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BW150045

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

Braidwood Station, Unit 2
Facility Operating License No. NPF-77
NRC Docket No. STN 50-457

Subject: Response to Request for Additional Information Regarding the Steam Generator Tube Inspection Report for Braidwood Station, Unit 2, Refueling Outage 17

References:
(1) Letter from M. E. Kanavos (Exelon Generation Company, LLC) to NRC, "Braidwood Station, Unit 2 Steam Generator Tube Inspection Report for Refueling Outage 17," dated November 14, 2014

(2) Email from J. S. Wiebe (NRC) to P. J. Raush (Exelon Generation Company, LLC), "RAIs Related to Braidwood Station, Unit 2 Steam Generator Inspection Report for Refueling Outage 17," dated April 6, 2015

In Reference 1, in accordance with Technical Specification 5.6.9, "Steam Generator (SG) Tube Inspection Report," Exelon Generation Company, LLC (EGC) submitted the results of the SG inspections that were completed during the Braidwood Station, Unit 2 Refueling Outage 17. In Reference 2, the NRC notified EGC that additional information was needed in order to complete their review of the subject report. The requested information is provided in Attachment 1 of this letter. As noted in Reference 2, this response is due to the NRC by May 6, 2015; i.e., 30 days from the data of the email.

This letter contains no new regulatory commitments.

If you have any questions concerning this letter, please contact Mr. Phillip Raush, Regulatory Assurance Manager, at (815) 417-2800.

Respectfully,

Mark E. Kanavos
Site Vice President
Braidwood Station

cc: NRC Regional Administrator, Region III
NRC Senior Resident Inspector – Braidwood Station
NRC Project Manager, NRR – Braidwood and Byron Stations
Illinois Emergency Management Agency – Division of Nuclear Safety

ATTACHMENT 1

Response to Request for Additional Information Regarding the Steam Generator Tube Inspection Report for Braidwood Station, Unit 2 Refueling Outage 17

In Reference 1, in accordance with Technical Specification 5.6.9, "Steam Generator (SG) Tube Inspection Report," Exelon Generation Company, LLC (EGC) submitted the results of the SG inspections that were completed during the Braidwood Station, Unit 2 Refueling Outage 17. In Reference 2, the NRC notified EGC that additional information was needed in order to complete their review of the subject report. The requested information is provided below.

NRC RAI

In reviewing the Exelon Generation Company, LLC's (Exelon's) submittal dated November 14, 2014 (Agency wide Document and Management System Accession No. ML14318A211), related to Braidwood, Unit 2, Steam Generator Tube Inspection Report for Refueling Outage 17, the NRC staff has determined that the following information is needed in order to complete its review:

RAI #1

In a response to a request for additional information regarding the SG tube inspections for RFO 16 (ADAMS Accession No. ML13219A320), it is stated that prior to the start of RFO 16, there were 71 previously known "-2 sigma tubes." The tube located at row 44, column 47 in SG 2C does not appear to be included in the 71 tubes. It is also stated that 2 of the 71 previously known "-2 sigma tubes" were preventatively plugged, apparently leaving 69 "-2 sigma tubes" in service. The scope for RFO 17 states that 68 tubes having potentially increased residual stress were inspected. Clarify the number of tubes identified in all four SGs as being "-2 sigma tubes."

Response

The response to the request for additional information erroneously identified 71 "-2 sigma tubes" previously known prior to the start of RFO 16 (Reference 3, Section 5.2.1). The total number previously known prior to the start of RFO 16 was actually 70 "-2 sigma tubes". This oversight was attributed to not updating the total count after RFO 15. During RFO 15, Row 15, Column 7 tube in the 2B SG was plugged due to potential secondary side foreign objects, and the location was inaccessible to perform a visual inspection (Reference 4, Table 5.1.2). This tube was a "-2 sigma tube." Therefore the total "-2 sigma tubes" decreased after RFO 15 from 71 to 70 "-2 sigma tubes" (Reference 4, Section 4.2.3).

During RFO 16 it was identified that one tube in the 2C SG, Row 44, Column 47, had been missed during the screening performed in 2003. This increased the total number to 71 "-2 sigma tubes" at the time of RFO 16, which was subsequently reduced to 68 when three "-2 sigma tubes", including Row 44, Column 47 tube in the 2C SG, were plugged during RFO 16.

In summary there were a total of 68 "-2 sigma tubes" at the start of RFO 17 and all of them presently remain in-service. The number of "-2 sigma tubes" per SG at the start of RFO 17 are clarified in Table 1 below. A historical summary of "-2 sigma tubes" per SG can be found in Appendix A.

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Table 1: Total "-2 Sigma Tubes" per SG prior to and after RFO 17

	2A	2B	2C	2D	Total
# "-2 sigma tubes" in-service	11	15	14	28	68

RAI #2

Your November 14, 2014 submittal stated that there were no "anomalies" observed during the plug visual inspections. Was any degradation observed?

