RAS 14224

APPLICANT'S EXH. 17

DRF 143071

GPU Nuclear **Calculation Sheet**

Subject	Calc No.	Rev. No.	Sheet No.
O.C Drywell Ext. Ut Evaluation in Sandbed	C-1302-187-5320-024	0	1 of 54

Originator	Date	Reviewed by	Date
MARK YEKTA	01/12/93	S. C. Tumminelli	04/16/93

1.0 PROBLEM STATEMENT:

The purpose of this calculation is to evaluate the UT thickness measurements taken in the sandbed region during the 14R outage in support of O.C drywell corrosion mitigation project. These measurements were taken from the outside of the shell. Access to the sandbed region was achieved by cutting ten holes completely through the shield wall from the torus room.

2.0 SUMMARY OF RESULTS:

This calculation demonstrates that the UT thickness measurements for all bays meet the minimum uniform and local required thicknesses.

The evaluation was performed by evaluating the UT measurements for each bay and dispositioning them relative to the uniform thickness of 0.736 inch used in GE structural analysis reports. Additional acceptance criteria was developed to address measurements below 0.736 inch. The results are summarized in Table 1.

UT measurements for bays 3, 5, 7, 9, and 19 were all above the 0.736 inches and therefore acceptable.

UT measurements for bays 11, 15, and 17 were all above 0.736 inches except for one measurement for each bay. After further evaluation of these three measurements including an examination of adjacent areas, it was determined that they were acceptable as shown on Table 1.

UT measurements for bays 1 and 13 were evaluated using detailed criteria described in this calculation and the results are summarized in Table 1 below:

2.0 SUMMARY OF RESULTS (Continued):

Summary of UT Evaluations

Table (1)

BAY/UT Location	UT Measurement (1)	AVG Micrometer (2)	Mean Depth/Valley (3)	T (Evaluation) (4)=(1)+(2)-(3)	Remarks
Bay 11/ Loc. 1	0.705"	0.246"	0.200"	0.751"	Acceptable
Bay 15/ Loc. 9	0.722"	0.337"	0.200"	0.859"	Acceptable
Bay 17/ Loc. 9	0.720"	0.351"	0.200"	0.871"	Acceptable
Bay 1/ Loc. 1	0.720"	0.218"	0.200"	0.738"	Acceptable
Bay 1/ Loc. 2	0.716"	0.143"	0.200"	0.659"	Acceptable
Bay 1/ Loc. 3	0.705"	0.347"	0.200"	0.852"	Acceptable
Bay 1/ Loc. 5	0.710"	0.313"	0.200"	0.823"	Acceptable
Bay 1/ Loc. 7	0.700"	0.266"	0.200"	0.766"	Acceptable
Bay 1/ Loc. 11	0.714"	0.212"	0.200"	0.726"	Acceptable
Bay 1/ Loc. 12	0.724"	0.301"	0.200"	0.825"	Acceptable
Bay 1/ Loc. 21	0.726"	0.211"	0.200"	0.737"	Acceptable
Bay 13/ Loc. 1	0.672"	0.351"	0.200"	0.823"	Acceptable
Bay 13/ Loc. 2	0.729"	0.360"	0.200"	0.882"	Acceptable
Bay 13/ Loc. 5	0.718"	0.217"	0.200"	0.735"	Acceptable
Bay 13/ Loc. 6	0.655"	0.301"	0.200"	0.756"	Acceptable
Bay 13/ Loc. 7	0.618"	0.257"	0.200"	0.675"	Acceptable
Bay 13/ Loc. 8	0.718"	0.278"	0.200"	0.796"	Acceptable
Bay 13/ Loc. 10	0.728"	0.211"	0.200"	0.739"	Acceptable
Bay 13/ Loc. 11	0.685"	0.256"	0.200"	0.741"	Acceptable
Bay 13/ Loc. 15	0.683"	0.273"	0.200"	0.756"	Acceptable

3.0 REFERENCES:

3.1 Drywell sandbed region pictures (see Appendix C).

3.2 An ASME Section VIII Evaluation of the Oyster Creek Drywell for Without Sand Case Performed by GE - Part 1 Stress Analysis, Revision 0 dated February, 1991 Report 9-3.

3.3 An ASME Section VIII Evaluation of the Oyster Creek Drywell for Without Sand Case Performed by GE - Part 2 Stability Analysis, Revision 2 dated November, 1992 Report 9-4.

3.4 ASME Section III Subsection NE Class MC Components 1989.

3.5 GE letter report " Sandbed Local Thinning and Raising the Fixity Height Analysis (Line Items 1 and 2 In Contract PC-0391407)" dated December 11, 1992.

3.6 GPUN Memo 5320-93-020 From K. Whitmore to J. C. Flynn "Inspection of Drywell Sand Bed Region and Access Hole", Dated January 28, 1993.

4.0 ASSUMPTIONS AND BASIC DATA:

4.1 Raw UT measurements are summarized for each bay in the body of calculation.

4.2 Observations of the outside surface of the drywell shell indicate a rough surface with varying peaks and valleys. In order to characterize an average roughness representing the depth difference of peaks and valleys, two impressions were made at the two lowest UT measurements for bay 13 using Epoxy putty .
Appendix A presents the calculation of the depth of surface roughness using the drywell shell impressions taken in the roughest bay. Two locations in bay 13 were selected since it is the roughest bay. Approximately 40 locations within the two impressions were measured for depth and the average plus one standard deviation was calculated. A value of 0.200 inch was used in this calculation as a conservative depth of uniform dimples for the entire outside surface of the drywell in the sandbed region .

5.0 CALCULATION:

ACCEPTANCE CRITERIA - GENERAL WALL:

The acceptance criteria used to evaluate the measured drywell thickness is based upon GE reports 9-3 and 9-4 (Ref. 3.2 & 3.3) as well as other GE studies (Ref. 3.5) plus visual observations of the drywell surface (Ref. 3.6 and Appendix C). The GE reports used an assumed uniform thickness of 0.736 inches in the sandbed area. This area is defined to be from the bottom to top of the sandbed, i.e., El. 8'-11½" to El. 12'-3" and extending circumferentially one full bay. Therefore, if all the UT measurements for thickness in one bay are greater than 0.736 inches the bay is evaluated to be acceptable. In bays where measurements are below 0.736 inches, more detailed evaluation is performed.

This detailed evaluation is based, in part, on visual observations of the shell surface plus a knowledge of the inspection process. The first part of this evaluation is to arrive at a meaningful value for shell thickness for use in the structural assessment. This meaningful value is referred to as the thickness for evaluation. It is computed by accounting for the depth of the spot where the thickness measurement is taken considering the roughness of the shell surface. The surface of the shell has been characterized as being "dimpled" as in the surface of a golf ball where the dimples are about one half inch in diameter (Appendix C). Also, the surface contains some depressions 12 to 18 inches in diameter not closer than 12 inches apart, edge to edge (Ref. 3.6). Appendix A presents the calculation of the depth of surface roughness using the drywell shell impressions taken in the roughest bay. Two locations in bay 13 were selected since it is the roughest bay. Approximately 40 locations within the two impressions were measured for depth and the average plus one standard deviation was calculated to be at 0.186 inches. A value of 0.200 inch was used in this calculation as a conservative depth of uniform dimples for the entire outside surface of the drywell in the sandbed region .

5.0 CALCULATION:

ACCEPTANCE CRITERIA - GENERAL WALL: (Continued)

The inspection focused on the thinnest portion of the drywell, even if it was very local, i.e., the inspection did not attempt to define a shell thickness suitable for structural evaluation. Observations indicate that some inspected spots are very deep. They are much deeper than the normal dimples found, and very local, not more than 1 to 2 inches in diameter. (Typically these observations were made after the spot was surface prepped for UT measurement. This results in a wide dimple to accommodate the meter and slightly deeper than originally found by 0.030 to 0.100 inches). The depth of these areas was measured and averaged with respect to the top of local areas as shown in Appendix A. These depths are referred to herein as the AVG micrometer measurements. The thickness for evaluation is then computed from the above information as:

T (evaluation) = UT (measurement) + AVG (micrometer) - 0.200 inches

where:

T (evaluation) = thickness for evaluation

UT (measurement) = thickness measurement at the area (location)

AVG (micrometer) = average depth of the area relative to its immediate surroundings

0.200 inch = a conservative value of depth of typical dimple on the shell surface.

After this calculation, if the thickness for analysis is greater than 0.736 inches; the area is evaluated to be acceptable.

5.0 CALCULATION:

ACCEPTANCE CRITERIA - LOCAL WALL:

If the thickness for evaluation is less than 0.736 inches, then the use of specific GE studies is employed (Ref. 3.5). These studies contain analyses of the drywell using the pie slice finite element model, reducing the thickness by 0.200 inches in an area 12 x 12 inches in the sandbed region, tapering to original thickness over an additional 12 inches, located to result in the largest reduction possible. This location is selected at the point of maximum deflection of the eigenvector shape associated with the lowest buckling load. The theoretical buckling load was reduced by 9.5% from 6.41 to 5.56. Also, the surrounding areas of thickness greater than 0.736 inches is also used to adjust the actual buckling values appropriately. Details are provided in the body of the calculation.

ACCEPTANCE CRITERIA - VERY LOCAL WALL (2½ Inches In DIAMETER):

All UT measurements below 0.736 inches have been determined to be in isolated locations less than 2½ inches in diameter.

The acceptance criteria for these measurements confined to an area less than 2½ inches in diameter is based on the ASME Section III Subsection NE Class MC Components paragraph NE 3332.1 and NE 3335.1 titled "OPENING NOT REQUIRING REINFORCEMENT AND REINFORCEMENT OF MULTIPLE OPENINGS".

These Code provisions allow holes up to 2½ inches in diameter in Class MC vessels without requiring reinforcement. Therefore, thinned areas less than 2½ inches in diameter need not be provided with reinforcement and are considered local. Per NE 3213.10 the stresses in these regions are classified as local primary membrane stresses which are limited to an allowable value of 1.5 Sm. Local areas not exceeding 2½ inches in diameter have no impact on the buckling margins. Using the 1.5 Sm criteria given above, the required minimum thickness in these areas is:

$$T\ (\text{required}) = (2/3) * (0.736) = 0.490 \text{ inches}$$

Where 2/3 is Sm/1.5Sm and is the ratio of the allowable stresses.

UT thickness measurements for all ten bays are above 0.490 inches.

5.0 CALCULATION:

UT EVALUATION:

BAY # 1:

The outside surface of this bay is rough and full of dimples similar to the outside surface of golf ball. This observation is made by the inspector who located the thinnest areas for the UT examination. This inspection focused on the thinnest areas of the drywell, even if it was very local, i.e., the inspection did not attempt to define a shell thickness suitable for structural evaluation. The shell appears to be relatively uniform in thickness except for a band of corrosion which looks like a "bathtub" ring, located 15 to 20 inches below the vent pipe reinforcement plate, i.e, weld line as shown in Figure 1. (Figure 1 and others like figures presented in this calculation are NOT TO SCALE). The bathtub ring is 12 to 18 inches wide and about 30 inches long located in the center of the bay. Beyond the bathtub ring on both sides, the shell appears to be uniform in thickness at a conservative value of 0.800 inches. Above the bathtub ring the shell exhibits no corrosion since the original lead primer on the vent pipe/reinforcement plate is intact. Measurements 14 and 15 confirm that the thickness above the bathtub ring is at 1.154 inches starting at elevation 11'-00". Below the bathtub ring the shell is uniform in thickness where no abrupt changes in thicknesses are present. Thickness measurements below the bathtub ring are all above 0.800 inches except location 7 which is very local area.

Therefore, a conservative mean thickness of 0.800 inches is estimated to represent the evaluation thickness for this bay. Given a uniform thickness of 0.800 inches, the buckling margin for the refueling load condition can be recalculated based on the GE report 9-4 (Ref. 3.3). The theoretical buckling strength from report 9-4 (ANSYS Load Factor) is a square function of plate thicknesses. Therefore, a new buckling capacity for the controlling refueling load combination is calculated to be at 13% above the ASME factor of safety of 2 as shown in Appendix B.

5.0 CALCULATION:

UT EVALUATION:

BAY # 1 (Continued):

Locations 1, 2, 3, 4, 5, 10, 11, 12, 13, 20, and 21 are confined to the bathtub ring as shown in Figure 1. An average value of these measurements is an evaluation thickness for this band as follows;

Location	Evaluation Thickness
1	0.738"
2	0.659"
3	0.852"
4	0.760"
5	0.823"
10	0.839"
11	0.726"
12	0.825"
13	0.792"
20	0.965"
21	0.737"

Average = 0.792"

An average evaluation thickness of 0.792 inches for the bathtub ring may raise concern given that the bathtub ring is noticeable and that the difference between its average evaluation thickness (0.792 inches) and the average thickness taken for the entire region (0.800 inches) is only 0.008 inches. This results from the fact that average micrometer readings were generally not taken for the remainder of the shell since each reading was greater than 0.736 inches. In reality, the remainder of the shell is much thicker than 0.800 inches. The appropriate evaluation thickness can not be quantified since no micrometer readings were taken.

