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A. Edward Scherer
Manager of
Nuclear Regulatory Affairs

August 31, 2007

U. S. Nuclear Regulatory Commission
ATTN: Document Control Desk
Washington, DC 20555-0001

Subject: **Docket No. 50-362**
Evaluation of Reactor Vessel Head Inspection Data for Control Element Drive Mechanism (CEDM) # 56
San Onofre Nuclear Generating Station Unit 3

References: Attached

Dear Sir or Madam:

This letter fulfils a commitment made by Southern California Edison (SCE) (References 1 and 2) to complete an evaluation of inspection data for the Unit 3 reactor vessel head penetration (RVHP) for control element drive mechanism (CEDM) # 56, which was collected during the Cycle 12, Cycle 13, and Cycle 14 refueling outages. The purpose of the evaluation was to make a final determination as whether the non destructive examination indication was due to a flaw attributed to primary water stress corrosion cracking (PWSCC).

SCE has completed the evaluation, which consisted of a reanalysis and independent review performed by the inspection vendor, a review by SCE staff engineers, and a third party review by an independent Level III examiner. Enclosed, please find a copy of the analysis summary prepared by the inspection vendor. This reanalysis summary is also being added as an addendum to the Unit 3, reactor vessel head inspection records.

Based on the reanalysis SCE is changing the inspection classification of the indication in the RVHP for CEDM # 56 from a defect to no detectable defect (NDD). As a result of this re-classification, SCE is hereby withdrawing the ISI-3-21 request for an alternative to ASME code rules for the embedded flaw repair process (Reference 3).

A047

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NRR

SCE has requested a meeting to discuss the evaluation and provide an opportunity to address any questions from the NRC staff.

Should you have any questions please contact Ms. Linda T. Conklin at (949) 368-9443.

Sincerely,

Attachment: List of References
Enclosure: Westinghouse Report of Unit 3 CEDM Nozzle Inspection Results

cc: B. S. Mallett, Regional Administrator, NRC Region IV
N. Kalyanam, NRC Project Manager, San Onofre Units 2 and 3
C. C. Osterholtz, NRC Senior Resident Inspector, San Onofre Units 2 and 3

Attachment
List of References

References:

1) Letter from A. E. Scherer (SCE) to the U. S. Nuclear Regulatory Commission (Document Control Desk) dated November 20, 2006; Subject: Docket No. 50-362, Additional Information Supporting Third Ten-Year Inservice Inspection (ISI) Interval Relief Request ISI-3-21 Request for Alternative to ASME Code Rules for the Embedded Flaw Repair Process for Control Element Drive Mechanism (CEDM) # 56, San Onofre Nuclear Generating Station Unit 3

2) Letter from A. E. Scherer (SCE) to the U. S. Nuclear Regulatory Commission (Document Control Desk) dated June 1, 2007; Subject: Docket No. 50-362, Evaluation Reactor Vessel Head Inspection Data for Control Element Drive Mechanism (CEDM) # 56 San Onofre Nuclear Generating Station Unit 3

3) Letter from A. E. Scherer (SCE) to the U. S. Nuclear Regulatory Commission (Document Control Desk) dated May 11, 2006; Subject: Docket No. 50-362, Third Ten-Year Inservice Inspection (ISI) Interval Relief Request ISI-3-21 Request for Alternative to ASME Code Rules for the Embedded Flaw Repair Process for Control Element Drive Mechanism (CEDM) # 56, San Onofre Nuclear Generating Station Unit 3

Enclosure

Westinghouse Report of Unit 3 CEDM Nozzle Inspection Results

Letter CONO-07-83
Dated August 28, 2007

Attachment 2 to CONO-07-83
San Onofre Unit # 3, Pen #56 Ultrasonic Examination Summary Report
Dated June 22, 2007

Attachment 5 to CONO-07-83
WESDYNE
Additional Analysis of San Onofre 3 Pen #56 Indication Re-evaluation Summary
Dated August 24, 2007

6/22/2007

SAN ONOFRE Unit # 3
Pen #56 Ultrasonic Examination Summary Report

Scope:

This report contains an analysis summary of RPVH penetration J-weld #56 TOFD ultrasonic data collected for the inspection periods of 2003, 2004 Pre and Post repair and 2006.

Examination Results:

2003 Inspection (PCS-24)

During the inspection of Penetration J-Weld #56 a PTI (Parent Tube Indication) was reported. Indication (Anomaly) #1 was located at a circumferential location of 356° near the lower extent of the weld. The L max location was 1.840". Indication #1 was reported to have a remaining ligament of 0.293"(Dl) and was correctly disposition as grain noise. In 2003 the intent was to identify special interest indications for confirmatory testing with OD ET. This was done and was classified as "no detectable degradation" (NDD), so no further work was performed on refining sizing for an indication that was not evaluated as PWSCC. If it was determined to be PWSCC, then more detailed sizing would have been performed.

Data from the 2003 inspection were re-reviewed in November 2006. Upon further evaluation of the Indication (Anomaly) #1 (Figure 1A and 1B) it appears the indication has a remaining wall of 0.169". This evaluation considered both the B and "B" prime scan for evaluation. Since the indication appears to be emanating from the OD, opposite phase sizing techniques were utilized. The indication length was originally reported as 0.24" but is actually 1.2".

2004 Inspection Results. (PCS-24)

During the inspection of Penetration J-Weld #56 a PTI was reported. This Indication (Anomaly) was the same reported during the 2003 inspection but appeared to be growing in depth due to the depth and length inaccuracy previously reported. Indication (Anomaly) #1 was reported at a circumferential location of 356° near the lower extent of the weld. The L max location was 1.020". It must be noted that the L location varied from each inspection period, possibly due to operator zero orientation and probe housing change. Indication (Anomaly) #1 was reported to have a thru wall height of 0.513" with a remaining ligament of 0.148" and a length of 1.2". This reported growth led to a weld repair from the ID of the penetration.

During my sizing evaluation of Indication (Anomaly) #1 in November 2006 the results were very similar to what was reported during the 2004 inspection. The indication through-wall height was 0.491" with a remaining ligament of 0.170". (See Figures 2A and 2B). Length measurement is 1.2".

The post repair inspection data appears to have no change from the pre repair inspection data. My reported remaining ligament is 0.170". (See Figure 3)

2006 Inspection Results. (PCS-24)

During the inspection of Penetration J-Weld #56 a PTI was reported. This Indication (Anomaly) was the same reported during the 2003 and 2004 pre and post repair. Indication (Anomaly) #1 was reported at a circumferential location of 350° near the lower extent of the weld. The L max location was 1.060". Indication (Anomaly) #1 was reported to have a thru wall height of 0.464" with a remaining ligament of 0.197" and the analyst noted there were no diffraction signals observed. This reported size indicates Indication (Anomaly) #1 was smaller in depth.

My evaluation concluded the Indication remained the same, with a through wall height of 0.492" and a remaining ligament of 0.169". (See Figures 4A and 4B).

Note: Depth and length sizing will vary between analyst but should not differ by more than 0.050".

Summary:

It appears as though the data from penetration #56 Indication (Anomaly) #1 during the 2003 inspection were not interpreted properly, resulting in under sizing of the indication, which led to reported growth during the 2004 inspection. Comparing Figures 1A and 4A you will see the depth remains the same from 2003 thru 2006. It must be noted that the L location varied from each inspection period, possibly due to operator zero orientation and probe housing change. During this comparison there are slight changes in the grain noise due to refinement in calibration settings, better contact and an increase in pulse voltage. It is my conclusion that Indication (Anomaly) #1 appears to be grain noise. This anomaly does not display the characteristics associated with PWSCC i.e. faceting, multiple tip signals and perturbation of the back wall. It is also my conclusion that Indication (Anomaly) #1 shows no growth from discovery in 2003.

