LOUISIANA POWER & LIGHT / 142 DELARONDE STREET
P. O. BOX 6008 • NEW ORLEANS, LOUISIANA 70174 • (504) 366-2345

MIDDLE SOUTH UTILITIES SYSTEM

L. V. MAURIN
Vice President Nuclear Operations

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Mr. Harold R. Denton
Director, Office of Nuclear Reactor Regulation
U. S. Nuclear Regulatory Commission
Washington, D. C. 20555

SUBJECT: Waterford 3 SES
Docket No. 50-382
Comparison of Reactor Vessel PSI with
Regulatory Guide 1.150 Requirements

ENCLOSURES: (1) Comparison of LP&L Waterford 3 PSE RPV Exam to NRC Regulatory Guide 1.150 Requirements

(2) Physical Limitations and Interferences

(3) Near Surface Areas Electronically Gated Out

(4) Acousitc Similarity

Dear Mr. Denton,

During a preliminary meeting held August 26, 1981 to discuss LP&L's Preservice Inspection (PSI) Program, the NRC staff reviewer requested information comparing the Preservice Inspection actually conducted on the Waterford 3 Pressure Vessel to the requirements of Regulatory Guide 1.150 since this inspection was conducted more than five years before the issuance of the Regulatory Guide. Please find the requested information enclosed.

It is hoped that this information will alleviate the staff's concern in this area. If you have any questions or require further information, please feel free to contact either myself or R. W. Prados.

Very truly yours,

L. V. Maurin

LVM/DEB:keh

Enclosures

cc: J. Wilson, W. M. Stevenson, E. L. Blake, M. Hum

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ENCLOSURE I

COMPARISON OF LP&L WATERFORD 3 PSE RPV EXAM TO NRC REGULATORY GUIDE 1.150 REQUIREMENTS

The preservice examination of LP&L's Waterford 3 reactor pressure vessel (RPV) was performed in accordance with ASME Boiler and Pressure Vessel Code, Section XI, 1974 Edition, Summer 1974 Addenda. This examination predated USNRC Regulatory Guide (R.G.) 1.150 by more than five (5) years. Based upon an LP&L/Ebasco request, CE undertook a comparison of the Waterford RPV examination results. The format of the comparison corresponds directly to Section X, "Regulatory Position" of Reg. Guide 1.150. Each numbered paragraph of Section C has been addressed here in a similarly numbered paragraph.

1. Instrument Performance Checks

   1.1 Frequency of checks. R.G. 1.150 requires as a minimum that instrument performance checks be verified within one day prior to and one day after the performance of the required examination. Conformance to this requirement will be addressed in conjunction with each specific check.

   1.2 Screen height linearity. This check was performed in accordance with Section XI requirements and therefore meets R.G. 1.150 requirements. The frequency of checks exceeds the requirements of R.G. 1.150 as these checks were performed at the beginning of each day of examination.

   1.3 Amplitude control linearity. This check was performed in accordance with Section XI requirements and therefore meets R.G. 1.150 requirements. The frequency of checks exceeds the requirements of R.G. 1.150 as these checks were performed at the beginning of each day of examination.

   1.4 Frequency Amplitude Curve. The frequency amplitude curve was recorded as part of the manufacturers equipment certification. A record of this certification was maintained as part of the examination record. The one day time requirement stated in Paragraph 1.1, however, was not met.

   1.5 Pulse shape. This check was not a Section XI requirement and therefore was not performed.

2. Calibration

   The general calibration methods utilized the utilities' Section XI calibration block to establish the distance amplitude correction (DAC) curve and the sweep range for each examination. The calibration settings were verified on the calibration block daily, as a minimum. In addition, the calibration was checked on an electronic calibration simulator every 4 hours of examination and at the completion of each set of examinations.

2.1 Calibration for Manual Scanning - Manual scanning calibration was done statically and the flaws were maximized during the preservice examination. For sizing flaws, the signals were maximized and static sizing techniques were used, so this feature is in compliance. For detection scanning, a dynamic DAC response is required by this guide, but had not been required by the ASME Code. This feature was not met.

