ATTACHMENT 6

Westinghouse Application for Withholding, Affidavit, and Non-Proprietary Version of Attachment 5

Westinghouse Electric Company
Nuclear Services
P.O. Box 355
Pittsburgh, Pennsylvania 15230-0355
USA

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

Direct tel: (412) 374-4419
Direct fax: (412) 374-4011
e-mail: maurerbf@westinghouse.com

Our ref: CAW-05-2080

December 13, 2005

APPLICATION FOR WITHHOLDING PROPRIETARY INFORMATION FROM PUBLIC DISCLOSURE

Subject: NF-BEX-05-188 P-Attachment, Quad Cities Unit 2, Cycle 19 SLMCPR (Proprietary)

The proprietary information for which withholding is being requested in the above-referenced report is further identified in Affidavit CAW-05-2080 signed by the owner of the proprietary information, Westinghouse Electric Company LLC. The affidavit, which accompanies this letter, sets forth the basis on which the information may be withheld from public disclosure by the Commission and addresses with specificity the considerations listed in paragraph (b)(4) of 10 CFR Section 2.390 of the Commission's regulations.

Accordingly, this letter authorizes the utilization of the accompanying affidavit by Exelon Generation.

Correspondence with respect to the proprietary aspects of the application for withholding or the Westinghouse affidavit should reference this letter, CAW-05-2080 and should be addressed to B. F. Maurer, Acting Manager, Regulatory Compliance and Plant Licensing, Westinghouse Electric Company LLC, P.O. Box 355, Pittsburgh, Pennsylvania 15230-0355.

Very truly yours,

B. F. Maurer, Acting Manager
Regulatory Compliance and Plant Licensing

Enclosures

cc: L. Rossbach/NRR
F. M. Akstulewicz/NRR
G. S. Shukla/NRR
L. M. Feizollahi/NRR (affidavit only)

CAW-05-2080

AFFIDAVIT

COMMONWEALTH OF PENNSYLVANIA:

ss

COUNTY OF ALLEGHENY:

Before me, the undersigned authority, personally appeared B. F. Maurer, who, being by me duly sworn according to law, deposes and says that he is authorized to execute this Affidavit on behalf of Westinghouse Electric Company LLC (Westinghouse), and that the averments of fact set forth in this Affidavit are true and correct to the best of his knowledge, information, and belief:

B. F. Maurer, Acting Manager
Regulatory Compliance and Plant Licensing

Sworn to and subscribed
before me this 13th day
of December, 2005

Notary Public

Notarial Seal
Sharon L. Fiori, Notary Public
Monroeville Boro, Allegheny County
My Commission Expires January 29, 2007
Member, Pennsylvania Association Of Notaries

(1) I am Acting Manager, Regulatory Compliance and Plant Licensing, in Nuclear Services, Westinghouse Electric Company LLC (Westinghouse), and as such, I have been specifically delegated the function of reviewing the proprietary information sought to be withheld from public disclosure in connection with nuclear power plant licensing and rule making proceedings, and am authorized to apply for its withholding on behalf of Westinghouse.

(2) I am making this Affidavit in conformance with the provisions of 10 CFR Section 2.390 of the Commission's regulations and in conjunction with the Westinghouse application for withholding accompanying this Affidavit.

(3) I have personal knowledge of the criteria and procedures utilized by Westinghouse in designating information as a trade secret, privileged or as confidential commercial or financial information.

(4) Pursuant to the provisions of paragraph (b)(4) of Section 2.390 of the Commission's regulations, the following is furnished for consideration by the Commission in determining whether the information sought to be withheld from public disclosure should be withheld.

(i) The information sought to be withheld from public disclosure is owned and has been held in confidence by Westinghouse.

(ii) The information is of a type customarily held in confidence by Westinghouse and not customarily disclosed to the public. Westinghouse has a rational basis for determining the types of information customarily held in confidence by it and, in that connection, utilizes a system to determine when and whether to hold certain types of information in confidence. The application of that system and the substance of that system constitutes Westinghouse policy and provides the rational basis required.

Under that system, information is held in confidence if it falls in one or more of several types, the release of which might result in the loss of an existing or potential competitive advantage, as follows:

(a) The information reveals the distinguishing aspects of a process (or component, structure, tool, method, etc.) where prevention of its use by any of Westinghouse's competitors without license from Westinghouse constitutes a competitive economic advantage over other companies.

(b) It consists of supporting data, including test data, relative to a process (or component, structure, tool, method, etc.), the application of which data secures a competitive economic advantage, e.g., by optimization or improved marketability.

(c) Its use by a competitor would reduce his expenditure of resources or improve his competitive position in the design, manufacture, shipment, installation, assurance of quality, or licensing a similar product.

(d) It reveals cost or price information, production capacities, budget levels, or commercial strategies of Westinghouse, its customers or suppliers.

(e) It reveals aspects of past, present, or future Westinghouse or customer funded development plans and programs of potential commercial value to Westinghouse.

(f) It contains patentable ideas, for which patent protection may be desirable.

There are sound policy reasons behind the Westinghouse system which include the following:

(a) The use of such information by Westinghouse gives Westinghouse a competitive advantage over its competitors. It is, therefore, withheld from disclosure to protect the Westinghouse competitive position.

(b) It is information that is marketable in many ways. The extent to which such information is available to competitors diminishes the Westinghouse ability to sell products and services involving the use of the information.

(c) Use by our competitor would put Westinghouse at a competitive disadvantage by reducing his expenditure of resources at our expense.

(d) Each component of proprietary information pertinent to a particular competitive advantage is potentially as valuable as the total competitive advantage. If competitors acquire components of proprietary information, any one component may be the key to the entire puzzle, thereby depriving Westinghouse of a competitive advantage.

(e) Unrestricted disclosure would jeopardize the position of prominence of Westinghouse in the world market, and thereby give a market advantage to the competition of those countries.

(f) The Westinghouse capacity to invest corporate assets in research and development depends upon the success in obtaining and maintaining a competitive advantage.

(iii) The information is being transmitted to the Commission in confidence and, under the provisions of 10 CFR Section 2.390, it is to be received in confidence by the Commission.

(iv) The information sought to be protected is not available in public sources or available information has not been previously employed in the same original manner or method to the best of our knowledge and belief.

(v) The proprietary information sought to be withheld in this submittal is that which is appropriately marked in "NF-BEX-05-188 P-Attachment to Quad Cities Unit 2 Cycle 19 SLMCPR" (Proprietary), for review and approval, being transmitted by Exelon Nuclear letter and Application for Withholding Proprietary Information from Public Disclosure, to the Document Control Desk. The proprietary information as submitted by Westinghouse for Quad Cities Unit 2 Cycle 19 SLMCPR for review and approval.

This information is part of that which will enable Westinghouse to:

(a) Support Exelon's use of Westinghouse Fuel at Quad City and Dresden.

(b) Assist customer to obtain license change.

Further this information has substantial commercial value as follows:

(a) Westinghouse can use this information to further enhance their licensing position with their competitors.

(b) The information requested to be withheld reveals the distinguishing aspects of a methodology which was developed by Westinghouse.

Public disclosure of this proprietary information is likely to cause substantial harm to the competitive position of Westinghouse because it would enhance the ability of competitors to provide similar analyses and licensing defense services for commercial power reactors without commensurate expenses. Also, public disclosure of the information would enable others to use the information to meet NRC requirements for licensing documentation without purchasing the right to use the information.

The development of the technology described in part by the information is the result of applying the results of many years of experience in an intensive Westinghouse effort and the expenditure of a considerable sum of money.

In order for competitors of Westinghouse to duplicate this information, similar technical programs would have to be performed and a significant manpower effort, having the requisite talent and experience, would have to be expended.

Further the deponent sayeth not.