The individual measured thicknesses must also be evaluated for structural compliance. Table 1-a identifies 23 locations of UT measurements that were selected to represent the thinnest areas, except locations 14 and 15, based on visual examination. These locations are a deliberate attempt to produce a minimum measurement. Locations 14 and 15 were selected to confirm that no corrosion had taken place in the area above the bathtub ring.

5.0 CALCULATION:

UT EVALUATION:

BAY # 1 (Continued):

Eight locations shown in Table 1-a (1, 2, 3, 5, 7, 11, 12, and 21) have measurements below 0.736 inches. Observations indicate that these locations were very deep and not more than 1 to 2 inches in diameter. The depth of each of these areas relative to its immediate surroundings was measured at 8 locations around the spot and the average is shown in Table 1-a. Using the general wall thickness acceptance criteria described earlier, the evaluation thickness for all measurements below 0.736 inches were found to be above 0.736 inches except for two locations, 2 and 11, as shown in Table 1-b. Locations 2 and 11 are in the bathtub ring and are about 4 inches apart. This area is characterized as a local area 4 x 4 inches located at about 15 to 20 inches below the vent pipe reinforcement plate with an average thickness of 0.692 inches. This thickness of 0.692 inches is 0.108 inches reduction from the conservative estimate of 0.800 inches evaluation thickness for the entire bay. In order to quantify the effect of this local region and to address structural compliance, the GE study on local effects is used (Ref. 3.5).

This study contains an analysis of the drywell shell using the pie slice finite element model, reducing the thickness by 0.200 inches (from 0.736 to 0.536 inches) in an area 12 x 12 inches in the sandbed region located to result in the largest reduction possible. This location is selected at the point of maximum deflection of the eigenvector shape associated with the lowest buckling load. The theoretical buckling load was reduced by 9.5%. The 4 x 4 inches local region is not at the point of maximum deflection. The area of 4 x 4 inches is only 11% of the 12 x 12 inches area used in the analysis. Therefore, this small 4 x 4 inches area has a negligible effect on the buckling capacity of the structure.

In summary, using a conservative estimate of 0.800 inches for evaluation thickness for the entire bay and the presence of a bathtub ring with an evaluation thickness of 0.792 inches plus the acceptance of a local area of 4 x 4 inches based on the GE study, it is concluded that the bay is acceptable.

5.0 CALCULATION:

UT EVALUATION:

BAY # 1 (Continued):

Bay # 1 UT Data

Table 1-a

Location	UT Measurement (inches)	Average Micrometer (inches)
1	0.720	0.218
2	0.716	0.143
3	0.705	0.347
4	0.760	---
5	0.710	0.313
6	0.760	---
7	0.700	0.266
8	0.805	---
9	0.805	---
10	0.839	---
11	0.714	0.212
12	0.724	0.301
13	0.792	---
14	1.147	---
15	1.156	---
16	0.796	---
17	0.860	---
18	0.917	---
19	0.890	---
20	0.965	---
21	0.726	0.211
22	0.852	---
23	0.850	---

5.0 CALCULATION:

UT EVALUATION:

BAY # 1:(Continued)

SUMMARY OF Measurements BELOW 0.7

Table 1-b

Location	UT Measurement (1)	AVG Micrometer (2)	Mean Depth/Valley (3)	T (Evaluation) (4)=(1)+(2)-(3)	Remarks
1	0.720"	0.218"	0.200"	0.738"	Acceptable
2	0.716"	0.143"	0.200"	0.659"	Acceptable
3	0.705"	0.347"	0.200"	0.852"	Acceptable
5	0.710"	0.313"	0.200"	0.823"	Acceptable
7	0.700"	0.266"	0.200"	0.766"	Acceptable
11	0.714"	0.212"	0.200"	0.726"	Acceptable
12	0.724"	0.301"	0.200"	0.825"	Acceptable
21	0.726"	0.211"	0.200"	0.737"	Acceptable

BAY #1 DATA

NOTES:

1. All "Location" measurements from intersection of the DW shell and vent collar fillet welds.
2. Pit depts are average of four readings taken at 0/45°/90°/135° within 1" band surrounding ground spots. Only measured where remaining wall thk. was below 0.736".

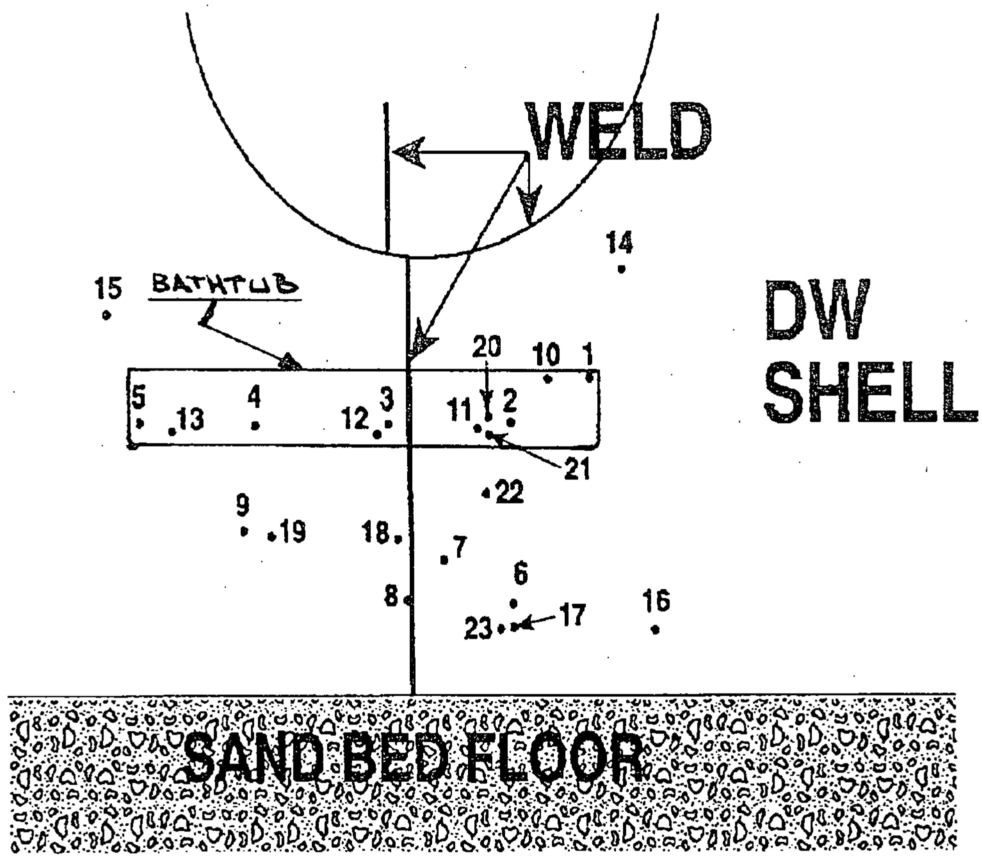

FIGURE (1)

5.0 CALCULATION:

UT EVALUATION:

BAY # 3:

The outside surface of this bay is rough, similar to bay one, full of dimples comparable to the outside surface of golf ball. This observation is made by the inspector who located the thinnest areas for the UT examination. The shell appears to be relatively uniform in thickness except for a bathtub ring 8 to 10 inches wide approximately 6 inches below the vent header reinforcement plate. The upper portion of the shell beyond the band exhibits no corrosion where the original red lead primer is still intact. Eight locations were selected to represent the thinnest areas based on the visual observations of the shell surface (Fig. 3). These locations are a deliberate attempt to produce a minimum measurement. Table 3 shows measurements taken to measure the thicknesses of the drywell shell using a D-meter. The results indicate that all of the areas have thickness greater than the 0.736 inches.

Given the UT measurements, a conservative mean evaluation thickness of 0.850 inches is estimated for this bay and therefore, it is concluded that the bay is acceptable.

Bay # 3 UT Data

Table 3

Location	UT Measurement (inches)	Average Micrometer (inches)
1	0.795	---
2	1.000	---
3	0.857	---
4	0.898	---
5	0.823	---
6	0.968	---
7	0.826	---
8	0.780	---

GPU Nuclear **Calculation Sheet**

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Originator MARK YEKTA	Date 01/12/93	Reviewed by S. C. Tumminelli		Date 04/16/93

BAY #3 DATA

NOTES:

1. All "Location" measurements from intersection of the DW shell and vent collar fillet welds.

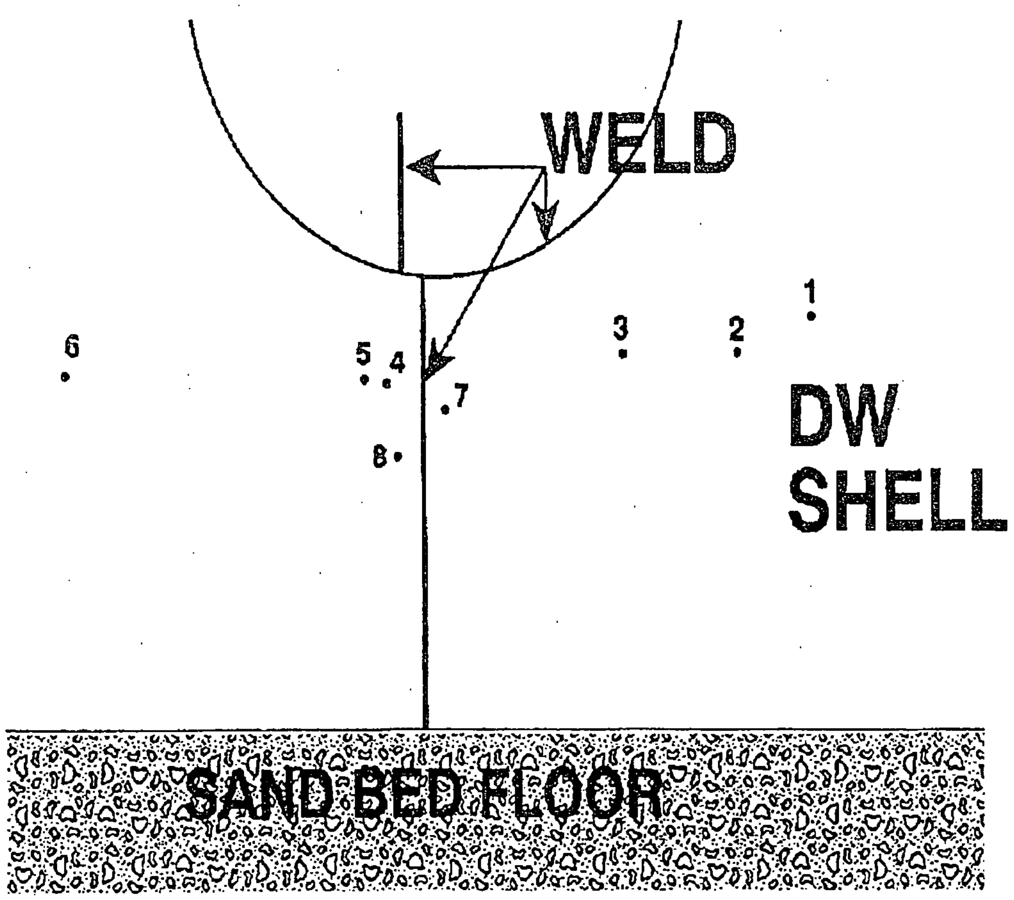

FIGURE (3)

5.0 CALCULATION:

UT EVALUATION:

BAY # 5:

The outside surface of this bay is rough and very similar to bay 3 except that the local areas are clustered at the junction of bays 3 and 5, at about 30 inches above the floor. The shell surface is full of dimples comparable to the outside surface of golf ball. This observation is made by the inspector who located the thinnest areas for the UT examination. The shell appears to be relatively uniform in thickness. Eight locations were selected to represent the thinnest areas based on the visual observations of the shell surface (see Fig. 5). These locations are a deliberate attempt to produce a minimum measurement. Table 5 shows readings taken to measure the thicknesses of the drywell shell using a D-meter. The results indicate that all of the areas have thickness greater than the 0.736 inches.

Given the UT measurements, a conservative mean evaluation thickness of 0.950 inches is estimated for this bay and therefore, it is concluded that the bay is acceptable.

Bay # 5 UT Data

Table 5

Location	UT Measurement (inches)	Average Micrometer (inches)
1	0.970	---
2	1.040	---
3	1.020	---
4	0.910	---
5	0.890	---
6	1.060	---
7	0.990	---
8	1.010	---

BAY #5 DATA

NOTES:

1. In this bay DW shell (butt) weld is about 8" to the right of C/L of vent tube. Therefore - all measurements were taken from a line drawn on shell which approx. coincide with vent tube C/L.

