside surface of the drywell steel has not been and is not, an engineering concern for the structural integrity of the drywell as long as the environmental conditions (e.g., pH and water purity) are maintained.

References

1. "Aging Effects for Structures and Structural Components (Structural Tools), Revision 1," EPRI, Palo Alto, CA, August 2003. 1002950.

2. EpH Web www.crct.polymtl.ca/ephweb.php.

3. S. Jäggi, H. Böhni and B. Elsener, "Macrocell Corrosion of Steel in Concrete – Experiments and Numerical Modeling," paper presented at Eurocorr 2001, Riva di Gardi, Italy, October, 1-4, 2001.

4. OC Drywell Chemistry Sample Results Summary – Revision 3, BWX Technologies, Lynchburg, VA, October 29, 2006.

5. F. Speller, Corrosion, Causes and Prevention, McGraw-Hill, New York, NY, 1951.

6. Water Density Calculator, http://www.csgnetwork.com/h2odenscalc.html

7. Oxygen Solubility Calculator, http://pointfour.com/cgi/pfscalc.cgi

Table 1: Oyster Creek Bay 5 Trench Water Chemistry Analyses [4]

Sample Description	BWXT ID	Date	Time	BWXT pH@21.2 °C	Oyster Creek pH	Cond., µS/cm	SO_4^{-2}, ppm	Cl^-, ppm	Ca, ppm	Comments
Bay 5 Trench Sample #3	0610012-03	10/20/06	18:20	8.40	9.30	656	230	14.6	83.5	Cl^- and SO_4^{-2} below EPRI thresholds
Bay 5 Trench Sample #4	0610012-04	10/20/06	00:20	10.21	10.35	672	228	13.6	96.6	Cl^- and SO_4^{-2} below EPRI thresholds

Notes: The original BWXT report reported the concentrations of sulfate, chloride and calcium in micrograms/liter, µg/l, which is equivalent to a part per billion, ppb. Since the reporting of chemical units in reactor waters are typically parts per million, ppm, the concentrations of sulfate, chloride and calcium are reported in ppm in Table 1. For example, the chloride concentration reported by BWXT was 14,600 µg/l = 14,600 ppb = 14.6 ppm since 1000 ppb = 1 ppm.

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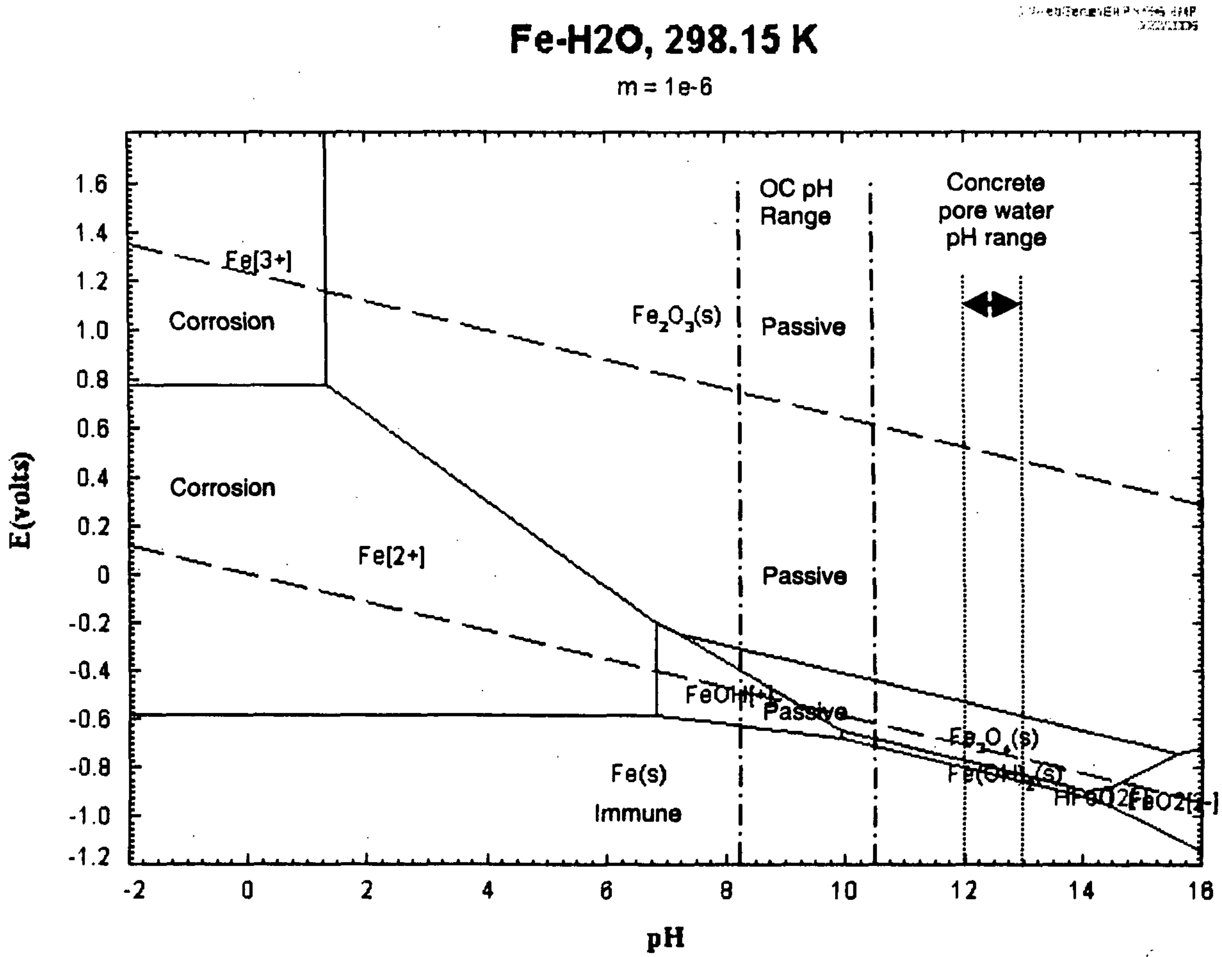

Figure 1: Iron - Water Pourbaix Diagram at 25 °C Indicating the Regions of Thermodynamic Stability for the Fe Ion (Corrosion), Passivity (Fe Oxides) and Corrosion Immunity (Fe) [2]

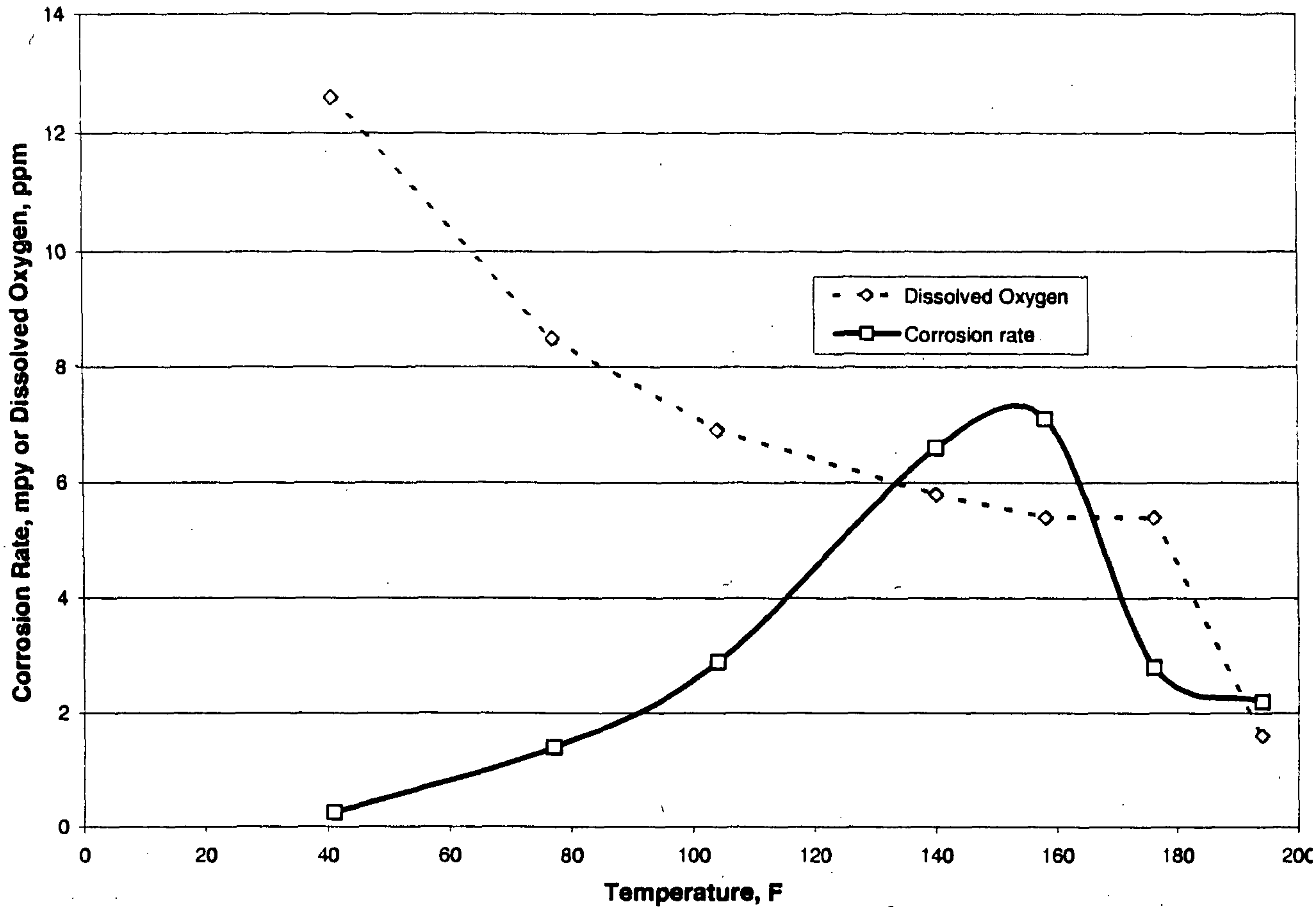

Figure 2. Effect of Temperature on the Corrosion Rate of Carbon Steel and Dissolved Oxygen Concentration

