TVA

Tennessee Valley Authority, Post Office Box 2000, Spring City, Tennessee 37381-2000

January 19, 2012

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

Watts Bar Nuclear Plant, Unit 2
NRC Docket No. 50-391

10 CFR 50.4

Subject: WATTS BAR NUCLEAR PLANT (WBN) UNIT 2 – INSTRUMENTATION AND CONTROLS STAFF INFORMATION REQUESTS

Reference: 1. Supplemental Safety Evaluation Report (SSER) 22, 23, 24 and 25 Appendix HH Watts Bar Unit 2 Action Items Table

The purpose of this letter is to provide TVA's responses to NRC's information requests regarding:

- SSER Appendix HH "Watts Bar Unit 2 Action Items Table," Item TVA21
- NRC to TVA letter dated November 18, 2011, "Watts Bar Nuclear Plant, Unit 2 - Request for Additional Information Regarding Supplemental Safety Evaluation Report Open Items 80, 81, 94, 105, and 108 (TAC NO. ME0853)" (ML113130218)
- Various TVA commitments

Enclosure 1 to this letter provides TVA's responses to the information requested by NRC. Enclosure 2 contains the supporting documents for TVA's responses provided in Enclosure 1. Enclosure 3 contains the list of references associated with TVA's commitments and responses. There are no new regulatory commitments contained in this letter.

Attachments 4, 6, 8 and 15 contain information proprietary to General Atomics Electronic Systems, Inc. (GA-ESI). Attachment 10 contains the necessary information supporting the request for withholding such information. TVA requests that the GA-ESI proprietary information be withheld from public disclosure in accordance with 10 CFR § 2.390(a)(4).

D030
NRR

Attachment 1 contains information proprietary to Westinghouse Electric Company LLC (WEC). Attachment 3 contains the necessary information supporting the request for withholding such information. TVA requests that the WEC proprietary information be withheld from public disclosure in accordance with 10 CFR § 2.390(a)(4).

If you have any questions, please contact Gordon Arent at (423) 365-2004.

I declare under penalty of perjury that the foregoing is true and correct. Executed on the 19th day of January 2012.

Respectfully,

Edwin E. Freeman
Watts Bar Unit 2 Completions Manager

Enclosures:

1. TVA Responses to Instrumentation and Controls Staff Information Requests
2. List of Attachments
3. List of References

cc (Enclosures):

U. S. Nuclear Regulatory Commission
Region II
Marquis One Tower
245 Peachtree Center Ave., NE Suite 1200
Atlanta, Georgia 30303-1257

NRC Resident Inspector Unit 2
Watts Bar Nuclear Plant
1260 Nuclear Plant Road
Spring City, Tennessee 37381

Enclosure 1
TVA Letter Dated January 19, 2012
TVA Responses to Instrumentation and Controls Staff Information Requests

Acronyms and Abbreviations

The following acronyms/abbreviations are used in this letter:

Common Q	Common Qualified Platform
EDMS	Enterprise Document Management System
EL.	Elevation
GA	General Atomics
GA-ESI	General Atomics-Electronic Systems, Inc.
HVAC	Heating Ventilating and Air Conditioning
IITA	In-Core Instrument Thimble Assembly
MI	Mineral Insulated
NRC	Nuclear Regulatory Commission
PAMS	Post Accident Monitoring System
RAI	Request for Additional Information
RG	Regulatory Guide
RRS	Required Response Spectra
SDOE	Secure Development and Operating Environment
SPS	Signal Processing System
SSER	Supplemental Safety Evaluation Report
TRS	Test Response Spectra
TVA	Tennessee Valley Authority
WBN	Watts Bar Nuclear Plant
WEC	Westinghouse Electric Company LLC
[1]WINCISE™	Westinghouse In-Core Information Surveillance & Engineering

Notes

1. In some instances, the abbreviation GA is used to refer to General Atomics. In some instances, the abbreviation GA-ESI is used to refer to General Atomics-Electronic Systems Inc. GA and GA-ESI are the same company and the abbreviations can be used interchangeably.

2. For some NRC requests for additional information (RAIs), this letter provides TVA's initial response. For the other NRC RAIs in this letter, a response has been provided in previous TVA letters to the NRC, and the NRC has subsequently requested additional information. For these latter requests, the initial TVA response is not repeated below. The additional NRC information requests are identified in this letter as "**Follow-up NRC Requests.**" TVA responses to these items are identified as "**TVA Response to Follow-up NRC Request.**"

[1] WINCISE is a registered trademark of the Westinghouse Electric Company LLC

Responses

1. **NRC Request (SSER 23 Appendix HH Item Number 108)**

TVA should demonstrate to the NRC staff that there are no synergistic effects between temperature and humidity for the Common Q PAMS equipment. (SSER 23, Section 7.5.2.2.3.5.2, pg 7-75).

Follow-up NRC Request

Upon review of the response to Action Item Number 94, it was noticed that TVA's response to these two action items provided different environmental conditions in each response (see Action Item Number 94 Clauses 4.5.3 and 4.7). It is no longer clear, in what environment the Common Q PAMS is required to operate or how qualification to this environment is demonstrated.

a. *Please provide EPM-MCP-071689, "Cooling/Heating Load & Equipment/Component Performance Analysis for the Control Building Electrical Board Room Areas (EL. 692.0 and 708.0)," Revision 19.*

b. *Please provide EPM-LCP-072489, "Cooling and Heating Load Analysis, Main Control Room HVAC [Heating, Ventilating, and Air Conditioning]," Revision 13.*

c. *Please provide the maximum temperature and the associated maximum relative humidity in which the Common Q PAMS is required to be operable.*

d. *Please provide the minimum temperature and the associated minimum relative humidity in which the Common Q PAMS is required to be operable.*

e. *Please explain why the relative humidity during a loss of coolant accident event is lower than the humidity during summer or winter.*

f. *Please describe how it is demonstrated that the Common Q PAMS equipment is qualified to the environments in which that equipment is required to operate. Please pay particular attention to the potential synergistic effects of temperature and humidity.*

TVA Partial Response to Follow-up NRC Request

Responses to "Draft Request for Additional Information Regarding Open Item 108," items a through e were provided in TVA to NRC letter dated December 22, 2011 (Reference 1). Item f is addressed as follows:

f. It is not possible to state whether or not there are any synergistic effects between temperature and humidity on the Common Q PAMS equipment. The NRC-approved qualification methods in WCAP-16097-P-A, "Common Qualified Platform Topical Report," Revision 0, do not perform or require such testing. What can be shown is that the WBN Unit 2 operating conditions are bounded by the Common Q PAMS hardware qualification testing.

Attachment 1 describes how the Common Q PAMS equipment is qualified for the environments in which it is required to operate.

Attachment 1 contains WEC proprietary document WBT-D-3711 P-Enclosure, "Westinghouse's Revised Response to Follow up NRC Request (SSER 24 Appendix HH Item Number 108)," dated January 2012. Attachment 2 contains WEC non-proprietary document WBT-D-3711 NP-Enclosure, "Westinghouse's Revised Response to Follow up NRC Request (SSER 24 Appendix HH Item Number 108)," dated January 2012. Attachment 3 contains WEC non-proprietary document CWA-12-3349, "Application for Withholding Information From Public Disclosure WBT-D-3711 P-Enclosure, 'Westinghouse's Revised Response to Follow up NRC Request (SSER 24 Appendix HH Item Number 108),' (Proprietary)," dated January 5, 2011.

2. <u>NRC Request (SSER Appendix HH Item Number TVA21)</u>

Provide proprietary, non-proprietary versions and affidavits for withholding for the following documents:

(a) General Atomics Electronic Systems 04038903-1SP, Qualification Basis for 04031101-001 (2-RE-90-130 &131).

(b) General Atomics Electronic Systems 04038903-2SP, Qualification Basis for 04031301-001 (2-RE-90-106).

(c) General Atomics Electronic Systems 04038903-4SP, Qualification Basis for 04031501-001 (2-RE-90-112).

<u>TVA Response to NRC Request</u>

(a) Attachment 4 contains demarcated proprietary GA-ESI document 04038903-1SP, "Qualification Basis for 04031101-001 (2-RE-90-130 &131)," Revision D. Attachment 5 contains redacted non-proprietary GA-ESI document 04038903-1SP, "Qualification Basis for 04031101-001 (2-RE-90-130 &131)," Revision D.

(b) Attachment 6 contains demarcated proprietary GA-ESI document 04038903-2SP, "Qualification Basis for 04031301-001 (2-RE-90-106)," Revision B. Attachment 7 contains redacted non-proprietary GA-ESI document 04038903-2SP, "Qualification Basis for 04031301-001 (2-RE-90-106)," Revision B.

(c) Attachment 8 contains demarcated proprietary GA-ESI document 04038903-4SP, "Qualification Basis for 04031501-001 (2-RE-90-112)," Revision B. Attachment 9 contains redacted non-proprietary GA-ESI document 04038903-4SP, "Qualification Basis for 04031501-001 (2-RE-90-112)," Revision B.

(d) Attachment 10 contains GA-ESI letter GA-ESI 4505, "Request by General Atomics Electronic Systems, Inc. to Withhold Certain Information from Public Disclosure under 10CFR2.390," dated January 4, 2012.

Review of the GA-ESI qualification reports found that the seismic Test Response Spectra (TRS) did not bound the WBN Required Response Spectra (RRS). Engineering performed an analysis of the differences and determined that the GA-ESI qualification testing was acceptable. The analysis is documented in TVA calculation WCGACQ0766. Attachment 11 contains TVA calculation WCGACQ0766, "Required Response Spectra for Evaluation of Radiation Monitoring Equipment," Revision 1.

3. <u>TVA Commitment</u>

TVA and Westinghouse committed to make available WINCISE documents for testing of the IITA assemblies at the Westinghouse Rockville office that were not releasable to the NRC.

<u>Commitment Closure</u>

The following documents are available for NRC audit at the WEC Rockville office.

Document Title	Document #	Revision
Incore Instrument Thimble Assembly (IITA) Insulation Resistance	LTR-NO-11-109	October 11, 2011
Quality Release & Certificate of Conformance	QR-121284-01	01
Westinghouse Certificate of Qualification Report	CQ-121284-01	01
Packing List	N/A	N/A
Quality Release & Certificate of Conformance	QR-QR-10-192	00
Quality Release & Certificate of Conformance	QR-10-351	00
Quality Release & Certificate of Conformance	QR-4500298582-001	00
Class 1E Qualification of the Incore Instrument (Core Exit Thermocouple Portion) and Mineral Insulated Cable Assembly	CE-NPSD-240-P	0
Design And Fabrication Specification For Electrical Connectors Supplied By Whittaker With And Without Integral Reference Junctions (Proprietary)	00000-FEA-6101	5
Engineering Specification for In-core Instrumentation Thimble Assembly (IITA) (Proprietary)	418A28	2
WBT-TVA-1060, Response to WINCISE SPS Cabinet Power Requirements, dated March 15, 2010 (Letter)	WBT-TVA-1060	NA
WINCISE Watts Bar IITA Dielectric Report (Mirion Proprietary)	021-8559	00
Watts Bar 2 Incore Instrumentation System Dielectric Characteristics of Completed MI Cable Assemblies	LTR-ME-10-3	0
Equipment Qualification Summary Report for WINCISE Signal Processing System (Proprietary)	EQ-QR-39-WBT-P	1

4. **TVA Commitment**

As commited to in TVA to NRC letter dated December 22, 2011 (Reference 1), a non-proprietary version of the GA-ESI letter 010-01038-001, Attachment: "04502050-001 Receipt Inspection" and affidavit for withholding will be submitted within two weeks of receipt from GA-ESI.

Commitment Closure

Attachment 15 contains demarcated proprietary "GA-ESI letter 010-01038-001, Attachment 1, 04502050-001 Receipt Inspection." Attachment 16 contains redacted non-proprietary "GA-ESI letter 010-01038-001, Attachment 1, 04502050-001 Receipt Inspection." Attachment 10 contains GA-ESI letter GA-ESI 4505, "Request by General Atomics Electronic Systems, Inc. to Withhold Certain Information from Public Disclosure under 10CFR2.390," dated January 4, 2012.

5. **TVA Commitment**

As committed to in TVA to NRC letter dated July 31, 2010, (Reference 2) submit non-proprietary version and affidavit for withholding for TR-1136 for Ametek containment sump level pressure transmitter.

Partial Commitment Closure

Attachment 17 contains non-proprietary Ametek Report No. TR-1136, "Qualification Documentation Review Package for Ametek Aerospace Gulton-Statham Products Nuclear Qualified Pressure Transmitter Series Enveloping --- Gage Pressure Transmitter Series PG 3200, Differential Pressure Transmitter Series PO 3200 Differential High Pressure Transmitter Series PDH 3200, Draft Range Pressure Transmitter Series DR 3200, Remote Diaphragm Seal Differential Pressure Transmitter Series PO 3218, Remote Diaphragm Seal Differential High Pressure Transmitter Series PDH 3218," Revision C.

Attachment 18 contains non-proprietary Ametek letter "Affidavit of Withholding from Public Disclosure for TR-1136 Environmental Qualifications Document," dated January 13, 2012

Enclosure 2
TVA Letter Dated January 19, 2012
List of Attachments

Note: While project coversheets have not been included, the attachments have been reviewed and approved by Engineering prior to submittal.

1. WEC proprietary document WBT-D-3711 P-Enclosure, "Westinghouse's Revised Response to Follow up NRC Request (SSER 24 Appendix HH Item Number 108)," dated January 2012 (Letter Item 1, SSER 23 Appendix HH Item Number 108)

2. WEC non-proprietary document WBT-D-3711 NP-Enclosure, "Westinghouse's Revised Response to Follow up NRC Request (SSER 24 Appendix HH Item Number 108)," dated January 2012 (Letter Item 1, SSER 23 Appendix HH Item Number 108)

3. WEC non-proprietary document CWA-12-3349, Application for Witholding Information From Public Disclosure "WBT-D-3711 P-Enclosure, 'Westinghouse's Revised Response to Follow up NRC Request (SSER 24 Appendix HH Item Number 108),' (Proprietary)" dated January 5, 2011 (Letter Item 1, SSER 23 Appendix HH Item Number 108)

4. Demarcated proprietary GA-ESI document 04038903-1SP, "Qualification Basis for 04031101-001 (2-RE-90-130 &131)," Revision D (Letter Item 2, SSER Appendix HH Item Number TVA21)

5. Redacted non-proprietary GA-ESI document 04038903-1SP, "Qualification Basis for 04031101-001 (2-RE-90-130 &131)," Revision D (Letter Item 2, SSER Appendix HH Item Number TVA21)

6. Demarcated proprietary GA-ESI document 04038903-2SP, "Qualification Basis for 04031301-001 (2-RE-90-106)," Revision B (Letter Item 2, SSER Appendix HH Item Number TVA21)

7. Redacted non-proprietary GA-ESI document 04038903-2SP, "Qualification Basis for 04031301-001 (2-RE-90-106)," Revision B (Letter Item 2, SSER Appendix HH Item Number TVA21)

8. Demarcated proprietary GA-ESI document 04038903-4SP, "Qualification Basis for 04031501-001 (2-RE-90-112)," Revision B (Letter Item 2, SSER Appendix HH Item Number TVA21)

9. Redacted non-proprietary GA-ESI document 04038903-4SP, "Qualification Basis for 04031501-001 (2-RE-90-112)," Revision B (Letter Item 2, SSER Appendix HH Item Number TVA21)

10. GA-ESI letter GA-ESI 4505, "Request by General Atomics Electronic Systems, Inc. to Withhold Certain Information from Public Disclosure under 10CFR2.390," dated January 4, 2012 (Letter Item 2, SSER Appendix HH Item Number TVA21 and Letter Item 4)

11. TVA calculation WCGACQ0766, "Required Response Spectra for Evaluation of Radiation Monitoring Equipment," Revision 1 (Letter Item 2, SSER Appendix HH Item Number TVA21)

12. Not Used

13. Not Used

14. Not Used

15. Demarcated proprietary "GA-ESI letter 010-01038-001, Attachment 1, 04502050-001 Receipt Inspection" (Letter Item 4)

16. Redacted non-proprietary "GA-ESI letter 010-01038-001, Attachment 1, 04502050-001 Receipt Inspection" (Letter Item 4)

17. Non-proprietary Ametek Report No. TR-1136, "Qualification Documentation Review Package for Ametek Aerospace Gulton-Statham Products Nuclear Qualified Pressure Transmitter Series Enveloping --- Gage Pressure Transmitter Series PG 3200, Differential Pressure Transmitter Series PO 3200 Differential High Pressure Transmitter Series PDH 3200, Draft Range Pressure Transmitter Series DR 3200, Remote Diaphragm Seal Differential Pressure Transmitter Series PO 3218, Remote Diaphragm Seal Differential High Pressure Transmitter Series PDH 3218," Revision C (Letter Item 5)

18. Non-proprietary Ametek letter "Affidavit of Withholding from Public Disclosure for TR-1136 Environmental Qualifications Document," dated January 13, 2012 (Letter Item 5)

Enclosure 3
TVA Letter Dated January 19, 2012
List of References

1. TVA to NRC letter dated December 22, 2011, "Watts Bar Nuclear Plant (WBN) Unit 2 – Instrumentation and Controls Staff Information Requests" (Letter Item 1, SSER 23 Appendix HH Item Number 108 and Letter Item 4)

2. TVA to NRC letter dated July 31, 2010, "Watts Bar Nuclear Plant (WBN) Unit 2 – Final Safety Analysis Report (FSAR) – Response to Preliminary Requests for Additional Information and Requests For Additional Information" (Letter Item 5)

Attachment 2

WEC non-proprietary document WBT-D-3711 NP-Enclosure, "Westinghouse's Revised Response to Follow up NRC Request (SSER 24 Appendix HH Item Number 108)," Dated January 2012 (Letter Item 1, SSER 24 Appendix HH Item Number 108)

Westinghouse's Revised Response to Follow up NRC Request (SSER 24 Appendix HH Item Number 108)

Watts Bar 2

January 2012

Westinghouse Electric Company LLC
1000 Westinghouse Drive
Cranberry Township, PA 16066

Follow up NRC Request to SSER 24 Appendix HH Item Number 108

Upon review of the response to Action Item No. 94, it was noticed that TVA's response to these two action items provided different environmental conditions in each response (see Action Item No. 94 Clause 4.5.3 and 4.7). It is no longer clear, in what environment the Common Q PAMS system is required to operate or how qualification to this environment is demonstrated.

F. Please describe how it is demonstrated that the Common Q PAMS equipment is qualified to the environments in which that equipment is required to operate. Please pay particular attention to the potential synergistic effects of temperature and humidity.

Westinghouse Response:

The Common Q PAMS equipment was environmentally qualified in accordance with NRC approved WCAP-16097-P-A, "Common Qualified Platform Topical Report," Revision 0, Section 8.2 "Environmental Testing."

Table 8.2-1 (copied below) of WCAP-16097-P-A, Revision 0 identifies the environmental design requirements for the Common Q cabinet. WCAP 16097-P-A, Revision 0 defines the environmental test profile used for qualifying the Common Q equipment. In accordance with this approved methodology, the equipment is tested at [ ][a,c] and also at a [ ][a,c]

The evaluation of the Watts Bar Unit 2 environmental requirements against the generic Common Q environmental testing is documented in Westinghouse document EQ-QR-68-WBT-P, "Qualification Summary Report for Post-Accident Monitoring System (PAMS)," Revision 0. The environmental (i.e., temperature and humidity) qualification analysis of the Common Q PAMS equipment was performed based upon the following tested conditions: [

][a,c]

Note 1) Per WCAP 16097-P-A, Revision 0, the required humidity for [

][a,c]

The tested conditions bound the actual Watts Bar Unit 2 conditions stated in the response to "C" and "D" of this NRC request.

Table 8.2-1 [ ][a,c]

a,c

Attachment 3

WEC non-proprietary document CWA-12-3349, Application for Withholding Information From Public Disclosure "WBT-D-3711 P-Enclosure, "Westinghouse's Revised Response to Follow up NRC Request (SSER 24Appendix HH Item Number 108)," (Proprietary)" Dated January 5, 2011 (Letter Item 1, SSER 24 Appendix HH Item Number 108)

Westinghouse

Westinghouse Electric Company LLC
Nuclear Services
1000 Westinghouse Drive
Cranberry Township, Pennsylvania 16066
USA

U.S. Nuclear Regulatory Commission
Document Control Desk
11555 Rockville Pike
Rockville, MD 20852

Direct tel: (412) 374-4643
Direct fax: (724) 720-0754
e-mail: greshaja@westinghouse.com
Proj letter: WBT-D-3711

CAW-12-3349

January 5, 2012

APPLICATION FOR WITHHOLDING PROPRIETARY
INFORMATION FROM PUBLIC DISCLOSURE

Subject: WBT-D-3711 P-Enclosure, "Westinghouse's Revised Response to Follow up NRC Request (SSER 24 Appendix HH Item Number 108" (Proprietary)

The proprietary information for which withholding is being requested in the above-referenced report is further identified in Affidavit CAW-12-3349 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 Tennessee Valley Authority.

Correspondence with respect to the proprietary aspects of the application for withholding or the Westinghouse affidavit should reference this letter, CAW-12-3349, and should be addressed to J. A. Gresham, Manager, Regulatory Compliance, Westinghouse Electric Company LLC, Suite 428, 1000 Westinghouse Drive, Cranberry Township, Pennsylvania 16066.

Very truly yours,

J. A. Gresham

J. A. Gresham, Manager
Regulatory Compliance

Enclosures

CAW-12-3349

AFFIDAVIT

COMMONWEALTH OF PENNSYLVANIA:

ss

COUNTY OF BUTLER:

Before me, the undersigned authority, personally appeared J. A. Gresham, 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:

J. A. Gresham

J. A. Gresham, Manager
Regulatory Compliance

Sworn to and subscribed before me
this 5th day of January 2012

Cynthia Olesky

Notary Public

COMMONWEALTH OF PENNSYLVANIA
Notarial Seal
Cynthia Olesky, Notary Public
Manor Boro, Westmoreland County
My Commission Expires July 16, 2014
Member, Pennsylvania Association of Notaries

(1) I am Manager, Regulatory Compliance, 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 Proprietary Information from Public Disclosure 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 WBT-D-3711 P-Enclosure, "Westinghouse's Revised Response to Follow up NRC Request (SSER 24 Appendix HH Item Number 108)" (Proprietary), dated January 2012, for submittal to the Commission, being transmitted by Tennessee Valley Authority letter and Application for Withholding Proprietary Information from Public Disclosure, to the Document Control Desk. The proprietary information as submitted by Westinghouse is that associated with the Post-Accident Monitoring System (PAMS) and may be used only for that purpose.

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

(a) Assist the customer in providing technical licensing information to the NRC that is required for approval of the Watts Bar Nuclear Unit 2 PAMS System.

Further this information has substantial commercial value as follows:

(a) Westinghouse plans to sell the use of similar information to its customers for the purpose of licensing in-core instrumentation systems.

(b) Its use by a competitor would improve his competitive position in the development and licensing of a similar product.

(c) The information requested to be withheld reveals the distinguishing aspects of a design 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 calculations, analysis 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).

Tennessee Valley Authority
Letter for Transmittal to the NRC

The following paragraphs should be included in your letter to the NRC:

Enclosed are:

1. __ copies of WBT-D-3711 P-Enclosure, "Westinghouse's Revised Response to Follow up NRC Request (SSER 24 Appendix HH Item Number 108)" (Proprietary)

2. __ copies of WBT-D-3711 NP-Enclosure, "Westinghouse's Revised Response to Follow up NRC Request (SSER 24 Appendix HH Item Number 108)" (Non-Proprietary)

Also enclosed is the Westinghouse Application for Withholding Proprietary Information from Public Disclosure CAW-12-3349, accompanying Affidavit, Proprietary Information Notice, and Copyright Notice.

As Item 1 contains information proprietary to Westinghouse Electric Company LLC, it is supported by an affidavit signed by Westinghouse, the owner of the information. The affidavit 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 Section 2.390 of the Commission's regulations.

Accordingly, it is respectfully requested that the information which is proprietary to Westinghouse be withheld from public disclosure in accordance with 10 CFR Section 2.390 of the Commission's regulations.

Correspondence with respect to the copyright or proprietary aspects of the items listed above or the supporting Westinghouse affidavit should reference CAW-12-3349 and should be addressed to J. A. Gresham, Manager, Regulatory Compliance, Westinghouse Electric Company LLC, Suite 428, 1000 Westinghouse Drive, Cranberry Township, Pennsylvania 16066.

Attachment 5

Redacted non-proprietary GA-ESI document 04038903-1SP,
"Qualification Basis for 04031101-001 (2-RE-90-130 &131)," Revision D
(Letter Item 2, SSER Appendix HH Item Number TVA21)

REVISIONS

REV	DESCRIPTION	DATE	APPROVED
B	INCORPORATED ECN 400001402 D. DOYLE 9/12/2011	9-12-11 9-19-11 9-21-11	B. Wilkinson P. Berner E. Cabel
C	INCORPORATED ECN 400001502 J. HEITHAUS 10/11/2011	10-12-11 10-12-11 10-12-11	R.Rocha J. Heithaus E. Cabel
D	INCORPORATED ECN 400001916 J. HEITHAUS 12/20/2011	12/20/11 12/20/11 12-20-11	[signature] [signature] [signature]

Document Classification Change

[redacted]

GENERAL ATOMICS ELECTRONIC SYSTEMS

4990 GREENCRAIG LANE
SAN DIEGO, CA 92123-1675

		DATE
DRAWN	A.E. BUTT	1/13/2011
CHECKED	B. WILKINSON	1/19/2011
ENGR	A.E. BUTT	1/19/2011
ENGR REV	W. GRATZA	1/19/2011
MFG ENGR	----------------------	----------
PROJ MGR	P. BERNER	1/19/2011
QUAL MGR	J. WINESKI	1/19/2011
RELEASE	E. CABEL	1/19/2011

QUALIFICATION BASIS FOR 04031101-001 (2-RE-90-130 & -131)

SIZE	CAGE CODE	DRAWING NUMBER	REV
A	58307	04038903-1SP	D

DRW LEVEL	SCALE	SHEET
3	NONE	1 OF 76

GA-ESI-0258 FORM-A Rev. 11-8-11

CHANGE RECORD

Issue	Date	Description of Change
Rev. A	January 2011	Original Issue
Rev. B	September 2011	Incorporated Customer Comments
Rev. C	October 2011	Incorporated Customer Comments
Rev. D	December 2011	Incorporated Customer Comments

CONTENTS

TABLES

FIGURES

1 INTRODUCTION

The Qualification Basis Report for GA-ESI P/N 04031101-001 Gas Monitor System provides the evaluation and justification to demonstrate the environmental, seismic, and Electromagnetic Compatibility (EMC) qualification. Note: The Gas Monitor uses an analog radiation analyzer and does not have software. This report is a supplement to the principle report GA-ESI report 04038903-QSR. GA-ESI report 04038903-QSR provides the following:

• Equipment Description	Section 2.1
• Environmental Qualification Requirements	Sections 3.2 and 3.2.1
•	Seismic Qualification Requirements Section 3.3 (Required Response Spectra Figures 3-11, 3-12, and 3-13 and TVA Document CEB-SS-5.10 R3, Figure 3-1)
• EMC Qualification Requirements	Section 3.4
• GA-ESI's Environmental Qual Program	Section 4.2
• GA-ESI's Seismic Qual Program	Section 4.3
• GA-ESI's EMC Qual Program	Section 4.4

1.1 COMMERCIAL GRADE ITEM CHANGES THAT AFFECT QUALIFICATION

This qualification report is based on the configuration of the monitor assembly on July 30, 2010.

In addition to qualifying assemblies and components by similarity, changes made to these parts and systems are reviewed and addressed in this report as follows:

> Some parts of the equipment qualified in this report have changes from those like-numbered parts that were qualified in the reports referenced in this report. All revisions and changes to parts that are Commercial Grade Items, and were qualified in the referenced qualification reports, have been evaluated and justified for qualification equivalency during the normal parts database management process. This qualification evaluation during parts database change is standard, in accordance with GA-ESI Operating Procedure OP-4.0-190. Similarly, all revisions and changes to any subassembly parts that were qualified in the referenced

qualification reports have been evaluated and justified during the standard Engineering Change Notice (ECN) process, in accordance with GA-ESI Operating Procedure OP-4.0-130.

1.2 REPORT CONTENTS

This report consists of the following sections.

Section 1. INTRODUCTION. This section describes the reason for the report, its organization, identification of the radiation monitors being qualified, and a description of the contents of each section.

Section 2. ENVIRONMENTAL QUALIFICATION BASIS. This section demonstrates the environmental qualification of the equipment by similarity to equipment and components successfully tested to requirements equal to or better than the requirements for the radiation monitors being supplied.

Section 3. SEISMIC QUALIFICATION BASIS. Section 3 documents the integrity and functionality of the Gas Monitor System during and after seismic events. This is accomplished by demonstrating that the Test Response Spectra (TRS) for similar equipment envelops the Required Response Spectra (RRS) for the equipment location and by analysis.

