South Carolina Electric & Gas Company

NND-13-0521

Enclosure 6

Virgil C. Summer Nuclear Station (VCSNS) Units 2 and 3

APP-OCS-GEH-122, "AP1000 Human Factors Engineering Design Verification Plan," Revision 1

(LAR 13-16)

Westinghouse

Westinghouse Non-Proprietary Class 3

AP1000

Human Factors Engineering Design Verification Plan

APP-OCS-GEH-122,
Rev. 1

August 2013

APPROVALS

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REVISION HISTORY

RECORD OF CHANGES

Revision	Author	Description	Completed
A	Todd W. Van Meter	Preliminary Issue	6/2008
B	Todd W. Van Meter	Class 3 changes. Revision was created to prepare the document with proprietary markings for transmittal.	4/2009
0	Julie I. Reed	Incorporation of APP-GW-GEE-4044, Rev. 0. Numerous updates to the References and Bibliography in accordance with the latest documents and revisions. Minor editorial clarifications throughout the document. Subsection 1.1.2, "Prerequisite," Section 2.1 "General Process," Section 2.3, "Criteria," Section 3.1, "Personnel Requirements and Techniques," and Appendices B and C: Clarified that the HSI design guideline allocations in Appendices B and C are preliminary and need to be checked and updated (if required) by the verifier prior to design verification. Subsection 1.1.3, "Process Strategy:" Added a description of the method to deal with design changes after design verification has been completed. Added reference to APP-GW-G0Y-002, "AP1000 Configuration Management Plan" and WNA-PC-0005-WAPP, "AP1000 I&C Projects Configuration Management Plan". Subsection 1.2.1, "Applicability:" Added reference to APP-OCS-GLR-001, "AP1000 Post-Accident Risk-Important Human Actions Summary Report." Subsection 1.2.2, "List of Human System Interfaces Requiring Verification:" Updated and clarified the list of HSI Resources and Operation and Control Centers. Subsection 1.2.3, "Limitation of Scope:" Stated that the TSC is not included as part of the verification. Added that the design verification for the EOF and the TSC are addressed in Task Support Verification and/or Design Verification at Plant Startup. Subsection 1.4, "List of Exceptions from WCAP-15860." A new section is added to identify deviations from WCAP-15860 "Programmatic Level Description of the AP1000 Human Factors Verification and Validation Plan."	3/2013

REVISION HISTORY (cont.)

RECORD OF CHANGES (cont.)

Revision	Author	Description	Completed
0 (cont.)	Julie I. Reed	Section 2.1, "General Process:" Included a note that HEDs are entered into the SPF Human Factors Tracking System. Section 2.1, "General Process:" Deleted information on the HED resolution process, responsibilities, prioritization, resolution, and the justification of deviations. Section 2.1, "General Process:" Changed the description of design verification completion from approval of the HED Resolution Report (APP-OCS-GER-420) to approval of the Design Verification Report (APP-OCS-GER-120). Deleted sentence "The OCS Product Manager is responsible for the HFE design verification activity and resource assignment." Section 2.2, "Resource Assignment:" Changed 'OCS Product Manager' to 'HF Manager' (in multiple subsections). Changed the definition of 'independent verifier' and included a reference to NSNP 3.3.3 "Design Verification by Independent Review or Alternate Calculations." Section 2.3, "Criteria:" Added a reference to APP-GW-GRP-001, "Local Panels and Maintainability Human Factors Design Guidelines." Section 3.2, "Discrepancy Documentation:" Added a reference to APP-OCS-GER-420, "AP1000 Human Factors Engineering Discrepancy Resolution Process." Updated the description of the HFE discrepancy form and changed Appendix A to reflect the updated Design Verification form in the HF Tracking System. Section 3.3, "Deliverables:" Minor updates regarding the HF Tracking System, HED resolution process, and added a reference to APP-GW-GRP-001, "Local Panels and Maintainability Human Factors Design Guidelines."	3/2013

REVISION HISTORY (cont.)

RECORD OF CHANGES (cont.)