Attachment 7.6

2006 Drywell maintenance rule structural monitoring walkdown write-up

ATTACHMENT 8
Structures and Components Monitoring Forms

Form # R2091380-01-01 **Sheet** 1 **of** 8

AREA: Inside the Drywell

Responsible Engineer/Examiner: Sujit Niogi / Sujit Niogi & Dan Fiorello **Date** 10/19/06

Element Type	Examination Criteria
Template # S-01 "Reinforced Concrete"	Attachment 2, Section 1
Template # S-02 "Structural Steel"	Attachment 2, Section 2
Template # S-03 "Masonry Walls"	Attachment 2, Section 3
Template # S-04 "Equipment and Component Foundations"	Attachment 2, Section 4
Template # S-05 "Roofing"	Attachment 2, Section 5
Template # S-06 "Component Supports"	Attachment 2, Section 6
Template # S-07 "Seismic Gaps"	Attachment 2, Section 7
Template # S-08 "Doors (secondary containment, watertight, steam barrier)"	Attachment 2, Section 8
Template # S-09 "Building Siding and Metal Deck"	Attachment 2, Section 9
Template # S-10 "Exterior Surfaces-Mechanical Components"	Attachment 2, Section 10
Template # S-11 "Panels and Enclosures"	Attachment 2, Section 11
Template # S-12 "Wooden Piles & Sheeting"	Attachment 2, Section 12
Template # S-13 "Earthen Structures & Embankments"	Attachment 2, Section 13
Template # S-14 "Penetration Seals and Structural Seals"	Attachment 2, Section 14
Template # S-15 "Permali Shielding Blocks"	Attachment 2, Section 15

Scope of inspection- The inspection includes visual inspection concrete Floor at elevation 10'-3" and pedestal, condition of the floor under the vessel, trough and sump, condition of the support frames, condition of the pipe and equipment supports, general condition of the Drywell surface (Shell) up to elevation 23'. This inspection was performed at elevation 10'-3" of the Drywell

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Structures and Components Monitoring Forms

Form # R2091380-01-01 **Sheet** 2 **of** 8

AREA: Inside the Drywell

OBSERVATIONS			
Seq. #	**Item Type**	**Item # / Location**	**Observation Description/ Observed Condition**
1	Concrete Floor Outside Pedestal	El. 10'-3"	The concrete floor outside the pedestal and pedestal are in good condition with no visible evidence of cracking, spalling or other structural defects. The floor was stained and dirty Concrete edge of the curb where it meets the steel shell was uneven. Some concrete had chipped off due to sharp edge. This resulted in small gap at the top of the curb where it meets the steel shell. This is not a structural concern, but possible path of water intrusion to interface surface between concrete slab and the steel shell. Two cutout areas at the curb were inspected. The cutout at bay 17 was dry but cutout at bay 5 was partially filled with water approximately 5 inches deep.
2.	Concrete Floor Inside Pedestal, Trough & Sump		Inspection of the Reactor Pedestal Wall and the floor under the Reactor Vessel found to be in good condition. The slab within the pedestal (under the vessel) is covered with an additional approximately 6" of concrete over lay. This over lay is crowned at the center and slopes gradually to the trough. The top surface of this over lay slab has exposed aggregate and some small chips on the floor. None of these are structural concern and is in good condition. The trough was partially filled with water and water was dripping from the overhead near the sump. There

			were some standing water maximum ¼" deep few locations around the outside of the pedestal. At the time of inspection some water was dripping into the area from above the Drywell hatch area. The inside surfaces of the sump were not inspected as they were not accessible.
3.	Structural Steel	El. 23'	The underside of the radial beams and the secondary beams are in good shape. Some minor rust stains are noticed. These stains were observed during previous inspections. No temporary overloads that may fail the existing structure were observed.
4.	Component Supports & Equipment Supports	El. 10'	Component supports and equipment supports are generally in good condition-no issues.

Evaluation of Results:

X **Acceptable; Seq. # 1, 2, 3 and 4**
☐ **Acceptable with Deficiencies; Seq. #_____**
☐ **Unacceptable; Seq. # __________**

Responsible Engineer: [signature] **Date:** 10/27/06

Responsible Manager: [signature] **Date:** 10/27/06

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Revision 0

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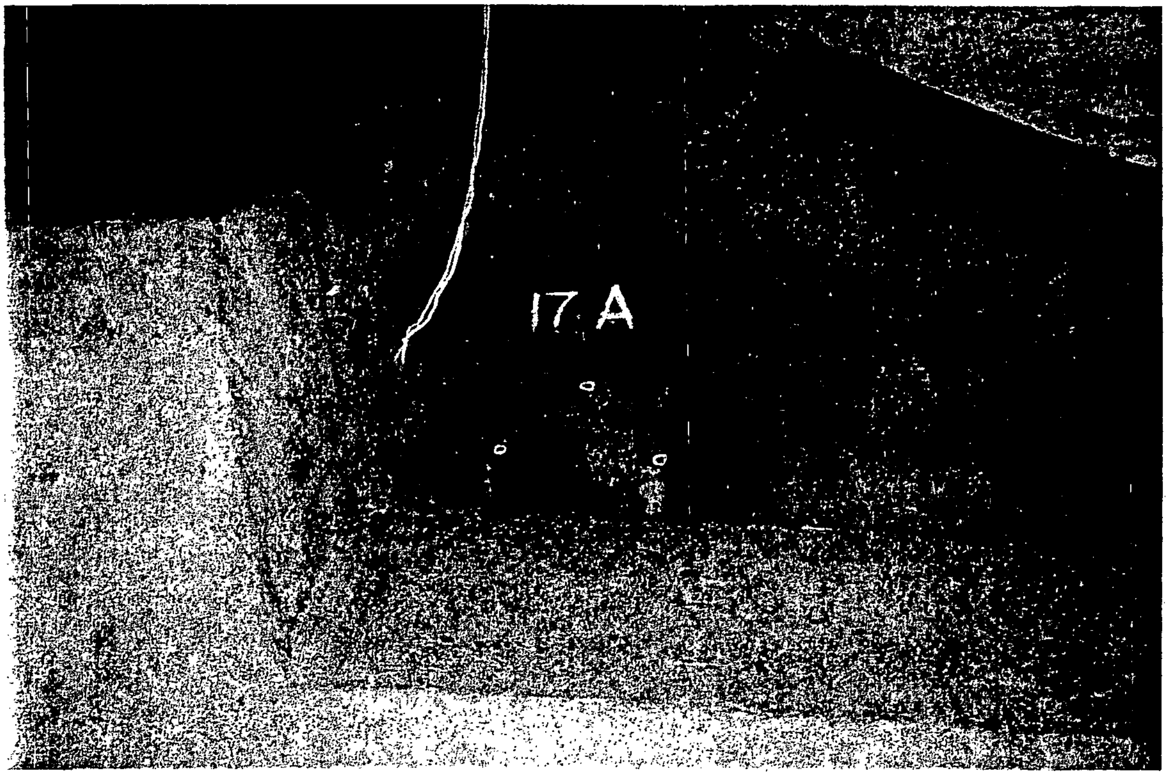
Structures and Components Monitoring Forms

Form # R2091380-01-01 Sheet 4 of 8

AREA: Inside the Drywell



Concrete Edge of the Curb and the Shell

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Structures and Components Monitoring Forms

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AREA: Inside the Drywell

Water on the Floor El.10'-3" Outside of Pedestal

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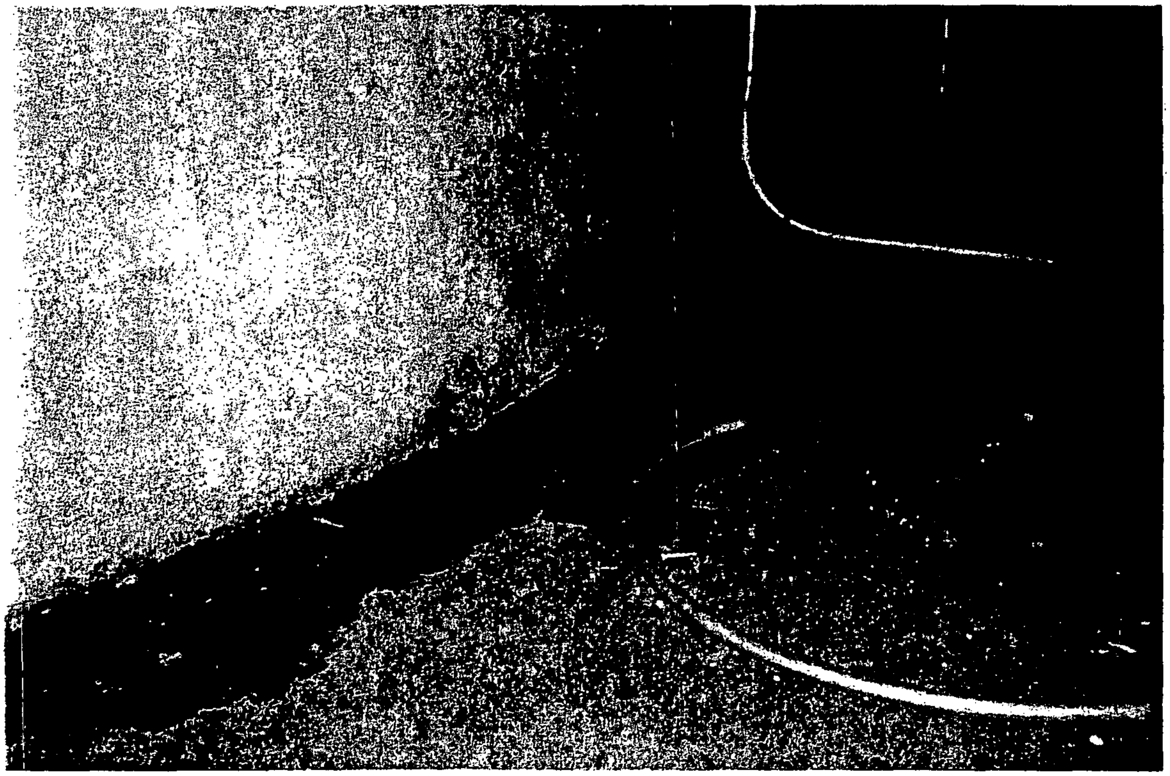
Structures and Components Monitoring Forms