Response

No degradation was observed during the plug visual inspections performed during RFO 17.

RAI #3

The plugging summary table on page 9 of your November 14, 2014, submittal discusses two tubes that were plugged due to large magnetic permeability indications, which resulted in a high noise portion of the tube that could potentially mask flaws. Discuss how you confirmed structural integrity of these tubes in the presence of the large magnetic permeability indications.

Response

The Westinghouse Data Union Software (DUS) was applied to inject the signal response from a flaw smaller than the structurally significant size flaw (i.e. 68% through wall (TW) x 0.5" long axial outer diameter stress corrosion cracking (ODSCC)) into the magnetic permeability (PVN) signal from the field +Point™ rotating coil data obtained from the two tubes with large permeability signals. The flaw was simulated by a uniform depth 60% TW x 0.5" long axial OD EDM notch scaled back to the voltage of an equivalent depth axial ODSCC crack. Analyst review of the resultant (combined) signal demonstrated detectability of the structurally significant flaw even in the presence of the noise from the PVN signal. Therefore, the +Point data from the two tubes with the large PVN indications was determined not to have masked signals from structurally significant flaws, if any were present, hence providing the basis for meeting one cycle condition monitoring structural integrity.

RAI #4

Discuss whether there was any evidence of the unknown red substance that was observed during RFO 16. Discuss whether there are any new insights on the cause/nature of these red spots.

Response

There was no evidence of the red substance observed during RFO 17.

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Visual examination was performed in the 2C SG preheater to determine if any red substance was present. Additionally, the affected tubes were examined with an X-probe. No degradation was detected, and visually there was no evidence of the red substance at the same location and no evidence it had migrated elsewhere. Although there was no sample of the red substance remaining to analyze, it was concluded that the red substance was likely organic material, because it was no longer present. It is assumed that it decomposed during an 18-month operating period. No tube degradation was detected.

RAI #5

Your November 14, 2014, submittal indicated that three tubes deep around the entire periphery, including the no tube lane and T-slot, were inspected in all four SGs with an X-probe. Clarify the axial extent of these exams (e.g., tube-end to tube-end, H distance to first support on both hot-leg and cold-leg). Discuss whether or not these exams included both hot-leg and cold-leg regions.*

Response

The axial extent was the tube end to flow distribution baffle (1st Tube Support Plate (TSP) -01C or 01H) for the entire periphery scope, including the no tube lane and T-slot. In the "head" of the T-slot on the hot leg, the extent of the exam was extended from 01H to 03H. The exams included both the hot leg and cold leg regions. This is shown in the attached tube sheet maps in Attachment B.

REFERENCES

1. Letter from M. E. Kanavos (Exelon Generation Company, LLC) to NRC, "Braidwood Station, Unit 2 Steam Generator Tube Inspection Report for Refueling Outage 17," dated November 14, 2014 (ADAMS Accession No. ML14318A211)

2. Email from J. S. Wiebe (NRC) to P. J. Raush (Exelon Generation Company, LLC), "RAIs Related to Braidwood Station, Unit 2 Steam Generator Inspection Report for Refueling Outage 17," dated April 6, 2015

3. Letter from Letter from D. Enright (Exelon Generation Company, LLC) to NRC, "Braidwood Station, Unit 2 Steam Generator Tube Inspection Report for Refueling Outage 16," dated February 5, 2013 (ADAMS Accession No. ML13039A042)

4. Letter from D. J. Enright (Exelon Generation Company, LLC) to NRC, "Braidwood Station, Unit 2 Steam Generator Tube Inspection Report for Refueling Outage 15," dated August 10, 2011 (ADAMS Accession No. ML11227A037)

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Appendix A

Historical Summary of "-2 Sigma Tubes" Totals in High Rows (Rows 10-49)

Outage	SG 2A	SG 2B	SG 2C	SG 2D	Total	Notes
After 2003 Screening (prior to RFO 10)	13	16	17	28	74	
Plugged during RFO 10	-1	0	-2	0	-3	Tubes were plugged due to ODSCC (Note 1).
Prior to RFO 11	12	16	15	28	71	
Plugged during RFO 11, RFO 12, RFO 13, RFO 14	0	0	0	0	0	
Plugged during RFO 15	0	-1	0	0	-1	Tube was preventatively plugged for possible loose part (Note 2).
Prior to RFO 16	12	15	15	28	70	Erroneously reported 71 tubes (Note 3).
Missed "-2 Sigma Tube" and added during RFO 16	0	0	+1	0	+1	Note: One tube was initially missed during 2003 screening.
Plugged during RFO 16	-1	0	-2	0	-3	
Remaining "-2 Sigma Tubes" prior to RFO 17	11	15	14	28	68	
Plugged during RFO 17	0	0	0	0	0	
Remaining "-2 Sigma Tubes" after RFO 17	11	15	14	28	68	

Notes:

1. Reference ADAMS Accession No. ML040540452, Attachment B.6 Tubes Containing ODSCC Tube sheet Maps.
2. Reference ADAMS Accession No. ML11227A037, Table 5.1.2.
3. Reference ADAMS Accession Nos. ML13219A320, RAI No. 3 and ML13039A042, Section 5.2.1.