Section 4 REPLACEMENT SCHEDULE. This section provides the replacement schedule for components whose life is less than 40 years.

Section 5. ELECTROMAGNETIC COMPATIBILITY QUALIFICATION BASIS: Section 5 describes the EMC of the Gas Monitor based on operating history and test of equipment similar to the equipment being supplied.

Section 6. REFERENCE DOCUMENTS. This section lists the GA-ESI documents and drawings referenced in the body of the report.

2 ENVIRONMENTAL QUALIFICATION BASIS

The environmental qualification of the Gas Monitor Assembly, GA-ESI P/N 04031101-001, is based on previously completed qualification tests, GA-ESI design review, and manufacturers design specifications.

2.1 SERVICE CONDITIONS

The Gas Monitor Assemblies are located in Electrical Equipment Room A19 Elevation 713 feet of the Watts Bar Unit 2 nuclear power plant. The service conditions in those areas are given in GA-ESI document 04038903-QSR and are summarized below.

- **Gas Monitor Assembly:** The service conditions are: Business Sensitive

[redacted]

2.2 02818905-QSR COMPONENT REVIEW

A review of the Gas Monitor System list of materials was made for major assemblies that were previously qualified by GA-ESI report 02818905-QSR. The Gas Monitor TVA Tag numbers 2-RE-90-130 and -131 were listed in GA-ESI report 02818905-QSR as GA-ESI P/N 02815127-004. GA-ESI P/N 04031101-001 is a redesign of the assembly to incorporate enhancements developed since the original monitor was designed. The functionality and performance of radiation monitoring remains the same. The RP-30AM Radiation Analyzer is the same part number as the unit supplied originally (GA-ESI P/N 02810443-001) and its qualification basis is in GA-ESI report 02818905-QSR (Environmental Qualification Summary Report for Class 1E Equipment for Watts Bar Units 1 & 2) and will not be duplicated here. The rest of the monitor will be qualified by this report.

2.3 QUALIFICATION BASIS

This section describes the basis for the qualification of the Gas Monitor System. The monitors are qualified for an Essentially Mild environment. Therefore, the monitor assemblies are qualified for normal and abnormal service conditions plus a DBE (Design Bases Event).

GA-ESI type tests electronic radiation monitoring and analysis assemblies that are designed and manufactured by GA-ESI to abnormal extremes to demonstrate performance over the temperature and humidity range that the assemblies may experience in service. Certain other assemblies, whose performance may be affected by extremes, designed and manufactured by GA-ESI, are also tested at temperature and humidity extremes. All other components and assemblies are selected for the generic service conditions and approved through a design review and commercial grade dedication process (in accordance with GA-ESI procedure OP-7.3-240). Performance and functionality are demonstrated by the final Acceptance Test Procedure (ATP). A certificate of compliance is provided with the accepted assembly. Components and modules that have a life less than 40 years are identified in Section 4, Replacement Schedule.

The monitors located in the Electrical Equipment Room A19 environment have a normal radiation total dose greater than GA-ESI levels of qualification. A radiation review of each part in the assemblies is performed using TVA RIMS report #B43'860721903 as the basis for qualifying the equipment to higher levels of radiation. The results of that review are given in Section 2.4.

Environmental Qualification Summary Table 2-1 identifies the assemblies that are qualified by test and the test article that was utilized to demonstrate that qualification. The subsequent subsections describe that testing performed for each assembly and compare the test article with the assembly being qualified.

Table 2-1 Environmental Qualification Summary Table for 04031101-001

Component	GA-ESI P/N	Test Article	Qual Report	Qual Section
Gas Monitor	04031101-001			
Radiation Analyzer Assembly	04031161-001			
RP-30AM Radiation Analyzer	02810443-001		02818905-QSR	2.3.1
Preamplifier	03602179-006*	03602179-001	E-255-1335	2.3.2
RD-52A-40D Gas Sampler	03602069-007			
RD-52-61 Detector	03662101-003	02810530-001	E-255-1058	2.3.3

* The –001 preamplifier was initially installed but had to be upgraded to the –006 to meet the performance requirements of the detector/preamplifier.

2.3.1 RP-30AM Radiation Analyzer

The RP-30AM Radiation Analyzer [redacted] is the same as the RP-30AM qualified for normal and abnormal environments found in Electrical Equipment Room A19. Refer to GA-ESI report 02818905-QSR for its qualification basis.

Business Sensitive

2.3.2 Preamplifier

A preamplifier (GA-ESI P/N 03602179-001) test article is similar to the 03602179-006 preamplifier being qualified. [redacted] The preamplifiers passed all performance tests and are considered qualified.

2.3.3 RD-52-61 Detector Assembly

An RD-52-61 detector assembly (GA-ESI P/N 02810530-001) test article, similar to the RD-52-61 detector assembly (GA-ESI P/N 03662101-003) being qualified, was tested to the extremes of temperature and humidity as reported in GA-ESI report E-255-1058. The detector being qualified is the entire detector assembly (includes socket assembly). The test article part number reported in the test report is the subassembly crystal/photomultiplier tube assembly. The entire assembly number was not recorded but would have had a socket assembly in order to operate. The test article detector is the same as the detector being qualified and it can be assumed that the socket assembly is similar. The design, materials of construction, and performance characteristics are the same between the test article and the detector being qualified.

Business Sensitive

Extreme testing was performed [redacted]
The RD-52 test article performed satisfactorily. The two detectors, the test article and the one being evaluated are considered similar and the RD-52-61 detector assembly is considered qualified.

2.4 HIGH RADIATION REVIEW

The Total Integrated Dose (TID) that the radiation monitor system located in the plant is above the GA-ESI rating for the equipment. GA-ESI rates the radiation monitor system at 1 x 10^3 RADS whereas the expected normal TID in the plant is 3.0 x 10^4 RADS (per Section 2.1). TVA report B43'860721903, *A Review of Electronic Components in a Radiation Environment of ≤ 5X10⁴ RADS,* states that all type of electronic components and materials are acceptable to 5 x 10^4 RADS with the exception of the following:

[redacted]

It should be noted that radiation monitoring systems include sample transport components. The TVA report describes materials that are generally used in these applications and as such the discussion in the TVA report can be applied to the sample transport components as well.

A review of the radiation monitor system parts of those assemblies located in the high radiation area was made to identify MOS devices, PIN diodes, and parts containing Fluorocarbons for further evaluation. The results of that review and evaluation are provided below.

Business Sensitive

MOS devices and PIN diodes are not used on this monitor.

Fluorocarbons are used in the following applications:

[redacted]

The maximum radiation dose to which the assemblies are exposed is 3.0 x 10^4 RADS (per Section 2.1). The TVA RIMS report #B43'860721903 states that fluorocarbon compounds "...can tolerate a gamma dose above 10^4 RADS but below 10^5 RADS. In a review of the source document used for the TVA report (EPRI NP-2129) polytetrafluoroethylene (Teflon) exhibited threshold damage in elongation at 1.5 x 10^4 RADS and 25% damage at 3.4 x 10^4 RADS.

The level of damage is not significant enough to affect the electrical or physical properties of the sleeve to cause electrical failure. The sleeve and tube are considered acceptable for the applications listed.

This level of damage for the ball valves is also considered acceptable since the components are static and the seals retain a full 75% of physical properties. If during manual operation (from one state to another) leakage is experienced, the valves should be replaced.

3 SEISMIC QUALIFICATION BASIS

This section describes the seismic qualification of the Gas Monitor System, [redacted], based on previously completed seismic tests and analysis.

Business Sensitive

3.1 SEISMIC REQUIREMENTS

The Gas Monitor System is safety related and seismic Category I and is required to operate during and after an earthquake. For qualification by random bi-axial or tri-axial testing; [redacted] is used to ensure that the Test Response Spectra envelopes the Required Response Spectra. For analysis the values of ZPA and peak accelerations [redacted].

Business Sensitive

3.1.1 Plant Equipment Seismic Requirements

The Required Response Spectra (RRS) for the seismic qualification of the Gas Monitor plant equipment located in the Electrical Equipment Room A19 Elevation 713 feet are found in GA-ESI document 04038903-QSR, Figures 3-11 through 3-13. The required acceleration values are given in Table 3-1.

Table 3-1 Required Acceleration Values for Gas Monitor Plant Equipment

[redacted]

Business Sensitive

- **Vertical:** The spectrum given in GA-ESI document 04038903-QSR [redacted] The vertical RRS is shown in Figure 3-1 (Data in Table 3-2). Business Sensitive
- **Horizontal:** The spectra given in GA-ESI document 04038903-QSR [redacted]

[redacted]

Table 3-2 Vertical Required Response Spectrum (Building ARS)

Business Sensitive

[redacted]

Business Sensitive

[redacted]

Business Sensitive

[redacted]

For analyzing structural and support elements the values given in Table 3-1 are modified by multiplying the peak and ZPA values by [redacted], are used if the natural frequency of the element being analyzed is not calculated or the natural frequency is in the dynamic range [redacted] ZPA values, [redacted] is conservatively used if the natural frequency is calculated and is in the rigid range [redacted] The required accelerations are calculated directly from Table 3-1, using [redacted]. Table 3-4 provides the required accelerations for analysis.

Business Sensitive

[redacted].

[redacted]

3.2 COMPONENT REVIEW

Business Sensitive

A review of the Gas Monitor System list of materials was made for major assemblies that were previously qualified by GA-ESI report E-115-0459. The original assembly for this application was qualified as part of GA-ESI report E-115-0459, however, the monitor has been redesigned to use the latest technology and enhancements. The RP-30AM Radiation Analyzer and its associated NIM Bin assembly, motor starter, and the [redacted] relays are qualified by GA-ESI report E-115-0459 (Seismic Qualification Summary Report for TVA) and will not be duplicated in this report. This qualification basis is for the rest of the Gas Monitor that has not been qualified by GA-ESI report E-115-0459.

3.3 QUALIFICATION BASIS

This section describes the basis for the seismic qualification of the Gas Monitor System. The monitor system is qualified as seismic Category I and is expected to be functional during and after a seismic event. Therefore, the monitor is qualified for structural integrity as well as functionality.

GA-ESI seismically qualifies radiation monitoring systems structurally by test and by analysis. Components and assemblies that are tested functionally as well as ensuring the seismic adequacy of the structure. GA-ESI has tested the radiation monitoring systems using sine-beat, bi-axial, and tri-axial seismic test methods. Conservative analysis is performed for certain components and structural elements that have not been tested. The methods used are described as part of the analysis and generally meet the program describe in GA-ESI document 04038903-QSR.

The Seismic Qualification Summary Table 3-5 identifies the assemblies that are qualified by test or analysis. The test article that was utilized to demonstrate qualification is provided as well as the test report. The subsequent subsections describe the testing or analysis for each assembly and compare the test article or the structure analyzed with the assembly being qualified.

Table 3-5 Seismic Qualification Summary Table for GA-ESI P/N 04031101-001

Component	[redacted]	Test Component	Test Article	Qual Report	Qual Section
Gas Monitor Assembly					
Skid Base & Frame Assembly			03691301-002 04706010-001 03771701-001 04706011-001	E-255-1081 04498905-QSR E-255-1131 04498905-QSR	3.3.1
Radiation Analyzer Assembly		03570220-004	03570220-004	E-255-0996	3.3.2
NIM Bin Assembly				E-115-459	3.3.2.1
RP-30AM Radiation Analyzer				E-115-459	3.3.2.1
24 V Power Supply		04502005-001	04500801-001	04508905-QR	3.3.2.2
Preamplifier		03602179-002	03602160-001	E-255-1335	3.3.2.3
Power Control Center		03662501-001	03662001-001	E-255-0968	3.3.3
EMI/RFI Filter & Surge Suppressor		50016149-001	03651201-001	03608917-3SP	3.3.3.1
EMI/RFI Filter			Analysis	03728906-QSR	3.3.3.2
Relay				E-255-0968	3.3.3.3
Relay				04038903-1SP	3.3.3.3
RD-52A-40D Gas Monitor		03662101-001	03662001-001	E-255-0968	3.3.4
Customer Interface Junction Box		03584015-002	03663001-001	E-255-0968	3.3.5
EMI/RFI Filter				04619036-3SP	3.3.5.1
Relay				E-255-0968	3.3.5.2
Sample Transport Components		Various	03662001-001	E-255-0968	3.3.6
Blower				04038904-QSR	3.3.6.1
Flow Switch		03600210-004	03862101-001	E-255-1236	3.3.6.2
Solenoid Valve		03600629-001	03662001-001	E-255-0968 03608917-4SP	3.3.6.3
Solenoid Valve		03600630-001	03662001-001	E-255-0968 03608917-4SP	3.3.6.3

Component	[redacted]	Test Component	Test Article	Qual Report	Qual Section
Actuator Valve Assembly		50011413-001	03691301-002	E-255-1081 03608917-5SP	3.3.6.4
Vacuum Switch		03608071-002	03691301-002	E-255-1081	3.3.6.5
Motor Starter				E-115-459	3.3.7
Starter				04038903-1SP E-115-459	3.3.8
RC-Network Assembly RC-Network				04038903-1SP	3.3.9

* The –001 preamplifier was initially installed but had to be upgraded to the –006 to meet the performance requirements of the detector/preamplifier. Business Sensitive

The Gas Monitor Assembl[redacted] is qualified for seismic functionality and structural integrity by test and analyses of similar components discussed in the following subsections.

3.3.1 Skid Base and Frame Assembly

Business Sensitive

The Skid Base and Frame Assembly is a recent enhanced frame design as compared to the older configuration. The Frame Assembly [redacted] is bolted to the Skid Base [redacted] whereas the older configuration is a single welded assembly. The older frame assembly and skid base has been seismically tested and shown to be structurally adequate. The new configuration has been analyzed to demonstrate its structural integrity. This subsection provides the results of previous testing for the older configuration and the analysis performed for the enhanced configuration to demonstrate structural adequacy of the skid base and frame for the Gas Monitor System.

A skid base similar to the Gas Monitor System skid base was previously seismically tested as part of a Particulate, Iodine, and Gas (PIG) Monitor Assembly [redacted] as described in GA-ESI report E-255-1081. The monitor tested used a skid base [redacted] and was mounted to the shake table with six [redacted] bolts in the same configuration as the skid base being qualified. The weight of the test monitor was approximately [redacted] lbs. Business Sensitive

The skid base for the Gas Monitor System is [redacted] and is mounted to the floor with six [redacted] bolts. The monitor weighs approximately [redacted]. The approximately [redacted] increase in weight between the tested skid base and the monitor skid base for the Gas Monitor System are not considered significant.

The floor attachment bolts will have a [redacted] higher stresses for the supplied skid base, however, the TRS was much greater than the RRS for the tested skid base. Business Sensitive

The seismic tests were bi-axial with the test article attached rigidly to the shake table in the same configuration as the unit being qualified would be in the field. There wasn't any amplification between the shake table and the mounting location. A resonance search was performed [redacted], [redacted] with no resonances were found [redacted] and transmissibility plots show several peaks between [redacted] These resonant frequencies are identified in the table on the next typed page. The test article was given five Operating Basis Earthquake (OBE) tests and one Safe Shutdown Earthquake (SSE) test then rotated 90° and the test sequence repeated. Figures 3-3 and 3-4 shows the accelerometer response at the top of the moving filter particulate detector, mounted rigidly to the skid base, and identifies the [redacted] damping Test Response Spectra (TRS). The test article remained intact throughout the testing. Since the skid base is a simple rigid welded structure, it is considered rigid and a comparison of the test ZPA and the required ZPA can be used to demonstrate qualification. As can be seen the TRS ZPA is well above the RRS ZPA and the skid is considered qualified.

[redacted]

[redacted]

A frame assembly similar to the Gas Monitor System frame assembly was previously seismically tested as part of a Particulate, Iodine, and Gas (PIG) Monitor Assembly [redacted] as described in GA-ESI report E-255-1131. The monitor tested used a frame assembly [redacted] wide and was mounted to the skid base by welds. The frame assembly use the same size tubular steel for a similar configuration as the frame assembly being qualified. An RM-80, motor controller, flow signal conditioner, a control station, and sample transport components were mounted on the test frame assembly. [redacted]

Business Sensitive

The frame assembly for the Gas Monitor System is [redacted] and is mounted to the skid base with four sets [redacted] bolts. The frame assembly is welded to the four bolt pads in the same manner as the tested frame assembly. A diagonal stiffener is added to the frame assembly for the Gas Monitor. [redacted] Except for the use of bolts to attach the frame assembly to the skid base and the added diagonal stiffener, the differences between the tested frame assembly and the monitor frame assembly for the Gas Monitor System are not significant.

The seismic tests were bi-axial with the test article attached rigidly to the shake table in the same configuration as the unit being qualified would be in the field. There wasn't any amplification between the shake table and the mounting location. A resonance search was performed [redacted]. Resonance frequencies were found [redacted] in the horizontal front-back direction and [redacted] in the side to side direction in the frame structure.

[redacted]

There were only minor resonances in the Y-Vertical direction in the first three modes. The test article was given five Operating Basis Earthquake (OBE) tests and one Safe Shutdown Earthquake (SSE) test then rotated [redacted] and the test sequence repeated. Figures 3-5 and 3-6 show the control accelerometer response and identify the [redacted] damping Test Response Spectra (TRS). The test article remained intact throughout the testing. As can be seen in Figure 3-5 and 3-6 the TRS does envelope the RRS. The frame structure is considered qualified. Business Sensitive

[redacted]

[redacted]

The bolted attachment of the frame assembly to the skid base is a recent design and an analysis is documented in GA-ESI report 04498905-QSR Appendix A. The analysis shows that the frame assembly is stiffer than the previously tested radiation monitor frame and that the stresses in the Gas Monitor System frame assembly are well below the GA-ESI maximum allowable stresses. The reason the frame assembly is stiffer is the use of more triangular structural elements.

Since the frame assembly is not rigid, a dynamic analysis was performed to determine the dynamic amplifications effects. The first four modal frequencies are in the horizontal plane and the vertical axis is relatively rigid. A summary of the frequency analysis is presented in Table 3-6 which shows that the stiffness has greatly improved and the design provides more than a 50% increase in the frequencies at the primary resonance mode.

Business Sensitive

[redacted]

The results of the dynamic analyses were compared with the generic acceleration data that GA-ESI uses to qualify all of the skid mounted parts. Generally, the GA-ESI criteria are more sever; therefore, the generic accelerations were used as the loading criteria for performing a stress analysis of the frame assembly attachment to the skid base.

[redacted]

The generic accelerations are far above the accelerations required for analysis by TVA specification CEB-SS-5.10 Rev 3 for floor mounted equipment in the Electrical Equipment Room A19 Elevation 713 feet. ZPA values for the location of the equipment [redacted]. This bolt attachment was analyzed for another TVA monitor and the ZPA values used for that analysis were at the 820 ft elevation with a horizontal ZPA [redacted] Since these are much higher than required for the Gas Monitor the analysis will use the higher accelerations for analyzing the stresses in the bolts.

Business Sensitive

The accelerations to be used are calculated on the basis of the formula given in CEB-SS-5.10 Rev 3. For a horizontal ZPA of 1.04 g's and vertical ZPA of 0.34 g's, the equation results in 6.76 g's horizontal and 2.21 g's vertical. However, we chose to use the peak values from the analysis at the 820 ft elevation. Therefore, applying [redacted] margin and a [redacted] factor to the peak values results in an [redacted] horizontal acceleration and [redacted] vertical acceleration for the analysis. An abbreviated analysis using these accelerations is given in Tables 3-5 and 3-6. The details of the analysis are found in GA-ESI report 04498905-QSR Appendix A.

Business Sensitive

[redacted]

Business Sensitive

[redacted]

[redacted]

3.3.2 Radiation Analyzer Assembly

Business Sensitive

The Radiation Analyzer Assembly is an enclosure mount on the Gas Monitor frame that houses the NIM Bin Assembly, the RP-30AM Radiation Analyzer, the preamplifier, the [redacted] power supply, and miscellaneous electrical components. Structurally, the enclosure and the miscellaneous electrical components are similar to those found in the RM-80 Assembly.

The RM-80 Assembly [redacted] was tested seismically as described in GA-ESI report E-255-0996. The seismic tests were bi-axial with the test article attached to a rigid test fixture in the same configuration as the unit being qualified would be in the field. There wasn't any amplification between the shake table and the mounting location of the RM-80 Assembly. The test article was given six Safe Shutdown Earthquak[redacted] and the test sequence repeated. During the first series of tests the door latch yielded, allowing the door to open. The latch mechanism was strengthened and the changes reflected in all subsequent RM-80 Assemblies. The series of tests were repeated. Figures 3-7 and 3-8 show the RM-80 Assembly the Test Response Spectra (TRS). [redacted] The TRS takes into consideration the amplification of the frame at the mounting location of the RM-80. The RM-80 Assembly remained intact throughout the testing and the Radiation Analyzer Assembly by similarity to the RM-80 Assembly is considered qualified.

Business Sensitive

[redacted]

[redacted]

3.3.2.1 NIM Bin Assembly and RP-30AM Radiation Analyzer

The NIM Bin Assembly and the RP-30AM Radiation Analyzer were qualified in GA-ESI report E-115-459. Refer to that report for their qualification bases.

3.3.2.2 24 Volt Power Supply

Business Sensitive

The 24 Volt Power Supply [redacted] is attached to the back of the NIM Bin Assembly mounted in an enclosure on the skid frame and provides power to the RP-30AM Radiation Analyzer. The power supply is a replacement power supply for the originally tested power supply [redacted] as reported in GA-ESI document 04508905-QR. GA-ESI document 04508905-QR demonstrates that the replacement power supply is similar to the test article, since they are by the same manufacturer and model series. The replacement power supply has a higher current rating and, therefore, slightly heavier. The Technical Evaluation further demonstrates that the slightly greater weight does not affect the seismic qualification.

[redacted]

Business Sensitive

[redacted]

[redacted]

3.3.2.3 Preamplifier

A preamplifier [redacted] similar to the preamplifier being qualified (GA-ESI P/N 03602179-006) was seismically tested as report in GA-ESI report E-255-1335. The tested preamplifier is housed inside a NEMA 12 enclosure whereas the preamplifier being qualified is house in the Radiation Analyzer Assembly. The mounting is in the same manner and the printed circuit boards are the same.

The seismic tests were bi-axial with the test article attached rigidly to the shake table in the same configuration as the unit being qualified would be in the field. There wasn't any amplification between the shake table and the mounting location. Resonance searches were performed in each orthogonal axis at [redacted] at a sweep rate o[redacted] No resonances were found [redacted]. The test article was given six Safe Shutdown Earthquake (SSE) tests then rotated 90° and the test sequence repeated. Figures 3-11 and 3-12 show the accelerometers response on the test article and identify the 5% damping Test Response Spectra (TRS). The detector and preamplifier were operational and performed within specification tolerance before, during, and after the testing. The test article remained intact throughout the testing and is considered qualified.

Business Sensitive

[redacted]

[redacted]

3.3.3 Power Control Center

Business Sensitive

The Power Control Center (PCC) [redacted] is similar to the power control center [redacted] tested as part of the Wide Range Gas Monitor (WRGM) Detection Skid [redacted] reported in GA-ESI test report E-255-0968. The size, material, and weight of the enclosure supplied are approximately the same as the test article. [redacted] Internally, the components are similar except for the addition of EMI/RFI filters, a solid state relay, and arrangement variations in internal components. The relays used in the PCC are the same as those used on the original TVA Gas Monitor. These are discussed in subsequent subsections.

The WRGM detection skid's seismic tests were bi-axial with the test article attached rigidly to the shake table in the same configuration as the unit being qualified would be in the field. There wasn't any amplification between the shake table and the mounting location. The test article passed a functional test before seismic testing. The test article was given five Operating Basis Earthquake (OBE) tests and one Safe Shutdown Earthquake (SSE) test then rotated 90° and the test sequence repeated. Figures 3-13 and 3-14 show the control accelerometers response and identify th[redacted] damping Test Response Spectra (TRS). The amplification at the Power Control Center mounting location was greater than the amplification that would be experienced on the frame of the monitor being qualified. The test article remained intact and operational throughout the testing and passed a functional test after the seismic testing. The PCC is considered qualified. The resonant frequencies for the power control center are the same as those quoted in Table 3-6 (see a portion of that table below).

Business Sensitive

[redacted]

Business Sensitive

[redacted]

[redacted]

Business Sensitive

3.3.3.1 EMI/RFI Filter and Surge Suppressor

The EMI/RFI Filter/Surge Suppressor [redacted] has been added to the PCC to reduce noise and suppress power line surges. This device does not have age related failure mechanisms. The operating range specified by the manufacturer is greater than the required operating range. The parts associated with the EMI/RFI Filter/Surge Suppressor have been seismically and environmentally qualified as Class 1E nuclear safety related in GA-ESI document 03608917 Supplement 3.

Business Sensitive

3.3.3.2 EMI/RFI Filter

The EMI/RFI Filter [redacted] has been added to reduce noise associated with the blower. It is a solid state device with no moving parts and no seismic age related failure mechanisms. It is a rigid device and it has been seismically and environmentally qualified as Class 1E nuclear safety related in GA-ESI document 03728906-QSR and is considered qualified for this application.

Business Sensitive

3.3.3.3 Relays

Two relay types are used in the PCC. The first is a Potter-Brumfield relay [redacted] which are the same relays tested as part of the Stack Selector Assembly (03665001-001) reported in GA-ESI test report E-255-968. The test relays were age conditioned prior to seismic testing [redacted] under simulated circuit load conditions. The relays were mounted in the Stack Selector enclosure in the same way as those being qualified for use in the PCC. The stack Selector Assembly was functionally tested prior to seismic testing. The WRGM equipment was given 5 OBE biaxial tests and 1 SSE biaxial test then rotated 90° and given 5 OBE biaxial tests and 1 SSE test. Figures 3-8 and 3-9 show that the TRS envelopes the RRS. The relays functioned properly during the seismic testing and the Stack Selector was given a functional test after the seismic tests. The relay is considered qualified.

Business Sensitive

[redacted]

3.3.4 RD-52A-40D Gas Monitor Assembly

Business Sensitive

The RD-52A-40D Gas Monitor Assembly [redacted] is similar to the RD-52A-61D Gas Sampler Assembly [redacted] as part of the WRGM detection Skid [redacted] reported in GA-ESI test report E-255-0968. [redacted] All other components and hardware are the same. [redacted]

The seismic tests performed are described in Section 3.3.3 and the TRS is compared to the RRS in Figures 3-13 and 3-14. The RD-52A-40D Gas Monitor Assembly is considered qualified.

3.3.5 Customer Interface Junction Box

Business Sensitive

The Customer Interface Junction Box (CIJB) [redacted] is similar to the CIJB [redacted] tested as part of the WRGM RM-80/CIJB Assembly [redacted] reported in GA-ESI test report E-255-0968. The size, material, and weight of the enclosure supplied are approximately the same as the test article. [redacted] [redacted] the rest of the differences are not seismically significant.

The seismic tests performed are described in Section 3.3.3 and the TRS is compared to the RRS in Figures 3-13 and 3-14. The CIJB is considered qualified.

[redacted]

Business Sensitive

[redacted]

The seismic tests performed are described in Section 3.3.3 and the TRS is compared to the RRS in Figures 3-13 and 3-14. The test article remained intact throughout the testing and sample transport components are considered qualified.

3.3.6.1 Blower

The blower [redacted] is seismically qualified by GA-ESI report 04038904-QSR specifically for this Gas Monitor. Refer to the report for qualification details.

Business Sensitive

3.3.6.2 Flow Switch

[redacted]

[redacted]

The Flow Switch Summary Table 3-9 compares the characteristics of the tested and qualified flow switch with the new flow switch. The subsequent paragraphs describe that testing performed and the seismic and environmental qualification of the new flow switch. Business Sensitive

[redacted]

[redacted]

[redacted]

[redacted]

[redacted]

[redacted]

Business Sensitive

[redacted]

[redacted]

[redacted]

[redacted]

[redacted]

[redacted]

[redacted]

[redacted]

[redacted]

[redacted]

Business Sensitive

3.3.6.3 *Solenoid Valves*

The solenoid valves [redacted] and [redacted] are similar to the solenoid valves [redacted] that were qualified as part of the WRGM detection skid reported in GA-ESI document E-115-968. Per the GA-ESI document E-115-968, the solenoid valve coil was age conditioned a[redacted]. The solenoid valves were assembled to the detection skid and given performance tests. These new valves are qualified by similarity per qualification report GA-ESI document 03608917-4SP. The seismic tests performed are described in Section 3.3.3 and the TRS is compared to the RRS in Figures 3-13 and 3-14. The solenoid valves remained intact and functional before, during, and after testing and are considered qualified.

Business Sensitive

3.3.6.4 *Motor Operated Valves*

The motor operated valve actuator [redacted] is similar to the actuator [redacted] that was qualified as part of the PIG monitor reported in GA-ESI document E-255-1081. The actuator motor insulation was oven age conditioned [redacted]. It was then assembled to the PIG monitor [redacted] and given performance and seismic tests. Two varistors [redacted] are added to a terminal block inside the motor drive housing. These new motor operated valves with varistors are qualified by similarity per qualification report GA-ESI document 03608917-5SP.