Form # R2091380-01-01 Sheet 6 of 8

AREA: Inside the Drywell



Water Outside Pedestal El. 10'-3" Near the Sleeve

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Structures and Components Monitoring Forms

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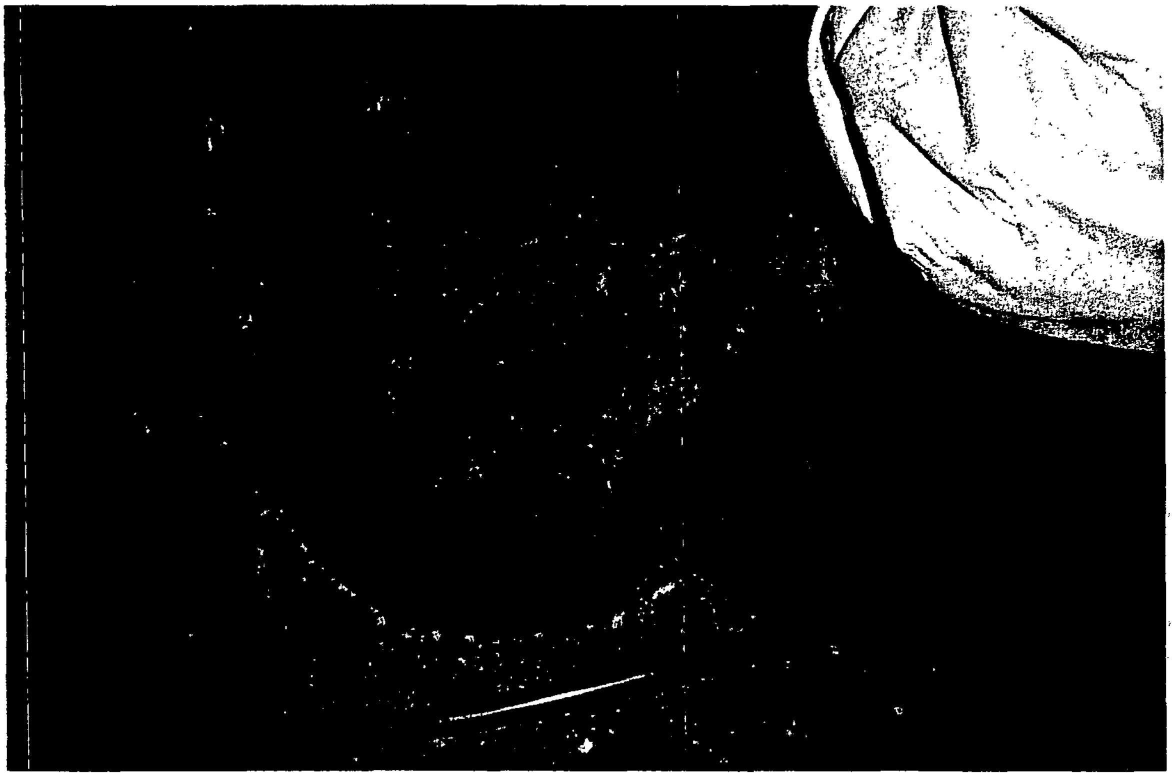
AREA: Inside the Drywell



Trench @ Bay No 5 Inside Drywell El 10'3"

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Structures and Components Monitoring Forms

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AREA: Inside the Drywell

Trough and ≈6" Thick Over Lay Concrete Floor Inside Pedestal (Under the Vessel)

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Structures and Components Monitoring Report

Form # R2091380-01-02 Sheet 1 of 11

AREA_: inspection of the area inside the reactor concrete pedestal was performed at Elevation 10'-10

During 1R21, an inspection of the area inside the reactor concrete pedestal was performed at Elevation 10'-10". The inspection was performed during a scheduled window within the CRD replacements when the area was wet and water was streaming from some of the de-torqued CRD flanges. The area had adequate light. The trough was cleaned and prepped for the inspection and a flashlight was used to inspect the internal condition of the trough.

OBSERVATIONS			
Seq. #	**Item Type**	**Item # / Location**	**Observation Description/ Observed Condition**
1	Concrete Trough	EL 10'-10"	During the visual examination of the trough, the as-found general condition of the trough was good. There were no signs of significant cracks in the trough. Some signs of erosion and localized minor degradations were observed around the floor drain holes from the area outside the reactor pedestal to the trough. Other minor degradations and localized erosion around the drain holes from the trough to 1-8 sump were also observed. The trough bottom surface is sloped to divert the collected water from the highest point around Azimuth 180 deg to the lowest at Azimuth 0 deg (1-8 Sump). The drainage slope is non-uniform, which was confirmed

ATTACHMENT 8
Structures and Components Monitoring Report

by field measurements for the water surface height in the trough with respect to the bottom of the trough. A depressed area in the trough bottom elevation was observed at Azimuth 270. The bottom of the trough is in good condition. The inner surface of the pedestal inside the trough showed some minor hair surface cracks at the construction joints. None of these wall cracks are through cracks. An area of slab corner was observed chipped away for approximately 2" deep by 12" long between Azimuth 0 deg and 90 deg. The surface stain color is similar to the surrounding concrete. As such, the degradation does not appear recent and could be since original construction. It should be noted that the chipped corner is in an area in the raised floor and has no structural contribution to the pedestal supporting structure.

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2	**Concrete Floor**	**Floor at El 10'-10"**	The surface of the floor inside the pedestal at El 10'-10" has exposed gravel. However, no loose gravel was observed except for the small amount that was removed by the field for the inspection prepping. The exposed gravel could be caused by water leakage from the above equipment such as the CRD's over the past years of operations. No signs of significant surface cracks were observed. Generally, the floor surface is in fair condition
3	**Steel Structure**	**10'-10"**	The steel structure was inspected and some minor surface corrosion was observed at approximately Azimuth 90 deg. No material loss was observed as expected due to the drywell being inerted with nitrogen (no oxygen) at power and the water leakage from the reactor CRD is not aggressive to steel.

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4	1-8 Sump	The 1-8 sump piping, pipe supports, and cover plates appear in good condition. The ¼" S.S linear appears also in good condition based on the inspection of the pictures provided by the FIN group.

Evaluation of Results:

☒ **Acceptable; Seq. #** 1, 2, 3, and 4
☐ **Acceptable with Deficiencies; Seq. #**_____
☐ **Unacceptable; Seq. #** _____

Responsible Engineer: [signature] **Date:** 10/27/06

Responsible Manager: [signature] **Date:** 10/27/06

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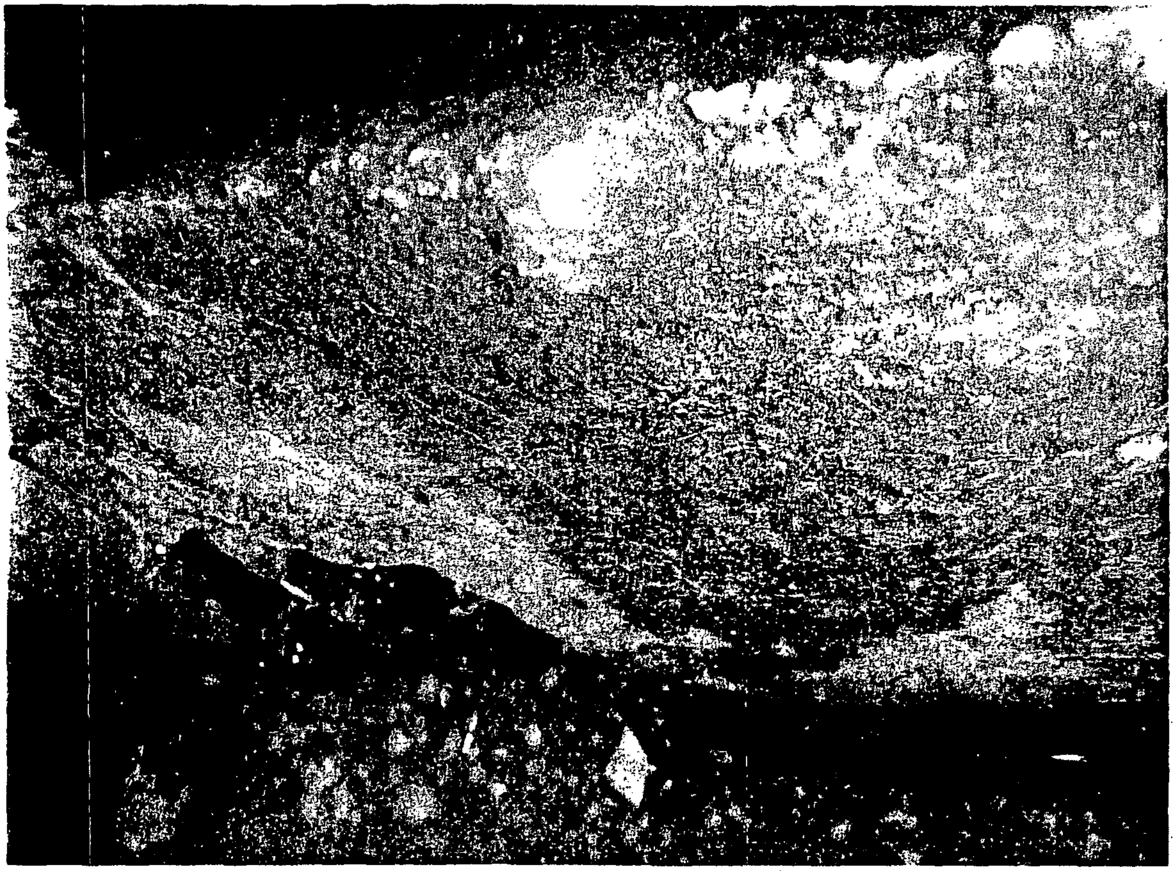

Drain Hole to the 1-8 Sump.