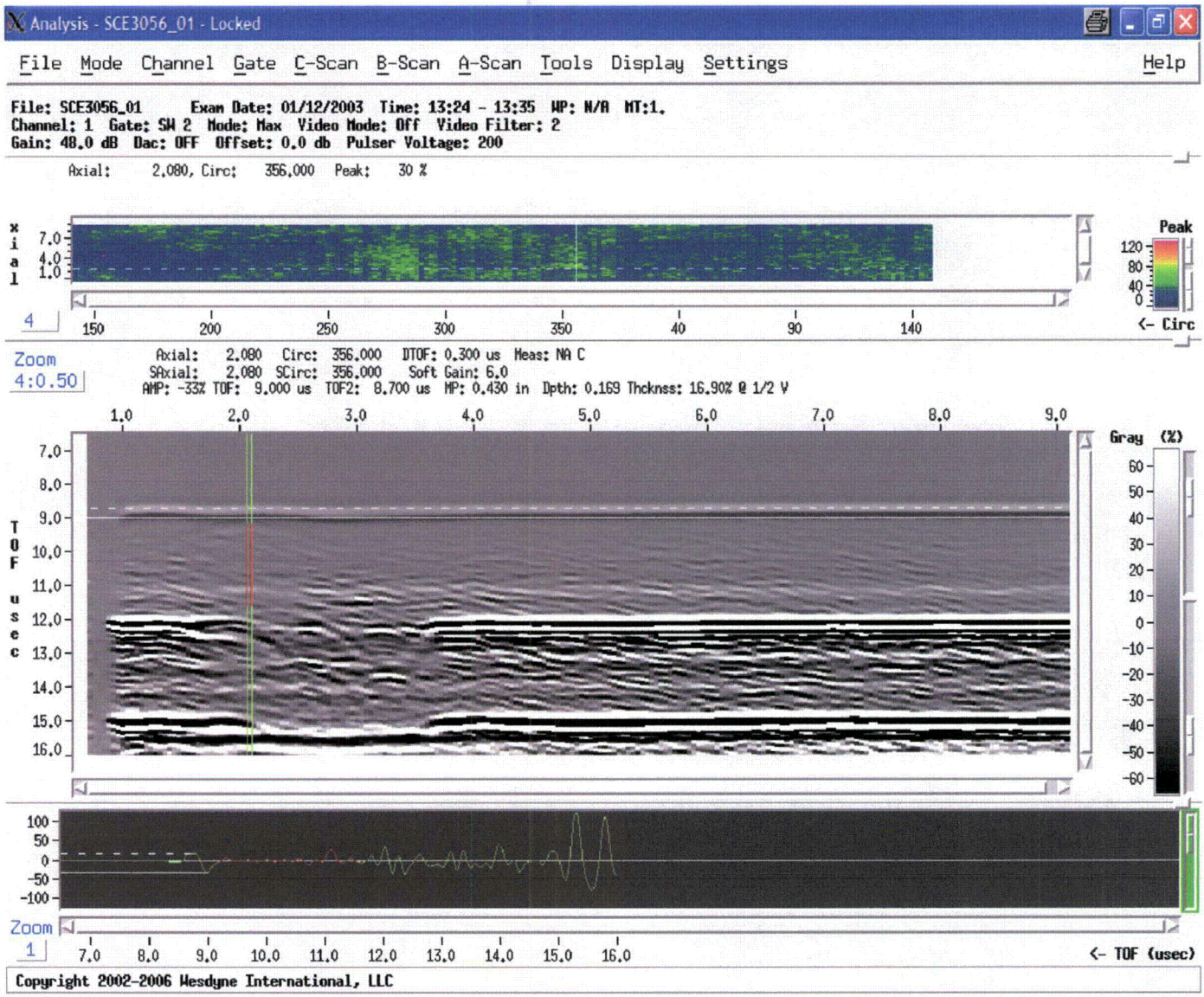
During the inspection of 2006 a special interest examination was also performed utilizing higher frequency zero degree probes a 5 MHz 60° shear wave probe and additional TOFD probes. The zero degree probes and the 60° probe were unsuccessful at revealing the grain noise or the anomaly however, the 60° revealed no evidence of any anomaly connected to the OD of the penetration. See Figures 5 and 6. The TOFD probe (Figure 6) did confirm grain noise. (Anomaly #1).

Indication #1 2003 Length (Circumferential) = 26° Width (Axial) = 1.2" TWH = 0.492" RL = 0.169"
Indication #1 2004 Pre Length (Circ) = 23° Width (Axial) = 0.92" TWH = 0.491" RL = 0.170"
Indication #1 2004 Post Length (Circ) = 25° Width (Axial) = 1.0" TWH = 0.491" RL = 0.170"
Indication #1 2006 Length (Circ) = 27° Width (Axial) = 0.96" TWH = 0.492" RL = 0.169"