Revision	Author	Description	Completed
1	Julie I. Reed	Incorporation of APP-GW-GEE-4523, Rev. 0. Updated document revision numbers in the Bibliography. Section 1.2.3, "Limitation of Scope" and Section 1.4, "List of Exceptions from WCAP-15860," deleted statement that the design verification of the Technical Support Center will be in the scope of the human factors design verification at plant startup. Section 1.2.3, "Limitation of Scope" and Section 1.4, "List of Exceptions from WCAP-15860," added reference to APP-GW-GJP-150, "Operating Procedures Verification and Validation." Note: An alternative document number is APP-OCS-GEH-120 (proprietary version)	See EDMS

DOCUMENT TRACEABILITY & COMPLIANCE

Created to Support the Following Document(s)	Document Number	Revision
AP1000 Human Factors Engineering Program Plan	APP-OCS-GBH-001	1

OPEN ITEMS

Item	Description	Status
None.		

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LIST OF TABLES

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ACRONYMS AND TRADEMARKS

Acronyms used in the document are defined in APP-GW-J9Y-001 (WNA-PS-00016-GEN), "Standard Acronyms and Definitions" (Reference 1), or included below to ensure unambiguous understanding of their use within this document.

Acronym	Definition
HF	Human Factors
SPF	SmartPlant® Foundation
TDC	Technical Document Control

GLOSSARY OF TERMS

Standard terms used in the document are defined in APP-GW-J9Y-001 (WNA-PS-00016-GEN), "Standard Acronyms and Definitions" (Reference 1), or included below to ensure unambiguous understanding of their use within this document.

Term	Definition
Human Factors Engineering (HFE) Design Verification	An evaluation to confirm that the human system interface (HSI) resources and Operation and Control Centers Systems (OCSs) are designed in conformance with the AP1000® HSI design guidelines.
Independent Verifier	Any competent individual(s) or group(s) other than those who performed the original design work, but who may be from the same organization or group.

REFERENCES

Following is a list of references used throughout this document.

1. APP-GW-J9Y-001, Rev. 0 (WNA-PS-00016-GEN, Rev. 5), "Standard Acronyms and Definitions," Westinghouse Electric Company LLC. (Proprietary)

2. APP-OCS-GBH-001, Rev. 1, "AP1000 Human Factors Engineering Program Plan," Westinghouse Electric Company LLC. (Proprietary)

3. APP-OCS-GEH-020, Rev. 2 (WCAP-15860), "Programmatic Level Description of the AP1000 Human Factors Verification and Validation Plan," Westinghouse Electric Company LLC.

4. NUREG-0711, Rev. 2, "Human Factors Engineering Program Review Model," U.S. Nuclear Regulatory Commission.

5. ISO 11064-7, First Edition, "Ergonomic Design of Control Centers, Part 7: Principles for the Evaluation of Control Centers," International Organization for Standardization.

6. APP-GW-G0Y-002, Rev. 3, "AP1000 Configuration Management Plan," Westinghouse Electric Company LLC. (Proprietary)

7. WNA-PC-00005-WAPP, Rev. 2, "AP1000 I&C Projects Configuration Management Plan," Westinghouse Electric Company LLC. (Proprietary)

8. WEC 3.3.3, Rev. 0.0, "Design Verification," Westinghouse Electric Company LLC, effective March 26, 2013.

BIBLIOGRAPHY

Following is a list of sources that were considered in preparing this document.

1. APP-OCS-J1-002, Rev. 2, "AP1000 Human System Interface Design Guidelines," Westinghouse Electric Company LLC. (Proprietary)

2. APP-OCS-GEH-220, Rev. 1, "AP1000 Human Factors Engineering Task Support Verification Plan," Westinghouse Electric Company LLC. (Proprietary)

3. APP-OCS-GEH-320, Rev. 3, "AP1000 Human Factors Engineering Integrated System Validation Plan," Westinghouse Electric Company LLC. (Proprietary)

4. APP-OCS-GEH-420, Rev. 1, "AP1000 Human Engineering Discrepancy Resolution Process," Westinghouse Electric Company LLC. (Proprietary)

5. APP-OCS-GEH-520, Rev. 2, "Plant Startup Human Factors Engineering Verification Plan," Westinghouse Electric Company LLC. (Proprietary).

6. APP-GW-GL-011, Rev. 0, "AP1000 Identification of Critical Human Actions and Risk Important Tasks," Westinghouse Electric Company LLC.