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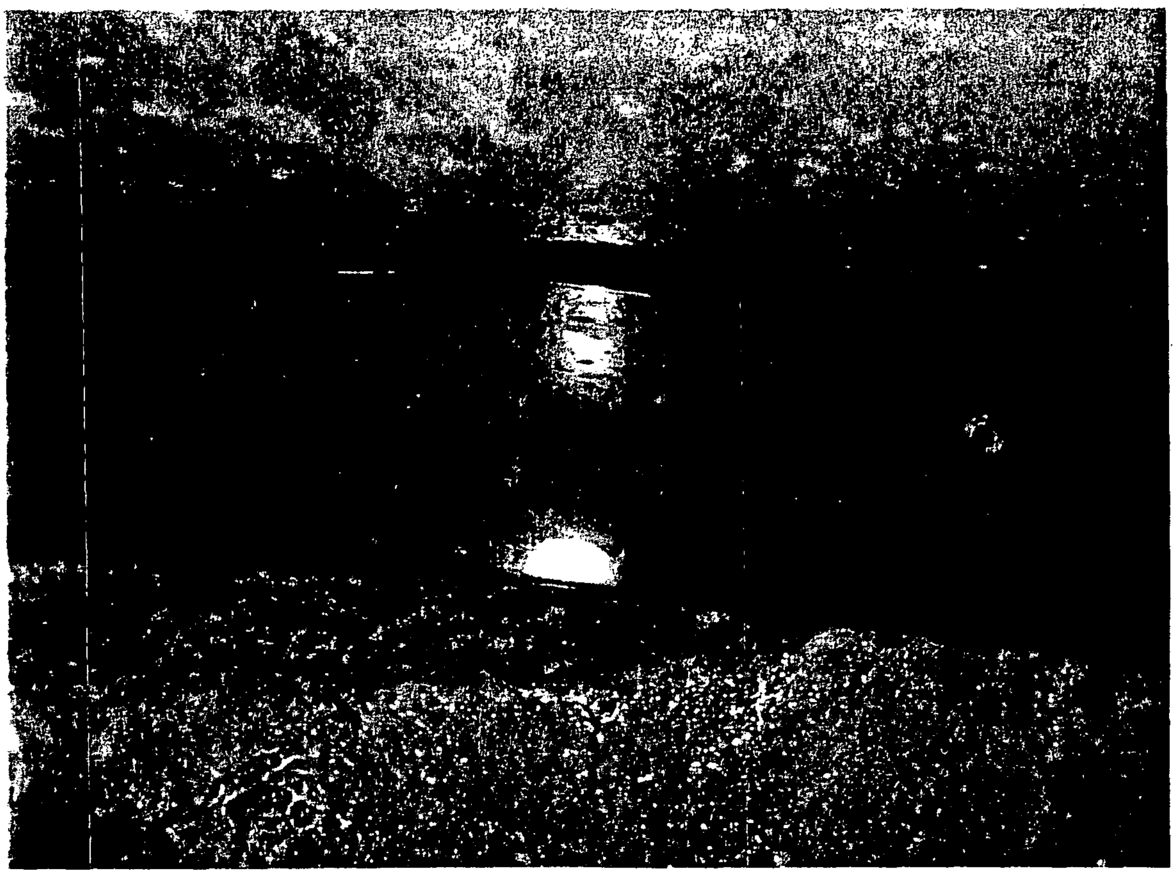
Form # R2091380-01-02 **Sheet** 6 **of** 11



Chipped Corner in the Tough.

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Azimuth 270 deg, the drain hole in the pedestal shows some minor degradation.

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Minor surface cracks in the pedestal construction joint. Bottom of the Trough is in good condition.

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Structures and Components Monitoring Report

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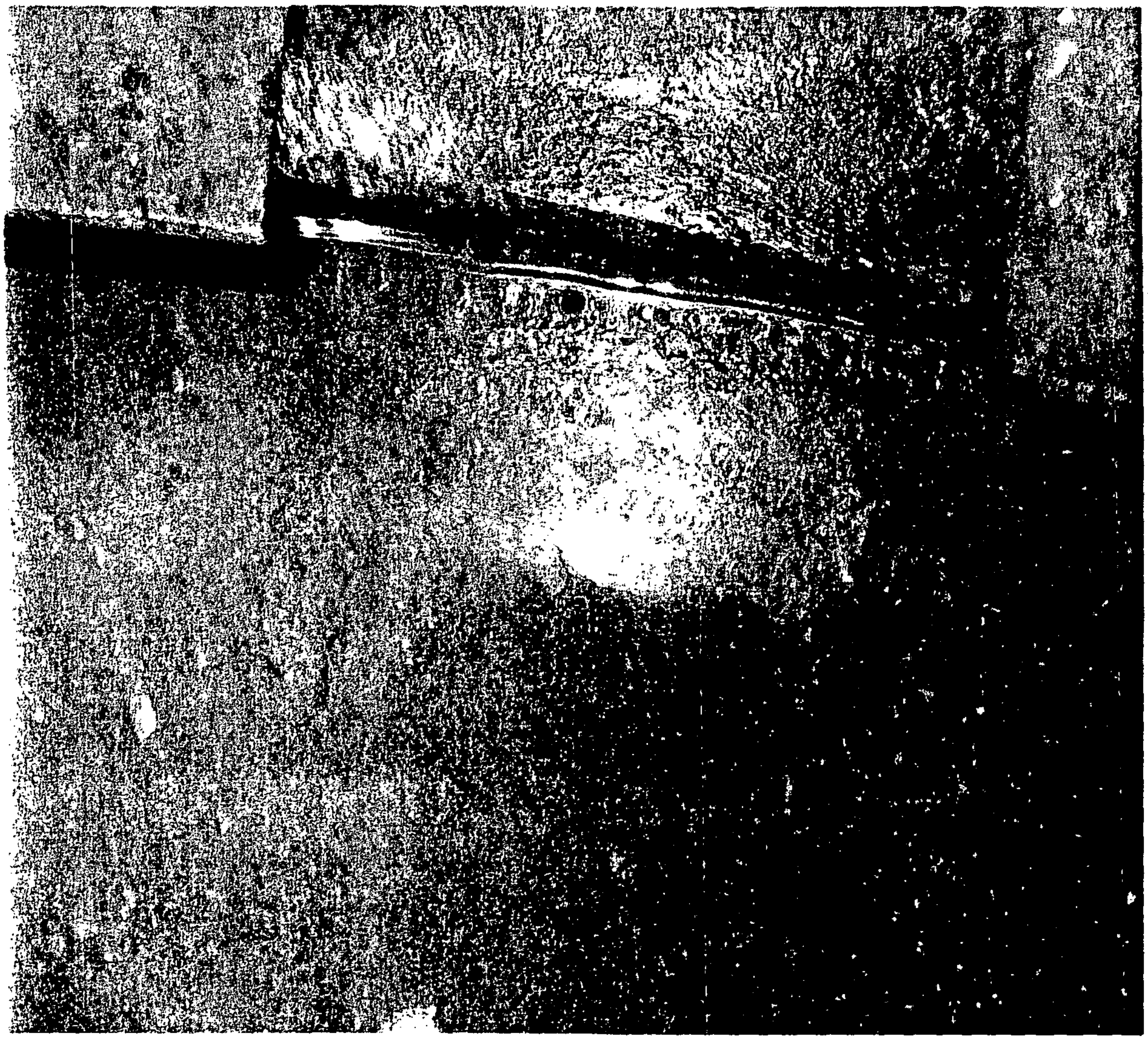

Azimuth 90 deg., the bottom of the trough is in good condition. Baseplates have minor surface corrosion.