Phil Lancaster III 8/20/07
Phil Lancaster Wes Dyne Level III

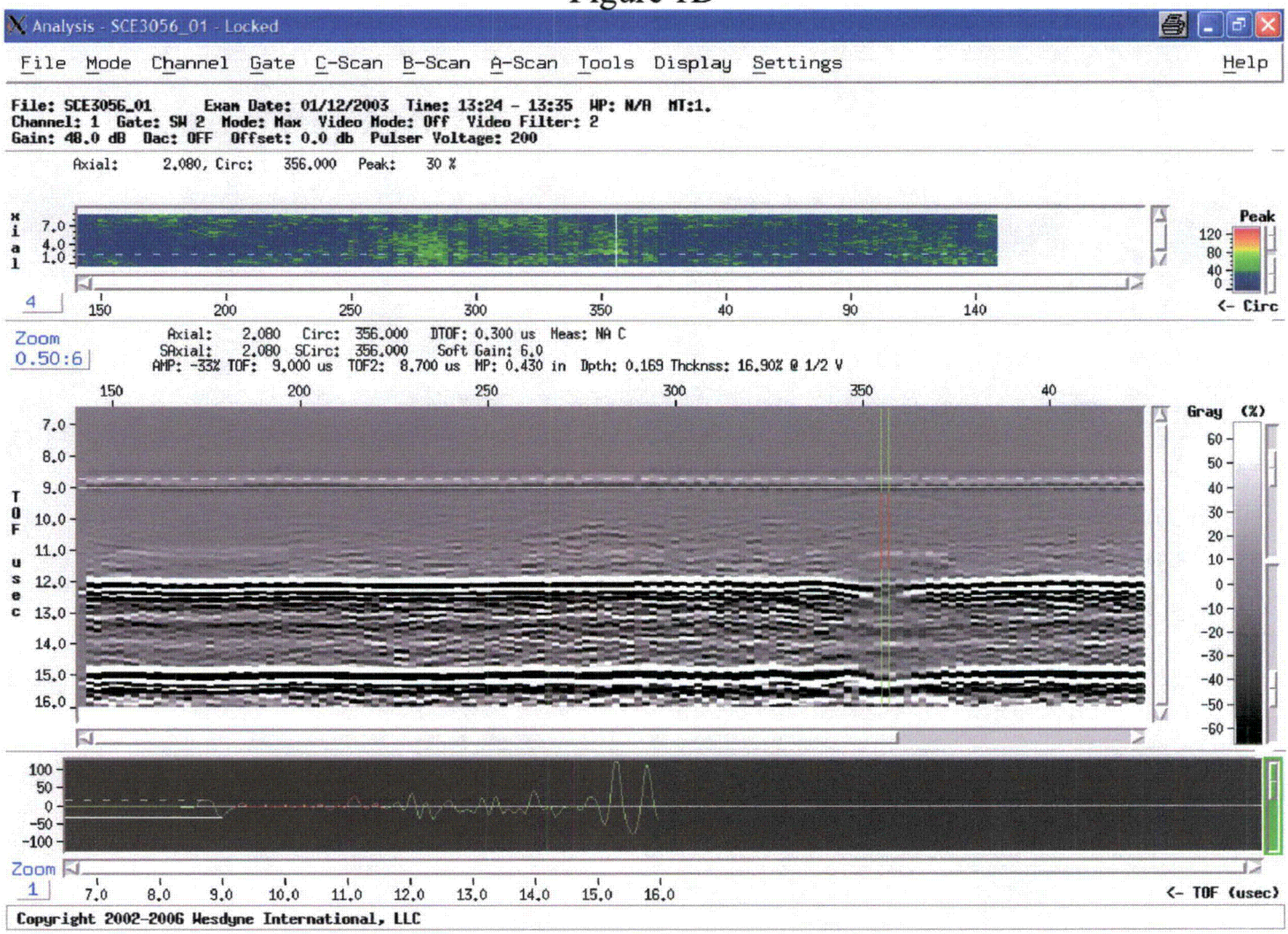
J Lanam Chief Eng 8/20/07
Reviewer Date

Figure 1A



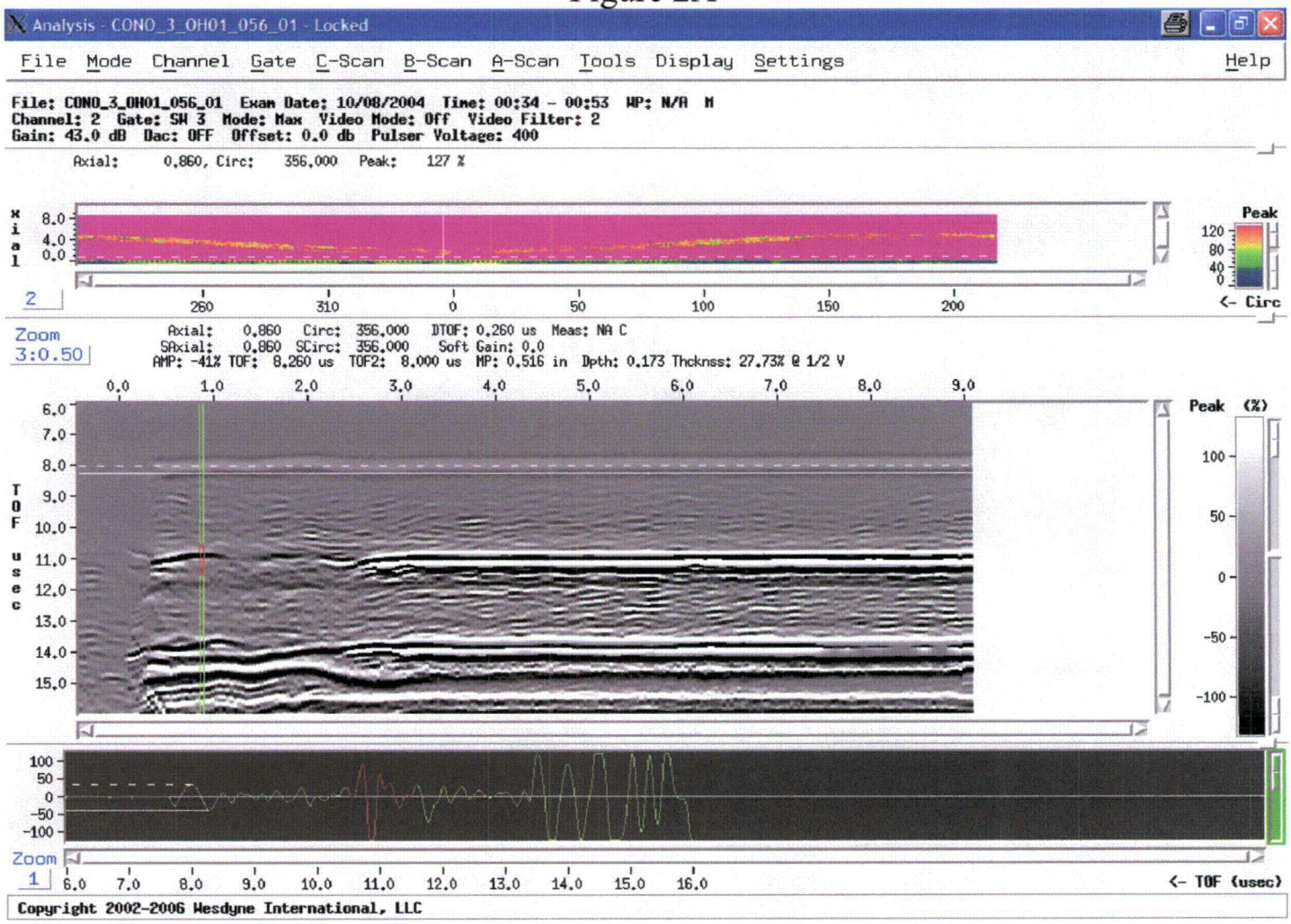
Indication (Anomaly) #1
B Scan Channel 1

Figure 1B



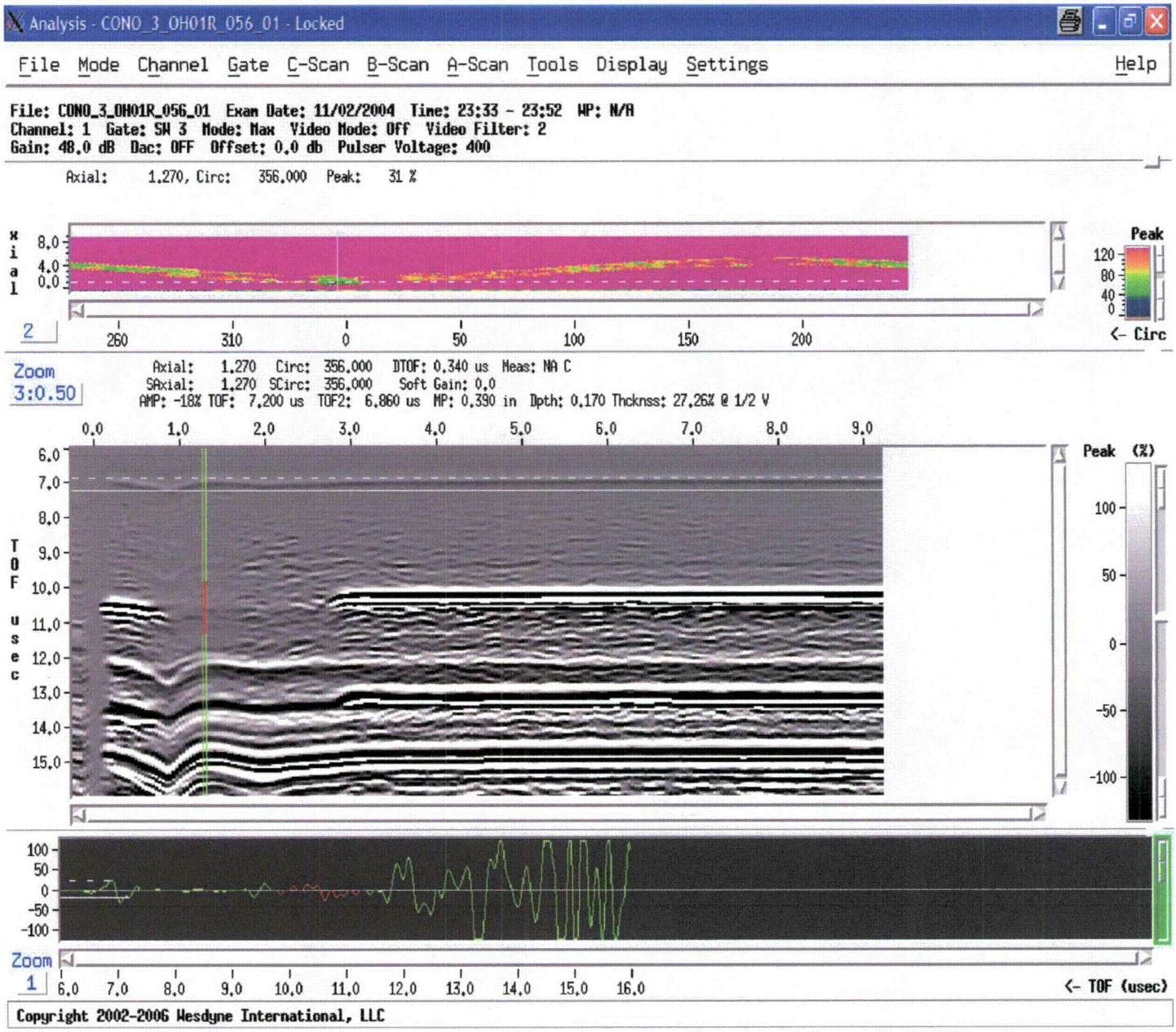
Indication (Anomaly) #1
"B" Prime Scan Channel 1

Figure 2A



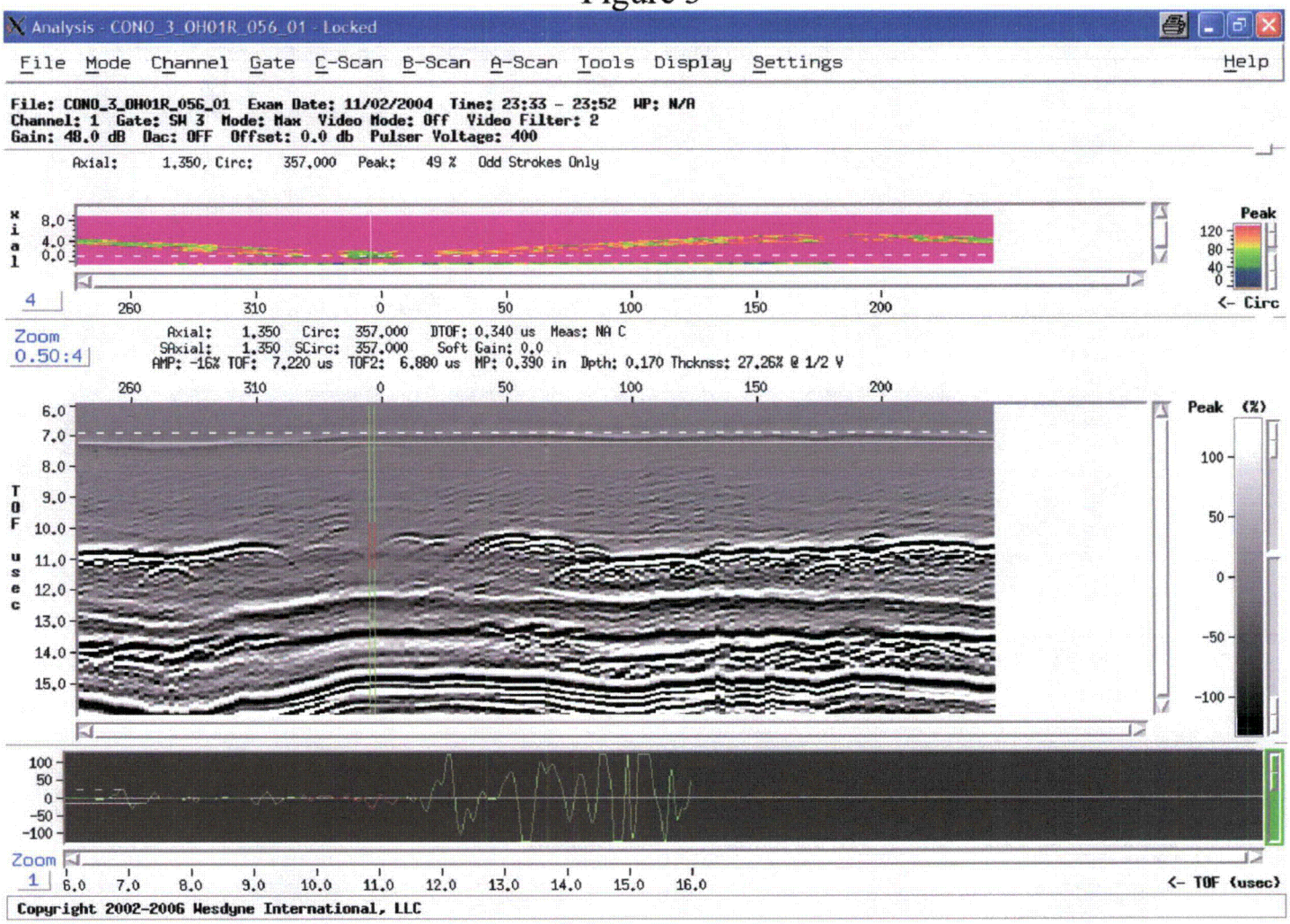
Indication (Anomaly) #1
B Scan Channel 2

