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**Ultrasonic Examination of
Double-Shell Tank 241-AN-101
Examination Completed November 2005**

AF Pardini
GJ Posakony

November 2005

Prepared for the U.S. Department of Energy
under Contract DE-AC05-76RL01830



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Richland, Washington 99352

Summary

COGEMA Engineering Corporation (COGEMA), under a contract from CH2M Hill Hanford Group (CH2M Hill), has performed an ultrasonic examination of selected portions of Double-Shell Tank 241-AN-101. The purpose of this examination was to provide information that could be used to evaluate the integrity of the wall of the primary tank. The requirements for the ultrasonic examination of Tank 241-AN-101 were to detect, characterize (identify, size, and locate), and record measurements made of any wall thinning or pitting, that might be present in the wall of the primary tank. Any measurements that exceed the requirements set forth in the Engineering Task Plan (ETP), RPP-PLAN-27202 (Jensen 2005) and summarized on page 1 of this document, are reported to CH2M Hill and the Pacific Northwest National Laboratory (PNNL) for further evaluation. Under the contract with CH2M Hill, all data is to be recorded on disk and paper copies of all measurements are provided to PNNL for third-party evaluation. PNNL is responsible for preparing a report(s) that describes the results of the COGEMA ultrasonic examinations.

Examination Results

The results of the examination of Tank 241-AN-101 have been evaluated by PNNL personnel. The ultrasonic examination consisted of one 11-in. wide scan path on Plate #2 and one 11-in. wide scan path on Plate #3. The examination was performed to detect any wall thinning, pitting, or cracking in the primary tank wall.

Primary Tank Wall Horizontal Scan Paths

One 11-in.-wide horizontal scan path approximately 11-ft. long was performed on Plate #2. The plate was examined for wall thinning and pitting on the primary tank wall. There were no areas of wall thinning that exceeded the reportable level of 10% of the nominal thickness. No pitting indications were detected in Plate #2.

One 11-in.-wide horizontal scan path approximately 11-ft. long was performed on Plate #3. The plate was examined for wall thinning and pitting on the primary tank wall. There were no areas of wall thinning that exceeded the reportable level of 10% of the nominal thickness. No pitting indications were detected in Plate #3.

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1.0 Introduction

COGEMA Engineering Corporation (COGEMA), under a contract from CH2M Hill Hanford Group (CH2M Hill), has performed an ultrasonic examination (UT) of selected portions of Double-Shell Tank (DST) 241-AN-101. The purpose of this examination was to provide information that could be used to evaluate the integrity of the DST. The requirements for the UT of Tank 241-AN-101 were to detect, characterize (identify, size, and locate), and record measurements made of any wall thinning or pitting that might be present in the wall of the primary tank. Any measurements that exceed the requirements set forth in the Engineering Task Plan (ETP), RPP-PLAN-27202 (Jensen 2005), are reported to CH2M Hill and the Pacific Northwest National Laboratory (PNNL) for further evaluation. Specific measurements that are reported include the following:

- Wall thinning that exceeds 10% of the nominal thickness of the plate.
- Pits with depths that exceed 25% of the nominal plate thickness.

The accuracy requirements for ultrasonic measurements for the different types of defects are as follows:

- Wall thinning – measure thickness within ± 0.020 in.
- Pits – size depths within ± 0.050 in.
- Location – locate all reportable indications within ± 1.0 in.

Under the contract with CH2M Hill, all data is to be recorded on disk and paper copies of all measurements are provided to PNNL for third-party evaluation. PNNL is responsible for preparing a report(s) that describes the results of the COGEMA UT.

2.0 Qualified Personnel, Procedures, and Equipment

Under contract from CH2M Hill, qualification of personnel participating in the DST inspection program, the UT equipment (instrument and mechanical scanning fixture), and the UT procedure that will be used in the examination of the current DST is required. Personnel participating in the examinations are to be certified in accordance with American Society for Nondestructive Testing (ASNT) Recommended Practice SNT-TC-1A, 1992 Edition, and associated documentation is to be provided. The capability of the UT system is to be validated through a performance demonstration test (PDT) on a mock-up simulating the actual DST. The current procedure for the UT is to be based on requirements listed in the American Society for Mechanical Engineers (ASME), Boiler and Pressure Vessel Code Section V, Article 4, *Ultrasonic Examination Methods for Inservice Inspection*.