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Structures and Components Monitoring Report

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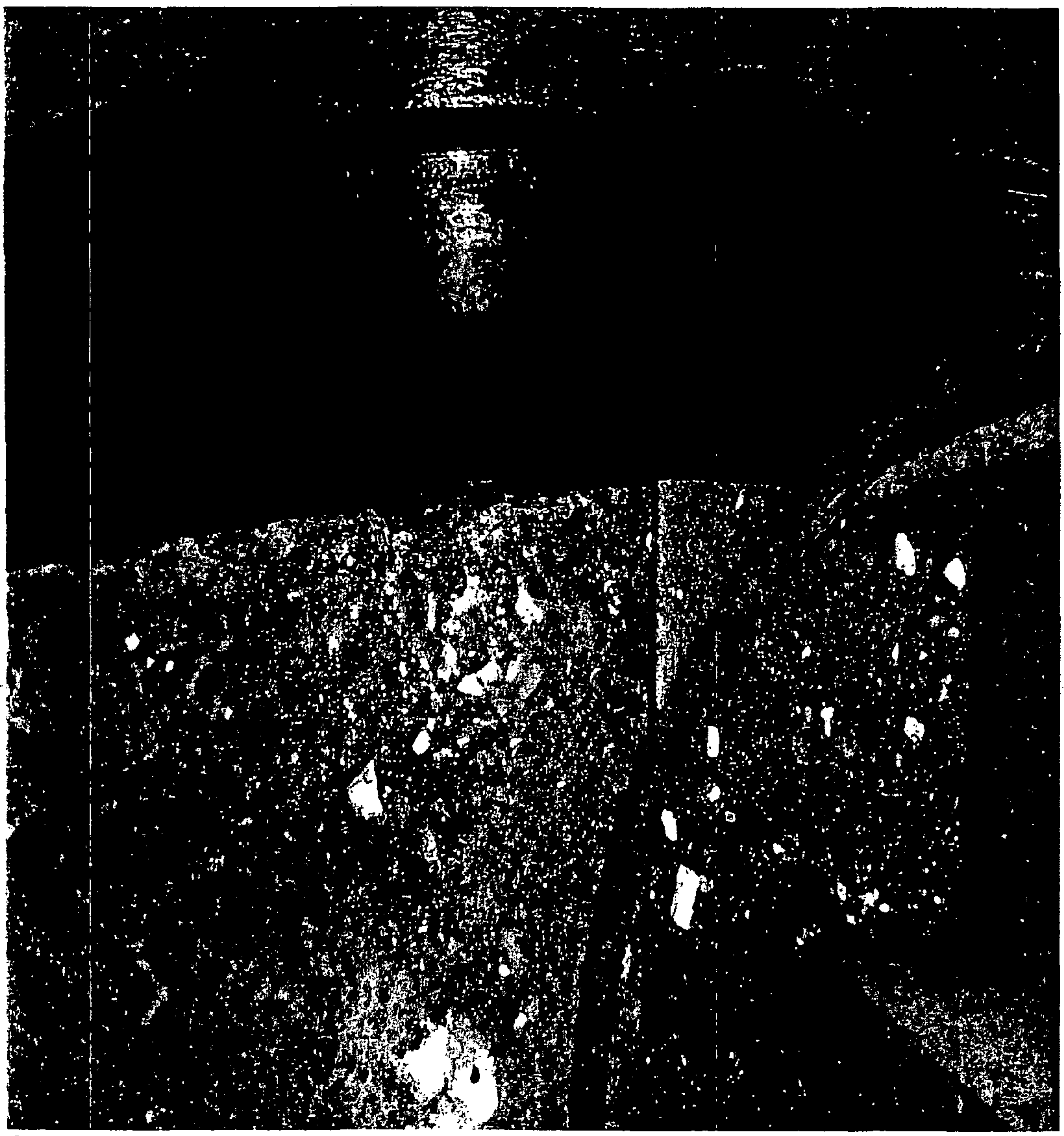

Some surface corrosion, but no material loss. Picture was taken prior to cleaning the area.

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Structures and Components Monitoring Report

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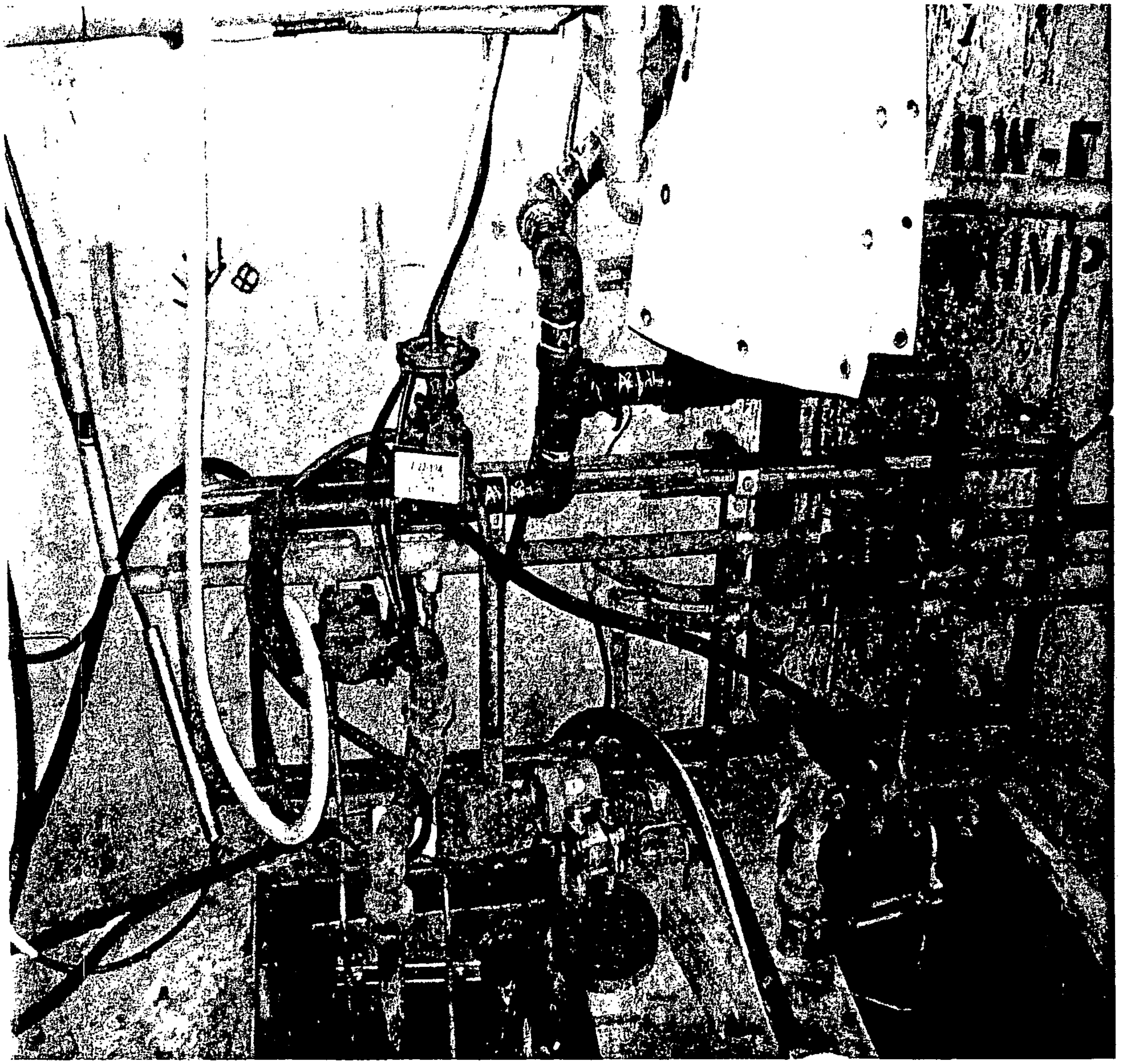

1-8 Sump appears in good condition.

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ATTACH PAGE 1 OF 3

Attachment 7.7

Sump 1-8 VT-1 Inspection results & report

IR 546044-02
ATTACHMENT 7.7
ATTACH PAGE 2

GE Nuclear Energy

VISUAL EXAMINATION REPORT

Site: OYSTER CREEK	Unit: 1	Report Number 21R-158	Sheet 1 of 2
Outage: 21R	Procedure: GEVT10 Version / Rev 3	DRR: N/A	
Comp / Weld No. 1-8 SUMP	Configuration: SUMP	Acceptance Criteria: GE-VT-101; MP-1083-165-01; DWG: SE-187-29-001	System: 187
Surface Condition: AS FOUND	Material: SS	Item: DRYWELL SUMP	

Visual Inspection System

Technique: VT-1 Resolution Verified by: VISUAL CARD RIR# 06-RIR-C-20 CARD #18 OF 56

Equipment Used: Mirror [X], Magnifier [ ], Remote B/W Video [ ], Remote Color Video [ ], Other [X] if so explain in "Comments" section. "CAMERA-ON-A-STICK"

Lighting Used: Ambient [ ], Flashlight [X], Other [ ] if so explain in "Comments" section.

Tools Used: Six Inch Scale [X], Binoculars [ ], Welding Gauge [ ], Thread Gauge [ ], Other [ ] if so explain in "Comments" section.

Examination Results

Item No.	Classification	Description	Accept / Reject
1	N/A	1-8 SUMP VERTICAL (4) WELDS TO 2 1/2 FROM BOTTOM	ACCEPT
1	N/A	1-8 SUMP TOP SURFACE WELD (360° AROUND)	ACCEPT
1	N/A	1-8 SUMP 4-SIDES BETWEEN WELDS	ACCEPT

Comments: A VT-1 WAS PERFORMED AND DOCUMENTED ON THE INTERIOR WALL OF THE SUBPILE SUMP STAINLESS STEEL LINER + WELDS (VERTICAL)
LOCATION: OW10, SUBPILE ROOM, AZ 000

WO# C2013732-04

39 mR

Signatures

Examiner Name & Level: [signature] LVL II	Date: 10-29-06
GE Review Name & Level:	Date:
Utility Review: [signature]	Date: 10-29-06
ANII/ANI Review	Date:

IR 546049 ASSIGN 02
ATTACHMENT 7.7
ATTACH PAGE 3 OF 3

ORIGINAL IN RED

GE Nuclear Energy

VISUAL EXAMINATION REPORT

Site: OYSTER CREEK	Unit: 1	Report Number 21R-154	Sheet 1 of 1
Outage: 21R	Procedure GE-VT-101 Version / Rev 3	DRR: N/A	
Comp / Weld No. 1-8 SUMP	Configuration: SUMP	Acceptance Criteria: GE-VT-101/3 DWG: MP 1083-165-01 3E-187-29-001	System: 187
Surface Condition: AS FOUND	Material: SS	Item: DRYWELL SUMP	

Visual Inspection System

Technique: VT-1 Resolution Verified by: TEST CARD

Equipment Used: Mirror ☐, Magnifier ☐, Remote B/W Video ☐, Remote Color Video ☑, Other ☐ if so explain in "Comments" section.