7. APP-OCS-GLR-001, Rev. 0, "AP1000 Post-Accident Risk-Important Human Actions Summary Report," Westinghouse Electric Company LLC. (Proprietary)

8. APP-GW-GJP-100, Rev. 0, "Writer's Guideline for Operating Procedures," Westinghouse Electric Company LLC. (Proprietary)

9. APP-GW-GJP-150, Rev. 0, "Operating Procedures Verification and Validation," Westinghouse Electric Company LLC. (Proprietary)

10. APP-GW-GRP-001, Rev. 1, "AP1000 Local Panels and Maintainability Human Factors Design Guidelines," Westinghouse Electric Company LLC. (Proprietary)

11. APP-GW-GL-700, Rev. 19, "AP1000 Design Control Document," Westinghouse Electric Company LLC.

12. APP-OCS-J7-001, Rev. 0, "AP1000 Operations and Control Centers System - System Specification Document," Westinghouse Electric Company LLC. (Proprietary)

13. NUREG-0700, Rev. 2, "Human-System Interface Design Review Guidelines," U.S. Nuclear Regulatory Commission.

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SECTION 1
INTRODUCTION

1.1 OVERVIEW

1.1.1 Purpose

The purpose of this document is to define the Human Factors (HF) Engineering (HFE) design verification plan for the AP1000® plant.

This document is based on the information and guidance described in APP-OCS-GBH-001, "AP1000 Human Factors Engineering Program Plan" (Reference 2); APP-OCS-GEH-020 (WCAP-15860), "Programmatic Level Description of the AP1000 Human Factors Verification and Validation Plan" (Reference 3); NUREG-0711, "Human Factors Engineering Program Review Model" (Reference 4); and ISO 11064-7, "Ergonomic Design of Control Centers, Part 7: Principles for the Evaluation of Control Centers" (Reference 5).

1.1.2 Prerequisite

This document uses the guidelines contained in APP-OCS-J1-002, "AP1000 Human System Interface Design Guidelines" (Bibliog 1) as the primary source of input for establishing the HFE design verification criteria. [

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1.1.3 Process Strategy

Formal HF verification and validation (V&V) activities are an integral part of the overall HFE design process. These activities and associated documents include the following, as defined in the HFE Program Plan (Reference 2):

- APP-OCS-GER-120, "AP1000 Human Factors Engineering Design Verification Report" [LATER]
- APP-OCS-GEH-220, "AP1000 Human Factors Engineering Task Support Verification Plan" (Bibliog 2)
- APP-OCS-GER-220, "AP1000 Human Factors Engineering Task Support Verification Report" [LATER]

- APP-OCS-GEH-320, "AP1000 Human Factors Engineering Integrated System Validation Plan" (Bibliog 3)
- APP-OCS-GER-320, "AP1000 Human Factors Engineering Integrated System Validation Report" [LATER]
- APP-OCS-GEH-420, "AP1000 Human Engineering Discrepancy Resolution Process" (Bibliog 4)
- APP-OCS-GER-420, "AP1000 Human Engineering Discrepancy Resolution Report" [LATER]
- APP-OCS-GEH-520, "Plant Startup Human Factors Engineering Design Verification Plan" (Bibliog 5)
- APP-OCS-GER-520, "Plant Startup Human Factors Engineering Design Verification Report" [LATER]

These V&V activities are a final check of the adequacy of the HSI Resources and Operation and Control Centers System (OCS) design. [

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1.2 SCOPE

1.2.1 Applicability

This document is applicable to the AP1000 HSI resources and Operation and Control Centers Systems (OCS) as identified in subsection 1.2.2.

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1.2.2 List of Human System Interfaces Requiring Verification

Below is a list of specific HSI resources and OCS that require design verification. Additional interfaces may be added to this list as they are identified by HFE personnel.

1. HSI Resources

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2. Operation and Control Centers System

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1.2.3 Limitation of Scope

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1.3 OBJECTIVE

The overall objective of V&V is to ensure that the AP1000 design attains a high standard of HF adequacy and thereby contributes to the safety, operability and maintainability of the plant.