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Appendix B

Three-Tube Periphery Array Probe (X-probe) Inspections Tube sheet Maps

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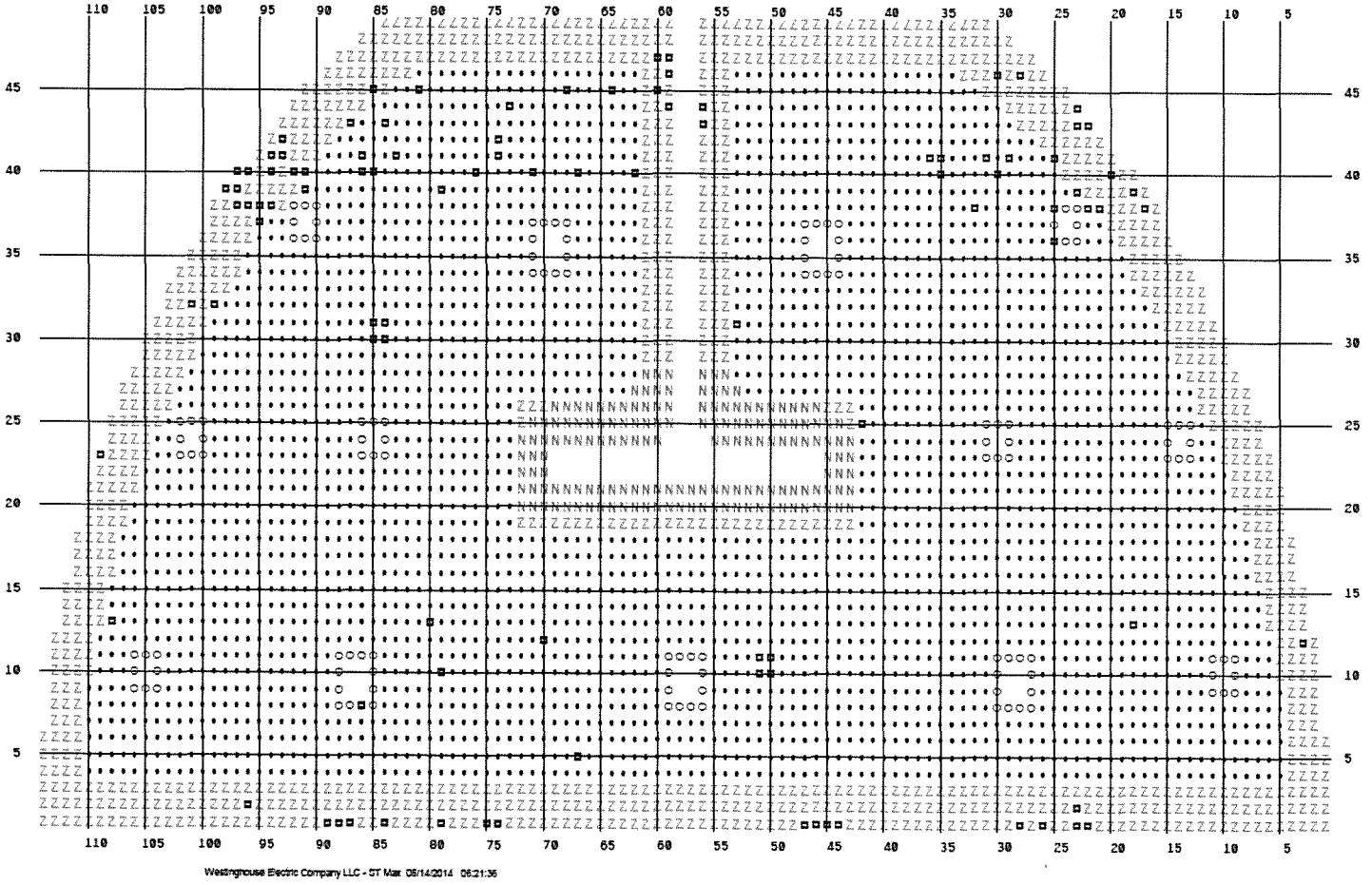
SG - A HOT LEG 3-TUBE PERIPHERY .610 ARRAY PROGRAM

Braidwood A2R17 CDE D5

Z 1025 TEST (01H - TSH -1")

N 160 TEST (03H - TSH -1")

