RAS 14225

U.S. NUCLEAR REGULATORY COMMISSION

In the Matter of AMERGEN ENERGY CO., LLC

Docket No. 50-0219-LR Official Exhibit No. 18 APPLICANT'S EXHIBIT 18

OFFERED by: Applicant/Licensee Intervenor _____ NRC Staff Other _____

IDENTIFIED on 9/20/07 Witness/Panel N/A

Action Taken: ADMITTED REJECTED WITHDRAWN

Reporter/Clerk NN

Exelon Nuclear

Revision 2
Page 28 of 61

ATTACHMENT 1

Design Analysis Cover Sheet
Page 1 of 117

Design Analysis (Major Revision)		Last Page No.[5] 117	
Analysis No.:[1]	C-1302-187-5320-024	Revision:[2]	1
Title:[3]	OC Drywell Ext. UT Evaluation in Sandbed		
EC/ECR No.:[4]	06-00634	Revision:[6]	0

		Component(s):[14]	
Station(s):[7]	Oyster Creek		
Unit No.:[8]	1	187	
Discipline:[9]	Mechanical/Structural Eng.		
Descrip. Code/Keyword:[10]	UT Data Assessments		
Safety/QA Class:[11]	Q		
System Code:[12]	187		
Structure:[13]	Drywell Vessel		

DOCKETED
USNRC

October 1, 2007 (10:45am)

OFFICE OF SECRETARY
RULEMAKINGS AND
ADJUDICATIONS STAFF

CONTROLLED DOCUMENT REFERENCES[15]

Document No.:	From/To	Document No.:	From/To
GE # Index 9-4	From		
GE # Index 9-3	From		
GE Letter Report: "Sandbed Local Thinning and Raising the Fixity Height Analysis"	From		

Is this Design Analysis Safeguards Information?[16] Yes ☐ No ☒ If yes, see SY-AA-101-106

Does this Design Analysis contain Unverified Assumptions?[17] Yes ☐ No ☒ If yes, ATI/AR#:

This Design Analysis SUPERCEDES:[18] N/A in its entirety.

Description of Revision (list affected pages for partials):[19] Revised Calculation to clarify methods used to evaluate UT Measurements of the external Drywell Shell. Also, reformatted portions of the calculation to bring it inline with the existing calculation procedure at Oyster Creek Generating Station. ~~Revised or added the following pages: 3, 4, 6, 7, 8, 9, 10, 11, 12, 13, 14, 15, 16, 17, 18, 19, 21, 23, 25, 27, 30, 32, 33, 34, 35, 36, 37, 39, 40, 42, 43, and 45.~~ Also added Appendix D, NDE Inspection Sheets

ALL PAGES CHANGED. JH

Preparer:[20]	Jeffrey H. Horton (Enercon)	Jeffrey H. Horton	07/24/06
	Print Name	Sign Name	Date
Method of Review:[21]	Detailed Review ☒	Alternate Calculations (attached) ☐	Testing ☐
Reviewer:[22]	Omesh Abhat (Enercon)	OBAbhat	07/24/06
	Print Name	Sign Name	Date
Review Notes:[23]	Independent review ☒	Peer review ☐	

Review of the revised part of the calculation has been performed and is acceptable. The review (Rev. 1) addresses clarification of the original calculation only as described above under Description of Revision. Analytical buckling inputs are taken from References 3.3 (Table 4.1) and 3.5. They are assumed acceptable inputs for this calculation as provided by the client.

(For External Analyses Only) External Approver:[24]	Don Shivas (Enercon)	Donald Shivas	07/21/06
	Print Name	Sign Name	Date
Exelon Reviewer:[25]	PT 8/3/06	Peter Tamburro	8/3/06 9/21/06
	Print Name	Sign Name	Date
Is a Supplemental Review Required?[26]	Yes ☐	No ☒	If yes, complete Attachment 3
Exelon Approver:[27]	T. NICKERSON *	Chas G. Nickerson	9/21/06
	Print Name	Sign Name	Date

* ACTING MANAGER FOR F.H. RAY (WITH HIS CONCURRENCE).

OCLR00014537

Template=SECY-028

SECY-02

ATTACHMENT 2
Owners Acceptance Review Checklist for External Design Analysis
Page 1 of 1

PAGE 1A OF 117

DESIGN ANALYSIS NO. C-1302-187-5370-024 **REV:** 001

		Yes	No	N/A
1.	Do assumptions have sufficient rationale?	☒	☐	☐
2.	Are assumptions compatible with the way the plant is operated and with the licensing basis?	☒	☐	☐
3.	Do the design inputs have sufficient rationale?	☒	☐	☐
4.	Are design inputs correct and reasonable?	☒	☐	☐
5.	Are design inputs compatible with the way the plant is operated and with the licensing basis?	☒	☐	☐
6.	Are Engineering Judgments clearly documented and justified?	☒	☐	☐
7.	Are Engineering Judgments compatible with the way the plant is operated and with the licensing basis?	☒	☐	☐
8.	Do the results and conclusions satisfy the purpose and objective of the Design Analysis?	☒	☐	☐
9.	Are the results and conclusions compatible with the way the plant is operated and with the licensing basis?	☒	☐	☐
10.	Does the Design Analysis include the applicable design basis documentation?	☒	☐	☐
11.	Have any limitations on the use of the results been identified and transmitted to the appropriate organizations?	☒	☐	☐
12.	Are there any unverified assumptions?	☐	☒	☐
13.	Do all unverified assumptions have a tracking and closure mechanism in place?	☐	☐	☒
14.	Have all affected design analyses been documented on the Affected Documents List (ADL) for the associated Configuration Change?	☒	☐	☐
15.	Do the sources of inputs and analysis methodology used meet current technical requirements and regulatory commitments? (If the input sources or analysis methodology are based on an out-of-date methodology or code, additional reconciliation may be required if the site has since committed to a more recent code)	☒	☐	☐
16.	Have vendor supporting technical documents and references (including GE DRFs) been reviewed when necessary?	☒	☐	☐

EXELON REVIEWER: Peter Tamburro / [signature] **DATE:** 8/2/06
Print / Sign

AmerGen	DOCUMENT NO. C-1302-187-5320-024

TITLE: OC Drywell Ext. UT Evaluation in Sandbed

REV	SUMMARY OF CHANGE	APPROVAL	DATE
0	Initial Issue	GPU Nuclear Signatures on File	04/16/93
1	Revised Calculation to clarify methods used to evaluate UT Measurements of the external Drywell Shell. Also, reformatted portions of the calculation to bring it inline with the existing calculation procedure at Oyster Creek Generating Station. ~~Revised or added the following pages:~~ ALL PG's CHANGED. ~~3, 4, 6, 7, 8, 9, 10, 11, 12, 13, 14, 15, 16, 17, 18, 19, 21, 23, 25, 27, 30, 32, 33, 34, 35, 36, 37, 39, 40, 42, 43, and 45.~~ Also added Appendix D, NDE Inspection Sheets A Complete Revision PT 9/21/06 REVISION PERFORMED UNDER ECR# 06-00634.	Jeffrey H. Horton Enercon Services Omesh Abhat Enercon Services Don Shivas Enercon Services	07/24/06 07/24/06 07/24/06
	Please Note Originator and Reviewer at the Top of Pages 3 through 117 are associated with Revision 0. Revision 1 originator and Reviewer are documented on Page 1 ABOVE. 9/21/06	Peter Tomberlin T. Nickerson (ACTING MGR. FOR F.H. RAY)	9/21/06 9/21/06

OCLR00014539

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PT 9/21/06

7.0 Calculations 14

PT 9/21/06

1.0 PROBLEM STATEMENT:

The purpose of this calculation is to evaluate the Ultrasonic Test (UT) thickness measurements taken in the sandbed region during the 14R outage in support of the 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 the GE structural analysis reports References 3.2, 3.3 and 3.5. Additional acceptance criteria was developed to address measurements below 0.736 inch. The results are summarized in Table 2-1.

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 2-1.

UT measurements for bays 1 and 13 were evaluated using detailed criteria described in this calculation and the results are summarized in Table 2-1 below:

SUMMARY OF UT EVALUATIONS
TABLE (2-1)

Drywell Bay	General Sandbed Shell Thickness[1]			Local Sandbed Thickness[2]			Comments
	Thickness Criteria Inches	Actual Thickness inches	Acceptable Yes/No	Thickness Criteria Inches	Actual Thickness	Acceptable Yes/No	
1	0.736" whole Bay	UT_{Avg}=0.822 T_{Eval}=0.766	Yes Yes	0.636" over a 12"x12" area	T_{Eval} = 0.692" Over a 4"x4" area	Yes	See Pages 14 through 21 for details of evaluation
3	0.736" whole Bay	UT_{Avg}=0.868	Yes	0.636" over a 12"x12" area	N/A	N/A	No locations in bay are below 0.736". See Pages 22 & 23
5	0.736" whole Bay	UT_{Avg}=0.986	Yes	0.636" over a 12"x12" area	N/A	N/A	No locations in bay are below 0.736". See Pages 24 & 25
7	0.736" whole Bay	UT_{Avg}=1.001	Yes	0.636" over a 12"x12" area	N/A	N/A	No Locations in bay are below 0.736" see Pages 26 & 27
9	0.736" whole bay	UT_{Avg}=0.915	Yes	0.636" over a 12"x12" area	N/A	N/A	No Locations in bay are below 0.736" see Pages 28 and 29
11	0.736" whole bay	UT_{Avg}=0.792 T_{Eval}=0.751	Yes	0.636" over a 12"x12" area	N/A	N/A	One location with a thickness less than 0.736" but not greater than 2" in Dia. See Pages 30 to 32
13	0.736" whole bay	UT_{Avg}=0.810 T_{Eval}=0.767	Yes	0.636" over a 12"x12" area	T_{Eval}=0.693"over a 6"x6" area	yes	See pages 33 through 40 for details of evaluation
15	0.736" Whole Bay	UT_{Avg}=0.816 T_{Eval}=0.859	Yes	0.636" over a 12"x12" area	N/A	N/A	One location with a thickness less than 0.736" but not greater than 2" in Dia. See Pages 41 to 43
17	0.736" Whole Bay	UT_{Avg}=0.918 T_{Eval}=0.871	Yes	0.636" over a 12"x12" area	N/A	N/A	One location with a thickness less than 0.736" but not greater than 2" in Dia. See Pages 44 to 46
19	0.736" Whole Bay	UT_{Avg}=0.885	Yes	0.636" over a 12"x12" area	N/A	N/A	No Locations in bay are below 0.736" see Pages 47 and 48

Notes: 1. UT_{Avg} are the average shell thickness readings using a D-Meter in local areas not less than the buckling design thickness of 0.736" these areas do not exceed 2" in diameter. T_{Eval} is the average calculated Thickness of the shell surrounding areas not exceeding 2" in diameter that have UT D-Meter shell thickness readings less than 0.736". See Section 6, Methods of Analysis, Acceptance Criteria – General Wall (Sandbed Region) for details.

2. Small Areas of reduced thickness 2&½" or less in diameter have a negligible effect on shell buckling. See Section 6 Methods of Analysis, Acceptance Criteria –Very Local Wall (2½ Inches in Diameter) for details.

OCLR00014542

3.0 REFERENCE:

3.1 Drywell sandbed region pictures (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.

3.7 Theory of Elastic Stability, by Stephen P. Timoshenko and James M. Gere, Second Edition, Engineering Societies Monographs, McGraw Hill Book Company, New York, 1961

4.0 ASSUMPTIONS AND BASIC DATA:

4.1 Raw UT measurements for each bay are presented in Appendix D and summarized in the body of calculation.

4.2 References 3.2, 3.3 and 3.5 have been design verified and are assumed correct.

5.0 DESIGN INPUTS:

5.1 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 roughness for the entire outside surface of the drywell in the sandbed region. This is defined as T_{rough}.

5.2 Drywell Design Pressure = 44.0 psig, Oyster Creek, UFSAR Revision 13, Section 3.8.2.8, Page 3.8-61

Drywell Design Temperature = 292°F, Oyster Creek, UFSAR Revision 13, Table 3.11-1

5.3 The required sandbed shell thickness for the Design Pressure and Temperature is defined in paragraph ASME B&PV Code, Subsection NE, paragraph NE-3324.4, Spherical Shells, as:

$$t = \frac{PR}{2S - 0.2P}$$ Where: P = Design Pressure

R = Inside Radius of the Shell = 420 inches

S = Maximum Allowable Stress, SA 212 Grade B
= 19,300 psi (From ASME B&PV Code Section VIII 1962 Edition and Reference 3.2, Section 2.2)

Substituting values in the equation we have:

$$t = \frac{(44.0\text{psig})(420.0")}{2(19{,}300\text{psi}) - 0.2(44.0\text{psig})} = 0.4789 \text{ inches}$$

5.3 Drywell Sandbed buckling design thickness is 0.736 inches. Taken from References 3.3, and 3.5

5.4 Analytical design inputs are taken from References 3.3, 3.4 and 3.5

6.0 METHODS OF ANALYSIS:

Development of "Evaluation Thickness"

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 the general sandbed 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.

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 with a depth gauge and straight edge at 0°, 45°, 90° and 135° around these inspected dimples. The depths obtained were averaged with respect to the tops of the locally rough areas. These depths are referred to herein as the AVG micrometer measurements. As these AVG micrometer measurements are very local in nature their effect on the structural response of the drywell to applied loads is very limited. A more meaningful shell thickness for the drywell structural response to applied loads is the general shell thickness near the UT measured indications. This can be obtained on a smooth shell exterior surface by adding the UT measured thickness at the bottom of the indication and the AVG micrometer measurements of the indication depth. But because the exterior of the drywell shell in the sandbed region is very rough and dimpled the measurement described above would give optimistic general shell thicknesses near the indications (See Figure 6.1). To determine a conservative general shell thickness at the locations of interest Design Input 5.1 of this calculation is subtracted from the combination of the UT measurement and the depth micrometer readings. This thickness is then used to determine the drywell shell susceptibility to buckling by comparing this thickness to the buckling design thickness of 0.736 inches. This thickness is referred to as the evaluation thickness which as described above is computed as:

T (evaluation) = UT (measurement) + AVG (micrometer) - T_{rough}
where:
T (evaluation) = General shell thickness used for the evaluation
UT (measurement) = thickness measurement at the area (location)
AVG (micrometer) = average depth of the area relative to its immediate surroundings
T_{rough} = 0.200 inches = a conservative value of depth of typical dimple on the shell surface. See Design Input 5.1.

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

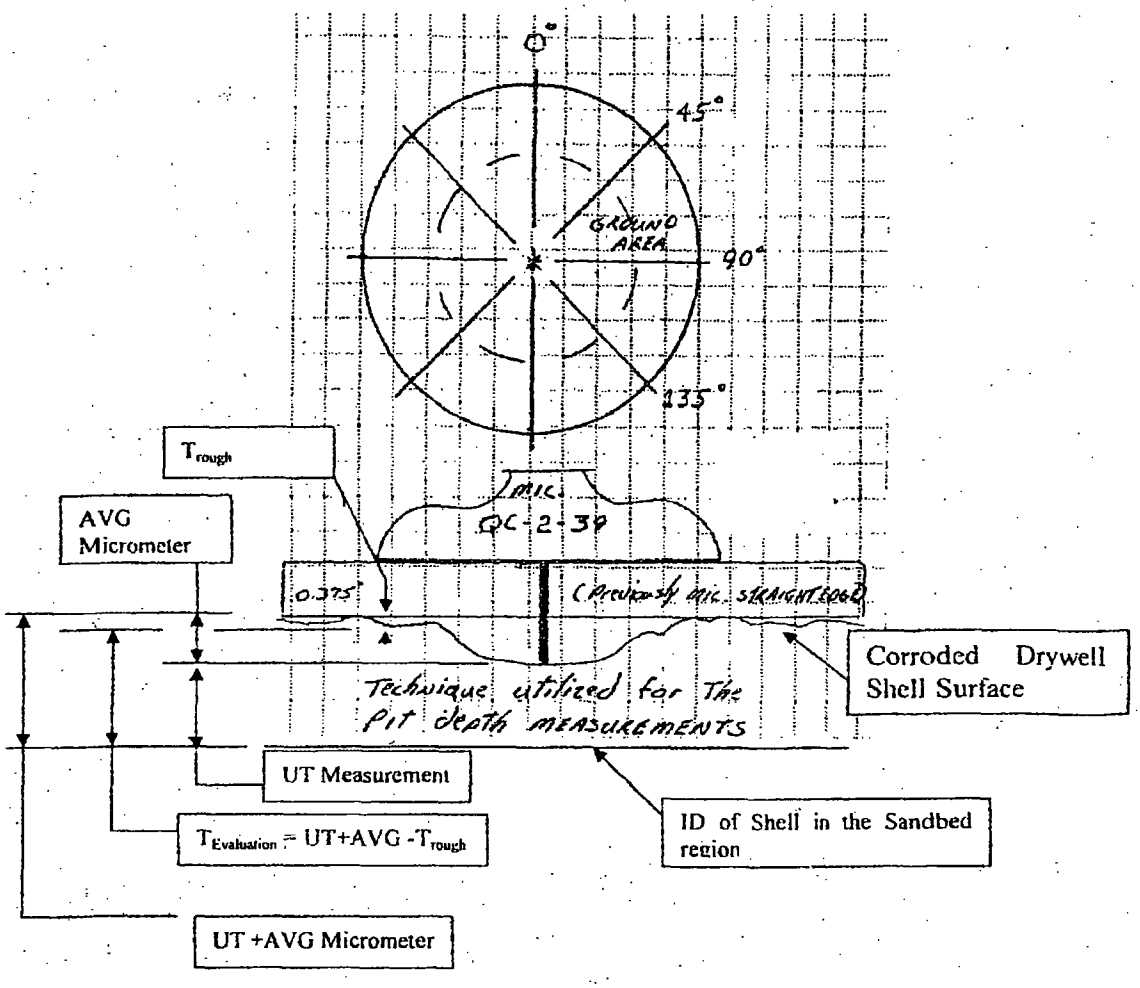
0°
45°
GROUND AREA
90°
135°
MIC. QC-2-39
0.375"
(Previously MIC. STRAIGHT EDGE)
Technique utilized for the Pit depth measurements
T_{rough}
AVG Micrometer
Corroded Drywell Shell Surface
UT Measurement
$T_{Evaluation}$ = UT+AVG -T_{rough}
ID of Shell in the Sandbed region
UT +AVG Micrometer

FIGURE 6.1

Sandbed General Wall Criteria:

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 a projected uniform thickness of 0.736 inches in the sandbed area taken from References 3.3, and 3.5. 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.

Local Wall Criteria:

If the thickness for evaluation is less than 0.736 inches, then the use of specific GE studies is employed (Ref. 3.5). The studies in Reference 3.5 do not reflect actual drywell shell conditions but are used as assessment tools for areas of the sandbed region that have reduced thicknesses. The methodology used in these studies is provided in reference 3.3 with a excerpt provided here. The studies contain a two step eigenvalue formulation procedure to perform linear elastic buckling analysis of the drywell shell with local areas of reduced thickness. The first step is a static analysis of the structure with all the anticipated loads applied. The structural stiffness matrix, [K], the stress stiffness matrix, [S], and the applied stresses, $\lfloor \sigma_{ap} \rfloor$, are developed and saved from this static analysis. A buckling pass is then run to solve for the lowest eigenvalue or load factor, λ, for the whole structure at which elastic buckling can occur. This load factor, or eigenvalue is a multiplier for the applied stress state or applied load at which the onset of elastic buckling will theoretically occur. All the applied stresses in the structure are scaled equally by the load factor.

This analysis technique is applied to the drywell pie slice finite element model, with a reduction in thickness of 0.200 inches (below the design buckling thickness of 0.736") in a local area of 12 x 12 inches in the sandbed region, tapering to the original thickness over an additional 12 inches, located to result in the largest reduction in load factor possible. This location is selected at the point of maximum deflection of the eigenvector shape associated with the lowest buckling load. The theoretical load factor / eigenvalue for this case was reduced by 9.5% from 6.14 to 5.56.

It should be noted that this reduction of 0.200 inches is over a 144 square inch area of the shell while the actual surface area including the tapering of the thickness is 36 by 36 inches or 1,296 square inch area with thicknesses that are below the 0.736 inch buckling design thickness. This additional tapered area and its reduced thicknesses also contributed to the 9.5% reduction in load factor.

In addition, to the reported result for the 0.536" or a 27% reduction in thickness buckling analysis, a second buckling analysis was performed for a wall thickness reduction of 13.5% or a thickness 0.636 inches over a one square foot area. The results of this case reduced the load factor and theoretical buckling stress by 3.9% in Reference 3.5. The center of the thinned area was located close to the maximum displacement point in the buckling analysis with uniform thickness 0.736" as per Reference 3.5. Again, although this reduction of 13.5% or 0.636 inches is over a 144 square inch area of the shell, the actual surface area including the tapering of the thickness is a 36 by 36 inch or 1,296 square inch area with thicknesses that are below the buckling design thickness. This additional tapered area and its reduced thicknesses also contribute to the 3.9% reduction in load factor stated previously.

Very Local Wall Criteria (2½ Inches In Diameter or Less):

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

Primary Membrane Plus Bending

The acceptance criteria for these measurements confined to an area less than 2 ½ inches in diameter experiencing primary membrane plus bending stresses is based on ASME B&PV Code, Section III, Subsection NE, Class MC Components, Paragraphs NE-3213.2 Gross Structural Discontinuity, NE-3213.10 Local Primary Membrane Stress, NE-3332.1 Openings not Requiring Reinforcement, NE-3332.2 Required Area of Reinforcement and NE-3335.1 Reinforcement of Multiple Openings. The use of Paragraph NE-3332.1 is limited by the requirements of Paragraphs NE-3213.2 and NE-3213.10. In particular NE-3213.10 limits the meridional distance between openings without reinforcement to $2.5\sqrt{Rt}$. Also Paragraph NE-3335.1 only applies to openings in shells that are closer than 2 times their average diameter.

The implication of these paragraphs are that shell failures at these locations from primary stresses produced by design pressure cannot occur provided openings in shells have sufficient reinforcement. The current design pressure of 44 psig for the drywell requires a thickness of 0.479 inches in the sandbed region of the drywell. A review of all the UT data presented in Appendix D of the calculation indicates that all thicknesses in the drywell sandbed region exceed the required pressure thickness by a substantial margin and there are no openings in the sandbed region of the drywell shell that do not contain the required design pressure reinforcement for the design code of record. Therefore, the requirements specified by the referenced code sections in the previous paragraph are not required for the very local wall thickness evaluation presented in the calculation.

Buckling

The effect of these very local wall thickness areas on the buckling of the shell requires some discussion of the buckling mechanism in a shell of revolution under an applied axial and lateral pressure load.

To begin the discussion we will describe the buckling of a simply supported cylindrical shell under the influence of lateral external pressure and axial load. As described in Chapter 11 of Reference 3.7, thin cylindrical shells buckle in lobes in both the axial and circumferential directions. These lobes are defined as half wave lengths of Sinusoidal functions. The functions are governed by the radius, thickness and length of the cylinder. If we look at a specific thin walled cylindrical shell both the length and radius would be essentially constants and if the thickness was reduced locally then this reduction would have to be significant and over a majority of the lobe so that the compressive stress in the lobe would exceed the critical buckling stress under the applied loads, thereby causing the shell to buckle locally. This is demonstrated in Reference 3.5 where a 12 x 12 square inch section of the drywell sandbed region is reduced by 200 mils and a local buckle occurred in the finite element eigenvalue extraction analysis of the drywell.

Now reviewing the stability analyses provided in both References 3.3 and 3.5 and recognizing that the finite elements in the sandbed region of the model are 3" x 3", it is clear that the circumferential buckling lobes for the drywell are substantially larger than the 2 ½ inch diameter very local wall areas. This combined with the local reinforcement surrounding these local areas and the spherical shell being close to the constraint provided by the concrete supporting structure indicates that these areas will have no impact on the buckling margins in the shell.

It is also clear from Reference 3.5 that a uniform reduction in thickness of 27% over a one square foot area followed by a transition zone would only create a 9.5% reduction in the load factor and theoretical buckling load of the drywell. Although this reduction of 27% is only over a 144 square inch area of the shell, the actual surface area including the transition zone to the 0.736 inch buckling design thickness is a 36 inch by 36 inch or 1,296 square inch area. This area of reduced thickness was located in the portion of the sandbed considered most susceptible to buckling, the midpoint of a bay between two vents.

In addition, a second buckling analysis was performed (Reference 3.5) for a wall thickness reduction of 13.5% or a thickness of 0.636 inches over a one square foot area followed by a transition zone from 0.636 inches to 0.736 inches. Again, although this reduction from 0.736 inches to 0.636 inches is over a 144 square inch area of the shell, while the actual surface area including the transition zone to the buckling design thickness is a 36 inch by 36 inch or a 1,296 square inch area. This second buckling analysis resulted in a 3.9% reduction in the load factor.

To bring these analyses results into perspective with the inspected very local areas, a review of the NDE Reports (Appendix D) indicates there are twenty UT measured areas

all less than 2½" in diameter or less than 4.9 square inches each in area isolated throughout the entire sandbed region that have thicknesses less than 0.736". Compared to the analyses presented in Reference 3.5 the twenty areas would have to have a minimum area of reduced thickness of 144 square inches with a thickness of 0.636 which represents a 13.5% reduction in wall thickness that equates to a 72.0 cubic inch loss of material located in the portion of the drywell sandbed region most susceptible to buckling to produce a 3.9% reduction in the theoretical buckling load and load factor for the drywell. The review of the NDE Reports also indicated that the average wall thickness of the twenty areas is 0.703 inches which represents a 4.5% reduction in wall thickness that equates to a 3.2 cubic inch loss of material and a total maximum area of 98 square inches if the twenty measured areas where contiguous with each other. This indicates that the twenty isolated areas with thicknesses less than the buckling design thickness would not have a significant effect on the buckling of the OC Drywell Shell.

7.0 CALCULATIONS:

UT EVALUATION BAY #1:

The outside surface of this bay is rough and full of dimples similar to the outside surface of a 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 other like figures presented in this calculation are NOT TO SCALE). The graphical presentation in Figure 1 of measured indications is extracted from Appendix D, Calculation Pages 71 to 76. Based on the inspectors observations the bathtub ring is 12 to 18 inches wide and about 75 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 (Locations 6, 7, 8, 9, 16, 17, 18, 19, 22 and 23) are all above 0.750 inches (See Table 1-b) except location 7 which is very local area.

Bay #1 General Wall (Sandbed Region) Thickness Evaluation

Therefore, taking the average of the UT measured thicknesses of locations 6, 7, 8, 9, 16, 18, 19 and 22 gives a average thickness of 0.816 inches for the shell below the bathtub ring. Based on this a conservative mean thickness of 0.800 inches, is estimated to represent the evaluation thickness for this bay outside the bounds of the bathtub ring. Given a uniform thickness of 0.800 inches for these areas of the bay, it is concluded that these areas are acceptable based on the thickness exceeding the buckling design thickness for the sandbed region of 0.736 inches using the results of Reference 3.3.

Locations 1, 2, 3, 4, 5, 10, 11, 12, 13, 20, and 21 are confined to the bathtub ring as shown in Figure 1. To determine the general shell thickness in the bathtub ring area of this bay the evaluation thicknesses for each of the locations defined above are averaged together. An example of a typical calculation of the general wall thickness defined as the evaluation thickness is presented below for clarity:

$$(\text{AVG Micrometer})_1 = \frac{D_{1-0^0} + D_{1-45^0} + D_{1-90^0} + D_{1-135^0}}{4}$$

Where: $D_{1-0}{}^0$ = Micrometer Depth Reading for location 1 at 0 degrees taken from Appendix D, Calculation Page 74, etc.

$$(\text{AVG Micrometer})_1 = \frac{0.272"+0.204"+0.206"+0.185"}{4} = 0.217"$$

$$T_{(Evaluation)1} = UT_{(Measurement)1} + (\text{AVG Micrometer})_1 - T_{rough}$$

Where: $UT_{(Measurement)1}$ = 0.720" Taken from Appendix D, Calculation Page 71, Location 1

T_{rough} = 0.200" See Design Input 5.1 and Section 6, Acceptance Criteria, General Wall.

$$T_{(Evaluation)1} = 0.720"+0.217"-0.200" = 0.737"$$

Bay 1 AVG Micrometer Calculations
Table 1-a

Location	Azimuth(1)				AVG
	0^0	45^0	90^0	135^0	
1	0.272"	0.204"	0.206"	0.185"	0.217"
2	0.143"	0.133"	0.143"	0.154"	0.143"
3	0.397"	0.316"	-------	0.329"	0.347"
5	0.330"	0.290"	0.304"	0.330"	0.313"
7	0.208	0.281"	0.246"	0.330"	0.266"
11	0.200"	0.211"	0.225"	0.211"	0.212"
12	0.299"	0.316"	0.261"	0.328"	0.301"
21	0.222"	0.202"	0.238"	0.183"	0.211"

NOTES: 1. AZIMUTH DATA TAKEN FROM APPENDIX D, CALCULATION PAGE 74.

An average value of the evaluation thicknesses presented in Table 1-c for this band is as follows;

Location	Evaluation Thickness
1	0.737"
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 cannot be quantified since no micrometer readings were taken.

Again given that the average evaluation thickness of the shell in the bathtub ring area exceeds the buckling design thickness of 0.736 inches the shell area within the bathtub ring is also acceptable using the results of Reference 3.3.

Bay #1 Local Wall and Very Local Wall Thickness Evaluation

The individual measured thicknesses must also be evaluated for compliance with the local wall thickness criteria. Table 1-b 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.

Eight locations shown in Table 1-b (1, 2, 3, 5, 7, 11, 12, and 21) have measurements below 0.736 inches. Inspectors 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 4 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 of very local areas below 0.736 inches were found to be above 0.736 inches except for two locations, 2 and 11, as shown in Table 1-c.

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.

In order to quantify the effect of this local region and to address structural compliance, the GE study on local effects was used (Ref. 3.5). This study contains an analysis of the drywell shell using the pie slice finite element model. The study reduced the thickness of a 12" by 12" area by 0.100 inches (0.636 inches) and included a transition zone of 12 inches all around from 0.636" to 0.736". When compared to a similar area with a buckling design thickness of 0.736" the total reduced area of 1,296 square inches represents a 13.5% reduction in local shell thickness and a material loss of 72.0 cubic inches. The center of the thinned area was located close to the calculated maximum displacement point in the buckling analysis with uniform thickness of 0.736 inch as per Reference 3.5. For this case the theoretical buckling load factor was reduced by 3.9%.

Based on the buckling design thickness of 0.736 inches the "as found" 4" by 4" area with a thickness of 0.692" represents a 6.3% reduction in local shell thickness and a material loss of 0.7 cubic inches. This volumetric consideration provides a quick visualization, while shell buckling depends on various parameters as discussed in Reference 3.3 and 3.7.