Proprietary Information Notice

Transmitted herewith are proprietary and/or non-proprietary versions of documents furnished to the NRC in connection with requests for generic and/or plant-specific review and approval.

In order to conform to the requirements of 10 CFR 2.390 of the Commission's regulations concerning the protection of proprietary information so submitted to the NRC, the information which is proprietary in the proprietary versions is contained within brackets, and where the proprietary information has been deleted in the non-proprietary versions, only the brackets remain (the information that was contained within the brackets in the proprietary versions having been deleted). The justification for claiming the information so designated as proprietary is indicated in both versions by means of lower case letters (a) through (f) located as a superscript immediately following the brackets enclosing each item of information being identified as proprietary or in the margin opposite such information. These lower case letters refer to the types of information Westinghouse customarily holds in confidence identified in Sections (4)(ii)(a) through (4)(ii)(f) of the affidavit accompanying this transmittal pursuant to 10 CFR 2.390(b)(1).

Copyright Notice

NF-BEX-05-188 NP-Attachment

Quad Cities Unit 2, Cycle 19 SLMCPR

Westinghouse Electric Company
P.O. Box 355
Pittsburgh, Pennsylvania 15230-0355

NF-BEX-05-188 NP-Attachment

1.0 Introduction

This document contains a description of the safety limit minimum critical power ratio (SLMCPR) evaluation for Quad Cities 2 (QC2) Cycle 19, as well as a summary of the Westinghouse establishment of a critical power ratio (CPR) correlation for Global Nuclear Fuel (GNF) GE14 fuel. As discussed below, dual and single recirculation loop SLMCPRs of 1.09 and 1.10, respectively, will be applied to the GE14 fuel in Quad Cities 2 Cycle 19. Dual and single recirculation loop SLMCPRs of 1.11 and 1.13, respectively, have been calculated for the Westinghouse SVEA-96 Optima2 assemblies in Quad Cities 2 Cycle 19.

The GNF NRC-approved methodology (References 1 and 2) was used previously to determine the appropriate SLMCPR values for the currently operating QC2 Cycle 18, which contains GNF GE14 and Framatome-ANP (FANP) ATRIUM-9B fuel assemblies. Consistent with the GNF methodology, the resulting Cycle 18 SLMCPRs apply to all fuel types in the core, such that the same SLMCPRs are applied to both the GE14 and ATRIUM-9B fuel assemblies.

For QC2 Cycle 19, Exelon Generation Company, LLC (EGC) will load Westinghouse SVEA-96 Optima2 fuel. Therefore, the Westinghouse NRC-approved methodology described in Reference 3 and further clarified in the response to request for additional information (RAI) D13 of Reference 4, was used to determine the SLMCPRs for Cycle 19. Unlike the GNF methodology, [

]^{a,c}

On June 15, 2005, EGC submitted a proposed license amendment to request NRC approval to use the Westinghouse methodology for core reload evaluations at QC2. This submittal (Reference 8) is currently under NRC review, and is scheduled to receive NRC approval prior to QC2 startup with a reload core containing SVEA-96 Optima2 fuel (i.e., Cycle 19).

Condition 7 in the NRC safety evaluation for Reference 3 requires that a conservative factor applied to the GE14 operating limit minimum critical power ratio (OLMCPR) be identified in licensee applications. The value of this factor is [ ]^{a,c}

2.0 GE14 SLMCPR for Quad Cities 2 Cycle 19

Consistent with the Westinghouse methodology described in Reference 3, the treatment of the SLMCPR in mixed cores containing non-Westinghouse fuel [

]^{a,c} QC2 Cycle 18 contained 508 GE14 fuel assembles and 216 ATRIUM-9B fuel assemblies. As shown in Figure 2, all of the ATRIUM-9B fuel assemblies were in their third cycle of operation and were loaded on or near

the core periphery in Cycle 18 (within the outer three rows), while the GE14 fuel was loaded in the central part of the core. Therefore, the SLMCPR for Cycle 18 was established by contributions from the GE14 fuel assemblies, [

] [a,c] The Cycle 18 SLMCPR was determined by GNF based on plant- and cycle-specific analyses using GNF's NRC-approved methodology and uncertainties (References 1 and 2) as supplemented with QC2-specific uncertainties. The GNF evaluation used the GEXL14 correlation for GE14 fuel. As shown in Reference 5, the resulting dual-loop and single-loop SLMCPRs for Cycle 18 are 1.09 and 1.10, respectively. [

] [a,c] A comparison between the Cycle 18 and 19 cores is shown in Table 1.

3.0 SVEA-96 Optima2 SLMCPR for Cycle 19

In establishing the SLMCPR for Westinghouse SVEA-96 Optima2 fuel assemblies, it is assumed that [

] [a,c]

[ ] [a,c] a Reference Core design (SVEA-96 Optima2 bundle designs, core loading pattern and state point depletion strategy) that represents realistic current plans for Cycle 19 loading and operation. The Reference Core loading pattern for Cycle 19 is shown in Figure 1. The Reference Core design was generated via collaboration between EGC and Westinghouse based on EGC's cycle assumptions and design goals. The Reference Core was designed to meet the cycle energy requirements, to satisfy all licensing requirements, to provide adequate thermal margins and operational flexibility, and to meet other design and manufacturing criteria established by EGC and Westinghouse.

In general, the calculated SLMCPR is dominated by the flatness of the assembly CPR distribution across the core and the flatness of the relative pin CPR distribution based on the pin-by-pin power/R-factor distribution in each bundle. Greater flatness in either parameter yields more rods susceptible to boiling transition and thus a higher SLMCPR.

The calculation of the SLMCPR as a function of cycle exposure captures the interplay between the relative fuel assembly CPR and bundle relative pin-by-pin CPR distributions established from the power/R-factor distributions and allows a determination of the maximum (limiting) SLMCPR for the entire cycle. This limiting SLMCPR is applied throughout the entire cycle.

The SVEA-96 Optima2 SLMCPR for QC2 Cycle 19 was determined as a function of cycle exposure based on the cycle exposure-dependent radial power distributions from [

] [a,c]

[

] a,c

Accordingly, the SVEA-96 Optima2 SLMCPR for dual recirculation loop operation was calculated at 100% power and 100% flow at 11 cycle exposures throughout the cycle to assure that the limiting SLMCPR was identified. In addition, the dual recirculation loop SLMCPRs were calculated at 100% power at the minimum allowed core flow at rated power (95.3% flow) and the maximum allowed core flow at rated power (108% flow) at the maximum 100% core flow SLMCPR cycle burnup to confirm that a limiting SLMCPR had been established. Figure 3 shows a current Quad Cities 2 power-to-flow map, which is applicable to Cycle 19.

Single recirculation loop SVEA-96 Optima2 SLMCPR calculations were also performed. These SLMCPR calculations were performed at the [

] a,c

The single loop calculations used the same procedure as the dual loop cases, except that the single loop cases applied a larger uncertainty for the core flow.

The SLMCPR results for Cycle 19 are plotted in Figure 4. As shown in Figure 4, the dual recirculation loop SLMCPR [

] a,c the interplay between the assembly relative CPRs and the relative fuel rod CPRs. In general, as the fraction of assembly or fuel rod CPRs in the vicinity of the minimum assembly or fuel rod CPR increases, the number of rods with a potential for experiencing dryout increases. Therefore, a larger SLMCPR is required to assure that fewer than 0.1% of the rods are in dryout.

Experience has shown that the assembly CPR distributions tend to become [

] a,c Therefore, the peak SLMCPR tends to occur when the assembly CPR and rod CPR distributions combine to place the maximum number of fuel rod CPRs close to the minimum CPR.