The objective of HFE design verification is to confirm that HSI resources and OCS conform to the project's HFE design guidelines, identify deviations, resolve deviations, and formally document the results. The HSI design guidelines are established to ensure that the HSI design can accommodate human capabilities and limitations and to provide a consistent HSI design approach across the project. The AP1000 HSI design guidelines are contained in APP-OCS-J1-002 (Bibliog 1), and are discussed in Section 2.3, "Criteria."

1.4 LIST OF EXCEPTIONS FROM WCAP-15860

The HFE design verification complies with WCAP-15860, "Programmatic Level Description of the AP1000 Human Factors Verification and Validation Plan" (Reference 3). However, WCAP-15860 was issued relatively early in the design stage of AP1000, and therefore, based on the current AP1000 design, three adjustments are required. These are described below:

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(Last Page of Section 1)

SECTION 2
VERIFICATION PROCESS

2.1 GENERAL PROCESS

This HFE design verification plan is established to confirm that the HSI resources and OCS are designed to accommodate human capabilities and limitations. To meet this objective, the HSI resources and OCS are evaluated against the design guidelines specified in APP-OCS-J1-002 "AP1000 Human System Interface Design Guidelines (Bibliog 1) by an independent verifier. Appendix B, "HSI Resource Design Verification Guidelines," and Appendix C, "Operation and Control Center Design Verification Guidelines," provides an initial basis to correlate the specific guidelines (mandatory and recommended) to the HSI resource or OCS.

Each HSI resource and OCS is evaluated as "Pass" or "Fail" using the criteria as described in Section 2.3. Each HSI resource or OCS that is evaluated as a "Fail" is submitted as a Design Verification Discrepancy in the SmartPlant® Foundation (SPF) HF Tracking System (see Section 3.2 for further details).

The HFE design verification activity is considered complete when HEDs are entered into the tracking database and the formal APP-OCS-GER-120 "AP1000 HFE Design Verification Report" is approved.

2.2 RESOURCE ASSIGNMENT

The HF Manager is responsible for identifying the HFE evaluation team. The HFE evaluation team consists of independent verifiers and the design engineering team. See WEC 3.3.3, "Design Verification" (Reference 8), for additional guidance on personnel independence and qualifications. The HFE evaluation team uses the approved acceptance criteria (Bibliog 1) for performing the HFE design verification.

2.3 CRITERIA

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2.4 DESIGN CHANGE VERIFICATION

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SECTION 3
METHODOLOGY AND MEASURES

3.1 PERSONNEL REQUIREMENTS AND TECHNIQUES

To provide an independent and unbiased review, the HFE design verification process is performed by independent verifiers with input from other design team members. As necessary, the design engineers will provide all configuration and control documentation (e.g., drawing, specifications) related to the HSI resource and OCS under evaluation to the independent verifier.

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3.2 DISCREPANCY DOCUMENTATION

Discrepancies are identified as HEDs and are required to be addressed by the formal resolution process, as described in APP-OCS-GEH-420 (Bibliog 4). [

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The HFE discrepancy form includes the following type of information:
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3.3 DELIVERABLES

The deliverables are defined in Section 5.9, "Verification and Validation," of APP-OCS-GBH-001, "AP1000 Human Factors Engineering Program Plan" (Reference 2).

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APPENDIX A
HFE DESIGN VERIFICATION DISCREPANCY FORM

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Figure A-1. Human Factors Discrepancy Form in SPF HF Tracking System

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APPENDIX B
PRELIMINARY ALLOCATION OF HFE DESIGN GUIDELINES TO HSI RESOURCES

Note

The design of the HSI resources may change or the HSI Design Guidelines may be updated prior to the implementation of Design Verification. Therefore, the information in this Appendix is provided as guidance or an example of the allocation of the HSI Design Guidelines (Bibliog 1) to the HSI resources. The verifier is responsible for the actual allocation of guidelines to the HSI resources; this will be documented in the results report, APP-OCS-GER-120.

Table B-1. HSI Resources and HFE Design Guidelines

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APPENDIX C
PRELIMINARY ALLOCATION OF HFE DESIGN GUIDELINES TO OPERATION AND CONTROL CENTERS

Note

The design of the operation and control centers may change or the HSI Design Guidelines may be updated prior to the implementation of the Design Verification. Therefore, the information in this Appendix is provided as guidance or an example of the allocation of the HSI Design Guidelines (Bibliog 1) to the operations and control centers. The verifier is responsible for the actual allocation of guidelines to the operation and control centers in accordance with the scope of design verification as specified in Section 1.2 "Scope". This will be documented in the results report, APP-OCS-GER-120.