2.2 Calibration for mechanized scanning. These calibrations were performed using hand manipulation of the transducer sled on the calibration block.

a. Calibration speed was static, therefore, R.G. 1.150 requirements were not met.

b. Maintaining the scanning direction relative to the calibration direction has a number of considerations. The original intent of this paragraph, as stated in meetings, was to correct for forward and backward scanning of the calibration block and test piece with the concern being possible rocking of the ultrasonic test sled. With immersion sleds with symmetric design, as used on the Waterford vessel, this is not a concern.

Although not specifically addressed, there are a number of technical considerations raised by this paragraph. The direction of the beam angle relative to the cladding direction (parallel or perpendicular to the cladding) as well as the direction of the beam angle relative to the scanning direction may have effects on the ultrasonic response. The ASME calibration block design is insufficient to determine these effects so no corrections were included.

c. During calibration the signals from the calibration reflectors were maximized with the transducer perpendicular to the axis of the reflector; angulation of the transducer to optimize the signal was not permitted.

d. The alternate guidelines listed for establishing the DAC curve cannot be completely met by the techniques utilized during the examinations.

(1) The DAC curve was established statically with hand manipulation techniques.

(2) Full scale mockups were not utilized or available.

(3) Models were not utilized or available.

(4) Detailed comparison between dynamic and static responses from indications was not performed. However, in general, it has been found that the static response is neither consistently higher nor consistently lower than the dynamic response.

2.3 Calibration checks. While an electronic simulator was used for intermediate calibration checks, the calibration was also checked every 12 hours as a minimum on the calibration block. Furthermore, a conventional calibration block was used rather than a universal calibration block. Therefore, this section is not of concern.

3. Near Surface Examination and Surface Resolution

Attachment 3 shows the volume of material gated out during the examinations. The information required to be recorded by R.G. 1.150 was recorded and accounted for in arriving at these figures. The start and stop of the gate was set at such points that the front surface signal did not alarm the recording device. The gate setting, therefore, incorporated the decay time of the clad-water interface reflection and the disturbance created by the clad-well-metal interface with parent metal at the front surface. The angle beam channels were electronically gated to include the far surface, the straight beam gate was set as close as possible to the far surface signal without continuously alarming the system.

4. Beam Profile

The vertical beam profile information was obtained for each transducer used for the examination in each thickness range in accordance with the 1974 Edition of Section XI Appendix I. This exceeds R.G. 1.150 as it was performed as a natural course of the examination procedure requirements rather than only if recordable indications were detected.

5. Scanning Weld-Metal Interface

The examinations performed for LP&L used the Code required 0, 45, and 60 degree examinations of the beltline region and all circumferential and longitudinal welds. In addition, perpendicular access was obtained for the nozzle-to-shell weld from the nozzle bores and the flange to upper shell from the flange mating surface. No alternative examinations were performed.

6. Sizing

Recording and sizing of indications including geometry were performed at the Section XI required 50% DAC levels. The R.G. 1.150 required recording and sizing of 20% DAC signals was not performed and cannot be extracted from the gathered data, nor were traveling indications segregated from the exam data except for evaluating planar reflectors above 50% DAC which was performed per Section XI.

7. Reporting of Results

No indications exceeding Code acceptable levels were detected and therefore not reported. The portion of the volume not examined has been identified in Attachment 2.

ENCLOSURE 2

PHYSICAL LIMITATIONS AND INTERFERENCES

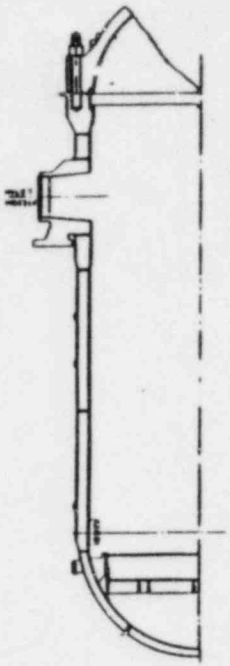
The outlet nozzle knuckle and the core stabilizing lugs are permanent physical limitations preventing access to some portion of the weld required volume (WRV). These areas are identified in the following table and figures. Other interferences, resulting in a lift-off situation, were caused by the vessel configuration or surface roughness. These areas are also identified in the following table and figures. Lift-off produces a spurious indication which is printed out on the paper.