This behavior is shown for the Quad Cities 2, Cycle 19 SLMCPR by the relative assembly CPR and relative fuel rod histograms shown in Figures 5 through 11 and 12 through 16, respectively. In Figures 5 through 11, assembly types UA19 and UB19 refer to the SVEA-96

Optima2 assembly types loaded in Cycle 19. Assembly type [
]^{a,c}

Inspection of the histograms in the dual recirculation loop histograms in Figures 5 through 11 and the relative fuel rod CPR histograms in Figures 12 through 16 leads to the following observations, which explain the SLMCPR behavior in Figure 4:

1. [

2.

3.

4.

]^{a,c}

Therefore, the dual recirculation loop SLMCPR results at rated conditions in Figure 4 can be understood in terms of [
]^{a,c}

As shown in Figure 3, QC2 can operate at rated power in a flow window from 95.3% core flow to 108% core flow. Therefore, the continued adequacy of a dual recirculation loop SLMCPR of [

]^{a,c}

The single recirculation loop results calculated at [
]^{a,c}

[

]a,c

In addition to the strong dependence on assembly CPR and relative fuel rod CPR distributions, the SLMCPR is strongly dependent on the distribution of assembly and relative fuel pin CPRs about their mean values leading to an overall distribution of fuel rod CPRs relative to their mean values. The wider these distributions, the higher the SLMCPR must be to prevent 0.1% of the fuel rods from experiencing boiling transition. The distributions of fuel rod CPRs relative to their mean values are determined by the uncertainties in determining the mean CPRs. Accordingly, the uncertainties used in establishing the SVEA-96 Optima2 SLMCPR for Cycle 19 are shown in Table 2.

4.0 Westinghouse CPR Correlation for GE14 Fuel

Westinghouse has generated a CPR correlation for use with GE14 fuel in reload design and licensing analyses. This correlation, which is referred to as the USAG14 correlation, will be used to establish the GE14 fuel OLMCPR in accordance with the methodology described in Reference 3. The USAG14 correlation was formed [

]a,c

In accordance with Condition 7 of the NRC safety evaluation for Reference 3, Westinghouse determined an appropriate adjustment factor that is applied when using the USAG14 correlation to determine the GE14 OLMCPR values. This adjustment factor accounts for possible variation between the CPR calculated by the USAG14 correlation and the GEXL14 CPR data provided by EGC. It also ensures that the resulting GE14 OLMCPR values are adequately conservative. [

]a,c The determination of this value was also based on EGC's plans to continue to monitor the CPR performance of GE14 fuel using the GNF GEXL14 correlation within the POWERPLEX-III online core monitoring system rather than the USAG14 correlation. This approach is consistent with Westinghouse's NRC-approved methodology per Reference 3.

[

]^{a,c} In accordance with Condition 7 of the NRC safety evaluation for Reference 3, this value must be submitted as part of the licensee's application for the transition to Westinghouse fuel. Accordingly, this issue was addressed in Reference 8 (Table 3 of Attachment 7), which provided a value for this adjustment factor [

]^{a,c}

5.0 References

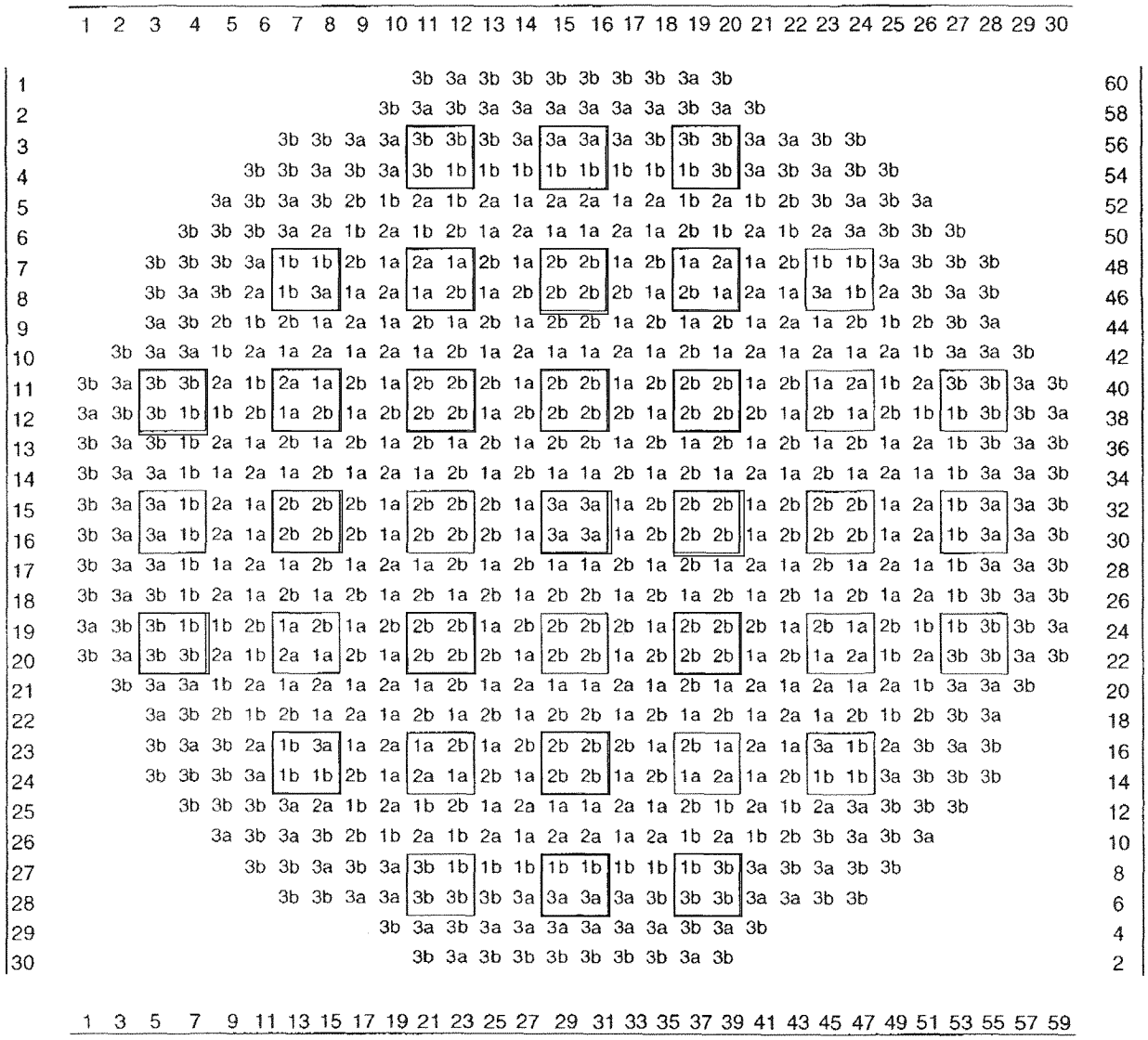
1. Letter, Frank Akstulewicz (NRC) to Glen A. Watford (GE), "Acceptance for Referencing of Licensing Topical Reports NEDC-32601P, *Methodology and Uncertainties for Safety Limit MCPR Evaluations*; NEDC-32694P, *Power Distribution Uncertainties for Safety Limit MCPR Evaluation*; and Amendment 25 to NEDE-24011-P-A on Cycle Specific Safety Limit MCPR," (TAC Nos. M97490, M99069, and M97491), March 11, 1999.
2. *General Electric BWR Thermal Analysis Basis (GETAB): Data, Correlation, and Design Application*, NEDO-10958-A, January 1977.
3. Licensing Topical Report, *Reference Safety Report for Boiling Water Reactor Reload Fuel*, CENPD-300-P-A, July 1996.
4. CENPD-389-P-A, *10x10 SVEA Fuel Critical Power Experiments and CPR Correlations: SVEA-96+*, August 1999.
5. Letter, Lawrence W. Rossbach (NRC) to Christopher M. Crane (Exelon Generation Company, LLC), *Quad Cities Nuclear Power Station, Unit 2 – Issuance of Amendment (TAC No. MC1329)*, dated March 10, 2004.
6. WCAP-16081-P-A, *10x10 SVEA Fuel Critical Power Experiments and CPR Correlation: SVEA-96 Optima2*, March 2005.
7. Letter, Jason S. Post (GE) to NRC, *Part 21 60 Day Interim Report Notification: Critical Power Determination for GE14 and GE12 Fuel With Zircaloy Spacers*, MFN 05-058 Rev 1, June 24, 2005, and GE Energy – Nuclear, 10 CFR Part 21 Communication, *60-Day Interim Report Notification and Transfer of Information, Critical Power Determination for GE14 and GE12 Fuel With Zircaloy Spacers*, SC05-04 Rev 1, June 24, 2005.
8. Letter, Patrick R. Simpson (Exelon Generation Company, LLC) to NRC, *Request for License Amendment Regarding Transition to Westinghouse Fuel*, dated June 15, 2005.