The PIG Monitor's seismic tests were bi-axial with the test article attached rigidly to the shake table. There wasn't any amplification between the shake table and the mounting location. The test article passed a functional test before seismic testing. The test article was given five Operating Basis Earthquake (OBE) tests and one Safe Shutdown Earthquake (SSE) test then rotated 90° and the test sequence repeated. Figures 3-17 and 3-18 show the accelerometer responses on PIG detector rigidly attached to the skid base and identify the [redacted] damping Test Response Spectra (TRS). The test article remained intact and the motor actuator remained operational throughout the testing and passed a functional test after the seismic testing. The actuator is considered qualified.

[redacted]

[redacted]

3.3.6.5 Vacuum Switch

Business Sensitive

The vacuum switch [redacted] is the same vacuum switch qualified as part of the PIG monitor [redacted] reported in GA-ESI document E-255-1081. The tested vacuum switch was mounted in a manner similar to the mounting of the switch being qualified.

The seismic tests performed are described in Section 3.3.6.4 and the TRS is compared to the RRS in Figures 3-17 and 3-18. The test article remained intact and the vacuum switch remained operational throughout the testing. The PIG Monitor passed a functional test after the seismic testing. The vacuum switch is considered qualified.

3.3.7 Motor Starter

The motor starter [redacted] is the same motor starter as used on the Gas Monitor tested and reported in GA-ESI report E-115-459. Refer to that report for its qualification basis. The Gas Monitor was tested [redacted] at the resonances of the Gas Monitor assembly. The motor starter performed satisfactorily during and after the testing. The test levels exceed the required levels of 0.41 g's horizontal and 0.28 g's vertical. The motor starter is considered qualified.

Business Sensitive

3.3.8 Starter

The starter [redacted] is utilized as pump motor starter in series with the Motor Starter (disconnect switch) described in Section 3.3.7.3. The Starter is similar to a motor starter [redacted] tested on a TVA Liquid Monitor and reported in E-115-459. [redacted] The manufacturer and model series are the same and the NEMA size is 00 for the tested starter and 0 for the starter being qualified

The seismic testing levels of the Liquid Monitor floor were lower than the required ZPA levels for the location of the PG monitor assembly [redacted] Therefore, additional seismic evaluation is necessary in order to demonstrate seismic qualification. The motor starter that was tested is a smaller version of the motor starter being qualified. [redacted] The motor starter is shown below.

Business Sensitive

Business Sensitive

[redacted]

The motor starter enclosure and molded casing are considered seismically rugged. This is demonstrated by the results of testing a manual motor starter [redacted] on the Gas Monitor reported in E-115-459. The Gas Monitor was tested [redacted] in the horizontal direction and [redacted] in the vertical direction. [redacted] The enclousure and molded case are similar to the ensclosure and molded case of the motor starter being qualified. This can be seen in the figure below. [redacted]se.

[redacted]

Business Sensitive

In the case of the [redacted] motor starter, the making of the power circuit is done magnetically. The following figure shows the Starter Bell-Crank assembly that closes the power contacts.

Business Sensitive

[redacted]

[redacted]

In series with the coil are thermal overload relays. There is one for each power line terminal. Their internal structure is shown below.

Business Sensitive

Business Sensitive

Business Sensitive

[redacted]

3.3.9 RC Network

The RC Network Assembly [redacted] which contains the RC-Network [redacted] is a three-phase 480 volt device used for electronics protection from conducted electrical noise generated in the blower motor. [redacted]. Business Sensitive

Business Sensitive

4 REPLACEMENT SCHEDULE

The replacement schedule for components that contain parts with significant aging mechanisms is provided in this section. The replacement schedules provided in Table 4-1 are based on an [redacted] average ambient temperature. Lifetime for components in enclosures include [redacted]. A dash entry indicates a higher-level assembly that does not require replacement but contains the component to be replaced. The individual components to be replaced are listed with their life in years.

[redacted]

5 EMC QUALIFICATION BASIS

Business Sensitive

This section demonstrates that [redacted] (Gas Monitor) is Electromagnetic Compatibility (EMC) qualified for operatio[redacted] The EMC qualification basis is established by demonstrating that GA-ESI's EMC qualification tests on the radiation monitoring systems meets the requirements for replacement radiation monitors and the significant differences between the radiation monitor system being qualified and the radiation monitor systems tested are reconciled.

The Gas Monitor System consists of a self contained skid mounted radiation monitoring system. The Block Diagram [redacted] shows the major components of the system as well as their electrical interconnections. The following subsections describe the EMC Qualification Basis for the system as a whole, [redacted] the detector and checksource, and the Sample Transport Components.

Business Sensitive

5.1 MONITOR SYSTEM QUALIFICATION BASIS

The monitor system uses the latest technology and components developed and tested to ensure Electromagnetic Compatibility. Filters, surge protection, and noise suppressors have been added to power input circuits and components that could generate noise, such as relays. Tests have been conducted individually, using the latest standards available at the time, on the microprocessor based radiation monitors and their associated detector and control/display units. Skid mounted radiation monitors consisting of components found in most radiation monitor have been conducted and the knowledge gained has been utilized in the design and manufacture of the Gas Monitor System. The electrical distribution cable and the instrument cable routing are similar in design and materials [redacted] All cabling is contained in metallic conduit and metal enclosures.

GA-ESI has performed the tests on a radiation monitoring system; [redacted] (Moving Filter Particulate and Gas Monitor) and [redacted] (RM2300 NIM Bin Assembly) the results of which are issued in GA-ESI report 04619048B, *RM-2000/RM-2300 EMI/RFI Qualification Report.* The equipment tested use an RM-2000 microprocessor radiation monitor and an RM-2300 Display/Control NIM Bin Assembly.

There are two major subsystems for the radiation monitors; the detection and data processing subsystem and the sample transport subsystem. The differences between the tested monitor and the monitor being qualified are described below and their qualification basis described in subsequent sections.

Business Sensitive

The detection and data processing subsystem of the tested monitor includes an RD-56B detector assembly (heated moving filter particulate monitor) and an RD-52 detector assembly (fixed volume heated gas detector) connected to an RM-2000 and RM-2300 Control/Display NIM Bin Assembly. The monitor being qualified uses the similar RD-52 detectors and an RP-30AM Radiation Analyzer enclosure. A CIJB is utilized in both monitors to connect between the radiation analyzer and customer connections to other components. Power input is provided by connection to a power line filter in the Power Control Center and to the blower motor through a motor starter and RC Network filter.

The sample transport system differs between the monitor tested and the monitor being qualified. Basically, the tested monitor transports gas and particulate samples and the monitor being qualified transports gas samples. Both monitors use a power control center, pump/motors, solenoid valves, and flow switches. Added features of the tested monitor (sample line heat trace, heated detectors, temperature controller, and paperless recorder) do not affect the qualification of the radiation monitoring system being qualified because: Business Sensitive

[redacted]

Table 5-1 and 5-2 lists the results for the tests performed to GA-ESI procedures demonstrating that the tested radiation monitoring system meets the requirements of EPRI TR-102323 Revision 3. The tested system did not exhibit any malfunction, degradation of performance, or deviation from specified indications, beyond the tolerances indicated in the individual equipment or subsystem specification, when subjected to a test signals specified in NRC Regulatory Guide 1.180 Revision 1. Changes to detector level (other than normal background variation) were limited to ±10%.

Table 5-1 Susceptibility and Immunity Test Summary

Test	Test Method	[redacted]	Compliance Status	
			Monitor	**RM-2300**
Low- Frequency Conducted Susceptibility	MIL-STD-461E Test CS101	[redacted]	**Pass**	**Pass**
High-Frequency Conducted Susceptibility	MIL-STD-461E Test CS114	[redacted]	**Pass**	**Pass**
Low-Frequency Radiated Magnetic Field Susceptibility	MIL-STD-461E Test RS101	[redacted]	**Pass**	**Pass**
High-Frequency Radiated Electric Field Susceptibility	MIL-STD-461E Test RS103	[redacted]	**Pass**	**Pass**
Surge Immunity	IEC 61000-4-5 (1995), A1(2001)	[redacted]	**Pass**	**Pass**
Electrical Fast Transient Immunity	IEC 61000-4-4 (1995) A1(2000), A2 (2001)	[redacted]	**Pass**	**Pass**
Electrostatic Immunity	IEC 61000-4-2 (1995), A1(1998), A2 (2000)	[redacted]	**Pass**	**Pass**

Business Sensitive

Business Sensitive

[redacted]

Table 5-2 Emissions Test Summary Business Sensitive

Test	Test Method	[redacted]	Compliance Status	
			Monitor	RM-2300
Low- Frequency Conducted Emissions	MIL-STD-461E Test CE101		**Pass**	**Pass**
High-Frequency Conducted Emissions	MIL-STD-461E Test CE102		**Pass**	**Pass**
Low-Frequency Radiated Magnetic Field Emissions	MIL-STD-461E Test RE101		**Pass**	**Pass**
High-Frequency Radiated Electric Field Emissions	MIL-STD-461E Test RE102		**Pass**	**Pass**

The physical arrangement of electronic/electric devices, the routing of the cabling, the techniques used for grounding are considered qualified by similarity to the tested monitor system.

5.2 RADIATION ANALYZER ENCLOSURE

Business Sensitive

The Radiation Analyzer Enclosure includes three components the qualification of which is discussed in the following subsections; an RP-30AM Radiation Analyzer, a detector preamplifier, and a 24 volt power supply. [redacted]. The Radiation Analyzer Enclosure contains other electrical components such as terminal blocks, fuses, and manual switches that are not considered significant from an EMC perspective.

The RP-30AM Radiation Analyzer [redacted] is the same RP-30AM Radiation Analyzer supplied [redacted]. The original RP-30AM's were supplied prior to issue of TVA SS E18.14.01 *Electromagnetic Interference (EMI) Testing Requirements for Electronic Devices* and, therefore, were not tested for EMI/RFI emissions or susceptibility. The RP-30AM is an analog electronic device that was superseded in the early 1980s by the digital RM-80/RM-23 radiation monitors. Since the analog radiation monitors were no longer current production there wasn't a need to perform EMC testing. The RP-30AM Radiation Analyzer being supplied is considered acceptable for the following reasons:

Business Sensitive

[redacted]

[redacted]

The detector preamplifier [redacted] is similar to the preamplifier [redacted] used on the RD-52 tested as part of the monitor described in Section 5.1. [redacted] It is considered acceptable. Business Sensitive

The Power Supply [redacted] is the same power supply used on the RM-1000 NIM Bin Assembly and tested as part of the monitor system described in GA-ESI report 04038800; *RM-1000 EMC Test Report, TVA*. The RM-1000 Radiation Monitoring Systems were given a series of susceptibility, surge, and emission tests in accordance with TVA specification SS E18.14.01 Rev 3. The RM-1000 system, including the power supply, performed satisfactorily for these tests. The power supply is considered acceptable.

5.3 CUSTOMER INTERFACE JUNCTION BOX

The RM-80/RM-23A test article did not have a CIJB, however, the results of the tests are considered acceptable. The CIJB does not contain power supplies. It does include the following items:

- Alarm relays,
- An EMI/RFI Filter, and
- Interconnecting cables between the RP-30AM and the flow switch.

The steel CIJB enclosure is the same enclosure type as the test article RM-80. It is grounded in the same manner. The cable penetrations and shield grounding are the same as the RM-80. A panel is provided for TVA to attach metal conduit and route cabling to interface with plant equipment.

The alarm relays are the same type tested as part of the RM-80 test article and have noise suppression networks included in the CIJB, further reducing conducted emissions due to being continuously energized in a fail-safe state condition. The alarm relays are considered acceptable.

The EMI/RFI filter [redacted] is a multi-pin bulkhead connector used for signal transmission between the RP-30AM and the flow switch to the alarm relays and customer connections. It has a maximum surge capability of [redacted] in the line-to-ground configuration and an attenuation of [redacted] It is the same connector used on the monitor CIJB tested and reported in Section 5.1.

Business Sensitive

The interconnecting cables are the same as the cables used for the EMI/RFI tests. They have the same shield coverage and are connected and grounded in the same manner. They are considered acceptable.

5.4 RD-52A-40D DETECTOR AND CHECKSOURCE

A detector similar to the detector used in the RD-52A-40D assembly was tested as part of the test monitor described in Section 5.1. The tested monitor uses an RD-56B detector assembly (heated moving filter particulate monitor) and an RD-52 detector assembly (fixed volume heated gas detector). The gas monitor being qualified uses an RD-52A detector assembly. The RD-56B detector assembly is more complex both mechanically and electrically than the other detectors. The detector assembly includes a stepper motor and heater that are not used on the monitor being qualified. Electrically, the detector assembly on the gas monitor being qualified is more closely associated with the RD-52 detector assembly [redacted] Both detectors are [redacted] installed in a steel enclosed, [redacted] lead shield assembly that is grounded providing protection from EMI/RFI. The cables and connectors to and from the detectors are the same and routed in a similar manner in flexible steel conduit. The signal from the detectors is input to the RP-30AM. [redacted] This is considered qualified.

Business Sensitive

A similar checksource to the one being qualified was used on the tested monitor. The detectors and the checksources are considered qualified.

5.5 POWER CONTROL CENTER

The Power Control Center (PCC) for the Gas Monitor being qualified is similar to the PCC of the PIG monitor tested as described in Section 5.1, They both contain EMI/RFI/Surge filters, switches and indicators, relays, noise suppression circuits and are housed in similar enclosures. The tested monitor is more complex than the monitor being qualified in that the tested monitor includes components to control heated detector assemblies, heat-traced sample lines which require a separate microprocessor and temperature control device, a moving filter assembly, and a paperless recorder. The arrangement of components is different between the two PCCs which is not significant.

Business Sensitive

A power line filter has been added to reduce conducted emissions and susceptibility. The filter has been used on radiation monitoring systems since 1995 and the filter has passed emission and susceptibility tests, describe in Section 5.1, on the power lines. The filter has transient reduction of more than [redacted] It meets IEEE Std C62.41 surge test at [redacted] ring wave. It is considered acceptable. The PCC is considered qualified.

Business Sensitive

5.6 SAMPLE TRANSPORT COMPONENTS

Electrically, the Gas Monitor System sample transport components are similar to the tested PIG monitor described in Section 5.1. Both contain pump motors of similar design but different voltage, electrically similar solenoid valves and flow switches. The tested monitor is more complex than the monitor being qualified in that the tested monitor includes heat-traced sample lines which require a separate microprocessor and temperature control device.

The motor powering the blower is [redacted] whereas that to the tested assembly is 120 volts AC. The 480 volt circuit includes an RC Network that is used to reduce conducted electrical noise from the motor.

The sample transport components are considered qualified.

6 REFERENCE DOCUMENTS

GA-ESI DRAWINGS

04031100	OUTLINE, GAS MONITOR SYSTEM
04031101	GAS MONITOR SYSTEM
04031110	BLOCK DIAGRAM. GAS MONITOR SYSTEM
04031120	CUSTOMER CONNECTION DIAGRAM, GAS MONITOR SYSTEM

GA-ESI DOCUMENTS

02818905-QSR	ENVIRONMENTAL QUALIFICATION SUMMARY REPORT FOR CLASS 1E EQUIPMENT FOR WATTS BAR UNITS 1 & 2
03608917-3SP	QUALIFICATION SUMMARY REPORT FOR RADIATION MONITOR REPLACEMENT PARTS
03608917-4SP	QUALIFICATION SUMMARY REPORT FOR RADIATION MONITOR REPLACEMENT PARTS
03608917-5SP	QUALIFICATION SUMMARY REPORT FOR RADIATION MONITOR REPLACEMENT PARTS
03728906-QSR	QUALIFICATION SUMMARY REPORT FOR IN DUCT GAS RADIATION MONITOR
04038800	RM-1000 EMC TEST REPORT, TVA
04038903-QSR	QUALIFICATION SUMMARY REPORT FOR WATTS BAR NUCLEAR PLANT UNIT 2 REPLACEMENT RADIATION MONITORS
04038904-QSR	QUALIFICATION SUMMARY REPORT FOR ROTRON REGENERATIVE BLOWER CLASS 1E
04498905-QSR	SEISMIC QUALIFICATION SUMMARY REPORT FOR CFE PIG MONITOR, (04491301)
04508905-QR	QUALIFICATION TEST REPORT FOR RM-1000 PROCESSOR MODULE AND CURRENT-TOFREQUENCY CONVERTER
04619036-3SP	SUPPLEMENT NUMBER 3 TO RM-2300 QUALIFICATION TEST REPORT FOR RADIATION MONITORING SYSTEMS
04619048	RM-2000/RM-2300 EMI/RFI QUALIFICATION REPORT

E-115-0459	SEISMIC QUALIFICATION SUMMARY REPORT FOR TVA RADIATION MONITORING EQUIPMENT
E-255-0968	QUALIFCATION TEST REPORT FOR CLASS 1E EQUIPMENT FOR WIDE RANGE GAS MONITORING SYSTEM
E-255-0996	QUALIFICATION TEST REPORT FOR CLASS 1E EQUIPMENT FOR GENERIC RADIATION MONITOR EQUIPMENT
E-255-1058	QUALIFICATION TEST REPORT FOR PROCESS MONITOR DETECTORS
E-255-1081	QUALIFICATION TEST REPORT FOR MAANSHAN CLASS 1E EQUIPMENT
E-255-1131	QUALIFICATION TEST REPORT FOR BEZNAU UNIT 1 AND 2 RADIATION MONITORING EQUIPMENT
E-255-1236	QUALIFICATION TEST REPORT FOR RIVER BEND RADIATION MONITORING EQUIPMENT
E-255-1335	QUALIFICATION TEST REPORT FOR RD-25A INLINE BETA DETECTOR AND RM-23A CONTROL/DISPLAY MODULE AND 2000 VOLT DC POWER SUPPLY
OP-7.3-240	SAFETY RELATED COMMERCIAL GRADE SPARE PARTS

<u>Attachment 7</u>

Redacted non-proprietary GA-ESI document 04038903-2SP, "Qualification Basis for 04031301-001 (2-RE-90-106)," Revision B (Letter Item 2, SSER Appendix HH Item Number TVA21)

REVISIONS

REV	DESCRIPTION	DATE	APPROVED
B	INCORPORATED ECN 400001917 J. HEITHAUS 12/20/2011	12/20/11 12/20/11 12-20-11	RRod J Heith E. [illegible]

Document Classification Change

[redacted]

GENERAL ATOMICS ELECTRONIC SYSTEMS

4990 GREENCRAIG LANE
SAN DIEGO, CA 92123-1675

DRAWN A.E. BUTT	DATE 1/19/2011	
CHECKED B. WILKINSON	1/19/2011	
ENGR A.E. BUTT	1/19/2011	QUALIFICATION BASIS FOR 04031301-001 (2-RE-90-106)
ENGR REV W. GRATZA	1/19/2011	
MFG ENGR ------------	--------	
PROJ MGR P. BERNER	1/19/2011	SIZE A · CAGE CODE 58307 · DRAWING NUMBER 04038903-2SP · REV B
QUAL MGR J. WINESKI	1/19/2011	
RELEASE E. CABEL	1/19/2011	DRW LEVEL 3 · SCALE NONE · SHEET 1 OF 74

GA-ESI-0258 FORM-A Rev. 11-8-11

CHANGE RECORD

Issue	Date	Description of Change
Rev. A	January 2011	Original Issue
Rev. B	December 2011	Incorporate Customer Comments

CONTENTS

TABLES

FIGURES

1. INTRODUCTION

Business Sensitive

The Qualification Basis Report for [redacted] Particulate and Gas (PG) Monitor System provides the evaluation and justification to demonstrate the environmental, seismic, Electromagnetic Compatibility (EMC), and software qualification. This report is a supplement to the principle report GA-ESI report 04038903-QSR. GA-ESI report 04038903-QSR provides the following:

• Equipment Description	Section 2.2
• Environmental Qualification Requirements	Sections 3.2 and 3.2.2
• Seismic Qualification Requirements	Section 3.3 (Required Response Spectra Figures 3-8 through 3-10 and 3-14 through 3-16)
• EMC Qualification Requirements	Section 3.4
• Software Qualification Requirements	Section 3.5
• GA-ESI's Environmental Qual Program	Section 4.2
• GA-ESI's Seismic Qual Program	Section 4.3
• GA-ESI's EMC Qual Program	Section 4.4
• GA-ESI's Software Qual Program	Section 4.5

1.1 ENGINEERING AND COMMERCIAL GRADE ITEM CHANGES THAT AFFECT QUALIFICATION

This qualification report is based on the configuration of the monitor assembly on November 24, 2010.

In addition to qualifying assemblies and components by similarity, changes made to these parts and systems are reviewed and addressed in this report as follows:

Some parts of the equipment qualified in this report have changes from those like-numbered parts that were qualified in the reports referenced in this report. All revisions and changes to parts that are Commercial Grade Items, and were qualified in the referenced qualification reports, have been evaluated and justified for qualification equivalency during the normal parts database management process. This qualification evaluation during parts database change is standard, in accordance with GA-ESI Operating Procedure OP-4.0-190. Similarly, all revisions and changes to any subassembly parts that were qualified in the referenced qualification reports have been evaluated and justified during the standard Engineering Change Notice (ECN) process, in accordance with GA-ESI Operating Procedure OP-4.0-130.

1.2 REPORT CONTENTS

This report consists of the following sections.

Section 1. INTRODUCTION. This section describes the reason for the report, its organization, identification of the radiation monitors being qualified, and a description of the contents of each section.

Section 2. ENVIRONMENTAL QUALIFICATION BASIS. This section demonstrates the environmental qualification of the equipment by similarity to equipment and components successfully tested to requirements equal to or better than the requirements for the radiation monitors being supplied.

Section 3. SEISMIC QUALIFICATION BASIS. Section 3 documents the integrity and functionality of the PG Monitor System during and after seismic events. This is accomplished by demonstrating that the Test Response Spectra (TRS) for similar equipment envelops the Required Response Spectra (RRS) for the equipment location and by analysis.

Section 4 REPLACEMENT SCHEDULE. This section provides the replacement schedule for components whose life is less than 40 years.

Section 5. ELECTROMAGNETIC COMPATIBILITY QUALIFICATION BASIS: Section 5 describes the EMC of the PG Monitor based on operating history and test of equipment similar to the equipment being supplied.

Section 6. SOFTWARE QUALIFICATION BASIS: The Software Qualification Basis section describes the history of software configuration control and testing in accordance with the requirements of a 10 CFR Part 50 Appendix A Quality Assurance program. The Verification and Validation program for the RM-80/RM-23 software has been reported in a number of reports which are identified in the section.

Section 7. REFERENCE DOCUMENTS. This section lists the GA-ESI documents and drawings referenced in the body of the report.

2. ENVIRONMENTAL QUALIFICATION BASIS

The environmental qualification of the Particulate and Gas (PG) Monitor System, [redacted], is based on previously completed qualification tests, GA-ESI design review, and manufacturers design specifications.

Business Sensitive

2.1 SERVICE CONDITIONS

The PG Monitor System consists of a PG Monitor Assembly, a local indicator, and RM-23A NIM Bin Assembly. [redacted] The PG Monitor is a RG 1.45 monitor that samples Lower Containment Compartment Atmosphere. The RM-23A NIM Bin Assembly is located in the Control Room. The service conditions for the PG Monitor Assembly and Local Indicator are given in TVA document DC-40-54 section 2.1 modified as shown below. The service conditions for RM-23A NIM Bin Assembly are given in GA-ESI report 02818905-QSR figure 3-9. These service conditions are summarized below.

[redacted]

2.2 02818905-QSR COMPONENT REVIEW

Business Sensitive

A review of the PG Monitor System list of materials was made for major assemblies that were previously qualified by GA-ESI report 02818905-QSR. The PG Monitor TVA Tag numbers were included in GA-ESI report 02818905-QSR [redacted]. [redacted] The functionality and performance of radiation monitoring remains the same. The analog radiation processor has been replaced by an RM-80/RM-23 digital radiation monitor that was not qualified in the GA-ESI report 02818905-QSR, therefore, the whole monitor system will be environmentally qualified by this report.

2.3 QUALIFICATION BASIS

Business Sensitive

This section describes the basis for the qualification of the PG Monitor System. [redacted] The PG Monitor is not required for post-accident monitoring per Table 9.0-4 of TVA NPG Design Criteria Document WB-DC-40-24 Rev 0021.

GA-ESI type tests electronic radiation monitoring assemblies that are designed and manufactured by GA-ESI to abnormal extremes to demonstrate performance over the temperature and humidity range that the assemblies may experience in service. Certain other assemblies, whose performance may be affected by extremes, designed and manufactured by GA-ESI, are also tested at temperature and humidity extremes. All other components and assemblies are selected for the generic service conditions and approved through a design review and commercial grade dedication process (in accordance with GA-ESI procedure OP-7.3-240). Performance and functionality are demonstrated by the final Acceptance Test Procedure (ATP). A certificate of compliance is provided with the accepted assembly. Components and modules [redacted] are identified in Section 4, Replacement Schedule.

Business Sensitive

The monitor assembly and local indicator located in the [redacted] respectively, have a normal radiation total dose greater than GA-ESI levels of qualification. A radiation review of each part in the assemblies is performed using TVA

Business Sensitive

RIMS report #B43'860721903 as the basis for qualifying the equipment to higher levels of radiation. The results of that review are given in Section 2.4.

Environmental Qualification Summary Table 2-1 identifies the assemblies that are qualified by test and the test article that was utilized to demonstrate that qualification. The subsequent subsections describe that testing performed for each assembly and compare the test article with the assembly being qualified.

Table 2-1 Environmental Qualification Summary Table for 04031301-001

Component	[redacted]	Test Article	Qual Report	Qual Section
PG Monitor System				
PG Monitor Assembly				
RD-59-30D Detector Assembly				
Gas Detector		02810530-001	E-255-1060	2.3.1
RD-56C Particulate Detector Assembly		03600036-002	E-255-1081	2.3.2
Particulate Detector		02810564-001	E-255-1060	2.3.2
RM-80 Microprocessor		03570122-001	E-255-996	2.3.3
RM-23 NIM Bin Assembly				
RM-23A Module		03573000-001	E-255-1335	2.3.4

2.3.1 RD-59-30D Gas Detector

Business Sensitive

The Gas Detector [redacted] is similar to the tested RD-52 Gas Detector [redacted] reported in GA-ESI report E-255-1060. The iodine detector well is empty with an end plug installed. The same Photomultiplier tube (PMT), light pipe, phosphorous, and socket assembly are used on both detectors. The detectors were given an ambient transfer calibration, an extremes test from [redacted] and a post extremes transfer calibration. [redacted]. These are considered qualified because they were able to be calibrated after the extremes temperature. The RD-59-30D detector is considered qualified.

Business Sensitive

2.3.2 RD-56C Particulate Detector Assembly and Detector

The RD-56C Particulate Monitor assembly (GA-ESI P/N 04600240-001) is an enhanced design of the assembly tested (SE P/N 03600036-002) as part of the PIG assembly (SE P/N 03691301-002) reported in SE document E-255-1081. The assemblies are considered similar as evaluated in GA-ESI report 04238926-1SP. The filter paper mechanism has been enhanced to minimize filter paper misalignment over time. A new stepper motor printed wiring assembly is being used to accommodate the new stepper motor. The PWA is considered similar to the tested PWA. The detectors are the same in both the tested assembly and the assembly being qualified.

Business Sensitive

[redacted]

The particulate detector [redacted] is similar to the tested RD-56 Particulate Detector [redacted] reported in GA-ESI report E-255-1060. The same Photomultiplier tube (PMT), light pipe, phosphorous, and socket assembly are used on both detectors. [redacted] These are considered qualified because they were able to be calibrated after the extremes temperature. The detector is considered qualified.

2.3.3 RM-80 Assembly

Business Sensitive

A similar RM-80 Assembly [redacted] to the RM-80 Assembly [redacted] being qualified, was tested to the extremes of temperature and humidity as reported in E-255-996. The RM-80 being qualified contains the same Printed Wiring Assemblies (PWAs) and subassemblies (power supplies, etc) as the tested RM-80. The PWAs and subassemblies have been changed to accommodate replacement to obsolete components. [redacted] Changes are approved by GA-ESI change review process and verified through acceptance testing.

The RM-80 test article was irradiated [redacted] and passed a functional test after irradiation. Next components with age related failure mechanisms were age conditioned to near end of life. Extremes tests were performed [redacted]. [redacted]. The RM-80 passed the performance tests. The RM-80 test article was further tested [redacted]. The RM-80 passed all performance tests. The RM-80 is considered qualified environmentally.

Business Sensitive

2.3.4 RM-23A Module Assembly

A similar RM-23 Module Assembly [redacted], to the RM-23A Assembly [redacted] being qualified, was tested to the extremes of temperature and humidity as reported in E-255-996. The RM-23 module assembly tested is essentially the same as the RM-23 module assembly being qualified. [redacted] The functions are the same and all other components are the same.