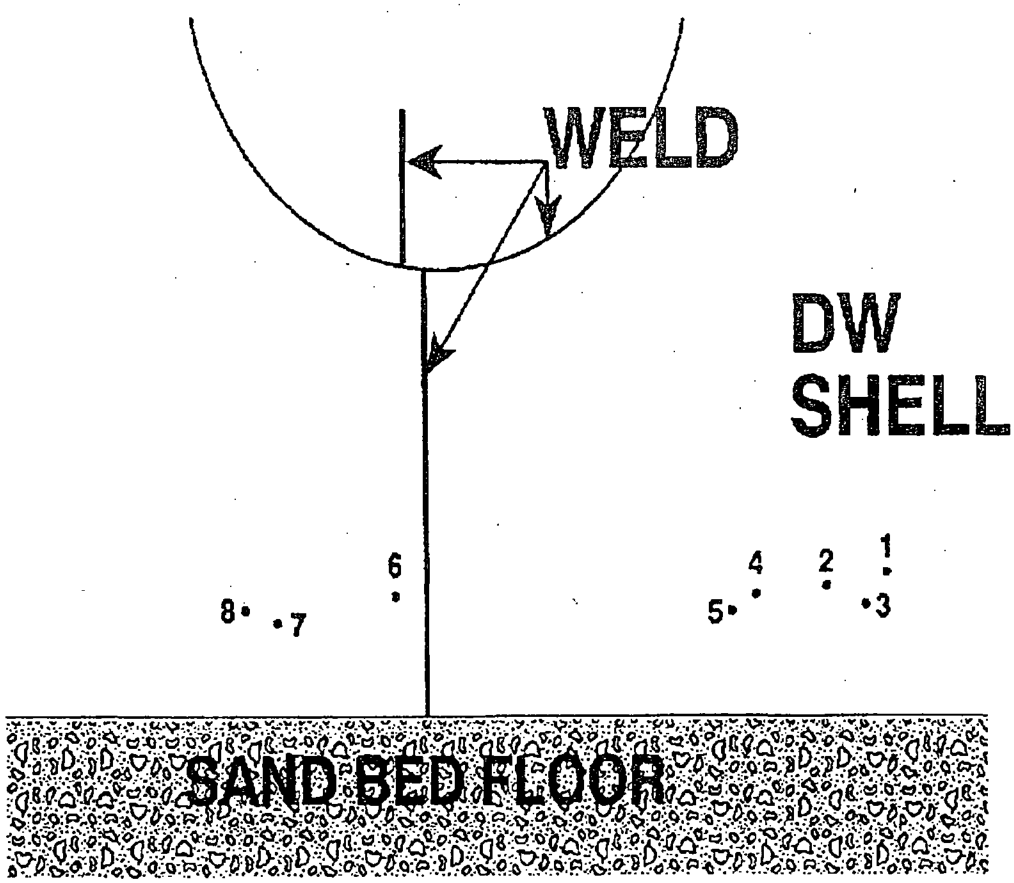

FIGURE (5)

5.0 CALCULATION:

UT EVALUATION:

BAY # 7:

The observation of the drywell surface for this bay showed uniform dimples in the corroded area, but they are shallow compared to those in bay 1. The bathtub ring seen in the other bays, was not very prominent in this bay. This observation is made by the inspector who located the thinnest areas for the UT examination. The shell appears to be relatively uniform in thickness. Seven locations were selected to represent the thinnest areas based on the visual observations of the shell surface (Fig. 7). These locations are a deliberate attempt to produce a minimum measurement. Table 7 shows readings taken to measure the thicknesses of the drywell shell using a D-meter. The results indicate that all of the areas have thickness greater than the 0.736 inches.

Given the UT measurements, a conservative mean evaluation thickness of 1.00 inches is estimated for this bay and therefore, it is concluded that the bay is acceptable.

Bay # 7 UT Data

Table 7

Location	UT Measurement (inches)	Average Micrometer (inches)
1	0.920	---
2	1.016	---
3	0.954	---
4	1.040	---
5	1.030	---
6	1.045	---
7	1.000	---

BAY #7 DATA

NOTES:

1. All measurements from the intersection of DW shell (butt) and vent collar (fillet) welds.

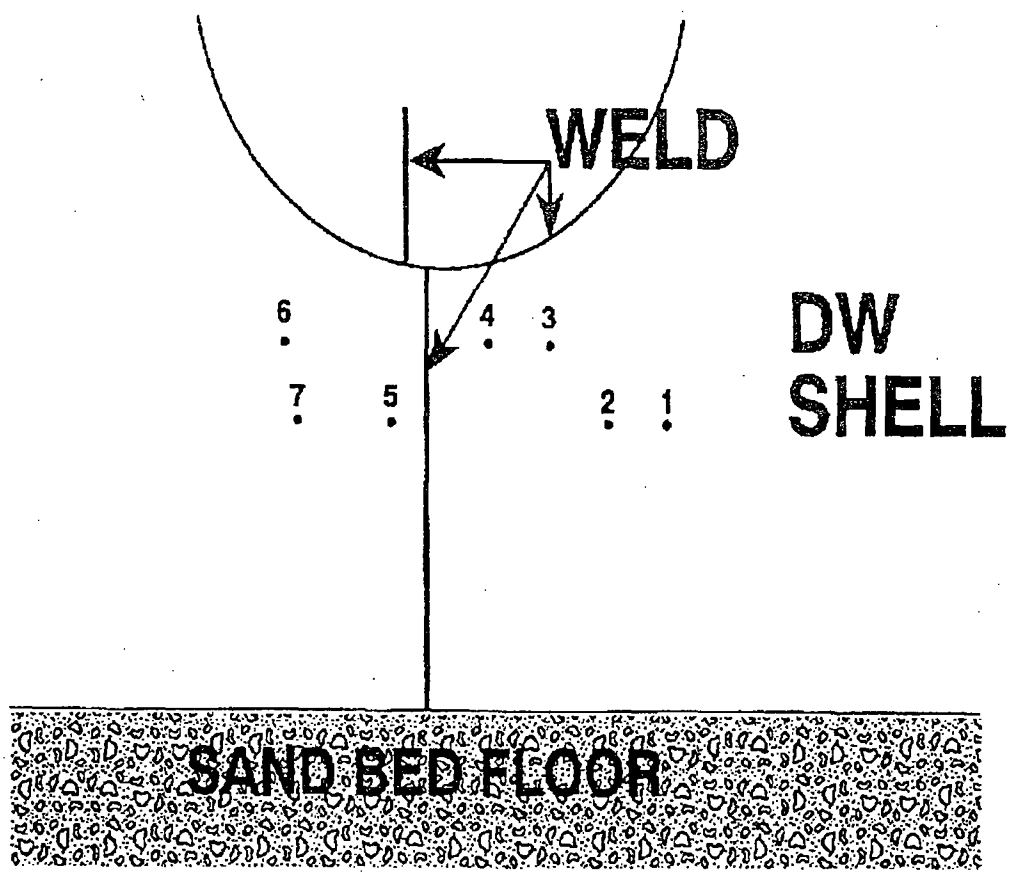

FIGURE (7)

5.0 CALCULATION:

UT EVALUATION:

BAY # 9:

The observation of the drywell shell for this bay was very similar to bay 7 except that the bathtub ring was more evident in this bay. The shell appears to be relatively uniform in thickness except for a bathtub ring 6 to 9 inches wide approximately 6 to 8 inches below the vent header reinforcement plate. The upper portion of the shell beyond the band exhibits no corrosion where the original red lead primer is still intact. Eight locations were selected to represent the thinnest areas based on the visual observations of the shell surface (Fig. 9). These locations are a deliberate attempt to produce a minimum measurement. Table 9 shows readings taken to measure the thicknesses of the drywell shell using a D-meter. The results indicate that all of the areas have thickness greater than the 0.736 inches.

Given the UT measurements, a conservative mean evaluation thickness of 0.900 inches is estimated for this bay and therefore, it is concluded that the bay is acceptable.

Bay # 9 UT Data

Table 9

Location	UT Measurement (inches)	Average Micrometer (inches)
1	0.960	---
2	0.940	---
3	0.994	---
4	1.020	---
5	0.985	---
6	0.820	---
7	0.825	---
8	0.791	---
9	0.832	---
10	0.980	---

BAY #9 DATA

NOTES:

1. All measurements from intersection of the DW shell (butt) and vent collar (fillet) welds.

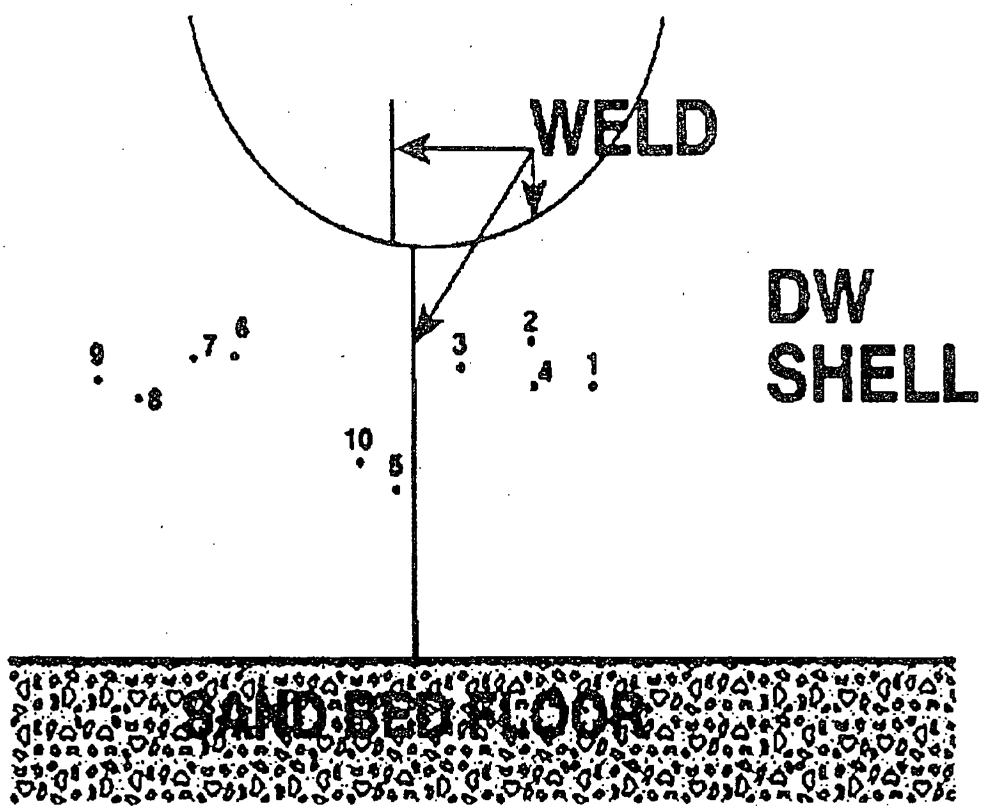

FIGURE (9)

5.0 CALCULATION:

UT EVALUATION:

BAY # 11:

The outside surface of this bay is rough, similar to bay 1, full of uniform dimples comparable to the outside surface of a golf ball. The shell appears to be relatively uniform in thickness except for local areas at the upper right corner of Figure 11, located at about 10 to 12 inches below the vent pipe reinforcement plate.

Eight locations were selected to represent the thinnest areas based on the visual observations of the shell surface (Fig. 11). These locations are a deliberate attempt to produce a minimum measurement. Table 11-a shows readings taken to measure the thicknesses of the drywell shell using a D-meter. The results indicate that all of the areas have thickness greater than the 0.736 inches, except one location. Location 1 as shown in Table 11-a, has a reading below 0.736 inches. Observations indicate that this location was very deep and not more than 1 to 2 inches in diameter. The depth of area relative to its immediate surroundings was measured at 8 locations around the spot and the average is shown in Table 11-a. Using the general wall thickness acceptance criteria described earlier, the evaluation thickness for location 1 was found to be above 0.736 inches as shown in Table 11-b.

Given the UT measurements, a conservative mean evaluation thickness of 0.790 inches is estimated for this bay and therefore, it is concluded that the bay is acceptable.

5.0 CALCULATION:

UT EVALUATION:

BAY # 11 (Continued):

Bay # 11 UT Data

Table 11-a

Location	UT Measurement (inches)	Average Micrometer (inches)
1	0.705	0.246
2	0.770	---
3	0.832	---
4	0.755	---
5	0.831	---
6	0.800	---
7	0.831	---
8	0.815	---

Summary of Measurements Below 0.736 Inches

Table 11-b

Location	UT Measurement (1)	AVG Micrometer (2)	Mean Depth/Valley (3)	T (Evaluation) (4)=(1)+(2)-(3)	Remarks
1	0.705"	0.246"	0.200"	0.751"	Acceptable

BAY #11 DATA

NOTES:

1. All measurements from intersection of the DW shell (butt) and vent collar (fillet) welds.

2. Pit depths are average of four readings taken at 0/45°/90°/135° within 1" band surrounding the ground spots. This measurement was only taken when wall thickness was below 0.736".