Figure 2B



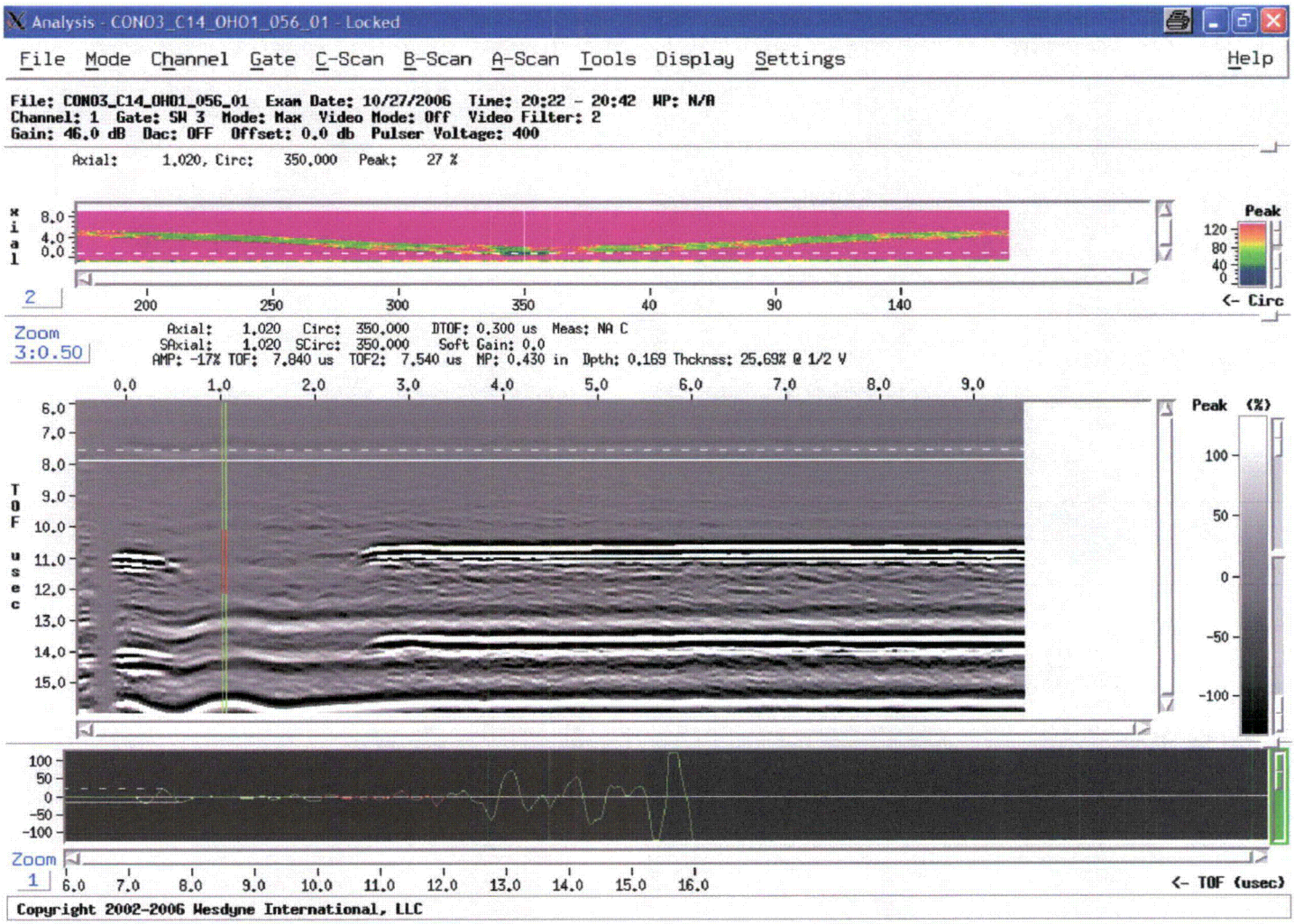
Indication (Anomaly) #1
B Scan Channel 1

Figure 3



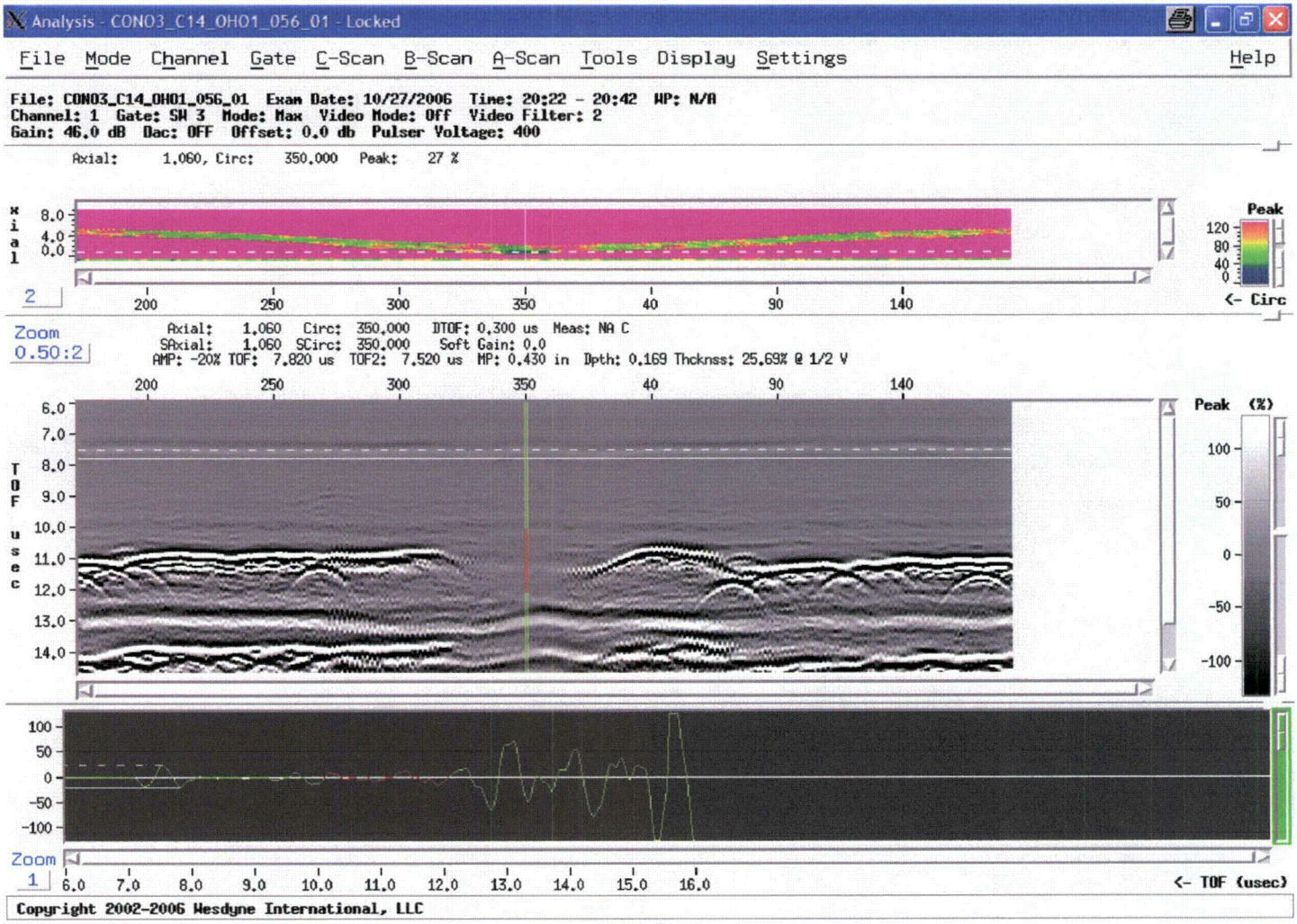
Post Repair Examination
"B" Prime Channel 1