The RM-23 test article was irradiated [redacted] and passed a functional test after irradiation. Next components with age related failure mechanisms were age conditioned to near end of life. [redacted] The RM-23 passed performance tests. The RM-23 test article was further tested [redacted]. The RM-23 passed all performance tests. The module assemblies are considered similar and the RM-23A is considered qualified.

Business Sensitive

2.4 HIGH RADIATION REVIEW

The Total Integrated Dose (TID) that the radiation monitor system located in the plant is above the GA-ESI rating for the equipment. [redacted]. TVA report B43'860721903, *A Review of Electronic Components in a Radiation Environment of ≤ 5X10^4 RADS,* states that all type of electronic components and materials are acceptable to 5 x 10^4 RADS with the exception of the following: Business Sensitive

- [redacted]

[redacted]

It should be noted that radiation monitoring systems include sample transport components. The TVA report describes materials that are generally used in these applications and as such the discussion in the TVA report can be applied to the sample transport components as well.

A review of the radiation monitor system parts of those assemblies located in the high radiation area was made to identify MOS devices and PIN diodes for further evaluation. Since Fluorocarbons' threshold of damage is above the expected radiation level, they are not included in the review. The results of that review and evaluation are provided below.

[redacted]

3. SEISMIC QUALIFICATION BASIS

This section describes the seismic qualification of the Particulate and Gas (PG) Monitor System, [redacted] based on previously completed seismic tests and analysis.

Business Sensitive

3.1 SEISMIC REQUIREMENTS

The PG Monitor System is safety related and seismic category I and is required to operate during and after an earthquake. For qualification by random bi-axial or tri-axial testing [redacted] damping is used to ensure that the Test Response Spectra envelopes the Required Response Spectra. For analysis the ZPA and peak acceleration values are based on [redacted] damping.

3.1.1 Plant Equipment Seismic Requirements

The Required Response Spectra (RRS) for the seismic qualification of the PG Monitor plant equipment located in the Auxiliary Building is taken at the 737 foot level are found in GA-ESI document 04038903-QSR, Figures 3-8 through 3-10. The ARS curves for PG Monitor Assembly, located at the 737 foot level of the Auxiliary Building, envelope the ARS curves for the Local Indicator, located at the 713 foot level of the Auxiliary Building. The values are given in Table 3-1.

Table 3-1 Required Acceleration Values for PG Monitor Plant Equipment

Parameter	Vertical	North-South	East-West
Testing (5% Damping)			
Zero Period Acceleration (ZPA) – g's	0.21	0.51	0.60
Peak Acceleration – g's	0.90	2.5	3.8
Analysis (3% Damping)			
Zero Period Acceleration – g's	0.21	0.51	0.60
Peak Acceleration – g's	1.20	3.5	5.2

For comparison of the Test Response Spectra (TRS) with the Required Response Spectra (RRS) a simplified RRS curve is constructed using the information given in GA-ESI document 04038903-QSR Figures 3-8, 3-9, 3-10 and Table 3-1, as follows.

- **Vertical:** The spectrum given in GA-ESI document 04038903-QSR Figure 3-8 is broadened and simplified to envelope the RRS shown in that figure. The vertical RRS is shown in Figure 3-1.
- **Horizontal:** Since the orientation of the equipment is not known, the spectra given in GA-ESI document 04038903-QSR Figures 3-9 and 3-10 are combined, broadened, and simplified to envelope a combined east-west and north-south RRS. The horizontal RRS is shown in Figure 3-2.

[redacted]

Business Sensitive

[redacted]

Business Sensitive

3.1.2 Seismic Requirements for Control Room Equipment and Devices

The requirements for the seismic qualification of the PG Monitor equipment located in the control room floor and walls (ARS) are found in GA-ESI document 04038903-QSR, Figures 3-14, 3-15, and 3-16. The ZPA and peak acceleration values for ARS are given in Table 3-3.

[redacted]

Business Sensitive

[redacted]

[redacted]

3.2 COMPONENT REVIEW

Business Sensitive

A review of the PG Monitor System list of materials was made for major assemblies that were previously qualified by GA-ESI report E-115-459. The original assembly for this application was qualified as part of GA-ESI report E-115-459, however, the monitor has been redesigned to use the latest technology and enhancements. The motor starters are qualified by GA-ESI report E-115-459 and their qualification basis will not be duplicated in this report. This qualification basis is for the rest of the PG Monitor that has not been qualified by GA-ESI report E-115-459.

3.3 QUALIFICATION BASIS

This section describes the basis for the seismic qualification of the PG Monitor System. The monitor system is qualified as seismic Category I and is expected to be functional during and after a seismic event. Therefore, the monitor is qualified for structural integrity as well as functionality.

GA-ESI seismically qualifies radiation monitoring systems structurally by test and by analysis. Components and assemblies that are tested are tested functionally as well as ensuring the seismic adequacy of the structure. GA-ESI has tested the radiation monitoring systems using sine-beat, bi-axial, and tri-axial seismic test methods. Conservative analysis is performed for certain components and structural elements that have not been tested. The methods used are described as part of the analysis and generally meet the program describe in GA-ESI document 04038903-QSR.

The Seismic Qualification Summary Table 3-6 identifies the assemblies that are qualified by test or analysis. The test article that was utilized to demonstrate qualification is provided as well as the test report. The subsequent subsections describe the testing or analysis for each assembly and compare the test article or the structure analyzed with the assembly being qualified.

Table 3-6 Seismic Qualification Summary Table for GA-ESI P/N 04031301-001

Component	[redacted]	Test Component	Test Article	Qual Report	Qual Section
PG Monitor System					
PG Monitor Assembly					
Skid Plate Assembly		03606017-001	03691301-002	E-255-1081	3.3.1
RD-59-30D Detector Assembly		See note	03691301-002	E-255-1081	3.3.2
RD-56C Detector Assembly		03600036-002	03691301-002	E-255-1081 04238926-1SP	3.3.3
RM-80 Microprocessor		03570122-001	03570122-001	E-255-996	3.3.4
Power Control Center		03662501-001	03662001-001	E-255-968	3.3.5
EMI/RFI Filter Assembly		50001533-001	03691301-002	E-255-1081	3.3.5.1
EMI/RFI Filter & Surge Suppressor		50016149-001	03651201-001	03608917-3SP	3.3.5.2
Relay		50009952-001	03665001-001	E-255-968	3.3.5.3
Customer Interface Junction Box		03584015-002	03663001-001	E-255-968	3.3.6
Isolation Transmitter		50009089-001	03663001-001	E-255-968	3.3.6.1
Relay		**50000245-001**	**03662001-001**	E-255-968	3.3.6.2
Sample Transport Components		Various	03662001-001	E-255-968	3.3.7
Blower				04038904-QSR	3.3.7.1
Motor Starter				E-115-459 04038903-2SP	3.3.7.2
Motor Starter				E-115-459	3.3.7.3
RC Network Assembly				04038903-2SP	3.3.7.4
Solenoid Valve		03600630-001	03662001-001	E-255-968 03608917-4SP	3.3.7.5
Motor Operated Valve Assemblies		50011413-001	03691301-002	E-255-1081 03608917-5SP	3.3.7.6
Vacuum Transducer Assembly				04038903-2SP	3.3.7.7

Component	[redacted]	Test Component	Test Article	Qual Report	Qual Section
Vacuum Transducer Sensor				04038903-2SP	3.3.7.7
Mass Flow Meter		03600630-001	03691301-002	E-255-1081 04038903-2SP	3.3.7.8
Flow Switch		03600210-004	03862101-001	E-255-1236 04038903-1SP	3.3.7.9
RM-23 NIM Bin Assembly					**3.3.8**
RM-23 NIM Bin		NIM Bin		04508905-QR	3.3.8.1
RM-23A Module		RM-23		E-255-996	3.3.8.2
Supervisor Switch Assembly				04508905-QR	3.3.8.3
Supervisor Switch		50008921-001	03664001-001	E-255-968	3.3.8.3
24 volt Power Supply Assembly				04038903-7SP Analysis	3.3.8.4
24 volt Power Supply		04502005-001	04500801-001	04508905-QR	3.3.8.4
8 volt Power Supply		04702120-001	04702120-001	E-255-968-6SP	3.3.8.5
Local Indicator Assembly		**03570300-003**	**03570300-003**	**E-255-996**	**3.3.9**
Relay		50008990-001	03570300-003	E-255-996	3.3.9

Business Sensitive

The PG Monitor System [redacted] is qualified for seismic functionality and structural integrity by test and analyses of similar components discussed in the following subsections.

3.3.1 Skid Plate Assembly

The Skid Plate Assembly [redacted] is designed to accommodate the components of the TVA PG Monitor Assembly. It is similar to the base and frame of a PIG monitor assembly [redacted] tested and reported in GA-ESI report E-255-1081 with some notable additions. The base of the TVA PG Monitor Assembly has been extended [redacted] the width remaining the same. To accommodate the extension a fourth channel support has been added and [redacted]

[redacted] Business Sensitive

The main portion of the frame on the TVA PG Monitor Assembly is essentially same as the frame of the PIG monitor tested. [redacted] Business Sensitive

The seismic tests were bi-axial with the test article attached rigidly to the shake table with [redacted] bolts. There wasn't any amplification between the shake table and the mounting location. [redacted] The same resonances and amplifications would be expected on the TVA PG Monitor. The test article was given five Operating Basis Earthquake (OBE) tests and one Safe Shutdown Earthquake (SSE) test then rotated 90° and the test sequence repeated. Figures 3-4 and 3-5 shows the accelerometer response at the top of the detector, mounted rigidly to the skid base, and identifies the 5% damping Test Response Spectra (TRS). The test article remained intact throughout the testing. As can be seen the TRS envelopes the RRS and the frame is considered qualified.

[redacted]

[redacted]

3.3.2 RD-59-30D Detector Assembly

Business Sensitive

The RD-59-30D Detector Assembly [redacted] is the same RD-59-30D Detector Assembly used on the PIG Monitor [redacted] tested and reported in GA-ESI report E-255-1081, except the iodine detector has been eliminated in the TVA PG Monitor and a plug seals the iodine detector well. The RD-59-30D assembly was not given an assembly number in the test article. Rather a number of components and parts were assembled as part of the top assembly. These components and parts are the same as the item being qualified.

The seismic tests performed are described in Section 3.3.1 and the TRS is compared to the RRS in Figures 3-4 and 3-5. The monitor assembly was functionally tested before and after the seismic testing and the detector operation monitored before, during, and after the each seismic test. The monitor and the detector functioned within specification requirements. The RD-59-30D Detector Assembly is considered qualified.

3.3.3 RD-56C Particulate Detector Assembly

Business Sensitive

The RD-56C Particulate Detector Assembly [redacted] is an enhanced design of the RD-56 Particulate Detector [redacted] tested as part of the PIG Monitor [redacted] reported in GA-ESI report E-255-1081. A similarity analysis and the qualification of the enhanced design are fully described in GA-ESI report 04238926-1SP.

The seismic tests performed on the original RD-56 are described in Section 3.3.1 and the TRS is compared to the RRS in Figures 3-4 and 3-5. The monitor assembly was functionally tested before and after the seismic testing and the detector operation monitored before, during, and after the each seismic test. The monitor and the detector functioned within specification requirements. The RD-56C Detector Assembly is considered qualified.

3.3.4 RM-80 Microprocessor

An RM-80 Assembly [redacted] similar to the RM-80 Assembly [redacted] being qualified, was tested seismically as described in GA-ESI report E-255-996. The RM-80 being qualified is enhanced by a number of changes to the printed wiring assemblies and the power supplies. These changes have been reviewed as part of the

Engineering Change Process described in the Section 1.1. The components are considered similar. The relays used in the RM-80 being qualified are the same as those tested.

The seismic tests were bi-axial with the test article attached to a rigid test fixture in the same configuration as the unit being qualified would be in the field. There wasn't any amplification between the shake table and the mounting location of the RM-80 Assembly. The test article was given six Safe Shutdown Earthquake (SSE) test then rotated 90° and the test sequence repeated. [redacted] Figures 3-6 and 3-7 show the RM-80 Assembly the Test Response Spectra (TRS). The TRS takes into consideration the amplification of the frame at the mounting location of the RM-80. The RM-80 was functionally tested before and after the seismic tests. During the tests the activity was recorded and the alarm relays were monitored for chatter. The RM-80 performed within specification tolerances without relay chatter. The RM-80 Assembly remained intact throughout the testing and is considered qualified.

Business Sensitive

[redacted]

[redacted]

3.3.5 Power Control Center

Business Sensitive

The Power Control Center (PCC) [redacted] is similar to the power control center [redacted] tested as part of the Wide Range Gas Monitor (WRGM) Detection Skid [redacted] reported in GA-ESI test report E-255-968. The size, material, and weight of the enclosure supplied are approximately the same as the test article. [redacted] Internally, the components are similar except for the addition of EMI/RFI filters and arrangement variations in internal components. The relays used in the PCC are the same as those used on the original TVA PG Monitor. These are discussed in subsequent subsections.

The WRGM detection skid's seismic tests were bi-axial with the test article attached rigidly to the shake table in the same configuration as the unit being qualified would be in the field. There wasn't any amplification between the shake table and the mounting location. The test article passed a functional test before seismic testing. The test article was given five Operating Basis Earthquake (OBE) tests and one Safe Shutdown Earthquake (SSE) test then rotated 90° and the test sequence repeated. Figures 3-8 and 3-9 show the control accelerometers response and identify the [redacted] damping Test Response Spectra (TRS). The acceleration levels at the Power Control Center mounting location was greater than the amplification [redacted] that would be experienced on the frame of the monitor being qualified. The test article remained intact and operational throughout the testing and passed a functional test after the seismic testing. The PCC is considered qualified.

3.3.5.1 EMI/RFI Filter

The EMI/RFI Filter [redacted] has been added to reduce electrical noise associated with the blower. [redacted]. [redacted] and neutral conductors are passed through the conduit fitting. [redacted]

[redacted]

[redacted] The EMI/RFI Filter is considered qualified.

[redacted]

[redacted]

3.3.5.2 *EMI/RFI Filter and Surge Suppressor* Business Sensitive

The EMI/RFI Filter/Surge Suppressor [redacted] has been added to the PCC to reduce noise. This device does not have age related seismic failure mechanisms. The operating range specified by the manufacturer is greater than the required operating range. The parts associated with the EMI/RFI Filter/Surge Suppressor are safety qualified per GA-ESI document 03608917-3SP.

[redacted]

[redacted]

[redacted]

3.3.5.3 Relays

Business Sensitive

The relays used in the PCC are Potter-Brumfield relays [redacted] are the same relays tested as part of the Stack Selector Assembly (03665001-001) reported in GA-ESI test report E-255-968. The test relays were age conditioned prior to seismic testing [redacted] under simulated circuit load conditions. The relays were mounted in the Stack Selector enclosure in the same way as those being qualified for use in the PCC. The stack Selector Assembly was functionally tested prior to seismic testing. The WRGM equipment was given 5 OBE biaxial tests and 1 SSE biaxial test then rotated 90º and given 5 OBE biaxial tests and 1 SSE test. Figures 3-8 and 3-9 show that the TRS envelopes the RRS. The relays functioned properly during the seismic testing and the Stack Selector was given a functional test after the seismic tests. The relay is considered qualified.

3.3.6 Customer Interface Junction Box

Business Sensitive

The Customer Interface Junction Box (CIJB) is similar to the CIJB [redacted] tested as part of the WRGM RM-80/CIJB Assembly [redacted] reported in GA-ESI test report E-255-968. The size, material, and weight of the enclosure supplied are approximately the same as the test article. [redacted] With the exception of the EMI/RFI Filter the rest of the differences are not seismically significant.

The seismic tests performed are described in Section 3.3.5 and the TRS is compared to the RRS in Figures 3-8 and 3-9. The CIJB is considered qualified.

3.3.6.1 Isolation Transmitter

Business Sensitive

The isolation transmitter [redacted] is qualified in GA-ESI report E-255-968-4SP and is an upgraded version of those tested and reported in E-255-968. [redacted] The manufacturer, basic model number and configuration are similar. They are a rugged design with no active mechanisms.

The seismic tests performed are described in Section 3.3.5 and the TRS is compared to the RRS in Figures 3-8 and 3-9. The isolation transmitters are considered qualified.

Business Sensitive

3.3.6.2 Relay

Business Sensitive

This is a [redacted] relay [redacted] ested as part of the WRGM Detection Skid (03662001-001) reported in GA-ESI test report E-255-968. The test relays were age conditioned prior to seismic testing [redacted] under simulated circuit load conditions. The relays were mounted in the Detection Skid enclosure in the same way as those being qualified for use in the CIJB. The Detection Skid was functionally tested prior to seismic testing. [redacted] Figures 3-8 and 3-9 show that the TRS envelopes the RRS. The relays functioned properly during the seismic testing and the Detection Skid was given a functional test after the seismic tests. The relay is considered qualified.

3.3.7 Sample Transport Components

The Sample Transport Components include piping, fittings, manual valves, solenoid valves, gages, a flow switch, a check valve, and brackets to attach the piping to the PG monitor frame are similar to the sample transport components as part of the WRGM Detection Skid [redacted] reported in GA-ESI test report E-255-968. The qualifications of the active components are discussed in the following subsections.

The seismic tests performed are described in Section 3.3.5 and the TRS is compared to the RRS in Figures 3-8 and 3-9. The test article remained intact throughout the testing and sample transport components are considered qualified.

3.3.7.1 Blower

Business Sensitive

The blower [redacted] is seismically qualified by GA-ESI report 04038904-QSR specifically for this Gas Monitor. Refer to the report for qualification details.

3.3.7.2 Motor Starter

The starter [redacted] is utilized as pump motor starter in series with the Motor Starter (disconnect switch) described in Section 3.3.7.3. The Starter is similar to a motor starter [redacted] tested on a TVA Liquid Monitor and reported in E-115-459. [redacted]. [redacted]

Business Sensitive

[redacted] The manufacturer and model series are the same and the NEMA size is 00 for the tested starter and 0 for the starter being qualified

The seismic testing levels of the Liquid Monitor floor were lower than the required ZPA levels for the location of the PG monitor assembly [redacted] Therefore, additional seismic evaluation is necessary in order to demonstrate seismic qualification. The motor starter that was tested is a smaller version of the motor starter being qualified. [redacted]

[redacted]

Business Sensitive

The motor starter enclosure and molded casing are considered seismically rugged. This is demonstrated by the results of testing a manual motor starter [redacted] on the Gas Monitor reported in E-115-459. [redacted] The enclousure and molded case are similar to the ensclosure and molded case of the motor starter being qualified. This can be seen in the figure below. [redacted]

Business Sensitive

[redacted]

[redacted]

[redacted]. Business Sensitive

In the case of the [redacted], the making of the power circuit is done magnetically. [redacted]

Business Sensitive

[redacted]

Business Sensitive

3.3.7.3 *Motor Starter*

Business Sensitive

The motor starter [redacted] is the same motor starter as used on the Gas Monitor tested and reported in GA-ESI report E-115-459. Refer to that report for its qualification basis. [redacted]. The motor starter performed satisfactorily during and after the testing. [redacted] The motor starter is considered qualified.

3.3.7.4 *RC Network Assembly*

The RC Network Assembly [redacted] consists of an enclosure that houses two RC Networks. The RC Network [redacted] is a three-phase [redacted] device used for electronics protection from conducted electrical noise generated in the blower motor. [redacted] The RC Network is considered a lump mass attached to an enclosure panel. The enclosure is similar to enclosures tested as part of the WRGM Detection Skid [redacted] reported in GA-ESI test report E-255-968, described in Section 3.3.6. The RC Network is analyzed below the result of which demonstrate that the attachment is adequate. The RC Network is considered qualified.

Business Sensitive

[redacted]

[redacted]

[redacted]

Business Sensitive

3.3.7.5 *Solenoid Valve*

The solenoid valve [redacted] is similar to the solenoid valve [redacted] that was qualified as part of the WRGM detection skid reported in GA-ESI document E-115-968. Per the GA-ESI document E-115-968, [redacted] The solenoid valves were assembled to the detection skid and given performance tests. These new valves are qualified by similarity per qualification report GA-ESI document 03608917-4SP. The seismic tests performed are described in Section 3.3.5 and the TRS is compared to the RRS in Figures 3-8 and 3-9. The solenoid valves remained intact and functional before, during, and after testing and are considered qualified.

3.3.7.6 Motor Operated Valves

Business Sensitive

The motor operated valve actuators [redacted] are similar to the actuator [redacted] that was qualified as part of the PIG monitor reported in GA-ESI document E-255-1081. [redacted] It was then assembled to the PIG monitor [redacted] and given performance and seismic tests. Two varistors [redacted] are added to a terminal block inside the motor drive housing. These new motor operated valves with varistors are qualified by similarity per qualification report GA-ESI document 03608917-5SP.

The PIG Monitor's seismic tests were bi-axial with the test article attached rigidly to the shake table. There wasn't any amplification between the shake table and the mounting location. The test article passed a functional test before seismic testing. The test article was given five Operating Basis Earthquake (OBE) tests and one Safe Shutdown Earthquake (SSE) test then rotated 90° and the test sequence repeated. Figures 3-4 and 3-5 show the accelerometer responses on PIG detector rigidly attached to the skid base and identify the [redacted] damping Test Response Spectra (TRS). The test article remained intact and the motor actuator remained operational throughout the testing and passed a functional test after the seismic testing. The actuator is considered qualified.

3.3.7.7 Vacuum Transducer

Business Sensitive

The vacuum transducer assembly consists of vacuum transducer [redacted] mounted inside a NEMA 12 metal enclosure [redacted] The vacuum transducer and the transducer assembly have not been seismically tested by GA-ESI. Qualification of the assembly is based on vendor information, analysis of the enclosure attachment, and engineering judgment.

[redacted]

assembly reported in GA-ESI report E-255-1081 for GA-ESI P/N 03691301-002. Figures 3-4 and 3-5 show that the TRS envelopes the RRS. The pipe fitting is considered qualified. The [redacted] construction of the enclosure wall will readily restrain the light weight [redacted] transducer for this application. The transducer is considered qualified.

[redacted]. The attachment is analyzed below. The stresses on the screw are within the TVA allowables and the attachment is considered qualified. Business Sensitive

[redacted]

[redacted]

[redacted]

[redacted]

Business Sensitive

3.3.7.8 Mass Flow Meter

The mass flow meter [redacted] is a rugged gas flow meter utilizing a principle of measuring the differential pressure across laminar plates which is linearly proportional to the flow rate. [redacted] The piping fittings are similar to the fitting found on other sample transport components. The mass flow meter has not been seismically tested; however, it is mounted in the same manner with the same piping fittings and has approximately the same mass as solenoid operated valves that have been tested on the PIG monitor [redacted] reported in E-255-1081. The TRS envelopes the RRS for the test article as shown in Figures 3-4 and 3-5. Since it is rugged construction with no moving parts it is considered qualified.

Business Sensitive

3.3.7.9 *Flow Switch*

The new flow switch assembly [redacted] is qualified seismically and environmentally in 04038903-1SP. The new flow switch [redacted] replaces the tested flow switch [redacted] that was part of the Liquid Monitor [redacted] qualified in GA-ESI report E-255-1236. Both switches are similar in many aspects even though they are manufactured by different companies and use different technologies. Both switches are designed to measure any fluid flow whether liquid or a gas and both have rugged housings design to be capable of withstanding high [redacted]. [redacted] The temperature differential is greatest at no flow and decreases as flow increases. This allows use in applications requiring a simple flow/no flow detection and for switch-points at a predetermined flow rate.

[redacted]

3.3.8 Control/Display NIM Bin Assembly

Business Sensitive

The Control/Display NIM Bin Assembly [redacted] consists of a NIM Bin with an RM-23A, a Supervisor Switch Assembly, and power supplies. The following subsections describe the seismic structural integrity and functional performance of these components.

3.3.8.1 *RM-23A NIM Bin Assembly*

A NIM Bin Assembly containing one RM-1000 and one Current-to-Frequency Converter Module was mounted in a frame testing fixture and given a seismic test as described in GA-ESI report

04508905-QR. The RM-1000 NIM Bin Assembly is structurally the same as the RM-23A NIM Bin assembly. The RM-1000 NIM Bin Assembly was subjected to 26 biaxial Operating Basis Earthquakes (OBE) and 9 biaxial Safe Shutdown Earthquakes (SSE). Fourteen OBEs were run in the X-Y plane and 12 in the Z-Y plane. Five SSEs were run in the X-Y plane and 4 in the Z-Y plane. Figures 3-14 and 3-15 shows the NIM Bin Assembly response and compares the Test Response Spectra (TRS) with the TVA document CEB-SS-5.10 R3 Figure 3.1 generic Required Response Spectra (RRS) for the final SSE. The NIM Bin Assembly remained intact throughout the testing.. The TRS does envelopes the generic RRS and is considered qualified.

3.3.8.2 RM-23A Module

Business Sensitive

An RM-23 Module was seismically tested as part of the generic qualification of Radiation Monitoring Equipment reported in GA-ESI report E-255-996. The RM-23A Module is similar to the RM-23 Module tested. [redacted]

The RM-23 module was mounted in a NIM Bin Assembly which in turn was installed in a shake table test frame. The RM-23 was electrically connected through an communications isolations device to a process RM-80 which was monitoring a radioactive source during the seismic testing. The RM-23 was given a functional test prior to start of testing. A sine sweep resonance search was performed [redacted] No resonances were found. The RM-23 was given 5 OBEs and 1 SSE then rotated 90° and given 5 OBEs and 1 SSE to one set of RRS. The RM-23 passed a functional test after the seismic testing and performed satisfactorily during the testing. The RM-23 was then given a second higher seismic test repeating the same number of OBEs and SSEs as the first set of tests. The RM-23 performed satisfactorily during and after the second set of testing. The TRS of the final SSE for the second set of test is shown in Figures 3-10 and 3-11. The RRS shown in these figures is the generic TVA RRS. The tests do not completely envelope the RRS and, therefore, cannot be considered qualified for all locations in Watts Bar Unit 2. TVA should evaluate the results to determine whether the RM-23 is qualified for the location of use.

[redacted]

[redacted]

3.3.8.3 Supervisor Switch Assembly Business Sensitive

The Supervisor Switch Assembly [redacted] consists of a metal face plate, a terminal block, and a supervisor switch. The face plate is the same size as the Current-to-Frequency Converter face plate and attached in the same manner to the NIM Bin Assembly. [redacted] The differences are not considered significant and the face plate is considered qualified as described in Section 3.3.8.1 and Figures 3-14 and 3-15.

The terminal block is the same as that that used in the Current-to-Frequency Converter and is considered qualified by Section 3.3.8.1 and Figures 3-14 and 3-15.

The Supervisor Switch [redacted] is the same switch used on the Control Room Equipment (GA-ESI P/N 03664001-001) seismically tested and reported in GA-ESI report E-255-968. The test article was given 7 OBE and 1 SSE tests and then rotated 90° and given 6 OBE and 1 SSE tests. The supervisor switch performed satisfactorily during and after all these tests. The TRS for the SSE test is shown in Figures 3-12 and 3-13. The TRS does not envelope the TVA generic RRS, therefore, cannot be considered qualified for all locations [redacted] TVA should evaluate the results to determine whether the Supervisor Switch is qualified for the location of use.

[redacted]

[redacted]

Business Sensitive

3.3.8.4 24 Volt Power Supply Assembly Business Sensitive

The Power Supply Assembly [redacted] and its associated bracket [redacted] are analyzed in GA-ESI document 04038903-7SP, Appendix A. The analyses are based on GA-ESI generic seismic RRS to allow the use of the analysis for any customer using GA-ESI acceptance criteria. The results are also compared to TVA acceptance criteria.

The analyses show that the stress levels of the bracket assembly are within the allowable stresses for both the GA-ESI generic and TVA specific cases. The power supply bracket is considered seismically adequate and qualified.

Business Sensitive

The 24 Volt Power Supply [redacted] is attached to the of the NIM Bin Assembly and provides power to the relays. The power supply is a replacement power supply for the originally tested power supply [redacted] GA-ESI document 04508905-QR demonstrates that the replacement power supply is similar to the test article, since they are by the same manufacturer and model series. The replacement power supply has a higher current rating and, therefore, slightly heavier. The Technical Evaluation further demonstrates that the slightly greater weight does not affect the seismic qualification.

The original power supply (test article) parts that had age related failure mechanisms (aluminum electrolytic capacitors, transformer, coils, and wire) were age conditioned as described in GA-ESI document 04508905-QR. The age conditioned parts were then assembled into the two power supplies that were mounted on the rear of the NIM Bin Assembly and provided power to the RM-1000 processor modules being qualified in that report. The RM-1000 NIM Bin Assembly with the power supply attached was subjected to 26 biaxial Operating Basis Earthquakes (OBE) and 9 biaxial Safe Shutdown Earthquakes (SSE). Fourteen OBEs were run in the X-Y plane and 12 in the Z-Y plane. Five SSEs were run in the X-Y plane and 4 in the Z-Y plane. The Test Response Spectra (TRS) for a typical SSE in the X-Y plane are shown in Figures 3-14 and 3-15. The low voltage power supply met all performance requirements before, during, and after these tests and is considered seismically qualified.