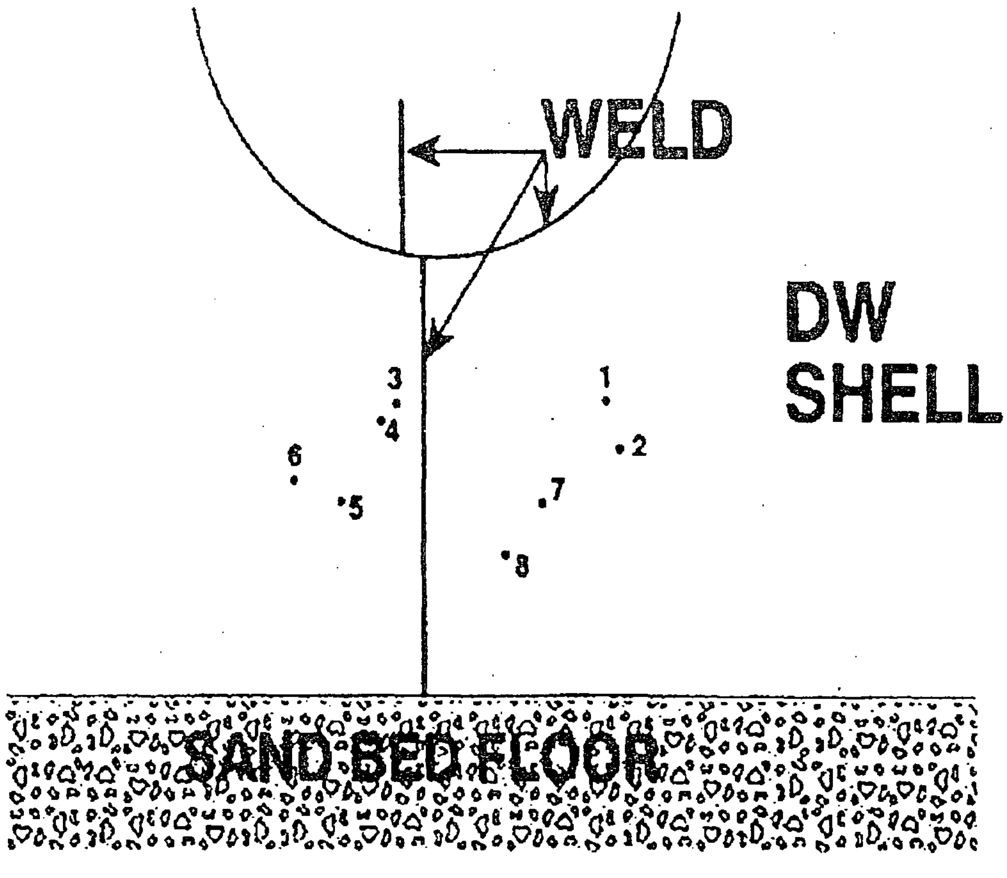

FIGURE (11)

5.0 CALCULATION:

UT EVALUATION:

BAY # 13:

The outside surface of this bay is rough and full of dimples similar to bay 1 as shown in Appendix C. This observation is made by the inspector who located the thinnest areas in deep valleys thereby biasing the remaining wall measurements to the conservative side. This inspection focused on the thinnest areas, even if very local, i.e., the inspection did not attempt to define a shell thickness suitable for structural evaluation. The variation in shell thickness is greater in this bay than in the other bays. The bathtub ring below the vent pipe reinforcement plate was less prominent than was seen in other bays. The corroded areas are about 12 to 18 inches in diameter and are at 12 inches apart, located in the middle of the sandbed. Beyond the corroded areas on both sides, the shell appears to be uniform in thickness at a conservative value of 0.800 inches. Near the vent pipe and reinforcement plate the shell exhibits no corrosion since the original lead primer on the vent pipe/reinforcement plate is intact. Measurement 20 confirms that the thickness above the bathtub ring is at 1.154 inches. Below the bathtub ring the shell appears to be fairly uniform in thickness where no abrupt changes in thickness are present. Thickness measurements below the bathtub ring are all 0.800 inches or better.

Therefore, a conservative mean thickness of 0.800 inches is estimated to represent the evaluation thickness for this bay. Given a uniform thickness of 0.800 inches, the buckling margin for the refueling load condition is recalculated based on the GE report 9-4 (Ref. 3.3). The theoretical buckling strength from report 9-4 (ANSYS Load Factor) is a square function of plate thicknesses. Therefore, a new buckling capacity for the controlling refueling load combination is calculated to be at 13% above the ASME factor of safety of 2 as shown in Appendix B.

5.0 CALCULATION:

UT EVALUATION:

BAY # 13 (Continued):

Locations 5, 6, 7, 8, 10, 11, 14, and 15 are confined to the bathtub ring as shown in Figure 13. An average value of these measurements is an evaluation thickness for this band as follows;

Location	Evaluation Thickness
5	0.735"
6	0.756"
7	0.675"
8	0.796"
10	0.739"
11	0.741"
12	0.885"
14	0.868"
15	0.756"
16	0.829"

Average = 0.778"

The inspector suspected that some of the above locations in the bathtub ring were over ground. Subsequent locations with suffix A, e.g. 5A, 6A, were located close to the spots in question and were ground carefully to remove the minimum amount of metal but adequate enough for UT examination as shown in Table 13-a. The results indicate that all subsequent measurements were above 0.736 inches. The average micrometer measurements taken for these locations confirm the depth measurements at these locations. In spite of the fact that the original measurements were taken at heavily ground locations they are the ones used in the evaluation.

The individual measurements must also be evaluated for structural compliance. Table 13-a identifies 20 locations of UT measurements that were selected to represent the thinnest areas, except location 20, based on visual examination. These locations are a deliberate attempt to produce a minimum measurement. Location 20 was selected to confirm that no corrosion had taken place in the area above the bathtub ring.

5.0 CALCULATION:

UT EVALUATION:

BAY # 13 (Continued):

Nine locations shown in Table 13-a (1, 2, 5, 6, 7, 8, 10, 11, and 15) have measurements below 0.736 inches. Observations indicate that these locations were very deep, overly ground, and not more than 1 to 2 inches in diameter. The depth of each of these areas relative to its immediate surroundings was measured at 8 locations around the spot and the average is shown in Table 13-a. Using the general wall thickness acceptance criteria described earlier, the evaluation thickness for all measurements below 0.736 inches were found to be above 0.736 inches except for two locations, 5 and 7, as shown in Table 13-b. In addition, subsequent measurements close to the locations identified above, were taken and they were all above 0.736 inches. Locations 5 and 7 are in the bathtub ring and are about 30 inches apart. These locations are characterized as local areas located at about 15 to 20 inches below the vent pipe reinforcement plate with an evaluation thicknesses of 0.735 inches and 0.677 inches. The location 5 is near to location 14 for an average value of 0.801 inches and therefore acceptable. Location 7 could conservatively exist over an area of 6 x 6 inches for a thickness of 0.677 inches. This thickness of 0.677 inches is a full 0.123 inches reduction from the conservative estimate of 0.800 inches evaluation thickness for the entire bay. In order to quantify the effect of this local region and to address structural compliance, the GE study on local effects is used (Ref. 3.5).

This study contains an analysis of the drywell shell using the pie slice finite element model, reducing the thickness by 0.200 inches (from 0.736 to 0.536 inches) in an area 12 x 12 inches in the sandbed region located to result in the largest reduction possible. This location is selected at the point of maximum deflection of the eigenvector shape associated with the lowest buckling load. The theoretical buckling load was reduced by 9.5%. The 6 x 6 inch local region is not at the point of maximum deflection. The area of 6 x 6 inches is only 25% of the 12 x 12 inches area used in the analysis. Therefore, this small 6 x 6 inch area has a negligible effect on the buckling capacity of the structure.

5.0 CALCULATION:

UT EVALUATION:

BAY # 13 (Continued):

In summary, using a conservative estimate of 0.800 inches for evaluation thickness for the entire bay and the presence of a bathtub ring with a evaluation thickness of 0.778 inches plus the acceptance of a local area of 6 x 6 inches based on the GE study, it is concluded that the bay is acceptable.

Bay # 13 UT Data

Table 13-a

Location	UT Measurement (inches)	Average Micrometer (inches)
1/1A	0.672/0.890	0.351
2/2A	0.722/0.943	0.360
3	0.941	---
4	0.915	---
5/5A	0.718/0.851	0.217
6/6A	0.655/0.976	0.301
7/7A	0.618/0.752	0.257
8/8A	0.718/0.900	0.278
9	0.924	---
10/10A	0.728/0.810	0.211
11/11A	0.685/0.854	0.256
12	0.885	---
13	0.932	---
14	0.868	---
15/15A	0.683/0.859	0.273
16	0.829	---
17	0.807	---
18	0.825	---
19	0.912	---
20	1.170	---

5.0 CALCULATION:

UT EVALUATION:

BAY # 13 (Continued):

Summary of Measurements Below 0.736 Inches

Table 13-b

Location	UT Measurement (1)	AVG Micrometer (2)	Mean Depth/Valley (3)	T (Evaluation) (4)=(1)+(2)-(3)	Remarks
1	0.672"	0.351"	0.200"	0.823"	Acceptable
2	0.722"	0.360"	0.200"	0.882"	Acceptable
5	0.718"	0.217"	0.200"	0.735"	Acceptable
6	0.655"	0.301"	0.200"	0.756"	Acceptable
7	0.618"	0.257"	0.200"	0.675"	Acceptable
8	0.718"	0.278"	0.200"	0.796"	Acceptable
10	0.728"	0.211"	0.200"	0.739"	Acceptable
11	0.685"	0.256"	0.200"	0.741"	Acceptable
15	0.683"	0.273"	0.200"	0.756"	Acceptable

BAY #13 DATA

NOTES:

1. All measurements from intersection of the DW shell (butt) and vent collar (fillet) welds.
2. Spots with suffix (e.g. IA or 2A) were located close to the spots in question and were ground carefully to remove minimum amount of metal but adequate enough for UT.
3. Pit depths are average of four readings taken at 0/45°/90°/135° within 1" distance around ground spot. Taken only where remaining wall showed below 0.736".

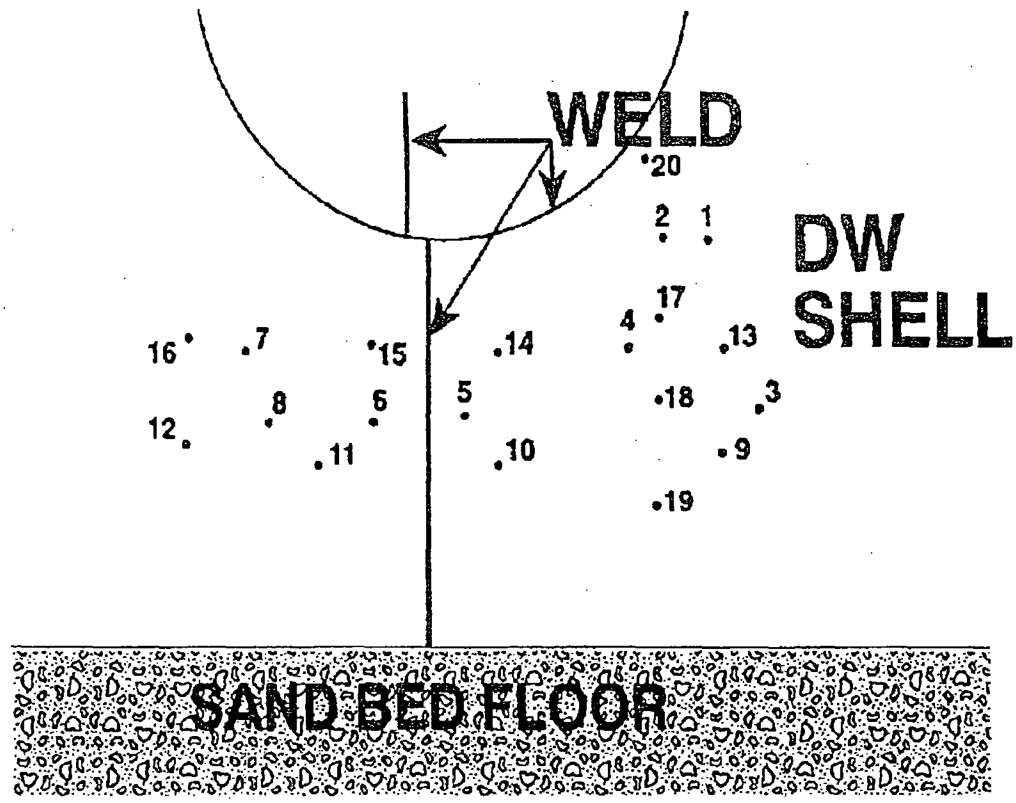

FIGURE (13)

5.0 CALCULATION:

UT EVALUATION:

BAY # 15:

The outside surface of this bay is rough, similar to bay 1, full of uniform dimples comparable to the outside surface of golf ball (Appendix C). The bathtub ring seen in the other bays, was not very prominent in this bay. This observation is made by the inspector who located the thinnest areas for the UT examination. The upper portion of the shell beyond the ring exhibits no corrosion where the original red lead primer is still intact. The shell appears to be relatively uniform in thickness.