▫ 100 PLUGGED TUBE



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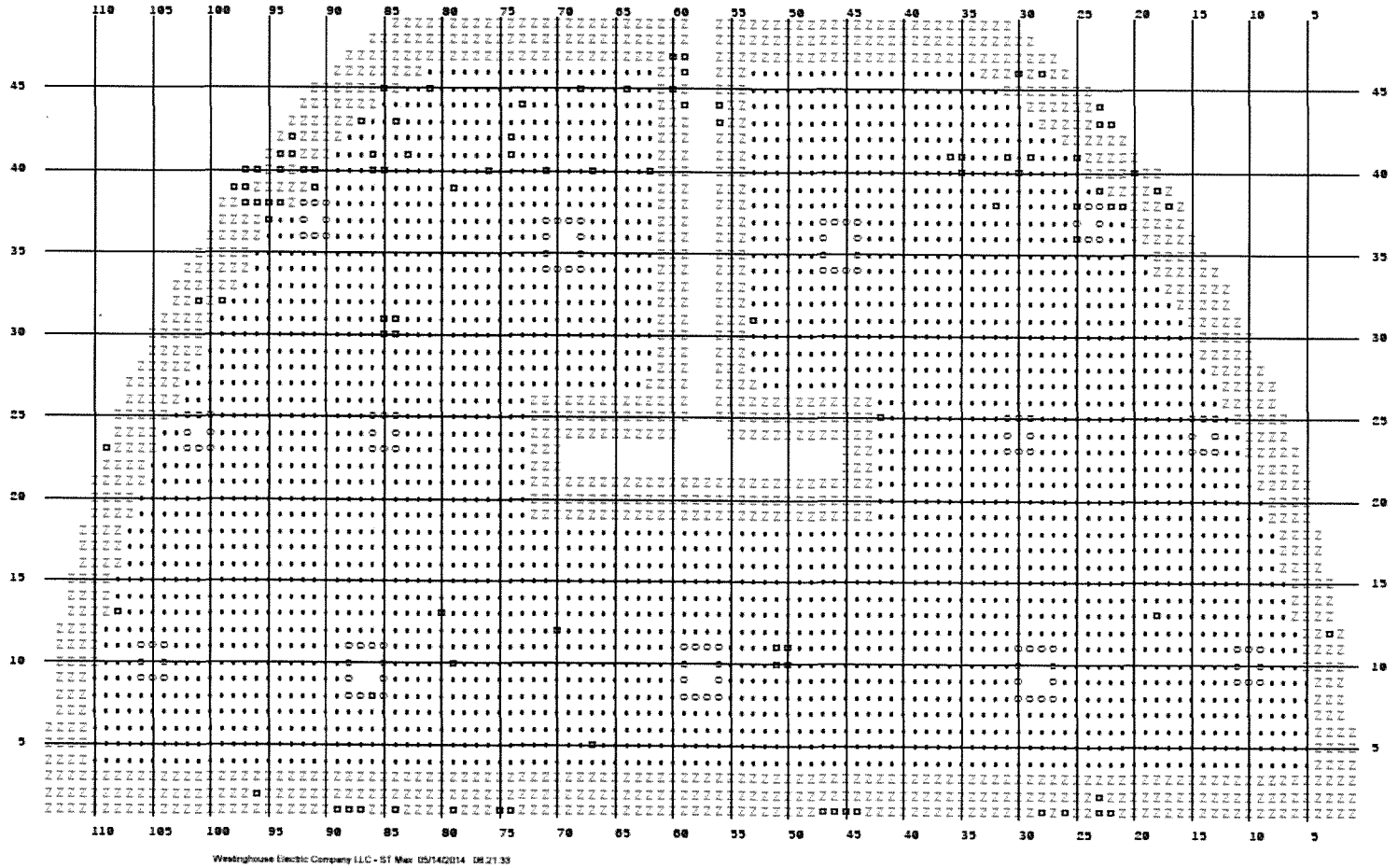
SG - A COLD LEG 3-TUBE PERIPHERY .610 ARRAY PROGRAM

Braidwood A2R17 CDE D5

Z 1185 TEST (01C - TSC -1")