[redacted]

[redacted]

3.3.8.5 8 Volt Power Supply Assembly

The Power Supply Assembly consists of a power supply [redacted] mounted to a plate [redacted] that in-turn is mounted on the back of the NIM Bin Assembly. The Power Supply Assembly is qualified by analysis GA-ESI documents E-255-968 Supplement 6. [redacted] The attachment is considered qualified.

Business Sensitive

3.3.9 Local Indicator

The Local Indicator [redacted] is similar to the RL-10 Local Indicators [redacted] seismically tested and reported in GA-ESI document E-255-996. The test article is larger than the local indicators being qualified but it contains all the same components. Both the test article and the Local Indicators being qualified are mounted with four [redacted] bolts The test article measures [redacted] whereas the local indicators being qualified measure [redacted]. The RL-10 Local Indicator test article was subjected to 7 biaxial Safe Shutdown Earthquakes (SSE); then rotated 90° and given 7 biaxial SSE. The Test Response Spectra (TRS) for a typical SSE are shown in Figures 3-6 and 3-7. The RL-10 Local Indicator and its mounting hardware successfully passed this testing. The Local Indicators are considered qualified.

4. REPLACEMENT SCHEDULE

The replacement schedule for components that contain parts with aging mechanisms is provided in this section. The replacement schedules provided in Table 4-1 are based on an [redacted]verage ambient temperature. Lifetime for components in enclosures include an [redacted] temperature rise. A dash entry indicates a higher-level assembly that does not require replacement but contains the component to be replaced. The individual components to be replaced are listed with a qualified life in years.

Business Sensitive **Table 4-1 PG Monitor Replacement Schedule**

Component	[redacted]	**Life @ 86°F Years**	**Notes**
PG Monitor System		---	
PG Monitor Assembly		---	
RD-59-30D Detector Assembly		--	
Gas Detector		SUR	2
RD-56C Detector Assembly		---	
Particulate Detector		SUR	2
Stepper Motor PWA		10	1
RM-80 Assembly		---	
Low Voltage Power Supply		10	1
Heat Sink Assembly		---	
5 Volt Logic Power Supply		10	1
Battery Assembly		5	
Display Cable Assembly		30	
High Voltage Power Supply		10	1
CPU PWA		SUR	4
Customer Interface Junction Box		---	
CIJB Backplane PWA		---	
Isolation Transmitter		10	1

Component	[redacted]	Life @ 86°F Years	Notes
Blower/Motor Assembly		6.2	3
Housing Gasket		26	
Motor (Bearings)		7.5	
Motor (Windings)		20	
Blower Moving Parts		15	
Piping and Valve Assemblies		---	
Flow Switch		10	1
NIM Bin Assembly		---	
24 Volt Power Supply		10	1
8 Volt Power Supply		10	1

[redacted]

5. EMC QUALIFICATION BASIS Business Sensitive

This section demonstrates that Particulate and Gas (PG) Monitor System [redacted] is Electromagnetic Compatibility (EMC) qualified for operation at [redacted] The EMC qualification basis is established by demonstrating that GA-ESI's EMC qualification tests on the radiation monitoring systems meets the requirements for replacement radiation monitors and the significant differences between the radiation monitor system being qualified and the radiation monitor systems tested are reconciled.

The PG Monitor System consists of three electrically connected subsystems; a PG Monitor Assembly, a Gas Channel Local Indicator Assembly, and a Control/Display NIM Bin Assembly. The Block Diagram [redacted] shows the major components of the system as well as their electrical interconnections. The following subsections describe the EMC Qualification Basis for the system as a whole and each of the subsystems.

5.1 MONITOR SYSTEM QUALIFICATION BASIS

The monitor system uses the latest technology and components developed and tested to ensure Electromagnetic Compatibility. Filters, surge protection, and noise suppressors have been added to power input circuits and components that could generate noise, such as relays. Tests have been conducted individually, using the latest standards available at the time, on the microprocessor based radiation monitors and their associated detector and control/display units. Test on skid mounted radiation monitors consisting of components found in most radiation monitors have been conducted and the knowledge gained has been utilized in the design and manufacture of the PG Monitor System. The electrical distribution cable and the instrument cable routing are similar in design and materials; [redacted]. All cabling is contained in metallic conduit and metal enclosures. Business Sensitive

GA-ESI has performed the tests on a radiation monitoring system; [redacted] (Moving Filter Particulate and Gas Monitor) and [redacted] (RM2300 NIM Bin Assembly) the results of which are issued in GA-ESI report number 04619048B, *RM-2000/RM-2300 EMI/RFI Qualification Report*. The equipment tested use an RM-2000 microprocessor radiation monitor and an RM-2300 Display/Control NIM Bin Assembly.

There are two major subsystems for the radiation monitors; the detection and data processing subsystem and the sample transport subsystem. The differences between the tested monitor and the monitor being qualified are described below and their qualification basis described in subsequent sections.

The detection and data processing subsystem of the tested monitor includes an RD-56B detector assembly (heated moving filter particulate monitor) and an RD-52 detector assembly (fixed volume heated gas detector) connected to an RM-2000 and RM-2300 Control/Display NIM Bin Assembly. The monitor being qualified uses an RD-59 Detector Assembly consisting of gas detector and an RD-56C moving filter particulate monitor. An RM-80 microprocessor assembly is used in the monitor being qualified as opposed to the RM-2000 of the test article. A CIJB is utilized in both monitors to connect between the radiation microprocessor and customer connections to other components. In both the test article and the monitor being qualified, power input is provided by connection to a power line filter in the Power Control Center and to the blower motor through a motor starter and RC Network filter. An RM-23A NIM Bin assembly is used on the PG Monitor System whereas the tested system uses an RM-2300 NIM Bin Assembly. A local indicator assembly for the gas channel has been added to the PG Monitor System; one is not included in the test system.

The sample transport system differs slightly between the monitor test and the monitor being qualified. Both the tested monitor and the monitor being qualified transport gas and particulate samples. Both monitors use a power control center, pump/motors, solenoid valves, and flow switches. Added features of the tested monitor (sample line heat trace, heated detectors, temperature controller, and paperless recorder) do not affect the qualification of the radiation monitoring system being qualified because: Business Sensitive

[redacted]

Table 5-1 and 5-2 lists the results for the tests performed to GA-ESI procedures demonstrating that the tested radiation monitoring system meets the requirements of EPRI TR-102323 Revision 3. The tested system did not exhibit any malfunction, degradation of performance, or deviation from specified indications, beyond the tolerances indicated in the individual equipment or subsystem specification, when subjected to a test signals specified in NRC Regulatory Guide 1.180 Revision 1. Changes to detector level (other than normal background variation) were limited to ±10%.

Table 5-1 Susceptibility and Immunity Test Summary

Test	Test Method	[redacted]	Compliance Status	
			Monitor	**RM-2300**
Low- Frequency Conducted Susceptibility	MIL-STD-461E Test CS101		**Pass**	**Pass**
High-Frequency Conducted Susceptibility	MIL-STD-461E Test CS114		**Pass**	**Pass**
Low-Frequency Radiated Magnetic Field Susceptibility	MIL-STD-461E Test RS101		**Pass**	**Pass**
High-Frequency Radiated Electric Field Susceptibility	MIL-STD-461E Test RS103		**Pass**	**Pass**
Surge Immunity	IEC 61000-4-5 (1995), A1(2001)		**Pass**	**Pass**
Electrical Fast Transient Immunity	IEC 61000-4-4 (1995) A1(2000), A2 (2001)		**Pass**	**Pass**
Electrostatic Immunity	IEC 61000-4-2 (1995), A1(1998), A2 (2000)		**Pass**	**Pass**

Business Sensitive

Table 5-2 Emissions Test Summary Business Sensitive

Test	Test Method	[redacted]	Compliance Status	
			Monitor	RM-2300
Low- Frequency Conducted Emissions	MIL-STD-461E Test CE101		Pass	Pass
High-Frequency Conducted Emissions	MIL-STD-461E Test CE102		Pass	Pass
Low-Frequency Radiated Magnetic Field Emissions	MIL-STD-461E Test RE101		Pass	Pass
High-Frequency Radiated Electric Field Emissions	MIL-STD-461E Test RE102		Pass	Pass

The physical arrangement of electronic/electric devices, the routing of the cabling, the techniques used for grounding are considered qualified by similarity to the tested monitor system.

5.2 PG Monitor Assembly

The PG Monitor Assembly is a skid whose structure supports the components for sensing and processing radiation data and for transporting gas and particulate samples to sensing detectors. As described in Section 5.1 it is similar to the PG monitor tested. The results demonstrate that the monitor as a whole meets the requirements of the TVA specification for EMC. The qualifications of major subassemblies of the PG Monitor are discussed in the following subsections.

5.2.1 RM-80 Microprocessor

The tested PG Monitor System used an RM-2000 microprocessor and an RM-2300 control/display module. The monitor system being qualified has an RM-80 microprocessor and RM-23A Control/Display Module.

The EMC qualification basis for the replacement RM-80 microprocessor and RM-23A is discussed in GA-ESI document 04038903-11SP. The tested RM-80 microprocessor and RM-

23A Control/Display Module did not have Customer Interface Junction Box (CIJB), Power Control Center (PCC), sample transport components, or the [redacted] NIM Bin power supply. Generally, the RM-80 microprocessor and RM-23 Radiation Monitoring System was given a series of susceptibility and emissions tests and met the requirements of TVA specification 64-821696. The tests performed are shown in Table 5-3.

Table 5-3 Electromagnetic Compatibility Test Results for RM-80/RM-23 Radiation Monitors

Test	Test Method	Compliance Status	
		RM-80	**RM-23**
Conducted Transient EMI Susceptibility	TVA 64-821696 Appendix E	**Pass**	**Pass**
RF Conducted Susceptibility	TVA 64-821696 Appendix E	**Pass**	**Pass**
Radiated Transient Electromagnetic Field	TVA 64-821696 Appendix E	**Pass**	**Pass**
Radiated RF/EMI Field Susceptibility	TVA 64-821696 Appendix E	**Pass**	**Pass**
Conducted Emissions	TVA 64-821696 Appendix E	**Pass**	**Note 2**
Surge Withstand Capability	TVA 64-821696 Appendix E	**Note 1**	**Not Required**
Radiated Susceptibility	SAMA PMC 33.1-1978	**Pass**	**Pass**

[redacted]

The equipment being qualified is similar to the RM-80 microprocessor and RM-23 radiation monitoring system that was tested. The RM-80 and the RM-23 NIM Bin are the same and are interconnected in the same way. The results are considered acceptable.

5.2.2 Customer Interface Junction Box

The RM-80/RM-23A test article did not have a CIJB; however, the results of the tests are considered acceptable based on the results of testing the PG monitor with RM-2000 microprocessor described in Section 5.1. The CIJB does not contain power supplies. It does include the following items: Business Sensitive

[redacted]

The steel CIJB enclosure is the same enclosure type as the test article RM-80. It is grounded in the same manner. The cable penetrations and shield grounding are the same as the RM-80. A panel is provided for TVA to attach metal conduit and route cabling to interface with plant equipment.

The alarm relays are the same type tested as part of the RM-80 test article and have noise suppression networks included in the CIJB, further reducing conducted emissions due to being continuously energized in a fail state condition. The alarm relays are considered acceptable.

The EMI/RFI filter [redacted] is a multi-pin bulkhead connector used for signal transmission between the RM-80 and the flow indicating switch to the alarm relays and customer connections. [redacted] It is the same connector used on the monitor CIJB tested and reported in Section 5.1. Business Sensitive

The interconnecting cables are the same as the cables used for the EMI/RFI tests. They have the same shield coverage and are connected and grounded in the same manner. They are considered acceptable.

5.2.3 RD-59 Detectors and Checksource

The detector used in the RD-59 Detector Assembly is similar to the detector used in the RD-52A-40D assembly that was tested as part of the RM-2000 PG monitor described in Section 5.1. The tested monitor uses an RD-52 detector assembly (fixed volume heated gas detector). The RD-52 detector is a scintillation detector with radiation sensitive crystal, light pipe, photomultiplier tube and electronic socket assembly of similar construction as the detectors being qualified. Electrically, the detectors operate in the same manner [redacted]

[redacted]. Both detectors are [redacted] installed in a steel enclosed, [redacted] lead shield assembly that is grounded providing protection from EMI/RFI. The cables and connectors to and from the detectors are the same and routed in a similar manner in flexible steel conduit. The signal from the detectors is input to the RM-80. High voltage is provided to detector to adjust the gain of the photomultiplier tube. [redacted] This is considered qualified. Business Sensitive

A similar checksource to the one being qualified was used on the tested monitor. The detectors and the checksources are considered qualified.

5.2.4 RD-56C Particulate Detector Assembly

The RD-56C moving filter particulate detector assembly is an enhanced version of the RD-56B detector assembly. The detectors are the same. The differences are in the paper transport mechanism. The detector assembly includes a heater that is not used on the monitor being qualified. The results of the tests described in Section 5.1 demonstrate that the RD-56C is EMC and is considered acceptable.

5.2.5 Power Control Center

The Power Control Center (PCC) for the PG Monitor is similar to the PCC of the RM-2000 PG monitor tested as described in Section 5.1, They both contain EMI/RFI/Surge filters, switches and indicators, relays, noise suppression circuits and are housed in similar enclosures. The tested monitor is more complex than the monitor being qualified in that the tested monitor includes components to control heated detector assemblies, heat-traced sample lines which require a separate microprocessor and temperature control device, and a paperless recorder. The arrangement of components is different between the two PCCs which is not significant.

A power line filter has been added to reduce conducted emissions and susceptibility. The filter has been used on radiation monitoring systems since 1995 and the filter has passed emission and susceptibility tests, describe in Section 5.1, on the power lines. [redacted] It meets IEEE STD C62.41 surge test at 6 kV ring wave. It is considered acceptable. The PCC is considered qualified.

Business Sensitive

5.2.6 Sample Transport Components

Electrically, the PG Monitor System sample transport components are similar to the tested RM-2000 PG monitor described in Section 5.1. Both contain pump motors of similar design but different voltage, electrically similar solenoid valves and flow switches. The tested monitor is more complex than the monitor being qualified in that the tested monitor includes heat-traced sample lines which require a separate microprocessor and temperature control device.

[redacted] Business Sensitive

The sample transport components are considered qualified.

5.3 RM-23A NIM Bin Assembly

The RM-23A NIM Bin assembly with the RM-23A module was tested as describe in Section 5.2.1. The control/display NIM Bin power is supplied by an [redacted] VDC power supply [redacted] that convert the [redacted] VDC required by the RM-23A Modules. A similar [redacted] was used as part of the tests of the [redacted] VAC power line to the RM-23 reported in GA-ESI document E-115-0988. A similarity analysis is documented in GA-ESI report E-255-0968-6SP. The [redacted] VAC power line tests that included th[redacted] VDC power supply are described in Table 5-3.

The power supply is considered acceptable based on the results of the required tests in accordance with TVA 64-821696 Appendix E. The slight excursion above the required emission limit at [redacted] is not considered serious enough to cause problems for other systems. The RM-23A NIM Bin Assembly is considered qualified. The difference between the tested RM-23A NIM Bin Assembly and the one being qualified is the addition of a [redacted] volt power supply to provide relay power. Business Sensitive

The Power Supply [redacted] is the same power supply used on the RM-1000 NIM Bin Assembly and tested as part of the monitor system described in GA-ESI report 04038800; *RM-1000 EMC Test Report, TVA.* The RM-1000 Radiation Monitoring Systems were given a series of susceptibility, surge, and emission tests in accordance with TVA specification SS E18.14.01 Rev 3. The RM-1000 system, including the power supply, performed satisfactorily for these tests. The power supply is considered acceptable.

5.4 Gas Channel Local Indicator

The gas channel local indicator assembly has not been tested, however, it is consider acceptable for the following reasons.

[redacted]

Business Sensitive

6. SOFTWARE QUALIFICATION BASIS

GA-ESI's software qualification program is in accordance with 10CFR 50 Appendix B since the program was initiated in the late 1970's. Before the advent of nuclear verification and validation (V&V) programs, GA-ESI produced a set of design, functional, and performance specifications for the RM-80 and RM-23 software. These radiation monitors were extensively tested against these specifications to ensure that they were able to perform their safety function and provide reliable data and alarm functions. This is evident by a long history of successful operation at many nuclear power plants throughout the world. Formal configuration control and error reporting fully meet the requirements of 10CFR50 Appendix B as well as 10CFR Part 21.

As the industry matured and NRC, EPRI, and IEEE establish new standards for the V&V of software, GA-ESI kept pace with the new standards by performing a formal V&V to the latest standards for the RM-80 and RM-23 in the late 1990s. The standards and regulatory documents used for this V&V were:

- NRC Draft Guides DG-1054 through DG-1059 (all issued in 1996)
- NRC NUREGs -95-02 and -4640
- IEEE Standards 729, 730.1-1990, 829, 830-1984, 833-1974, 934-1987, 983, 1002, 1012-1986, 1016-1987, 10231988, 1028-1988, and 1074-1995. Business Sensitive

[redacted]

These reports demonstrate that the RM-80/RM-23 Radiation Monitoring System software meets the requirements for verification and validation of safety related software.

7. REFERENCE DOCUMENTS

GA-ESI DRAWINGS

04031300	OUTLINE, PARTICULATE AND GAS MONITOR SYSTEM
04031301	PARTICULATE AND GAS MONITOR SYSTEM
04031310	BLOCK DIAGRAM. PARTICULATE AND GAS MONITOR SYSTEM
04031320	CUSTOMER CONNECTION DIAGRAM, PARTICULATE AND GAS MONITOR SYSTEM

GA-ESI DOCUMENTS

02818905-QSR	ENVIRONMENTAL QUALIFICATION SUMMARY REPORT FOR CLASS 1E EQUIPMENT FOR WATTS BAR UNITS 1 & 2
03608917-3SP	QUALIFICATION SUMMARY REPORT FOR RADIATION MONITOR REPLACEMENT PARTS
03608917-4SP	QUALIFICATION SUMMARY REPORT FOR RADIATION MONITOR REPLACEMENT PARTS
03608917-5SP	QUALIFICATION SUMMARY REPORT FOR RADIATION MONITOR REPLACEMENT PARTS
03728906-QSR	QUALIFICATION SUMMARY REPORT FOR IN DUCT GAS RADIATION MONITOR
03988910	RM-80 AND RM-23 OPERATIONAL HISTORY AND SYSTEM RELIABILITY
04038800	RM-1000 EMC TEST REPORT, TVA
04038903-QSR	QUALIFICATION SUMMARY REPORT FOR WATTS BAR NUCLEAR PLANT UNIT 2 REPLACEMENT RADIATION MONITORS
04038903-7SP	QUALIFICATIONBASIS FOR 04034101-001 (2-RE-90-271, -272, -273, & -274)
04038903-11SP	ELECTROMAGNETIC COMPATIBILITY QUALIFICATION BASIS FOR RM-80/RM-23 RADIATION MONITORS
04038904-QSR	QUALIFICATION SUMMARY REPORT FOR ROTRON REGENERATIVE BLOWER CLASS 1E
04238926-1SP	SEISMIC QUALIFICATION SUMMARY REPORT FOR R11/12 CONTAINMENT ATMOSPHERE RADIATION MONITOR

04508905-QR	QUALIFICATION TEST REPORT FOR RM-1000 PROCESSOR MODULE AND CURRENT-TOFREQUENCY CONVERTER
04609041	RM-80/RM-23 SOFTWARE V&V PLAN
04609042	RM-80/RM-23A SOFTWARE QA PLAN/SOFTWARE CONFIGURATION MANAGEMENT
04609043	RM-80 SUPPLEMENT VALIDATION TEST REPORT
04609046	RM-23 SOFTWARE V&V REPORT
04619036-3SP	SUPPLEMENT NUMBER 3 TO RM-2300 QUALIFICATION TEST REPORT FOR RADIATION MONITORING SYSTEMS
04619048	RM-2000/RM-2300 EMI/RFI QUALIFICATION REPORT
E-115-459	SEISMIC QUALIFICATION SUMMARY REPORT FOR TVA RADIATION MONITORING EQUIPMENT
E-115-0988	ELECTROMAGNETIC INTERFERENCE TESTS, METHODS, AND TEST LIMITS
E-255-968	QUALIFCATION TEST REPORT FOR CLASS 1E EQUIPMENT FOR WIDE RANGE GAS MONITORING SYSTEM
E-255-968-6SP	QUALIFICATION SUMMARY REPORT DC POWER SUPPLY ASSEMBLY GA-ESI PART NUMBER 04702121-001 & -002
E-255-996	QUALIFICATION TEST REPORT FOR CLASS 1E EQUIPMENT FOR GENERIC RADIATION MONITOR EQUIPMENT
E-255-1060	QUALIFICATION TEST REPORT FOR PROCESS MONITOR DETECTORS
E-255-1081	QUALIFICATION TEST REPORT FOR MAANSHAN CLASS 1E EQUIPMENT
E-255-1236	QUALIFICATION TEST REPORT FOR RIVER BEND RADIATION MONITORING EQUIPMENT
OP-7.3-240	SAFETY RELATED COMMERCIAL GRADE SPARE PARTS

Attachment 9

Redacted non-proprietary GA-ESI document 04038903-4SP, "Qualification Basis for 04031501-001 (2-RE-90-112)," Revision B (Letter Item 2, SSER Appendix HH Item Number TVA21)

REVISIONS

REV	DESCRIPTION	DATE	APPROVED
B	INCORPORATED ECN 400001918 J. HEITHAUS 12/20/2011	12/20/11 12/20/11 12-20-11	

Document
Classification
Change

[redacted]

GENERAL ATOMICS
ELECTRONIC SYSTEMS

4990 GREENCRAIG LANE
SAN DIEGO, CA 92123-1675

	NAME	DATE
DRAWN	A.E. BUTT	1/19/2011
CHECKED	B. WILKINSON	1/19/2011
ENGR	A.E. BUTT	1/19/2011
ENGR REV	W. GRATZA	1/19/2011
MFG ENGR	--------------------	----------
PROJ MGR	P. BERNER	1/19/2011
QUAL MGR	J. WINESKI	1/19/2011
RELEASE	E. CABEL	1/19/2011

QUALIFICATION BASIS FOR 04031501-001 (2-RE-90-112)

SIZE	CAGE CODE	DRAWING NUMBER	REV
A	58307	04038903-4SP	B

DRW LEVEL	SCALE	SHEET
3	NONE	1 OF 75

CHANGE RECORD

Issue	Date	Description of Change
Rev. A	January 2011	Original Issue
Rev. B	December 2011	Incorporate Customer Comments

CONTENTS

TABLES

FIGURES

1. INTRODUCTION

The Qualification Basis Report for [redacted] Particulate, Iodine, and Gas (PIG) Monitor System provides the evaluation and justification to demonstrate the environmental, seismic, Electromagnetic Compatibility (EMC), and software qualification. This report is a supplement to the principle report GA-ESI report 04038903-QSR. GA-ESI report 04038903-QSR provides the following:

- Equipment Description — Section 2.4
- Environmental Qualification Requirements — Sections 3.2 and 3.2.4
- Seismic Qualification Requirements — Section 3.3 (Required Response Spectra Figures 3-8 through 3-10 and 3-14 through 3-16)
- EMC Qualification Requirements — Section 3.4
- Software Qualification Requirements — Section 3.5
- GA-ESI's Environmental Qual Program — Section 4.2
- GA-ESI's Seismic Qual Program — Section 4.3
- GA-ESI's EMC Qual Program — Section 4.4
- GA-ESI's Software Qual Program — Section 4.5

1.1 ENGINEERING AND COMMERCIAL GRADE ITEM CHANGES THAT AFFECT QUALIFICATION

This qualification report is based on the configuration of the monitor assembly on November 24, 2010.

In addition to qualifying assemblies and components by similarity, changes made to these parts and systems are reviewed and addressed in this report as follows:

> Some parts of the equipment qualified in this report have changes from those like-numbered parts that were qualified in the reports referenced in this report. All revisions and changes to parts that are Commercial Grade Items, and were qualified in the referenced qualification reports, have been evaluated and justified for qualification equivalency during the normal parts database management process. This qualification evaluation during parts database change is standard, in accordance with GA-ESI Operating Procedure OP-4.0-190. Similarly, all revisions

and changes to any subassembly parts that were qualified in the referenced qualification reports have been evaluated and justified during the standard Engineering Change Notice (ECN) process, in accordance with GA-ESI Operating Procedure OP-4.0-130.

1.2 REPORT CONTENTS

This report consists of the following sections.

Section 1. INTRODUCTION. This section describes the reason for the report, its organization, identification of the radiation monitors being qualified, and a description of the contents of each section.

Section 2. ENVIRONMENTAL QUALIFICATION BASIS. This section demonstrates the environmental qualification of the equipment by similarity to equipment and components successfully tested to requirements equal to or better than the requirements for the radiation monitors being supplied.

Section 3. SEISMIC QUALIFICATION BASIS. Section 3 documents the integrity and functionality of the PIG Monitor System during and after seismic events. This is accomplished by demonstrating that the Test Response Spectra (TRS) for similar equipment envelops the Required Response Spectra (RRS) for the equipment location and by analysis.

Section 4 REPLACEMENT SCHEDULE. This section provides the replacement schedule for components whose life is less than 40 years.

Section 5. ELECTROMAGNETIC COMPATIBILITY QUALIFICATION BASIS: Section 5 describes the EMC of the PIG Monitor based on operating history and test of equipment similar to the equipment being supplied.

Section 6. SOFTWARE QUALIFICATION BASIS: The Software Qualification Basis section describes the history of software configuration control and testing in accordance with the requirements of a 10 CFR Part 50 Appendix A Quality Assurance program. The Verification and Validation program for the RM-80/RM-23 software has been reported in a number of reports which are identified in the section.

Section 7. REFERENCE DOCUMENTS. This section lists the GA-ESI documents and drawings referenced in the body of the report.

2. ENVIRONMENTAL QUALIFICATION BASIS

The environmental qualification of the Particulate, Iodine, and Gas (PIG) Monitor System, [redacted], is based on previously completed qualification tests, GA-ESI design review, and manufacturers design specifications.

2.1 SERVICE CONDITIONS

The PIG Monitor System consists of a PIG Monitor Assembly, a local indicator, and RM-23A NIM Bin Assembly. [redacted] The PIG Monitor is a RG 1.45 monitor that samples Upper Containment Compartment Atmosphere. The RM-23A NIM Bin Assembly is located in the Control Room. The service conditions for the PIG Monitor Assembly are given in GA-ESI report 02818905-QSR figure 3-2 as modified below. The service conditions for the Local Indicator are given below. The service conditions for RM-23A NIM Bin Assembly are given in GA-ESI report 02818905-QSR figure 3-9, as modified below. These service conditions are summarized below.

[redacted]

2.2 02818905-QSR COMPONENT REVIEW

A review of the PIG Monitor System list of materials was made for major assemblies that were previously qualified by GA-ESI report 02818905-QSR. The PIG Monitor TVA Tag numbers were included in GA-ESI report 02818905-QSR as [redacted]. [redacted] is a redesign of the assembly to incorporate enhancements developed since the original monitor was designed. The functionality and performance of radiation monitoring remains the same. The analog radiation processor has been replaced by an RM-80/RM-23 digital radiation monitor that was not qualified in the GA-ESI report 02818905-QSR, therefore, the whole monitor system will be environmentally qualified by this report.

2.3 QUALIFICATION BASIS

Business Sensitive

This section describes the basis for the qualification of the PIG Monitor System. The PIG Monitor Assembly and the Local Indicator are located in a harsh environment but not required to meet the accident environmental conditions. [redacted] The Local Indicator is qualified for all normal and abnormal conditions except the normal radiation. The Local Indicator is qualified for 5.0 x 10^4 RADS. The PIG Monitor is not required for post-accident monitoring per Table 9.0-4 of TVA NPG Design Criteria Document WB-DC-40-24 Rev 0021.

GA-ESI type tests electronic radiation monitoring assemblies that are designed and manufactured by GA-ESI to abnormal extremes to demonstrate performance over the temperature and humidity range that the assemblies may experience in service. Certain other assemblies, whose performance may be affected by extremes, designed and manufactured by GA-ESI, are also tested at temperature and humidity extremes. All other components and assemblies are selected for the generic service conditions and approved through a design review and commercial grade dedication process (in accordance with GA-ESI procedure OP-7.3-240). Performance and functionality are demonstrated by the final Acceptance Test Procedure (ATP). A certificate of compliance is provided with the accepted assembly. Components and modules that have a life less than 40 years are identified in Section 4, Replacement Schedule.

The monitor assembly and local indicator located in the Auxiliary Building at the 737 and 757 foot level environments, respectively, have a normal radiation total dose greater than GA-ESI levels of qualification. A radiation review of each part in the assemblies is performed using TVA

RIMS report #B43'860721903 as the basis for qualifying the equipment to higher levels of radiation. The results of that review are given in Section 2.4.

Environmental Qualification Summary Table 2-1 identifies the assemblies that are qualified by test and the test article that was utilized to demonstrate that qualification. The subsequent subsections describe that testing performed for each assembly and compare the test article with the assembly being qualified.