Lighting Used: Ambient ☐, Flashlight ☑, Other ☐ if so explain in "Comments" section.

Tools Used: Six Inch Scale ☐, Binoculars ☐, Welding Gauge ☐, Thread Gauge ☐, Other ☐ if so explain in "Comments" section.

Examination Results

Item No.	Classification	Description	Accept / Reject
1	N/A	1-8 Sump Lower 2" Inspected	Accept
		N/A	

Comments: A VT-1 WAS PERFORMED AND DOCUMENTED ON THE LOWER 2" OF THE INTERIOR DRYWELL SUBPILE SUMP STAINLESS STEEL LINER. LOCATION: DW10', SUBPILE ROOM, A2000.

WO# C2013732-04 1 MREM

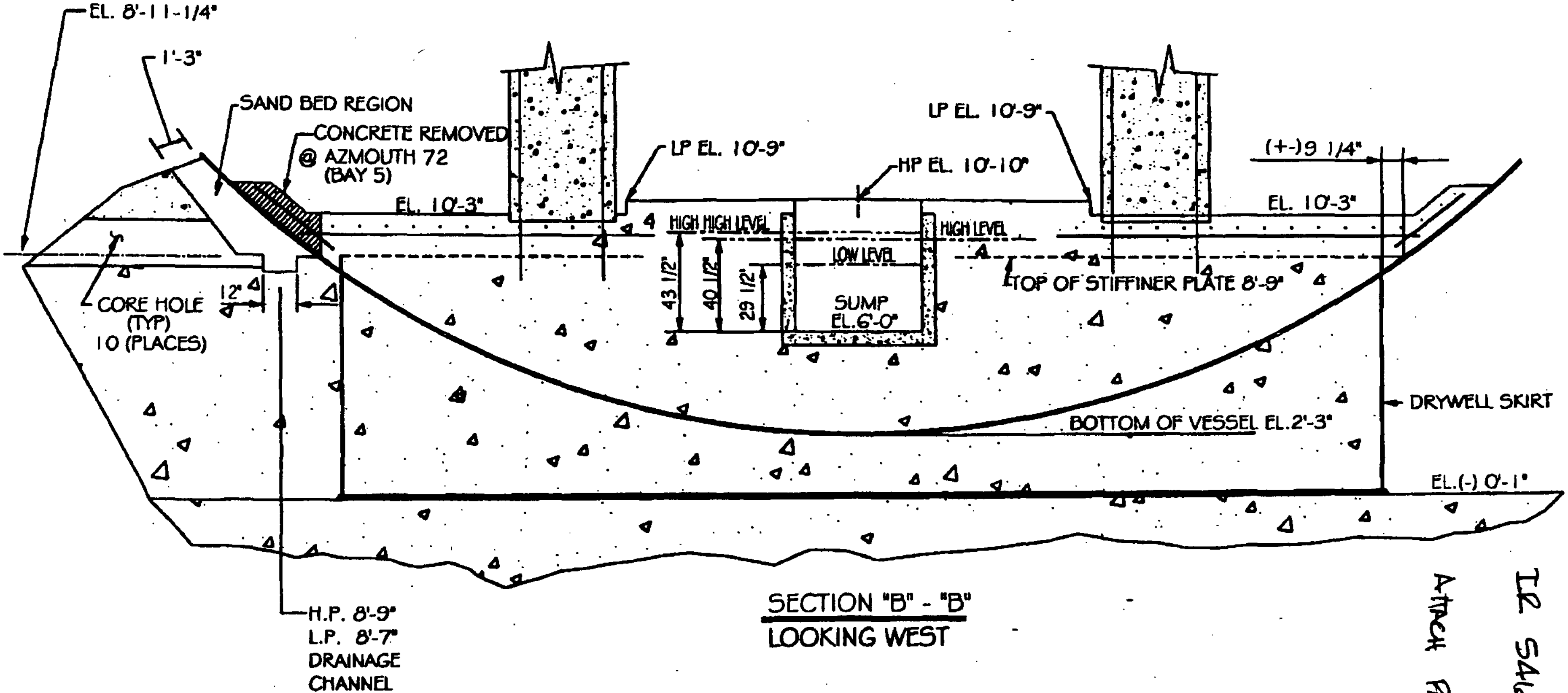
Signatures

Examiner Name & Level: Ryan Taucher [signature] II	Date: 10-29-06
GE Review Name & Level: [signature] LII	Date: 10-29-06
Utility Review: [signature]	Date: 10-29-06
ANII/ANI Review ____	Date: ____

Attachment 7.8

Simplified sketch showing inspection trenches, sump pit, sub-pile room trough and drywell shell

SKETCH SHOWING LOWER DRYWELL-
SAND BED, TRENCH & SUMP



SECTION "B" - "B"
LOOKING WEST

Attachment 7.8

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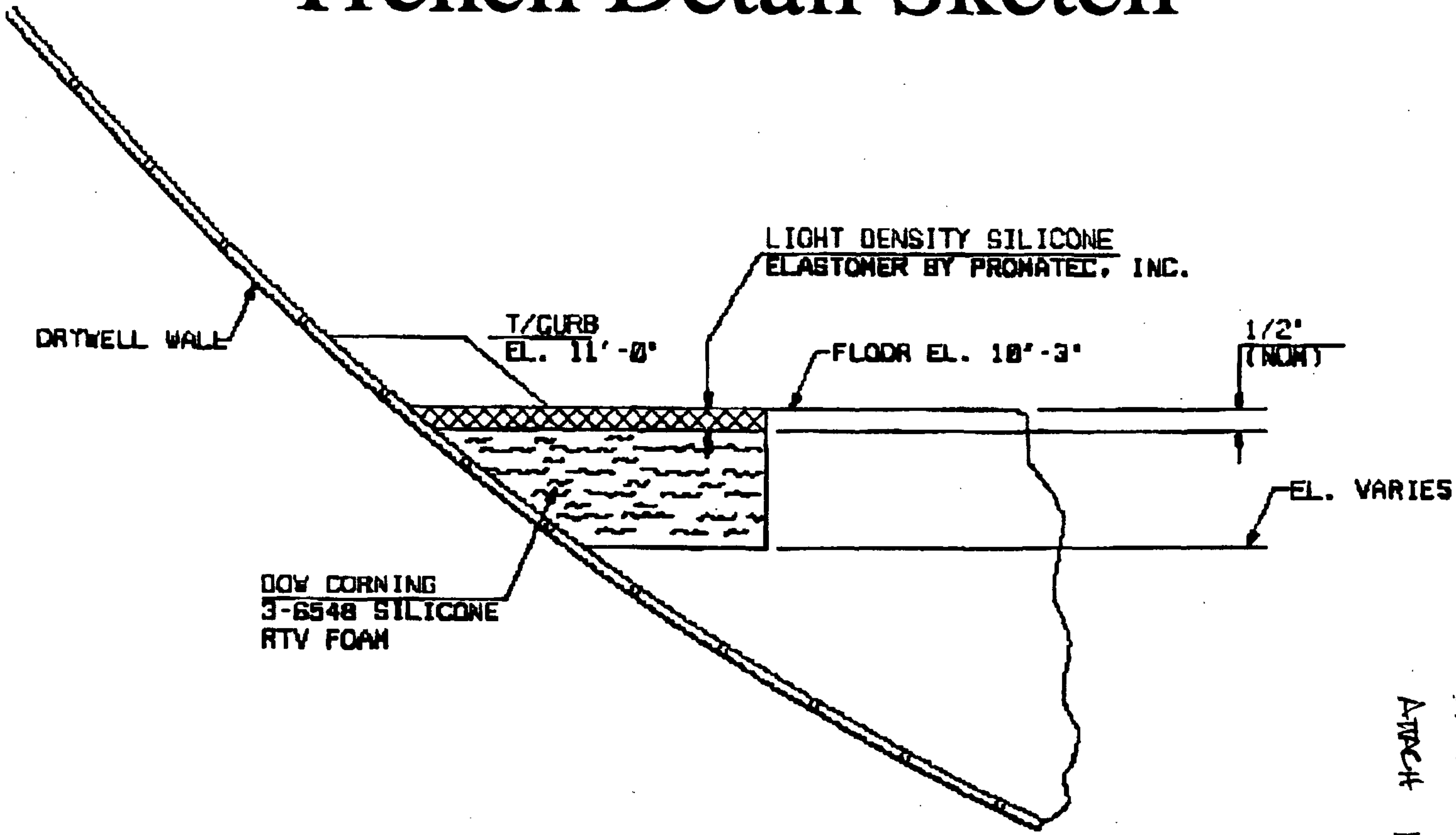
Trench Detail Sketch