Table 1 Comparison of Cycle 18 and 19 Cores

Description	Quad Cities 2 Cycle 18	Quad Cities 2 Cycle 19
Number of Bundles in Core	724	724
Limiting Cycle Exposure Point	N/A (GNF proprietary)	Near EOC
Cycle Exposure at Limiting Point, EFPH	N/A (GNF proprietary)	12,219 EFPH
Reload Fuel Type	GE14	SVEA-96 Optima2
Reload Batch Average Weight % Enrichment	3.99 w/o	3.91 w/o
Reload Batch Fraction (%)	33.1%	31.5%
Batch Fraction of SVEA-96 Optima2 Fuel	00.0%	31.5%
Batch Fraction of GNF GE14 Fuel	70.2%	68.5%
Batch Fraction of FANP ATRIUM-9B Fuel	29.8%	00.0%
Core Average Weight % Enrichment	3.97 w/o	3.99 w/o
Calculated Safety Limit MCPR (DLO)	1.09 for all fuel types	[ ]a,c
Calculated Safety Limit MCPR (SLO)	1.10 for all fuel types	[ ]a,c

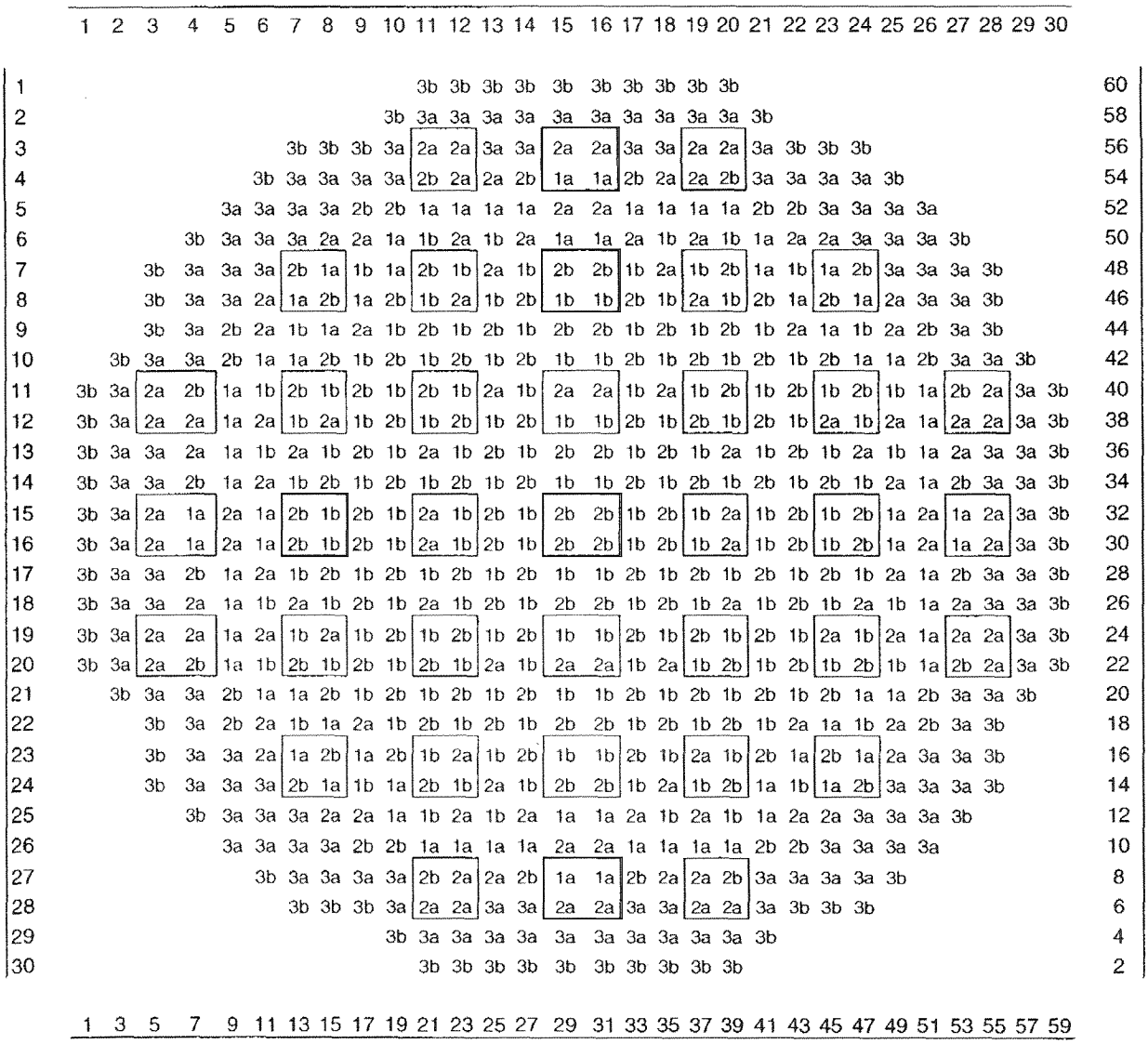
Table 2 - Uncertainties used in Quad Cities 2 Cycle 19 SVEA-96 Optima2 SLMCPR Determination

a, c



Designation	Bundle Type	Bundle Name	Number of Bundles	Cycle Loaded
1a	Optima2	Opt2-3.89-16GZ8.00-2G6.00	152	19
1b	Optima2	Opt2-3.94-13GZ7.00-2G6.00	76	19
2a	GE14	GE14-P10DNAB418-16GZ-2646	80	18
2b	GE14	GE14-P10DNAB389-18GZ-2650	160	18
3a	GE14	GE14-P10DNAB409-15GZ-2507	112	17
3b	GE14	GE14-P10DNAB406-16GZ-2508	144	17

Figure 1 – Quad Cities 2 Cycle 19 – Reference Loading Pattern



Designation	Bundle Type	Bundle Name	Number of Bundles	Cycle Loaded
1a	GE14	GE14-P10DNAB418-16GZ-2646	80	18
1b	GE14	GE14-P10DNAB389-18GZ-2650	160	18
2a	GE14	GE14-P10DNAB409-15GZ-2507	116	17
2b	GE14	GE14-P10DNAB406-16GZ-2508	152	17
3a	ATRIUM-9B	SPCA9-383B-11GZH-ADV	136	16
3b	ATRIUM-9B	SPCA9-381B-12GZL-ADV	80	16