Comparison of the "as found" area of 4" x 4" with the "as analyzed" criteria of 0.636" over a 12" x 12" area, with an additional transition zone of 12", and its associated 13.5% reduction in shell wall thickness and a material loss of 72 cubic inches leads to the conclusion that the effect on the theoretical buckling load factor is negligible. Also based on the location of this 4" x 4" area, is almost directly below the vent and vent header assembly (between 12 to 17 inches to the right of the vent centerline and between 22 and 23 inches down from the vent weld line). This is in the area where buckling of the shell is limited due to the stiffening effect of the vent and vent header assembly. This effect can be clearly seen in the buckling analyses presented in References 3.3 and 3.5.

Remaining Very Local Areas:

A review of Appendix D, Calculation pages 71, 73 and 75 indicates the remaining very local areas of reduced thickness are isolated from each other and therefore, have a negligible effect on the shell buckling. See Section 6, Very Local Wall Criteria (2 ½ inches in diameter or less) for details. Furthermore, the remaining local areas are centered about the vent which significantly stiffen the shell. This stiffening effect combined with the restraint provided by the concrete support structure limits the shell buckling to a point in the sandbed region which is located at the midpoint between the two vents.

Conclusion

In summary, using a conservative estimate of 0.800 inches for evaluation thickness for the entire bay (except the bathtub ring) and a 0.792 inch evaluation thickness for the bathtub ring , plus the acceptance of the local 4" by 4" area with an evaluation thickness of 0.692" based on the GE study, it is concluded that the bay is acceptable.

Bay # 1 UT Data
Table 1-b

Location	D-Meter UT Measurement (inches)	Appendix D on Calculation Page	Average Micrometer (See Table 1-a) (inches)
1	0.720	71	0.217
2	0.716	71	0.143
3	0.705	71	0.347
4	0.760	71	---
5	0.710	71	0.313
6	0.760	71	---
7	0.700	71	0.266
8	0.805	71	---
9	0.805	71	---
10	0.839	73	---
11	0.714	73	0.212
12	0.724	73	0.301
13	0.792	73	---
14	1.147	73	---
15	1.156	73	---
16	0.796	75	---
17	0.860	75	---
18	0.917	75	---
19	0.890	75	---
20	0.965	75	---
21	0.726	75	0.211
22	0.852	75	---
23	0.850	75	---

Summary Of Measurements Below 0.736"
Table 1-c

Location	UT Measurement (1)	AVG Micrometer (2)	Mean Depth/Valley (3)	T (Evaluation) (4)=(1)+(2)-(3)	Remarks
1	0.720"	0.217"	0.200"	0.737"	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".

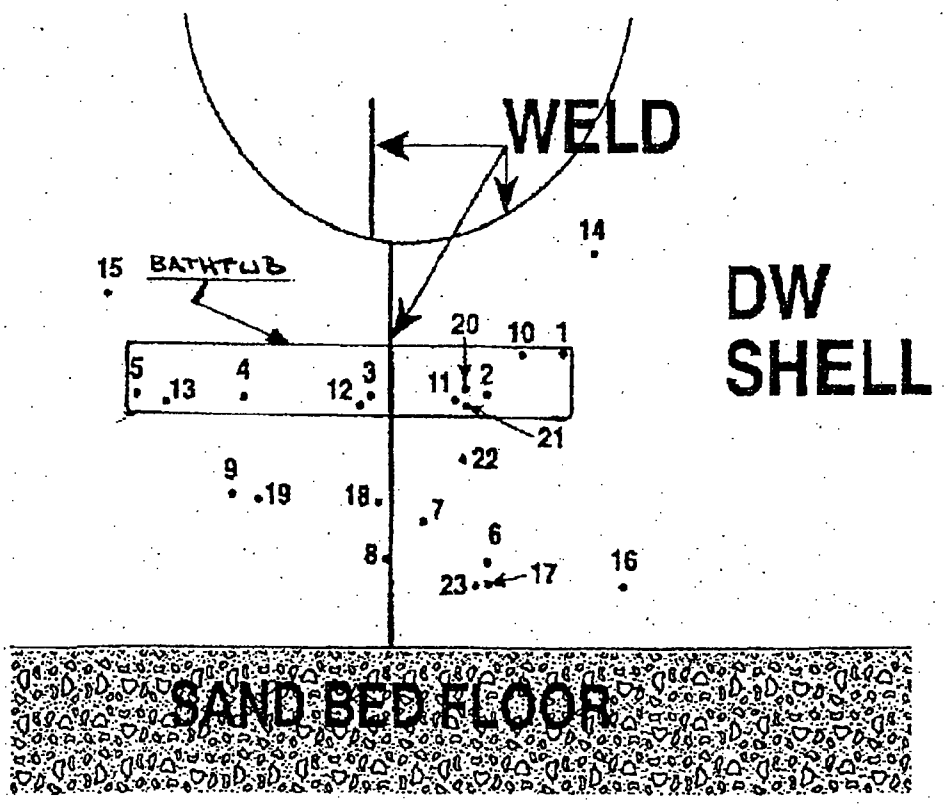

FIGURE (1)

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.

Bay #3 General Wall (SandBed Region) Thickness Evaluation

Given an average of the UT measurements presented in Table 3 equal to 0.868 inches, a conservative mean evaluation thickness of 0.850 inches is estimated for this bay. Therefore, it is concluded that the bay is acceptable based on the bay evaluation thickness exceeding the buckling design thickness for the sandbed region of 0.736 inches using results of Reference 3.3.

Bay # 3 UT Data
Table 3

Location	D-Meter UT Measurement (inches)	Appendix D on Calculation Page	Average Micrometer (inches)
1	0.795	77	---
2	1.000	77	---
3	0.857	77	---
4	0.898	77	---
5	0.823	77	---
6	0.968	77	---
7	0.826	77	---
8	0.780	77	---

BAY #3 DATA

NOTES:

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

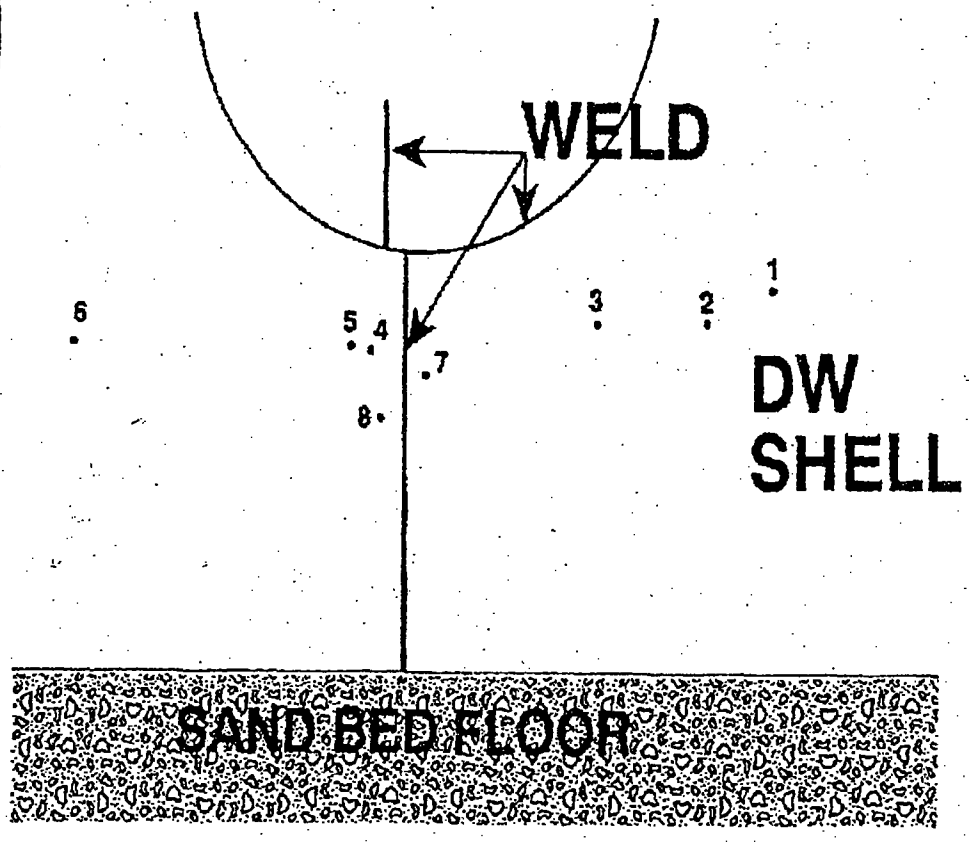

FIGURE (3)

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 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. 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.

Bay #5 General Wall (Sandbed Region) Thickness Evaluation

Given an average of the UT measurements presented in Table 5 equal to 0.986 inches, a conservative mean evaluation thickness of 0.950 inches is estimated for this bay. Therefore, it is concluded that the bay is acceptable based on the bay evaluation thickness exceeding the buckling design thickness for the sandbed region of 0.736 inches using the results of Reference 3.3.

Bay # 5 UT Data
Table 5

Location	D-Meter UT Measurement (inches)	Appendix D on Calculation Page	Average Micrometer (inches)
1	0.970	80	---
2	1.040	80	---
3	1.020	80	---
4	0.910	80	---
5	0.890	80	---
6	1.060	80	---
7	0.990	80	---
8	1.010	80	---

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.

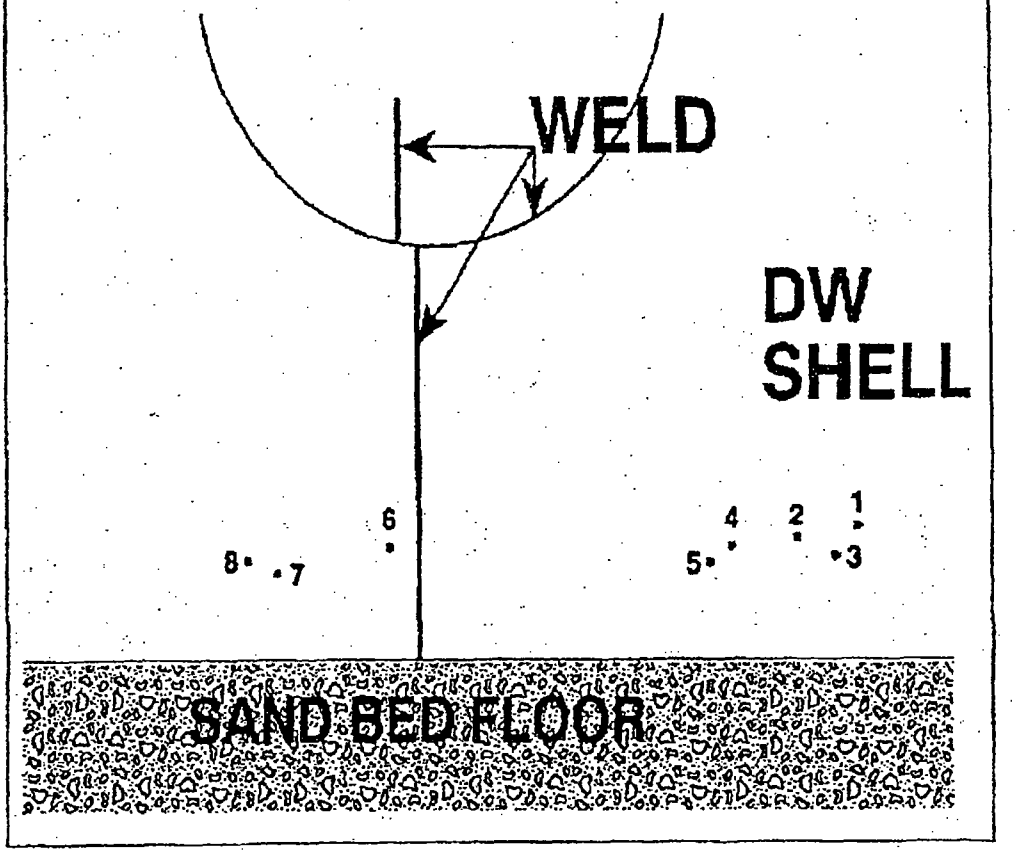

FIGURE (5)

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.

Bay #7 General Wall (Sandbed Region) Thickness Evaluation

Given an average of the UT measurements presented in Table 7 equal to 1.001, a mean evaluation thickness of 1.00 inch is estimated for this bay. Therefore, it is concluded that the bay is acceptable based on the bay evaluation thickness exceeding the buckling design thickness for the sandbed region of 0.736 inches using the results of Reference 3.3.

Bay # 7 UT Data
Table 7

Location	D-Meter UT Measurement (inches)	Appendix D on Calculation Page	Average Micrometer (inches)
1	0.920	84	---
2	1.016	84	---
3	0.954	84	---
4	1.040	84	---
5	1.030	84	---
6	1.045	84	---
7	1.000	84	---

BAY #7 DATA

NOTES:

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

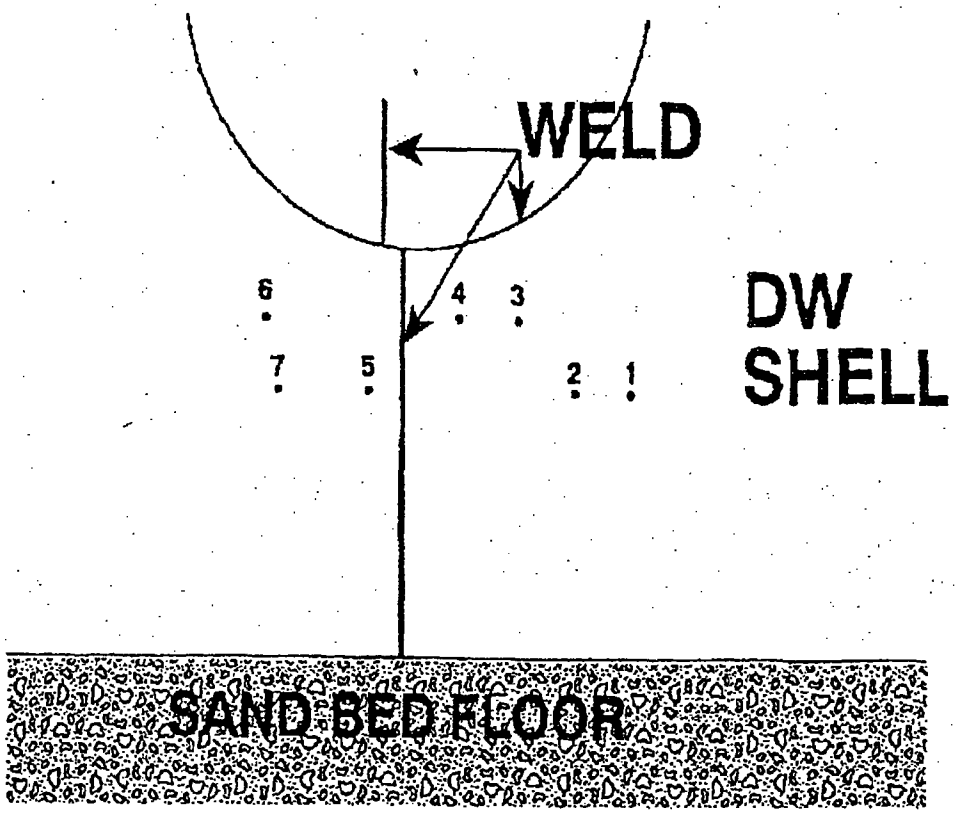

FIGURE (7)

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. Ten 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.

Bay #9 General Wall (Sandbed Region) Thickness Evaluation

Given an average of the UT measurements presented in Table 9 equal to 0.915, a conservative mean evaluation thickness of 0.900 inches is estimated for this bay. Therefore, it is concluded that the bay is acceptable based on the bay evaluation thickness exceeding the buckling design thickness for the sandbed region of 0.736 inches using the results of Reference 3.3.

Bay # 9 UT Data
Table 9

Location	D-Meter UT Measurement (inches)	Appendix D on Calculation Page	Average Micrometer (inches)
1	0.960	85	---
2	0.940	85	---
3	0.994	85	---
4	1.020	85	---
5	0.985	85	---
6	0.820	85	---
7	0.825	85	---
8	0.791	85	---
9	0.832	85	---
10	0.980	85	---

BAY #9 DATA

NOTES:

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

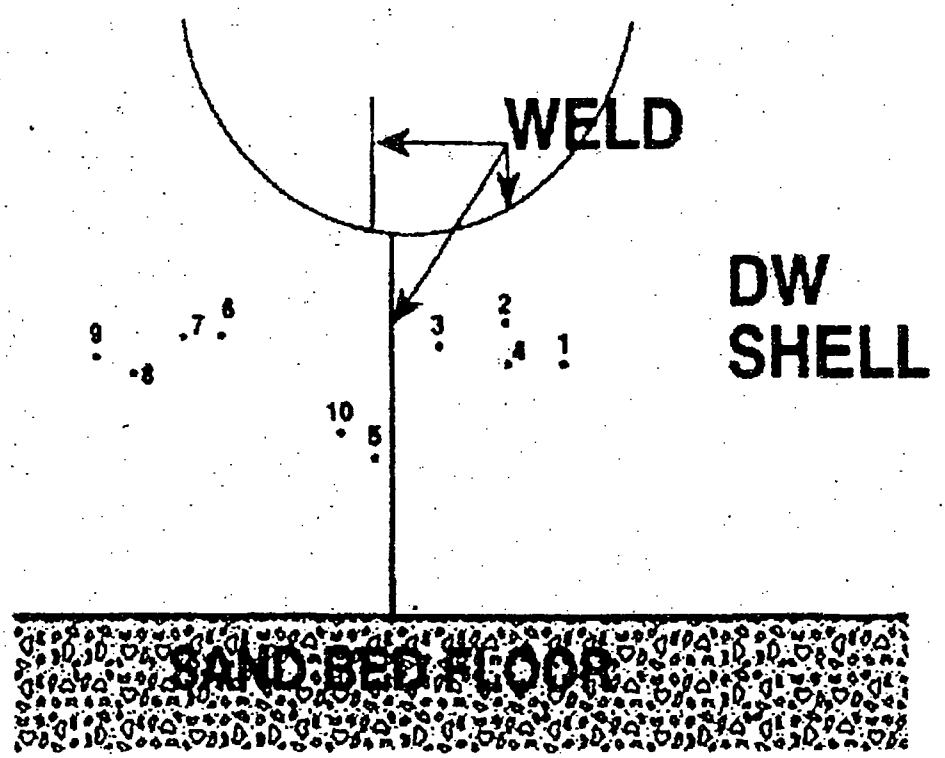

FIGURE (9)

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. Inspectors 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 surrounds was measured at 4 locations around the spot and the average is shown in Table 11-a. As described in Section 6, Methods of Analysis, Very Local Wall Acceptance Criteria, areas of reduced thickness equal to or less than 2 ½ inches are too small to reduce the shell critical buckling load. This combined with the location of the very local indication near the vent reinforcement (See Appendix D, Calculation Page 87) indicates that this area would have a negligible effect on the shell buckling response.

Bay #11 General Wall (Sandbed Region) Thickness Evaluation

Given an average of the UT measurements presented in Table 11-a equal to 0.792 inches, a conservative mean evaluation thickness of 0.790 inches is estimated for this bay. Therefore, it is concluded that the bay is acceptable based on the bay evaluation thickness exceeding the buckling design thickness for the sandbed region of 0.736 inches using the results of Reference 3.3.

The calculation of the average depth for Bay 11, Location 1 is as follows:

$$(\text{AVG Micrometer})_1 = \frac{D_{1-0^0} + D_{1-45^0} + D_{1-90^0} + D_{1-135^0}}{4}$$

Where: $D_{1-0}{}^0$ = Micrometer Depth Reading for location 1 at 0 degrees taken from Appendix D, Calculation Page 91, etc.

$$(\text{AVG Micrometer})_1 = \frac{0.289" + 0.338" + 0.157" + 0.200"}{4} = 0.246"$$

Bay # 11 UT Data
Table 11-a

Location	UT Measurement (inches)	Appendix D Presented on Calculation Page	Average Micrometer (inches)
1	0.705	87	0.246
2	0.770	87	---
3	0.832	87	---
4	0.755	87	---
5	0.831	87	---
6	0.800	87	---
7	0.831	87	---
8	0.815	87	---

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".

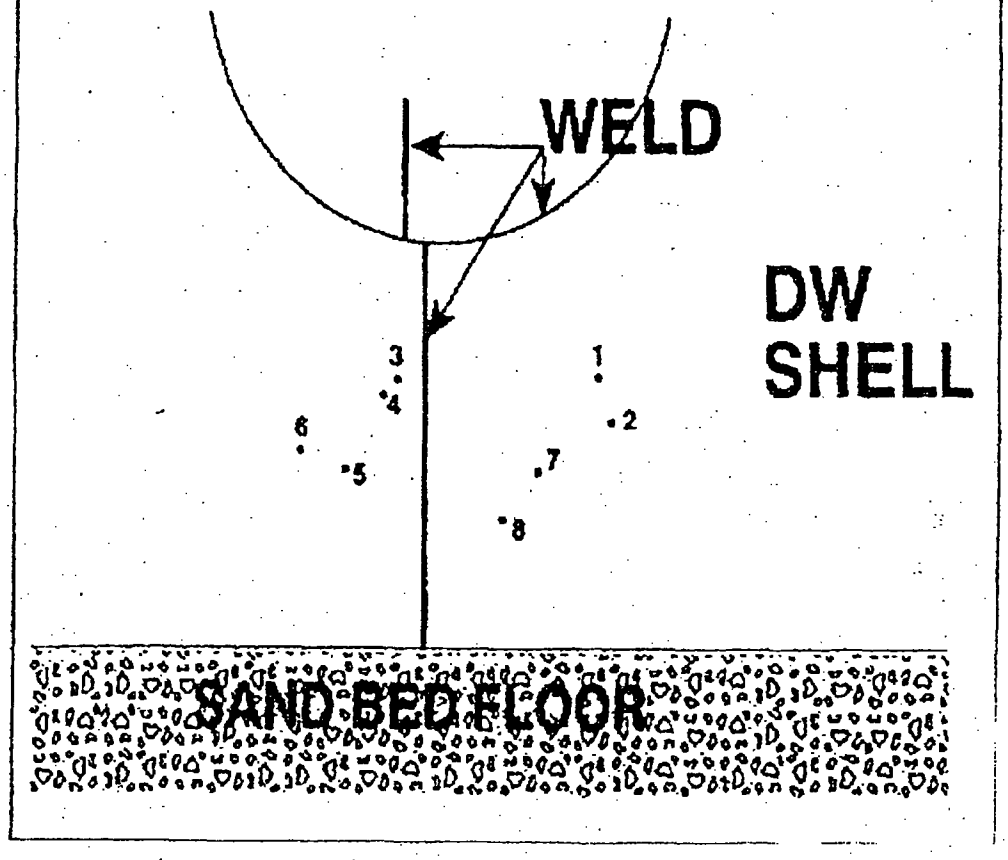

FIGURE (11)

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". 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 (Locations 3, 4, 9, 12, 13, 16, 17, 18, and 19) are all 0.800 inches or better (See Table 13-b).

Bay #13 General Wall (Sandbed Region) Thickness Evaluation

Therefore, given an average of the UT measurements of the locations below the bathtub ring is equal to 0.884 inches, a conservative mean thickness of 0.800 inches is estimated to represent the evaluation thickness for areas of shell in this bay outside the bathtub ring. Given a uniform thickness of 0.800 inches for these areas of the bay it is concluded that these areas are acceptable based on the thickness exceeding the buckling design thickness for the sandbed region of 0.736 inches using the results of Reference 3.3.

Locations 5, 6, 7, 8, 10, 11, 14, and 15 are confined to the bathtub ring as shown in Figure 13. To determine the general shell thickness in the bathtub ring area of this bay the evaluation thicknesses (See Table 13-c) for each of the locations defined above are averaged together. An example of a typical calculation of the general wall thickness defined as the evaluation thickness is presented below for clarity:

$$(\text{AVG Micrometer})_5 = \frac{D_{5-0^0} + D_{5-45^0} + D_{5-90^0} + D_{5-135^0}}{4}$$

Where: $D_{5-0}{}^0$ = Micrometer Depth Reading for Bay 13, location 5 at 0 degrees taken from Appendix D, Calculation Page 98, etc.

$$(\text{AVG Micrometer})_5 = \frac{0.150"+0.193"+0.230"+0.298"}{4} = 0.217"$$

$$T_{(Evaluation)5} = UT_{(Measurement)5} + (\text{AVG Micrometer})_5 - T_{rough}$$

Where: $UT_{(Measurement)5}$ = 0.718" Taken from Appendix D, Calc Page 93, Location 5

T_{rough} = 0.200" See Design Input 5.1 and Section 6, Acceptance Criteria, General Wall.

$$T_{(Evaluation)5} = 0.718"+0.217"-0.200" = 0.735"$$

Bay 13 AVG Micrometer Calculations
Table 13-a

Location	Azimuth[1]				AVG
	0^0	45^0	90^0	135^0	
1	0.330"	0.382"	0.346"	0.346"	0.351"
2	0.312"	0.377"	0.360"	0.393"	0.360"
5	0.150"	0.193"	0.230"	0.298"	0.217"
6	0.327"	0.339"	0.290"	0.247"	0.301"
7	0.241	0.279"	0.260"	0.239"	0.255"
8	0.324"	0.245"	0.262"	0.279"	0.278"
10	0.186"	0.173"	0.255"	0.229"	0.211"
11	0.240"	0.231"	0.271"	0.283"	0.256"
15	0.288"	0.277"	0.239"	0.288"	0.273"

Notes: 1. Azimuth data taken from Appendix D, Calculation Page 98.

An average value of the evaluation thicknesses presented in Table 13-c for this band is 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-b. 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.

Again given that the average evaluation thickness of the shell in the bathtub ring area exceeds the buckling design thickness of 0.736 inches the shell area within the bathtub ring is also acceptable based on the results of Reference 3.3.

Bay #13 Local Wall Thickness Evaluation

The individual measurements must also be evaluated for compliance with the local wall thickness criteria. Table 13-b 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.

Nine locations shown in Table 13-b (1, 2, 5, 6, 7, 8, 10, 11, and 15) have measurements below 0.736 inches. Inspectors observations indicate that these locations were very deep, overly ground, and not more than 1 to 2 inches in diameters. The depth of each of these areas relative to its immediate surroundings was measured at 4 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 0.673 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 0.673 inches.

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. The study reduced the thickness of a 12" by 12" area by 0.100 inches (0.636 inches) and included a transition zone of 12 inches all around from 0.636" to 0.736". When compared to a similar area with a buckling design thickness of 0.736" the modeled area represents a 13.5% reduction in local shell thickness and a material loss of 72.0 cubic inches. The center of the thinned area was located close to the calculated maximum displacement point in the buckling analysis with uniform thickness of 0.736 inch as per Reference 3.5. For this case the theoretical buckling load factor was reduced by 3.9%.

Based on the buckling design thickness of 0.736 inches the "as found" 6" by 6" area with a thickness of 0.673" represents a 8.6% reduction in local shell thickness and a material loss of 2.3 cubic inches. The volumetric consideration provides a quick visualization. While shell buckling depends on various parameters as discussed in References 3.3 and 3.7.

Comparison of the "as found" area of 6" x 6" with the "as analyzed" criteria of 0.636" over a 12" x 12" area, with an additional transition zone of 12", and its associated 13.5% reduction in shell wall thickness and a material loss of 72 cubic inches leads to the conclusion that the effect on the theoretical buckling load factor is negligible. Also based on the location of this 6" x 6" area, is almost directly below the vent and vent header assembly (between 20 to 26 inches to the left of the vent centerline and between 14 to 20 inches down from the vent weld line). This is in the area where buckling of the shell is limited due to the stiffening effect of the vent and vent header assembly. This effect can be clearly seen in the buckling analyses presented in References 3.3 and 3.5.

Remaining Very Local Areas:

A review of Appendix D, calculation pages 93, 94, 95 and 96 indicates the remaining very local areas of reduced thickness are isolated from each other and therefore, have a negligible effect on the shell buckling. See Section 6, Very Local Wall Criteria (2&½ inches in diameter or less) for details. Furthermore, the remaining local areas are centered about the vent which significantly stiffen the shell. This stiffening effect combined with the restraint provided by the concrete support structure limits the shell buckling to a point in the sandbed region which is located at the midpoint between the two vents.

Conclusion

In summary, using a conservative estimate of 0.800 inches for evaluation thickness for the entire bay (except the bathtub ring) and a 0.778 inch evaluation thickness for the bathtub ring , plus the acceptance of the local 6" by 6" area with an evaluation thickness of 0.673" based on the GE study, it is concluded that the bay is acceptable.

Bay # 13 UT Data

Table 13-b

Location	D-Meter UT Measurement (inches)	Appendix D presented on Calculation Page	Average Micrometer[1] (Table 13-a) (inches)
1/1A	0.672/0.890	93/95	0.351
2/2A	0.722/0.943	93/95	0.360
3	0.941	93	---
4	0.915	93	---
5/5A	0.718/0.851	93/95	0.217
6/6A	0.655/0.976	93/95	0.301
7/7A	0.618/0.752	93/95	0.255
8/8A	0.718/0.900	93/95	0.278
9	0.924	93	---
10/10A	0.728/0.810	93/95	0.211
11/11A	0.685/0.854	93/95	0.256
12	0.885	93	---
13	0.932	93	---
14	0.868	93	---
15/15A	0.683/0.859	93/95	0.273
16	0.829	93	---
17	0.807	93	---
18	0.825	93	---
19	0.912	93	---
20	1.170	93	---

(1) (1) Average values provided in this column are for locations 1, 2, 5, etc.

(1) (without suffix A) and not for 1A, 2A, 5A, etc. The values are compiled in Table 13-a

Summary of Measurements Below 0.736 Inches
Table 13-c

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"	0.255"	0.200"	0.673"	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. 1A 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".