Eleven locations were selected to represent the thinnest areas based on the visual observations of the shell surface (Fig. 15). These locations are a deliberate attempt to produce a minimum measurement. Table 15-a shows readings taken to measure the thicknesses of the drywell shell using a D-meter. The results indicate that all of the areas have thickness greater than the 0.736 inches, except one location. Location 9 as shown in Table 15-a, has a reading below 0.736 inches. Observations indicate that this location was very deep and not more than 1 to 2 inches in diameter. The depth of area relative to its immediate surrounding was measured at 8 locations around the spot and the average is shown in Table 15-a. Using the general wall thickness acceptance criteria described earlier, the evaluation thickness for location 9 was found to be above 0.736 inches as shown in Table 15-b.

Given the UT measurements, a conservative mean evaluation thickness of 0.800 inches is estimated for this bay and therefore, it is concluded that the bay is acceptable.

5.0 CALCULATION:

UT EVALUATION:

BAY # 15:

Bay #15 UT Data

Table 15-a

Location	UT Measurement (inches)	Average Micrometer (inches)
1	0.786	---
2	0.829	---
3	0.932	---
4	0.795	---
5	0.850	---
6	0.794	---
7	0.808	---
8	0.770	---
9	0.722	0.337
10	0.860	---
11	0.825	---

Summary of Measurements Below 0.736 Inches

Table 15-b

Location	UT Measurement (1)	AVG Micrometer (2)	Mean Depth/Valley (3)	T (Evaluation) (4)=(1)+(2)-(3)	Remarks
9	0.722"	0.337"	0.200"	0.859"	Acceptable

BAY #15 DATA

NOTES:

1. All measurements from intersection of the DW shell and vent collar (fillet) welds.
2. Pit depths are average of four readings taken at 0/45°/90°/135° within 1" distance around ground spots. Taken only when remaining wall thickness shown below 0.736".

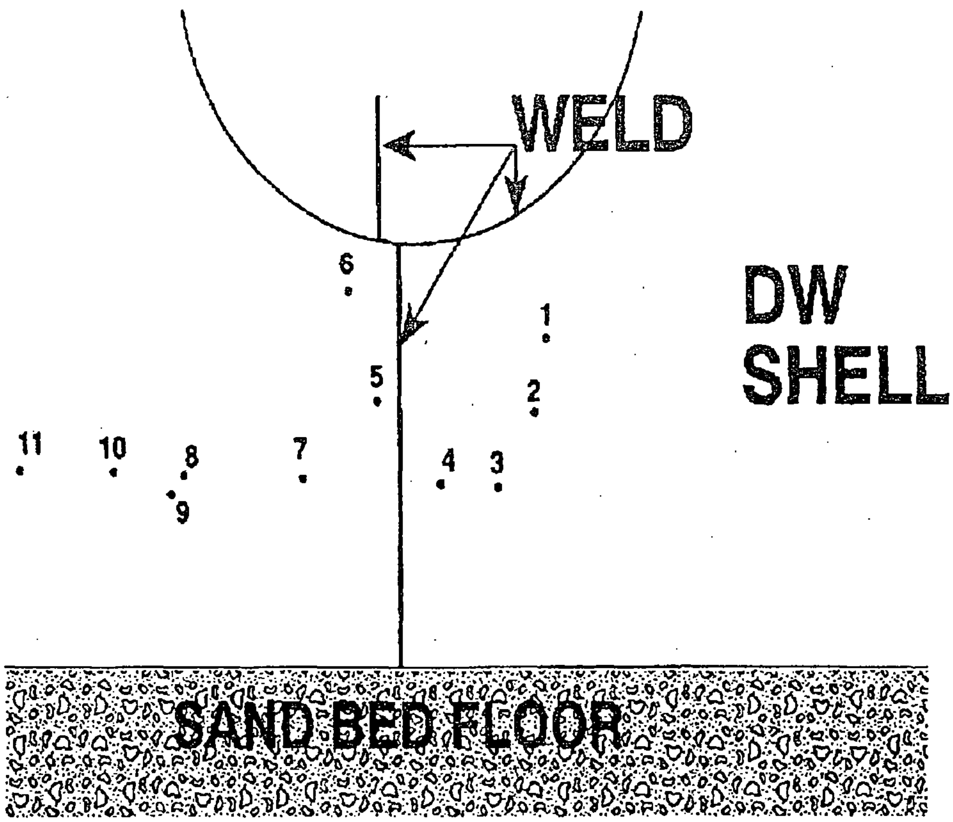

FIGURE (15)

5.0 CALCULATION:

UT EVALUATION:

BAY # 17:

The outside surface of this bay is rough, similar to bay 1, full of uniform dimples comparable to the outside surface of golf ball. The shell appears to be relatively uniform in thickness except for a band 8 to 10 inches wide approximately 6 inches below the vent header reinforcement plate. The upper portion of the shell beyond the band exhibits no corrosion where the original red lead primer is still intact.

Eleven locations were selected to represent the thinnest areas based on the visual observations of the shell surface (Fig. 17). These locations are a deliberate attempt to produce a minimum measurement. Table 17-a shows readings taken to measure the thicknesses of the drywell shell using a D-meter. The results indicate that all of the areas have thickness greater than the 0.736 inches, except one location. Location 9 as shown in Table 17-a, has a reading below 0.736 inches. Observations indicate that this location is very deep and not more than 1 to 2 inches in diameter. The depth of area relative to its immediate surroundings was measured at 8 locations around the spot and the average is shown in Table 17-a. Using the general wall thickness acceptance criteria described earlier, the evaluation thickness for location 9 was found to be above 0.736 inches as shown in Table 17-b.

Given the UT measurements, a conservative mean evaluation thickness of 0.900 inches is estimated for this bay and therefore, it is concluded that the bay is acceptable.

5.0 CALCULATION:

UT EVALUATION:

BAY # 17 (Continued):

Bay #17 UT Data

Table 17-a

Location	UT Measurement (inches)	Average Micrometer (inches)
1	0.916	---
2	1.150	---
3	0.898	---
4	0.951	---
5	0.913	---
6	0.992	---
7	0.970	---
8	0.990	---
9	0.720	0.351
10	0.830	---
11	0.770	---

Summary of Measurements Below 0.736 Inches

Table 17-b

Location	UT Measurement (1)	AVG Micrometer (2)	Mean Depth/Valley (3)	T (Evaluation) (4)=(1)+(2)-(3)	Remarks
9	0.720"	0.351"	0.200"	0.871"	Acceptable

GPU Nuclear

Calculation Sheet

Subject		Calc No.	Rev. No.	Sheet No.
O.C Drywell Ext. Ut Evaluation in Sandbed		C-1302-187-5320-024	0	35 of 54
Originator MARK YEKTA	Date 01/12/93	Reviewed by S. C. Tumminelli		Date 04/16/93

BAY #17 DATA

NOTES:

1. All measurements from intersection of the DW (butt) shell and vent collar (fillet) welds.
2. Pit depths are average of four readings taken at 0/45°/90°/135° within 1" distance around ground spots. Taken only when remaining wall thickness was below 0.736".

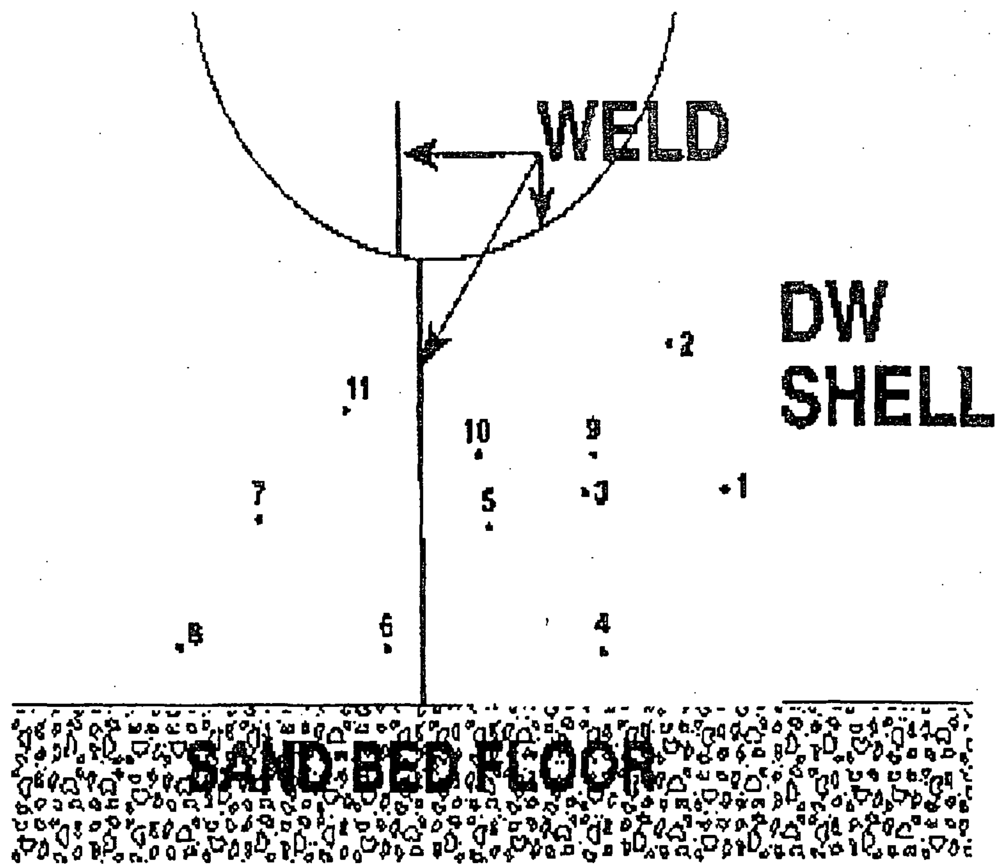

FIGURE (17)

5.0 CALCULATION:

UT EVALUATION:

BAY # 19:

The outside surface of this bay is rough and very similar to bay 17. Locations 1 through 7 as shown in Table 19, were ground carefully to minimize loss of good metal. The shell surface is full of dimples comparable to the outside surface of a golf ball. This observation is made by the inspector who located the thinnest areas for the UT examination. The shell appears to be relatively uniform in thickness. Ten locations were selected to represent the thinnest areas based on the visual observations of the shell surface (Fig. 19). These locations are a deliberate attempt to produce a minimum measurement. Table 19 shows readings taken to measure the thicknesses of the drywell shell using a D-meter. The results indicate that all of the areas have thickness greater than the 0.736 inches.

Given the UT measurements, a conservative mean evaluation thickness of 0.850 inches is estimated for this bay and therefore, it is concluded that the bay is acceptable.