Figure 4A



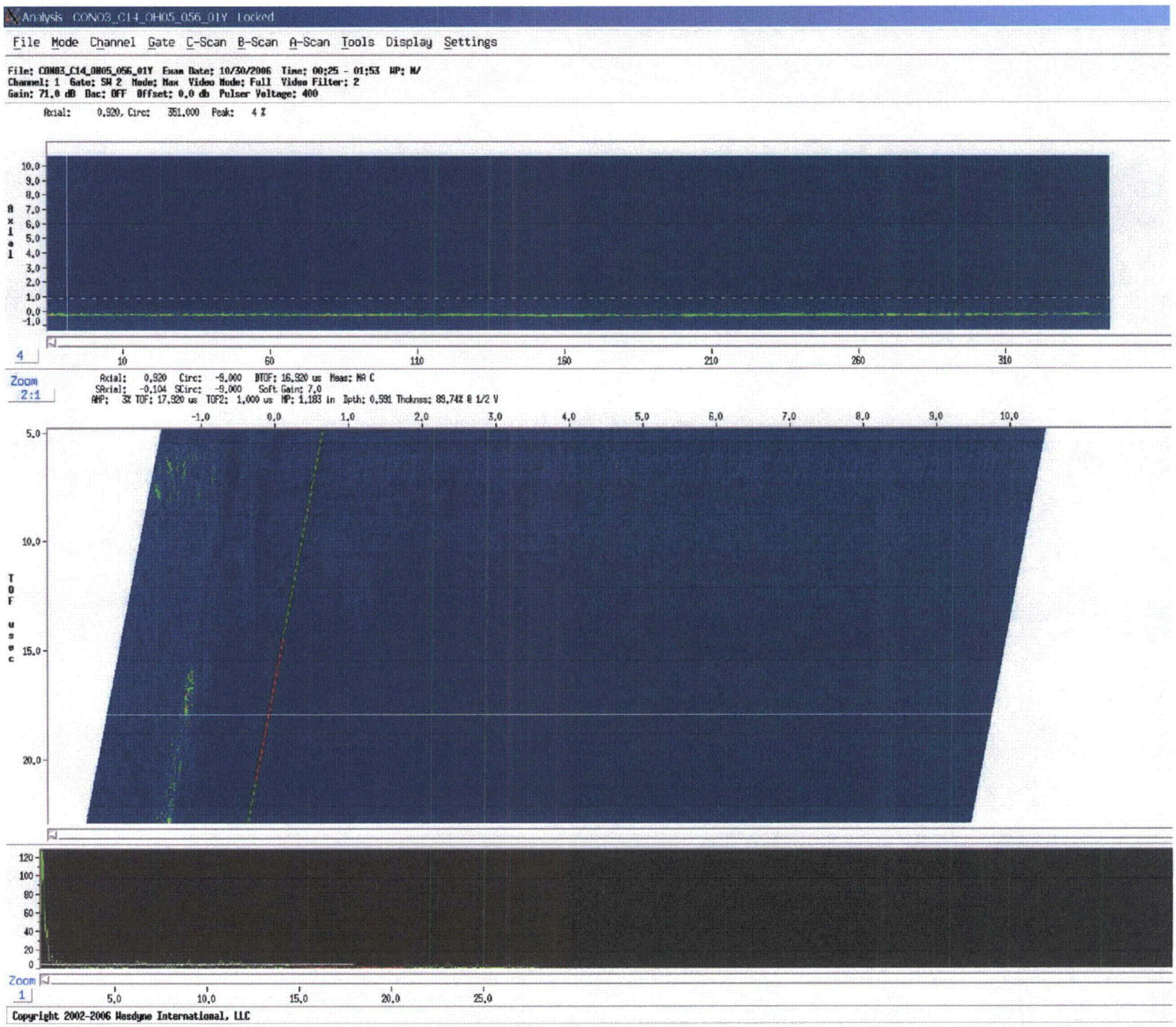
Indication (Anomaly) #1
B Scan Channel 1

Figure 4B



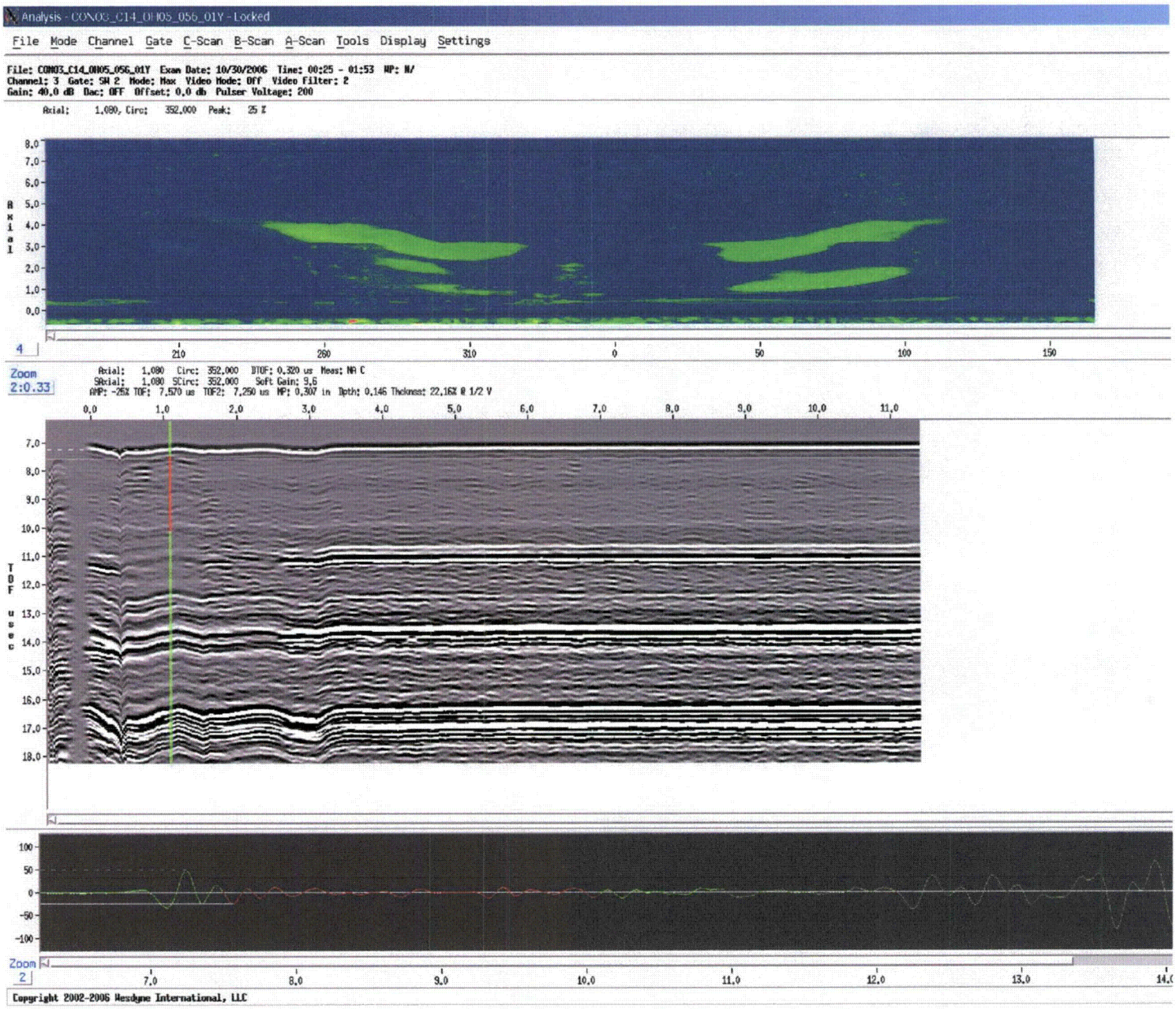
Indication (Anomaly) #1
"B" Prime Scan Channel 1

Figure 5



Indication (Anomaly) #1
SI Inspection Channel 1
Anomaly Not Observed

Figure 6



Indication (Anomaly) #1
SI Inspection Channel 3
Confirmation of Grain Noise

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Attachment 5

Additional Analysis of San Onofre 3 Pen #56 Indication Re-evaluation Summary
August 24, 2007

J. P. Lareau JP Lareau 8/24/07
Chief Engineer
WesDyne International

Phil Lancaster Phil Lancaster III 8/24/07
UT Level III
WesDyne

A re-evaluation of the Pen #56 TOFD-UT call of a 78% throughwall flaw in R13 was performed using the data fromR12, R13 and R14, including all the Special Interest (SI) examinations performed.