100 PLUGGED TUBE



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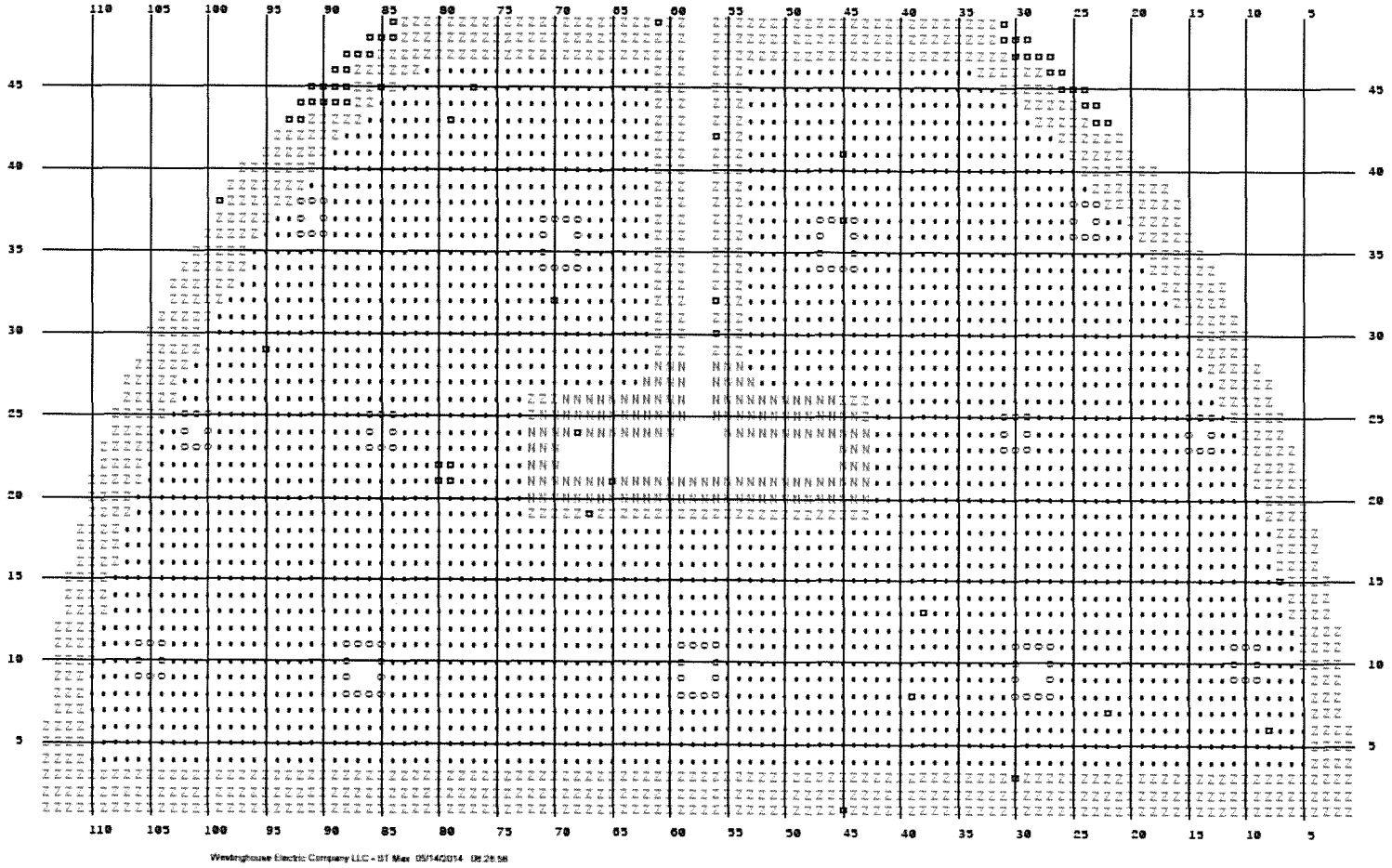
SG - B HOT LEG 3-TUBE PERIPHERY .610 ARRAY PROGRAM