2.1 Personnel Qualifications

The following individuals were qualified and certified to perform UT of the Hanford DST 241-AN-101:

- **Mr. Wesley Nelson**, ASNT Level III (#LM-1874) in UT, has been identified as COGEMA's UT Level III authority for this project. Mr. Nelson has been certified by COGEMA as a UT Level III in accordance with COGEMA procedure COGEMA-SVCP-PRC-014, latest revision. Further documentation has been provided to establish his qualifications. Reference: Letter from PNNL to C.E. Jensen dated August 22, 2000, "Report on Performance Demonstration Test – PDT, May 2000."
- **Mr. James B. Elder**, ASNT Level III (#JM-1891) in UT, has been contracted by COGEMA to provide peer review of all DST UT data. Mr. Elder has been certified by JBNDT as a UT Level III in accordance with JBNDT written practice JBNDT-WP-1, latest revision. Further documentation has been provided to establish his qualifications. Reference: PNNL-11971, *Final Report - Ultrasonic Examination of Double-Shell Tank 241-AN-107*.
- **Mr. William D. Purdy**, COGEMA UT Level II limited (for P-Scan data acquisition only). Mr. Purdy has been certified in accordance with COGEMA procedure COGEMA-SVCP-PRC-014, latest revision. Further documentation has been provided to establish his qualifications. Reference: Letter from PNNL to C.E. Jensen dated October 5, 2001, "Purdy Performance Demonstration Test (PDT) Report."

2.2 Ultrasonic Examination Equipment

CH2M Hill has provided the UT equipment for the examination of Tank 241-AN-101. This equipment consists of a Force Institute P-Scan ultrasonic test instrument and a Force Institute AWS-5D remote-controlled, magnetic-wheel crawler for examining the primary tank wall. Ultrasonic transducers used for the examinations are commercial off the shelf. The P-Scan ultrasonic system has been qualified through a PDT administered by PNNL. Reference: PNNL-11971, *Final Report- Ultrasonic Examination of Double-Shell Tank 241-AN-107*.

2.3 Ultrasonic Examination Procedure

COGEMA has provided the UT procedure for the examination of Tank 241-AN-101. This procedure, COGEMA-SVUT-INS-007.3, Revision 3, outlines the type of UT and mechanical equipment that are to be used as well as the types of transducers. Only straight-beam transducers were used for the examination of the primary tank wall. The examination procedures include full documentation on methods for calibration, examination, and reporting. Hard copies of the T-Scan (thickness) views of all areas scanned are made available for analysis. The UT procedure requires the use of specific UT transducers for the different examinations. A calibration performed before and after the examinations identifies the specific transducers used and the sensitivity adjustments needed to perform the inspection. The COGEMA UT procedure has been qualified through a Performance Demonstration Test. Reference: PNNL-11971, *Final Report - Ultrasonic Examination of Double-Shell Tank 241-AN-107*.

3.0 Ultrasonic Examination Configuration

COGEMA is required to inspect selected portions of the DSTs which may include the primary and secondary tank walls, the HAZ of the primary tank vertical and horizontal welds, and the tank knuckle and bottoms. The P-Scan system has been configured to perform these examinations and has been performance tested. The examination of Tank 241-AN-101 only included UT of the primary tank wall for wall thinning and pitting.

3.1 Primary Tank Wall Transducer Configuration

Figure 3.1 provides an example of the scanning configuration used during the examination of the primary tank wall of 241-AN-101. For this examination, only the straight-beam transducer was used. The functional diagram in Figure 3.1 shows one straight-beam transducer for examining the primary tank wall. The straight beam is designed to detect and record wall thinning and pits that may be present. Information is captured every 0.035-in. (or as set by the NDE inspector) as the assembly is scanned across a line. At the end of each scan line the fixture is indexed 0.035-in. (or as set by the NDE inspector) and the scan is repeated. The mechanical scanning fixture is designed to scan a maximum of 15-in. and then index for the next scan however; this was modified for this examination due to entrance into a 12-in. riser. Therefore, the maximum scan was 11-in. The hard copy provides a permanent record that is used for the subsequent analysis.