R12

TOFD-UT indicated a Parent Tube Indication (PTI), which lead to a Special Interest (SI) categorization for additional testing. In this case, the SI examination included OD eddy current testing (ET) of the nozzle OD in the area of interest and the J weld at the weld toe region. This exam concluded an NDD condition and the nozzle was returned to service.

Subsequently, these ET results were compared to the results from BV1 and 2. BV1 had confirmed PWSCC within the weld elevation and extending down the nozzle below the weld, similar to the location and extent of the suspect SCE 3 TOFD indication (but shorter and shallower at BV1). The BV1 ET results were very straightforward and showed the PWSCC on the nozzle OD and extending below the weld. By comparison, the UT indication at San Onofre 3 extends significantly below (0.7 inch) the weld and would be expected to generate clear ET response if surface connected PWSCC were actually present. The SCE 3 result was NDD. Figure 1 provides a direct comparison of the relevant ET results of the nozzle below the weld toe for a confirmed PWSCC flaw at Beaver Valley 1 and the corresponding lack of a response at San Onofre 3 nozzle 56.

BV2 had OD TOFD UT indications in three CRDM's that did not extend below the toe of the weld into the accessible portion of the nozzle OD Therefore, eddy current tests (J weld Grooveman) were performed on all three suspect welds. Geometry limitations allowed only one of the three locations to be adequately covered by the scanner. At San Onofre 3, extra steps were taken to improve weld coverage in the area of interest and there was no ET indication in the region of the weld. Figures 2 and 3 show the corresponding J weld ET scans for BV2 #61 and San Onofre 3 #56. The BV2 results indicate a subsurface linear flaw, which was confirmed by shallow grinding and penetrant testing. San Onofre 3 #56 has no indications.

The BV1 TOFD indications are less complex in terms of a single response rather than multiple aligned and distributed indication as in San Onofre 3. The two sets of responses look very different from a TOFD analysis perspective with the former a classic TOFD

R13

The TOFD-UT again confirmed the same indication in nozzle 56. The initial evaluation of the reports indicated substantial growth in depth relative to the R12 NDE record. The observation of apparent growth lead to a direct comparison of data from the two outages. The R12 methodology was not intended to be precise in depth measurement if the SI results were NDD, so the reported depth measurement was not required to be precise. There were differing professional opinions on whether there had been any growth of the flaw depth and, at that time, there was no clear guidance on the definition of "Cleared By History" to determine whether growth had occurred. Accordingly, a direct comparison of the two sets of data was performed *again* as part of this re-evaluation. This comparison has concluded that no change in depth had actually been indicated. (See Attachment 2)

The indication was identified as SI and additional exams were performed again on the nozzle OD. In this R13 outage the OD scanner was not available, so a local manual scan was performed using both TOFD and ET using a clockwise and counterclockwise line scan of 90 degrees that was at an elevation corresponding to the mid point of the flaw extension below the weld. A PWSCC flaw would provide a large, unambiguous signal and the TOFD UT would have a corresponding loss of lateral wave for a surface flaw. Neither the TOFD nor the ET results indicated an OD connected flaw in this region, consistent with the R12 results.

The embedded flaw repair technique was used conservatively during R13 and the standard ID exams using TOFD, 0 degree and ET were performed after the repair. No change in the indication was detected following the repair.

R14

During R14, the standard ID exams were performed and no change was detected in any of these examinations. In addition, a high precision TOFD exam was performed to satisfy commitments made to the NRC to detect a 0.020" change in depth, which is tighter than the normal tolerance used. This technique was also used to refine whether the indication exceeded the NRC mandated limit of 75% throughwall for the continued use of the embedded flaw repair without additional mitigation. The results of this inspection came out so close to 75%, it was not pursued as a potential argument for a change in the relief request status.

One addition SI exam was added using shear wave probe techniques from the ID. Both an axially oriented 60 degree probe and a circumferentially oriented 70/40 degree (ID entry surface angle and OD surface resultant angle due to curvature, respectively) were used. The intent of the circumferential 70/40 probe to investigate two conditions:
1) to determine if a corner trap signal at the overlay interface could be detected and
2) to determine if the overlay to nozzle OD interface was interrupted by the presence of a deep OD connected axial crack (this response is the shear wave equivalent to the WII signals with TOFD).

No corner trap signals were detected in the region of interest and no interruption of the interface signal occurred. There were several localized discontinuous reflectors distributed throughout the depth of the nozzle wall, and no corner trap signal was detected with a signal amplitude that would be expected. These results are consistent with localized grain noise

There is an ultrasonic technique using "obscuration" in which the presence of a deep crack would shadow reflectors behind the crack. This technique is used for bolt thread inspections where a crack shadows the nearby threads. By comparison of the interface signal around the circumference and at different elevations, one can see that no shadowing exists, again indicating that the reflections are scattered grain noise rather than a surface connected flaw. Figure 6 shows the results of the "obscuration" technique for nozzle #56.

Conclusion:

The combination of all the SI inspections performed over three inspection cycles and direct comparison to similar plants indicate that PWSCC is not the cause of the TOFD indications in nozzle 56 in San Onofre 3. Application of the current Westinghouse RVH inspection technology, which incorporates industry experience to date, would have concluded that no defect is present in CEDM #56 had the cycle 12 and 13 depth measurements been made on a consistent basis and all the confirmatory inspection data from each cycle was taken into consideration for the final conclusion.

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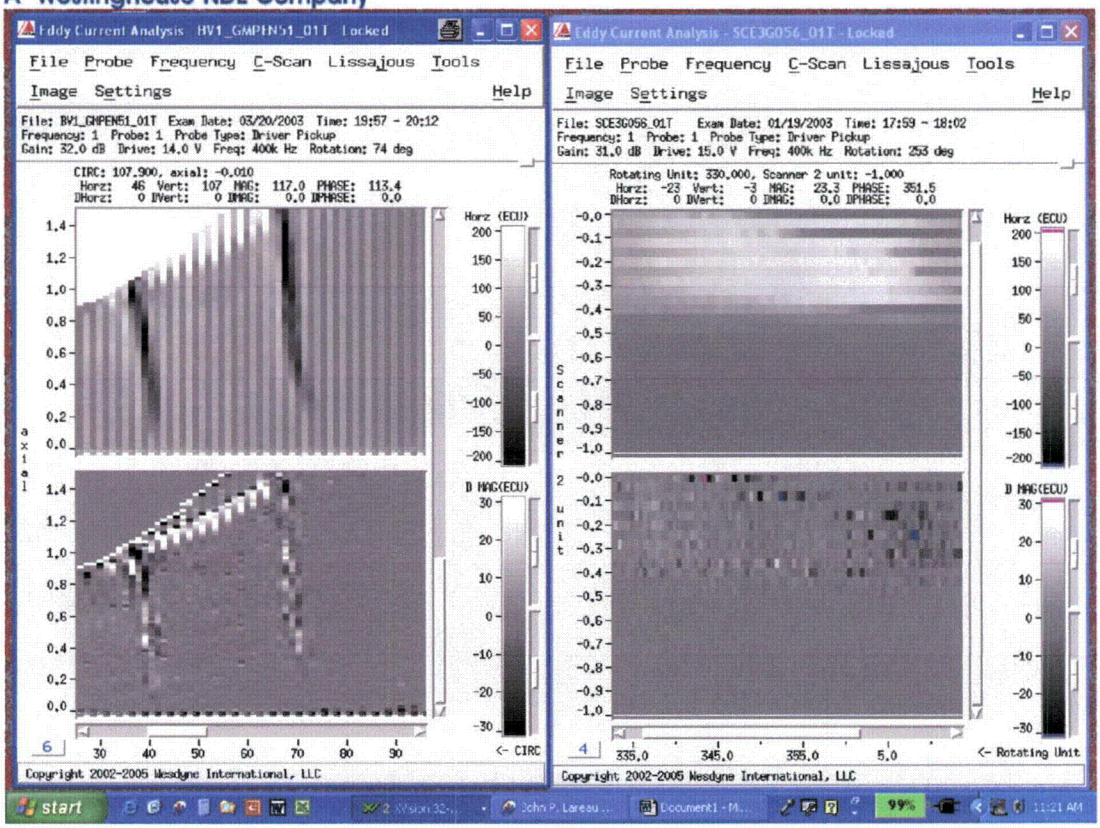

Figure 1:

Comparison of CRDM OD ECT scans from BV1 #51 and SCE3 #56 (3R12): The left image show two axial OD flaws extending below the weld on BV #51. The right image shows the equivalent scan of the tube OD on SCE3 #56. The toe of the weld is at approximately 0.4" and the scan extended 0.6" below the weld. The UT indication was reported at approximately 355 degree and extended 0.7" below the weld. There is no corresponding ET signal indicating a surface connected flaw in this region, which precludes PWSCC.