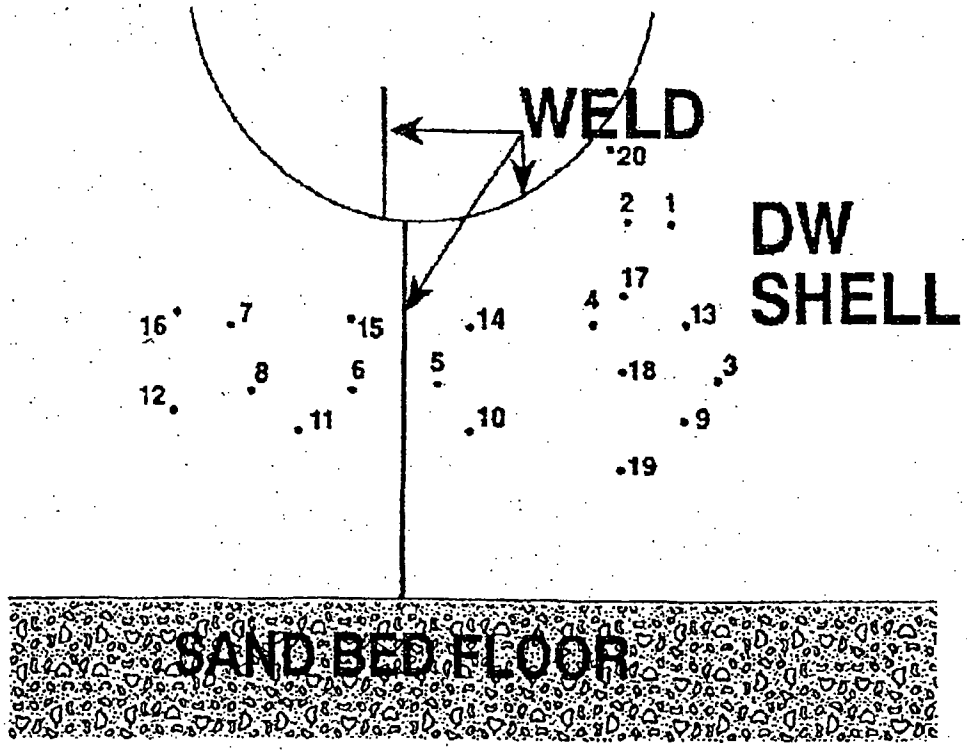

Figure (13)

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. Inspectors 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 4 locations around the spot and the average is shown in Table 15-a. As described in Section 6, Methods of Analysis, Very Local Wall Acceptance Criteria, areas of reduced thickness equal to or less than 2 ½ inches are too small to reduce the shell critical buckling load. This combined with the location of the very local indication near the vent reinforcement (See Appendix D, Calculation Page 99) indicates that this area would have a negligible effect on the shell buckling response.

Bay #15 General Wall (Sandbed Region) Thickness Evaluation

Given an average of the UT measurements presented in Table 15-a is equal to 0.816 inches, a conservative mean evaluation thickness of 0.800 inches is estimated for this bay. Therefore, it is concluded that the bay is acceptable based on the bay evaluation thickness exceeding the buckling design thickness for the sandbed region of 0.736 inches using the results of Reference 3.3.

The calculation of the average depth for Bay 15, Location 9 is as follows:

$$(\text{AVG Micrometer})_9 = \frac{D_{9-0^0} + D_{9-45^0} + D_{9-90^0} + D_{9-135^0}}{4}$$

Where: $D_{9-0}{}^0$ = Micrometer Depth Reading for location 9 at 0 degrees taken from Appendix D, Calculation Page 100, etc.

$$(\text{AVG Micrometer})_1 = \frac{0.356" + 0.350" + 0.359" + 0.282"}{4} = 0.337"$$

Bay # 15 UT Data

Table 15-a

Location	D-Meter UT Measurement (inches)	Appendix D on Calculation Page	Average Micrometer (inches)
1	0.786	99	---
2	0.829	99	---
3	0.932	99	---
4	0.795	99	---
5	0.850	99	---
6	0.794	99	---
7	0.808	99	---
8	0.770	99	---
9	0.722	99	0.337
10	0.860	99	---
11	0.825	99	---

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".

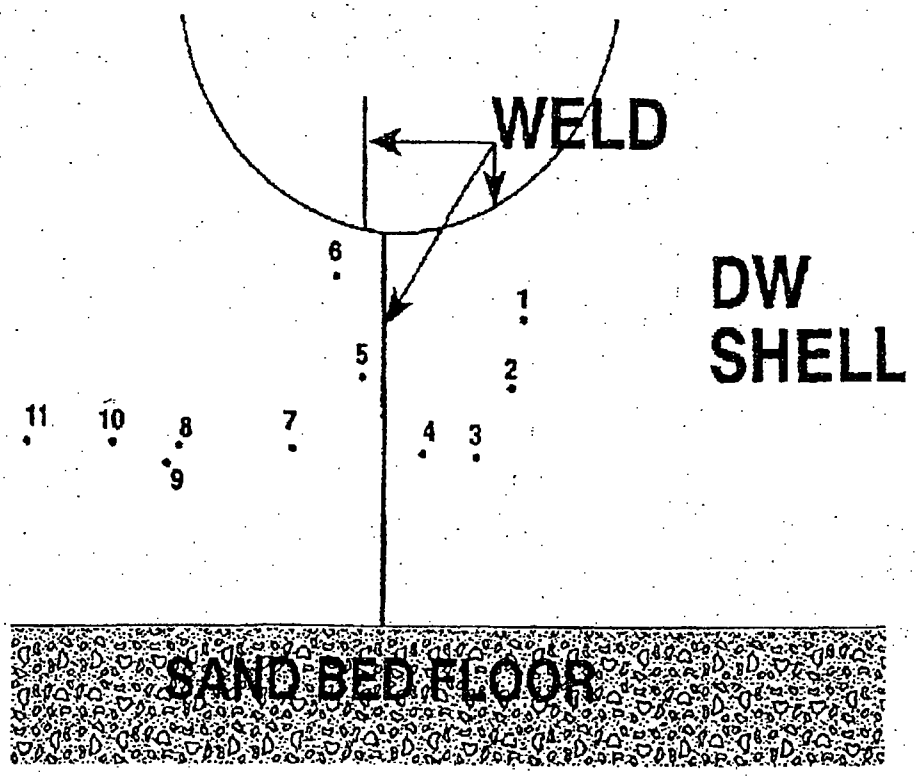

FIGURE (15)

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. Inspectors 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 4 locations around the spot and the average is shown in Table 17-a. As described in Section 6, Methods of Analysis, Very Local Wall Acceptance Criteria, areas of reduced thickness equal to or less than 2 & ½ inches are too small to reduce the shell critical buckling load. This combined with the location of the very local indication near the vent reinforcement (See Appendix D, Calculation Page 103) indicates that this area would have a negligible effect on the shell buckling response.

Bay #17 General Wall (Sandbed Region) Thickness Evaluation

Given an average of the UT measurements presented in Table 17-a is equal to 0.918 inches, a conservative mean evaluation thickness of 0.900 inches is estimated for this bay. Therefore, it is concluded that the bay is acceptable based on the bay evaluation thickness exceeding the buckling design thickness for the sandbed region of 0.736 inches using the results of Reference 3.3.

The calculation of the average depth for Bay 17, Location 9 is as follows:

$$(\text{AVG Micrometer})_9 = \frac{D_{9-0^0} + D_{9-45^0} + D_{9-90^0} + D_{9-135^0}}{4}$$

Where: $D_{9-0}{}^0$ = Micrometer Depth Reading for location 9 at 0 degrees taken from Appendix D, Calculation Page 105, etc.

$$(\text{AVG Micrometer})_1 = \frac{0.368" + 0.407" + 0.289" + 0.342"}{4} = 0.351"$$

Bay # 17 UT Data
Table 17-a

Location	D-Meter UT Measurement (inches)	Appendix D on Calculation Page	Average Micrometer (inches)
1	0.916	104	---
2	1.150	104	---
3	0.898	104	---
4	0.951	104	---
5	0.913	104	---
6	0.992	104	---
7	0.970	104	---
8	0.990	104	---
9	0.720	103	0.351
10	0.830	103	---
11	0.770	103	---

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

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 0.735".

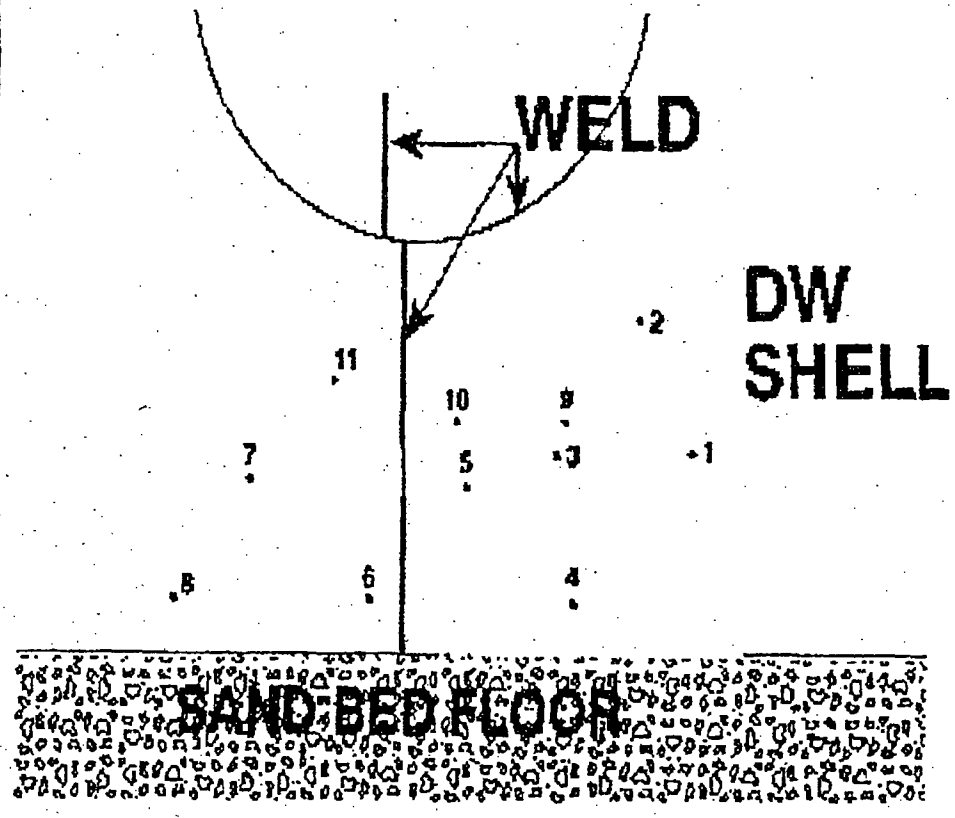

FIGURE (17)

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.

Bay #19 General Wall (Sandbed Region) Thickness Evaluation

Given an average of the UT measurements presented in Table 19 is equal to 0.885 inches, a conservative mean evaluation thickness of 0.850 inches is estimated for this bay. Therefore, it is concluded that the bay is acceptable based on the bay evaluation thickness exceeding the buckling design thickness for the sandbed region of 0.736 inches using the results of Reference 3.3.

Bay # 19 UT Data
Table 19

Location	D-Meter UT Measurement (inches)	Appendix D on Calculation Page	Average Micrometer (inches)
1	0.932	109	---
2	0.924	109	---
3	0.955	109	---
4	0.940	109	---
5	0.950	109	---
6	0.860	109	---
7	0.969	109	---
8	0.753	108	---
9	0.776	108	---
10	0.790	108	---

BAY #19 DATA

NOTES:

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

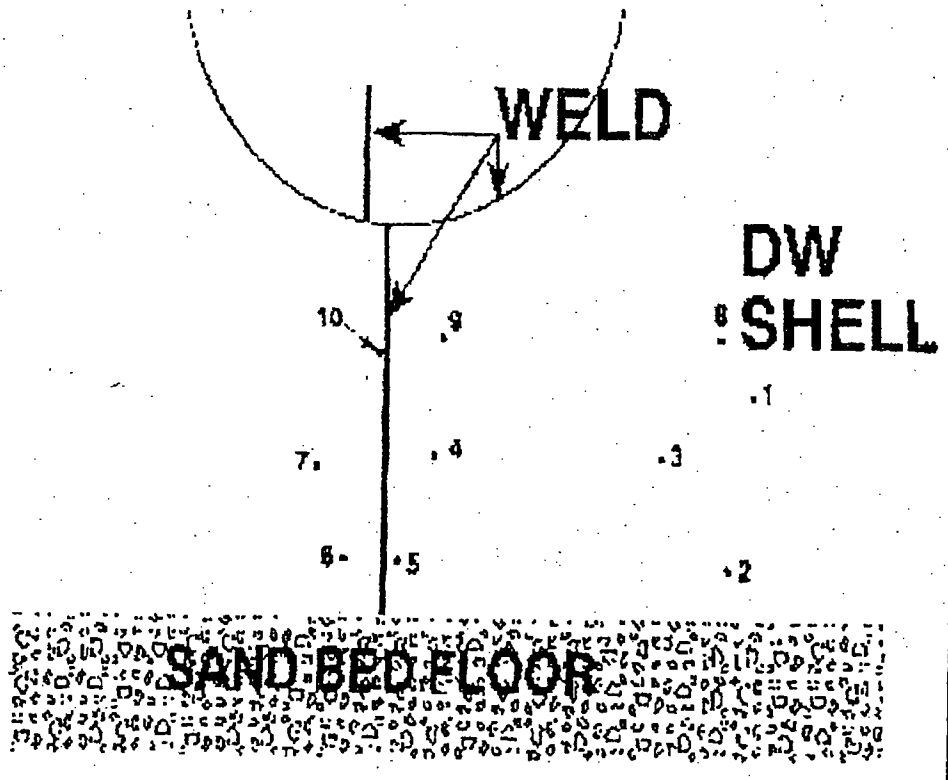

FIGURE (19)

Appendix A: Summary Of Measurements Of Impressions Taken From Bay #13 (3 pages total)

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)	(inches)	DEPTH #10 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 Through The Whole Sandbed Region Of The Drywell (5 pages total)

Based Upon GE Buckling Analysis (Reference 3.3)

Note: Tables on sheets 53 to 56 are not used in this calculation and are provided for historical purpose only from Rev. 0.

GPU Nuclear

Subject		Calc No.	Rev. No.	Sheet No.
O.C. Drywell Ext. UT Evaluation in Sandbed		C-1302-187-5320-024	1	53 of 117
Originator	**Date**	**Reviewed by**		**Date**
Mark Yekta	01/12/93	S. C. Tumminelli		

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,1, 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	

OCLR00014590

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O.C. Drywell Ext. UT Evaluation in Sandbed		C-1302-187-5320-024	1	54 of 117
Originator	**Date**	**Reviewed by**		**Date**
Mark Yekta	01/12/93	S. C. Tumminelli		

CALCULATION OF BUCKLING MARGIN - REFUELING CASE, NO SAND - GE OYCRFST01 - 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,1, 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)	15.183	2.165
	*** ALLOWABLE COMPRESSIVE STRESS CALCULATION			
18	Allowable Compressive Stress, Sall = SI/FS	(ksi)	7.592	1.082
19	Compressive Stress Margin, M-(Sall/Sm -1) x 100%	(%)	8.2	

OCLR00014591

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	(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,1, 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	

OCLR00014592

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O.C. Drywell Ext. UT Evaluation in Sandbed		C-1302-187-5320-024	1	56 of 117
Originator	**Date**	**Reviewed by**		**Date**
Mark Yekta	01/12/93	S. C. Tumminelli		

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	(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,1, 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	

OCLR00014593

Appendix C: Pictures Showing Condition Of The Drywell In The Sandbed Region (9 pages total)

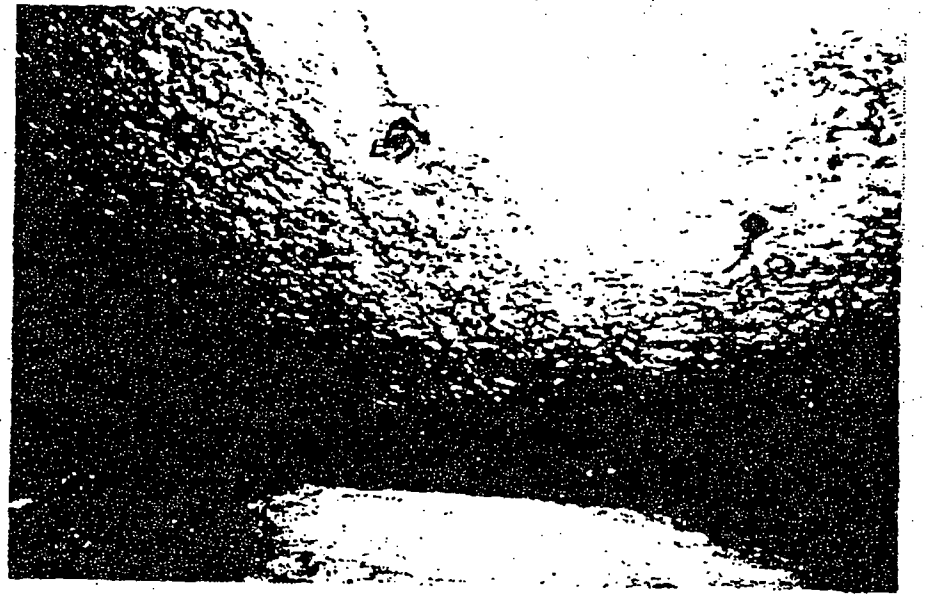
Sand Bed Region - Typical condition found on initial entry.

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.

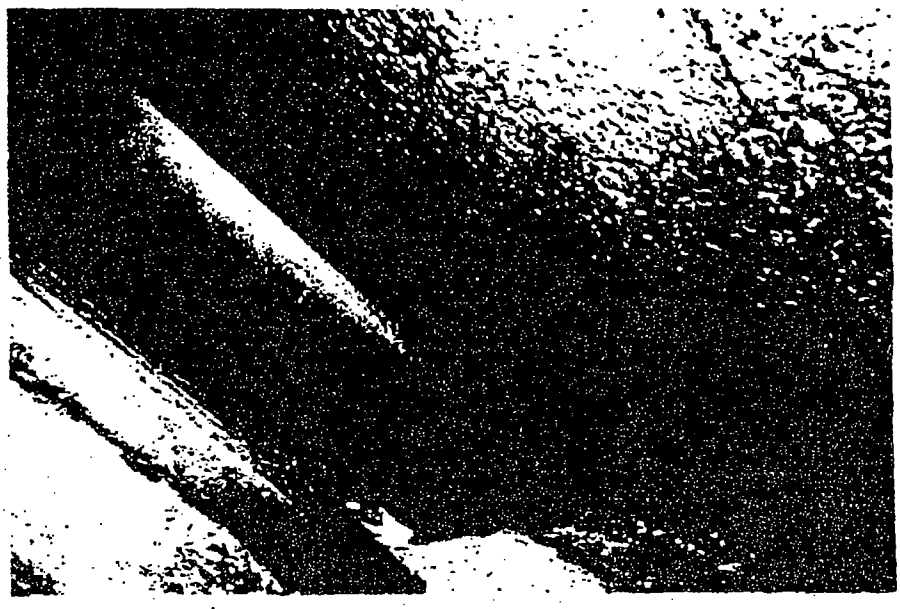
Bay #13 - D/W shell showed less prominent "Tub Ring" than what was seen in other

Bay #1 - Looking at the worst corroded area on shell near vent tube collar/ring. The ground spots seen here correspond to UT spot 20,21,22,3

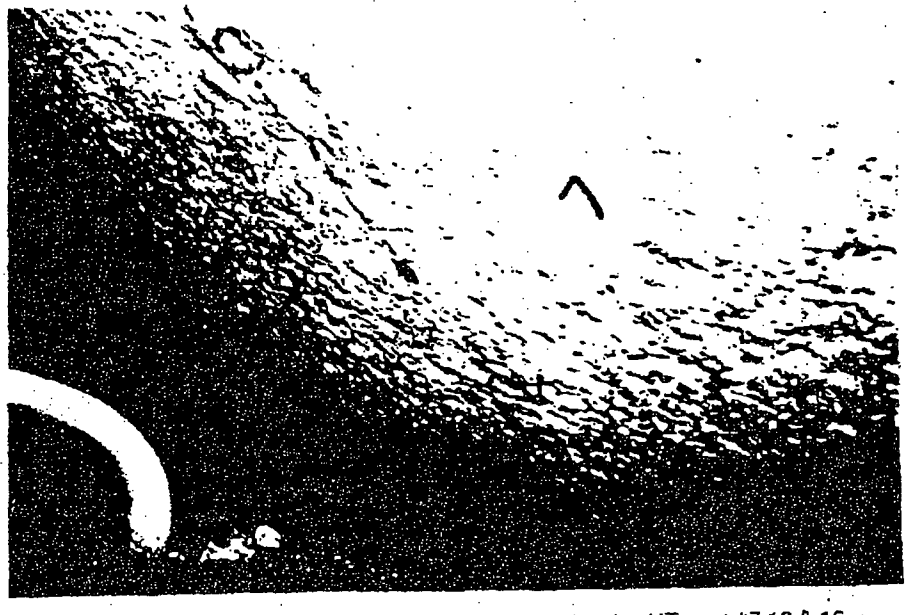


Bay #13 - Lower Mid portion of the D/W shell showing UT spot 5,6 and 10. This close up photo shows the roughness of the corroded surface and how each UT spot has been picked up in the deep valleys thereby biasing the remaining wall readings to the conservative side

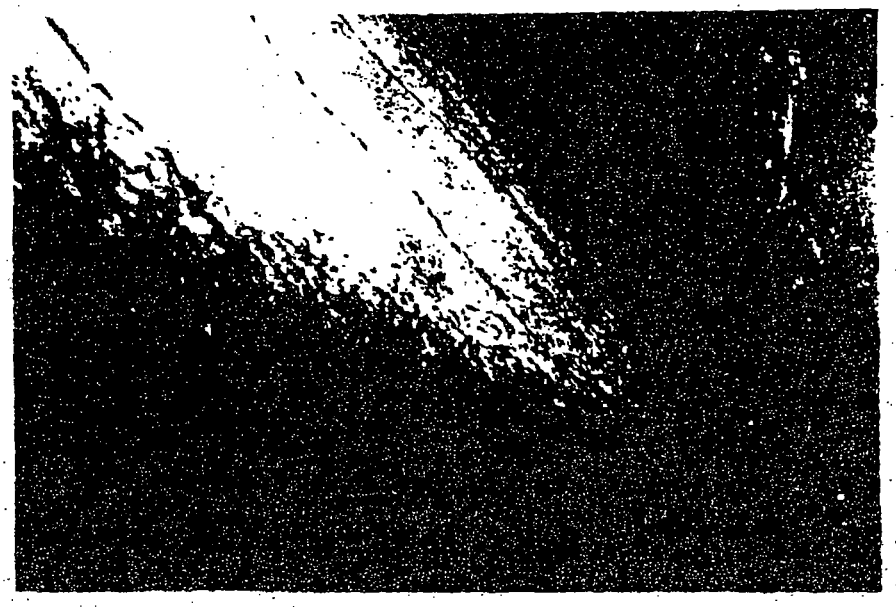
Bay #13 - Looking towards **Bay#11** - Upper right corner of D/W shell. Note ① - Grinding depth on UT spot #1 & 2. ② - A part of "Drill Tub Ring" as delineated by marking and ③ locations of UT spots 3,4,13 & 17. The photo on right (although blurred by flash reflection) shows 1/8" projection of plug.



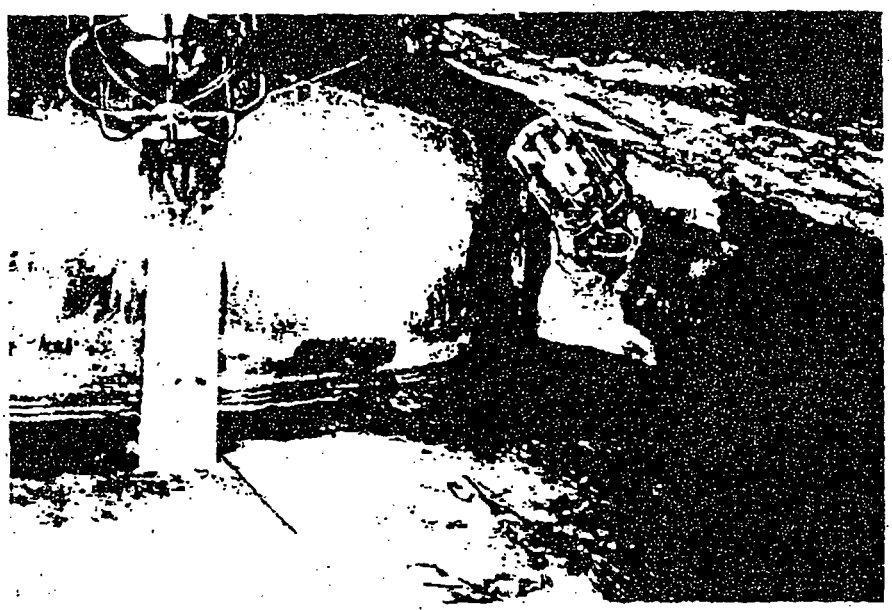
Bay #15 Looking towards Bay#17 which has been closed with foam for coating work in Bay #17. Note the typical surface of the D/W shell and localized corroded spot



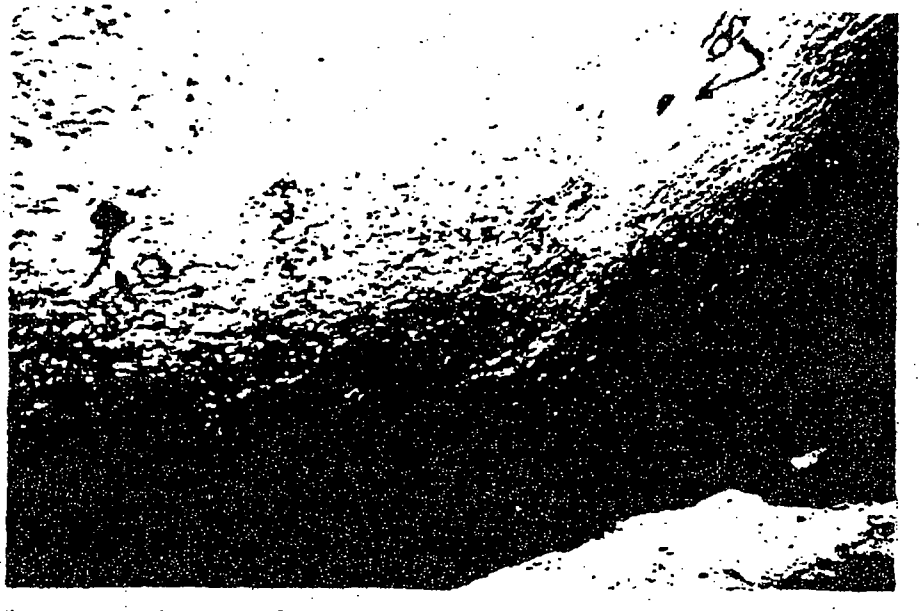
Bay #13 - Looking toward Bay #15 - Lower left corner showing UT spot #7,12 & 16. This close up has captured the peaks and valleys of the corroded shell in vivid detail. Later NDE inspection revealed pitch between peaks and valleys in the 0.25" - 0.40"



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

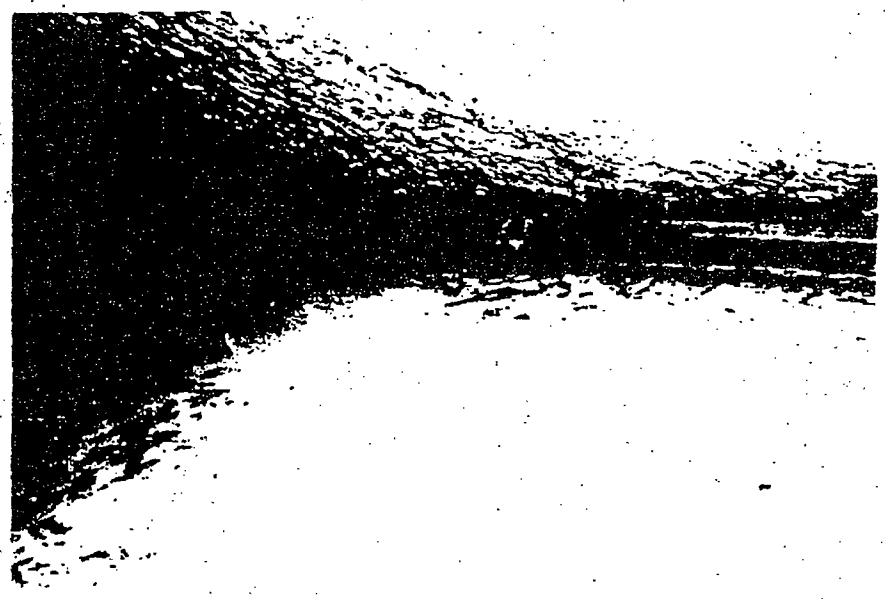


Bay #15 - Note the original lead primer on vent tube OD surface. The "Tub Ring" was less prominent on the shell in this bay except a portion in lower left corner. Also note presence of lead primer on vent collar/ring plate.