Figure 2 Quad Cities 2 Cycle 18 – Reference Loading Pattern

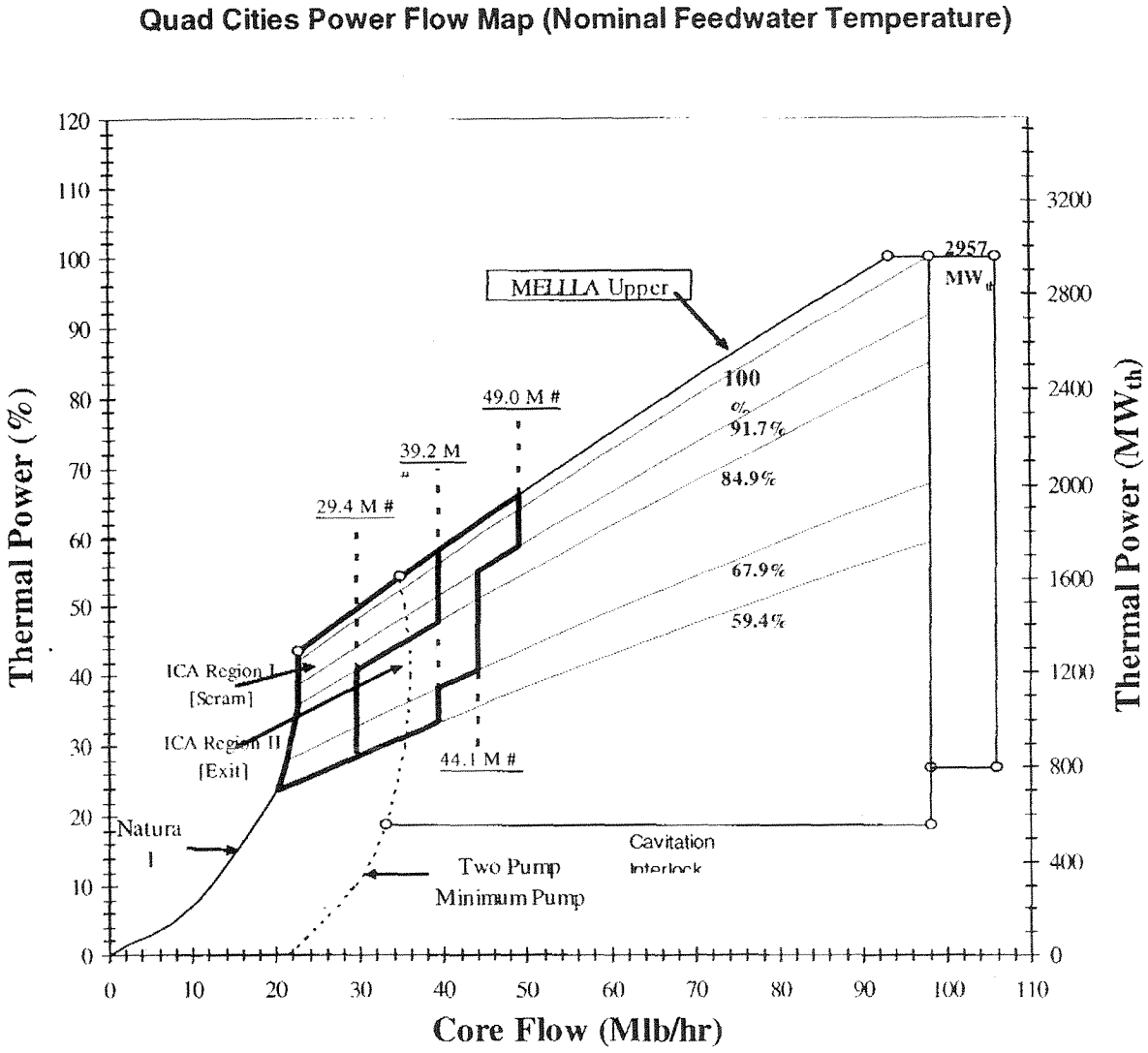


Figure 3 – Quad Cities Power Flow Map (Nominal Feedwater Temperature)

[a,c]