The indication in BV1 was confirmed by TOFD UT and is less deep and shorter than the reported values at SCE #56

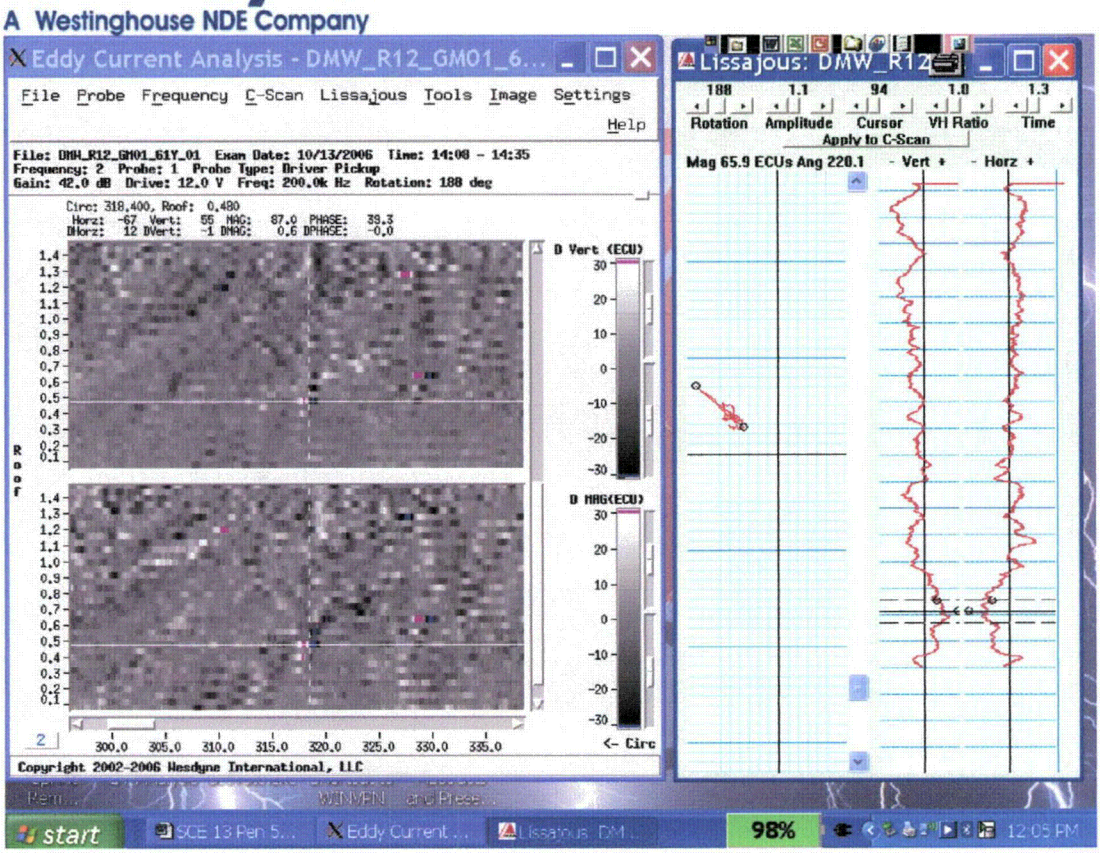

Figure 2:
Beaver Valley 2 Nozzle 61 J weld ET Results: The cursor marks the location of a near subsurface linear indication at a location corresponding to a Parent Tube Indication reported by TOFD UT from the nozzle ID. Comparison of the Lissajous responses at the two test frequencies (100 kHz and 400kHz) indicated the subsurface nature. Shallow grinding confirmed the presence of a subsurface linear flaw.

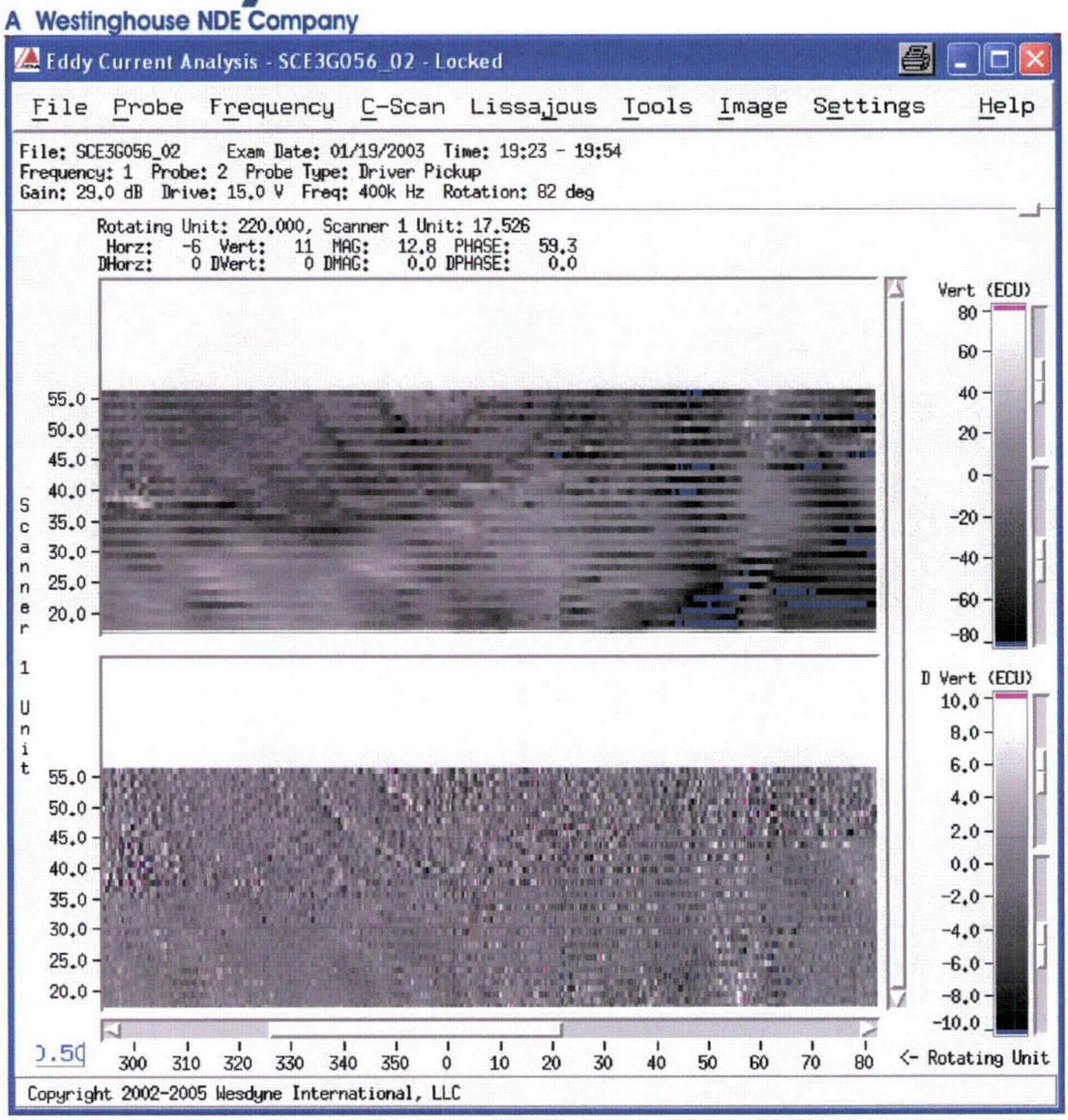

Figure 3:
San Onofre 3 Nozzle #56 J Weld ET Results:
Eddy Current Test of J groove Weld, 3R12: No indications were observed. The scan coverage extends onto weld fillet. The TOFD UT indication was reported at 358 degrees.