Braidwood A2R17 CDE D5

Z 1036 TEST (01H - TSH -1")
N 158 TEST (03H - TSH -1")
□ 63 PLUGGED TUBE



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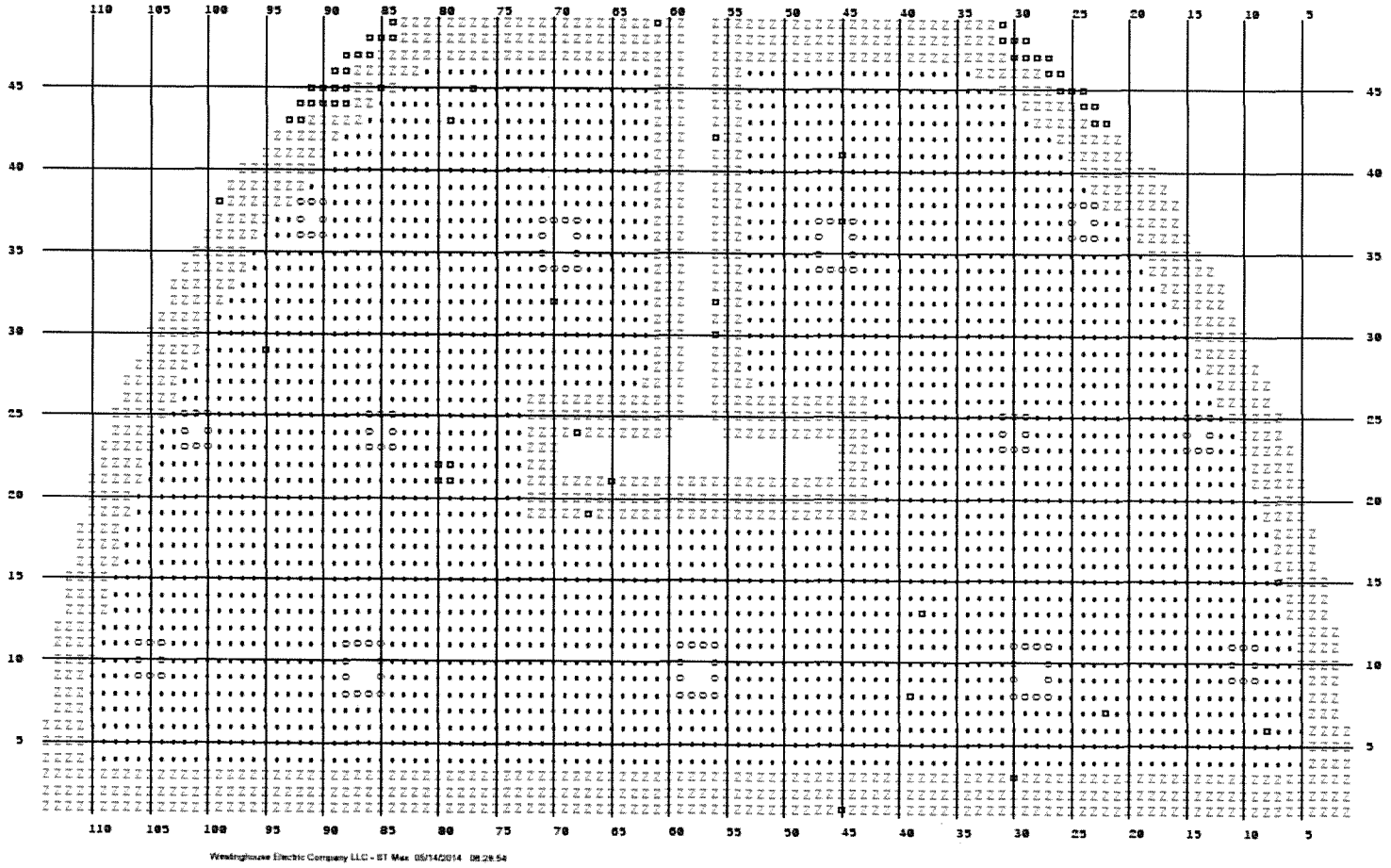
SG - B COLD LEG 3-TUBE PERIPHERY .610 ARRAY PROGRAM

Braidwood A2R17 CDE D5

Z 1194 TEST (01C - TSC -1")

63 PLUGGED TUBE



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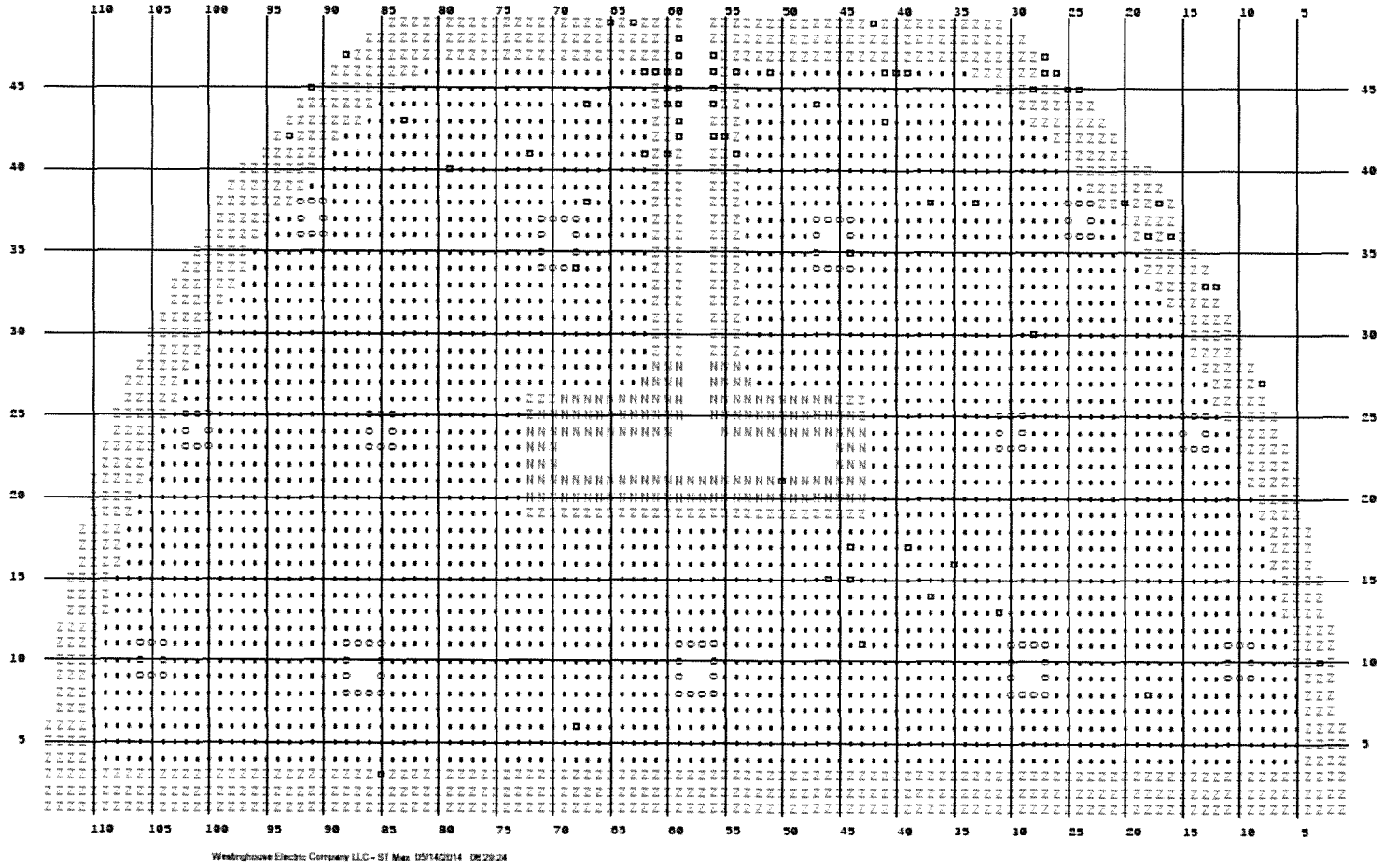
SG - C HOT LEG 3-TUBE PERIPHERY .610 ARRAY PROGRAM