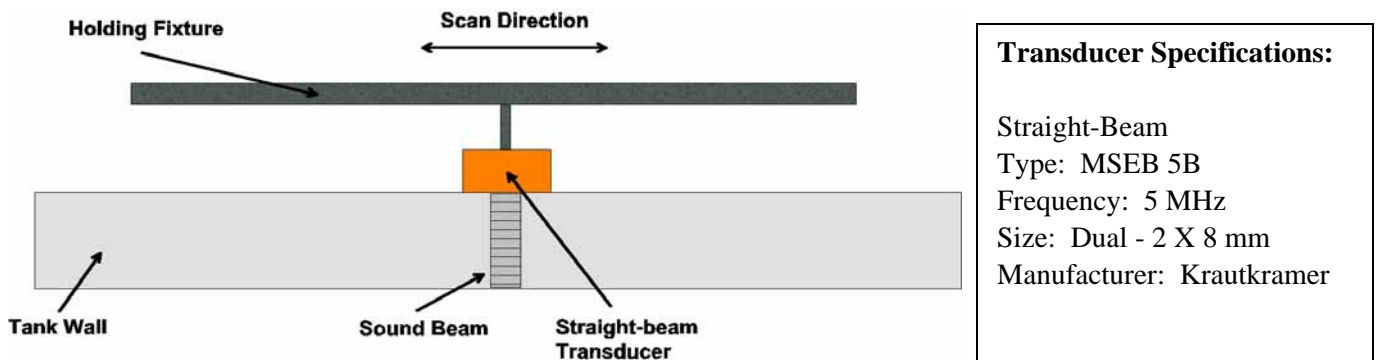


Figure 3.1. Transducer Configuration for Examining the Primary Tank Wall

4.0 Ultrasonic Examination Location

Tank 241-AN-101 is located in the Hanford 200 East area in AN Tank Farm. The crawler and associated scanner were lowered into the 12-in. riser located on the west side of 241-AN-101 and designated as Riser 51. Figure 4.1 provides a graphic of the location of this riser.