Table 2-1 Environmental Qualification Summary Table for 04031501-001

Component	[redacted]	Test Article	Qual Report	Qual Section
PIG Monitor System				
PIG Monitor Assembly				
RD-59-30D Detector Assembly				
Gas Detector		02810530-001	E-255-1060	2.3.1
Iodine Detector		02810910-001	E-255-1060	2.3.1
RD-56C Particulate Detector Assembly		03600036-002	E-255-1081	2.3.2
Particulate Detector		02810564-001	E-255-1060	2.3.2
RM-80 Microprocessor		03570122-001	E-255-996	2.3.3
RM-23 NIM Bin Assembly				
RM-23A Module		03573000-001	E-255-1335	2.3.4

2.3.1 RD-59-30D Gas and Iodine Detectors

Business Sensitive

The Gas Detector [redacted] and Iodine Detector [redacted] are similar to the tested RD-52 Gas Detector [redacted]1) and RD-55 Iodine Detector [redacted] reported in GA-ESI report E-255-1060. The same Photomultiplier tube (PMT), light pipe, phosphorous, and socket assembly are used on all four detectors. The detectors were given an ambient transfer [redacted] and a post extremes transfer calibration. The detectors did exhibit a variance greater than [redacted] because PMTs exhibit unpredictable variations in sensitivity as a result of temperature. These are considered qualified because they were able to be calibrated after the extremes temperature. The RD-59-30D detectors are considered qualified.

2.3.2 RD-56C Particulate Detector Assembly and Detector

Business Sensitive

The RD-56C Particulate Monitor assembly [redacted] is an enhanced design of the assembly tested [redacted] as part of the PIG assembly [redacted] reported in SE document E-255-1081. The assemblies are consider similar as evaluated in GA-ESI report 04238926-1SP. The filter paper mechanism has been enhanced to minimize filter paper misalignment over time. A new stepper motor printed wiring assembly is being used [redacted] to accommodate the new stepper motor. The PWA is considered similar to the tested PWA The detectors are the same in both the tested assembly and the assembly being qualified.

The electronics for the stepper motor was subjected to temperature cycling [redacted] It was then given an extremes test [redacted] The stepper motor electronics functioned within specification limited before, during and after these tests. It is considered qualified.

The particulate detector [redacted] is similar to the tested RD-56 Particulate Detector [redacted] reported in GA-ESI report E-255-1060. The same Photomultiplier tube (PMT), light pipe, phosphorous, and socket assembly are used on all four detectors. The detectors were given an ambient transfer calibration, an extremes test [redacted] and a post extremes transfer calibration. The detectors did exhibit a variance greater tha[redacted] because PMTs exhibit unpredictable variations in sensitivity as a result of temperature. These are considered qualified because they were able to be calibrated after the extremes temperature. The detector is considered qualified.

Business Sensitive

2.3.3 RM-80 Assembly

A similar RM-80 Assembly [redacted], to the RM-80 Assembly [redacted] being qualified, was tested to the extremes of temperature and humidity as reported in E-255-996. The RM-80 being qualified contains the same Printed Wiring Assemblies (PWAs) and subassemblies (power supplies, etc) as the tested RM-80. The PWAs and subassemblies have been changed to accommodate replacement to obsolete components. The replacement components have the same functional characteristics but some differed in size and placement of connection points, requiring modification to the printed circuit board. Changes are approved by GA-ESI change review process and verified through acceptance testing.

The RM-80 test article was irradiated [redacted] and passed a functional test after irradiation. Next components with age related failure mechanisms were age conditioned to near end of life. Extremes tests were performed [redacted]. The RM-80 passed the performance tests. The RM-80 test article was further tested by temperature cycling [redacted]. The RM-80 passed all performance tests. The RM-80 is considered qualified environmentally.

2.3.4 RM-23A Module Assembly

A similar RM-23 Module Assembly [redacted] to the RM-23A Assembly [redacted] being qualified, was tested to the extremes of temperature and humidity as reported in E-255-996. The RM-23 module assembly tested is essentially the same as the RM-23 module assembly being qualified. The significant differences are the redesign of the processor printed circuit board and replacement of an obsolete erasable PROM. There are a few minor changes in resistors and capacitors. The functions are the same and all other components are the same. Business Sensitive

The RM-23 test article was irradiated [redacted] and passed a functional test after irradiation. Next components with age related failure mechanisms were age conditioned to near end of life. Extremes tests were performed [redacted]. The RM-23 passed performance tests. The RM-23 test article was further tested by temperature cycling [redacted] The RM-23 passed all performance tests. The module assemblies are considered similar and the RM-23A is considered qualified.

2.4 HIGH RADIATION REVIEW

Business Sensitive

The Total Integrated Dose (TID) that the radiation monitor system located in the plant is above the GA-ESI rating for the equipment. [redacted] TVA report B43'860721903, *A Review of Electronic Components in a Radiation Environment of ≤ $5X10^4$ RADS,* states that all type of electronic components and materials are acceptable to 5 x 10^4 RADS with the exception of the following:

[redacted]

It should be noted that radiation monitoring systems include sample transport components. The TVA report describes materials that are generally used in these applications and as such the discussion in the TVA report can be applied to the sample transport components as well.

A review of the radiation monitor system parts of those assemblies located in the high radiation area was made to identify MOS devices and PIN diodes for further evaluation. Since Fluorocarbons' threshold of damage is above the expected radiation level, they are not included in the review. The results of that review and evaluation are provided below.

[redacted]

The Local Indicator does not contain MOS devices, PIN diodes, or Teflon parts. It is considered qualified for 5 x 10^4 RADS TID. Business Sensitive

3. SEISMIC QUALIFICATION BASIS

This section describes the seismic qualification of the Particulate, Iodine, and Gas (PIG) Monitor System, [redacted], based on previously completed seismic tests and analysis.

3.1 SEISMIC REQUIREMENTS

Business Sensitive

The PIG Monitor System is safety related and seismic category I and is required to operate during and after an earthquake. For qualification by random bi-axial or tri-axial testing [redacted] damping is used to ensure that the Test Response Spectra envelopes the Required Response Spectra. For analysis the ZPA and peak acceleration values are based on [redacted] damping.

3.1.1 Plant Equipment Seismic Requirements

The Required Response Spectra (RRS) for the seismic qualification of the PIG Monitor plant equipment located in the Auxiliary Building is taken at the 737 foot level are found in GA-ESI document 04038903-QSR, Figures 3-8 through 3-10. The ARS curves for the PIG Monitor Assembly, located at the 737 foot level of the Auxiliary Building, envelope the ARS curves for the Local Indicator, located at the 757 foot level of the Auxiliary Building. The values are given in Table 3-1.

Table 3-1 Required Acceleration Values for PIG Monitor Plant Equipment

Parameter	Vertical	North-South	East-West
Testing (5% Damping)			
Zero Period Acceleration (ZPA) – g's	0.21	0.51	0.60
Peak Acceleration – g's	0.90	2.5	3.8
Analysis (3% Damping)			
Zero Period Acceleration – g's	0.21	0.51	0.60
Peak Acceleration – g's	1.20	3.5	5.2

For comparison of the Test Response Spectra (TRS) with the Required Response Spectra (RRS) a simplified RRS curve is constructed using the information given in GA-ESI document 04038903-QSR Figures 3-8, 3-9, 3-10 and Table 3-1, as follows.

- **Vertical:** The spectrum given in GA-ESI document 04038903-QSR Figure 3-8 is broadened and simplified to envelope the RRS shown in that figure. [redacted]
- **Horizontal:** Since the orientation of the equipment is not known, the spectra given in GA-ESI document 04038903-QSR Figures 3-9 and 3-10 are combined, broadened, and simplified to envelope a combined east-west and north-south RRS. [redacted]

[redacted]

[redacted]

Table 3-2 Required Analysis Accelerations for PIG Monitor Plant Equipment

Analysis Method	[redacted]	
Natural Frequency not Calculated or in the Dynamic Range		
Natural Frequency Calculated and in Rigid Range		

3.1.2 Seismic Requirements for Control Room Equipment and Devices

The requirements for the seismic qualification of the PIG Monitor equipment located in the control room floor and walls (ARS) are found in GA-ESI document 04038903-QSR, Figures 3-14, 3-15, and 3-16. The ZPA and peak acceleration values for ARS are given in Table 3-3.

[redacted]

Business Sensitive

[redacted]

[redacted]

3.2 COMPONENT REVIEW

Business Sensitive

A review of the PIG Monitor System list of materials was made for major assemblies that were previously qualified by GA-ESI report E-115-459. The original assembly for this application was qualified as part of GA-ESI report E-115-459, however, the monitor has been redesigned to use the latest technology and enhancements. The motor starters are qualified by GA-ESI report E-115-459 and their qualification basis will not be duplicated in this report. This qualification basis is for the rest of the PIG Monitor that has not been qualified by GA-ESI report E-115-459.

3.3 QUALIFICATION BASIS

This section describes the basis for the seismic qualification of the PIG Monitor System. The monitor system is qualified as seismic Category I and is expected to be functional during and after a seismic event. Therefore, the monitor is qualified for structural integrity as well as functionality.

GA-ESI seismically qualifies radiation monitoring systems structurally by test and by analysis. Components and assemblies that are tested are tested functionally as well as ensuring the seismic adequacy of the structure. GA-ESI has tested the radiation monitoring systems using sine-beat, bi-axial, and tri-axial seismic test methods. Conservative analysis is performed for certain components and structural elements that have not been tested. The methods used are described as part of the analysis and generally meet the program describe in GA-ESI document 04038903-QSR.

The Seismic Qualification Summary Table 3-6 identifies the assemblies that are qualified by test or analysis. The test article that was utilized to demonstrate qualification is provided as well as the test report. The subsequent subsections describe the testing or analysis for each assembly and compare the test article or the structure analyzed with the assembly being qualified.

[redacted]

[redacted]

The PIG Monitor System [redacted] is qualified for seismic functionality and structural integrity by test and analyses of similar components discussed in the following subsections. Business Sensitive

3.3.1 Skid Plate Assembly

The Skid Plate Assembly [redacted] is designed to accommodate the components of the TVA PIG Monitor Assembly. It is similar to the base and frame of a PIG monitor assembly [redacted] tested and reported in GA-ESI report E-255-1081 with some notable additions. The base of the TVA PIG Monitor Assembly has been extended [redacted] the width remaining the same. To accommodate the extension a [redacted] channel support has been added and the number of [redacted]

[redacted] The approximate [redacted] increase in weight is not considered significant since the number of hold-down bolts has increased by [redacted] thus reducing the stress on each bolt from that tested.

The main portion of the frame on the TVA PIG Monitor Assembly is essentially same as the frame of the PIG monitor tested. The frame has been extended [redacted] to accommodate the motor starters and RC Network. The extended frame is made using the same size tubular structure as the main frame and welded to the base and the main frame using the same size weld as used on the main frame. The extended frame is braced to the main frame with a diagonal tubular section to create a stiffener and lateral restraint. Since the extension uses the same structural elements as the main frame and that it is only half the frame height it is considered acceptable and the testing that demonstrates the structural integrity of the main frame can be applied to the extended section. Business Sensitive

The seismic tests were bi-axial with the test article attached rigidly to the shake table with [redacted] bolts. There wasn't any amplification between the shake table and the mounting location. A resonance search was performed [redacted]. The second modal frequencies are taken as [redacted] side-to-side and [redacted] front-to-back. The same resonances and amplifications would be expected on the TVA PIG Monitor. The test article was given five Operating Basis Earthquake (OBE) tests and one Safe Shutdown Earthquake (SSE) test then rotated 90° and the test sequence repeated. Figures 3-4 and 3-5 shows the accelerometer response at the top of the detector, mounted rigidly to the skid base, and identifies the [redacted] damping Test Response Spectra (TRS). The test article remained intact throughout the testing. As can be seen the TRS envelopes the RRS and the frame is considered qualified.

[redacted]

[redacted]

3.3.2 RD-59-30D Detector Assembly

Business Sensitive

The RD-59-30D Detector Assembly [redacted] is the same RD-59-30D Detector Assembly used on the PIG Monitor [redacted] tested and reported in GA-ESI report E-255-1081. The RD-59-30D assembly was not given an assembly number in the test article. Rather a number of components and parts were assembled as part of the top assembly. These components and parts are the same as the item being qualified.

The seismic tests performed are described in Section 3.3.1 and the TRS is compared to the RRS in Figures 3-4 and 3-5. The monitor assembly was functionally tested before and after the seismic testing and the detector operation monitored before, during, and after the each seismic test. The monitor and the detector functioned within specification requirements. The RD-59-30D Detector Assembly is considered qualified.

3.3.3 RD-56C Particulate Detector Assembly

The RD-56C Particulate Detector Assembly [redacted] is an enhanced design of the RD-56 Particulate Detector [redacted] tested as part of the PIG Monitor [redacted] reported in GA-ESI report E-255-1081. A similarity analysis and the qualification of the enhanced design are fully described in GA-ESI report 04238926-1SP.

The seismic tests performed on the original RD-56 are described in Section 3.3.1 and the TRS is compared to the RRS in Figures 3-4 and 3-5. The monitor assembly was functionally tested before and after the seismic testing and the detector operation monitored before, during, and after the each seismic test. The monitor and the detector functioned within specification requirements. The RD-56C Detector Assembly is considered qualified.

3.3.4 RM-80 Microprocessor

Business Sensitive

An RM-80 Assembly [redacted], similar to the RM-80 Assembly [redacted] being qualified, was tested seismically as described in GA-ESI report E-255-996. The RM-80 being qualified is enhanced by a number of changes to the printed wiring assemblies and the power supplies. These changes have been reviewed as part of the Engineering Change Process described in the Section 1.1. The components are considered similar. The relays used in the RM-80 being qualified are the same as those tested.

The seismic tests were bi-axial with the test article attached to a rigid test fixture in the same configuration as the unit being qualified would be in the field. There wasn't any amplification between the shake table and the mounting location of the RM-80 Assembly. The test article was given six Safe Shutdown Earthquake (SSE) test then rotated 90° and the test sequence repeated. During the first series of tests the door latch yielded, allowing the door to open. The latch mechanism was strengthened and the changes reflected in all subsequent RM-80 Assemblies. The series of tests were repeated. [redacted]. The TRS takes into consideration the amplification of the frame at the mounting location of the RM-80. The RM-80 was functionally tested before and after the seismic tests. During the tests the activity was recorded and the alarm relays were monitored for chatter. The RM-80 performed within specification tolerances without relay chatter. The RM-80 Assembly remained intact throughout the testing and is considered qualified.

Business Sensitive

[redacted]

[redacted]

3.3.5 Power Control Center

Business Sensitive

The Power Control Center (PCC) [redacted] is similar to the power control center [redacted] tested as part of the Wide Range Gas Monitor (WRGM) Detection Skid [redacted] reported in GA-ESI test report E-255-968. The size, material, and weight of the enclosure supplied are approximately the same as the test article. [redacted]. Internally, the components are similar [redacted]. The relays used in the PCC are the same as those used on the original TVA PIG Monitor. These are discussed in subsequent subsections.

The WRGM detection skid's seismic tests were bi-axial with the test article attached rigidly to the shake table in the same configuration as the unit being qualified would be in the field. There wasn't any amplification between the shake table and the mounting location. The test article passed a functional test before seismic testing. The test article was given five Operating Basis Earthquake (OBE) tests and one Safe Shutdown Earthquake (SSE) test then rotated 90° and the test sequence repeated. [redacted] The acceleration levels at the Power Control Center mounting location was greater than the amplification [redacted] that would be experienced on the frame of the monitor being qualified. The test article remained intact and operational throughout the testing and passed a functional test after the seismic testing. The PCC is considered qualified.

Business Sensitive

[redacted]

[redacted]

[redacted] The EMI/RFI Filter is considered qualified.

Business Sensitive

[redacted]

[redacted]

3.3.5.2 EMI/RFI Filter and Surge Suppressor

Business Sensitive

The EMI/RFI Filter/Surge Suppressor [redacted] has been added to the PCC to reduce noise. This device does not have age related seismic failure mechanisms. The operating range specified by the manufacturer is greater than the required operating range. The parts associated with the EMI/RFI Filter/Surge Suppressor are safety qualified per GA-ESI Doc. No. 03608917 Supplement 3.

The EMI/RFI Filter and Surge Suppressor is mounted inside the Power Control Center enclosure on the inside top wall. [redacted] The device has not been seismically tested; however, it is an encapsulated assembly with no moving parts. The following analysis demonstrates that the mounting hardware is adequate for a design seismic event. [redacted]

The stress on the attachment screws is within TVA allowable stress and the filter is considered qualified.

Business Sensitive

[redacted]

[redacted]

[redacted]

3.3.5.3 Relays

Business Sensitive

The relays used in the PCC are Potter-Brumfield relays [redacted] are the same relays tested as part of the Stack Selector Assembly (03665001-001) reported in GA-ESI test report E-255-968. The test relays were age conditioned prior to seismic testing for between [redacted] under simulated circuit load conditions. The relays were mounted in the Stack Selector enclosure in the same way as those being qualified for use in the PCC. The stack Selector Assembly was functionally tested prior to seismic testing. The WRGM equipment was given 5 OBE biaxial tests and 1 SSE biaxial test then rotated 90° and given 5 OBE biaxial tests and 1 SSE test. [redacted] The relays functioned properly during the seismic testing and the Stack Selector was given a functional test after the seismic tests. The relay is considered qualified.

3.3.6 Customer Interface Junction Box

Business Sensitive

The Customer Interface Junction Box (CIJB) is similar to the CIJB [redacted] tested as part of the WRGM RM-80/CIJB Assembly [redacted] reported in GA-ESI test report E-255-968. The size, material, and weight of the enclosure supplied are approximately the same as the test article. [redacted] With the exception of the EMI/RFI Filter the rest of the differences are not seismically significant.

The seismic tests performed are described in Section 3.3.5 and the TRS is compared to the RRS in Figures 3-8 and 3-9. The CIJB is considered qualified.

3.3.6.1 Isolation Transmitter

The isolation transmitter [redacted] is qualified in GA-ESI report E-255-968-4SP and is an upgraded version of those tested and reported in E-255-968. [redacted]. The manufacturer, basic model number and configuration are similar. They are a rugged design with no active mechanisms.

The seismic tests performed are described in Section 3.3.5 and the TRS is compared to the RRS in Figures 3-8 and 3-9. The isolation transmitters are considered qualified.

Business Sensitive

3.3.6.2 Relay

Business Sensitive

This is [redacted] reported in GA-ESI test report E-255-968. The The test relays were age conditioned prior to seismic testing [redacted] under simulated circuit load conditions. The relays were mounted in the Detection Skid enclosure in the same way as those being qualified for use in the CIJB. The Detection Skid was functionally tested prior to seismic testing. The WRGM equipment was given 5 OBE biaxial tests and 1 SSE biaxial test then rotated 90° and given 5 OBE biaxial tests and 1 SSE test. [redacted] The relays functioned properly during the seismic testing and the Detection Skid was given a functional test after the seismic tests. The relay is considered qualified.

3.3.7 Sample Transport Components

The Sample Transport Components include piping, fittings, manual valves, solenoid valves, gages, a flow switch, a check valve, and brackets to attach the piping to the PIG monitor frame are similar to the sample transport components as part of the WRGM Detection Skid [redacted]orted in GA-ESI test report E-255-968. The qualifications of the active components are discussed in the following subsections.

The seismic tests performed are described in Section 3.3.5 and the TRS is compared to the RRS in Figures 3-8 and 3-9. The test article remained intact throughout the testing and sample transport components are considered qualified.

3.3.7.1 Blower

Business Sensitive

The blower [redacted] is seismically qualified by GA-ESI report 04038904-QSR specifically for this Gas Monitor. Refer to the report for qualification details.

3.3.7.2 Motor Starter

The starter [redacted] is utilized as pump motor starter in series with the Motor Starter (disconnect switch) described in Section 3.3.7.3. The Starter is similar to a motor starter [redacted] tested on a TVA Liquid Monitor and reported in E-115-459. [redacted]

[redacted] The manufacturer and model series are the same and the [redacted] for the tested starter and [redacted] for the starter being qualified

The seismic testing levels of the Liquid Monitor floor were lower than the required ZPA levels for the location of the PIG monitor assembly [redacted]. Therefore, additional seismic evaluation is necessary in order to demonstrate seismic qualification. The motor starter that was tested is a smaller version of the motor starter being qualified. [redacted]

Business Sensitive

[redacted]

The motor starter enclosure and molded casing are considered seismically rugged. This is demonstrated by the results of testing a manual motor starter [redacted] on the Gas Monitor reported in E-115-459. The Gas Monitor was tested [redacted] in the horizontal direction and [redacted] in the vertical direction. [redacted] The enclousure and molded case are similar to the ensclosure and molded case of the motor starter being qualified. [redacted]

[redacted]

[redacted]

In the case of the [redacted] motor starter, the making of the power circuit is done magnetically. [redacted]

[redacted]. This same arrangement was tested as part of the smaller motor starter [redacted] on the Liquid Monitor reported in GA-ESI report E-115-459. The acceleration during testing in the vertical direction [redacted] which is greater than the required acceleration of [redacted] The armature held the contacts closed during and after the testing.

In series with the coil are thermal overload relays. There is one for each power line terminal. Their internal structure is shown below.

Business Sensitive

Business Sensitive

Business Sensitive [redacted]

[redacted].

The only seismic failure mode that can be postulated is chatter of the power contacts and, although unlikely, the thermal overload protector. In both cases the circuits that the contacts are in have highly inductive loads. In the case of the power contacts, the load is a rotating pump-motor combination. Chatter in the power contacts will not cause the motor to stop due the rotational inertia and the high induction of the motor windings. In the case of the coil circuit, the magnet has a shaded pole arrangement that retains residual magnetism and holds the armature in place. The motor starter is considered qualified.

3.3.7.3 *Motor Starter*

The motor starter [redacted] is the same motor starter as used on the Gas Monitor tested and reported in GA-ESI report E-115-459. Refer to that report for its qualification basis. The Gas Monitor was tested with a floor acceleration [redacted] horizontal and [redacted] vertical at the resonances of the monitor assembly. The motor starter performed satisfactorily during and after the testing. [redacted] The motor starter is considered qualified.

Business Sensitive

3.3.7.4 *RC Network Assembly*

The RC Network Assembly [redacted] consists of an enclosure that houses two RC Networks. The RC Network [redacted] is a three-phase 480 volt device used for electronics protection from conducted electrical noise generated in the blower motor. [redacted]. The RC Network is encapsulated and has no moving parts. It is mounted on an enclosure panel with [redacted] screws. [redacted]. The RC Network is considered a lump mass attached to an enclosure panel. The enclosure is similar to enclosures tested as part of the WRGM Detection Skid [redacted] reported in GA-ESI test report E-255-968, described in Section 3.3.6. [redacted]. The RC Network is considered qualified.

[redacted]

[redacted]

[redacted]

3.3.7.5 Solenoid Valve

Business Sensitive

The solenoid valve [redacted] is similar to the solenoid valve [redacted] that was qualified as part of the WRGM detection skid reported in GA-ESI document E-115-968. Per the GA-ESI document E-115-968, the solenoid valve coil was age conditioned [redacted]. The solenoid valves were assembled to the detection skid and given performance tests. These new valves are qualified by similarity per qualification report GA-ESI document 03608917-4SP. The seismic tests performed are described in Section 3.3.5 and the TRS is compared to the RRS in Figures 3-8 and 3-9. The solenoid valves remained intact and functional before, during, and after testing and are considered qualified.

Business Sensitive

3.3.7.6 *Motor Operated Valves*

Business Sensitive

The motor operated valve actuators [redacted] are similar to the actuator [redacted] that was qualified as part of the PIG monitor reported in GA-ESI document E-255-1081. The actuator motor insulation was oven age conditioned [redacted]. It was then assembled to the PIG monitor [redacted] and given performance and seismic tests. Two varistors [redacted] are added to a terminal block inside the motor drive housing. These new motor operated valves with varistors are qualified by similarity per qualification report GA-ESI document 03608917-5SP.

The PIG Monitor's seismic tests were bi-axial with the test article attached rigidly to the shake table. There wasn't any amplification between the shake table and the mounting location. The test article passed a functional test before seismic testing. The test article was given five Operating Basis Earthquake (OBE) tests and one Safe Shutdown Earthquake (SSE) test then rotated 90° and the test sequence repeated. Figures 3-4 and 3-5 show the accelerometer responses on PIG detector rigidly attached to the skid base and identify the [redacted] damping Test Response Spectra (TRS). The test article remained intact and the motor actuator remained operational throughout the testing and passed a functional test after the seismic testing. The actuator is considered qualified.

3.3.7.7 *Vacuum Transducer*

Business Sensitive

The vacuum transducer assembly consists of vacuum transducer [redacted] mounted inside a NEMA 12 metal enclosure [redacted] The sensor is wired to a terminal block mounted on a panel inside the enclosure. [redacted] The vacuum transducer and the transducer assembly have not been seismically tested by GA-ESI. Qualification of the assembly is based on vendor information, analysis of the enclosure attachment, and engineering judgment.

[redacted] itor

[redacted]

[redacted]. The transducer is considered qualified.

The vacuum transducer enclosure is mounted to the frame of the PG monitor with [redacted] screws. The attachment is analyzed below. The stresses on the screw are within the TVA allowables and the attachment is considered qualified.

[redacted]

[redacted]

[redacted]

[redacted]

3.3.7.8 Mass Flow Meter Business Sensitive

The mass flow meter [redacted] is a rugged gas flow meter utilizing a principle of measuring the differential pressure across laminar plates which is linearly proportional to the flow rate. [redacted]. [redacted] The piping fittings are similar to the fitting found on other sample transport components. The mass flow meter has not been seismically tested; however, it is mounted in the same manner with the same piping fittings and has approximately the same mass as solenoid operated valves that have been tested on the PIG monitor [redacted] reported in E-255-1081. [redacted] Since it is rugged construction with no moving parts it is considered qualified.

3.3.7.9 Flow Switch

The new flow switch assembly [redacted] is qualified seismically and environmentally in 04038903-1SP. The new flow switch [redacted] replaces the tested flow switch [redacted] that was part of the Liquid Monitor [redacted] qualified in GA-ESI report E-255-1236. Both switches are similar in many aspects even though they are manufactured by different companies and use different technologies. Both switches are designed to measure any fluid flow whether liquid or a gas and both have rugged housings design to be capable of withstanding high pressure [redacted] This allows use in applications requiring a simple flow/no flow detection and for switch-points at a predetermined flow rate.

The new flow switch assembly [redacted] includes a flow probe sensor and a transmitter PCA. The probe senses the flow rate within the sample line and feeds the signal to the transmitter PCA. The PCA conditions the signal, producing a relay signal output that indicates that the sample flow rate is above a set low limit. The relay output of the PCA feeds the digital flow signal directly to the RM-80.

3.3.8 Control/Display NIM Bin Assembly

The Control/Display NIM Bin Assembly [redacted] consists of a NIM Bin with an RM-23A, a Supervisor Switch Assembly, and power supplies. The following subsections demonstrate the seismic structural integrity and functional performance of these components.

3.3.8.1 RM-23A NIM Bin Assembly

A NIM Bin Assembly containing one RM-1000 and one Current-to-Frequency Converter Modules was mounted in a frame testing fixture and given a seismic test as described in GA-ESI report04508905-QR. The RM-1000 NIM Bin Assembly is structurally the same as the RM-23A NIM Bin assembly. The RM-1000 NIM Bin Assembly was subjected to 26 biaxial Operating Basis Earthquakes (OBE) and 9 biaxial Safe Shutdown Earthquakes (SSE). Fourteen OBEs were run in the X-Y plane and 12 in the Z-Y plane. Five SSEs were run in the X-Y plane and 4 in the Z-Y plane. [redacted]. The NIM Bin Assembly remained intact throughout the testing. The TRS does envelopes the generic RRS and is considered qualified.

Business Sensitive

3.3.8.2 RM-23A Module

An RM-23 Module was seismically tested as part of the generic qualification of Radiation Monitoring Equipment reported in GA-ESI report E-255-996. The RM-23A Module is similar to the RM-23 Module tested. [redacted].

Business Sensitive

The RM-23 module was mounted in a NIM Bin Assembly which in turn was installed in a shake table test frame. The RM-23 was electrically connected through an communications isolations device to a process RM-80 which was monitoring a radioactive source during the seismic testing. The RM-23 was given a functional test prior to start of testing. A sine sweep resonance search was performed [redacted]. No resonances were found. The RM-23 was given 5 OBEs and 1 SSE then rotated 90° and given 5 OBEs and 1 SSE to one set of RRS. The RM-23 passed a functional test after the seismic testing and performed satisfactorily during the testing. The RM-23 was then given a second higher seismic test repeating the same number of OBEs and SSEs as the first set of tests. The RM-23 performed satisfactorily during and after the second set of testing. The TRS of the final SSE for the second set of test is shown in Figures 3-10 and 3-11. [redacted] The tests do not completely envelope the RRS and, therefore, cannot be considered qualified for all locations in Watts Bar Unit 2. TVA should evaluate the results to determine whether the RM-23 is qualified for the location of use.