Braidwood A2R17 CDE D5

Z 1041 TEST (01H - TSH -1")

N 159 TEST (03H - TSH -1")

▫ 70 PLUGGED TUBE



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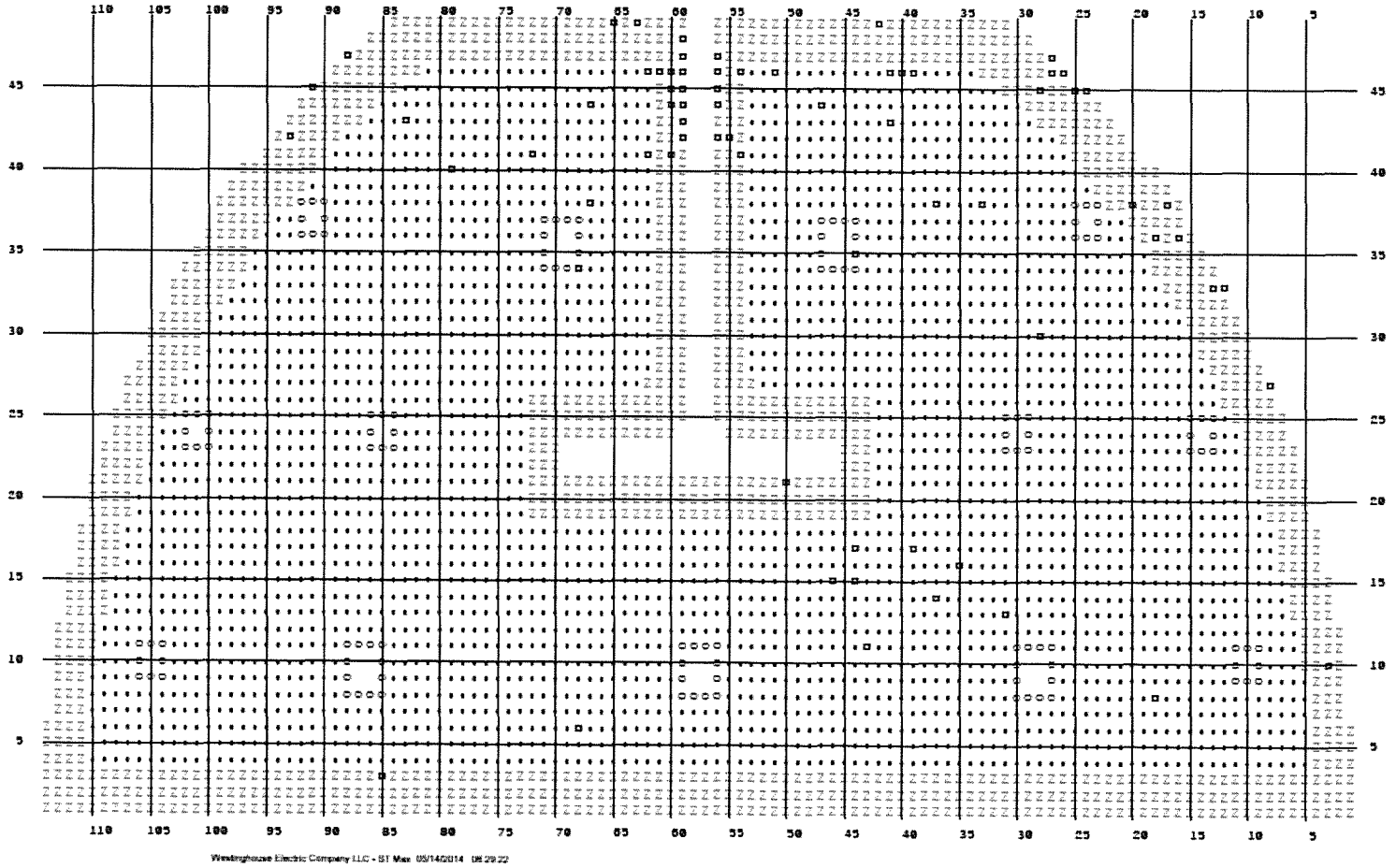
SG - C COLD LEG 3-TUBE PERIPHERY .610 ARRAY PROGRAM