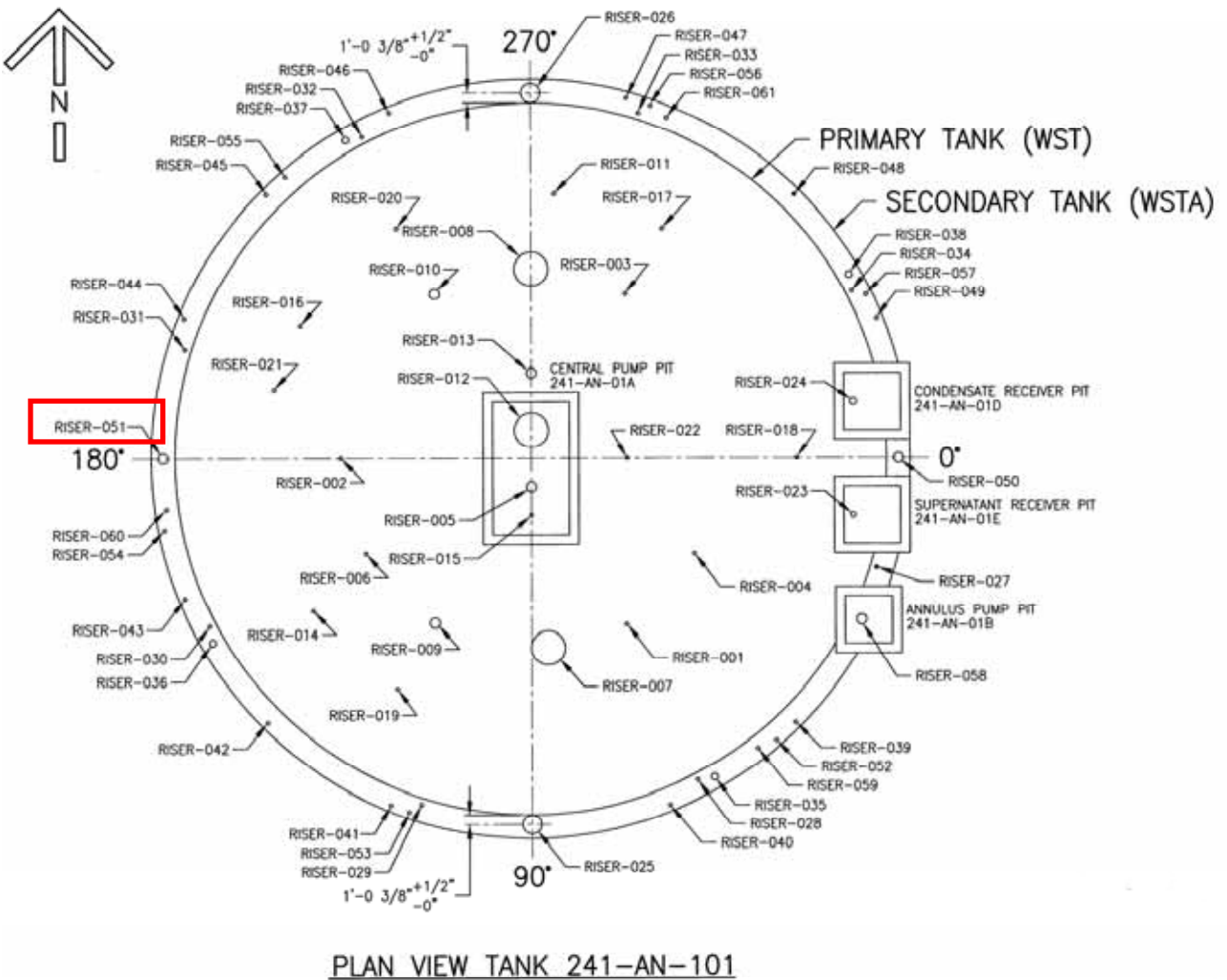


Figure 4.1. UT of 241-AN-101 Riser 51

Figure 4.2 describes the areas on the primary wall of Tank 241-AN-101 that were ultrasonically examined. One 11-in.-wide horizontal scan path was performed on Plate #2, and one 11-in.-wide horizontal scan path was performed on Plate #3. Both scans began at the air line north of the 12-in. entrance riser #51.