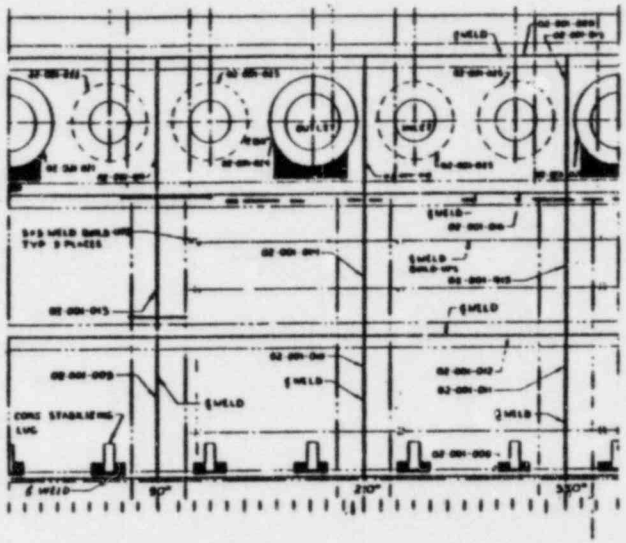
ENCLOSURE 2

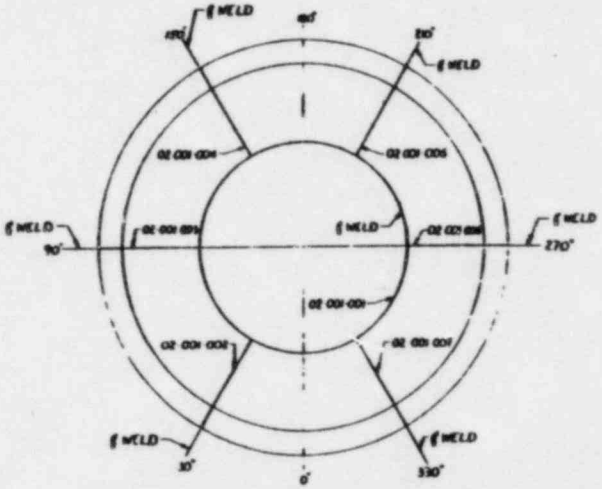
TABLE 1 PHYSICAL LIMITATIONS AND INTERFERENCES

WELD	SCAN DIRECTION	HOIST COORDINATES	*BOOM ROTATE COORDINATES	LIMITATION OF INTERFERENCE
01-008	⊥	335.5"-343.5"	0°-10°	Core Stabilizing Lug
01-008	"	335.5"-343.5"	50°-70°	Core Stabilizing Lug
01-008	"	335.5"-343.5"	110°-130°	Core Stabilizing Lug
01-008	"	335.5"-343.5"	170°-190°	Core Stabilizing Lug
01-008	"	335.5"-343.5"	230°-250°	Core Stabilizing Lug
01-008	"	335.5"-343.5"	290°-310°	Core Stabilizing Lug
01-008	"	335.5"-343.5"	350°-360°	Core Stabilizing Lug
01-012	"	217"	75°-105°	Liftoff
01-016	"	110"-124"	0°-20°	Outlet Nozzle Knuckle
01-016	"	110"-124"	335°-360°	Outlet Nozzle Knuckle
01-016	"	110"-126"	150°-200°	Outlet Nozzle Knuckle
01-016	"	132"	0°-6°	Liftoff
01-016	"	134"	71°-120°	Liftoff
01-016	"	135"	128°-132°	Surface Roughness
01-016	"	135"	135°-154°	Surface Roughness
01-016	"	135"	181°-186°	Surface Roughness
01-016	"	135"	199°-205°	Surface Roughness
01-016	"	135"	213°-217°	Surface Roughness
01-016	"	135"	269°-275°	Surface Roughness
01-016	"	135"	313°-336°	Surface Roughness
01-016	"	135"	343°-350°	Surface Roughness
01-016	"	135"	359°-360°	Surface Roughness

*these coordinates are determined from the position of the 0° transducer (center of the sled assembly) on the inside diameter of the RPV. Associated volume that is missed is dependent on transducer interrogation angle.