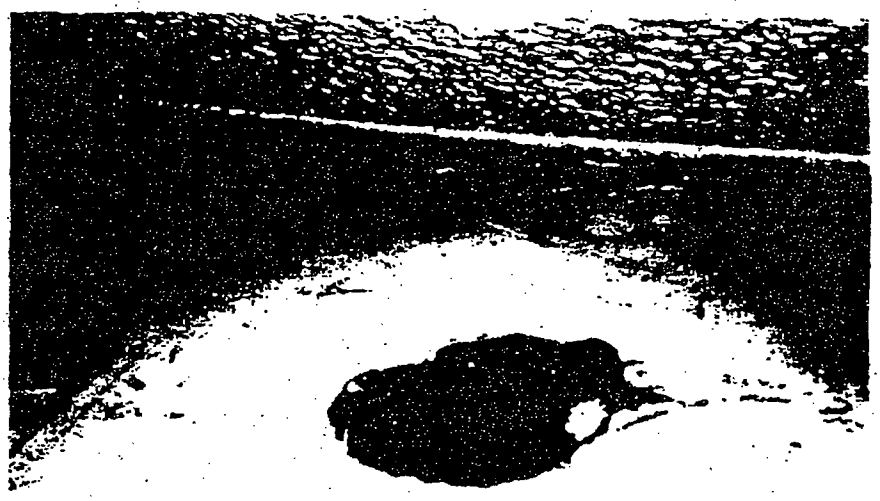


Bay #13 Looking toward Bay #11 - Lower right corner of D/W shell showing UT spots 9, 10, 18 & 19 Note the location of these spots - all are located in the valleys of the corroded surface This photo also shows the condition of the concrete floor. It appears

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



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



Drain after floor has been refurbished

Appendix D: NDE Inspection Sheets for the Drywell Sandbed Region (52 pages total)

GPU Nuclear

NDE Request
Oyster Creek

QC Charge No. 354-57307 Request No. 92-C72

1 To be filled in by Requestor

Job Order No.	Short Form No.	BA No. 322245	Date of Request

Job Description: UT THICKNESS OF DW LINER

System:

Job Location: SAND BED AREA

Applicable Code/Specification: ANSI B12

Type of NDE requested:

- ☐ Visual
- ☐ Leakage
- ☐ Video
- ☐ Liquid Penetrant
- ☐ Magnetic Particle
- ☐ Radiographic
- ☐ Eddy Current
- ☐ Alloy Separator
- ☐ Ferrite
- ☒ Ultrasonic
- ☐ Acoustic Emissions

NDE Requested by: J SLITER FOR JOHN FLYNN | Phone No.: | Date 12-6-92

Remarks

2 To be filled in by NDE Coordinator

NDE Coordinator: J SLITER | Date

Instructions

UT	PT	MT	RT	VT	ET
☒ 0°	Type	Dry	Isotope	☐ Direct	☐ Probe
☐ 45°	☐ A-1	☐ Red	☐ Ir^{192}	☐ Weld Insp	☐ Double
☐ 60°	☐ A-2	☐ Black	☐ Co^{60}	INDIRECT/VIDEO	☐ Single
☐ 70°	☐ A-3	☐ Grey	X-Ray	☐ Mirror	☐ Coil
☐ Other	☐ B-1	☐ Other	☐ 150 KV	☐ Boroscope	☐ Double
☐ Acoustic Emissions	☐ B-2	Wet	☐ 250 KV	☐ Fiberoptic	☐ Single
	☐ B-3	☐ Black		☐ Binocular	☐ Alloy Sep.
		☐ Flourescent		☐ Camera	☐ Ferrite

Remarks

Results	MNCR #'s open/close/cond. rel.	Proc. No.	
☒ Accept		Proc. No.	
☐ Reject	N/A	Proc. No.	
☐ Only		Job start date	Job stop date
	NDE Coordinator	Date Closed	Date to DCC

Yellow - Originator Final Copy Gold - Originators Initial Copy N60892 (03-87)
Pink - NDE Field Work Copy

GPU Nuclear

NDE/ISI Report Log

Page ____ of ____

Oyster Creek - OC

NDE Req. #: 92-072

Test: ☐ PT ☐ MT ☒ VT ☐ RT ☐ UT ☐ ____

System/Location: ____

Item: ____

Report #	Test Type	Date of Test	Results: Acc	Results: Rej	Results: Recordable	Remarks:
92-072-21	UT	1-8-93				BAY 15
92-072-22	UT	1-7-93				BAY 9
92-072-23	UT	1/8/93				BAY 13
92-072-24	UT	1-11-93				BAY 13
92-072-25	UT	1-11-93				BAY 13
92-072-26	UT	1-11-93				BAY 13
92-072-27	VT	1-11-93				BAY 13 DEPTH GAUGE
92-072-28	VT	1-12-93				BAY 1 DEPTH GAUGE
92-072-29	VT	1-12-93				BAY 17 DEPTH GAUGE
92-072-30	VT	1-12-93				BAY 15 DEPTH GAUGE
92-072-31	VT	1-12-93				BAY 11 DEPTH GAUGE

Form ID 6155ADM 2230 01-2 18 92

A0001537

GPU Nuclear

Oyster Creek - QC

NDE/ISI Report Log — Page ____ of ____

NDE Req. #: 92-072 — Test: ☐ PT ☐ MT ☐ VT ☐ RT ☒ UT ☐ ____

System/Location: DW LINER SANDBED — Item: ____

Report #	Test Type	Date of Test	Results: Acc	Results: Rej	Results: Recordable	Remarks:
92-072-01	UT	12-5-92				BAY 17
92-072-02	UT	12-5-92				BAY 19
92-072-03	UT	12-14-92				BAY 19
92-072-04	UT	12-14-92				BAY 17
92-072-05	UT	12-14-92				BAY 19
92-072-06	UT	12-14-92				BAY 17
92-072-07	UT	12-11-92				BAY 19
92-072-08	UT	12-11-92				BAY 17
92-072-09	UT	12-22-92				BAY 11
92-072-10	UT	12-22-92				BAY 11
92-072-11	VT	12-14-92				OVERLAY PLATE
92-072-12	UT	1-2-93				BAY 1
92-072-13	UT	1-2-93				BAY 1
92-072-14	UT	1-2-93				BAY 3
92-072-15	UT	1-2-93				BAY 3
92-072-16	UT	1-2-93				BAY 5
92-072-17	UT	1-2-93				BAY 5
92-072-18	UT	1-4-93				BAY 1
92-072-19	UT	1-5-93				BAY 1
92-072-20	UT	1-8-93				BAY 7

Form ID 6133ADM 7230 01.2 (6 82) — ADOC1537

Program	Xducer	Screen	Digital
1	5 mhz 3/4" Single H31900 (SP)	2"	2"
2	2.25 mhz 3/4" Single F28932	2"	2"
3	2 mhz MSEB MC8524	2"	2"
4	5 mhz bubbler water delay	2" delayed	2" delayed
5	5 mhz bubbler water delay	2" sync. screen	NONE
6	5 mhz bubbler water delay	2" sync. screen	2"
7	5 mhz 3/4" single H31900(SP)	1"	1"
8	2 mhz MSEB MC8524	1"	1"
9	5 mhz 1/4" delay GD0504 single	2"	NONE
10	5 mhz 1/4" dual D14252	1"	1"
11	5 mhz 1/4" dual D14252	2"	2"

Image for your info. [illegible]

GPU Nuclear

Subject	Calc No.	Sheet No.
O.C. Drywell Ext. UT Evaluation in Sandbed	C-1302-187-5320-024	71 of 117
Originator Mark Yekta	**Reviewed by** S. C. Tummineli	**Rev. No.** 1
Date 01/12/93		**Date**

GPU Nuclear — **Ultrasonic Thickness Data Sheet**

☒ OC ☐ TMI-1 ☐ TMI-2	Class: N/A	Item: N/A	NDE Request: 92-072	Data Sheet No.: 92-072-2-R
Task Description: UT Thickness			Task No.: 01 Q	Date: 1/2/93
Comp. Desc.: Drywell Liner	System: 187		Code/Spec.: ENG. INFO.	
Procedure/Rev.: 6100-QAP-7209.07 Rev 0		Drawing No./Rev.: 3E-187-29-001 Rev 0		
Test Surface: O.D		Thickness: 1 1/8"	Material: C/S	
Examiner	Sign: [signature]	Print: J. Van der Linde	ID No.: 154-48-0319	Level: II
Examiner	Sign: [signature]	Print: Mark F. Burnell	ID No.: 553-60-1862	Level: I

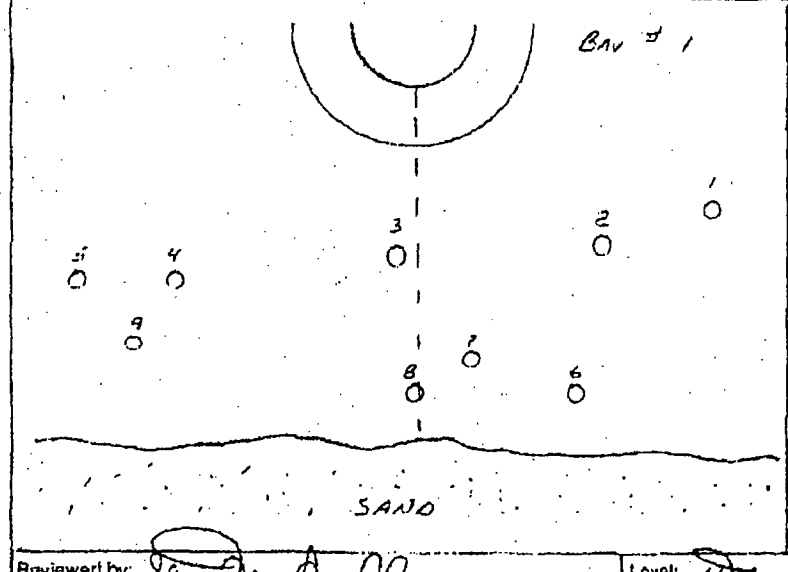
Thermometer S/N 88-001 Part Temperature 72 F D-Meter S/N 92-035
Cal. Blk. S/N 214 Cal. In: N/A AM 11:51 PM
Cal. Blk. Temp. 72 F Cal. Out: N/A AM 23:15 PM

Calibration Readings (Inches)

Cal. Blk.	.5	.75	1.0	1.25	1.5	N/A
D-Meter	.5	.75	1.0	1.25	1.5	

Techniques: ☐ CRT ☒ D-Meter Other N/A

Position #/Reading in Inches



Drawing

	AREA		MEASUREMENT
1	0-16"	R30"	1.20"
2	0-22"	R17"	.710"
3	0-23"	L3"	.705"
4	0-24"	L33"	.700"
5	0-24"	L45"	.710"
6	0-48"	R16"	.700
7	0-39"	R5"	.700"
8	0-48"	0"	[illegible]
9	0-36"	L36"	.605"

Reviewed by: [signature] Level: III Date: 1-5-93 Page 1 of 91

OCLR00014608

GPU Nuclear

Subject	Calc No.	Rev. No.	Sheet No.
O.C. Drywell Ext. UT Evaluation in Sandbed	C-1302-187-5320-024	1	72 of 117
Originator Mark Yekta	**Reviewed by** S. C. Tummineli		
Date 01/12/93			**Date**

GPU Nuclear — **Ultrasonic Thickness Data Sheet**

☑ OC ☐ TMI-1 ☐ TMI-2	Class: N/A	Item: N/A	NDE Request: 92-072	Data Sheet No.: 92.072-13
Task Description: UT Thickness			Task No.: N/A	Date: 1/2/93
Comp. Desc.: Drywell Liner	System: 187			Code/Spec.: ENL INFER
Procedure/Rev.: 6100-QAP-7209.07 Rev. 0		Drawing No./Rev.: 3E-187-29-001 Rev. 0		
Test Surface: O.D.		Thickness: 1 1/8"		Material: C/S
Examiner	Sign: [signature]	Print: J. Chandler Linde	ID No.: 154-48-0318	Level: II
Examiner	Sign: [signature]	Print: Mark F. Bergnell	ID No.: 553-[illegible]	Level: I

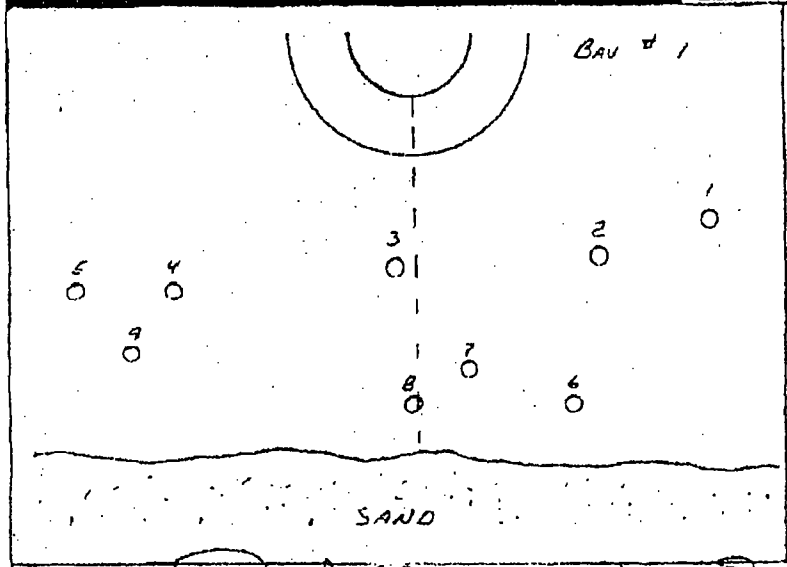
Thermometer S/N 88-081 Part Temperature 22 F D-Meter S/N 137-113
Cal. Blk. S/N 214 Cal. In: N/A AM 2151 PM
Cal. Blk. Temp. 72 F Cal. Out: N/A AM 2215 PM

Calibration Readings (Inches)

Cal. Blk.	.5	.75	1.0	1.25	1.5	N/A
D-Meter	.5	.75	1.0	1.25	1.5	

Techniques: ☒ CRT ☐ D-Meter
Other N/A

Position #/Reading in Inches



Drawing

	AREA		MEASUREMENT
1	0-16'	R30'	[illegible]
2	0-22'	R17'	[illegible]
3	0-23'	L3'	[illegible]
4	0-24'	L33'	[illegible]
5	0-24'	L45'	[illegible]
6	0-48'	R16'	[illegible]
7	0-39'	R5'	[illegible]
8	0-46'	0'	[illegible]
9	0-36'	L38'	[illegible]

Reviewed by: [signature] Level: III Date: 1-3-93 Page 21 of 81

OCLR00014609

GPU Nuclear

Subject	Calc No.	Rev. No.	Sheet No.
O.C. Drywell Ext. UT Evaluation in Sandbed	C-1302-187-5320-024	1	73 of 117
Originator: Mark Yekta	Reviewed by: S. C. Tummineelli		
Date: 01/12/93		Date	

GPU Nuclear

Ultrasonic Thickness Data Sheet

☒ OC ☐ TMI-1 ☐ TMI-2	Class: N/A	Item: N/A	NDE Request: 92-072
Data Sheet No.: 92-072-18			
Task Description: ILT THICKNESS		Task No.: N/A	Date: 1-4-93
Comp. Desc.: DRYWELL LINER Bay 1	System: 187		Code/Spec.: ENG. INFO.
Procedure/Rev.: 6100-QAP-7209.07 REV. D		Drawing No./Rev.: 3E-187-29-001	
Test Surface: O.D.		Thickness: 1 1/8"	Material: C.S.
Examiner Sign: [signature]	Print: Joel Wardlaw Lueck	ID No.: 134-46-0346	Level: II
Examiner Sign: [signature]	Print: Mark F. Bagnell	ID No.: 553-61-1602	Level: I

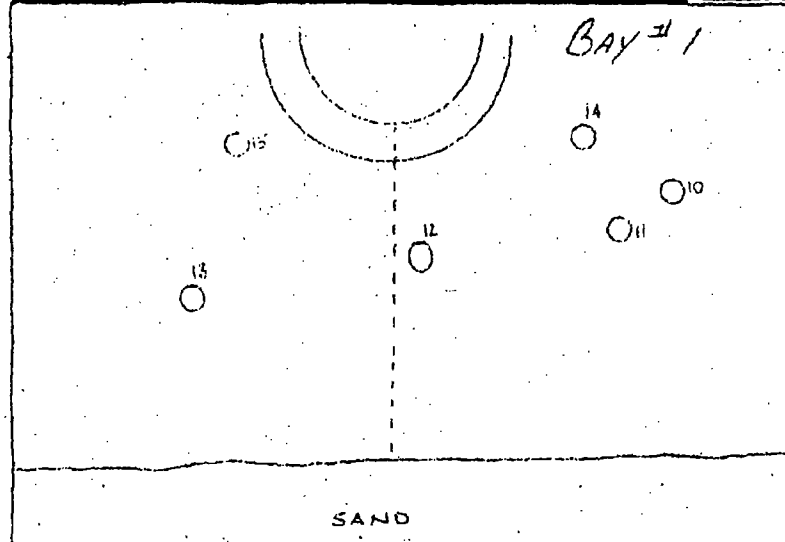
Thermometer S/N 92-066 Part Temperature 76° F D-Meter S/N 92-056
Cal. Blk. S/N INV 219 Cal. In: N/A AM 23:11 PM
Cal. Blk. Temp. 76° F Cal. Out: N/A AM 23:21 PM

Calibration Readings (Inches)

Cal. Blk.	.5	.75	1.0	1.25	1.5	N/A
D-Meter	.5	.75	1.0	1.25	1.5	

Techniques: ☐ CRT ☒ D-Meter Other N/A

Position #/Reading in Inches



Drawing

AREA	MEASUREMENT
10 D 16" R 23"	600"
11 D 23" R 12"	714"
12 D 24" L 5"	724"
13 D 24" L 40"	796"
14 D 2" R 35"	1.047"
15 D 8" L 51"	1.056"

NOTE ADDITIONAL READINGS TAKEN FOR CONFORMATION OF PREVIOUS INSPECTION

Reviewed by: [signature] Level: II Date: 1-5-93 Page 1 of 1

OCLR00014610

GPU Nuclear

Subject	Calc No.	Sheet No.
O.C. Drywell Ext. UT Evaluation in Sandbed	C-1302-187-5320-024	74 of 117
Originator: Mark Yekta	Reviewed by: S. C. Tummuinelli	Rev. No.: 1
Date: 01/12/93		Date:

GPU Nuclear

☒ OC ☐ TMI ☐ OTHER _____

Sketch Form (with grid)

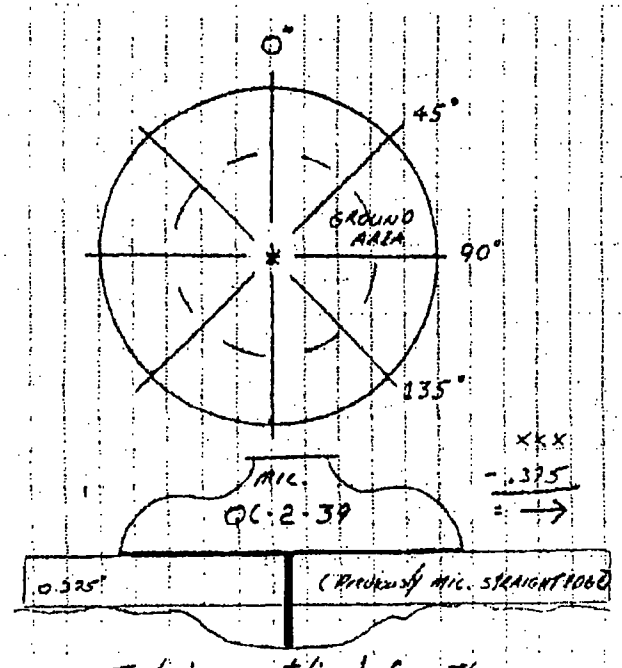
Component: DRYWELL liner SANDBED AREA

Data Sheet No.: 92-072-28

Location: BAY # 1

Drawing No.: N/A Rev.: N/A

Drawing



Technique utilized for the pit depth measurements

AZIMUTH

AREA	0°	45°	90°	135°
1	.272	.204	.206	.185
2	.143	.137	.143	.154
3	.397	.316	*	.329
5	.330	.290	.304	.330
7	.208	.281	.246	.330
11	.200	.211	.225	.211
12	.279	.316	.261	.328
21	.222	.202	.238	.183

* VALLEY FROM AREA #12 INTERFERED WITH TAKE TAKING MEANINGFUL MEASUREMENT JRA 1/12/93

Prepared by: [signature] Title: VT LV II Date: 1-12-93

Reviewed by: [signature] Level: II Date: 1-15-93 Page 1 of 1 NDE Request No.: 92-072

FORM 8130-DAP-7200.05 (12-89)

OCLR00014611

one part under

GPU Nuclear — **Ultrasonic Thickness Data Sheet**

☒ OC ☐ TMI-1 ☐ TMI-2	Class: N/A	Item: N/A	NDE Request: 92-072	Data Sheet No.: 92-072-11
Task Description: UT THICKNESS			Task No.: N/A	Date: 1-5-93
Comp. Desc.: DRYWELL LINER Bay 1	System: 187		Code/Spec.: ENG. INFO.	
Procedure/Rev.: GPUN GAP-7205.07 REV. 0			Drawing No./Rev.: 5E-187-2E-001 REV. 0	
Test Surface: O.D.			Thickness: 1/8"	Material: C.S.
Examiner	Sign: [illegible]	Print: Toni [illegible]	ID No.: 154-48-6-319	Level: II
Examiner	Sign: [illegible]	Print: Mark C. Bergnell	ID No.: 553-61-1812	Level: I

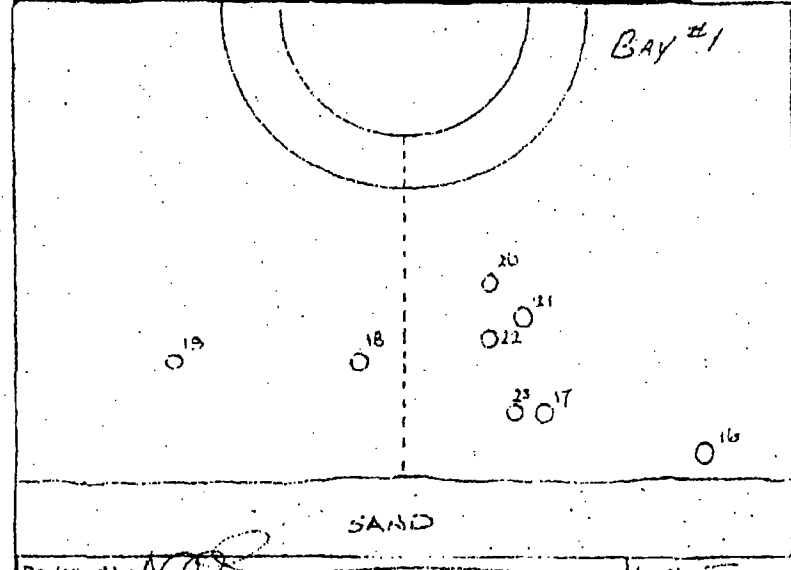
Thermometer S/N 88-081 Part Temperature 72° F D-Meter S/N 90-036
Cal. Blk. S/N INV 214 Cal In: N/A AM 22:42 PM
Cal. Blk. Temp. 72° F Cal. Out: N/A AM 22:55 PM

Calibration Readings (Inches)

Cal. Blk.	5	.75	1.0	1.25	1.5	N/A
D-Meter	.5	.75	1.0	1.25	1.5	

Techniques: ☐ CRT ☒ D-Meter Other N/A

Position #/Reading in Inches



Drawing

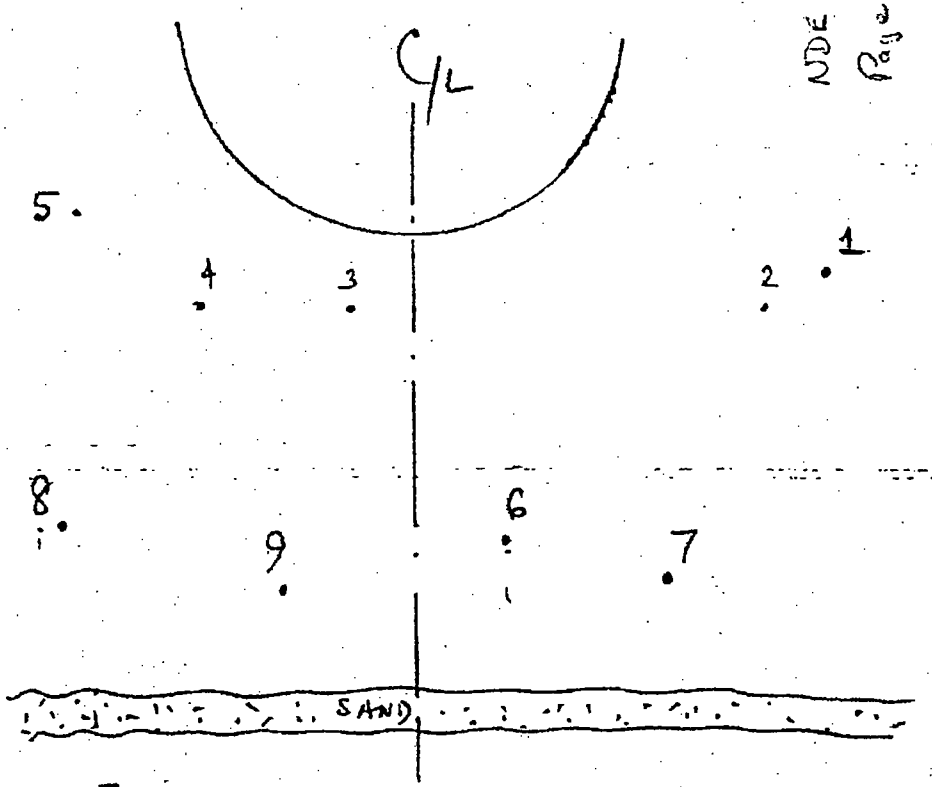
	AREA		MEASUREMENT
16	D 50"	R 46"	796"
17	D 48"	R 16"	800"
18	D 38"	L 2"	917"
19	D 38"	L 24"	890"
20	D 18"	R 13"	965"
21	D 24"	R 15"	726" X
22	D 52"	R 13"	862"
23	D 48"	R 15"	850"

Reviewed by: [illegible] Level: [illegible] Date: 1-6-93 Page 1 of 1

N5452 (R3-89)

OCLR00014612

NDE REQ. 92-072
Page 3 of 9



INSPECTION SPOTS FOR UT
BAY #1

NOTE:
1. GRIND FLAT FOR UT WITH MINIMUM REMOVAL OF SHELL AT THE VALLEY.

GPU Nuclear

Subject	Calc No.	Sheet No.
O.C. Drywell Ext. UT Evaluation in Sandbed	C-1302-187-5320-024	77 of 117
Originator Mark Yekta	**Reviewed by** S. C. Tummineli	
Date 01/12/93	**Rev. No.** 1	**Date**

GPU Nuclear — **Ultrasonic Thickness Data Sheet**

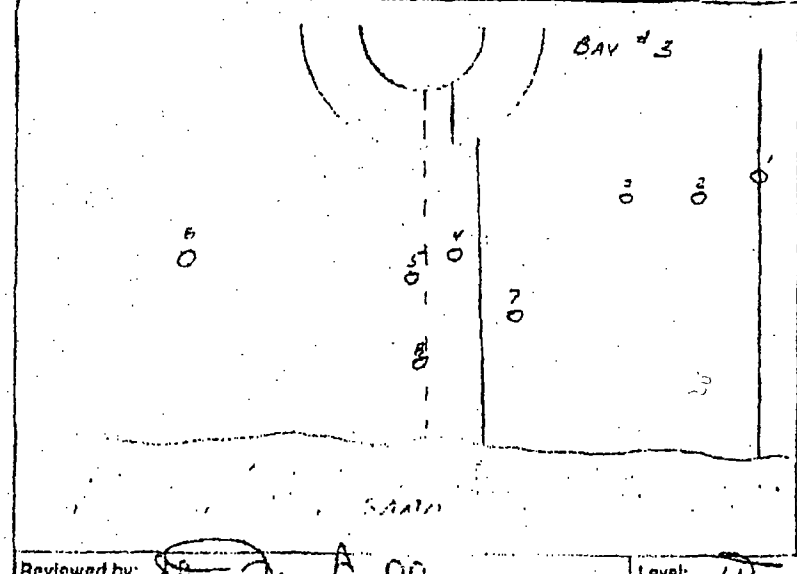
☑ OC ☐ TMI-1 ☐ TMI-2	Class: N/A	Item: N/A	NDE Request: 92-072	Data Sheet No.: 92-072-14
Task Description: UT Thickness			Task No.: N/A	Date: 1/12/93
Comp. Desc.: Drywell Liner	System: 187		Code/Spec.: EIUC INFOR	
Procedure/Rev.: 6100-GAF-2209.02 Rev 0		Drawing No./Rev.: 5E 187-24 Sh 1 Rev 0		
Test Surface: O.D.		Thickness: 1 1/8"	Material: CS	
Examiner Sign:	Print: T. Walter Linde	ID No.: 155-48-0314	Level: II	
Examiner Sign: Mark F. Baynell	Print: Mark F. Baynell	ID No.: 557-81-1622	Level: I	

Thermometer S/N 88-081 Part Temperature 72 F D-Meter S/N 92-0355
Cal. Blk. S/N 214 Cal. In: N/A AM 2146 PM
Cal. Blk. Temp. 72 F Cal. Out: N/A AM 2145 PM

Calibration Readings (Inches)						
Cal. Blk.	.5	.75	1.0	1.25	1.5	N/A
D-Meter	.5	.75	1.0	1.25	1.5	

Techniques: ☐ CRT ☒ D-Meter Other N/A

Position # Reading in Inches



Drawing

	AREA	MEASUREMENT
1	0-5" R 63	795"
2	0-9" R 50	[illegible]
3	0-9" R 33	857"
4	0-13" L 5	808"
5	0-15" L 8	823"
6	0-15" L 56	966"
7	0-17" R	820"
8	0-24" L	780"

Reviewed by: [signature] Level: III Date: 1-3-93 Page 41 of 91

615455 (05-90)

OCLR00014614

GPU Nuclear

Subject	Originator	Date	Calc No.	Rev. No.	Sheet No.
O.C. Drywell Ext. UT Evaluation in Sandbed	Mark Yekta	01/12/93	C-1302-187-5320-024	1	78 of 117
			Reviewed by S. C. Tummineli		Date

GPU Nuclear — Ultrasonic Thickness Data Sheet

☒ OC ☐ TMI-1 ☐ TMI-2 | Class: N/A | Item: N/A | NDE Request: 92-072 | Data Sheet No. 92-072-15

Task Description: UT Thickness | Task No.: N/A | Date: 1/2/93

Comp. Desc.: Drywell Liner | System: 187 | Code/Spec.: Ent. Inter.