Figure 4 QC2 Cycle 19 SLMCPR Result

Figure 5 – Assembly Histograms

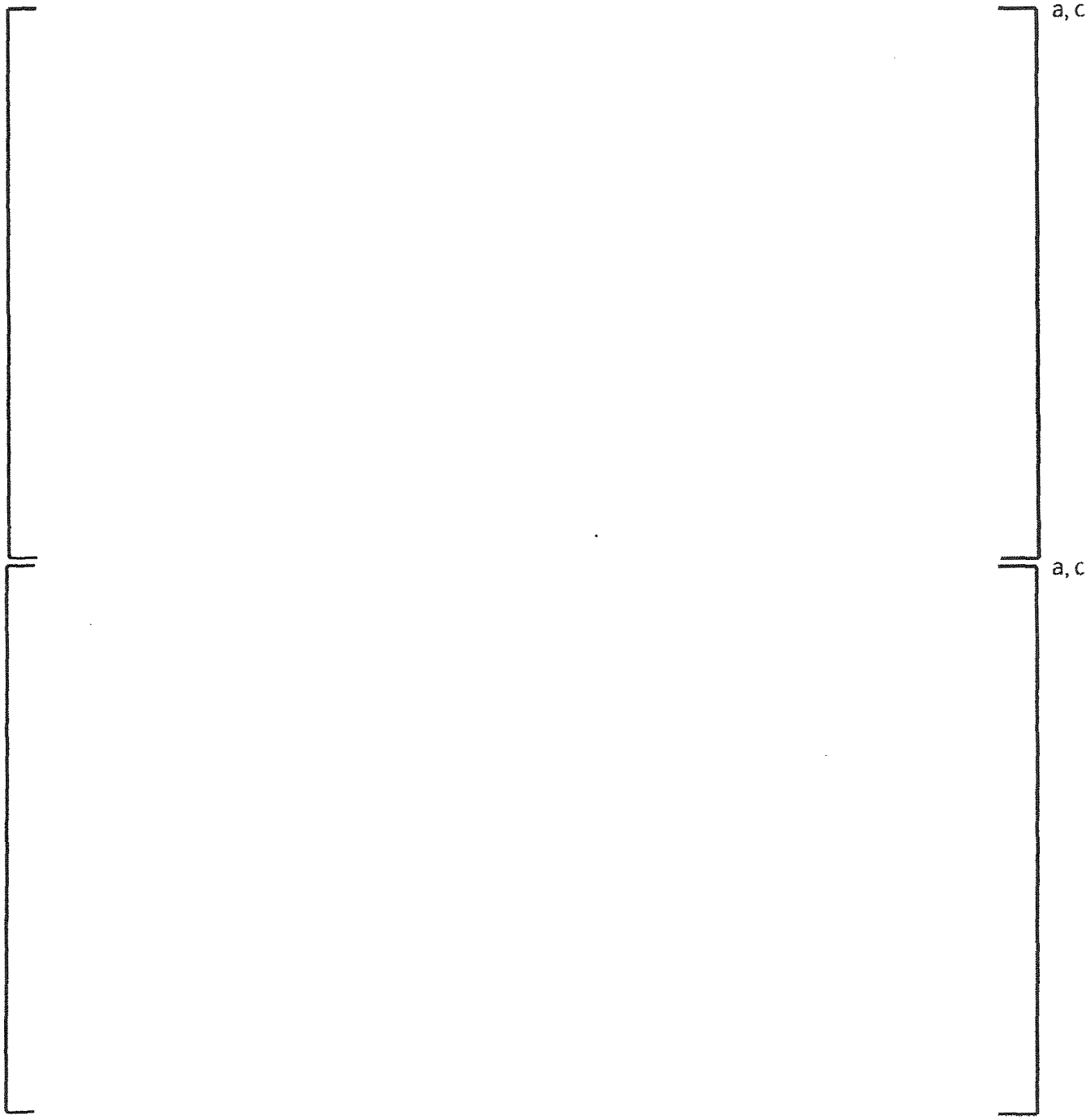


Figure 6 – Assembly Histograms

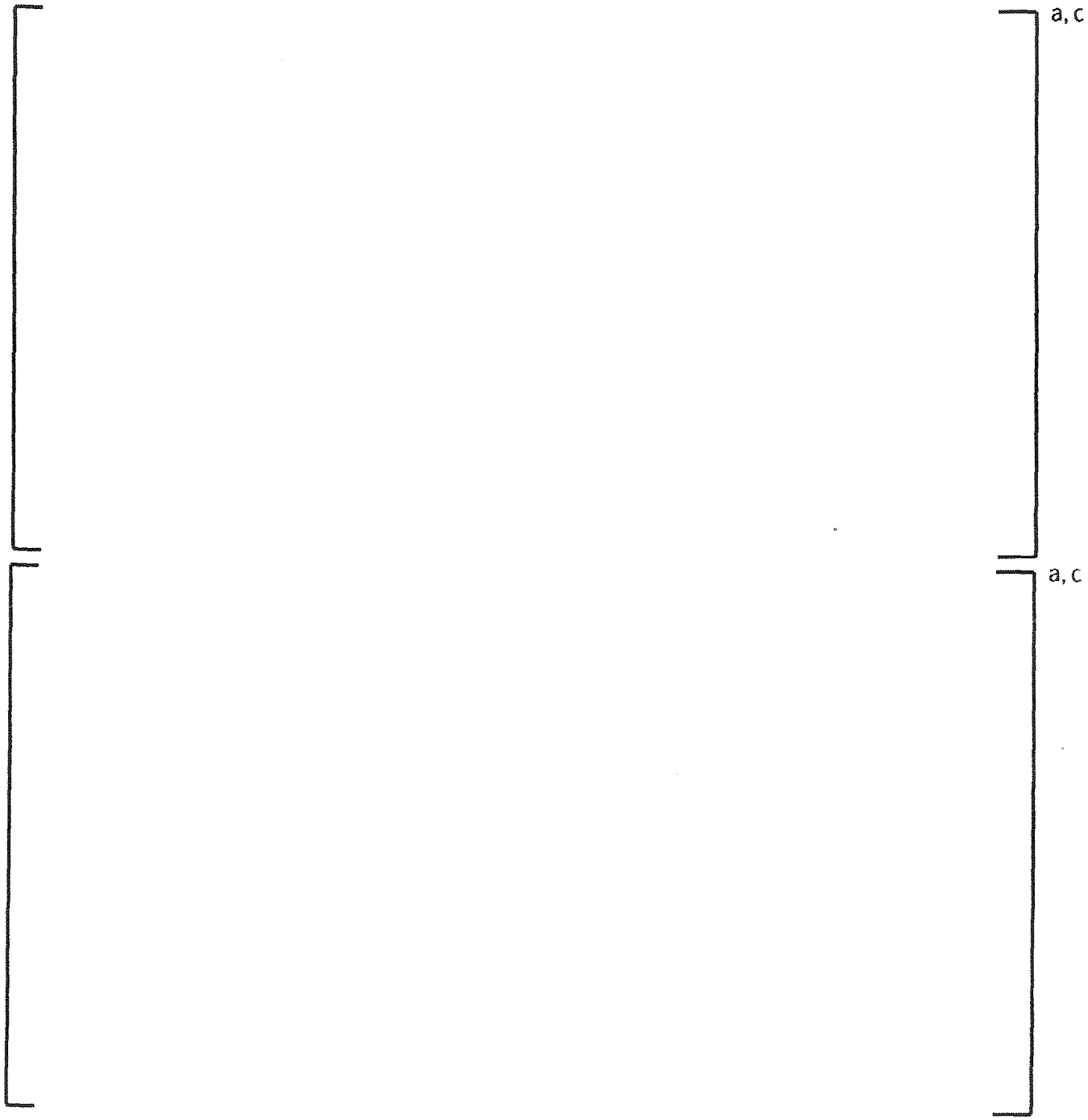


Figure 7 – Assembly Histograms

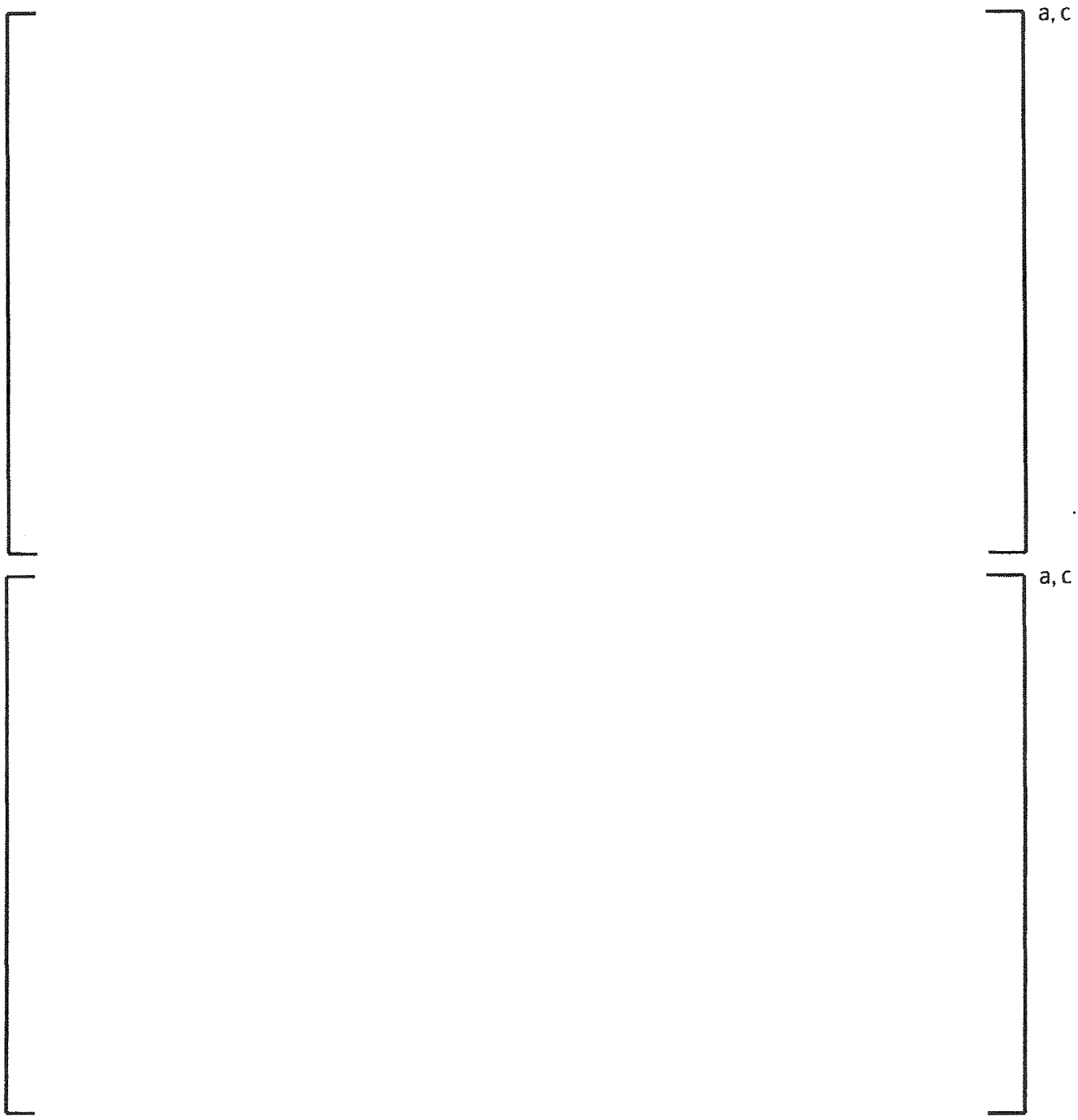