Bay #19 UT Data

Table 19

Location	UT Measurement (inches)	Average Micrometer (inches)
1	0.932	---
2	0.924	---
3	0.955	---
4	0.940	---
5	0.950	---
6	0.860	---
7	0.969	---
8	0.753	---
9	0.776	---
10	0.790	---

GPU Nuclear Calculation Sheet

Subject		Calc No.	Rev. No.	Sheet No.
O.C Drywell Ext. Ut Evaluation in Sandbed		C-1302-187-5320-024	0	37 of 54
Originator: MARK YEKTA	Date: 01/12/93	Reviewed by: S. C. Tumminelli		Date: 04/16/93

BAY #19 DATA

NOTES:

1. All measurements from intersection of the DW shell (butt) and vent collar (fillet) welds.

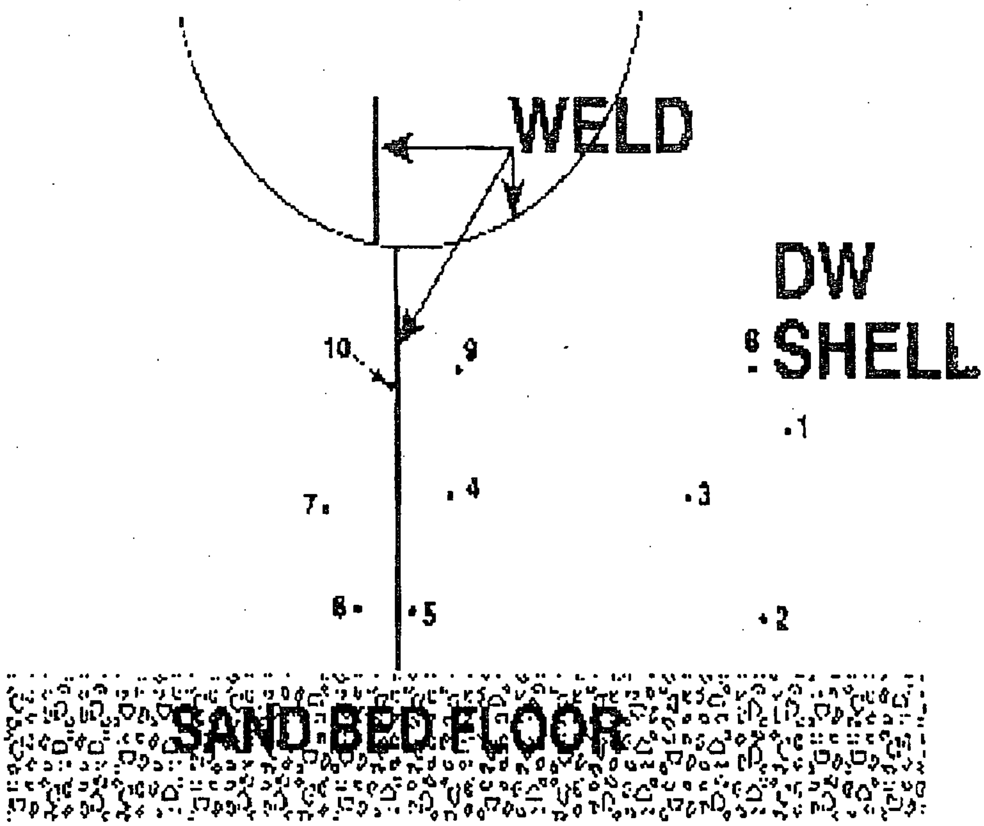

FIGURE (19)

APPENDIX A

SUMMARY OF MEASUREMENTS

OF

IMPRESSIONS TAKEN FROM BAY #13

Subject		Calc No.	Rev. No.	Sheet No.
O.C Drywell Ext. Ut Evaluation in Sandbed		C-1302-187-5320-024	0	39 of 54
Originator: MARK YEKTA	Date: 01/12/93	Reviewed by: S. C. Tumminelli		Date: 04/16/93

The purpose of this appendix is to characterize the depth of typical uniform dimples on the shell surface. This depth is used in acceptance criteria to quantify the evaluation thickness for an area where the micrometer readings are available.

Two locations in bay 13 were selected since bay 13 is the roughest bay. Impressions of drywell shell surface using DMR_503 Epoxy Replication Putty manufactured by Dyna Mold Inc were made. These impressions were about 10 inches in diameter and about 1 inch thick. The UT locations 7 and 10 in bay 13 were identified in each of these impression as the reference points. This is a positive impression of the drywell shell surface. The depth of the typical dimples were measured as follows;

READING (Location)	**DEPTH # 10** (inches)	**DEPTH # 7** (inches)
1	0.150	0.075
2	0.000	0.110
3	0.200	0.135
4	0.140	0.200
5	0.150	0.000
6	0.040	0.000
7	0.150	0.170
8	0.010	0.205
9	0.134	-----
10	0.145	0.145
11	0.118	0.064
12	0.105	0.200
13	0.125	0.045
14	0.200	0.180
15	0.135	0.105
16	0.100	----
17	0.175	0.035
18	0.175	0.015
19	0.155	0.190
20	0.175	0.055
21	0.175	0.305
22	-----	0.135

Location # 10:

Mean Value = 0.131
Standard Deviation = 0.055

Mean Value + One S.D = 0.186

Location # 7:

Mean Value = 0.118

Standard Deviation = 0.082

Mean Value + One S.D = 0.200

Therefore, a value of 0.200 inches was used as the depth of uniform dimples for the entire outside surface of the drywell in the sandbed region.

APPENDIX B

BUCKLING CAPACITY EVALUATION

FOR VARYING

UNIFORM THICKNESS

GPU Nuclear **Calculation Sheet**

Subject	Calc No.	Rev. No.	Sheet No.
O.C Drywell Ext. Ut Evaluation in Sandbed	C-1302-187-5320-024	0	42 of 54
Originator: MARK YEKTA — Date: 01/12/93	Reviewed by: S. C. Tumminelli		Date: 04/16/93

CALCULATION OF BUCKLING MARGIN - REFUELING CASE, NO SAND -
GE OYCR1S&T - UNIFORM THICKNESS t= 0.736 Inch

ITEM	PARAMETER	UNITS	VALUE	LOAD FACTOR
	*** DRYWELL GEOMETRY AND MATERIALS			
1	Sphere Radius, R	(in.)	420	
2	Sphere Thickness, t	(in.)	0.736	
3	Material Yield Strength, Sy	(ksi)	38	
4	Material Modolus of Elasticity, E	(ksi)	29600	
5	Factor of Safety, FS		2	
	*** BUCKLING ANALYSIS RESULTS			
6	Theoretical Elastic Instability Stress, Ste	(ksi)	46.590	6.140
	*** STRESS ANALYSIS RESULTS			
7	Applied Meridional Compressive Stress, Sm	(ksi)	7.588	5.588
8	Applied Circumferential Tensile Stress, Sc	(ksi)	4.510	3.300
	*** CAPACITY REDUCTION FACTOR CALCULATION			
9	Capacity Reduction Factor, ALPHAI		0.207	
10	Circumferential Stress Equivalent Pressure, Peq	(psi)	15.806	
11	'X' Parameter, X= (Peq/8E) (d/t)^2		0.087	
12	Delta C (From Figure -)	-	0.072	
13	Modified Capacity Reduction Factor, ALPHA,i,mod		0.326	
14	Reduced Elastic Instability Stress, Se	(ksi)	15.182	2.001
	*** PLASTICITY REDUCTION FACTOR CALCULATION			
15	Yield Stress Ratio, DELTA=Se/Sy		0.400	
16	Plasticity Reduction Factor, NUi		1.000	
17	Inelastic Instability Stress, Si = NUi x Se	(ksi)	15.182	2.001
	*** ALLOWABLE COMPRESSIVE STRESS CALCULATION			
18	Allowable Compressive Stress, Sall = SI/FS	(ksi)	7.591	1.000
19	Compressive Stress Margin, M=(Sall/Sm -1) x 100%	(%)	0.0	

CALCULATION OF BUCKLING MARGIN - REFUELING CASE, NO SAND
GE OCRFST01 - UNIFORM THICKNESS t=0.776 Inch

ITEM	PARAMETER	UNITS	VALUE	LOAD FACTOR
	*** DRYWELL GEOMETRY AND MATERIALS			
1	Sphere Radius, R	(in.)	420	
2	Sphere Thickness, t	(in.)	0.776	
3	Material Yield Strength, Sy	(ksi)	38	
4	Material Modolus of Elasticity, E	(ksi)	29600	
5	Factor of Safety, FS		2	
	*** BUCKLING ANALYSIS RESULTS			
6	Theoretical Elastic Instability Stress, Ste	(ksi)	49.357	6.857
	*** STRESS ANALYSIS RESULTS			
7	Applied meridional Compressive Stress, Sm	(ksi)	7.198	5.588
8	Applied Circumferential Tensile Stress, Sc	(ksi)	4.248	3.300
	*** CAPACITY REDUCTION FACTOR CALCULATION			
9	Capacity Reduction Factor, ALPHAI		0.207	
10	Circumferential Stress Equivalent Pressure, Peq	(psi)	15.697	
11	'X' Parameter, X= (Peq/8E) (d/t)^2		0.078	
12	Delta C (From Figure -)	-	0.066	
13	Modified Capacity Reduction Factor, ALPHA,i,mod		0.316	
14	Reduced Elastic Instability Stress, Se	(ksi)	15.583	2.165
	*** PLASTICITY REDUCTION FACTOR CALCULATION			
15	Yield Stress Ratio, DELTA=Se/Sy		0.410	
16	Plasticity Reduction Factor, NUi		1.000	
17	Inelastic Instability Stress, Si = NUi x Se	(ksi)	15.583	2.165
	ALLOWABLE COMPRESSIVE STRESS CALCULATION			
18	Allowable Compressive Stress, Sall = SI/FS	(ksi)	7.792	1.082
19	Compressive Stress Margin, M=(Sall/Sm -1) x 100%		8.2	

CALCULATION OF BUCKLING MARGIN - REFUELING CASE, NO SAND
GPUN EVALUATION FOR UNIFORM THICKNESS t=0.800 Inch USING THICKNESS RATIO

ITEM	PARAMETER	UNITS	VALUE	LOAD FACTOR
	*** DRYWELL GEOMETRY AND MATERIALS			
1	Sphere Radius, R	(in.)	420	
2	Sphere Thickness, t	(in.)	0.800	
3	Material Yield Strength, Sy	(ksi)	38	
4	Material Modolus of Elasticity, E	(ksi)	29600	
5	Factor of Safety, FS		2	
	*** BUCKLING ANALYSIS RESULTS			
6	Theoretical Elastic Instability Stress, Ste 6.857 * (0.800/0.776)^2 = 7.288	(ksi)	50.884	7.288
	*** STRESS ANALYSIS RESULTS			
7	Applied meridional Compressive Stress, Sm	(ksi)	6.982	5.588
8	Applied Circumferential Tensile Stress, Sc	(ksi)	4.120	3.300
	*** CAPACITY REDUCTION FACTOR CALCULATION			
9	Capacity Reduction Factor, ALPHAI		0.207	
10	Circumferential Stress Equivalent Pressure, Peq	(psi)	15.697	
11	'X' Parameter, X= (Peq/8E) (d/t)^2		0.073	
12	Delta C (From Figure -)	-	0.063	
13	Modified Capacity Reduction Factor, ALPHA,i,mod		0.311	
14	Reduced Elastic Instability Stress, Se	(ksi)	15.824	2.266
	*** PLASTICITY REDUCTION FACTOR CALCULATION			
15	Yield Stress Ratio, DELTA=Se/Sy		0.416	
16	Plasticity Reduction Factor, NUi		1.000	
17	Inelastic Instability Stress, Si = NUi x Se	(ksi)	15.824	2.266
	ALLOWABLE COMPRESSIVE STRESS CALCULATION			
18	Allowable Compressive Stress, Sall = SI/FS	(ksi)	7.912	1.133
19	Compressive Stress Margin, M=(Sall/Sm -1) x 100%		13.3	

Subject		Calc No.	Rev. No.	Sheet No.
O.C Drywell Ext. Ut Evaluation in Sandbed		C-1302-187-5320-024	0	45 of 54
Originator: MARK YEKTA	Date: 01/12/93	Reviewed by: S. C. Tumminelli		Date: 04/16/93

CALCULATION OF BUCKLING MARGIN - REFUELING CASE, NO SAND
GPUN EVALUATION FOR UNIFORM THICKNESS t=0.850 Inch USING THICKNESS RATIO

ITEM	PARAMETER	UNITS	VALUE	LOAD FACTOR
	*** DRYWELL GEOMETRY AND MATERIALS			
1	Sphere Radius, R	(in.)	420	
2	Sphere Thickness, t	(in.)	0.850	
3	Material Yield Strength, Sy	(ksi)	38	
4	Material Modolus of Elasticity, E	(ksi)	29600	
5	Factor of Safety, FS		2	
	*** BUCKLING ANALYSIS RESULTS			
6	Theoretical Elastic Instability Stress, Ste 6.857 * (0.800/0.776)^2 = 7.288	(ksi)	54.063	8.227
	*** STRESS ANALYSIS RESULTS			
7	Applied meridional Compressive Stress, Sm	(ksi)	6.571	5.588
8	Applied Circumferential Tensile Stress, Sc	(ksi)	3.878	3.300
	*** CAPACITY REDUCTION FACTOR CALCULATION			
9	Capacity Reduction Factor, ALPHAI		0.207	
10	Circumferential Stress Equivalent Pressure, Peq	(psi)	15.697	
11	'X' Parameter, X= (Peq/8E) (d/t)^2		0.065	
12	Delta C (From Figure -)	-	0.057	
13	Modified Capacity Reduction Factor, ALPHA,i,mod		0.300	
14	Reduced Elastic Instability Stress, Se	(ksi)	16.257	2.474
	*** PLASTICITY REDUCTION FACTOR CALCULATION			
15	Yield Stress Ratio, DELTA=Se/Sy		0.428	
16	Plasticity Reduction Factor, NUi		1.000	
17	Inelastic Instability Stress, Si = NUi x Se	(ksi)	16.257	2.474
	ALLOWABLE COMPRESSIVE STRESS CALCULATION			
18	Allowable Compressive Stress, Sall = SI/FS	(ksi)	8.128	1.237
19	Compressive Stress Margin, M=(Sall/Sm -1) x 100%		23.7	

APPENDIX C

PICTURES SHOWING CONDITION

OF THE DRYWELL

IN THE SANDBED REGION

Sand Bed Region - Typical condition found on initial entry

Corrosion product on drywell vessel

Bay #13 - D/W shell showing plug . The plug is located in the middle of the worst corroded area of the shell The plug showed no sign of corrosion.