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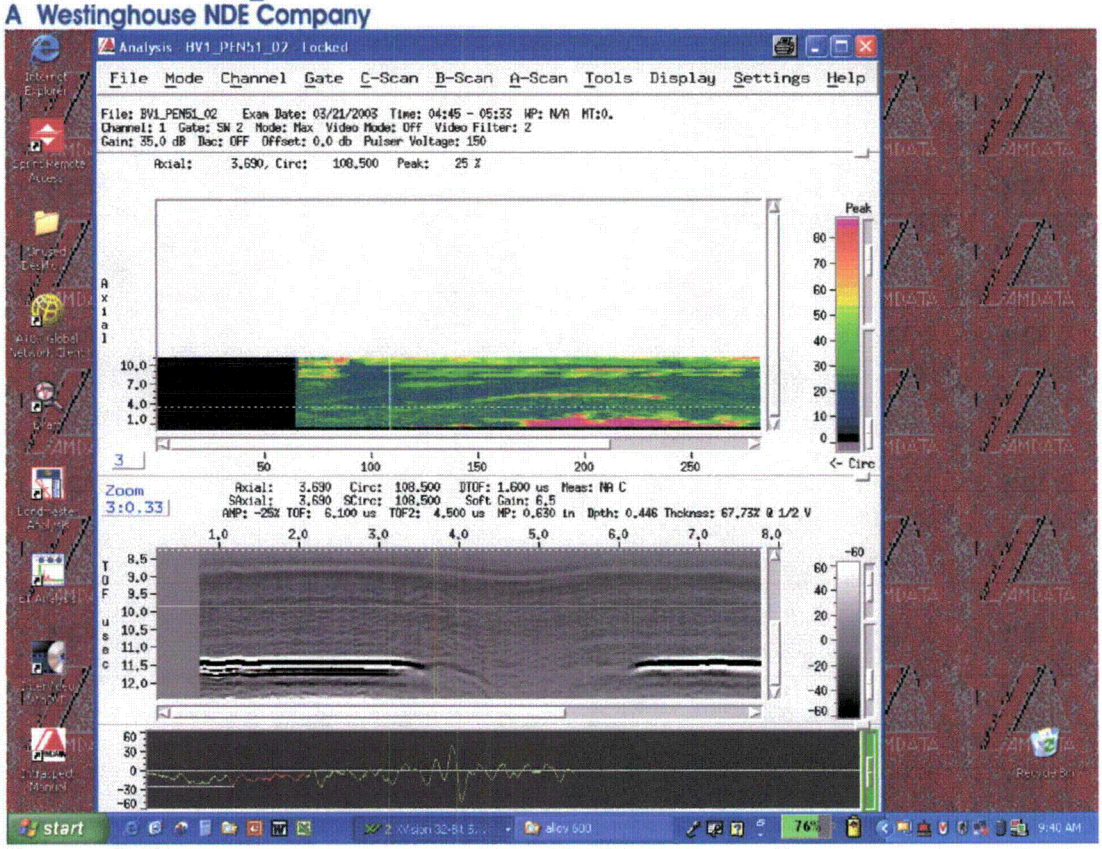

Figure 4:
Beaver Valley 1 TOFD UT Response: This signal is from a confirmed OD PWSCC flaw below the weld in the nozzle. Note the simple tip response geometry and the associated reduction in backwall response.

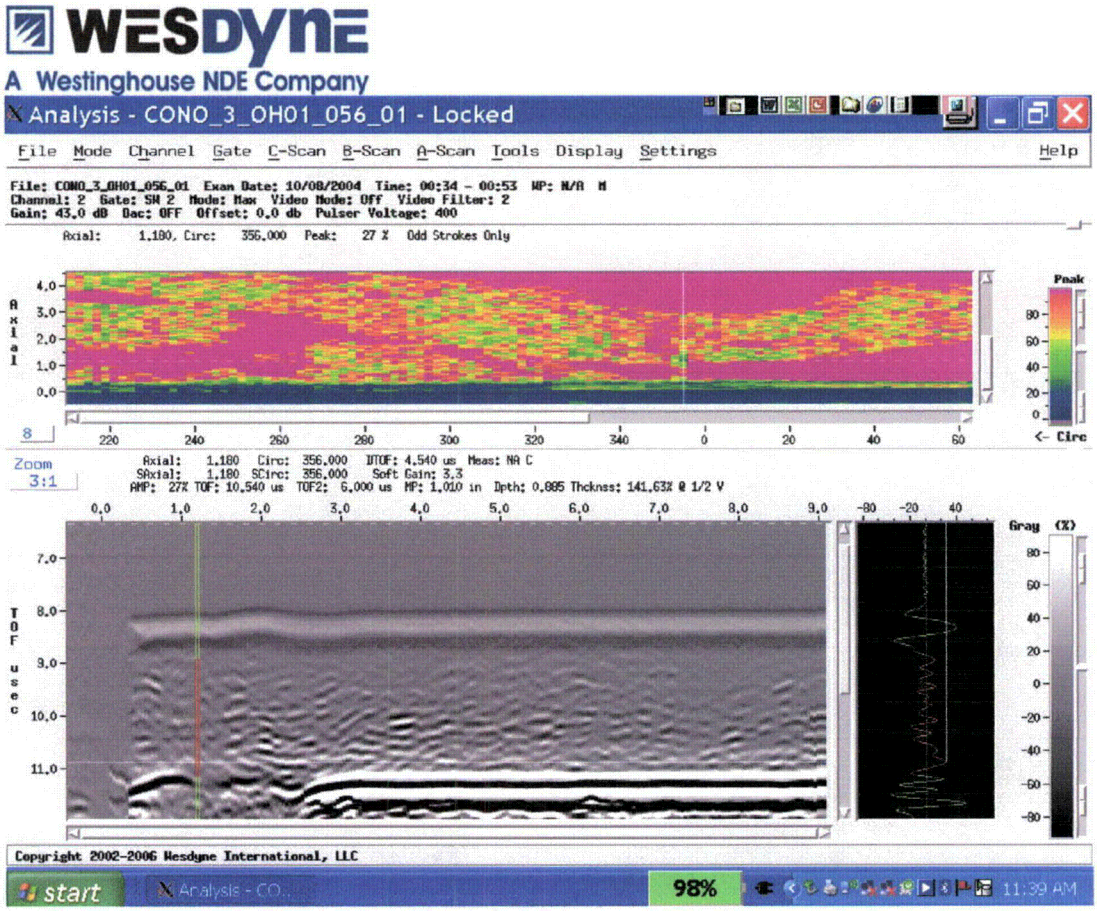

Figure 5:
San Onofre 3 Nozzle 56 TOFD UT Results: Area with reported TOFD indication showing general background noise and no response similar to Beaver Valley 1 confirmed PWSCC.

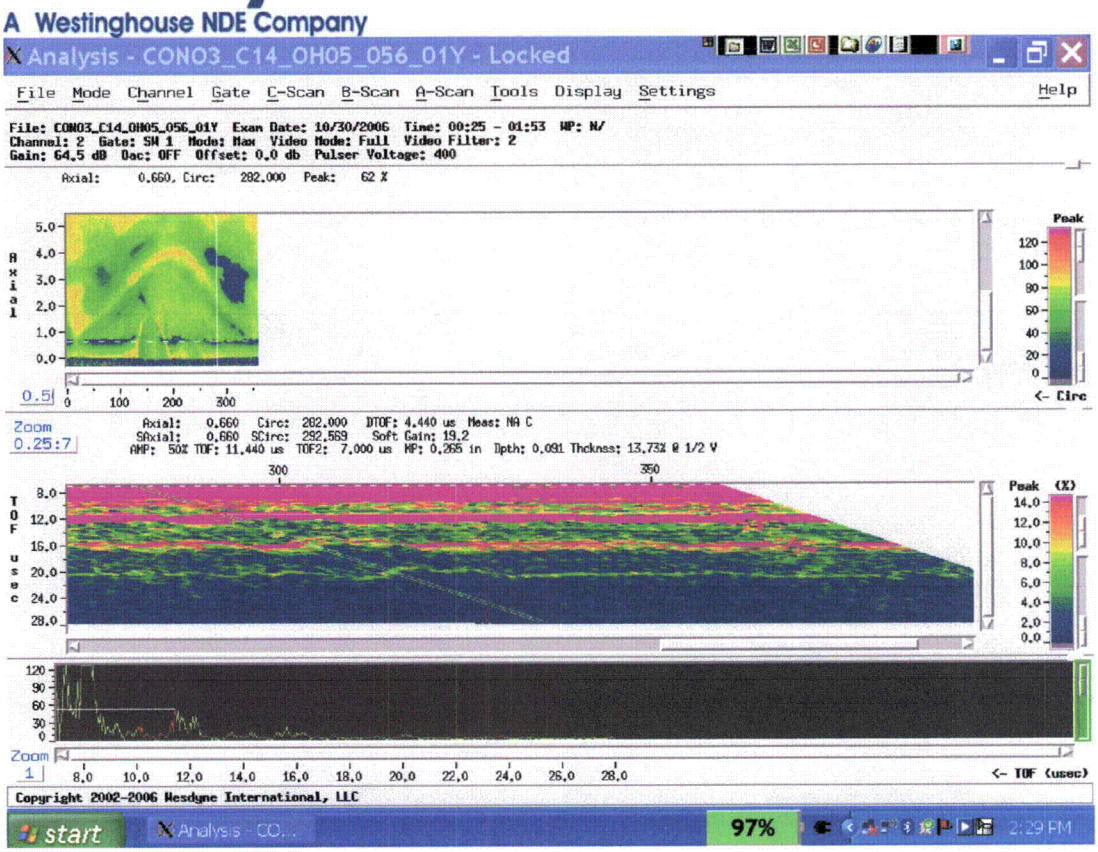

Figure 6:
San Onofre 3 Nozzle #56 Shear Wave Special Interest Results: The continuous yellow-green line at approximately 20 microseconds on the B scan show the partial reflection from the nozzle OD to weld overlay interface (similar to the TOFD WII results). The presence of PWSCC would obscure this interface response behind the flaw (approximately 350-360 degrees), which does not happen in this case. Also, there are isolated, discontinuous reflections throughout the wall thickness in the region, consistent with increased grain noise.