Business Sensitive

[redacted]

[redacted]

3.3.8.3 Supervisor Switch Assembly

The Supervisor Switch Assembly [redacted] consists of a metal face plate, a terminal block, and a supervisor switch. The face plate is the same size as the Current-to-Frequency Converter face plate and attached in the same manner to the NIM Bin Assembly. The difference is that the Supervisor Switch face plate has a hole to accommodate the supervisor switch. The differences are not considered significant and the face plate is considered qualified as described in Section 3.3.8.1 and Figures 3-14 and 3-15.

The terminal block is the same as that that used in the Current-to-Frequency Converter and is considered qualified by Section 3.3.8.1 and Figures 3-14 and 3-15.

The Supervisor Switch [redacted] is the same switch used on the Control Room Equipment [redacted] seismically tested and reported in GA-ESI report E-255-968. The test article was given 7 OBE and 1 SSE tests and then rotated 90° and given 6 OBE and 1 SSE tests. The supervisor switch performed satisfactorily during and after all these tests. The TRS for the SSE test is shown in Figures 3-12 and 3-13. The TRS does not envelope the TVA generic RRS, therefore, cannot be considered qualified for all locations in [redacted] TVA should evaluate the results to determine whether the Supervisor Switch is qualified for the location of use.

Business Sensitive

[redacted]

[redacted]

3.3.8.4 24 Volt Power Supply Assembly

Business Sensitive

The Power Supply Assembly [redacted] and its associated bracket [redacted] are analyzed in GA-ESI document 04038903-7SP, Appendix A. The analyses are based on GA-ESI generic seismic RRS to allow the use of the analysis for any customer using GA-ESI acceptance criteria. The results are also compared to TVA acceptance criteria.

The analyses show that the stress levels of the bracket assembly are within the allowable stresses for both the GA-ESI generic and TVA specific cases. The power supply bracket is considered seismically adequate and qualified.

Business Sensitive

The [redacted] Power Supply [redacted] is attached to the of the NIM Bin Assembly and provides power to the relays. The power supply is a replacement power supply for the originally tested power supply [redacted] GA-ESI document 04508905-QR demonstrates that the replacement power supply is similar to the test article, since they are by the same manufacturer and model series. The replacement power supply has a higher current rating and, therefore, slightly heavier. The Technical Evaluation further demonstrates that the slightly greater weight does not affect the seismic qualification.

The original power supply (test article) parts that had age related failure mechanisms (aluminum electrolytic capacitors, transformer, coils, and wire) were age conditioned as described in GA-ESI document 04508905-QR. The age conditioned parts were then assembled into the two power supplies that were mounted on the rear of the NIM Bin Assembly and provided power to the RM-1000 processor modules being qualified in that report. The RM-1000 NIM Bin Assembly with the power supply attached was subjected to 26 biaxial Operating Basis Earthquakes (OBE) and 9 biaxial Safe Shutdown Earthquakes (SSE). Fourteen OBEs were run in the X-Y plane and 12 in the Z-Y plane. Five SSEs were run in the X-Y plane and 4 in the Z-Y plane. The Test Response Spectra (TRS) for a typical SSE in the X-Y plane are shown in Figures 3-14 and 3-15. The low voltage power supply met all performance requirements before, during, and after these tests and is considered seismically qualified.

Business Sensitive

[redacted]

[redacted]

3.3.8.5 8 Volt Power Supply Assembly

The Power Supply Assembly consists of a power supply [redacted] mounted to a plate [redacted] that in-turn is mounted on the back of the NIM Bin Assembly. The Power Supply Assembly is qualified by analysis GA-ESI documents E-255-968 Supplement 6. The natural frequency was not calculated, therefore, the peak acceleration times 1.5 was used for the analysis. The analysis was performed using a peak vertical acceleration of [redacted] and a peak horizontal acceleration o[redacted]. [redacted] The attachment is considered qualified.

Business Sensitive

3.3.9 Local Indicator

The Local Indicator [redacted] is similar to the RL-10 Local Indicators [redacted] seismically tested and reported in GA-ESI document E-255-996. The test article is larger than the local indicators being qualified but it contains all the same components. Both the test article and the Local Indicators being qualified are mounted with [redacted] bolts [redacted] The RL-10 Local Indicator test article was subjected to 7 biaxial Safe Shutdown Earthquakes (SSE); then rotated 90° and given 7 biaxial SSE. The Test Response Spectra (TRS) for a typical SSE are shown in Figures 3-6 and 3-7. The RL-10 Local Indicator and its mounting hardware successfully passed this testing. The Local Indicators are considered qualified for normal and abnormal service condition except normal radiation. Performance beyond 5×10^4 RADS is not known. TVA should review this qualification basis and establish a course of action when 5×10^4 RADS is reached.

4. REPLACEMENT SCHEDULE

The replacement schedule for components that contain parts with aging mechanisms is provided in this section. The replacement schedules provided in Table 4-1 are based on an 86°F (30°C) average ambient temperature. Lifetime for components in enclosures include an 18°F (10°C) temperature rise. A dash entry indicates a higher-level assembly that does not require replacement but contains the component to be replaced. The individual components to be replaced are listed with a qualified life in years.

Table 4-1 PIG Monitor Replacement Schedule

Component	[redacted]	Life @ 86°F Years	Notes
PIG Monitor System		**---**	
PIG Monitor Assembly		**---**	
RD-59-30D Detector Assembly		--	
Gas Detector		SUR	2
Iodine Detector		SUR	2
RD-56C Detector Assembly		---	
Particulate Detector		SUR	2
Stepper Motor PWA		10	1
RM-80 Assembly		---	
Low Voltage Power Supply		10	1
Heat Sink Assembly		---	
5 Volt Logic Power Supply		10	1
Battery Assembly		5	
Display Cable Assembly		30	
High Voltage Power Supply		10	1
CPU PWA		SUR	4
Customer Interface Junction Box		---	
CIJB Backplane PWA		---	

Component	[redacted]	Life @ 86°F Years	Notes
Isolation Transmitter		10	1
Blower/Motor Assembly		6.2	3
Housing Gasket		26	
Motor (Bearings)		7.5	
Motor (Windings)		20	
Blower Moving Parts		15	
Piping and Valve Assemblies		---	
Flow Switch		10	1
Local Indicator		**SUR**	**5**
NIM Bin Assembly		---	
24 Volt Power Supply		10	1
8 Volt Power Supply		10	1

[redacted]

5. EMC QUALIFICATION BASIS

Business Sensitive

This section demonstrates that Particulate, Iodine, and Gas (PIG) Monitor System [redacted] is Electromagnetic Compatibility (EMC) qualified for operation at TVA's [redacted]. The EMC qualification basis is established by demonstrating that GA-ESI's EMC qualification tests on the radiation monitoring systems meets the requirements for replacement radiation monitors and the significant differences between the radiation monitor system being qualified and the radiation monitor systems tested are reconciled.

The PIG Monitor System consists of three electrically connected subsystems; a PIG Monitor Assembly, a Gas Channel Local Indicator Assembly, and a Control/Display NIM Bin Assembly. The Block Diagram [redacted] shows the major components of the system as well as their electrical interconnections. The following subsections describe the EMC Qualification Basis for the system as a whole and each of the subsystems.

5.1 MONITOR SYSTEM QUALIFICATION BASIS

The monitor system uses the latest technology and components developed and tested to ensure Electromagnetic Compatibility. Filters, surge protection, and noise suppressors have been added to power input circuits and components that could generate noise, such as relays. Tests have been conducted individually, using the latest standards available at the time, on the microprocessor based radiation monitors and their associated detector and control/display units. Test on skid mounted radiation monitors consisting of components found in most radiation monitors have been conducted and the knowledge gained has been utilized in the design and manufacture of the PIG Monitor System. The electrical distribution cable and the instrument cable routing are similar in design and materials; the difference being the routing of the cables. All cabling is contained in metallic conduit and metal enclosures. Business Sensitive

GA-ESI has performed the tests on a radiation monitoring system; [redacted] (Moving Filter Particulate and Gas Monitor) and [redacted] (RM2300 NIM Bin Assembly) the results of which are issued in GA-ESI report number 04619048B, *RM-2000/RM-2300 EMI/RFI Qualification Report.* The equipment tested use an RM-2000 microprocessor radiation monitor and an RM-2300 Display/Control NIM Bin Assembly.

There are two major subsystems for the radiation monitors; the detection and data processing subsystem and the sample transport subsystem. The differences between the tested monitor and the monitor being qualified are described below and their qualification basis described in subsequent sections.

The detection and data processing subsystem of the tested monitor includes an RD-56B detector assembly (heated moving filter particulate monitor) and an RD-52 detector assembly (fixed volume heated gas detector) connected to an RM-2000 and RM-2300 Control/Display NIM Bin Assembly. The monitor being qualified uses an RD-59 Detector Assembly consisting of gas and iodine detectors and an RD-56C moving filter particulate monitor. An RM-80 microprocessor assembly is used in the monitor being qualified as opposed to the RM-2000 of the test article. A CIJB is utilized in both monitors to connect between the radiation microprocessor and customer connections to other components. In both the test article and the monitor being qualified, power input is provided by connection to a power line filter in the Power Control Center and to the blower motor through a motor starter and RC Network filter. An RM-23A NIM Bin assembly is used on the PIG Monitor System whereas the tested system uses an RM-2300 NIM Bin Assembly. A local indicator assembly for the gas channel has been added to the PIG Monitor System; one is not included in the test system.

The sample transport system differs slightly between the monitor test and the monitor being qualified. Both the tested monitor and the monitor being qualified transport gas and particulate samples. Both monitors use a power control center, pump/motors, solenoid valves, and flow switches. Added features of the tested monitor (sample line heat trace, heated detectors, temperature controller, and paperless recorder) do not affect the qualification of the radiation monitoring system being qualified because: Business Sensitive

[redacted]

Table 5-1 and 5-2 lists the results for the tests performed to GA-ESI procedures demonstrating that the tested radiation monitoring system meets the requirements of EPRI TR-102323 Revision 3. The tested system did not exhibit any malfunction, degradation of performance, or deviation from specified indications, beyond the tolerances indicated in the individual equipment or subsystem specification, when subjected to a test signals specified in NRC Regulatory Guide 1.180 Revision 1. Changes to detector level (other than normal background variation) were limited to ±10%.

Table 5-1 Susceptibility and Immunity Test Summary

Test	Test Method	[redacted]	Compliance Status	
			Monitor	**RM-2300**
Low- Frequency Conducted Susceptibility	MIL-STD-461E Test CS101		**Pass**	**Pass**
High-Frequency Conducted Susceptibility	MIL-STD-461E Test CS114		**Pass**	**Pass**
Low-Frequency Radiated Magnetic Field Susceptibility	MIL-STD-461E Test RS101		**Pass**	**Pass**
High-Frequency Radiated Electric Field Susceptibility	MIL-STD-461E Test RS103		**Pass**	**Pass**
Surge Immunity	IEC 61000-4-5 1995), A1(2001)		**Pass**	**Pass**
Electrical Fast Transient Immunity	IEC 61000-4-4 (1995) A1(2000), A2 (2001)		**Pass**	**Pass**
Electrostatic Immunity	IEC 61000-4-2 (1995), A1(1998), A2 (2000)		**Pass**	**Pass**

Business Sensitive

Table 5-2 Emissions Test Summary Business Sensitive

Test	Test Method	[redacted]	Compliance Status	
			Monitor	RM-2300
Low- Frequency Conducted Emissions	MIL-STD-461E Test CE101		Pass	Pass
High-Frequency Conducted Emissions	MIL-STD-461E Test CE102		Pass	Pass
Low-Frequency Radiated Magnetic Field Emissions	MIL-STD-461E Test RE101		Pass	Pass
High-Frequency Radiated Electric Field Emissions	MIL-STD-461E Test RE102		Pass	Pass

The physical arrangement of electronic/electric devices, the routing of the cabling, the techniques used for grounding are considered qualified by similarity to the tested monitor system.

5.2 PIG Monitor Assembly

The PIG Monitor Assembly is a skid whose structure supports the components for sensing and processing radiation data and for transporting gas and particulate samples to sensing detectors. As described in Section 5.1 it is similar to the PG monitor tested. The results demonstrate that the monitor as a whole meets the requirements of the TVA specification for EMC. The qualification of major subassemblies of the PIG Monitor are discussed in the following subsections.

5.2.1 RM-80 Microprocessor

The tested PIG Monitor System used an RM-2000 microprocessor and an RM-2300 control/display module. The monitor system being qualified has an RM-80 microprocessor and RM-23A Control/Display Module.

The EMC qualification basis for the replacement RM-80 microprocessor and RM-23A is discussed in GA-ESI document 04038903-11SP. The tested RM-80 microprocessor and RM-

23A Control/Display Module did not have Customer Interface Junction Box (CIJB), Power Control Center (PCC), sample transport components, or the 24 volt NIM Bin power supply. Generally, the RM-80 microprocessor and RM-23 Radiation Monitoring System was given a series of susceptibility and emissions tests and met the requirements of TVA specification 64-821696. The tests performed are shown in Table 5-3.

Table 5-3 Electromagnetic Compatibility Test Results for RM-80/RM-23 Radiation Monitors

Test	Test Method	Compliance Status	
		RM-80	RM-23
Conducted Transient EMI Susceptibility	TVA 64-821696 Appendix E	Pass	Pass
RF Conducted Susceptibility	TVA 64-821696 Appendix E	Pass	Pass
Radiated Transient Electromagnetic Field	TVA 64-821696 Appendix E	Pass	Pass
Radiated RF/EMI Field Susceptibility	TVA 64-821696 Appendix E	Pass	Pass
Conducted Emissions	TVA 64-821696 Appendix E	Pass	Note 2
Surge Withstand Capability	TVA 64-821696 Appendix E	Note 1	Not Required
Radiated Susceptibility	SAMA PMC 33.1-1978	Pass	Pass

[redacted]

The equipment being qualified is similar to the RM-80 microprocessor and RM-23 radiation monitoring system that was tested. The RM-80 and the RM-23 NIM Bin are the same and are interconnected in the same way. The results are considered acceptable.

5.2.2 Customer Interface Junction Box

The RM-80/RM-23A test article did not have a CIJB, however, the results of the tests are considered acceptable based on the results of testing the PG monitor described in Section 5.1. The CIJB does not contain power supplies. It does include the following items:

- Alarm relays,
- An EMI/RFI Filter, and
- Interconnecting cables between the RM-80 and the flow indicating switch.

The steel CIJB enclosure is the same enclosure type as the test article RM-80. It is grounded in the same manner. The cable penetrations and shield grounding are the same as the RM-80. A panel is provided for TVA to attach metal conduit and route cabling to interface with plant equipment.

The alarm relays are the same type tested as part of the RM-80 test article and have noise suppression networks included in the CIJB, further reducing conducted emissions due to being continuously energized in a fail state condition. The alarm relays are considered acceptable.

The EMI/RFI filter [redacted] is a multi-pin bulkhead connector used for signal transmission between the RM-80 and the flow indicating switch to the alarm relays and customer connections. [redacted] It is the same connector used on the monitor CIJB tested and reported in Section 5.1. Business Sensitive

The interconnecting cables are the same as the cables used for the EMI/RFI tests. They have the same shield coverage and are connected and grounded in the same manner. They are considered acceptable.

5.2.3 RD-59 Detectors and Checksource

A detectors used in the RD-59 Detector Assembly are similar to the detector used in the RD-52A-40D assembly that was tested as part of the PG monitor described in Section 5.1. The tested monitor uses an RD-52 detector assembly (fixed volume heated gas detector). The RD-52 detector is a scintillation detector with radiation sensitive crystal, light pipe, photomultiplier tube and electronic socket assembly of similar construction as the detectors being qualified. Electrically, the detectors operate in the same manner except the detectors being qualified do not have a wrapped heater as does the detector tested. All detectors [redacted] installed in a steel

Business Sensitive

[redacted]

enclosed, [redacted] lead shield assembly that is grounded providing protection from EMI/RFI. The cables and connectors to and from the detectors are the same and routed in a similar manner in flexible steel conduit. The signal from the detectors is input to the RM-80. High voltage is provided to detector to adjust the gain of the photomultiplier tube. [redacted] This is considered qualified.

A similar checksource to the one being qualified was used on the tested monitor. The detectors and the checksources are considered qualified.

5.2.4 RD-56C Particulate Detector Assembly

The RD-56C moving filter particulate detector assembly is an enhanced version of the RD-56B detector assembly. The detectors are the same. The differences are in the paper transport mechanism. The detector assembly includes a heater that is not used on the monitor being qualified. The results of the tests described in Section 5.1 demonstrate that the RD-56C is EMC and is considered acceptable.

5.2.5 Power Control Center

The Power Control Center (PCC) for the PIG Monitor is similar to the PCC of the PG monitor tested as described in Section 5.1, They both contain EMI/RFI/Surge filters, switches and indicators, relays, noise suppression circuits and are housed in similar enclosures. The tested monitor is more complex than the monitor being qualified in that the tested monitor includes components to control heated detector assemblies, heat-traced sample lines which require a separate microprocessor and temperature control device, and a paperless recorder. The arrangement of components is different between the two PCCs which is not significant.

A power line filter has been added to reduce conducted emissions and susceptibility. The filter has been used on radiation monitoring systems since 1995 and the filter has passed emission and susceptibility tests, describe in Section 5.1, on the power lines. [redacted] It meets IEEE Std C62.41 surge test at 6 kV ring wave. It is considered acceptable. The PCC is considered qualified.

Business Sensitive

5.2.6 Sample Transport Components

Electrically, the PIG Monitor System sample transport components are similar to the tested PG monitor described in Section 5.1. Both contain pump motors of similar design but different voltage, electrically similar solenoid valves and flow switches. The tested monitor is more complex than the monitor being qualified in that the tested monitor includes heat-traced sample lines which require a separate microprocessor and temperature control device.

[redacted].

Business Sensitive

The sample transport components are considered qualified.

5.3 RM-23A NIM Bin Assembly

The RM-23A NIM Bin assembly with the RM-23A module was tested as describe in Section 5.2.1. The control/display NIM Bin power is supplied by an 8 VDC power supply [redacted] that convert the 120 VAC input to 8 VDC required by the RM-23A Modules. A similar 7 VDC power supply (GA-ESI P/N 50009377-001) was used as part of the tests of the 115 VAC power line to the RM-23 reported in GA-ESI document E-115-0988. A similarity analysis is documented in GA-ESI report E-255-0968 Supplement 6. The 115 VAC power line tests that included the 7 VDC power supply are described in Table 5-3.

The power supply is considered acceptable based on the results of the required tests in accordance with TVA 64-821696 Appendix E. The slight excursion above the required emission limit at 12 MHz is not considered serious enough to cause problems for other systems. The RM-23A NIM Bin Assembly is considered qualified. [redacted]

Business Sensitive

The Power Supply [redacted] is the same power supply used on the RM-1000 NIM Bin Assembly and tested as part of the monitor system described in GA-ESI report 04038800; *RM-1000 EMC Test Report, TVA.* The RM-1000 Radiation Monitoring Systems were given a series of susceptibility, surge, and emission tests in accordance with TVA specification SS E18.14.01 Rev 3. The RM-1000 system, including the power supply, performed satisfactorily for these tests. The power supply is considered acceptable.

5.4 Gas Channel Local Indicator

The gas channel local indicator assembly has not been tested, however, it is consider acceptable for the following reasons.

Business Sensitive

[redacted]

Business Sensitive

6. SOFTWARE QUALIFICATION BASIS

GA-ESI's software qualification program is in accordance with 10CFR 50 Appendix B since the program was initiated in the late 1970's. Before the advent of nuclear verification and validation (V&V) programs, GA-ESI produced a set of design, functional, and performance specifications for the RM-80 and RM-23 software. These radiation monitors were extensively tested against these specifications to ensure that they were able to perform their safety function and provide reliable data and alarm functions. This is evident by a long history of successful operation at many nuclear power plants throughout the world. Formal configuration control and error reporting fully meet the requirements of 10CFR50 Appendix B as well as 10CFR Part 21.

As the industry matured and NRC, EPRI, and IEEE establish new standards for the V&V of software, GA-ESI kept pace with the new standards by performing a formal V&V to the latest standards for the RM-80 and RM-23 in the late 1990s. The standards and regulatory documents used for this V&V were:

- NRC Draft Guides DG-1054 through DG-1059 (all issued in 1996)
- NRC NUREGs -95-02 and -4640
- IEEE Standards 729, 730.1-1990, 829, 830-1984, 833-1974, 934-1987, 983, 1002, 1012-1986, 1016-1987, 10231988, 1028-1988, and 1074-1995.

The results of the V&V are reported in the following GA-ESI documents.

- 03988910 RM-80 and RM-23A Operational History and System Reliability
- 04609041 RM-80/RM-23A Software V&V Plan
- 04609042 RM-80/RM-23A Software QA Plan/Software Configuration Management
- 04609043 RM-80 Supplement Validation Test Report
- 04609046 RM-23 Software V&V Report

These reports demonstrate that the RM-80/RM-23 Radiation Monitoring System software meets the requirements for verification and validation of safety related software.

7. REFERENCE DOCUMENTS

GA-ESI DRAWINGS

04031500	OUTLINE, PARTICULATE, IODINE AND GAS MONITOR SYSTEM
04031501	PARTICULATE, IODINE AND GAS MONITOR SYSTEM
04031510	BLOCK DIAGRAM. PARTICULATE, IODINE AND GAS MONITOR SYSTEM
04031120	CUSTOMER CONNECTION DIAGRAM, PARTICULATE, IODINE AND GAS MONITOR SYSTEM

GA-ESI DOCUMENTS

02818905-QSR	ENVIRONMENTAL QUALIFICATION SUMMARY REPORT FOR CLASS 1E EQUIPMENT FOR WATTS BAR UNITS 1 & 2
03608917-3SP	QUALIFICATION SUMMARY REPORT FOR RADIATION MONITOR REPLACEMENT PARTS
03608917-4SP	QUALIFICATION SUMMARY REPORT FOR RADIATION MONITOR REPLACEMENT PARTS
03608917-5SP	QUALIFICATION SUMMARY REPORT FOR RADIATION MONITOR REPLACEMENT PARTS
03728906-QSR	QUALIFICATION SUMMARY REPORT FOR IN DUCT GAS RADIATION MONITOR
03988910	RM-80 AND RM-23 OPERATIONAL HISTORY AND SYSTEM RELIABILITY
04038800	RM-1000 EMC TEST REPORT, TVA
04038903-QSR	QUALIFICATION SUMMARY REPORT FOR WATTS BAR NUCLEAR PLANT UNIT 2 REPLACEMENT RADIATION MONITORS
04038903-7SP	QUALIFICATIONBASIS FOR 04034101-001 (2-RE-90-271, -272, -273, & -274)
04038903-11SP	ELECTROMAGNETIC COMPATIBILITY QUALIFICATION BASIS FOR RM-80/RM-23 RADIATION MONITORS
04038904-QSR	QUALIFICATION SUMMARY REPORT FOR ROTRON REGENERATIVE BLOWER CLASS 1E
04238926-1SP	SEISMIC QUALIFICATION SUMMARY REPORT FOR R11/12 CONTAINMENT ATMOSPHERE RADIATION MONITOR

04508905-QR	QUALIFICATION TEST REPORT FOR RM-1000 PROCESSOR MODULE AND CURRENT-TOFREQUENCY CONVERTER
04609041	RM-80/RM-23 SOFTWARE V&V PLAN
04609042	RM-80/RM-23A SOFTWARE QA PLAN/SOFTWARE CONFIGURATION MANAGEMENT
04609043	RM-80 SUPPLEMENT VALIDATION TEST REPORT
04609046	RM-23 SOFTWARE V&V REPORT
04619036-3SP	SUPPLEMENT NUMBER 3 TO RM-2300 QUALIFICATION TEST REPORT FOR RADIATION MONITORING SYSTEMS
04619048	RM-2000/RM-2300 EMI/RFI QUALIFICATION REPORT
E-115-459	SEISMIC QUALIFICATION SUMMARY REPORT FOR TVA RADIATION MONITORING EQUIPMENT
E-115-0988	ELECTROMAGNETIC INTERFERENCE TESTS, METHODS, AND TEST LIMITS
E-255-968	QUALIFCATION TEST REPORT FOR CLASS 1E EQUIPMENT FOR WIDE RANGE GAS MONITORING SYSTEM
E-255-968-6SP	QUALIFICATION SUMMARY REPORT DC POWER SUPPLY ASSEMBLY GA-ESI PART NUMBER 04702121-001 & -002
E-255-996	QUALIFICATION TEST REPORT FOR CLASS 1E EQUIPMENT FOR GENERIC RADIATION MONITOR EQUIPMENT
E-255-1060	QUALIFICATION TEST REPORT FOR PROCESS MONITOR DETECTORS
E-255-1081	QUALIFICATION TEST REPORT FOR MAANSHAN CLASS 1E EQUIPMENT
E-255-1236	QUALIFICATION TEST REPORT FOR RIVER BEND RADIATION MONITORING EQUIPMENT
OP-7.3-240	SAFETY RELATED COMMERCIAL GRADE SPARE PARTS

Attachment 10

GA-ESI letter GA-ESI 4505, “Request by General Atomics Electronic Systems, Inc. to Withhold Certain Information from Public Disclosure under 10CFR2.390,” Dated January 4, 2012 (Letter Item 2, SSER Appendix HH Item Number TVA21 and Letter Item 4)

GENERAL ATOMICS

January 4, 2012
GA/ESI-4505

Document Control Desk
U.S. Nuclear Regulatory Commission
Washington, D.C. 2055

Subject: **Request by General Atomics Electronic Systems, Inc. to Withhold Certain Information from Public Disclosure under 10CFR2.390**

Reference: Tennessee Valley Authority / Watts Bar 2 Completion Project

To Whom It May Concern:

General Atomics Electronic Systems Inc., (GA-ESI) hereby submits the following documents related to its Radiation Monitoring System pursuant to the specific request of Bechtel Power Corp. Control Systems in support of the Tennessee Valley Authority's Watts Bar 2 Completion Project:

04038903-1SP Qualification Basis for 04031101-001 (2-RE-90-130 & -131)
04038903-2SP Qualification Basis for 04031301-001 (2-RE-90-106)
04038903-4SP Qualification Basis for 04031501-001 (2-RE-90-112)
010-01038-001 Response to AC Filter Question

Certain portions of the enclosed documents include GA-ESI proprietary commercially strategic information which GA-ESI has held in confidence, and which is not available through public sources. Accordingly, GA-ESI is submitting these documents in confidence and, as set forth in the enclosed affidavit of Mr. John P. Morris, GA-ESI requests that this information be treated as proprietary information under the provisions of 10CFR2.390 and be withheld from public disclosure. The enclosed affidavit addresses specifically the considerations listed in paragraph (b)(4) of 10 CFR Section 2.390 of the of the NRC's regulations.

GA-ESI is submitting both a proprietary version of the documents plus a nonproprietary version of the same. In the proprietary versions of the documents, the proprietary material is delineated by "business sensitive" or "trade secret" designation on specific paragraphs and highlighted text, sentence, figure or drawing to which the designation applies. In the nonproprietary versions, the proprietary information has been obscured/blacked-out.

If you have questions regarding this submittal, please do not hesitate to contact Mr. John Morris at (858) 522-8425 or john.morris@ga-esi.com, or me at (858) 455-2823 or keith.asmussen@ga.com.

Very truly yours,

Keith E. Asmussen

Keith E. Asmussen, Ph.D., Director
Licensing, Safety and Nuclear Compliance

Enclosures: 1) Documents as listed in text
2) Affidavit of Mr. John P. Morris

STATE OF CALIFORNIA)

) ss

COUNTY OF SAN DIEGO)

AFFIDAVIT OF JOHN P. MORRIS

I, John P. Morris, Radiation Monitoring Systems Program Director of General Atomics Electronic Systems, Inc., do hereby affirm and state:

(1) I have been delegated the function of reviewing the information sought to be withheld by General Atomics Electronic Systems, Inc. and I am authorized to execute this affidavit on behalf of General Atomics Electronic Systems, Inc.

(2) The affidavit is submitted under the provisions of 10CFR Part 2.390 in order to withhold the enclosed confidential commercial information (as set forth in paragraph 3 following) of General Atomics Electronic Systems, Inc. from public disclosure or publication.

(3) The information sought to be withheld is related to General Atomics Electronic Systems' Radiation Monitoring System (i.e., RM-1000) and is contained in the documents designated as:

04038903-1SP Qualification Basis for 04031101-001 (2-RE-90-130 & -131)
04038903-2SP Qualification Basis for 04031301-001 (2-RE-90-106)
04038903-4SP Qualification Basis for 04031501-001 (2-RE-90-112)
010-01038-001 Response to AC Filter Question

The proprietary material in these documents is delineated by "business sensitive" or "trade secret" designation on specific paragraphs and highlighted text, sentence, figure or drawing to which the designation applies.