Bay #13 - D/W shell showed less prominent "Tub Ring" than what was seen in other

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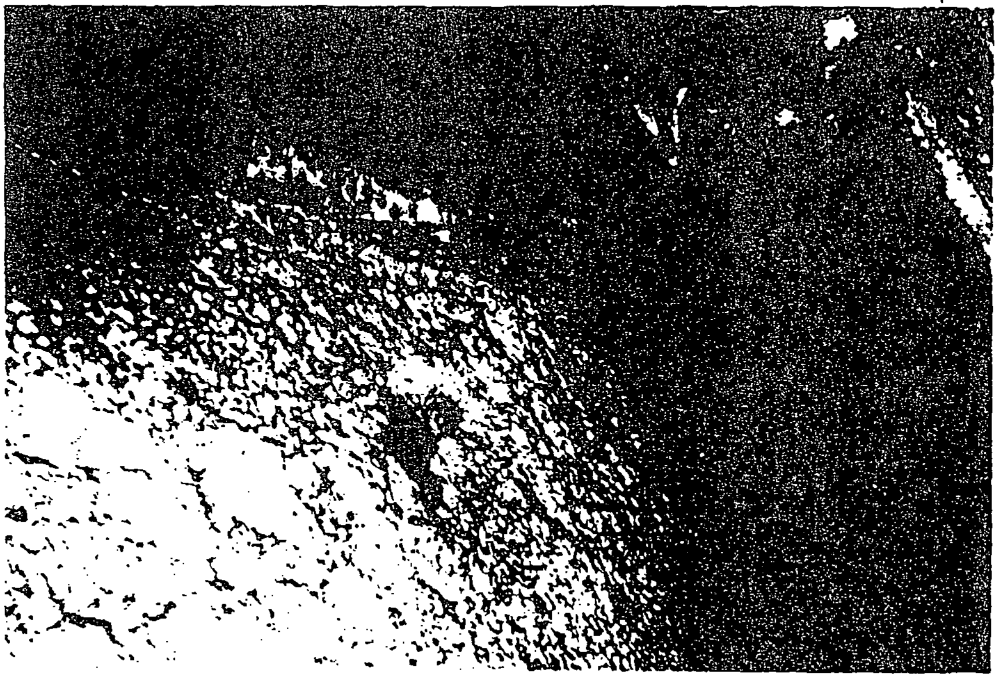
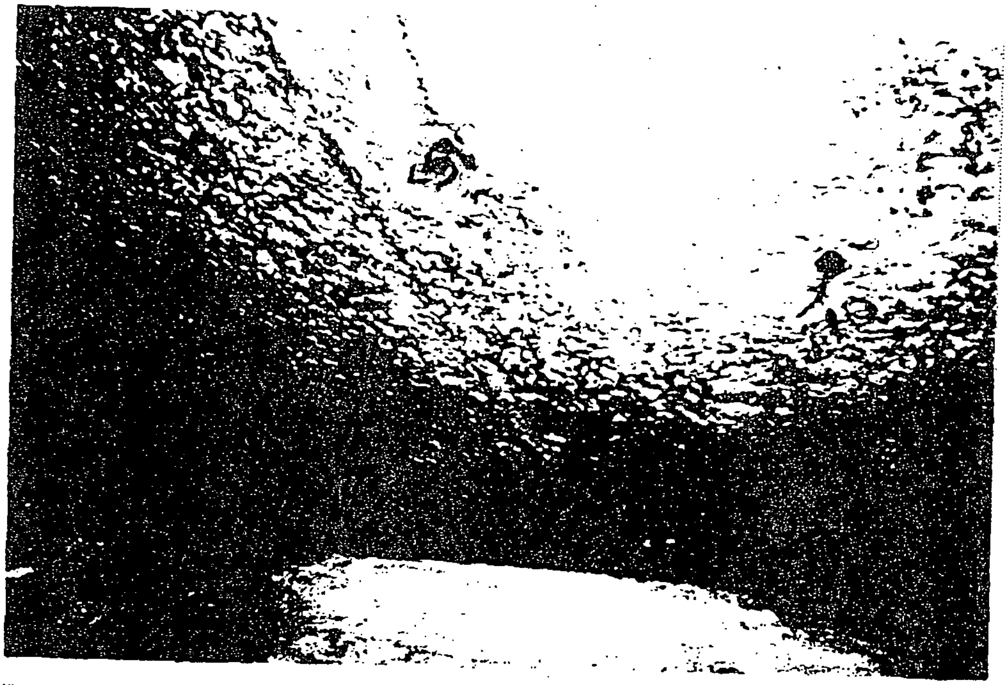
Calculation Sheet

Subject		Calc No.	Rev. No.	Sheet No.
O.C Drywell Ext. Ut Evaluation in Sandbed		C-1302-187-5320-024	0	49 of 54
Originator: MARK YEKTA	Date: 01/12/93	Reviewed by: S. C. Tumminelli		Date: 04/1[illegible]3



Bay #1 - Looking at the worst corroded area on shell near vent tube collar/ring. The ground spots seen here correspond to UT spot 20/21/23

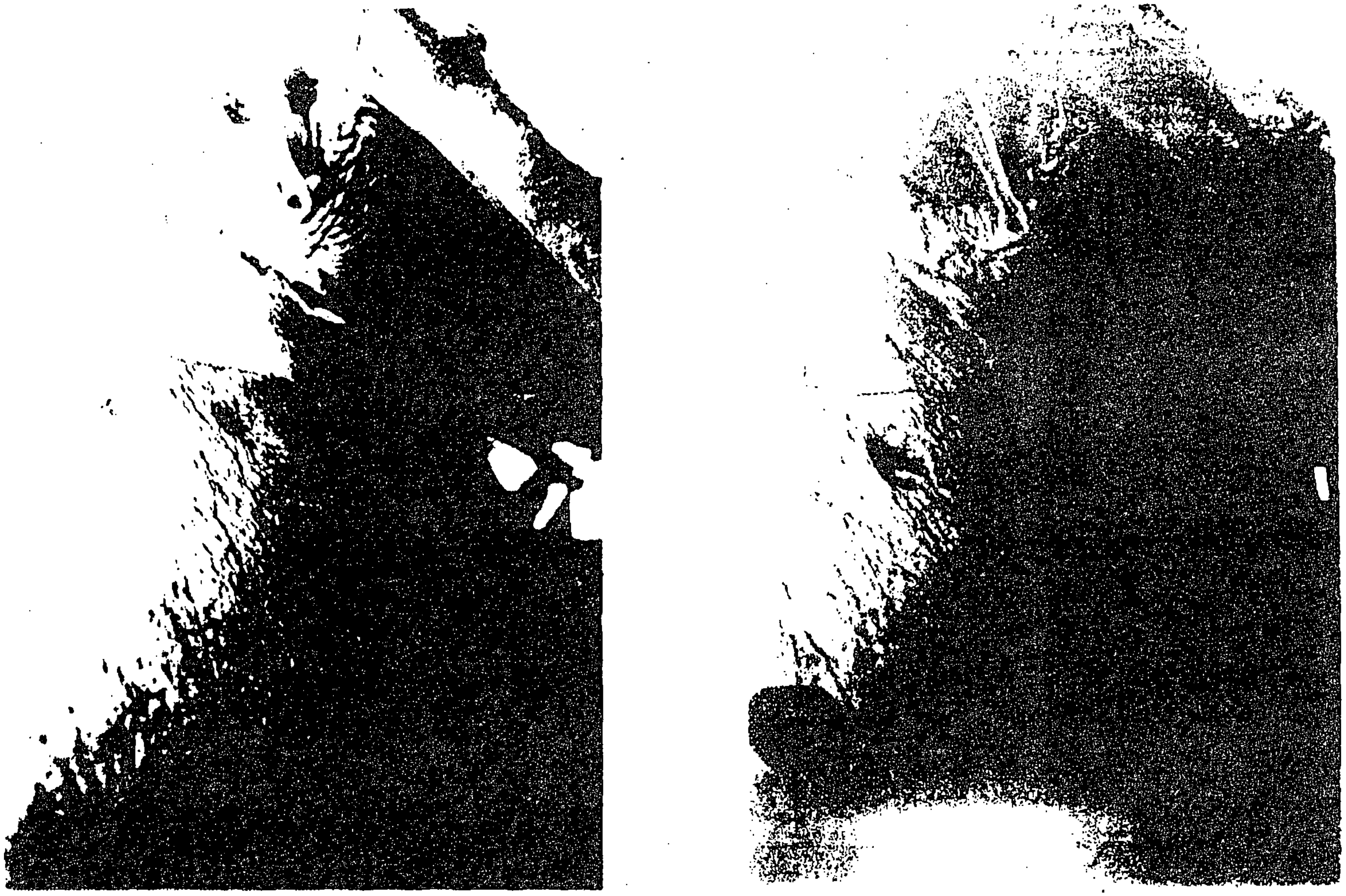


Bay #13 - Lower Mid portion of the D/W shell showing UT spot 5,6 and 10. This close up photo shows the roughness of the corroded surface and how each UT spot has been picked up in the deep valleys thereby biasing the remaining wall readings to the conservative side

GPU Nuclear Calculation Sheet

Subject	Calc No.	Rev. No.	Sheet No.
O.C Drywell Ext. Ut Evaluation in Sandbed	C-1302-187-5320-024	0	50 of 54

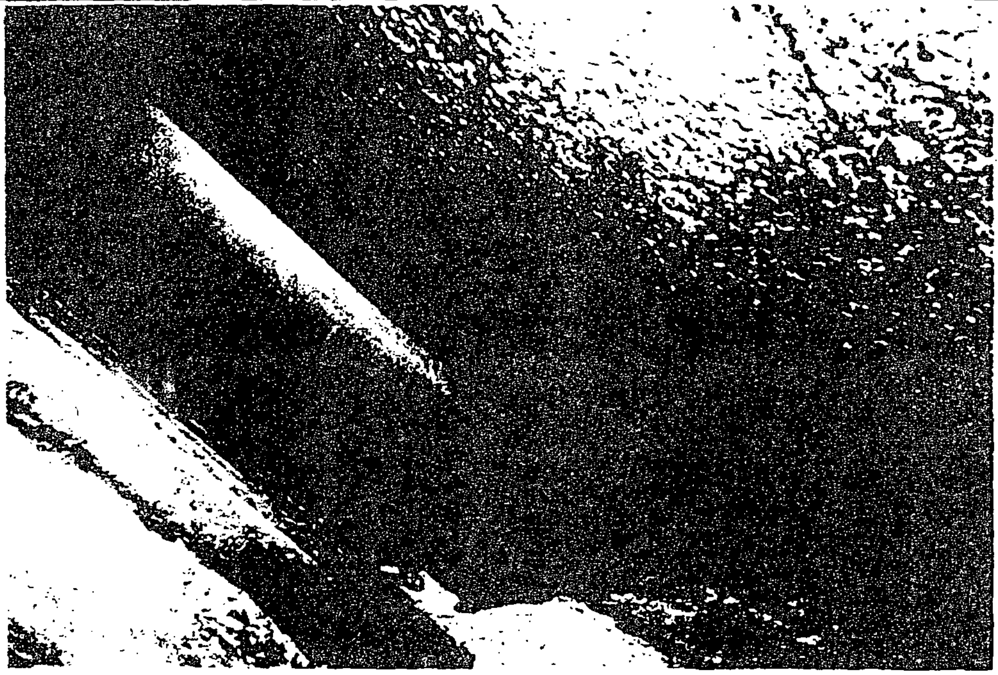
Originator	Date	Reviewed by	Date
MARK YEKTA	01/12/93	S. C. Tumminelli	04/16/93