Procedure/Rev.: 6100-ONP-7209.02 Rev. 0 | Drawing No./Rev.: 3E-187-29.001 Rev. 0

Test Surface: O.D. | Thickness: 1 1/8" | Material: CS

	Sign	Print	ID No.	Level
Examiner	[signature]	J. Van der Linde	154-48-0328	II
Examiner	[signature]	Mark T. Bagnell	SSS-[illegible]	II

Thermometer S/N 85-081 Part Temperature 22 F D-Meter S/N 177-113

Cal. Blk. S/N 214 Cal. In: N/A AM 11:18 PM

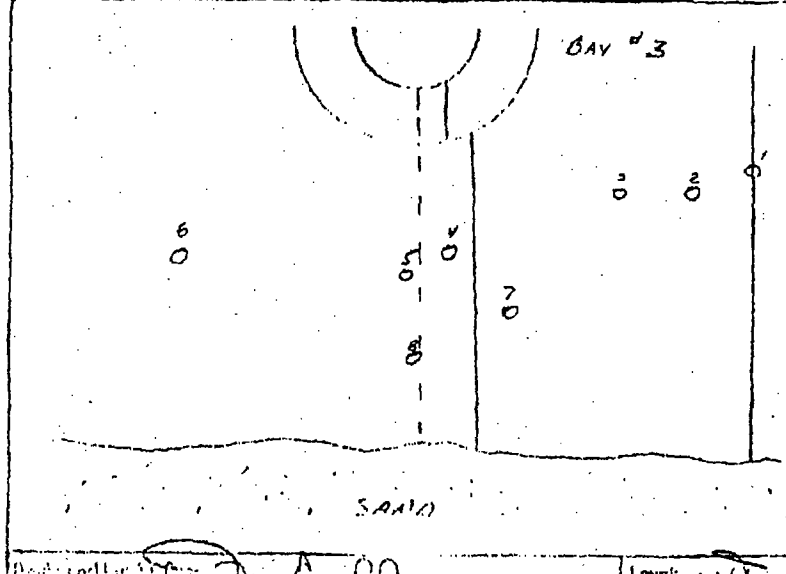
Cal. Blk. Temp. 72 F Cal. Out: N/A AM 11:45 PM

Calibration Readings (inches)

Cal. Blk.	.5	.75	1.0	1.25	1.5	N/A
D-Meter	.5	.75	1.0	1.25	1.5	

Techniques: ☒ CRT ☐ D Meter; Other N/A

Position # Reading in inches



Drawing

	AREA	Measurement
1	0-5" R-63	1.00"
2	0-9" R-50	1.00"
3	0-9" R-33	.800"
4	0-13" L-5	.900"
5	0-15" L-8	.840"
6	0-15" L-56	1.00"
7	0-17" R-	.840"
8	0-24" L-	1.00"

Level: III | Date: 1-3-93 | Page 51 of 91

OCLR00014615

GPU Nuclear

Subject	Calc No.	Rev. No.	Sheet No.
O.C. Drywell Ext. UT Evaluation in Sandbed	C-1302-187-5320-024	1	79 of 117
Originator Mark Yekta	**Reviewed by** S. C. Tumminelli		
Date 01/12/93			**Date**

Ultrasonic Thickness Data Sheet

GPU Nuclear

☒ OC ☐ TMI-1 ☐ TMI-2 | Class: U1A | Item: U1A | NDE Request: 92-072 | Data Sheet No. 92-072-15

Task Description: UT Thickness | Task No.: U1A | Date: 1/2/93

Comp. Desc.: Drywell Liner | System: 187 | Code/Spec.: ENG. INFOR

Procedure/Rev.: 6100-ONA-7209.03 Rev. 0 | Drawing No./Rev.: 3E-187-2Y-001 Rev. 0

Test Surface: O.D | Thickness: 1 1/8" | Material: CS

Examiner	Sign: [signature]	Print: J. Vander Linde	ID No.: 154-48-0318	Level: II
Examiner	Sign: [signature]	Print: Mark T. Bagnell	ID No.: 355-60-1842	Level: II

Thermometer S/N 68 001 Part Temperature 72 F D-Meter S/N 157-113

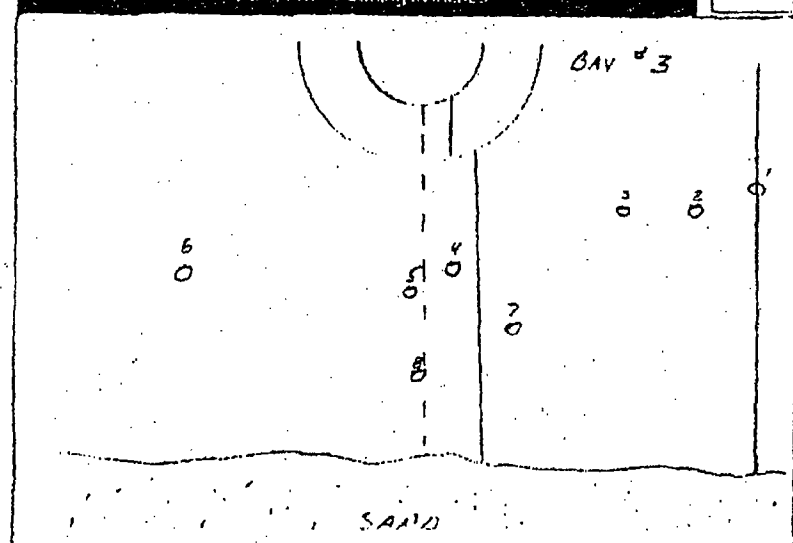
Cal. Blk. S/N 214 Cal. In: N/A AM 11:18 PM

Cal. Blk. Temp. 72 F Cal. Out: N/A AM 11:45 PM

Calibration Readings (Inches)						
Cal. Blk.	.5"	.75"	1.0	1.25"	1.5"	N/A
D-Meter	.5"	.75"	1.0	1.25"	1.5"	

Techniques: ☒ CRT ☐ D Meter Other N/A

Position # Reading in Inches



Drawing

	AREA	Measurement
1	0-5" R-63	[illegible]
2	0-9" R-50	[illegible]
3	0-9" R-33	.860"
4	0-13" L-5	.900"
5	0-15" L-8	.840"
6	0-15" L-56	[illegible]
7	0-17" R-	.840"
8	0-24" L-	.790"

Level: III | Date: 1-3-93 | Page 51 of 71

OCLR00014616

GPU Nuclear

Subject	Calc No.	Rev. No.	Sheet No.
O.C. Drywell Ext. UT Evaluation in Sandbed	C-1302-187-5320-024	1	80 of 117
Originator Mark Yekta	**Reviewed by** S. C. Tummineli		
Date 01/12/93			**Date**

GPU Nuclear — **Ultrasonic Thickness Data Sheet**

☑ OC ☐ TMI-1 ☐ TMI-2 | Class: NIA | Item: NIA | NDE Request: 92-072 | Data Sheet No.: 92-072-16

Task Description: UT Thickness | Task No.: NIA | Date: 1/2/93

Comp. Desc.: Drywell Liner | System: 187 | Code/Spec.: ENG. INTER.

Procedure/Rev.: 6100-QAP-7209.02 Rev. 0 | Drawing No./Rev.: 32-187-29-001 Rev. 0

Test Surface: O.D | Thickness: 1 1/2" | Material: CS

Examiner | Sign: [signature] | Print: J. Unlohr Linde | ID No.: [illegible] | Level: II

Examiner | Sign: [signature] | Print: Mark F. Brainell | ID No.: 553-81-1802 | Level: I

Thermometer S/N 83-081 Part Temperature 72 F D-Meter S/N 81-035

Cal. Blk. S/N 214 Cal. In: N/A AM 11:33 PM

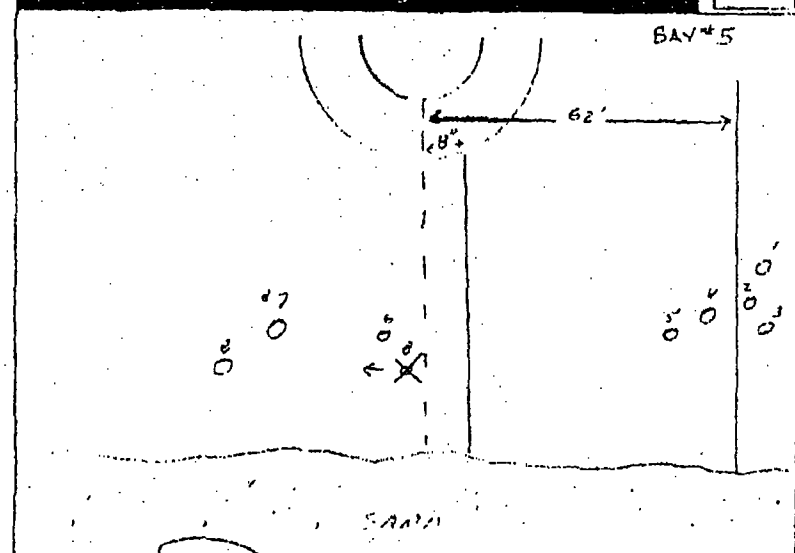
Cal. Blk. Temp. 72 F Cal. Out: N/A AM 12:38 PM

Calibration Readings (Inches)

Cal. Blk.	.5	.75"	1.0	1.25"	1.5"	N/A
D-Meter	.5"	.75"	1.0	1.25"	1.5"	

Techniques: ☐ CRT ☒ D-Meter; Other N/A

Position # Reading in Inches



Drawing

	AREA	MEASUREMENT
1	0-40" R-13"	.970"
2	0-42" R-8"	1.040"
3	0-44" R-10"	1.010"
4	0-44" R-7"	.910"
5	0-46" R-11"	.890"
6	0-44" L-4"	1.000"
7	0-48" L-24"	.990"
8	0-46" L-28"	1.010"

* from weld

Reviewed by: [signature] | Level: III | Date: 1-3-93 | Page 71 of 81

N3453 (05 90)

OCLR00014617

GPU Nuclear	Subject: O.C. Drywell Ext. UT Evaluation in Sandbed	Calc No.: C-1302-187-5320-024	Rev. No.: 1	Sheet No.: 81 of 117
Originator: Mark Yekta	Date: 01/12/93	Reviewed by: S. C. Tumminelli		Date:

all good

Ultrasonic Thickness Data Sheet

☑ OC ☐ TMI-1 ☐ TMI-2 | Class: N/A | Item: N/A | NDE Request: 92-072 | Data Sheet No.: 92-072-11

Task Description: UT Thickness | Task No.: N/A | Date: 1/12/93

Comp. Desc.: Drywell Liner | System: 187 | Code/Spec.: ENS TMP 2

Procedure/Rev.: 6100-QAP 7209.02 Rev. 0 | Drawing No./Rev.: 3E-187-29-001 Rev. 0

Test Surface: O.D. | Thickness: 1 1/8" | Material: CS

Examiner	Sign:	Print: J. Van der Linde	ID No.: 154-48-0318	Level: II
Examiner	Sign:	Print: Mark F. Burnell	ID No.: 553-21-1862	Level: I

Thermometer S/N 88-08 Part Temperature 22 F D-Meter S/N 137-113

Cal. Blk. S/N 214 Cal. In: N/A AM 22:23 PM

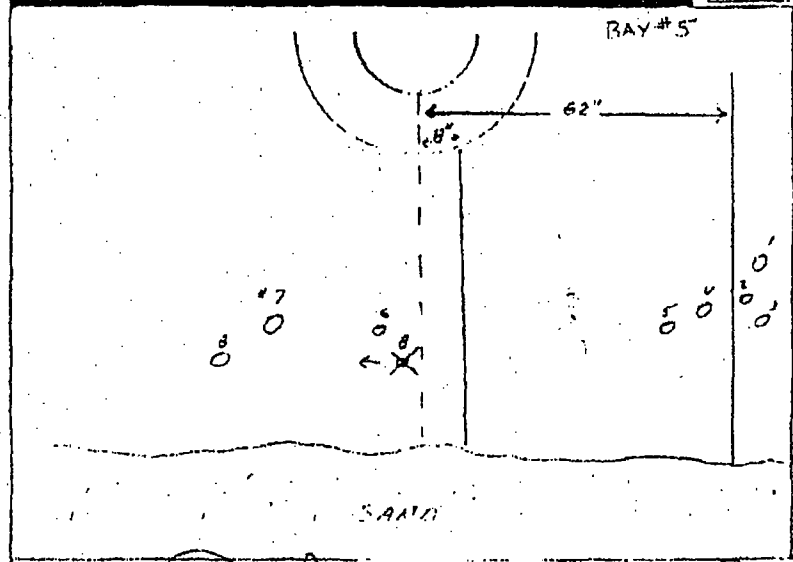
Cal. Blk. Temp. 72 F Cal. Out: N/A AM 22:56 PM

Calibration Readings (Inches)

Cal. Blk.	.5"	.75"	1.0	1.25"	1.5"	N/A
D-Meter	.5"	.75"	1.0	1.25"	1.5"	

Techniques: ☒ CRT ☐ D Meter Other N/A

Position = Reading in Inches



Drawing

	AREA		Measurement
1	0-40"	X-13"	1 OC
2	0-42"	X-8"	1 OC
3	0-44"	X-19"	1 OC
4	0-44"	X-7"	1 OC
5	0-46"	X-11"	1 OC
6	0-44"	L-4"	1 OC
7	0-48"	L-24"	1 OC
8	0-46"	L-28"	1 OC

* FROM WELD

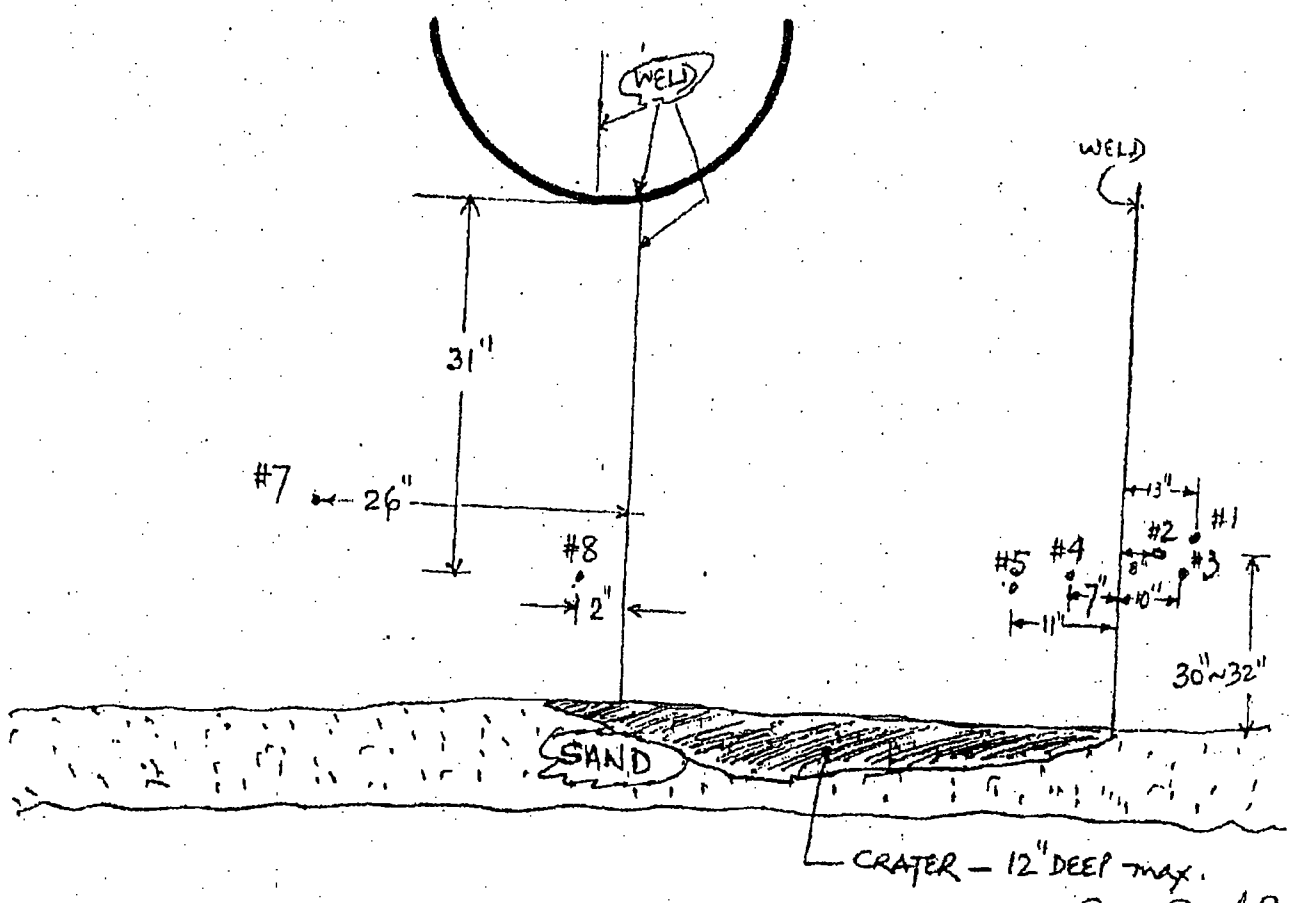
Reviewed by: [signature] | Level: III | Date: 1-3-93 | Page 81 of 81

OCLR00014618

GPU Nuclear

Subject		Calc No.		Sheet No.
O.C. Drywell Ext. UT Evaluation in Sandbed		C-1302-187-5320-024		82 of 117
Originator	**Date**	**Reviewed by**	**Rev. No.**	**Date**
Mark Yekta	01/12/93	S. C. Turmmincelli	1	

BAY #5



NDE 92-072 —— Page 9 of 9

GPU Nuclear

Subject: O.C. Drywell Ext. UT Evaluation in Sandbed
Originator: Mark Yekta
Date: 01/12/93
Calc No.: C-1302-187-5320-024
Reviewed by: S. C. Tummineilli
Rev. No.: 1
Sheet No.: 83 of 117

GPU Nuclear

Calibration Sheet

Cal Sheet# 14R-103

System: 187
Component: Drywell Liner
Procedure: 6100-QAP-7209.07 Rev 0

Examiner: Signature: [signature] Print: J VanCampen Linde Initial: [initials] ID# 154-48-0218 Level II
Examiner: Signature: [signature] Print: Mark F. Bergwell Initial: [initials] ID# 155-61-1822 Level I

Instrument Settings
ID# 122-113
Model/Manuf: Sonic 122 Staveley

Gain
Coarse: 65
Fine: n/a
Uncal: n/a

Sweep Circuit
Coarse: 2" (Range)
Fine: uncal 0.231
Delay: 0.995
Screen Depth: 2"

Operation
(I&R) Normal
Frequency: 2.25 MHZ
Reject: ☐Off ☒On %
Filter: ☐Off ☒On 1 %
Damping: ☐Off ☒On 100 %

Rep Rate: 1000 Hz

Cal Standard
ID# 214
Size n/a Sch. n/a
Thickness .5" & 1.5"
S/S (CS)
Temp 22 °F

System Check
☐Exit Point n/a
☐Angle +/- 2

Date 1-2-93

Search Unit
ID# M08524
Type MSCB
Freq 2 MHZ
Size 1/2"
Angle 0 Mode Comp.

Cal Direction
☐Axial ☐Both
☐Circ. ☒Normal

Time 1900

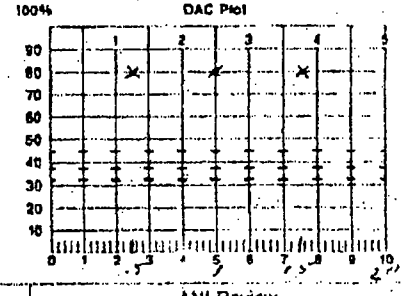
Search Unit Cable
Type BNC to Cinch Length 2x 6'

Couplant
Make Sonidiate Batch# 3SP-89-1-02

Thermometer
S/N: 88-081 Cal Due 1-9-93

Reflector	Amplitude % of FSH	Screen Reading in Inches
.5"	80	.5
1.5"	80	1.5

DAC Plot



Time/Date	2118 / 1-2-93		2151 / 1-2-93		2223 / 1-2-93	
Reflector	% FSH	Inches	% FSH	Inches	% FSH	Inches
.5	80	.5	80	.5	80	.5
1.5	80	1.5	80	1.5	80	1.5
Initials	[initials]		[initials]		[initials]	

Remarks:
Drywell liner thickness measurements
Digital utilized

Components Examined:
Bays 1, 3 & 5

ANI Review

Technical Review
Reviewed By [signature]
Level III Date 1-3-93

NDE Request#: 92-072

N0927 (05-90)

OCLR00014620

allgood

GPU Nuclear — **Ultrasonic Thickness Data Sheet**

☒ OC ☐ TMI-1 ☐ TMI-2 | Class: N/A | Item: N/A | NDE Request: 92-072 | Data Sheet No.: 92-072-06

Task Description: UT THICKNESS | Task No.: N/A | Date: 1-8-93

Comp. Desc.: Drywell Liner | System: 187 | Code/Spec.: Eng. Info.

Procedure/Rev.: 6100-CAP-2208.03 Rev.0 | Drawing No./Rev.: 3E-187-29-001

Test Surface: OD | Thickness: 1/8" | Material: CS

Examiner	Sign: [signature]	Print: Jon VanOstrand	ID No.: 154-43-0015	Level: II
Examiner	Sign: [signature]	Print: Luis Valenzuela	ID No.: 114-44-2524	Level: II

Thermometer S/N 92-066 Part Temperature 70 F D-Meter S/N 92-035

Cal. Blk. S/N 219 Cal. In: 0220 AM ____ PM

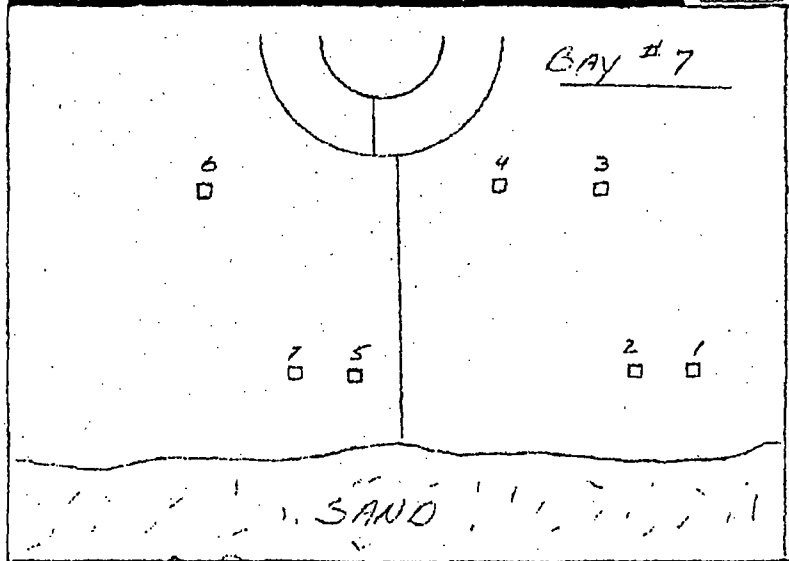
Cal. Blk. Temp. 72 F Cal. Out: 0225 AM ____ PM

Calibration Readings (Inches)

Cal. Blk.	.5	1.0	1.5			
D-Meter	.5	1.0	1.5			

Techniques: ☐ CRT ☒ D-Meter ☐ Other ____

Position #/Reading in inches



Drawing

	AREA		MEASUREMENT
1	0-21"	R-39"	0.95"
2	0-21"	R-32"	1.016"
3	0-10"	R-20"	0.984"
4	0-10"	R-10"	1.04"
5	0-21"	L-6"	1.03"
6	0-10"	L-23"	1.045"
7	0-21"	L-12"	1.0"

Reviewed by: [signature] | Level: II | Date: 1-8-93 | Page 1 of 1

GPU Nuclear

Subject	Calc No.	Rev. No.	Sheet No.
O.C. Drywell Ext. UT Evaluation in Sandbed	C-1302-187-5320-024	1	84 of 117
Originator: Mark Yekta	Reviewed by: S. C. Turnminelli		
Date: 01/12/93			Date

OCLR00014621

All good

GPU Nuclear — **Ultrasonic Thickness Data Sheet**

☒ OC ☐ TMI-1 ☐ TMI-2 | Class: N/A | Item: N/A | NDE Request: 92-072 | Data Sheet No.: 92-072-2

Task Description: UT Thickness | Task No.: N/A | Date: 1-7-93

Comp. Desc.: Drywell Liner | System: 157 | Code/Spec.: Exp. Info.

Procedure/Rev.: 6100-EXP-7209.07 Rev. 0 | Drawing No./Rev.: 32-157-29-001 Rev. 0

Test Surface: O.D. Bay #9 | Thickness: 1/8" | Material: C/S

Examiner	Sign: [signature]	Print: J. Wanchik Linde	ID No.: 54-9603A	Level: II
Examiner	Sign: [signature]	Print: Luis Lincenzeira	ID No.: 114-44-2514	Level: II

Thermometer S/N 92-008 Part Temperature 72 F D-Meter S/N 92-009

Cal. Blk. S/N 219 Cal. In: 0202 AM 0202 PM

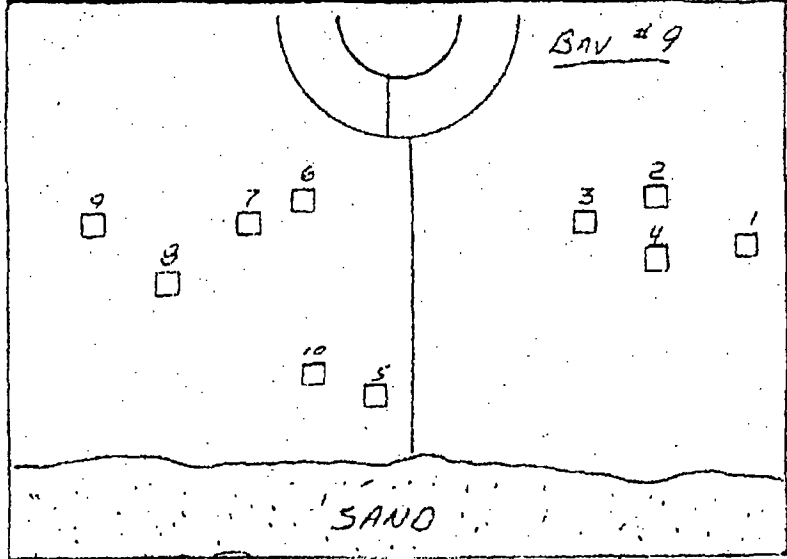
Cal. Blk. Temp. 72 F Cal. Out: 0415 AM 0415 PM

Calibration Readings (Inches)

Cal. Blk.	.5	1.0	1.5			
D-Meter	.5	1.0	1.5			

Techniques: ☐ CRT ☒ D-Meter ☐ Other

Position #/Reading in Inches



Drawing

	AREA			MEASUREMENT
1	0-21	R	22	.940
2	0-12	R	17	.94
3	0-18	R	8	.994
4	0-21	R	17	1.020
5	0-36	L	4	.955
6	0-34	L	30	.652
7	0-13	L		.825
8	0-22"	L		.791
9	0-50	L	55	.832
10	0-32	L	6	.980

Reviewed by: [signature] | Level: II | Date: 1-8-93 | Page 1 of 1

HS445.165.001

GPU Nuclear			
Subject: O.C. Drywell Ext. UT Evaluation in Sandbed		Calc No.: C-1302-187-5320-024	Rev. No.: 1
Originator: Mark Yekta	Date: 01/12/93	Reviewed by: S. C. Tummanelli	Sheet No.: 85 of 117
			Date

OCLR00014622

GPU Nuclear

Subject	Calc No.	Rev. No.	Sheet No.
O.C. Drywell Ext. UT Evaluation in Sandbed	C-1302-187-5320-024	1	86 of 117
Originator Mark Yekta	**Reviewed by** S. C. Tummineli		
Date 01/12/93			**Date**

GPU Nuclear

Ultrasonic Thickness Data Sheet

☑ OC ☐ TMI-1 ☐ TMI-2	Class: N/A	Item: N/A	NDE Request: 92-072	Data Sheet No.: 92-072-09
Task Description: [illegible]			Task No.: N/A	Date: [illegible]
Comp. Desc.: Drywell [illegible] Cap II	System: 1F3		Code/Spec.: ASME [illegible]	
Procedure/Rev.: [illegible]		Drawing No./Rev.: [illegible] Rev. 0		
Test Surface: C.S.		Thickness: 1 1/8"	Material: C/S	
Examiner Sign: [illegible]	Print: J. [illegible]	ID No.: [illegible]	Level: II	
Examiner Sign: [illegible]	Print: Mark F. Bagnell	ID No.: 553-[illegible]	Level: I	

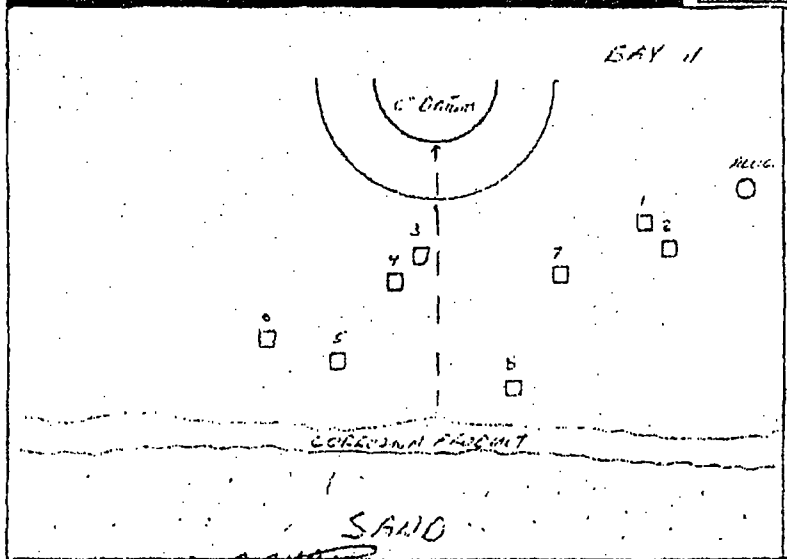
Thermometer S/N [illegible] Part Temperature 65 F D-Meter S/N [illegible]
Cal. Blk. S/N [illegible] Cal. In: [illegible] AM [illegible] PM
Cal. Blk. Temp. 65 F Cal. Out: [illegible] AM [illegible] PM

Calibration Readings (Inches)

Cal. Blk.	.5	.75	1.0			
D-Meter	.5	.75	1.0			

Techniques
☑ CRT ☐ D-Meter
Other _____

Position #/Reading in Inches



Drawing

	AREA		THICKNESS
1	0-20" K-29"		[illegible]
2	0-25" K-32"		[illegible]
3	0-[illegible] L-4"		[illegible]
4	0-24" L-6"		[illegible]
5	0-35" L-14"		[illegible]
6	0-27" L-20"		[illegible]
7	0-[illegible] K-20"		[illegible]
8	0-40" K-13"		[illegible]

Reviewed by: [illegible] Level: III Date: 12-27-92 Page 1 of 1

NS455 (03-90)

OCLR00014623

GPU Nuclear

Subject	Calc No.	Sheet No.
O.C. Drywell Ext. UT Evaluation in Sandbed	C-1302-187-5320-024	87 of 117
Originator Mark Yekta — **Date** 01/12/93	**Reviewed by** S. C. Tummineli — **Rev. No.** 1 — **Date**	

Ultrasonic Thickness Data Sheet

GPU Nuclear

☑ OC ☐ TMI-1 ☐ TMI-2 | Class: N/A | Item: N/A | NDE Request: 92-072 | Data Sheet No.: 92-072-10

Task Description: [illegible] | Task No.: N/A | Date: [illegible]

Comp. Desc.: [illegible] Bay 11 | System: 137 | Code/Spec.: [illegible]

Procedure/Rev.: [illegible] | Drawing No./Rev.: 3E-187-25-001 REV

Test Surface: [illegible] | Thickness: 1/8" | Material: C/S

Examiner	Sign: [illegible]	Print: [illegible]	ID No.: [illegible]	Level: II
Examiner	Sign: [illegible]	Print: Mark F. Bagnell	ID No.: 553-[illegible]	Level: II

Thermometer S/N [illegible] Part Temperature 65 F D-Meter S/N [illegible]

Cal. Blk. S/N 72 Cal. In: [illegible] AM [illegible] PM

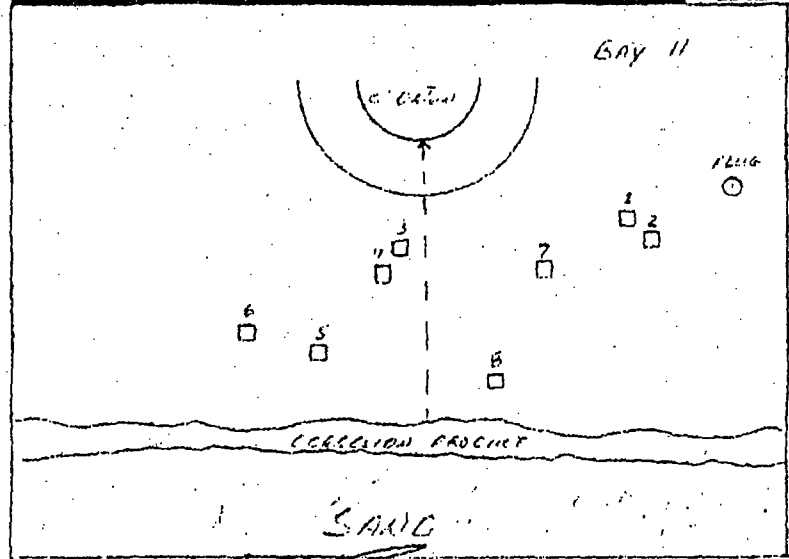
Cal. Blk. Temp. 65 F Cal. Out: [illegible] AM 3:00 PM