Shaded AREAS REPRESENT THE APPROXIMATE LOCATIONS OF THE OBSTRUCTED AREAS DENOTED IN THE TABLE

Figure 1

ENCLOSURE 3

NEAR SURFACE AREAS ELECTRONICALLY GATED OUT

In order to prevent spurious signals caused by surface and near surface interferences from obscurring true signals on the paper tapes, the near surface is gated out during the automated examinations. Welds 01-008 through 01-019 were examined from the shell course with 0°, 45° and 60° parallel and perpendicular scans. Weld 01-020 was scanned from both the shell course and the flange surface. Welds 01-021 through 01-026 were examined from the shell course and from the nozzle bore. Nozzle inner radius areas 01-027 through 01-032 were examined with only a 70° scan. The depth of the near surface area gated out for each of these scans is identified on the attached table.

Manual examinations were performed on the bottom head peel segment dome welds (01-001 through 01-007). A manual examination was also performed on the bottom head to lower shell weld (01-008) in addition to the automated examination noted in the table of Attachment 3. Since these examinations were performed manually, there is no loss of examination coverage due to gating. However, there is a small volume missed on the outside surface, typically less than .5", due to the near field and ring down effect of the manual type transducer. To identify more specifically the volume missed would require considerable research and experimentation.

ENCLOSURE 3

TABLE 1 IDENTIFICATION OF NEAR SURFACE ELECTRONICALLY GATED OUT

Weld	Number of Inches Gated Out 0°		45°		60°		0° Flange Surface	8° Flange Surface	19° Flange Surface	5° Nozzle Bore	20° Nozzle Bore	70° Inner Radius
01-008	.78	.78	1.6	1.6	1.6	1.6						
01-009	1.68	1.68	1.12	1.12	1.12	1.12						
01-010	1.68	1.68	1.12	1.12	1.12	1.14						
01-011	1.68	1.68	1.12	1.12	1.12	1.14						
01-012	1.68	1.68	1.12	1.12	1.12	1.12						
01-013	1.68	1.68	1.12	1.12	1.12	1.12						
01-014	1.68	1.68	1.12	1.12	1.12	1.12						
01-015	1.68	1.68	1.12	1.12	1.12	1.12						
01-016	2.0	1.68	2.0	1.12	2.0	1.12						
01-017	2.0	2.0	2.0	2.0	2.0	2.0						
01-018	2.0	2.0	2.0	2.0	2.0	2.0						
01-019	2.0	2.0	2.0	2.0	2.0	2.0						
01-020	2.0	NA	2.0	NA	2.0	NA	0.0	0.0	0.0			
01-021	2.0	NA	2.0	NA	2.0	NA				4.5	4.5	
01-022	2.0	NA	2.0	NA	2.0	NA				4.5	4.5	
01-023	2.0	NA	2.0	NA	2.0	NA				4.5	4.5	
01-024	2.0	NA	2.0	NA	2.0	NA				4.5	4.5	
01-025	2.0	NA	2.0	NA	2.0	NA				4.5	4.5	
01-026	2.0	NA	2.0	NA	2.0	NA				4.5	4.5	
01-027												.6
01-028												.6
01-029												.6
01-030												.6
01-031												.6
01-032												.6

ENCLOSURE 4

ACOUSTIC SIMILARITY

The amplitude of the OD surface reflection was monitored periodically by observing the 0° channel display for loss of back reflection. This information was not specifically recorded since only one display could be observed at a time. No significant loss of reflection was assumed to have occurred since it was not noted on the data.