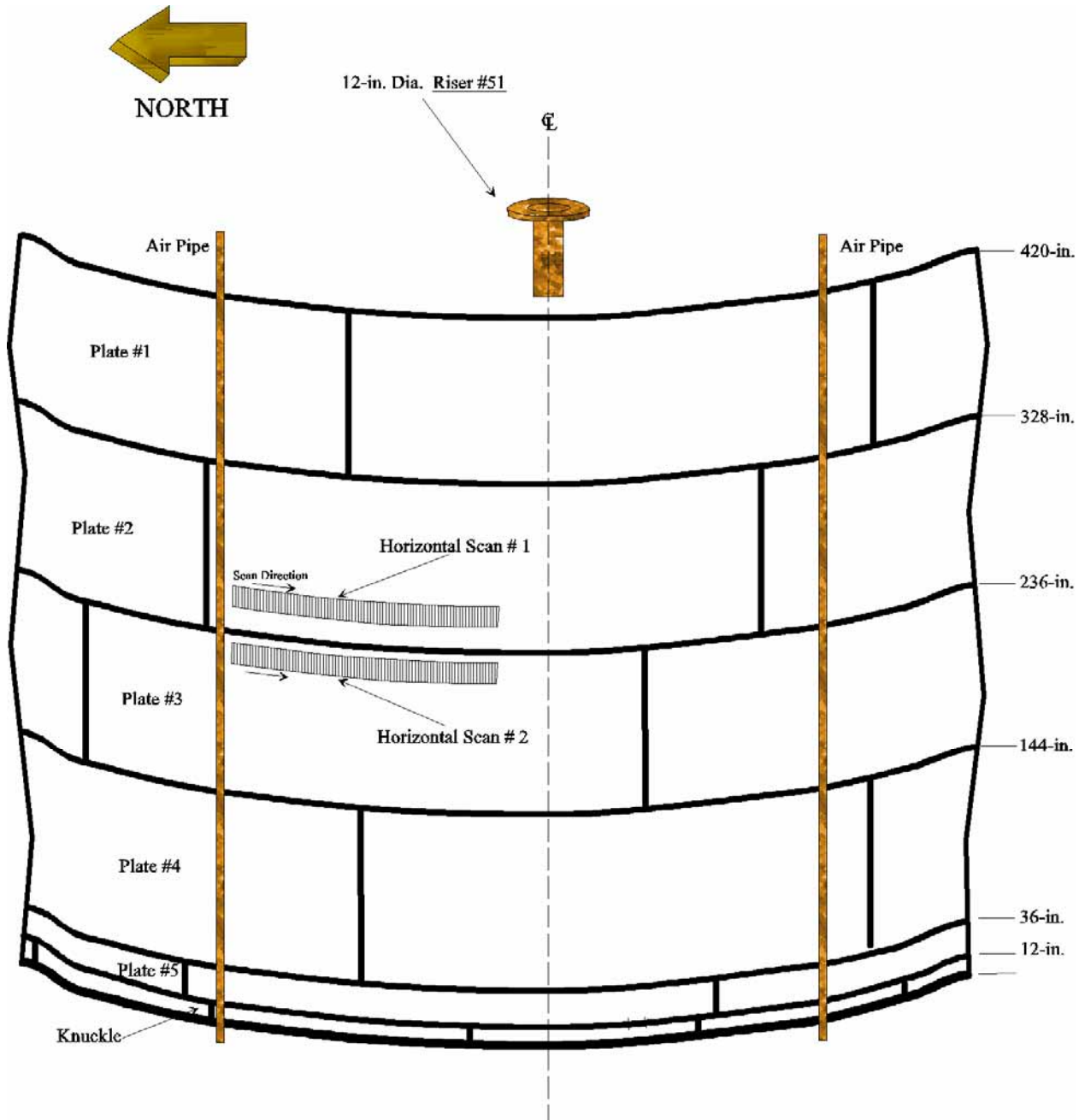


Figure 4.2. Sketch of Scan Paths on Tank 241-AN-101

5.0 Ultrasonic Examination Results

COGEMA has provided detailed reports including T-Scan and P-Scan hard copies of all areas that were ultrasonically examined to PNNL for third-party review. The data was analyzed by COGEMA Level III Mr. Wes Nelson, and peer reviewed by JBNDT Level III Mr. Jim Elder. The results of the examination of Tank 241-AN-101 are presented in Figure 5.1.

Figure 5.1 shows the wall thickness examination results for the primary tank wall. The examination consisted of one 11-in. wide scan path approximately 11-ft. long on Plate #2 and one 11-in. wide scan path approximately 11-ft. long on Plate #3. Figure 5.1 displays the minimum readings taken in each 11-in. wide by 12-in. long area of the scan.