Calibration Readings (Inches)

Cal. Blk.	.5	.75	1.0			
D-Meter	.5	.75	1.0			

Techniques: ☐ CRT ☑ D-Meter; Other _____

Position #/Reading in Inches



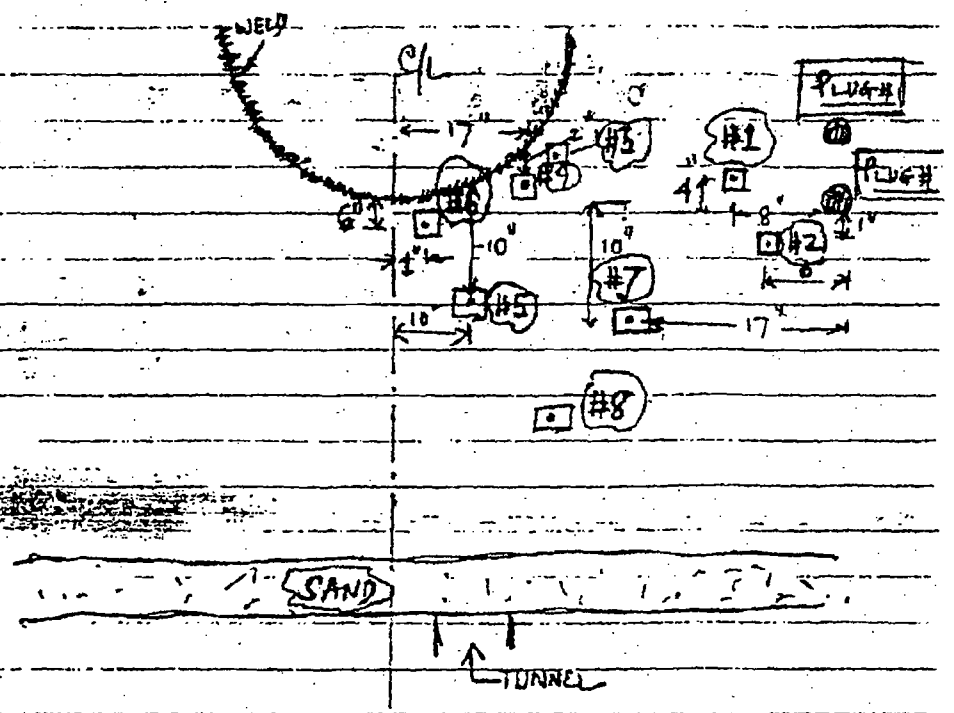
Drawing

Point	Area	Thickness
1	0.20" x 0.20"	0.[illegible]
2	0.25" x 0.25"	0.720"
3	0.27" x 0.9"	0.832
4	0.24" x 0.6"	0.7[illegible]
5	0.22" x 0.4"	0.39[illegible]
6	0.27" x 0.20"	0.50
7	0.31" x 0.20"	0.531
8	0.40" x 0.15"	0.8[illegible]

Reviewed by: [illegible] | Level: II | Date: 12-27-92 | Page 1 of 1

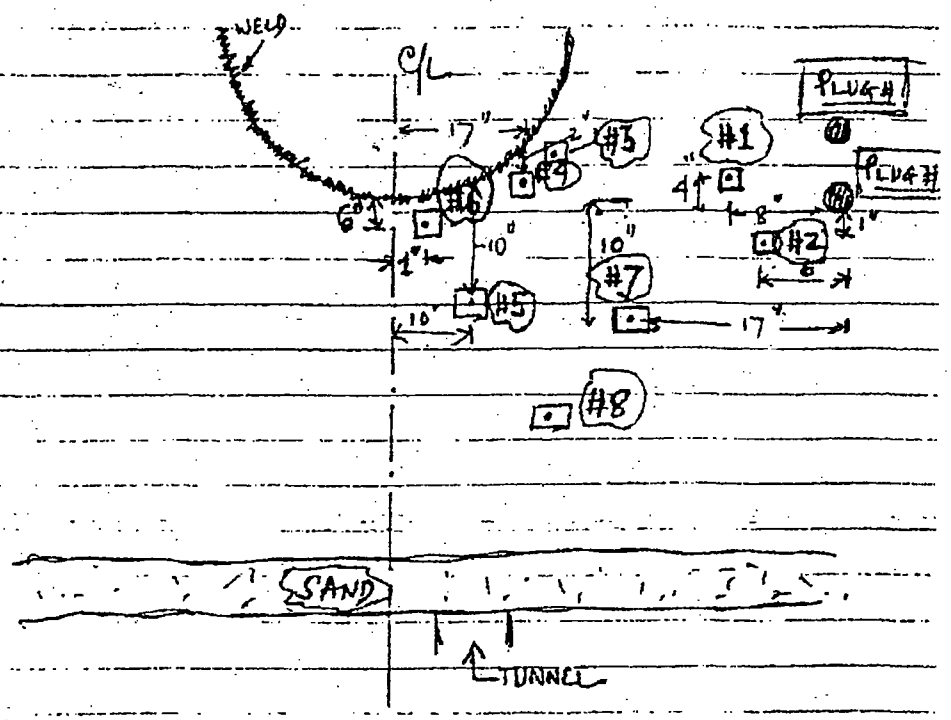
N5653 (03-90)

OCLR00014624



BAY-11 — UT SPOTS FOR GRINDING

NOTE: GRIND ONE SPOT AT A TIME. REMARK THE SPOT # AFTER GRINDING.



BAY-11 — U.T. SPOTS FOR GRINDING

NOTE: GRIND ONE SPOT AT A TIME. REMARK THE SPOT # AFTER GRINDING.

GPU Nuclear

Subject	Calc No.	Rev. No.	Sheet No.
O.C. Drywell Ext. UT Evaluation in Sandbed	C-1302-187-5320-024	1	90 of 117
Originator Mark Yekta	**Reviewed by** S. C. Tummarelli		
Date 01/12/93			**Date**

I/OC I ITMI

GPU Nuclear

Calibration Sheet

Cal Sheet# 14K-002

System	Component	Procedure	Rev
107	Drywell Ext. Ex II	6100-SRP-720907	0

Examiner:	Signature:	Print:	Initial:	ID#	Level
		J Hendricks Cook			II
Examiner:	Signature:	Print:	Initial:	ID#	Level
	Mark Bagnell	Mark F Bagnell	MFB		I

Instrument Settings
ID# 232-113
Model/Manuf Sonic 137 Sonic

Gain
Coarse 22.2
Fine n/a
Uncal n/a

Sweep Circuit
Coarse 2 (Range)
Fine 100 Clear
Delay 1
Screen Depth 2

Operation (I&R) Normal
Frequency: 2.25 MHZ
Reject: I Off I On %
Filter: I Off I On 1 %
Damping: I Off I On 2000 %

Rep Rate: Local Hz

Cal Standard
ID# 95
Size 10.1" Sch. n/a
Thickness .5 .25 .10
S/S CS
Temp 65 °F

System Check
☐ Exit Point n/a
☐ Angle +/- 2

Search Unit
ID# 100324
Type MSEE
Freq 2 MHZ
Size 1"
Angle 0 Mode long

Cal Direction
☐ Axial ☐ Both
☐ Circ. ☑ Normal

Date 12/22/92 Time 15:05

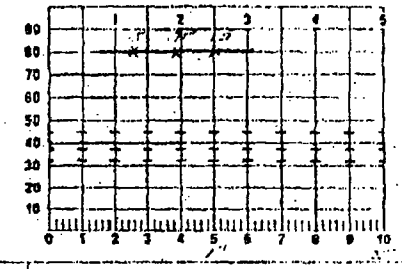
Reflector	Amplitude % of FSH	Screen Reading in Inches
.5	50	.5
.25	50	.25
1.0	50	1.0

Search Unit Cable
Type Dual Cable Length 2 x 6'

Couplant
Make Sonotrak Batch# 3242-92-C-00

Thermometer
S/N: 92-055 Cal Due 5/23/93

DAC Plot



Time/Date	15:30 1 minute		1		1	
Reflector	% FSH	Inches	% FSH	Inches	% FSH	Inches
.5	50	.5				
.25	50	.25				
1.0	50	1.0				
Initials						

Remarks:

Components Examined: GRV 11

ANI Review

Technical Review
Reviewed By
Level III Date 12-22-92

NDE Request#: 92-072

NX927 (05-90)

OCLR00014627

GPU Nuclear

Subject	Calc No.	Rev. No.	Sheet No.
O.C. Drywell Ext. UT Evaluation in Sandbed	C-1302-187-5320-024	1	91 of 117
Originator Mark Yekta	**Reviewed by** S. C. Tummineli		
Date 01/12/93			**Date**

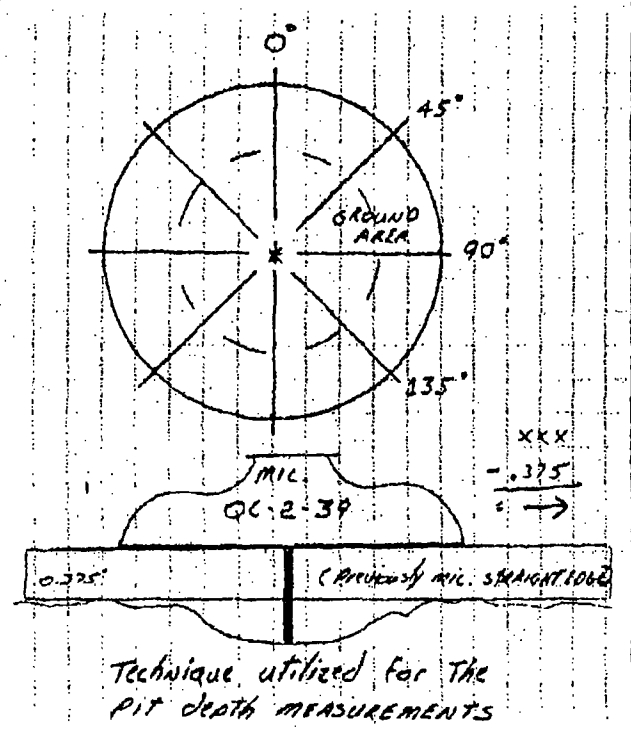
GPU Nuclear

☒ OC ☐ TMI ☐ OTHER _____

Sketch Form (with grid)

Component: DRYWELL LINER SANDBED AREA	Data Sheet No.: 92-072-31
Location: BAY # 11	Drawing No.: N/A Rev.: NA

Drawing



Technique utilized for the pit depth measurements

AZIMUTH

AREA	0°	45°	90°	135°
1	.289	.338	.157	.200

Prepared by:			Title: VT LV II		Date: 1/12/93
Reviewed by:	Level: II	Date: 1-13-93	Page 1 of 1	NDE Request No.: 92-072	

OCLR00014628

Low Points under

GPU Nuclear — **Ultrasonic Thickness Data Sheet**

☒ OC ☐ TMI-1 ☐ TMI-2	Class: NA	Item: NA	NDE Request: 92-012	Data Sheet No.: 92-012-23
Task Description: DRYWELL CORROSION CONTROL (LINER THICKNESS)		Task No.: NA	Date: 1/8/93
Comp. Desc.: DRYWELL LINER BAY 13	System: DRYWELL	Code/Spec.: GNL. INFO.	
Procedure/Rev.: 6100-QAP-7209.07 Rev 0		Drawing No./Rev.: 36-187-29-001	
Test Surface: C D		Thickness: 1 1/8"	Material: C S

Examiner	Sign: T J A Sloan	Print: N. B. SHERRER	ID No.: 217-56-4172	Level: II
Examiner	Sign: NA	Print: NA	ID No.: NA	Level: NA

Thermometer S/N 92-068 Part Temperature 74° F D-Meter S/N 92-009
Cal. Blk. S/N 219 Cal. In: NA AM 1620 PM
Cal. Blk. Temp. 69° F Cal. Out: NA AM 2330 PM

Calibration Readings (Inches)

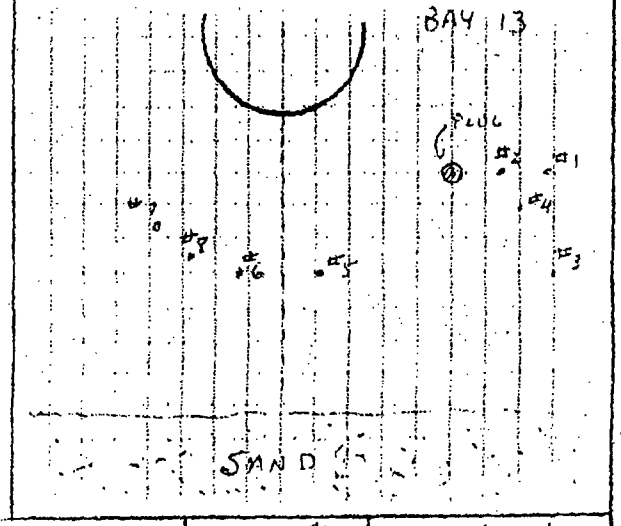
Cal. Blk.	.502"	1.499"			NA	
D-Meter	.502"	1.500"				

Techniques: ☐ CRT ☒ D-Meter; Other NA

Position #/Reading in Inches

AREA	LOCATION	THK
1	D 6" R 46"	.814"
2	D 6" R 38"	.615"
3	D 16" R 42"	.939"
4	D 12" R 35"	.914"
5	D 26" R 6"	.735"
6	D 24" L 8"	.633"
7	D 17" L 23	.632"
8	D 22" L 20"	.744"

Drawing



Reviewed by: [signature] Level: N/A Date: 1-8-93 Page 1 of 1

NS455 (03-90)

GPU Nuclear

Subject: O.C. Drywell Ext. UT Evaluation in Sandbed		Calc No.: C-1302-187-5320-024	Sheet No.: 92 of 117
Originator: Mark Yekta	Date: 01/12/93	Reviewed by: S. C. Turminelli	Rev. No.: 1
			Date

OCLR00014629

GPU Nuclear

Subject	Calc No.	Rev. No.	Sheet No.
O.C. Drywell Ext. UT Evaluation in Sandbed	C-1302-187-5320-024	1	93 of 117
Originator Mark Yekta	**Reviewed by** S. C. Turmmpelli		
Date 01/12/93			**Date**

7 Points under

GPU Nuclear — Ultrasonic Thickness Data Sheet

☒ OC ☐ TMI-1 ☐ TMI-2 | Class: N/A | Item: N/A | NDE Request: 92-C22 | Data Sheet No.: 92-C22-21

Task Description: Drywell Liner T.U. Measurements | Task No.: N/A | Date: 1-11-93

Comp. Desc.: Drywell Liner Bay 13 | System: 187 | Code/Spec.: N/A (Eng. Infor.)

Procedure/Rev.: 6410-CAP-7200.07 Rev. C | Drawing No./Rev.: 3E-187-24 001

Test Surface: O.D. | Thickness: 1/8" | Material: C.S.

Examiner Sign: [signature] Print: J. Van Sickle Cindi | ID No.: 154-46-3318 | Level: II

Examiner Sign: [signature] Print: Luis Valenzuela | ID No.: 116-44-2524 | Level: II

Thermometer S/N 92-045 Part Temperature 65 F D-Meter S/N 92-035

Cal. Blk. S/N 219 Cal. In: 11/ AM 2225 PM

Cal. Blk. Temp. 154 F Cal. Out: 11/ AM 2300 PM

Calibration Readings (Inches)

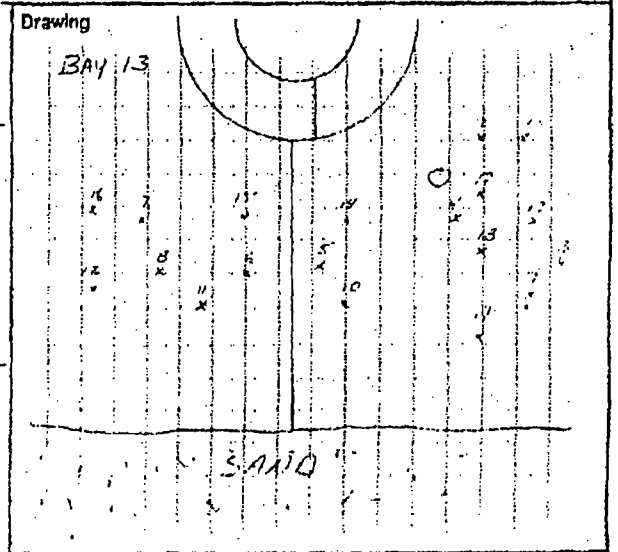
Cal. Blk.	.5	1.0	1.5			
D-Meter	.5	1.0	1.5			

Techniques: ☐ CRT ☒ D-Meter Other _____

Position #/Reading in Inches

Area	Location	Thk.
1	UP 1" R. 45"	0.672"
2	UP 1" R. 38"	0.724"
3	0.21" R. 48"	0.741"
4	0.12" R. 36"	0.803"
5	0.21" R. 6"	0.816"
6	0.24" L. 8"	0.833"
7	0.12" L. 22"	0.845"
8	0.24" L. 26"	0.816"
9	0.28" R. 41"	0.924"
10	0.28" R. 12"	0.726"
11	0.28" L. 15"	0.683"
12	0.28" L. 23"	0.683"
13	0.12" R. 40"	0.823"
14	0.12" R. 8"	0.866"
15	0.20" L. 9"	0.866"
16	0.20" L. 28"	0.835"
17	0.12" R. 12"	0.835"
18	0.22" R. 12"	0.835"
19	0.32" R. 38"	0.835"

Drawing



Reviewed by: [signature] Level: III Date: 1-11-93 Page 1 of 2

NS455 (03-90)

OCLR00014630

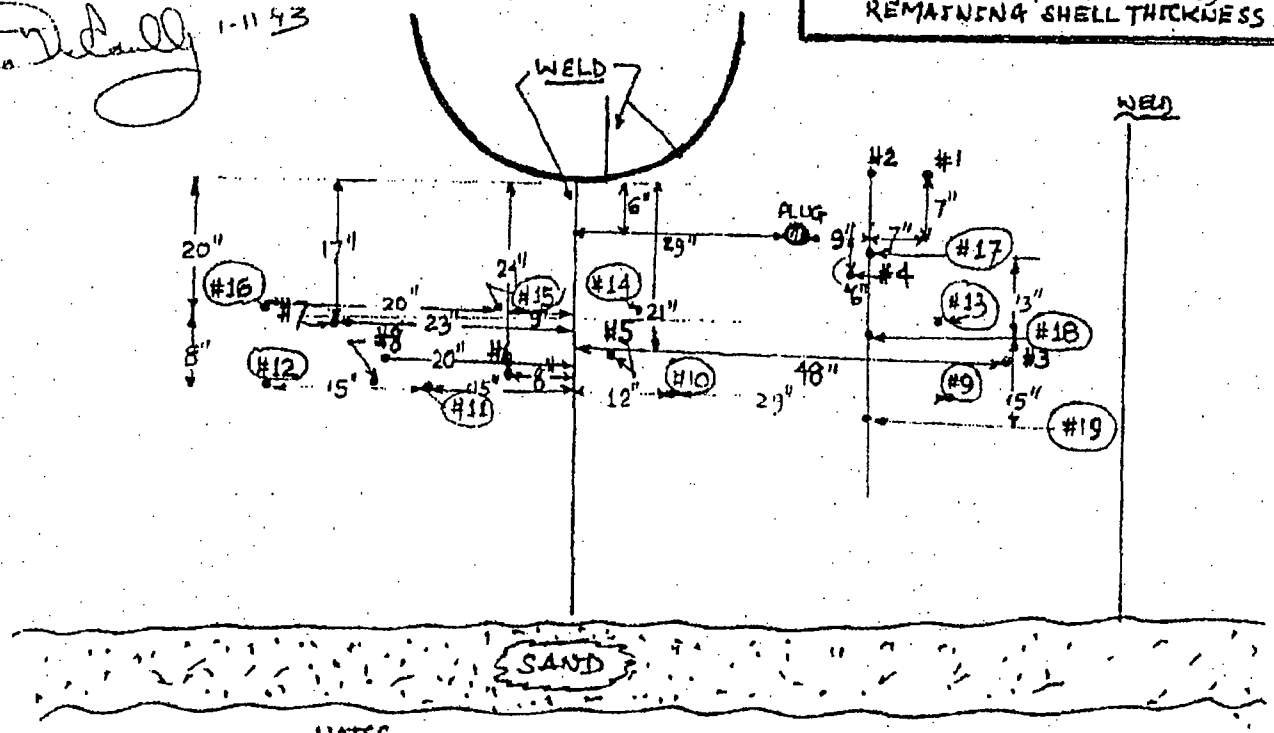
GPU Nuclear

Subject		Calc No.	Rev. No.	Sheet No.
O.C. Drywell Ext. UT Evaluation in Sandbed		C-1302-187-5320-024	1	94 of 117
Originator	**Date**	**Reviewed by**		**Date**
Mark Yekta	01/12/93	S. C. Tumminelli		/

BAY # 13

#1.2 6.72 24
Pg 2 of 2
1-11-93

NOTES:
- SPOT #9 THRU 19 MARKED ON 1/10/93. SKD 1/10/93
- GRIND ABOVE SPOTS CAREFULLY AS NOT TO REDUCE SHELL THICKNESS EXCESSIVE
- UT ALL SPOTS (1 THRU 19) FOR REMAINING SHELL THICKNESS



NOTES
- PLUG UNCORRODED – LOCATED IN A DEEP VALLEY.
- "TUB RING" LESS PROMINENT.
- SHELL & FLOOR NEEDS MORE CLEANING.

SKD

OCLR00014631

GPU Nuclear

Subject	Calc No.	Sheet No.
O.C. Drywell Ext UT Evaluation in Sandbed	C-1302-187-5320-024	95 of 117
Originator Mark Yekta	**Reviewed by** S. C. Tummineli	**Rev. No.** 1
Date 01/12/93		**Date**

GPU Nuclear — Ultrasonic Thickness Data Sheet

☑ OC ☐ TMI-1 ☐ TMI-2 | Class: N/A | Item: N/A | NDE Request: 92-072 | Data Sheet No.: 92-072-15

Task Description: Drywell liner Thk. measurements | Task No.: N/A | Date: 1/11/93

Comp. Desc.: Drywell liner Bay 13 | System: 187 | Code/Spec.: Eng Info

Procedure/Rev.: 6100-OAP-7209.07 Rev 0 | Drawing No./Rev.: 3E-187-29-001

Test Surface: O.D. | Thickness: 1 1/8" | Material: CS

Examiner	Sign: [signature]	Print: J. VanOrden Linde	ID No.: 15448-0309	Level: II
Examiner	Sign: N/A	Print: N/A	ID No.: N/A	Level: N/A

Thermometer S/N 92-062 Part Temperature 70 F D-Meter S/N 92-035

Cal. Blk. S/N 219 Cal. In: N/A AM 1030 PM

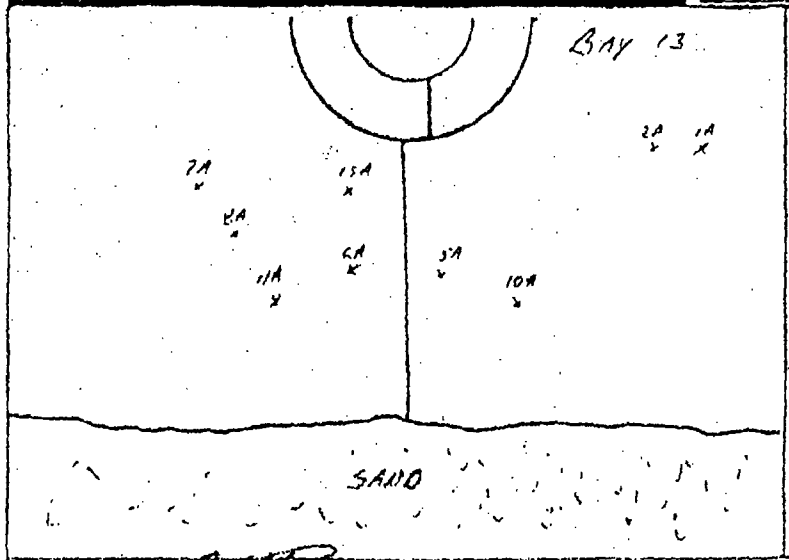
Cal. Blk. Temp. 70 F Cal. Out: N/A AM 1045 PM

Calibration Readings (Inches)

Cal. Blk.	.5	1.0	1.5		N/A	
D-Meter	.5	1.0	1.5			

Techniques: ☐ CRT ☑ D-Meter ☐ Other

Position #/Reading in Inches



Drawing

AREA	THICKNESS
1A	0.89"
2A	0.943"
5A	0.851"
10A	0.81"
11A	0.859"
8A	0.9"
7A	0.752
6A	~~0.859~~ .776"
15A	~~0.866~~ .757"

A minimal grind area adjacent to previous grind out locations

Reviewed by: [signature] | Level: III | Date: 1/11/93 | Page 1 of 1

NS455 (05-90)

OCLR00014632

Hole under

GPU Nuclear — **Ultrasonic Thickness Data Sheet**

☒ OC ☐ TMI-1 ☐ TMI-2 | Class: NA | Item: NA | NDE Request: 92-072 | Data Sheet No.: 92-072-26

Task Description: Drywell Final Thickness | Task No.: N/A | Date: 1/11/93

Comp. Desc.: Drywell Outer Bay 13 | System: 187 | Code/Spec.: Eng. Info.

Procedure/Rev.: 6100-QAP 7209.07 Rev. 0 | Drawing No./Rev.: 3E-187-29-001

Test Surface: O.D. | Thickness: 1 7/8" | Material: C/S

Examiner	Sign: [signature]	Print: J. Van der Linde	ID No.: 154-48-2318	Level: II
Examiner	Sign: NA	Print: NA	ID No.: NA	Level: NA

Thermometer S/N 22-068 Part Temperature 70 F D-Meter S/N 133-13

Cal. Blk. S/N 218 Cal. In: N/A AM 1032 PM

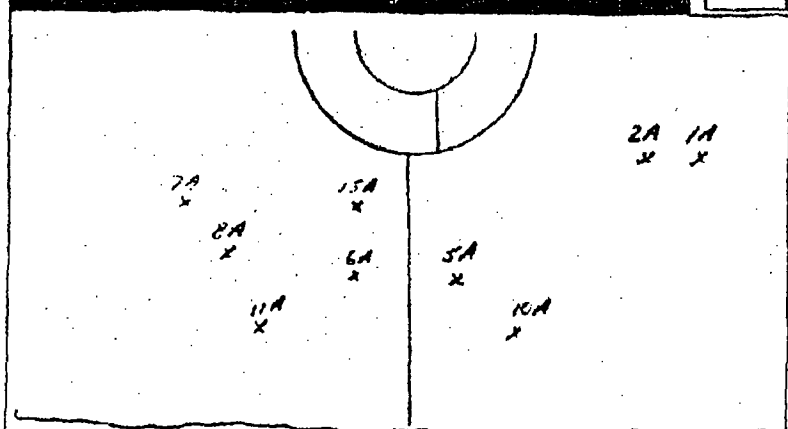
Cal. Blk. Temp. 70 F Cal. Out: N/A AM 1105 PM

Calibration Readings (Inches)

Cal. Blk.	.5	1.0	1.5		N/A	
D-Meter	.5	1.0	1.5			

Techniques: ☒ CRT ☒ D-Meter Other ____

Position & Reading in Inches



SAND

Drawing

AREA	Thickness
1A	0.88
2A	0.7
5A	0.83
10A	0.82
11A	0.83
8A	0.87
7A	0.76
6A	0.97
15A	0.85

"A" minimal grind area adjacent to previous grind/UT locations

Reviewed by: [signature] | Level: III | Date: 1-11-93 | Page 1 of 1

GPU Nuclear			
Subject: O.C. Drywell Ext. UT Evaluation in Sandbed		Calc No. C-1302-187-5320-024	Rev. No. 1
Originator: Mark Yekta	Date: 01/12/93	Reviewed by: S. C. Tummineelli	Date
			Sheet No. 96 of 117

OCLR00014633

GPU Nuclear

Calibration Sheet

Cal Sheet# 14A-113

System 187	Component BAY 13 LINER	Procedure 6100-OAP-7209.07	Rev 0

Examiner:	Signature:	Print: J. VanDerLinde	Initial:	ID# 154-48-0207	Level II
Examiner:	Signature: N/A	Print: N/A	Initial: N/A	ID# N/A	Level N/A

Instrument Settings
ID# 132-113
Model/Manuf SONIC 132 STAVELY

Gain
Coarse 426
Fine N/A
Uncal N/A

Sweep Circuit
Coarse 2 (Range)
Fine N/A 0.224
Delay 0.365"
Screen Depth 2"

Operation
(T&R) Normal
Frequency: 5 MHZ
Reject: ☐Off ☐On %
Filter: ☐Off ☐On 1 %
Damping: ☐Off ☐On 100 %

Rep Rate: 200 Hz

Cal Standard
ID# 219
Size 4 Sch. N/A
Thickness .5 to 1.5"
S/S (CS)
Temp 70 °F

System Check
☐Exit Point N/A
☐Angle +/- 2

Search Unit
ID# D032264
Type 5DA GAMMA
Freq 5 MHZ
Size .25"
Angle 0 Mode Long.