Table C-1. Operation and Control Center and HFE Design Guidelines

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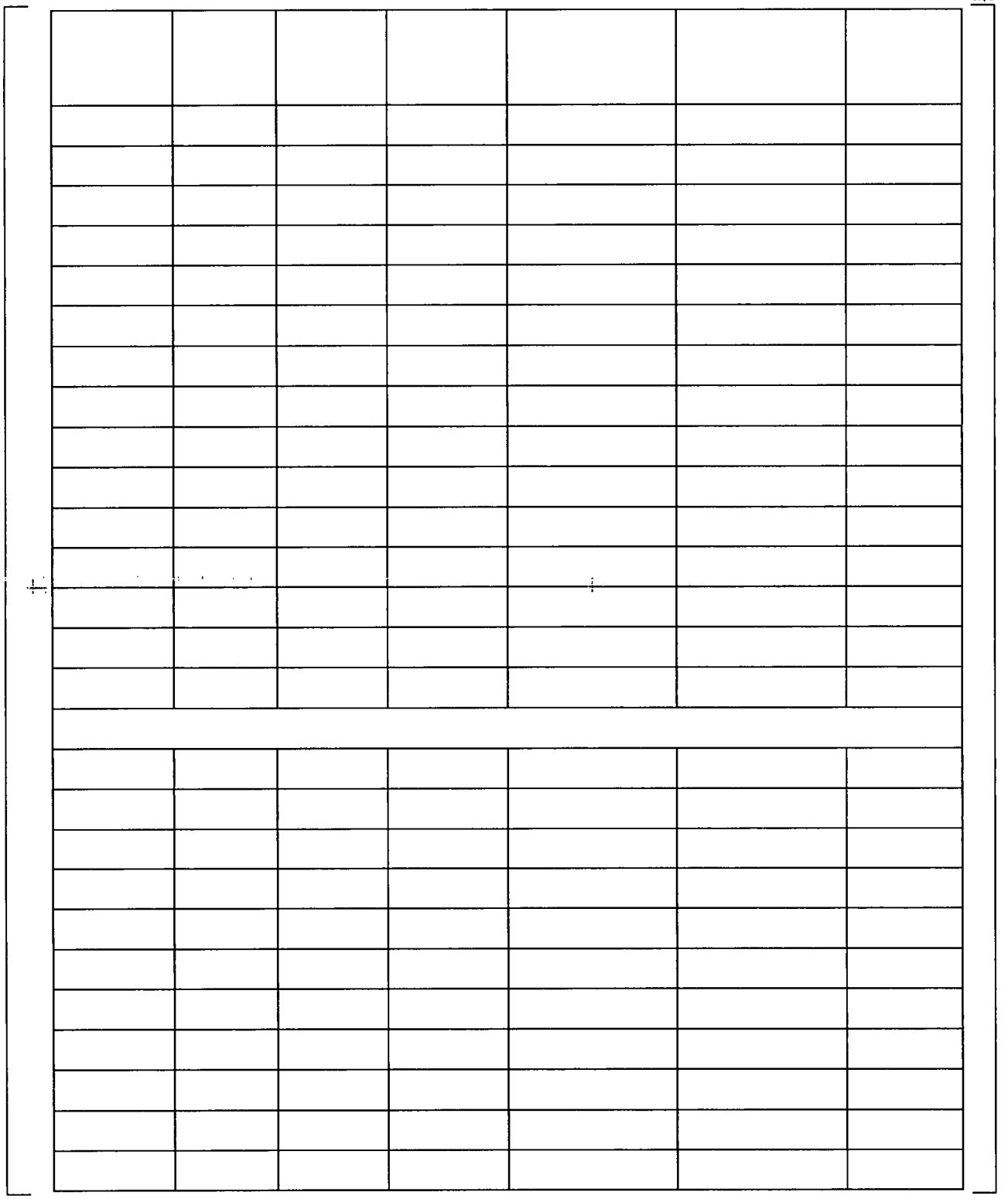

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