Figure 8 – Assembly Histograms

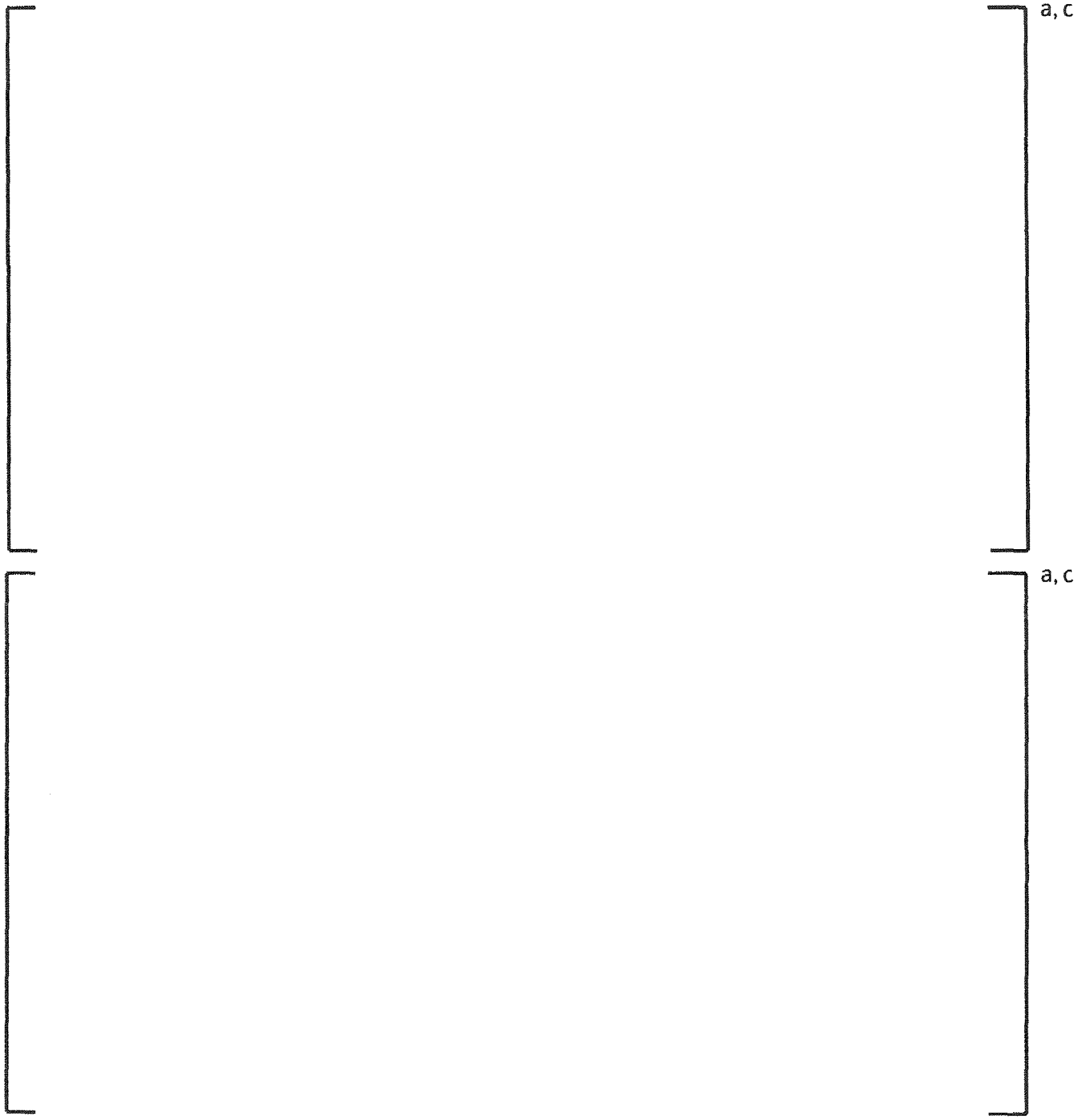


Figure 9 – Assembly Histograms

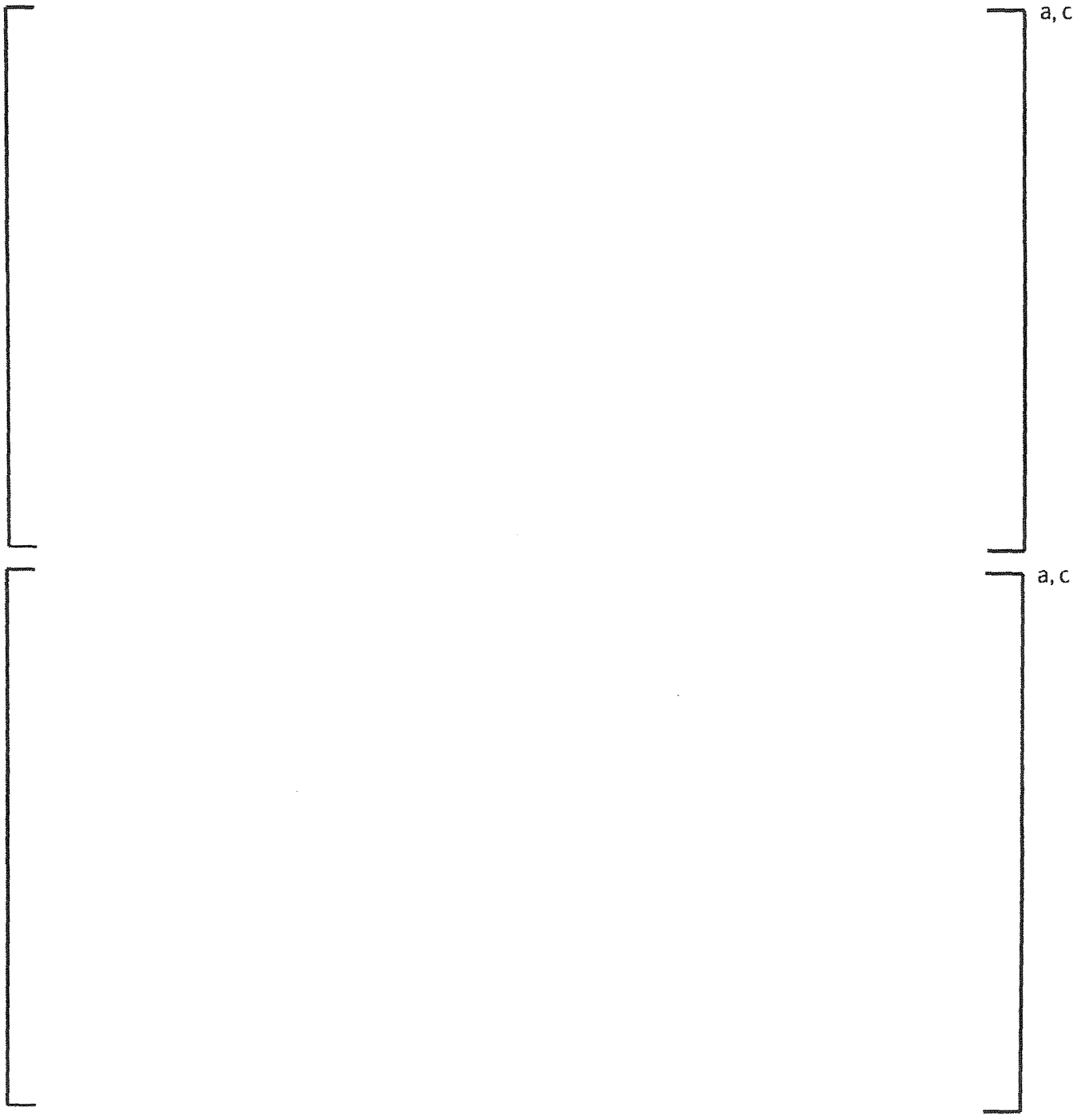


Figure 10 – Assembly Histograms

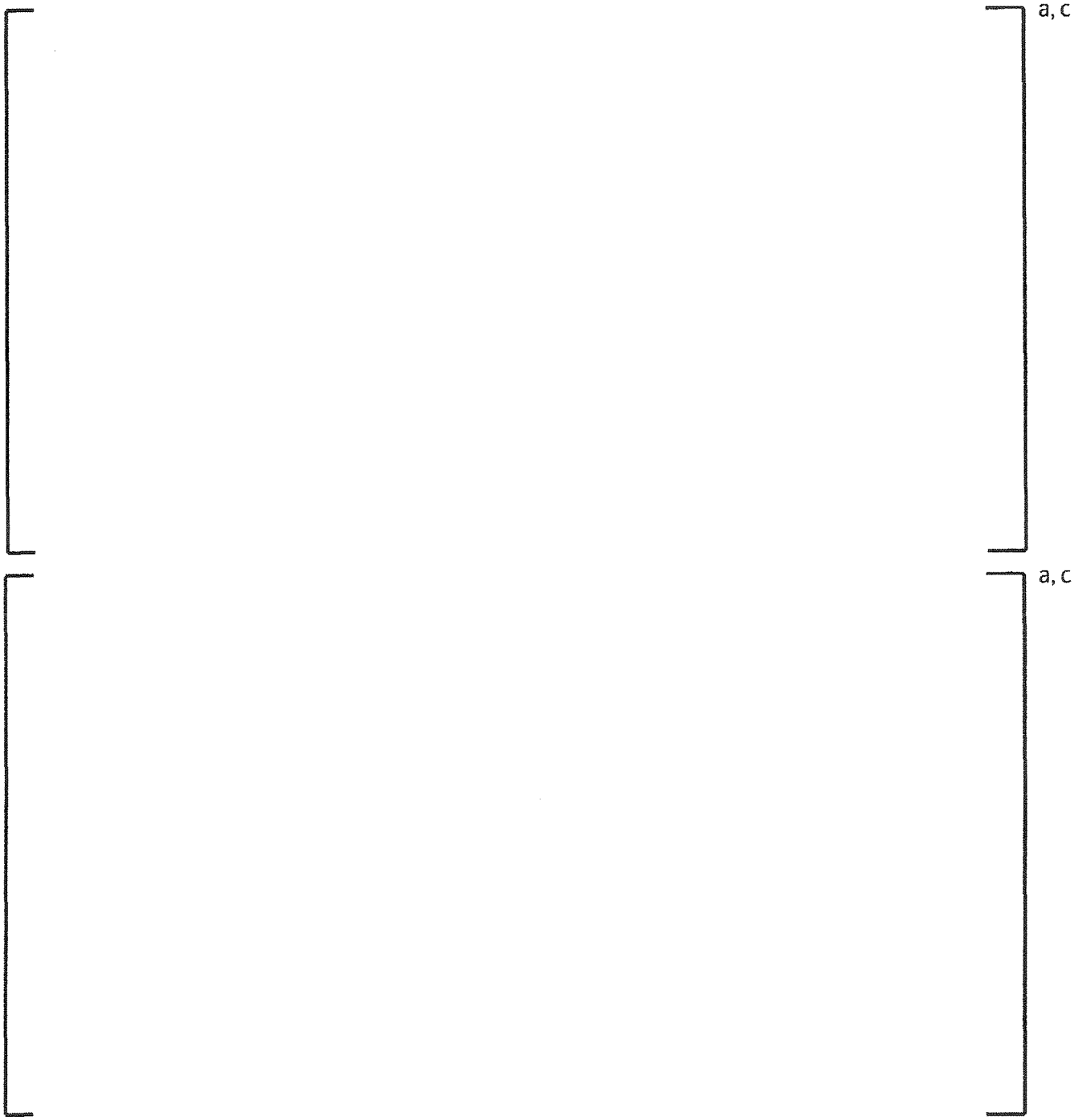