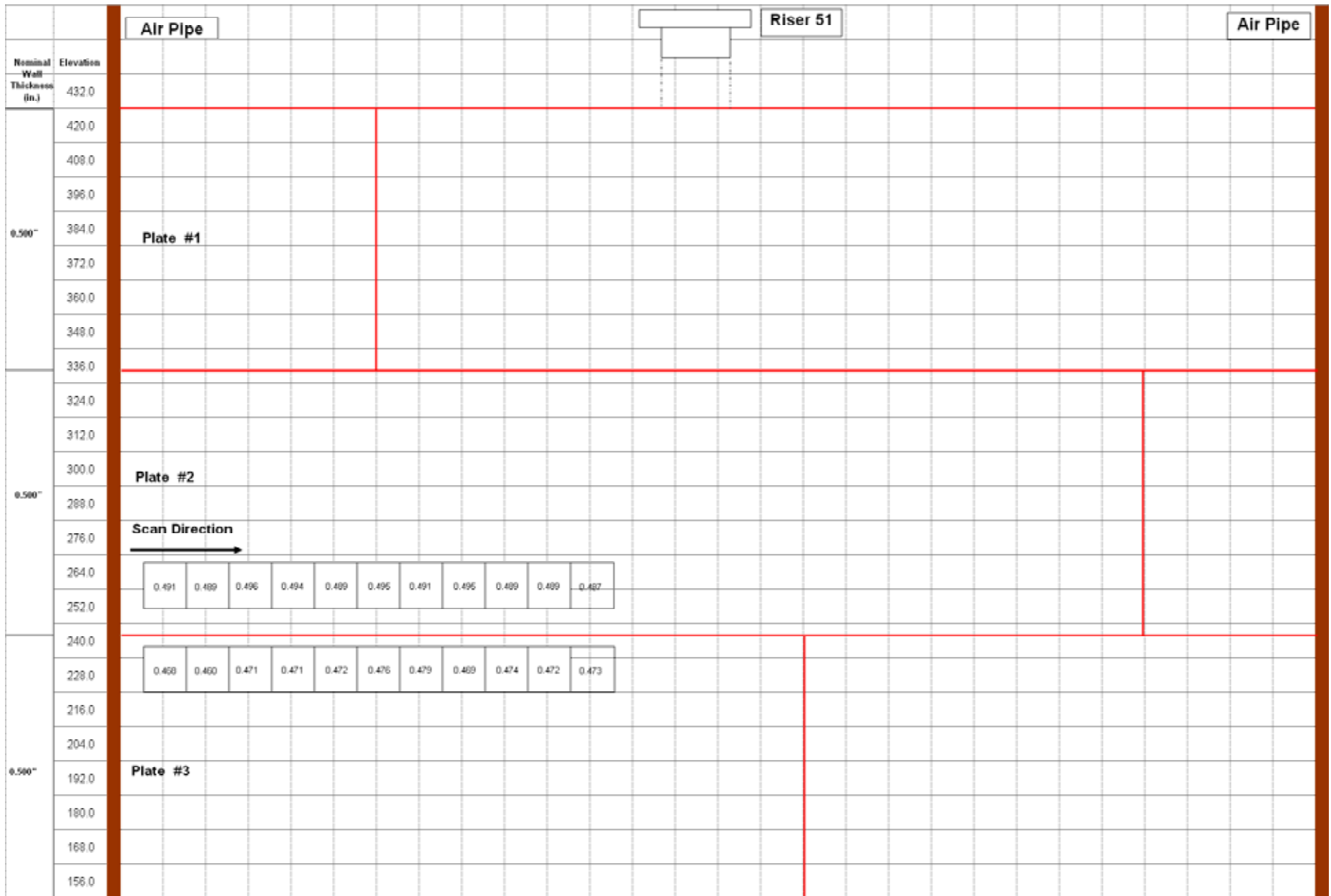


Figure 5.1. UT Data from Tank 241-AN-101

6.0 Conclusions

The results of the examination of Tank 241-AN-101 have been evaluated by PNNL personnel. The examination consisted of one 11-in. wide scan path on Plate #2 and one 11-in. wide scan path on Plate #3. The examination was performed to detect any wall thinning or pitting in the primary tank wall.

6.1 Primary Tank Wall Horizontal Scan Paths

One 11-in.-wide horizontal scan path approximately 11-ft. long was performed on Plate #2. The plate was examined for wall thinning and pitting on the primary tank wall. The results indicated that the minimum thickness in the areas scanned on Plate #2 with nominal thickness of 0.500-in. was 0.487-in. There were no areas of wall thinning that exceeded the reportable level of 10% of the nominal thickness. No pitting indications were detected in Plate #2.

One 11-in.-wide horizontal scan path approximately 11-ft. long was performed on Plate #3. The plate was examined for wall thinning and pitting on the primary tank wall. The results indicated that the minimum thickness in the areas scanned on Plate #3 with nominal thickness of 0.500-in. was 0.460-in. There were no areas of wall thinning that exceeded the reportable level of 10% of the nominal thickness. No pitting indications were detected in Plate #3.

7.0 References

Jensen, C. E., 2005, *Engineering Task Plan for the Ultrasonic Inspection of Hanford Double-Shell Tanks FY2006 and FY2007*, RPP-PLAN-27202, Rev 0, October 2005, CH2M Hill Hanford Group, Inc., Richland, Washington.

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