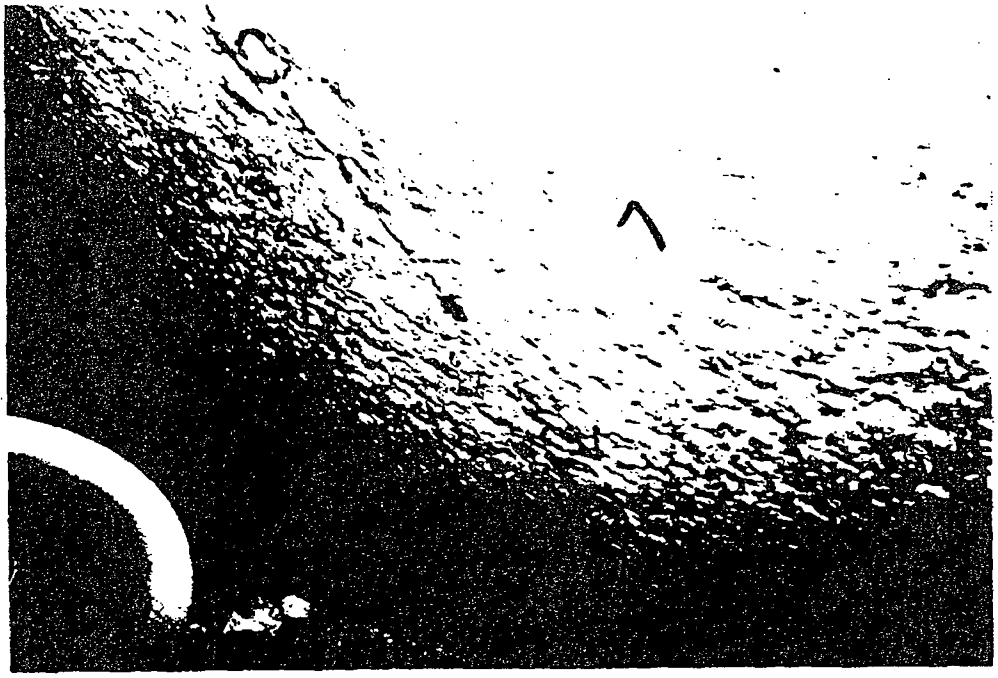
Bay #13 - Looking towards **Bay#11** - Upper right corner of D/W shell. Note ① - Grinding depth on UT spot #1 & 2, ② - A part of "Bath Tub Ring" as delineated by marking and ③ locations of UT spots 3,4,13 & 17. The photo on right (although blurred by flash reflection) shows 1/8" projection of plug.

GPU Nuclear **Calculation Sheet**

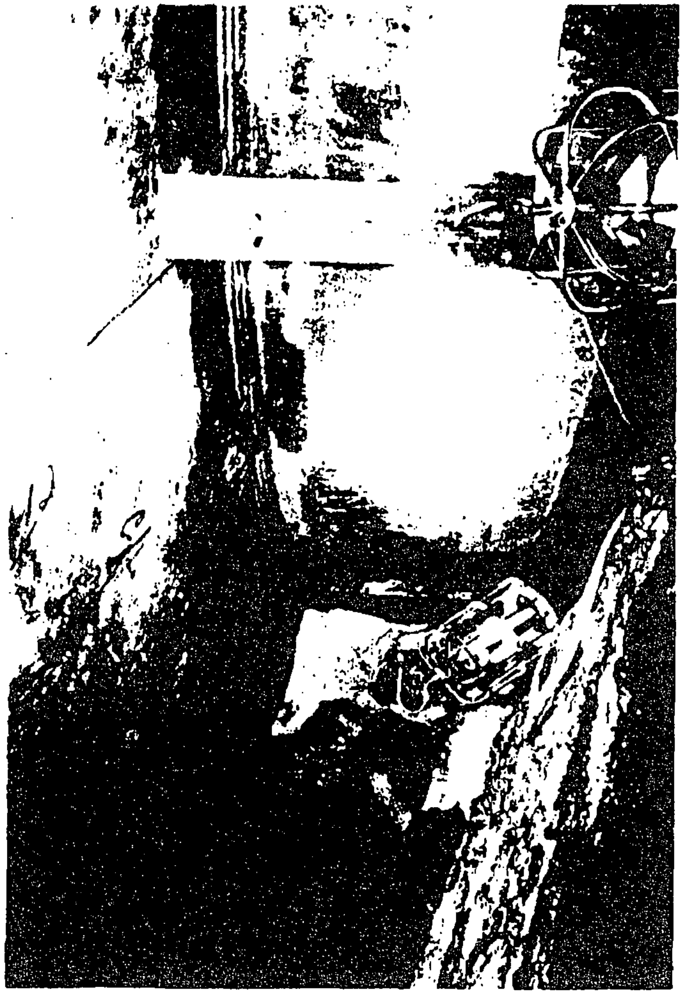
Subject		Calc No.	Rev. No.	Sheet No.
O.C Drywell Ext. Ut Evaluation in Sandbed		C-1302-187-5320-024	0	51 of 54
Originator MARK YEKTA	Date 01/12/93	Reviewed by S. C. Tumminelli		Date 04/16/93



Bay #15 Looking towards **Bay#17** which has been closed with foam for coating work in **Bay #17**. Note the typical surface of the D/W shell and localized corroded spot



Bay #13 - Looking toward Bay #15 - Lower left corner showing UT spot #7,12 & 16. This close up has captured the peaks and valleys of the corroded shell in vivid detail. Later NDE inspection revealed depth between peaks and valleys in the 0.25" - 0.40"



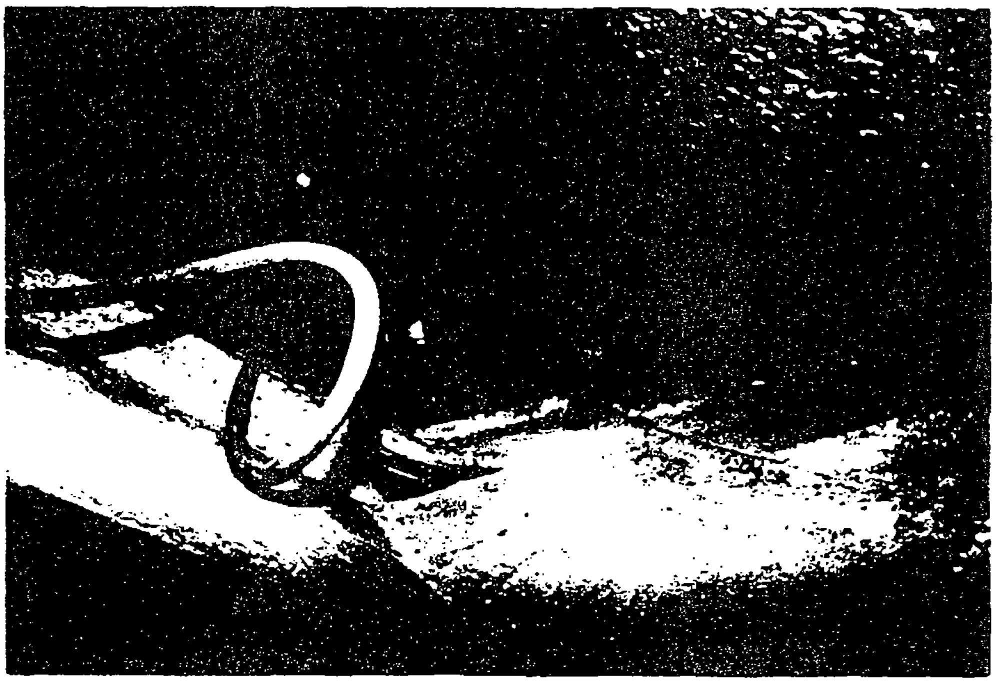
Bay #15 - Note the original lead primer on vent tube OD surface. The "Tub Ring" was less prominent on the shell in this bay except a portion in lower left corner. Also note presence of lead primer on vent collar/ring plate.

Bay #15 Looking toward Bay #13 showing portions of D/W shell and concrete floor, after removal of loose debris / sand / rust. The concrete floor in this bay is one of the better ones. However - Note ① no drainage channel and ② cratered holes near shell corner.

GPU Nuclear **Calculation Sheet**

Subject		Calc No.	Rev. No.	Sheet No.
O.C Drywell Ext. Ut.Evaluation in Sandbed		C-1302-187-5320-024	0	53 of 54
Originator MARK YEKTA	Date 01/12/93	Reviewed by S. C. Tumminelli		Date 04/16/93

Bay #13 - Looking toward **Bay #11** - Lower right corner of D/W shell showing UT spots 9, 10, 18 & 19 Note the location of these spots - all are located in the valleys of the corroded surface This photo also shows the condition of the concrete floor. It appears



Bay #13 - Looking toward **Bay #15** - This photo captures the concrete floor condition and a portion of lower shell corroded surface in very great detail. The floor in this area

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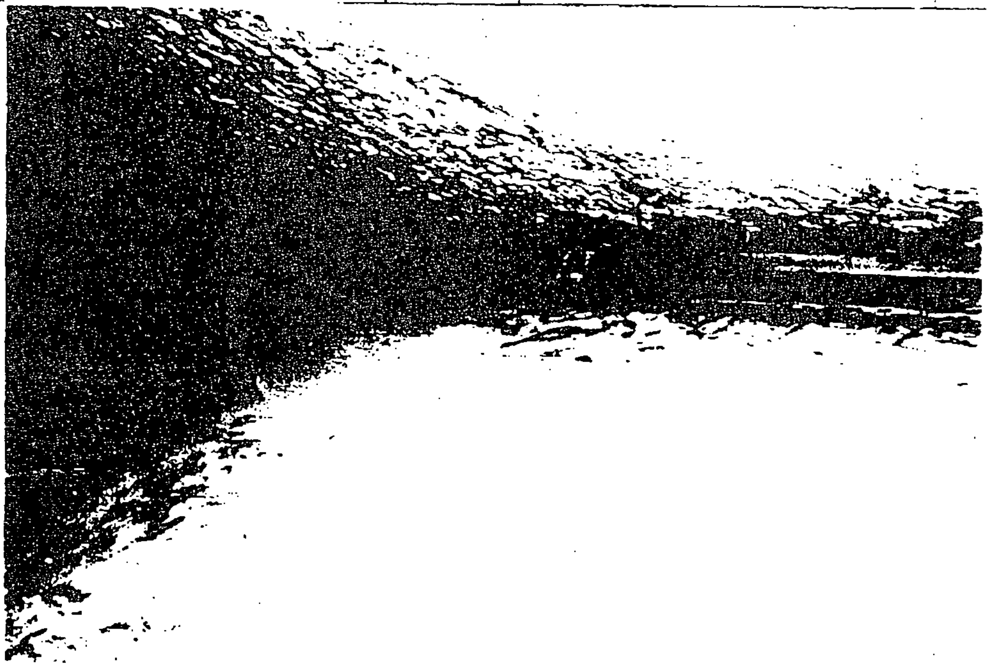
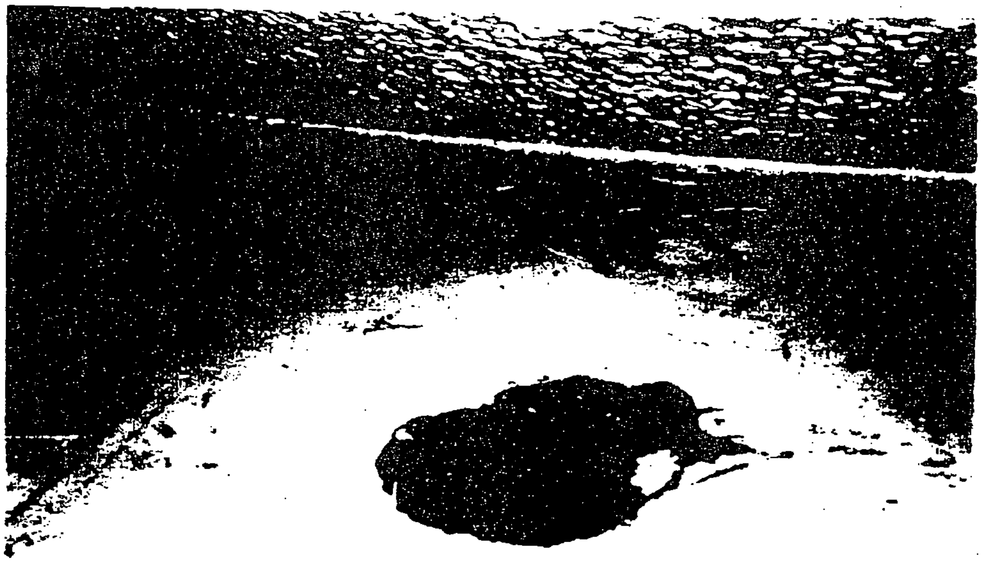
Subject		Calc No.	Rev No.	Sheet No.
O.C Drywell Ext. Ut Evaluation in Sandbed		C-1302-187-5320-024	0	54 of 54
Originator: MARK YEKTA	Date: 01/12/93	Reviewed by: S. C. Tumminelli		Date: 04/16/93



Finished floor, vessel with two top coats - caulking material applied.



Drain after floor has been refurbished