Braidwood A2R17 CDE D5

Z 1200 TEST (01C - TSC -1")

▫ 70 PLUGGED TUBE



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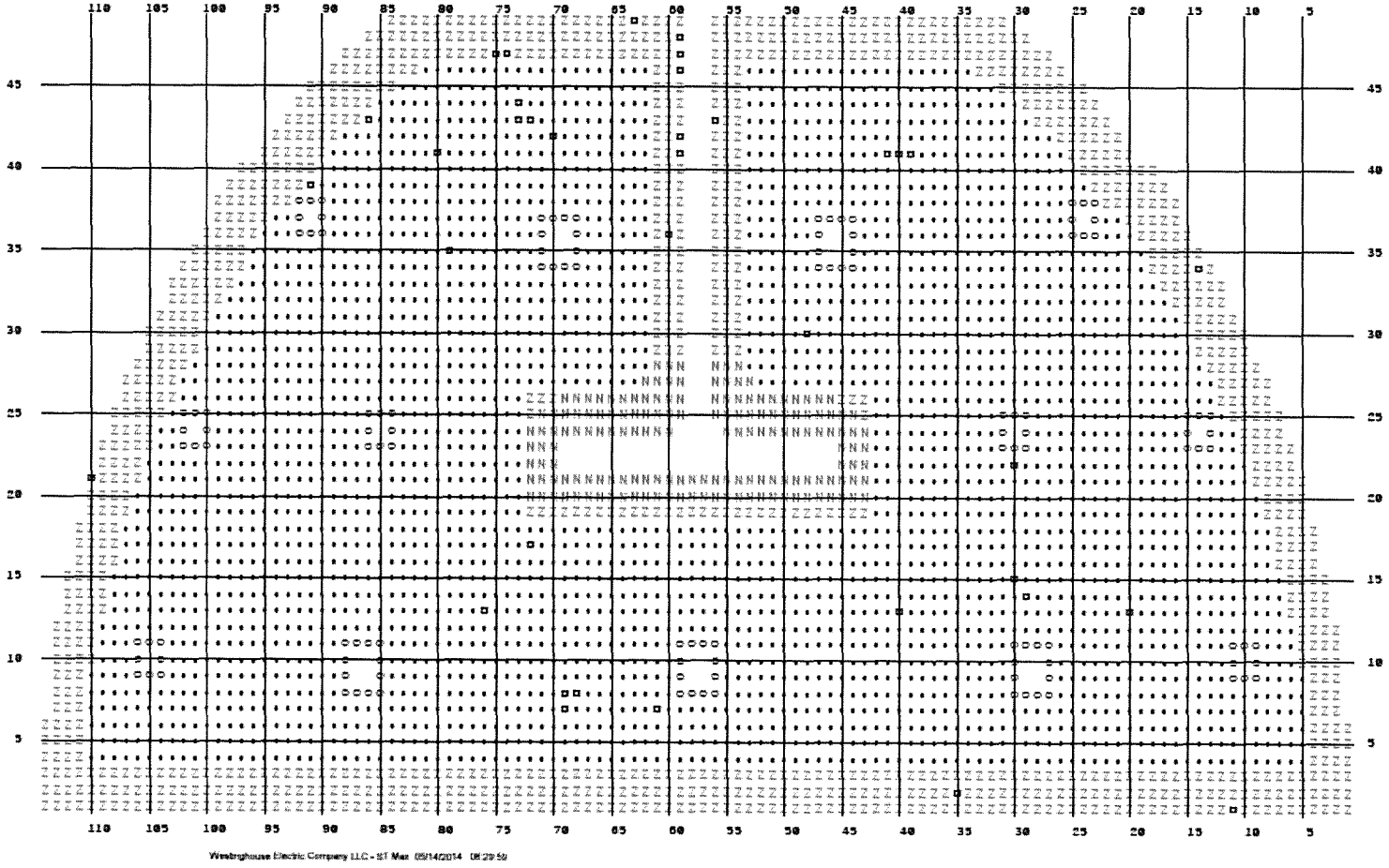
SG - D HOT LEG 3-TUBE PERIPHERY .610 ARRAY PROGRAM

Braidwood A2R17 CDE D5

Z 1068 TEST (01H - TSH -1")

N 160 TEST (03H - TSH -1")

▫ 37 PLUGGED TUBE



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SG - D COLD LEG 3-TUBE PERIPHERY .610 ARRAY PROGRAM

Braidwood A2R17 CDE D5

Z 1228 TEST (01C - TSC -1")

37 PLUGGED TUBE