Cal Direction
☐Axial ☐Both
☐Circ. ☑Normal

Date 1/11/93 Time 1032 AM

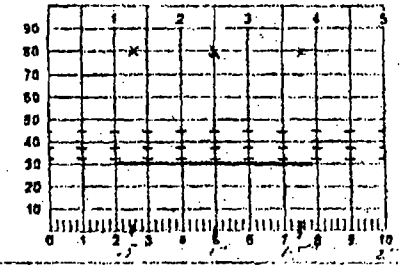
Search Unit Cable
Type SK CONTAINED Length 2x6'

Couplant
Make Sonotate Batch# SIP 89-1.05

Thermometer
S/N: 92-058 Cal Due 5/24/93

Reflector	Amplitude % of FSH	Screen Reading in Inches
.5	80	.5
1.0	80	1.0
1.5	80	1.5

DAC Plot



Time/Date	1105AM 1/11/93		/		/	
Reflector	% FSH	Inches	% FSH	Inches	% FSH	Inches
.5	80	.5				
1.0	80	1.0				
1.5	80	1.5				
Initials						

Remarks:
Original utilized
Gate at 30% FSH
Refer to UT Thickness
Data sheet 92-072-26

Components Examined:
Drywell liner Bay 13

ANI Review

Technical Review
Reviewed By
Level Date 1-11-93

NDE Request#: 92-072

N0927 (05-90)

Subject: O.C. Drywell Ext. UT Evaluation in Sandbed			GPU Nuclear
Originator: Mark Yekta	Date: 01/12/93	Calc No.: C-1302-187-5320-024	Rev. No.: 1
		Reviewed by: S. C. Tummminelli	Date:
			Sheet No.: 97 of 117

OCLR00014634

GPU Nuclear

☒ OC ☐ TMI ☐ OTHER _____

Sketch Form (with grid)

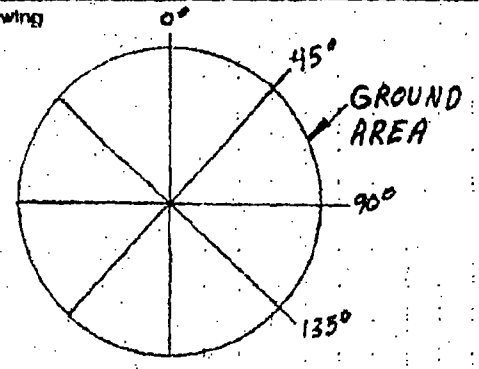
Component: DRY WELL LINEAR

Data Sheet No.: 92-072-2427

Location: BAY 13

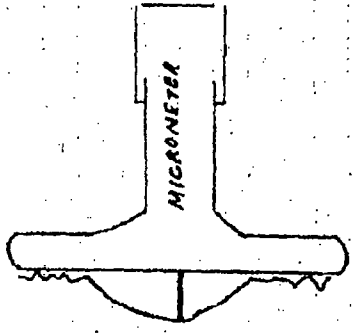
Drawing No.: N/A Rev.: N/A

Drawing



UT READING LOCATIONS	0°	45°	90°	135°
1	.330	.382	.346	.346
2	.312	.377	.360	.393
5	.150	.193	.230	.298
6	.327	.339	.290	.247
7	.241	.279	.260	.239
8	.324	.245	.267	.279
10	.186	.173	.255	.229
11	.240	.231	.271	.283
15	.288	.277	.239	.288

DEPTH MICROMETER USED QC-2-39
VERIFIED ON BLOCK 219 & 207



TECHNIQUE USED TO DETERMINE DETH OF GROUND AREAS

Prepared by: [signature] Title: UT LEVEL II Date: 1-11-93

Reviewed by: [signature] Level: II Date: 1-13-93 Page 1 of 1 NDE Request No.: 92-072

N9454 (05 90)

GPU Nuclear

Subject	Calc No.	Rev. No.	Sheet No.
O.C. Drywell Ext. UT Evaluation in Sandbed	C-1302-187-5320-024	1	98 of 117
Originator Mark Ycka	**Date** 01/12/93	**Reviewed by** S. C. Tumminelli	**Date**

OCLR00014635

GPU Nuclear

Subject	Calc No.	Rev. No.	Sheet No.
O.C. Drywell Ext. UT Evaluation in Sandbed	C-1302-187-5320-024	1	99 of 117
Originator: Mark Yekta — Date: 01/12/93	Reviewed by: S. C. Turminelli		Date

GPU Nuclear

Ultrasonic Thickness Data Sheet

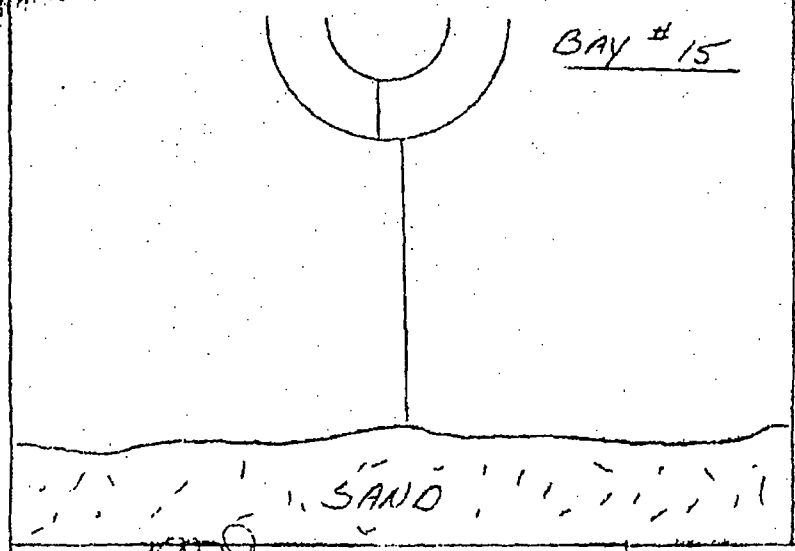
☒ OC ☐ TMI-1 ☐ TMI-2	Class: N/A	Item: N/A	NDE Request: 92-072
Data Sheet No.: 92-072-01			
Task Description: UT Thickness		Task No.: N/A	Date: 1-8-93
Comp. Desc.: Drywell Liner	System: 187		Code/Spec.: ENG. INFO.
Procedure/Rev.: 6100-QAP-7209.07 Rev. 0		Drawing No./Rev.: 3E-187-29-001	
Test Surface: O.D.		Thickness: 1/8"	Material: c/s
Examiner Sign: [signature]	Print: JON VAN DER LINDE	ID No.: 154-48-0319	Level: II
Examiner Sign: [signature]	Print: LUIS VALENZUELA	ID No.: 110-44-1524	Level: II

Thermometer S/N 92-005 Part Temperature 70 F D-Meter S/N 92-035
Cal. Blk. S/N 218 Cal. In: 0021 AM ___ PM
Cal. Blk. Temp. 72 F Cal. Out: 0225 AM ___ PM

Calibration Readings (inches)

Cal. Blk.	.5	1.0	1.5			
D-Meter	.5	1.0	1.5			

Techniques: ☐ CRT ☒ D-Meter Other ___



Drawing

	AREA	MEASUREMENT
1	0-12" R-26	0.784" *
2	0-22" R-24"	0.824"
3	0-33" R-17"	0.732"
4	0-33" R-7"	0.745"
5	0-26" L-3	0.93"
6	0-6" L-8"	0.774"
7	0-24" L-12"	0.603"
8	0-24" L-36"	0.72"
9	0-36" L-40"	0.762" *
10	0-24" L-48"	0.56"
11	0-24" L-65"	0.825"

Reviewed by: [signature] Level: II Date: 1-8-93 Page 1 of 1

OCLR00014636

GPU Nuclear

Subject	Calc No.	Rev. No.	Sheet No.
O.C. Drywell Ext. UT Evaluation in Sandbed	C-1302-187-5320-024	1	100 of 117
Originator Mark Yekta	**Reviewed by** S. C. Tummineli		
Date 01/12/93			**Date**

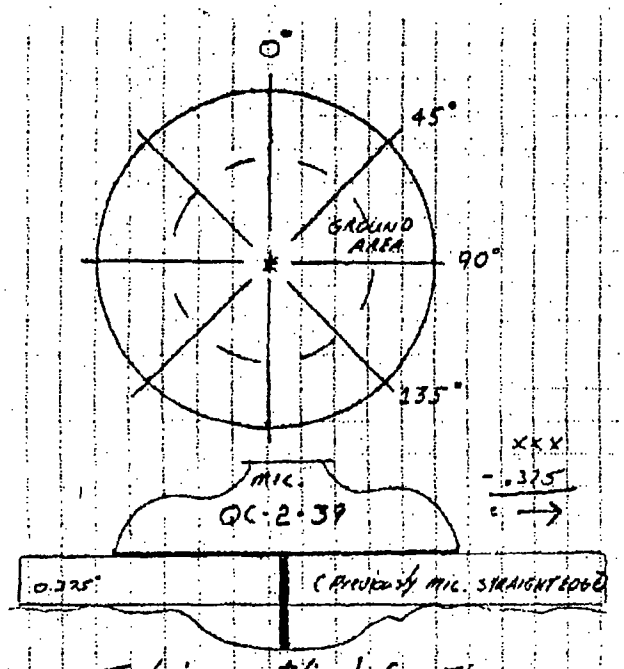
GPU Nuclear

☒ OC ☐ TMI ☐ OTHER _____

Sketch Form (with grid)

Component: DRYWELL liner SANDBED AREA	Date Sheet No.: 92-072-30
Location: BAY # 15	Drawing No.: N/A Rev.: N/A

Drawing



Technique utilized for The Pit depth MEASUREMENTS

AREA	AZIMUTH 0°	45°	90°	135°
9	.356	.358	.359	.282

Prepared by:	Title: VT LV II		Date: 1/12/93
Reviewed by: Level: II	Date: 1-13-93	Page 1 of 1	NDE Request No.: 92-072

OR46113-QAP-F2000.06(12-90)

OCLR00014637

GPU Nuclear

Subject	Calc No.	Rev. No.	Sheet No.
O.C. Drywell Ext. UT Evaluation in Sandbed	C-1302-187-5320-024	1	101 of 117
Originator Mark Yekta	**Reviewed by** S. C. Tumminelli		
Date 01/12/93			**Date**

GPU Nuclear — Ultrasonic Thickness Data Sheet

☒ OC ☐ TMI-1 ☐ TMI-2 | Class: n/a | Item: n/a | NDE Request: 92-072 | Data Sheet No.: 92-072-01

Task Description: CRT Thickness Measurements | Task No.: n/a | Date: 12/5/92

Comp. Desc.: Drywell Liner Bay 17 | System: 187 | Code/Spec.: ASME Sect. VIII

Procedure/Rev.: GPU-SAF-9209.07 Rev 0 | Drawing No./Rev.: 3E-197-29-001 Rev 0

Test Surface: O.D. | Thickness: 1 1/8" | Material: C/S

Examiner	Sign: [signature]	Print: Jonathan Underwood	ID No.: 154-48-0319	Level: II
Examiner	Sign: Mark F. Bugnell	Print: Mark F. Bugnell	ID No.: 553-81-1802	Level: II

Thermometer S/N 97-057 | Part Temperature 65 F | D-Meter S/N 157-115

Cal. Blk. S/N 218 | Cal. In: 7:40 AM n/a PM

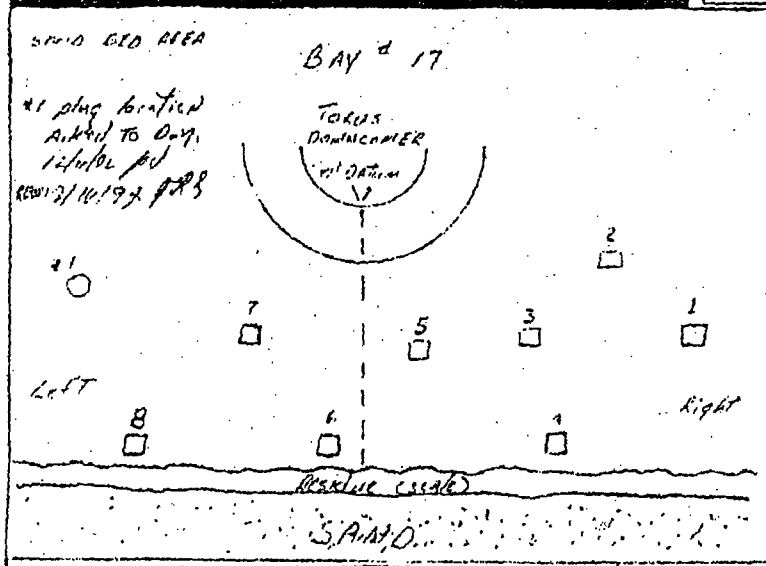
Cal. Blk. Temp: 68 F | Cal. Out: 9:35 AM n/a PM

Calibration Readings (Inches)

Cal. Blk.	0.5"	0.75"	1.0"	1.25"	1.5"	n/a
D-Meter	0.5"	0.75"	1.0"	1.25"	1.5"	n/a

Techniques: ☒ CRT ☒ D-Meter; Other Sonic 122

Position #/Reading in Inches



Drawing

AREA	*Position	**UT measurement
1	0-30" R-52"	0.99"
2	0-12" R-42"	1.16"
3	0-22" R-24"	0.92"
4	0-53" R-30"	1.03"
5	0-36" R-12"	0.94"
6	0-52" L-6"	1.01"
7	0-36" L-26"	0.97"
8	0-52" L-40"	1.03"

*Approximate position measurements
0: Down R: Right L: Left

**Minimum back wall reflection indicates minimum surface at I.D. of liner.

Reviewed by: [signature] | Level: III | Date: 12-5-92 | Page 1 of 1

N5455 (05-90)

OCLR00014638

GPU Nuclear

Subject	Originator	Date	Calc No.	Rev. No.	Sheet No.
O.C. Drywell Ext. UT Evaluation in Sandbed	Mark Yekta	01/12/93	C-1302-187-5320-024	1	102 of 117
			Reviewed by S. C. Tummineilli		Date

GPU Nuclear — Ultrasonic Thickness Data Sheet

☒ OC ☐ TMI-1 ☐ TMI-2	Class: N/A	Item: N/A	NDE Request: 92-072	Data Sheet No.: 92-072-04
Task Description: CAT Thickness			Task No.: N/A	Date: 12/14/92
Comp. Desc.: Drywell Liner Bay 17	System: 187		Code/Spec.: ASME Sect VIII	
Procedure/Rev.: 6100 ADM-7209.03 Rev. 0		Drawing No./Rev.: 3E-187-29-001 Rev. 0		
Test Surface: C.O		Thickness: 1/8"	Material: C/S	
Examiner	Sign: [signature]	Print: Jonathan Wooster Cinda	ID No.: 137-90-0278	Level: II
Examiner	Sign: N/A	Print: N/A	ID No.: N/A	Level: N/A

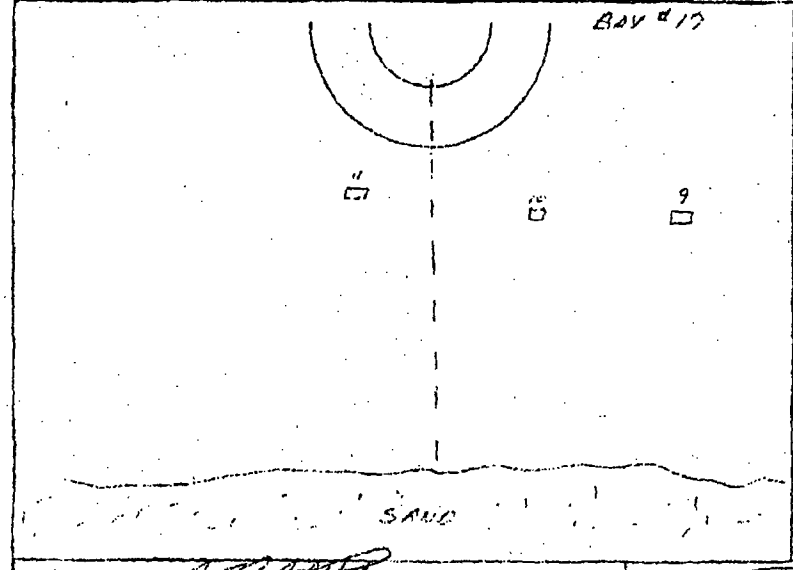
Thermometer S/N 92-057 Part Temperature 68 F D-Meter S/N 132-112
Cal. Blk. S/N 58 Cal. In: N/A AM 1:00 PM
Cal. Blk. Temp. 69 F Cal. Out: N/A AM 1:30 PM

Calibration Readings (Inches)

Cal. Blk.	.5	.75	1.0	N/A		
D-Meter	.5	.75	1.0			

Techniques: ☒ CRT ☒ D-Meter Other _____

Position #/Reading in Inches



Drawing

ACEK		Thickness
9	0.29" R-10"	0.72"
10	0.26" R-11"	0.55"
11	0.21" R-12"	0.96"

Performed after cavity cleanup

Reviewed by: [signature] Level: III Date: 12-14-92 Page 1 of 1

NS455 (03-90)

OCLR00014639

GPU Nuclear

Subject	Originator	Date	Calc No.	Rev. No.	Sheet No.
O.C. Drywell Ext. UT Evaluation in Sandbed	Mark Yekta	01/12/93	C-1302-187-5320-024	1	103 of 117
			Reviewed by S. C. Tummarelli		Date

GPU Nuclear — Ultrasonic Thickness Data Sheet

☒ OC ☐ TMI-1 ☐ TMI-2 | Class: n/a | Item: n/a | NDE Request: 92-072 | Data Sheet No.: 92-072-06

Task Description: UT Thickness | Task No.: n/a | Date: 12/14/92

Comp. Desc.: Drywell Liner Bay 17 | System: 187 | Code/Spec.: ASME Sect III

Procedure/Rev.: 6100-CAC-7600-07 Rev 0 | Drawing No./Rev.: 3E-187-29-001 Rev 0

Test Surface: O.D. | Thickness: 1 1/8" | Material: C/S

Examiner	Sign: [signature]	Print: J. Unacker (Unak)	ID No.: 154-48-0319	Level: II
Examiner	Sign: n/a	Print: n/a	ID No.: n/a	Level: n/a

Thermometer S/N 22-057 Part Temperature 65 F ~~D-Meter S/N~~ 92-010

Cal. Blk. S/N 98 Cal. In: n/a AM 1.05 PM

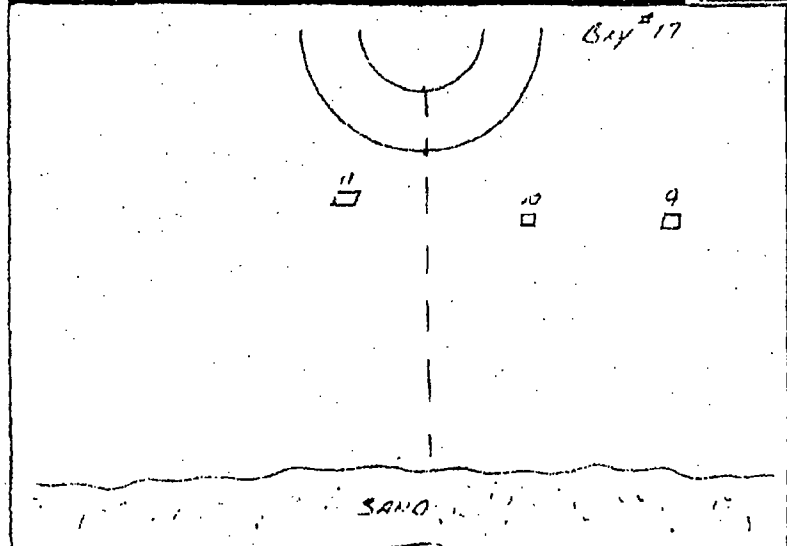
Cal. Blk. Temp. 68 F Cal. Out: n/a AM 1.21 PM

Calibration Readings (inches)

Cal. Blk.	.5	.75	1.0		n/a	
D-Meter	.5	.75	1.0			

Techniques: ☒ CRT ☒ D-Meter Other _____

Position #/Reading in Inches



Drawing

Meter		Thickness
9	0.47" R-32"	0.72"
10	0.26" R-11"	0.55"
11	0.27" L-12"	0.77"

Performed after nominal grinding then min. finish

Reviewed by: [signature] Level: III Date: 12-14-92 Page 1 of 1

N5455 (05-90)

OCLR00014640

GPU Nuclear

Subject	Calc No.	Rev. No.	Sheet No.
O.C. Drywell Ext. UT Evaluation in Sandbed	C-1302-187-5320-024	1	104 of 117
Originator Mark Yekta	**Reviewed by** S. C. Tummincelli		
Date 01/12/93			**Date**

GPU Nuclear — **Ultrasonic Thickness Data Sheet**

☒ OC ☐ TMI-1 ☐ TMI-2 | Class: N/A | Item: N/A | NDE Request: 92-072 | Data Sheet No.: 92-072-C5

Task Description: UT Thickness Measurements | Task No.: N/A | Date: 12/11/92

Comp. Desc.: Drywell Liner Bay 187 | System: 187 | Code/Spec.: ASME Sect. XI

Procedure/Rev.: 6100 OAP-7209.07 Rev. 0 | Drawing No./Rev.: 3E-187-29-001 Rev. 0

Test Surface: O.D. | Thickness: 1 1/8" | Material: C/S

Examiner	Sign: [signature]	Print: Jonathan Vanderlinde	ID No.: 154-48-0318	Level: II
Examiner	Sign: [signature]	Print: MARK F. BARNELL	ID No.: 551-61-1662	Level: I

Thermometer S/N 27-0:3 Part Temperature 72 F D-Meter S/N 92-010

Cal. Blk. S/N 88 Cal. In: 1145 AM ___ PM

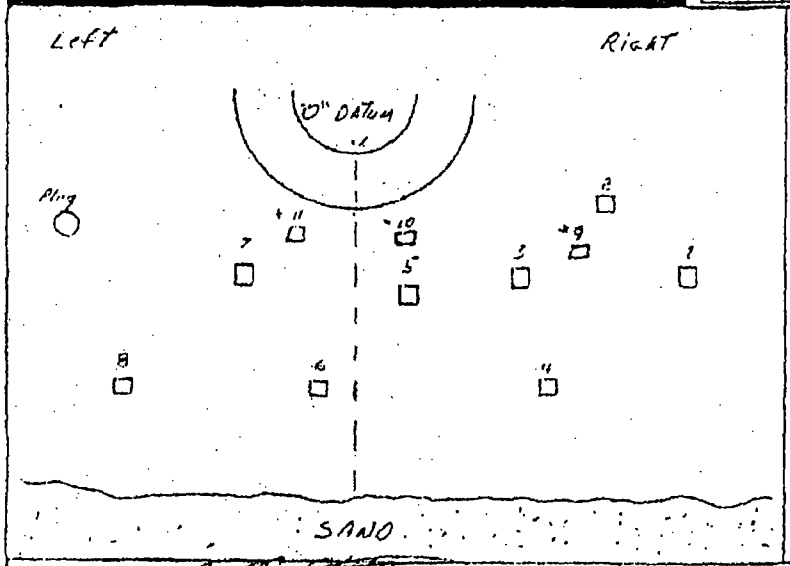
Cal. Blk. Temp. 72 F Cal. Out: ___ AM 1225 PM

Calibration Readings (inches)

Cal. Blk.	0.5"	0.75"	1.0"	~~N/A~~	~~N/A~~	~~N/A~~
D-Meter	0.5"	0.75"	1.0"			

Techniques: ☐ CRT ☒ D-Meter Other ____

Position #/Reading in Inches



Drawing

AREA	Position	Thickness
1	0-30" R-52"	0.916"
2	0-12" R-42"	1.15"
3	0-32" R-28"	0.898"
4	0-52" R-30"	0.951"
5	0-36" R-12"	0.913"
6	0-52" L-6"	0.992"
7	0-36" L-26"	0.97"
8	0-52" L-40"	0.98"
Plug	0-22" L-58"	
*9	0-27" R-30"	0.83" [illegible]
*10	0-26" R-11"	0.843" [illegible]
*11	0-21" L-12	0.762" [illegible]

*AREA's Dished - High noise levels unable to achieve accuracy

Reviewed by: [signature] | Level: II | Date: 12-16-92 | Page 1 of 1

N3455 (05-90)

OCLR00014641

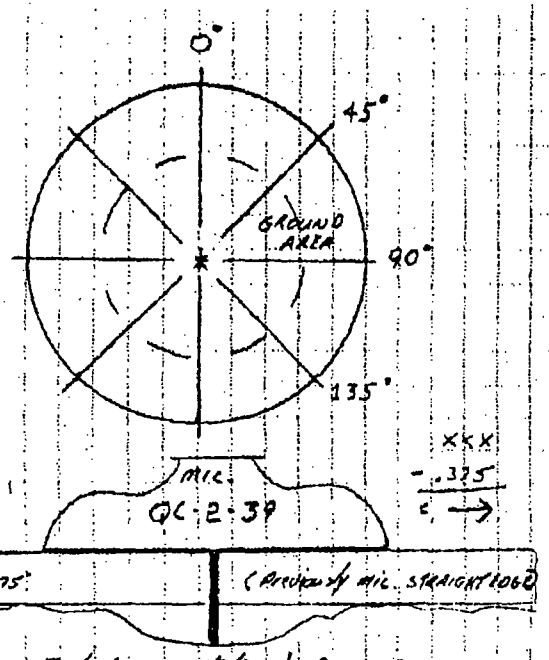
GPU Nuclear

☒ OC ☐ TMI ☐ OTHER _____

Sketch Form (with grid)

Component: DRYWELL liner Sandbed AREA	Data Sheet No.: 92-072-29
Location: BAY # 17	Drawing No.: N/A Rev.: N/A

Drawing



Technique utilized for The Pit depth MEASUREMENTS

AZIMUTH

AREA	0°	45°	90°	135°
9	.368	.407	.289	.342

Prepared by:			Title: VT LV II		Date: 1/12/93
Reviewed by:	Level: II	Date: 1-13-93	Page 1 of 1	NDE Request No.: 92-072	

FORM 8130-QAP-7200.06(11-4)

N9434 (05-90)

GPU Nuclear			
Subject: O.C. Drywell Ext. UT Evaluation in Sandbed		Calc. No. C-1302-187-5320-024	Rev. No. 1	Sheet No. 105 of 117
Originator: Mark Yekta	Date 01/12/93	Reviewed by: S. C. Tummineli		Date

GPU Nuclear

Subject: O.C. Drywell Ext. UT Evaluation in Sandbed

Originator: Mark Yekta | Date: 01/12/93

Calc No.: C-1302-187-5320-024 | Reviewed by: S. C. Tummulelli | Rev. No.: 1 | Sheet No.: 106 of 117 | Date:

GPU Nuclear — Ultrasonic Thickness Data Sheet

☒ OC ☐ TMI-1 ☐ TMI-2 | Class: n/a | Item: n/a | NDE Request: 92-072 | Data Sheet No.: 92-072-02

Task Description: UT Thickness | Task No.: n/a | Date: 12/15/92

Comp. Desc.: Drywell Liner Bay 19 | System: 187 | Code/Spec.: ASME Sec. VIII

Procedure/Rev.: 6100-ANP-2209.02 Rev. 0 | Drawing No./Rev.: 3E-187-29-001 Rev. 0

Test Surface: O.D. | Thickness: 1 1/8" | Material: C/S

Examiner	Sign: [signature]	Print: Jonathan Sanchez Linda	ID No.: 154-98-0311	Level: II
Examiner	Sign: [signature]	Print: Mark F. Bagnell	ID No.: 553-81-1802	Level: I

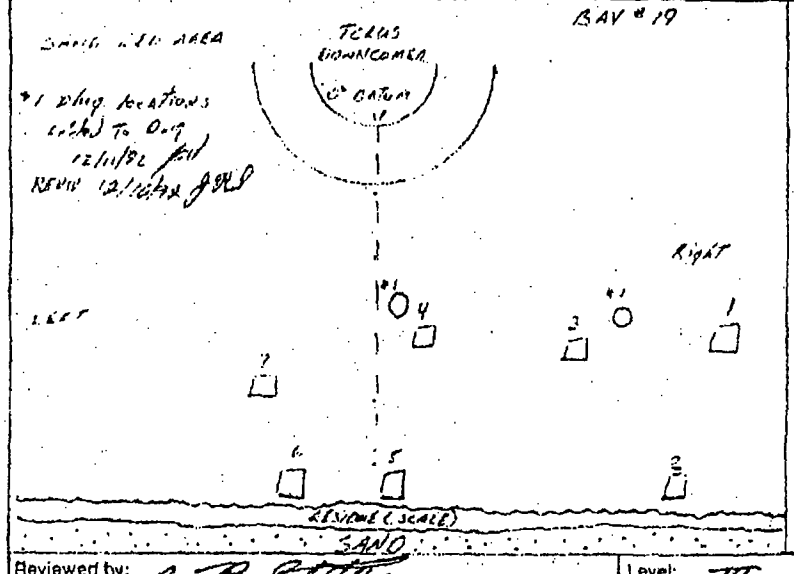
Thermometer S/N 92-077 Part Temperature 68 F D-Meter S/N 137-113
Cal. Blk. S/N 218 Cal. In: 10:20 AM n/a PM
Cal. Blk. Temp. 68 F Cal. Out: 10:35 AM n/a PM

Calibration Readings (Inches)

Cal. Blk.	0.5	0.75	1.0	1.25	1.5	
D-Meter	0.5	0.75	1.0	1.25	1.5	

Techniques: ☒ CRT ☒ D-Meter; Other Sonic 132

Position #/Reading in Inches



Drawing

AREA	*POSITION	UT MEASUREMENT**
1	D-30" R-20"	0.98"
2	D-52" R-66"	0.96"
3	D-32" R-49"	0.98"
4	D-32" R-11"	0.99"
5	D-53" R-2"	0.95"
6	D-52" L-6"	0.86"
7	D-38" L-12"	0.98"

* Position measurements are approximate

** uniform back wall reflection indicates a uniform surface at the I.D. of liner

Reviewed by: [signature] | Level: III | Date: 12-5-92 | Page 1 of 1

NS455 (05-90)

OCLR00014643

GPU Nuclear

Subject	Calc No.	Sheet No.
O.C. Drywell Ext. UT Evaluation in Sandbed	C-1302-187-5320-024	107 of 117
Originator Mark Yckta, **Date** 01/12/93	**Reviewed by** S. C. Tummineli	**Rev. No.** 1, **Date**

GPU Nuclear — **Ultrasonic Thickness Data Sheet**

☒ OC ☐ TMI-1 ☐ TMI-2 | Class: N6 | Item: N6 | NDE Request: 92-072 | Data Sheet No.: 92-072-03

Task Description: UT Thickness | Task No.: N6 | Date: 12/16/92

Comp. Desc.: Drywell Liner Ring 19 | System: 187 | Code/Spec.: ASME Sect III

Procedure/Rev.: [illegible] Rev 0 | Drawing No./Rev.: 3E-187-29-[illegible] Rev 0

Test Surface: O.D. | Thickness: 1 1/8" | Material: C/S

Examiner	Sign: [illegible]	Print: J. [illegible]	ID No.: 154-98-03/9	Level: II
Examiner	Sign: N6	Print: N6	ID No.: N6	Level: N6