CROSS-SECTION AREA
OF TRENCHES IN BAYS 5 & 17

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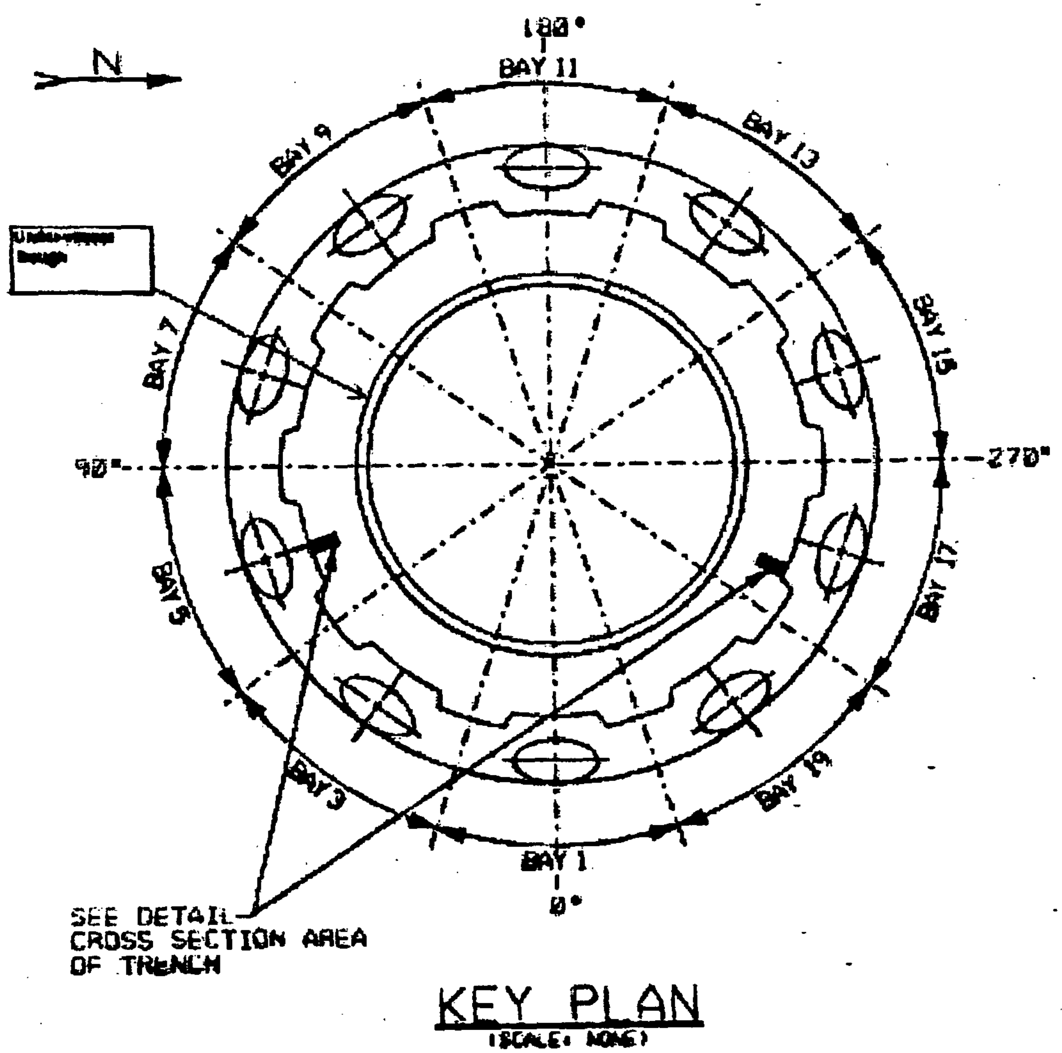
ATTACHMENT 7.8
ATTACH PAGE 3

Plan View of Trough and Trenches



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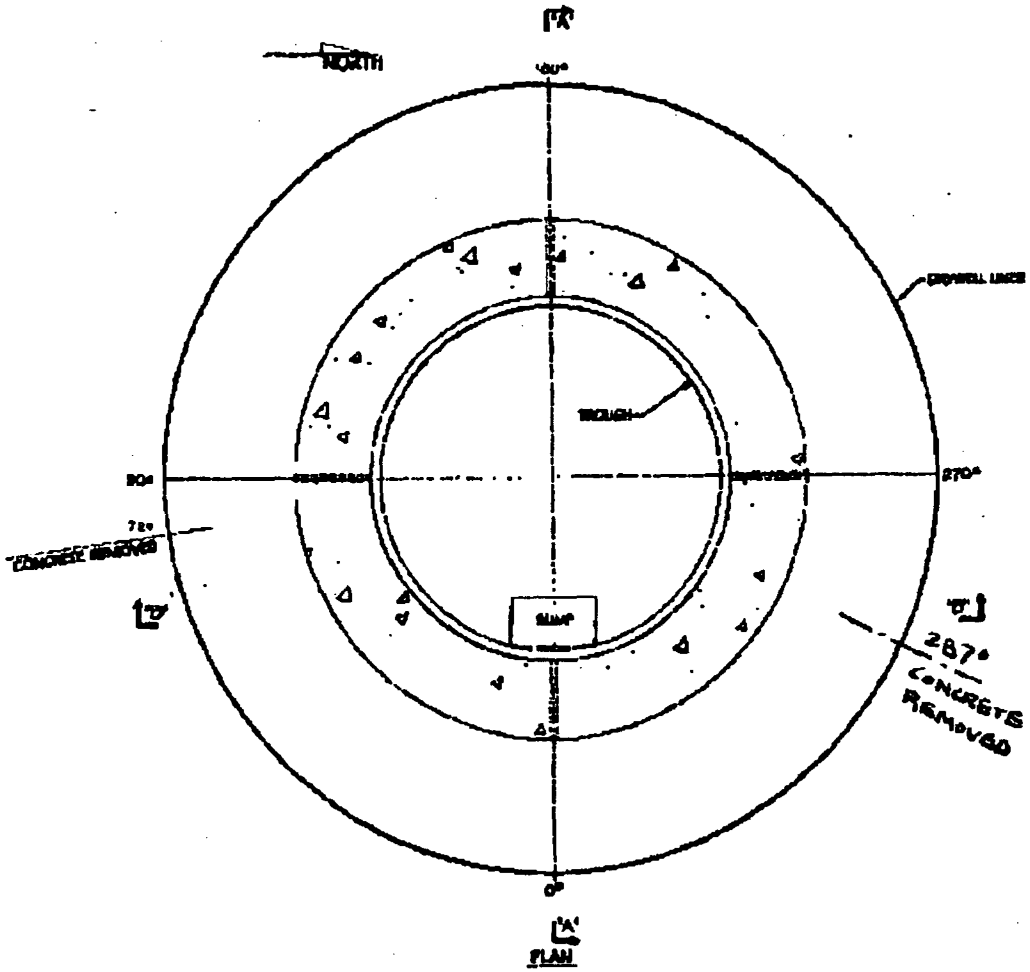
Top View – Drywell Floor Sketch



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ATTACH PAGE 5 OF

Attachment 7.9

Type A Testing Evaluation

(5 Pages)

October 31, 2006

Evaluation of the Ability of Type A Integrated Leak Rate Test to Detect Through Wall Breach in the Concrete Encased Area of the Drywell Shell

The Type A test or Integrated Leak Rate Test (ILRT) is an extremely sensitive test in detecting leakage paths from the containment pressure boundary. ANSI/ANS 56.8-1994 requires pressure instrumentation that is accurate to ± 0.02 psi and repeatable to 0.005 psi, temperature instrumentation accurate to ± 1.0° F and repeatable to 0.2° F, and relative humidity instrumentation accurate to ± 3.5% RH and repeatable to 1%RH. Repeatability is an important parameter since calculation of the leakage rate is a function of change in readings rather than the absolute value of the reading.

At Oyster Creek, the maximum allowable leakage rate (L_a) is 1% by weight per day, the calculated design basis accident pressure (P_a) is 35 psig and the containment net free volume is 302,400 cubic feet. For the Type A test, the allowable leakage rate is 75% of L_a or 0.75% by weight per day. This leakage value would be exceeded through an orifice slightly larger than 3/32 of an inch.

The last 10CFR50 Appendix J Type A test at Oyster Creek was completed on November 8, 2000 with a measured integrated leakage rate of 0.3658 % by weight per day, which substantiated the integrity of the drywell shell. At the upper 95% confidence level, the integrated leakage rate is 0.3767 % by weight per day (from "Oyster Creek Integrated Leakage Rate Test November 8, 2000 Final Test Report"). The close agreement between the measured leakage rate and the 95% upper confidence leakage rate is a good indication of the quality of the data and a stable leakage rate as indicated on the attached graph. In addition, the measured integrated leakage rate is well below the test acceptable leakage rate of 0.75 % by weight per day and the maximum allowable leakage rate of 1% by weight per day.

Concrete is a porous substance and during the conduct of the test, as the containment is being pressurized, air is forced into the concrete. This phenomenon is referred to as "in-gassing." During many pre-operational tests, when the structural integrity test was performed at a higher test pressure and the pressure reduced to the design basis accident pressure, the air that was forced into the concrete at the structural integrity pressure "out-gassed" back into the containment. As a result, ANSI/ANS 56.8-1994 Section 5.4 now contains a requirement if the containment pressure is above the Type A test pressure, it must be reduced to 85% of the Type A test pressure for a period of 24 hours prior to re-pressurizing to the Type A test pressure.

Empirical evidence also exists that the Type A test would detect leakage through a breach in the containment liner. EPRI Report No. 1009325, Risk Impact Assessment of Extending Integrated Leak Rate Testing Intervals, Appendix A identifies excessive containment leakage paths that were identified during the Type A (ILRT) Test. These include items such as holes that were inadvertently drilled through the liner, vent pipes not capped, tubing plugs not installed and bellows cracks.

Thus, if the shell were breached at the bottom, even with a layer of concrete above and below the breach, a leakage path would exist. If that leakage path exceeded the equivalent of a 3/32-inch orifice, the Type A test would fail. If the voids in the concrete were filled with water that leaked through the breach, the Type A test pressure would force the water back through the breach and the leakage would be detected by the Type A test.