Figure 11 – Assembly Histograms

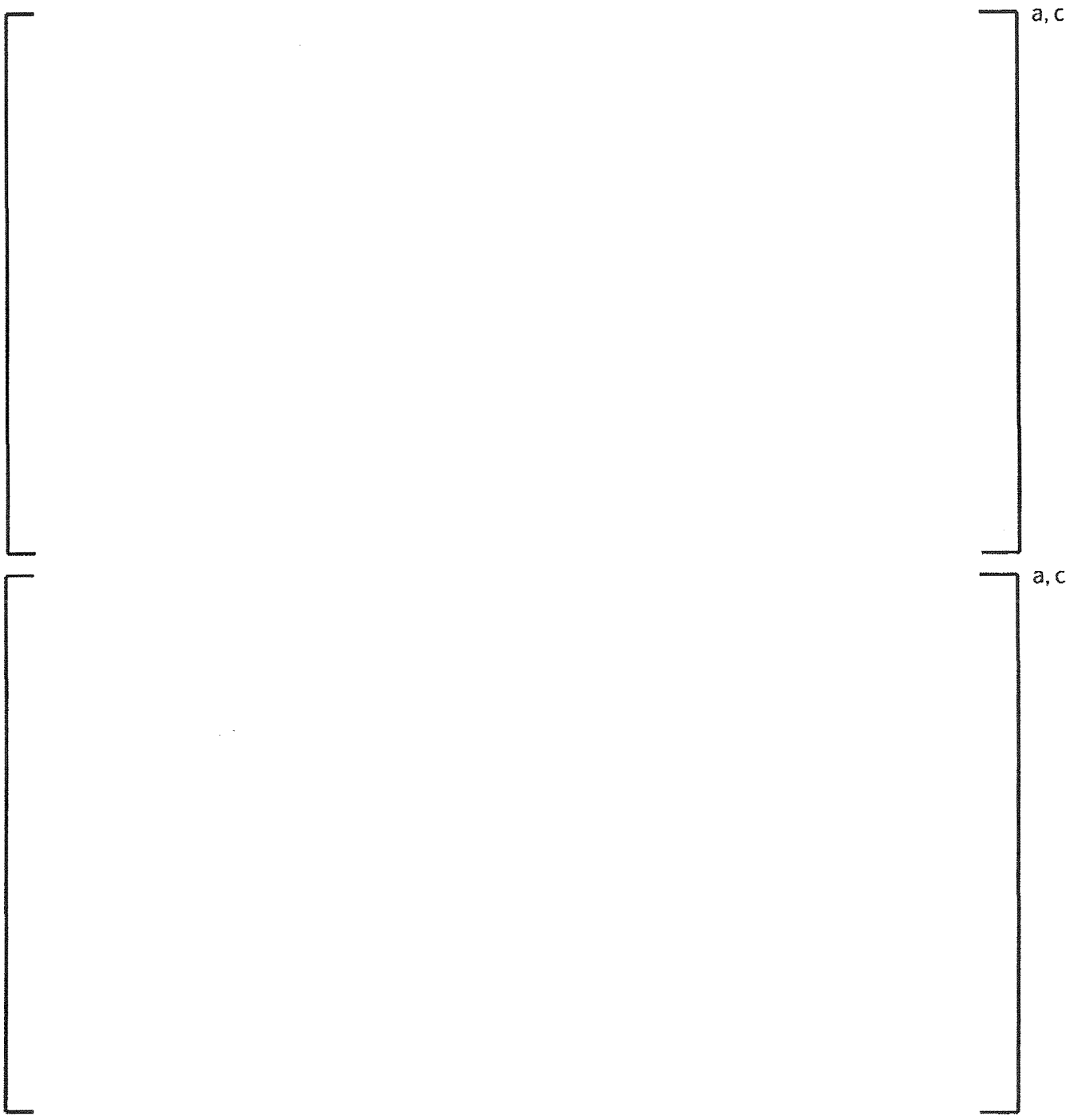


Figure 12 – Fuel Rod Histograms

Figure 13 – Fuel Rod Histograms

Figure 14 – Fuel Rod Histograms

Figure 15 – Fuel Rod Histograms

Figure 16 – Fuel Rod Histograms