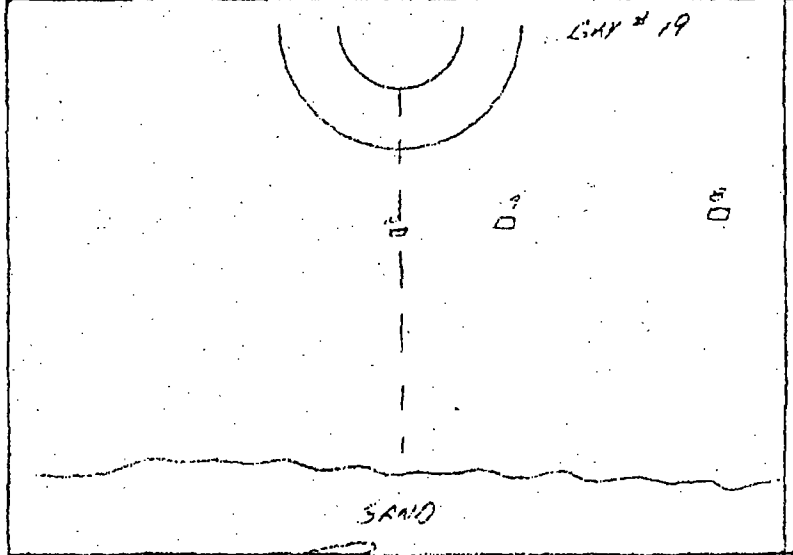
Thermometer S/N 92-037 Part Temperature 65 F D-Meter S/N 132-113
Cal. Blk. S/N 89 Cal. In: N6 AM 1:31 PM
Cal. Blk. Temp. 65 F Cal. Out: N6 AM 2:00 PM

Calibration Readings (Inches)

Cal. Blk.	.5"	.75"	1.0		N/A	
D-Meter	.5"	.75"	1.0			

Techniques: ☒ CRT ☒ D-Meter Other ____

Position #/Reading in Inches



Drawing

Point		Thickness
5	0.18" E.53"	0.997
9	0.18" E.12"	0.995
10	0.18" N.07"	0.996

Reviewed after additional analysis

Reviewed by: [signature] | Level: III | Date: 12-16-92 | Page 1 of 1

N3455 (05-90)

OCLR00014644

GPU Nuclear

Subject	Calc No.	Rev. No.	Sheet No.
O.C. Drywell Ext. UT Evaluation in Sandbed	C-1302-187-5320-024	1	108 of 117
Originator Mark Yekta	**Reviewed by** S. C. Tummineli		
Date 01/12/93			**Date**

GPU Nuclear — **Ultrasonic Thickness Data Sheet**

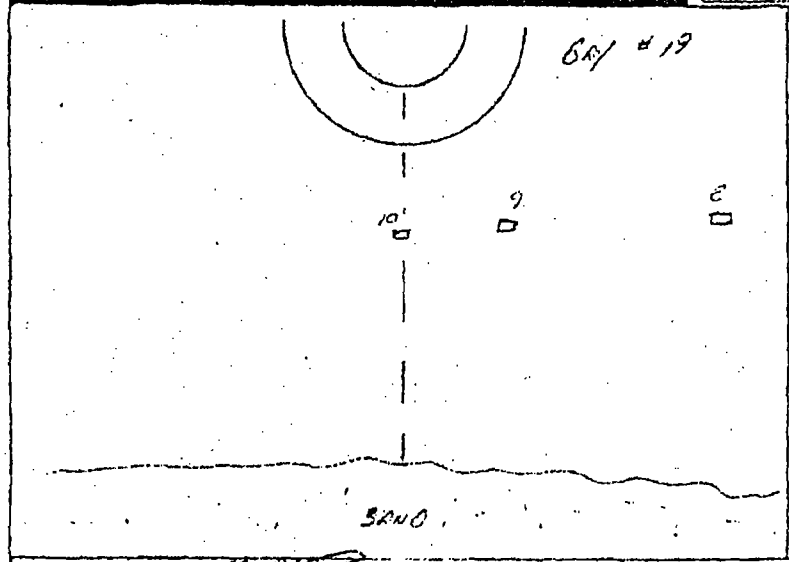
☒ OC ☐ TMI-1 ☐ TMI-2	Class: n/a	Item: n/a	NDE Request: 92-072	Data Sheet No.: 92-072-05
Task Description: UT Thickness		Task No.: n/a	Date: 12/14/92
Comp. Desc.: Drywell Liner Bay 19	System: 167	Code/Spec.: ASME Sect III
Procedure/Rev.: 6100-QAP-7209.07 Rev. 0	Drawing No./Rev.: 3C-187-29-001 Rev. 0	
Test Surface: O.D.	Thickness: 1 1/8"	Material: C/S
Examiner Sign: [signature]	Print: T. Uzacki-Lindb	ID No.: 15448-0319	Level: II
Examiner Sign: n/a	Print: n/a	ID No.: n/a	Level: n/a

Thermometer S/N 92-007 Part Temperature 66 F D-Meter S/N 92-010
Cal. Blk. S/N 68 Cal. In: n/a AM 1:37 PM
Cal. Blk. Temp. 65 F Cal. Out: n/a AM 2:05 PM

Calibration Readings (Inches)						
Cal. Blk.	.5	.75	1.0			
D-Meter	.5	.75	1.0			

Techniques: ☒ CRT ☒ D-Meter Other _____

Position #/Reading In Inches



Drawing

AREA		THICKNESS
8	0.15" R 6.5"	0.957
9	0.16" R 12"	0.774
10	0.19" R 0"	0.790

Additional data additional readings

back side bowl

Reviewed by: [signature]	Level: III	Date: 12-16-92	Page 1 of 1

OCLR00014645

GPU Nuclear

Subject	Calc No.	Rev. No.	Sheet No.
O.C. Drywell Ext. UT Evaluation in Sandbed	C-1302-187-5320-024	1	109 of 117
Originator Mark Yekta	**Reviewed by** S. C. Tummineli		
Date 01/12/93			**Date**

GPU Nuclear — Ultrasonic Thickness Data Sheet

[X] OC [ ] TMI-1 [ ] TMI-2	Class: N/A	Item: N/A	NDE Request: 92-072	Data Sheet No.: 92-072-07
Task Description: LOW THICKNESS		Task No.: N/A	Date: 12-11-92
Comp. Desc.: DRYWELL LINER BAY 19	System: 181	Code/Spec.: ASME SEC. VIII
Procedure/Rev.: GPUN-QAP 7201-07 REV 0	Drawing No./Rev.: 3E-181-207-001 REV 0	
Test Surface: O.D.	Thickness: 1 1/8"	Material: C/S

Examiner	Sign: [signature]	Print: JONATHAN WINDERCIWE	ID No.: 159-48-0218	Level: II
Examiner	Sign: [signature]	Print: MARK F. BABNELL	ID No.: 553-81-1662	Level: I

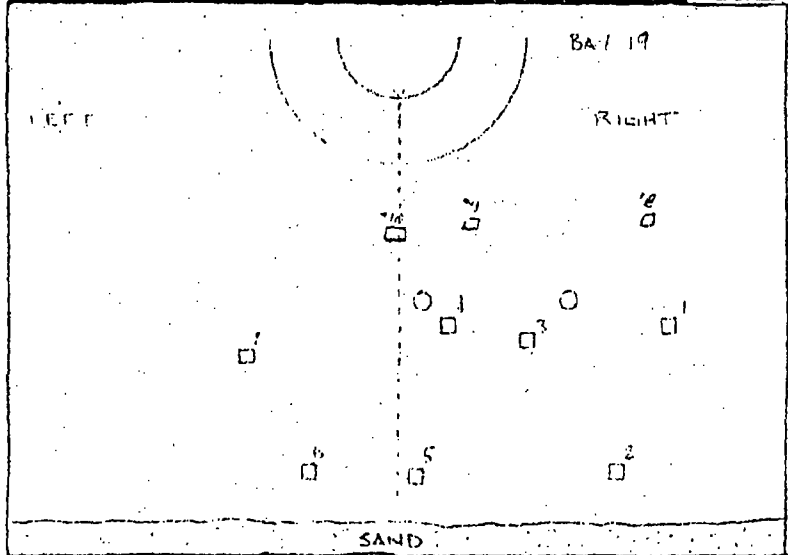
Thermometer S/N B1-059 Part Temperature 72° F D-Meter S/N 92-010
Cal. Blk. S/N 88 Cal. In: N/A AM 12:45 PM
Cal. Blk. Temp. 72° F Cal. Out: N/A AM 12:15 PM

Calibration Readings (Inches)

Cal. Blk.	0.5	0.75	1.0	N/A	N/A	N/A
D-Meter	0.5	0.75	1.0	N/A	N/A	N/A

Techniques: [ ] CRT [X] D-Meter Other N/A

Position #/Reading in Inches



Drawing

AREA	LOCATION	MEASUREMENT
1	D 70 R 70	0.122
2	D 62 R 66	0.122
3	D [illegible] R 40	0.155
4	D 52 R 11	0.146
5	D 52 R 2	0.156
6	D 52 L 6	0.160
7	D 51 L 12	0.164
8	D 46 R 63	0.165
9	D 46 R 12	0.155
10	D 41 0	0.184
PLUG #1	D 21 R 6	
PLUG #2	D 21 R 55	

* Surface ground unable to achieve accurate measurements

Reviewed by: [signature] Level: [signature] Date: 12-11-92 Page 1 of 1

OCLR00014646

MOC TMI

GPU Nuclear

Calibration Sheet

Cal Sheet# 18-034

System 157	Component Drywell Liner	Procedure 6100-QAP-7209.07	Rev C

Examiner:	Signature:	Print: J Vanchaciode	Initial:	ID# 154-43-0719	Level II
Examiner:	Signature: Mark Bagnell	Print: Mark F. Bagnell	Initial: MB	ID# 553 81-1803	Level I

Instrument Settings
ID# 157-113
Model/Manuf Sonic 132 Istavely

Gain
Coarse 60.6
Fine N/A
Uncal N/A

Sweep Circuit
Coarse 20" (cycle 0.221"/div) (Range)
Fine N/A
Delay 1.0
Screen Depth 2" (cycle 20)

Operation (1&2)
Normal
Frequency: 2.25 MHZ
Reject: ☐Off ☐On %
Filter: ☐Off ☐On 1 %
Damping: ☐Off ☐On 200 %

Rep Rate: 1000 Hz

Cal Standard
ID# 218
Size N/A Sch. N/A
Thickness .5 x .25"
S/S CS
Temp 68 °F

System Check
☐Exit Point N/A
☐Angle 1/- 2

Search Unit
ID# M08524
Type MSEB
Freq 2 MHZ
Size 1/2"
Angle 0 Mode Long

Cal Direction
☐Axial ☐Both
☐Circ. ☒Normal

Search Unit Cable
Type Dual Lemo Length 216'

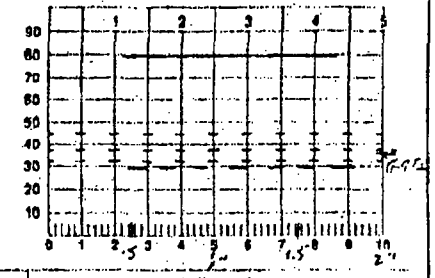
Couplant
Make Sonicsafe Batch# 550-80-1-02

Thermometer
S/N: 82-057 Cal Due 5-24-93

Date 12-5-92 Time 0910

Reflector	Amplitude % of FSH	Screen Reading in Inches
.5	80	.5
.75	80	.75
1.0	80	1.0
1.25	80	1.25
1.5	80	1.5

DAC Plot



Time/Date	0936 / 12-5-92		1020 / 12-5-92		1036 / 12-5-92	
Reflector inches	% FSH	Inches	% FSH	Inches	% FSH	Inches
.5	80	.5	80	.5	80	.5
.75	80		80		80	
1.0	80		80		80	
1.25	80		80		80	
1.5	80	1.5	80	1.5	80	1.5
Initials						

Remarks:
* Reflectors adjusted to 80% FSH as required
** Digital calibration independent of CRT
min .5"
max 2"

Components Examined:
Bay 17 & Bay 19

ANI Review

Technical Review
Reviewed By
Level III Date 12-5-92

NDE Request#: 92-72

N0927 (05-90)

Subject: O.C. Drywell Ext. UT Evaluation in Sandbed	Originator: Mark Yekta	Date: 01/12/93	Calc No. C-1302-187-5320-024
Reviewed by: S. C. Tummminelli	Rev. No. 1	Date	Sheet No. 110 of 117

GPU Nuclear

OCLR00014647

GPU Nuclear

Subject	Calc No.	Sheet No.
O.C. Drywell Ext. UT Evaluation in Sandbed	C-1302-187-5320-024	111 of 117
Originator Mark Yekta	**Reviewed by** S. C. Turnminelli	**Rev. No.** 1
Date 01/12/93		**Date**

GPU Nuclear — **Calibration Sheet** — Cal Sheet# [illegible]

System	Component	Procedure	Rev
[illegible]	[illegible]	[illegible]	[illegible]

	Signature	Print	Initial	ID#	Level
Examiner:	[illegible]	J. Unschelinde	[illegible]	137-48-0519	II
Examiner:	[illegible]	Mark F. Bagnell	MFB	253-81-1802	I

Instrument Settings
ID# [illegible]
Model/Manuf DC 26 Panametrics

Gain
Coarse N/A
Fine N/A
Uncal N/A

Sweep Circuit
Coarse N/A (Range)
Fine N/A
Delay N/A
Screen Depth N/A

Operation (T&R) Normal
Frequency: N/A MHZ
Reject: ☐Off ☐On N/A %
Filter: ☐Off ☐On N/A %
Damping: ☐Off ☐On N/A %

Rep Rate: N/A

Cal Standard
ID# 86
Size N/A Sch. N/A
Thickness 2.0 to 10"
S/S CS
Temp 22 °F

Search Unit
ID# 82-038
Type 0270 SM
Freq 5 MHZ
Size 0.75
Angle 0 Mode Long

Search Unit Cable
Type 50K coaxial wire Length 5 x 5'

Couplant
Make Sonarsoft Batch# SSP-82-1000

Thermometer
S/N: 82-0553 Cal Due 1-9-93

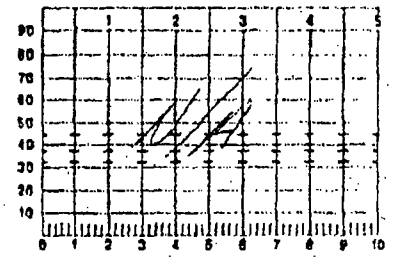
System Check
☐Exit Point
☐Angle +/- 2 N/A

Cal Direction
☐Axial ☐Both
☐Circ. ☐Normal

Date 12/4/92 Time 1145

Reflector	Amplitude % of FSH	Screen Reading in Inches
.5	N/A	N/A
.25	N/A	N/A
1.0	N/A	N/A

DAC Plot



Time/Date	1225 / 12/4/92		1245 / 12/4/92		1315 / 12/4/92	
Reflector	% FSH	Inches	% FSH	Inches	% FSH	Inches
.5	N/A	.5	N/A	.5	N/A	.5
.25	N/A	.75	N/A	.75	N/A	.75
1.0	N/A	1.0	N/A	1.0	N/A	1.0
Initials	[illegible]		[illegible]		[illegible]	

Remarks:

Components Examined: Cap 17 to 8

ANI Review

Technical Review
Reviewed By [illegible]
Level III Date 12-16-92

NDE Request#: 92-072

N0927 (05 90)

OCLR00014648

NDC TMI

GPU Nuclear

Calibration Sheet

Cal Sheet# [illegible]

System	Component	Procedure	Rev
187	Drywell liner	6100-OAP-7208.07	0

Examiner:	Signature:	Print:	Initial:	ID#	Level
	[signature]	J Vancha Linde	[illegible]	154-18-030	II
Examiner:	Signature:	Print:	Initial:	ID#	Level
	n/a	n/a	n/a	n/a	n/a

Instrument Settings
ID# 92-010
Model/Manuf OL-26 Panametrics

Gain
Coarse n/a
Fine n/a
Uncal n/a

Sweep Circuit
Coarse n/a (Range)
Fine n/a
Delay n/a
Screen Depth n/a

Operation
(LR) Normal
Frequency: n/a MHZ
Reject: ☐Off ☐On n/a %
Filter: ☐Off ☐On n/a %
Damping: ☐Off ☐On n/a %

Rep Rate: n/a

Cal Standard
ID# 88
Size n/a Sch. n/a
Thickness .5 - 10
S/S CS
Temp 68 °F

System Check
☐Exit Point
☐Angle +/- 2 n/a

Date 12/14/92

Search Unit
ID# 92-006
Type [illegible]
Freq 5 MHZ
Size 0.5
Angle 0 Mode [illegible]

Cal Direction
☐Axial ☐Both
☐Circ. ☒Normal

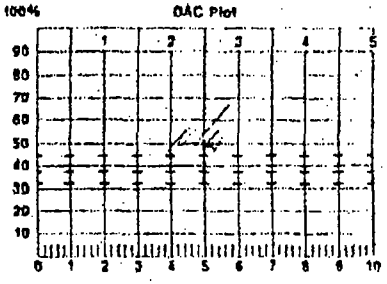
Time 1305

Search Unit Cable
Type [illegible] Length [illegible]

Couplant
Make [illegible] Batch# [illegible]

Thermometer [illegible]
S/N: [illegible] 92-057 Cal Due 5-24-93

Reflector	Amplitude % of FSH	Screen Reading in Inches
.5	n/a	n/a
.75	n/a	n/a
1.0	n/a	n/a



Time/Date	1325 / 12/14/92		1337 / 12/14/92		1405 / 12/14/92	
Reflector	% FSH	Inches	% FSH	Inches	% FSH	Inches
.5	n/a	.5	n/a	.5	n/a	.5
.75	n/a	.75	n/a	.75	n/a	.75
1.0	n/a	1.0	n/a	1.0	n/a	1.0
Initials	[signature]		[signature]		[signature]	

Remarks:

Components Examined:
OA 17019

ANI Review

Technical Review
Reviewed By [signature]
Level III Date 12-16-92

NDE Request#: 92-072

N0927 (05-90)

GPU Nuclear

Subject	Calc No.	Sheet No.
O.C. Drywell Ext. UT Evaluation in Sandbed	C-1302-187-5320-024	112 of 117
Originator	**Reviewed by**	**Rev. No.**
Mark Yekta	S. C. Tumminelli	1
Date		**Date**
01/12/93		

OCLR00014649

GPU Nuclear

Subject: O.C. Drywell Ext. UT Evaluation in Sandbed

Originator: Mark Yekta | Date: 01/12/93

Calc No.: C-1302-187-5320-024 | Reviewed by: S. C. Tummminelli

Rev. No.: 1 | Date:

Sheet No.: 113 of 117

MOC 11TMI

GPU Nuclear

Calibration Sheet

Cal Sheet# [illegible]

System: 187 | Component: Drywell Liner | Procedure: 6100-ONP-7209.07 | Rev: 0

Examiner:	Signature: [illegible]	Print: J. Van der Linde	Initial: [illegible]	ID# 154 18-031P	Level: II
Examiner:	Signature: n/a	Print: n/a	Initial: n/a	ID# n/a	Level: n/a

Instrument Settings
ID#: 137-113
Model/Manuf: SONIC 132 STANLEY
Gain
Coarse: 60.2
Fine: n/a
Uncal: n/a
Sweep Circuit
Coarse: 2.0" (vel. 0.231"/us) (Range)
Fine: n/a
Delay: 1.0
Screen Depth: 2"
Operation (T&P) Normal
Frequency: 2.25 MHZ
Reject: ☒Off ☐On ___ %
Filter: ☐Off ☒On 1 %
Damping: ☐Off ☒On 200 %
Rep Rate: 1000 Hz

Cal Standard
ID#: 88
Size: n/a Sch.: n/a
Thickness: .5 - 1.0
S/S (5)
Temp: 68 °F

System Check
☐Exit Point
☐Angle +/- 2 n/a
Date: 12/14/92

Search Unit
ID#: 000824
Type: MSEB
Freq: 2 MHZ
Size: 1/2"
Angle: 0 Mode: Comp

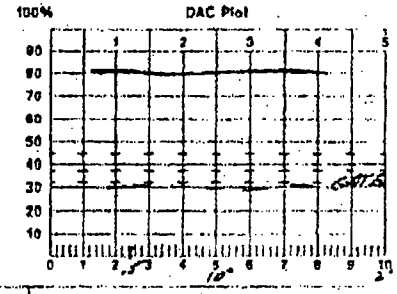
Cal Direction
☐Axial ☐Both
☐Circ. ☒Normal
Time: 1300

Search Unit Cable
Type: dual line Length: 3x6'

Couplant
Make: Sonicsafe Batch#: 1SC 89-1-02

Thermometer
S/N: 92-057 Cal Due: 5-24-93

Reflector	Amplitude % of FSH	Screen Reading in Inches
.5	80	.5
.75	80	.75
1.0	80	1.0



Time/Date	1330 / 12/14/92		1335 / 12/14/92		1400 / 12/14/92	
Reflector	% FSH	Inches	% FSH	Inches	% FSH	Inches
.5	80	.5	80	.5	80	.5
.75	80	.75	80	.75	80	.75
1.0	80	1.0	80	1.0	80	1.0
Initials	[illegible]		[illegible]		[illegible]	

Remarks:
* backwall maintained at 80% FSH

Components Examined:
Bay 17 & 19

ANI Review

Technical Review
Reviewed By: [illegible]
Level: III Date: 12-16-92

NDE Request#: 92-072

N0927 (05-90)

OCLR00014650

GPU Nuclear

Subject	Calc No.	Sheet No.
O.C. Drywell Ext. UT Evaluation in Sandbed	C-1302-187-5320-024	114 of 117
Originator Mark Yekta	**Reviewed by** S. C. Tummingelli	
Date 01/12/93	**Rev. No.** 1	**Date**

GPU Nuclear

Ultrasonic Thickness Data Sheet

☒ OC ☐ TMI-1 ☐ TMI-2	Class: N/A	Item: N/A	NDE Request: 92-072	Data Sheet No.: 92-072-11
Task Description: DRY WALL LINER MOCK-UP		Task No.: N/A	Date: 12-16-92
Comp. Desc.: WELD OVERLAY TEST PLATE	System: 187		Code/Spec.: ASME SECT VIII
Procedure/Rev.: 6100-QAP-7209.07 / 0		Drawing No./Rev.: -NA-	
Test Surface: OD		Thickness: 3/4"	Material: C/S
Examiner Sign: [signature]	Print: J. Van der Linde	ID No.: 154-48-0319	Level: II
Examiner Sign: [signature]	Print: JAMES PHILLIPPI	ID No.: 462277035	Level: I

Thermometer S/N 92-063 Part Temperature 68° F D-Meter S/N 92-010
Cal. Blk. S/N 214 Cal. In: N/A AM 1420 PM
Cal. Blk. Temp. 68° F Cal. Out: N/A AM 1440 PM

Calibration Readings (Inches)

Cal. Blk.	.502	.752	1.001	1.251		
D-Meter	.502	.751	1.000	1.250		

Techniques: ☐ CRT ☒ D-Meter
Other -NA-

Position #;Reading in Inches

Drawing

	A1SCAN	26 DL
BASE METAL	.73	.128
1 PASS	.94	.927
2 PASS	1.12	1.114

Reviewed by: [signature] Level: III Date: 12-27-92 Page 1 of 1

N5455 (05-90)

OCLR00014651

GPU Nuclear

Subject	Calc No.	Rev. No.	Sheet No.
O.C. Drywell Ext. UT Evaluation in Sandbed	C-1302-187-5320-024	1	115 of 117
Originator: Mark Yckta	Reviewed by: S. C. Tummunelli		
Date: 01/12/93			Date

GPU Nuclear

Ultrasonic Thickness Data Sheet

☒ OC ☐ TMI-1 ☐ TMI-2	Class: N/A	Item: N/A	NDE Request: 92-072	Data Sheet No.: 92-072-11
Task Description: DRY WALL LINER MOCK-UP			Task No.: N/A	Date: 12-16-92
Comp. Desc.: WELD OVERLAY TEST PLATE	System: 107			Code/Spec.: ASME SECT VIII
Procedure/Rev.: 6100-QAP-7209.07 / 0			Drawing No./Rev.: -NA-	
Test Surface: OD			Thickness: 3/4"	Material: C/S
Examiner Sign:	Print: J. Van der Linde		ID No.: 154-45-0319	Level: II
Examiner Sign:	Print: JAMES PHILLIPPI		ID No.: 462277035	Level: I

Thermometer S/N 92-063 Part Temperature 68° F D-Meter S/N 92-010
Cal. Blk. S/N 214 Cal. In: N/A AM 1420 PM
Cal. Blk. Temp. 68° F Cal. Out: N/A AM 1440 PM

Calibration Readings (Inches)

Cal. Blk.	.502	.752	1.001	1.251		
D-Meter	.502	.751	1.000	1.250		

Techniques: ☐ CRT ☒ D-Meter
Other -NA-

Position #/Reading in Inches

Drawing

A-SCAN 26 DL

BASE METAL	.73	.728
1 PASS	.94	.927
2 PASS	1.12	1.114

Reviewed by: [signature] Level: III Date: 11-27-92 Page 1 of 1

N9055 (05-90)

OCLR00014652

GPU Nuclear

Subject: O.C. Drywell Ext. UT Evaluation in Sandbed
Originator: Mark Yekta
Date: 01/12/93
Calc No.: C-1302-187-5320-024
Reviewed by: S. C. Tummineli
Rev. No.: 1
Date:
Sheet No.: 116 of 117

GPU Nuclear

1-6C 1 ITMI

Calibration Sheet

Cal Sheet# 14R-01-2

System: 187
Component: DRYWELL LINER
Procedure: 6100-QAP-7209.07 Rev 0

Examiner: Signature: [illegible] Print: J Vanderlinde Initial: JV ID# 5446-01A Level II
Examiner: Signature: James Phillippi Print: JAMES PHILLIPPI Initial: JP ID# 462277035 Level I

Instrument Settings
ID# 137-113
Model/Manuf: SONIC 137 / STAVELEY

Gain
Coarse 60 2 dB
Fine N/A
Uncal N/A

Sweep Circuit
Coarse 2.0" (VEL = .231 "/µs) (Range)
Fine N/A
Delay 1.0
Screen Depth 2"

Operation
T&R Normal
Frequency: 2.25 MHZ
Reject: X Off ☐ On N/A %
Filter: ☐ Off ☒ On FILT. 1 %
Damping: ☐ Off X On 200Ω %

Rep Rate:

Cal Standard
ID# 214
Size NA Sch. NA
Thickness .5-1.25
S/S (CS) NA
Temp 68 °F

Search Unit
ID# M08524
Type MSER
Freq 2.0 MHZ
Size .5"
Angle 0 Mode LONG

Search Unit Cable
Type DUAL LIMO Length 2 x 6'

Couplant
Make SOUNDSAFE Batch# SSP-89-1-02

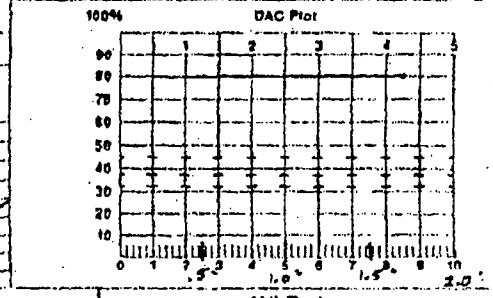
Thermometer
S/N: 92-063 Cal Due 5-24-93

System Check N/
☐ Exit Point A
☐ Angle +/- 2

Cal Direction
☐ Axial ☐ Both
☐ Circ. ☒ Normal

Date 12-16-92 Time 1410

Reflector	Amplitude % of FSH	Screen Reading in Inches
.5	80	.5
.75	80	.75
1.0	80	1.0
1.25	80	1.25



Time/Date	1415 / 12-16-92		1425 / 12-16-92		/	
Reflector	% FSH	Inches	% FSH	Inches	% FSH	Inches
.5	80	.5	80	.5		
.75	80	.75	80	.75		
1.0	80	1.0	80	1.0		
1.25	80	1.25	80	1.25		
Initials	[illegible]		[illegible]			

Remarks:

Components Examined: Drywell liner wild overlay
Test Note

ANI Review

Technical Review
Reviewed By [illegible]
Level II Date 12-27-92

NDE Request#: 92-072

#0927 (05/90)

OCLR00014653

GPU Nuclear

Subject	Calc No.	Rev. No.	Sheet No.
O.C. Drywell Ext. UT Evaluation in Sandbed	C-1302-187-5320-024	1	117 of 117
Originator Mark Yekta	**Reviewed by** S. C. Tummingelli		
Date 01/12/93			**Date**

Examiner: Signature: James Phillippi Print: JAMES PHILLIPPI Initial: JP ID# 462277035 Level I

Instrument Settings
ID# 92-010
Model/Manul DL-26 PANAMETRICS

Gain
Coarse N/A
Fine N/A
Uncal N/A

Sweep Circuit
Coarse N/A (Range)
Fine N/A
Delay N/A
Screen Depth N/A

Operation
T&R Normal
Frequency: N/A MHZ
Reject: ☐Off ☐On N/A %
Filter: ☐Off ☐On N/A %
Damping: ☐Off ☐On N/A %

Rep Rate: N/A

Cal Standard
ID# 214
Size N/A Sch. N/A
Thickness .5 - 1.5
S/S (CS) N/A
Temp 68 °F

Search Unit
ID# 92-039
Type D790 SM
Freq 5 MHZ
Size .312
Angle 0 Mode LONG

Search Unit Cable
Type SELF CONTAINED Length 2 x 6'

Couplant
Make SOUNDSAFE Batch# SSP-89-1-02

Thermometer
S/N: 92-063 Cal Due 5-24-93

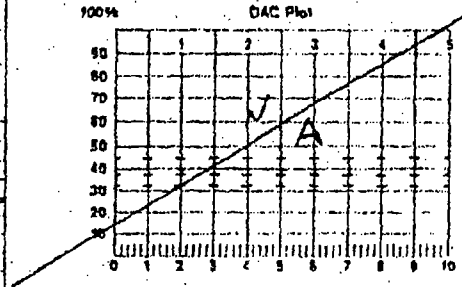
System Check N/A
☐Exit Point A
☐Angle +/- 2

Cal Direction
☐Axial ☐Both
☐Circ. ☒Normal

Date 12-16-92 Time 1412

Reflector	Amplitude % of FSH	Screen Reading in Inches
.5	N/A	N/A
.75	N/A	N/A
1.0	N/A	N/A
1.25	N/A	N/A

DAC Plot



Time/Date	1420 12-16-92		1440 12-16-92			
Reflector	% FSH	Inches	% FSH	Inches	% FSH	Inches
.5	N/A	.5	N/A	.5		
.75	N/A	.75	N/A	.75		
1.0	N/A	1.0	N/A	1.0		
1.25	N/A	1.25	N/A	1.25		
Initials						

Remarks:

ANI Review

Technical Review
Reviewed By
Level II Date 12-27-92

Components Examined:
Drywell Liner weld overlay
Test plate

NDE Request#: 92-072

N0927 (05-90)

OCLR00014654