If the voids in the concrete inside containment above the shell were filled with water, but no breach existed in the shell, there would be no impact to the conduct or validity of the Type A test. Humidity or dewpoint instrument sensors are used for the conduct of the Type A test to measure the amount of water vapor in the air. This compensates for the changes in the total air pressure that are due to changes in water vapor (evaporation or condensation) and are not indications of containment leakage. The torus or suppression pools of BWRs contain a large amount of water during the conduct of Type A testing that do not negatively impact the conduct or validity of the Type A test.

Since calculations of the Type A test leakage rate depend upon changes in the weight of air, the calculated leakage rate is independent of the absolute value of the containment net free volume. From ANSI/ANS 56.8-1994, the Type A leakage rate is calculated from the following equation:

$L_{am} = -2400\ A/B$ [Eqn 1]

Where:

L_{am} is the measured integrated leakage rate
A is the slope of the least squares fit line
B is the intercept of the least squares fit line

The slope of the least squares fit line can be expressed as:

$A = W_i - W_o$

Where W_i is the containment air mass at time $t = t_i$ and W_o is the containment air mass at time $t=0$

The intercept of the least squares fit line $B = W_o$

From ANSI/ANS 56.8-1994

$$W_i = \frac{144\,V}{R}\left[\frac{(P_i - P_{vi})}{T_i}\right] \quad \text{and} \quad W_o = \frac{144\,V}{R}\left[\frac{(P_o - P_{vo})}{T_o}\right]$$

where:

V = containment net free volume
R = ideal gas constant
P = total absolute pressure in containment
P_v = containment weighted vapor pressure
T = containment weighted absolute temperature

Substituting into Eqn 1:

$$L_{am} = -2400\frac{\left(\frac{144V}{R}\right)\left[\frac{(P_i - P_{vi})}{T_i}\right] - \left(\frac{144V}{R}\right)\left[\frac{(P_o - P_{vo})}{T_o}\right]}{\left(\frac{144V}{R}\right)\left[\frac{(P_o - P_{vo})}{T_o}\right]}$$

$$L_{am} = -2400\left[\frac{T_o\,(P_i - P_{vi})}{T_i\,(P_o - P_{vo})} - 1\right] \text{ or } L_{am} = 2400\left[1 - \frac{T_o\,(P_i - P_{vi})}{T_i\,(P_o - P_{vo})}\right]$$

Thus the measured Type A test or ILRT leakage rate depends only upon the containment total pressure, partial pressure of water vapor and containment temperature and not on the absolute value of the containment net free volume.

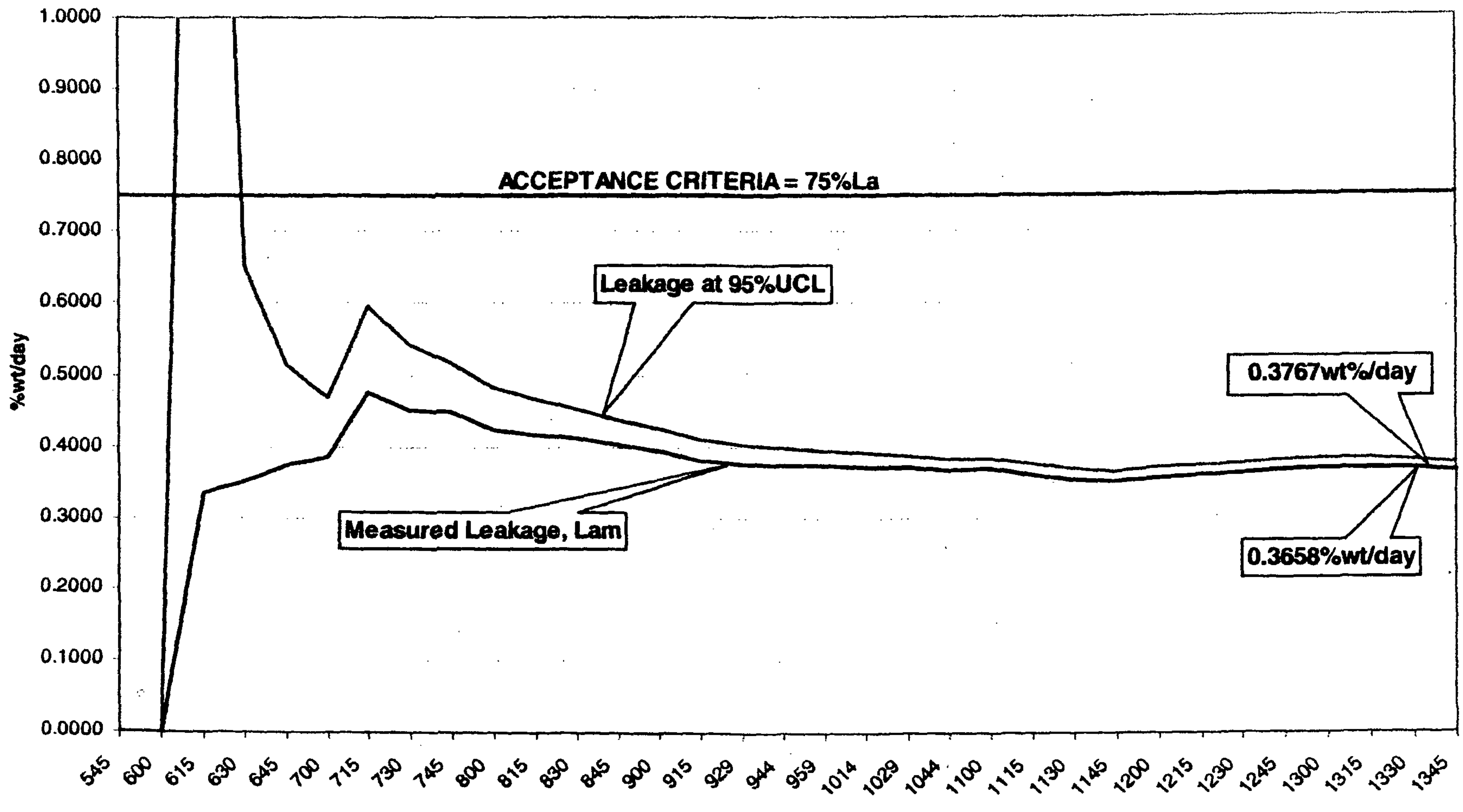
Conclusion:

A breach in the concrete encased area of the drywell shell, slightly in excess of an equivalent 3/32-inch orifice, would have been identified by the Type A test as a change in pressure and/or temperature that would have resulted in a leakage rate in excess of the test allowable value of 0.75 % by weight per day. This was not identified in the November 2000 Type A test at Oyster Creek.

Prepared By: Robert E Shik   Date: 10/31/06

Reviewed By: James D Hallhaak   Date: 10/31/06

OYSTER CREEK ILRT November 8, 2000



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Attachment 7.10

MPR Third Party Review

(3 Pages)

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ATTACHMENT 7.10
ATTACH PAGE 2

MPR ASSOCIATES INC.
ENGINEERS

Privileged and Confidential

November 3, 2006

Mr. F. Howie Ray
Manager, Mech/Struct Design
Oyster Creek Generating Station
AmerGen Energy Company, LLC
U.S. Route #9
Forked River, NJ 08731-0388

Subject: Third Party Independent Review of Oyster Creek Drywell Water Evaluation

Dear Mr. Ray:

MPR has completed a HU-AA-1212 Independent Third Party Review of the Oyster Creek drywell evaluation concerning standing water found in drywell shell inspection trenches in the 10' 3" concrete floor in the drywell. This review included the following documents:

- Technical Evaluation A/R A2152754 E06, with attachments
- Technical Evaluation A/R A2152754 E09, with attachments
- ECR 06-00879

Based on this review, we generated two comments, one concerning reported local wall thinning in Bay 17 possibly exceeding limiting dimensions for being considered local, and one concerning the relatively low pH value (and possible corrosivity) of trench/drywell gap water during outages when the migration of CRD water through the concrete pad to the inspection trenches and drywell wall occurs. These were transmitted to you via email on November 2. Both comments have been resolved as follows:

- Local wall thinning in Bay 17: Technical Evaluation A/R A2152754 E09 has been revised to include another local thinning acceptance criterion documented in Oyster Creek calculation C-1302-187-5320-024. The UT measurements of concern meet this acceptance criterion and this issue is considered resolved.
- Characterization of the water in the drywell: Section 2.8 of Technical Evaluation A/R A2152754 E06 has been revised to clarify the following points:
  - Any subsequent water (such as reactor coolant) entering the concrete floor-to-drywell gap will increase in pH due to its migration through and contact with the concrete. This will reduce its corrosivity compared to neutral pH water.

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ATTACH PAGE 3 OF 3

- The corrosion of drywell steel surfaces in contact with gap water is expected to occur only during outages when oxygen is present. Corrosion during operation is expected to be almost nil since the drywell operates inerted and no oxygen is present to drive the corrosion reaction. During outages, shell corrosion losses in the gap are expected to be small since the exposure time is very limited and the water pH is expected to be relatively high.
- The expected low corrosion losses in the concrete-to-drywell gap area have been confirmed by examination of steel surfaces in the trenches which has revealed only superficial corrosion of the drywell shell.

With the resolution of these concerns, we consider that the Technical Evaluations and attachments successfully address:

- The structural integrity of the concrete and drywell shell,
- The adequacy of repairs, and the effect of the repairs on the assumptions or inputs used for safety and other analyses, and
- The impacts of past water migration and current repairs on design and the licensing bases.

We also reviewed the technical bases for the Technical Evaluation and conclude that all inputs are accurate or conservative, assumptions are conservative, chemical analysis results are used appropriately, and corrosion evaluations are correct and results used accurately.

Please let me know if you have any questions about this letter.

Sincerely,

J. E. Nestell, PhD