(4) In making this application for withholding of proprietary information of which it is the owner, General Atomics Electronic Systems, Inc. relies upon the exemption from disclosure set forth is the Freedom of Information Act ("FOIA"), 5 USC Sec. 552.(b)(4) and the Trade Secrets Act, 18 USC Sec. 1905, and NRC regulations 10CFR Part 9.17(a)(4) and 2.390(a)(4) for "trade secrets and commercial or financial information obtained from a person and privileged or confidential." The material for which exemption from disclosure is hereby sought is all "confidential

commercial information," and some portions also qualify under the narrower definition of "trade secret," within the meanings assigned to those terms for purposes of FOIA Exemption 4 in, respectively, Critical Mass Energy Project v. Nuclear Regulatory Commission, 975F2d871 (DC Cir. 1992), and Public Citizen Health Research Group v. FDA, 704F2d1280 (DC Cir. 1983).

(5) Some examples of categories of information which fit into the definition of proprietary information are:

a. Information that discloses a process, method, or apparatus, including supporting data and analyses, where prevention of its use by General Atomics Electronic Systems, Inc.'s competitors without license from General Atomics Electronic Systems, Inc. constitutes a competitive economic advantage over other companies;

b. Information which, if used by a competitor, would reduce his or her expenditure of resources or improve his or her competitive position in the design, manufacture, shipment, installation, assurance or quality, or licensing of a similar product.

c. Information which discloses patentable subject matter for which it may be desirable to obtain patent protection.

(6) The information sought to be withheld is being submitted to the NRC in confidence. The information is of a sort customarily held in confidence, is of a sort customarily held in confidence by General Atomics Electronic Systems, Inc., and is in fact so held. The information sought to be withheld has, to the best of my knowledge and belief, consistently been held in confidence by General Atomics Electronic Systems, Inc. No public disclosure has been made, and it is not available in public sources. All disclosures to third parties, including any required transmittals to the NRC, have been made, or must be made, pursuant to regulatory provisions or proprietary agreements which provide for maintenance of the information in confidence. Its initial designation as proprietary information, and the subsequent steps taken to prevent its unauthorized disclosure, are as set forth in paragraphs (7) and (8) following.

(7) Initial approval of proprietary treatment of a document is made by the manager of the originating component, the person most likely to be acquainted with the value and sensitivity of the information in relation to industry knowledge. Access to

such documents within General Atomics Electronic Systems, Inc. is controlled to protect it from unauthorized disclosure.

(8) The procedure for approval of external release of such a document typically requires review by the staff manager, project manager, principal scientist or other equivalent authority, by the manager of the cognizant marketing function (or his designee), and by the Legal Department, for technical content, competitive effect, and determination of the accuracy of the proprietary designation. Disclosures outside General Atomics Electronic Systems, Inc. are limited to regulatory bodies, customers, and potential customers, and their agents, suppliers, and licensees, and others with a legitimate need for the information, and then only in accordance with appropriate regulatory provisions or proprietary agreements for protecting the information from further disclosure.

(9) The information classified as proprietary was developed and compiled by General Atomics Electronic Systems, Inc. at a significant cost to General Atomics Electronic Systems, Inc. This information is classified as proprietary because it contains detailed historical data and analytical results not available elsewhere. This information would provide other parties, including competitors, with information from General Atomics Electronic Systems, Inc. technical database and the results of evaluations performed using codes developed by General Atomics Electronic Systems, Inc. Release of this information would improve a competitor's position without the competitor having to expend similar resources for the development of the database. A substantial effort has been expended by General Atomics Electronic Systems, Inc. to develop this information.

(10) Public disclosure of the information sought to be withheld is likely to cause substantial harm to General Atomics Electronic Systems, Inc.'s competitive position and foreclose or reduce the availability of profit-making opportunities. The information is part of General Atomics Electronic Systems, Inc.'s comprehensive radiation monitoring system technology base, and its commercial value extends beyond the original development cost.

The value of the technology base goes beyond the extensive physical database and analytical methodology, and includes development of the expertise to determine and apply the appropriate evaluation process.

The research, development, engineering, and analytical costs comprise a substantial investment of time and money by General Atomics Electronic Systems, Inc.

The precise value of the expertise to devise an evaluation process and apply the correct analytical methodology is difficult to quantify, but it is clearly substantial. General Atomics Electronic Systems, Inc. competitive advantage will be lost if its competitors are able to use the results of the General Atomics Electronic Systems, Inc.'s experience to normalize or verity their own process or if they are able to claim an equivalent understanding by demonstrating that they can arrive at the same or similar conclusions.

GENERAL ATOMICS ELECTRONIC SYSTEMS, INC.

John P. Morris

John P. Morris, Radiation Monitoring
Systems Program Director

State of California
County of San Diego

On January 4, 2012 before me, Lynne-Marie Vetters, Notary Public, personally appeared John P. Morris, who proved to me on the basis of satisfactory evidence to be the person whose name is subscribed to the within instrument and who acknowledged to me that he executed the same in his authorized capacity, and by his signature on the instrument the person, or entity upon behalf of which the person acted, executed the instrument.

I certify under PENALTY of PERJURY under the laws of the state of California that the foregoing paragraph is true and correct.

WITNESS my hand and official seal.

LMVetters

(Signature of Notary)

LYNNE-MARIE VETTERS
Commission # 1919792
Notary Public - California
San Diego County
My Comm. Expires Jan 1, 2015

Attachment 12

NOT USED

Attachment 13

NOT USED

Attachment 14

NOT USED

Attachment 16

Redacted non-proprietary “GA-ESI letter 010-01038-001, Attachment 1, 04502050-001 Receipt Inspection” (Letter Item 4)

PO 124787
(COMPLETE)

GENERAL ATOMICS ELECTRONIC SYSTEMS

Business Sensitive

PURCHASE PART RECEIVER

Date Printed: 2/5/2009 10:55:47 AM

CLOSED

PURCHASE ORDER	VENDOR ID	VENDOR NAME	PRODUCT CODE	COMMODITY CODE	BUYER	ORDER DATE	REC'D BY
124787 / 1	[redacted]	[redacted]	010-10	05-999	SHARONP	2/2/2009	HECTORJ

RECEIVER #	LINE #	WAREHOUSE/LOCATION/WBS	RECEIVED DATE	REQUESTOR	DELIVER TO	SHIP TO
83066	1	MAIN/INSP	2/5/2009			GA - ESI

PART #	INSP REQ'D	REV	UM	ORDER QTY	REC'D QTY	TRACE ID	MFG NAME	MFG PART #
[redacted]	Y	-	EA	24.00	24.00	RM013784	01-GA-ESI	04502050-001

[redacted],POWER SUPPLY,24VDC,1.8 AMP

QA NOTE CODES: A

Business Sensitive

RECEIVING INSPECTION:

INSPECTED BY	DATE
DCorrea	03/16/09

STOCKROOM:

LOCATION ID	STOCKED BY	DATE
INSP		

WORK ORDER SHORTAGE FOR:

WORK ORDER #	PIECE #	QTY SHORT	DUE DATE	WAREHOUSE	WBS CODE
/					

PO LINE SPECS:

[redacted]

Business Sensitive

100857 1

[redacted]

ORDER#	ORDER DATE	VIP	REQ. SHIP DATE	CUSTOMER P.O.	SHIP VIA	PAGE
14965554-000	02/02/09	ISR	02/02/09	124787	UPS Ground Commerc	1

Message:

BILL TO: BILL TO NO.: 877303

GENERAL ATOMICS,ELECT,INC.
4949 GREENCRAIG LN
SAN DIEGO
SAN DIEGO CA 92123 1675

SHIP TO: SHIP TO NO.: 877303

GENERAL ATOMICS,ELECT,INC. DC
4949 GREENCRAIG LN
SAN DIEGO
SAN DIEGO CA 92123 1675

Qty Ordered	Qty Shipped	UM	[redacted]	Manufacturer	Manufacturer Part Number	Description	Unit Price	Amount
24	24	EA	[redacted]	[redacted]	[redacted]	PWR SPLY,SW,ENCL,43W, UPS COMMERCIAL		
			1-24	Business Sensitive	83066			
1					**End**			

GA-ESI
The certifications received have been checked for accuracy and completeness
INSPECTED BY: DCorrea
DATE: 03/16/09

020209 14:27:14

IMPORTANT RETURN INFORMATION

RMA Required. Please call 800-536-4316. 30-Day Money-Back Guarantee

Business Sensitive

ESTIMATED ORDER TOTAL...............
ESTIMATED SALES TAX..................
PREPAID....................
ORDER BALANCE

[redacted]

GENERAL ATOMICS
ELECTRONIC SYSTEMS INC.

DATA BASE CHANGE REQUEST (DBCR)

ESI Part/Drawing Number: (12 characters) [redacted] Business Sensitive

PART X DOCUMENT

SECTION 1

ORIGINATOR: Robert C. Weddle		DATE: 09/06/2005	
ACTION: ADD:	MOD: X	PRODUCT LINE: RMS	
MAKE:	PURCHASE: X	TOP ASSEMBLY: YES:	NO: X
DESCRIPTION: SCD,POWER SUPPLY,24VDC,1.8 AMP			
MANUFACTURER: [redacted] Business Sensitive			
MANUFACTURER'S PART NUMBER:			
UNITS OF MEASURE:	WHERE USED: ATTACHED	PROJ: SPARES	
COMMENTS/JUSTIFICATION: Activate SRCGI Status			

SECTION 2

TRANSCRIBER:			DATE:	
PART ID:				
DESCRIPTION (40):				
UNIT OF MEASURE:	PRODUCT CODE:	FAB:	PUR:	DETAIL ONLY:

DEFAULTS TAB		
MFR-1:	MFR PART NUMBER-1:	
MFR-2:	MFR PART NUMBER-2:	
MFR-3:	MFR PART NUMBER-3:	
MFR-4:	MFR PART NUMBER-4:	
PRIMARY WAREHOUSE ID:	PRIMARY LOCATION ID–INSP:	REC'D:
INSPECTION REQUIRED: YES: NO:	TRACE: YES:	NO:

USER DEF TAB
FULL DESCRIPTION (80):
QA NOTE CODES:
ADDITIONAL SPEC REQD ON PO'S:

CONFIGURATION MGT TAB	
STAGE:	REVISION ID:
DRAWING NUMBER:	DRAWING REVISION:
ECN CONTROLS REVISION: YES: NO:	

9.8-05

ENTERED BY: DATE: 9-8-05

VERIFIED BY: DATE: 9/8/05

GA-ESI 0079 (10/04)

GENERAL ATOMICS
ELECTRONIC SYSTEMS INC.

RMS Part/Drawing Number: (12 characters) [redacted]

Business Sensitive

SECTION 3

DESIGN ENGINEERING NAME: **Robert Weddle** DATE: **09/06/2005**

	SRCGI	BASIC COMPONENT	SAFETY RELATED EQUIPMENT	RE-QUALIFICATION REQUIRED	QUALIFICATION DOCUMENTS AFFECTED
YES	X		X		X
NO		X		X	

NOTE: Attach Any Critical Characteristics if SRCGI is marked YES.

Business Sensitive

AFFECTED DOCUMENT NUMBER: [redacted]

SECTION 4

IND. ENG. [signature] DATE: 9-8-05

Q.A. Frances McCord DATE: 9-8-05

SEE ATTACHED FORM SE0159-2B (PAGE 2 OF 2)
REVISION [-]

QUALITY CONTROL CRITICAL CHARACTERISTIC ACCEPTANCE PLAN
"DBCR & QCI-146" (APPLICABLE DOCUMENTATION REQUIRED)

Business Sensitive

PART NUMBER [redacted] P.O. #: 124787 ITEM #: 1 RECEIVER #: 83066
DESCRIPTION: SCD, POWER SUPPLY, 24VDC, 1.8 AMP
LOT SIZE: 9 SAMPLE SIZE: 9 NMR #:

REQUIREMENTS [X] (CRITICAL CHARACTERISTICS)	[ ] SAMPLE LOT INSPECTION PER, NP-7218 AND QCI -100 TABLE 1 [ ] REDUCED [ ] NORMAL [ ] TIGHTENED [X] SPECIAL **NOTE:** APPEND ENGINEERING/ QUALITY JUSTIFICATION FOR ANY SAMPLING OF ANY CHARACTERISTIC WHICH IS NOT PER NORMAL TABLE 1 OF QCI 100.	[X] 100% INSPECTION AND TEST [X] SERIALIZATION REQUIRED
1. MARKING AND VISUAL	[✓] PASS [ ] FAIL	SERIAL NO./ SAMPLE LOT EA8910 — PASS FAIL CCN 1. 8371 [✓] [ ]
2. DIMENSIONAL	[✓] PASS [ ] FAIL CCN: 15-2-CE	2. 8372 [✓] [ ] 3. 8373 [✓] [ ]
3. FUNCTIONAL	[✓] PASS [ ] FAIL CCN: 07-1-B1	4. 8374 [✓] [ ] 5. 8375 [✓] [ ]
4. MATERIAL N/A	[ ] PASS [ ] FAIL CCN:	6. 8376 [✓] [ ] 7. 8377 [✓] [ ]
5. OTHER/SPECIAL		8. 8378 [✓] [ ] 9. 8379 [✓] [ ]

INSPECTOR SIGNATURE: DCorrea DATE: 02/05/09

W/O #: S/O #:

TEST TECH. SIGNATURE: [signature] DATE: 3/16/09

WORKORDER #: 800-88600-0-0-1-10

SERIALIZED RECORDED CHARACTERISTICS WHEN REQUIRED ABOVE:

1.
2.
3.

Use additional sheets as required

"NUCLEAR SAFETY RELATED"

SEE ATTACHED FORM SE0159-2B (PAGE 2 OF 2)
REVISION [-]

QUALITY CONTROL CRITICAL CHARACTERISTIC ACCEPTANCE PLAN
"DBCR & QCI-146" (APPLICABLE DOCUMENTATION REQUIRED)

Business Sensitive

PART NUMBER: [redacted] P.O. #: 124787 ITEM #: 1 RECEIVER #: 83066
DESCRIPTION: SCD, POWER SUPPLY, 24VDC, 1.8 AMP
LOT SIZE: 9 SAMPLE SIZE: 9 NMR #:

REQUIREMENTS [X] (CRITICAL CHARACTERISTICS)	[ ] SAMPLE LOT INSPECTION PER. NP-7218 AND QCI –100 TABLE I [ ] REDUCED [ ] NORMAL [ ] TIGHTENED [X] SPECIAL **NOTE:** APPEND ENGINEERING/ QUALITY JUSTIFICATION FOR ANY SAMPLING OF ANY CHARACTERISTIC WHICH IS NOT PER NORMAL TABLE 1 OF QCI 100.	[X] 100% INSPECTION AND TEST [X] SERIALIZATION REQUIRED
1. MARKING AND VISUAL	[✓] PASS [ ] FAIL	SERIAL NO./ SAMPLE LOT EA8910 — PASS — FAIL — CCN 1. 8380 [✓] [ ]
2. DIMENSIONAL	[✓] PASS [ ] FAIL CCN: 15-2-CE	2. 8381 [✓] [ ] 3. 8382 [✓] [ ]
3. FUNCTIONAL	[✓] PASS [ ] FAIL CCN: 07-1-B1	4. 8383 [✓] [ ] 5. 8384 [✓] [ ]
4. MATERIAL N/A	[✓] PASS [ ] FAIL CCN: ~~07-1-B1~~	6. 8385 [✓] [ ] 7. 8389 [✓] [ ]
5. OTHER/SPECIAL		8. 8390 [✓] [ ] 9. 8392 [✓] [ ]

INSPECTOR SIGNATURE: DCorrea DATE: 02/05/09 W/O #: S/O #: TEST TECH. SIGNATURE: [signature] DATE: 3/16/09 WORKORDER #: 800-88600-0-0-1-10 "NUCLEAR SAFETY RELATED"	SERIALIZED RECORDED CHARACTERISTICS WHEN REQUIRED ABOVE: 1. 2. 3. Use additional sheets as required

SEE ATTACHED FORM SE0159-2B (PAGE 2 OF 2)
REVISION [-]

QUALITY CONTROL CRITICAL CHARACTERISTIC ACCEPTANCE PLAN

Business Sensitive

"DBCR & QCI-146" (APPLICABLE DOCUMENTATION REQUIRED)

PART NUMBER: [redacted] P.O. #: 124787 ITEM #: 1 RECEIVER #: 83066

DESCRIPTION: SCD, POWER SUPPLY, 24VDC, 1.8 AMP

LOT SIZE: 6 SAMPLE SIZE: 6 NMR #:

REQUIREMENTS [X] (CRITICAL CHARACTERISTICS)	[ ] SAMPLE LOT INSPECTION PER, NP-7218 AND QCI -100 TABLE 1 [ ] REDUCED [ ] NORMAL [ ] TIGHTENED [X] SPECIAL **NOTE:** APPEND ENGINEERING/ QUALITY JUSTIFICATION FOR ANY SAMPLING OF ANY CHARACTERISTIC WHICH IS NOT PER NORMAL TABLE 1 OF QCI 100.	[X] 100% INSPECTION AND TEST [X] SERIALIZATION REQUIRED
1. MARKING AND VISUAL	[✓] PASS [ ] FAIL	SERIAL NO./ SAMPLE LOT PASS FAIL CCN EA8910 1. 8393 [✓] [ ]
2. DIMENSIONAL	[✓] PASS [ ] FAIL CCN: 15-2-CE	2. 8395 [✓] [ ] 3. 8397 [✓] [ ]
3. FUNCTIONAL	[✓] PASS [ ] FAIL CCN: 07-1-B1	4. 8398 [✓] [ ] 5. 8399 [✓] [ ]
4. MATERIAL N/A	[ ] PASS [ ] FAIL CCN:	6. 8400 [✓] [ ] 7. [ ] [ ]
5. OTHER/SPECIAL		8. [ ] [ ] 9. [ ] [ ]

INSPECTOR SIGNATURE: DCorrea DATE: 02/05/09

W/O #: S/O #:

TEST TECH. SIGNATURE: [signature] DATE: 3/16/09

WORKORDER #: 800-88600-0-0-1-10

"NUCLEAR SAFETY RELATED"

SERIALIZED RECORDED CHARACTERISTICS WHEN REQUIRED ABOVE:

1.

2.

3.

Use additional sheets as required

GENERAL ATOMICS, ELECTRONIC SYSTEMS

COMMERCIAL GRADE ITEM ENGINEERING EVALUATION

GA-ESI Part Number: 04502050-001

Technical Evaluation:
This POWER SUPPLY, 24VDC, 1.8 AMP is a switching power unit and as such is an active electrical part whose normal function is to provide stable 24VDC to users. The part is essential to RMS & Equipt safety function: to limit RAD exposure to the public per 10CFR100. To maintain part form, fit, function & prevent or mitigate the consequences of part failure , credible failure mode: Circuit Failure has been selected. Critical design & verif. Attribute selection, based on the foregoing, is given in the CGI worksheet.

Equivalency Evaluation:
Tech Evaluation References: EPRI JUTG TE-CGIPW01. REV 0

DETERMINATION OF CRITICAL CHARACTERISTICS

Environment Harsh: No Mild: Yes Seismic: Yes

Business Sensitive

Critical Characteristic		Range
Physical: Dim: L/W/H-(inches)- Mounting Holes-Threaded(5PLS) Mounting Holes-Spacing	[redacted]	Nom Nom +/-.03" +/-.03"
Functional: Input voltage / Freq <Per QCI 106 as Output voltage applicable> ripple (@1.8A)		+/-10% +/-4% Max
Material:		
Other: ~~Marked with mfgr's P/N~~ Open Frame Construction Input/Output terminal locations Weight	~~Ref WDS database~~ Ref Datasheet Ref Datasheet 1.0 Lbs	 Approx.

Engineer: Robert Charles Waddle	Date: 09/20/2005
Independent Reviewer: W Williams	Date: 9-20-05
QA Review: C M. Miller	Date: 9-20-05

GENERAL ATOMICS ELECTRONIC SYTSEMS

COMMERCIAL GRADE ITEM ENGINEERING EVALUATION

Date: September 8, 2005 GA-ESI Part #: [redacted]
Customer: [redacted] Business Sensitive Plant: [redacted]
Cust. P.O.#: P108862 Sales Order#: 201977 Item: 0001

QUALIFIED APPLICATION

Previously Verified?: No

Top Assembly Tag Numbers	Qual Report	Qual Type
[redacted]	04338901-Q	SR
[redacted]	04338901-Q	SR

Notes: Qualification Summary Report is 04338901

COMMERCIAL GRADE EVALUATION

Supplier: SE Model # [redacted]

Notes: *Power Supply, 24VDC, 1.8 Amps Business Sensitive

TECHNICAL EVALUATION

Has part been evaluated before?: No

Part replacement type Like-For-Like?: Yes Alternate: No

Significant changes since last evaluation:

Engineer Robert C. Webb[illegible]	Date: 09/08/2005
Independent Reviewer [illegible]	Date: 9-8-05
QA Review [illegible] McCord	Date: 9-8-05

Record Center add SRCGI to WDS
File with Part Number

COMMERCIAL GRADE WORKSHEET – FOR PART NUMBER: [redacted]

Business Sensitive

I. GENERAL

Parent Equipment normal function: Detect, display, and convey radiation signals

Parent Equipment safety function: Limit radiation exposure to public, per 10CFR100

Item normal function: Provide Stable 24 VDC to users.

Item credible failure modes: [ ] Rupture/fracture [ ] Blockage [ ] Corrosion/Erosion [ ] Seizure [ ] Loss of Properties [X] Circuit Failure

[ ] Fail to Actuate [ ] ______ [ ] ______

II. CHARACTERISTICS NEEDED TO LOWER THE PROBABILITY OF A CREDIBLE FAILURE AND SUPPORT PARENT EQUIPMENT SAFETY FUNCTION:

CRITICAL DESIGN CHARACTERISTICS (REF. EPRI-TERI GUIDE)

PHYSICAL ATTRIBUTES	Check as needed).	
1	Rating ( )	[ ]
2	Rating ( )	[ ]
3	Purity	[ ]
4	Hardness ( )	[ ]
5	Tensile Strength	[ ]
6	Mounting Orientation	[X]
7	Weight Approx 1.0 Lbs	[X]
8	Insulating Property	[ ]
9	Viscosity	[ ]
10	Elasticity	[ ]
11	Density/Spec. Gravity	[ ]
12	Surface Finish	[ ]
13	Shelf Life	[ ]
14	Configuration	[X]
15	Dimensions	[X]
16	Material	[X]
17	Non-Flammability/Shrinkage	[ ]
PERFORMANCE CHAR.		
20	Dielectric	[ ]
21	Volt/Amperes	[X]
22		[ ]
23	Polarity	[ ]
24	Turns Ratio	[ ]
25	Chatter	[ ]
26	Accuracy	[ ]
27	Pressure Drop	[ ]
28	Direction (Rotation)	[ ]
29	Function Logic	[ ]
30	Continuity	[ ]
31		[ ]
40	**IDENTIFICATION**	[X]
SPECIAL TEST/INSPECTION		[ ]
50	Set Point	[ ]
51	Repeatability	[ ]
52	Pick-up / Drop-out Voltage	[ ]
53		[ ]
54		[ ]

ACCEPTANCE METHODS

CRITICAL CHARACTERISTICS FOR PROCUREMENT

Instructions: Enter the checked critical characteristics numbers into boxes provided below. Check the acceptance method (the shaded areas on the right) for the critical characteristics chosen.

Note: Blank spaces and boxes are for critical characteristics not listed.

Critical Characteristics	EPRI NCIG - 07 METHOD ONE: SPECIAL INSPECTIONS AND TESTS					EPRI NCIG - 07 METHOD TWO: SUPPLIER SURVEY			
	RECEIVING INSPECTION (VISUAL)	RECEIVING INSPECTION (MEASURED)	RECEIVING INSPECTION MATERIAL ANALYSIS	RECEIVING INSPECTION BENCH TEST	TEST POST INSTALLATION OR AT ATP	TEST / CHECK MAINTENANCE	CERTIFICATE OF CONFORMANCE	TEST REPORT / TEST DATA REQUIRED	NOTES/REMARKS
[40] MFR. PART NUMBER	X								
[6,14] CONFIGURATION									
(General Arrangement)									
[ ] Per Purchase Order				X					
[X] Per Data Sheet	X								
[ ] Insulating Property									
[ ] Non-Flammability/shrinkage									
[15] DIMENSIONS									
[ ] Per Purchase Order									
[X] Per Data Sheet and Attached Dimensions Sketch		X							
[ ] Tolerance:									
[ ] Sample Size:									
[ ] Weight									
[16] MATERIAL (Visual) Metal Chassis.	X								
[ ] ITEM MARKINGS									
[ ] OPERABILITY : Special Test									
NOTES:									

Operability Tests: 21

III. RECOMMENDED CGI SURVEY ELEMENTS:

[X] Survey N/A
[ ] Performance Test Control
[ ] Production Identification
[ ] Instrument Calibration Control
[ ] Attributes Control
[ ] Document Control
[ ] Design Control
[ ] Material Source Control
[ ] ______
[ ] ______
[ ] ______
[ ] ______

PREPARED BY: Bob Weddle **TITLE:** Qualification Engineer **DATE:** 09/06/2005

REVISIONS

REV	DESCRIPTION	DATE	APPROVED

Document Classification Change

INFORMATION
AUG 3 1 2005
ONLY

[redacted]

SHEET	29	30	31	32	33	34	35	36	37	38	39	40	41	42	43	44	45	46	47	48	49	50	51	52	53	54	55	56
REV																												
SHEET	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28
REV																												

SORRENTO ELECTRONICS

	DATE	
DRAWN M.GERONIMO	8-4-99	SPECIFICATION CONTROL DRAWING
CHECKED Gadwa	8-6-99	POWER SUPPLY, 24VDC, 1.8 AMP
ENGR N. Zeng	8-4-99	
ENGR REV R.C. Deddle	8-5-99	
PROJ MGR [signature]	8/5/99	
MFG ENGR		SIZE A · FSCM NO. 58307 · DRAWING NO. [redacted] · REV —
QUAL MGR J McCord	8/5/99	RELEASE E Pelinoni 8/6/99 · SHEET 1 OF 4
ENGR MGR [signature]	8-5-99	DRAWING LEVEL 3

Business Sensitive

DWG NO. 04502050

REV —

SE-0009 3/97

NOTES:

1. IDENTIFICATION OF THE SUGGESTED SOURCE(S) OF SUPPLY HEREON IS NOT TO BE CONSTRUED AS A GUARANTEE OF PRESENT OR CONTINUED AVAILABILITY AS A SOURCE OF SUPPLY FOR THE ITEM(S).

2. IDENTIFY WITH PART NUMBER, APPROPRIATE DASH NUMBER, AND LATEST REVISION USING A CONTRASTING AND PERMANENT INK. CHARACTERS TO BE LEGIBLE AND APPROXIMATELY .12 HIGH.

3. VENDOR TO SUPPLY CERTIFICATION FOR MEETING THE REQUIREMENTS OF THIS DRAWING FOR ALL UNITS SUPPLIED.

[redacted]

Business Sensitive

[redacted]

Business Sensitive

[redacted]

Business Sensitive

[redacted]

[redacted]

[redacted]

PRINT DATE: 9/12/2005

RMS Part Database Report

PART [redacted] - SCD,POWER SUPPLY,24VDC,1.8 AMP

ENGINEERING: Business Sensitive

SAFETY RELATED:	Y	**SRCGI:**	Y
BASIC COMPONENT:	N	**SRCGI DATE:**	
RE QUALIFICATION:	N	**QUAL DOCS AFFECT:**	Y
DOCUMENT NUMBER:			

QUALITY:

CCAP REV:	-	**SHELF LIFE:**	

SALES:

PRICE VALID:	Y	**REPAIRABLE:**	N
RADIOACTIVE:	N	**LEAD TIME:**	14
CATALOG PRICE:	$179.00	**RAD SOURCE:**	
PRICE UPDATE:	9/2/2005	**PRICE UPDATED BY:**	PAMBAC
MIN SELL QTY:	1		

PART APPLICATION NOTES:

Business Sensitive

1. **SCOPE** ASSEMBLY P/N: [redacted] S/N: [redacted]

This procedure outlines tests to verify that power supplies meet their specifications. It will be used for receiving inspection of power supplies unless the customer provides other instructions. This procedure and its reference documents constitute a complete inspection instruction for power supplies.

CAUTION: Testing of high voltage equipment always requires good safety practices. Make certain all equipment is securely grounded. Do not touch connections unless equipment is off and internal capacitance is discharged. Do not ground yourself or work under wet or damp conditions.

2. **REFERENCE DOCUMENTS**

2.1 QCI 100, Receiving Inspection (General)

2.2 Applicable manufacturer's specification or GA-ESI's specification.

2.3 Quality Manual, Section 10, Inspection Program

Business Sensitive

2.4 [redacted]

3. **VISUAL INSPECTION**

3.1 Visually inspect the power supply as described in QCI 100.

4. **TEST EQUIPMENT**

4.1 Digital voltmeter with accuracy 4 times better than the voltage tolerance of the power supply.

4.2 Variable AC or DC voltage source (as required).

4.3 DC Electronic Load [redacted] and/or load resistors (as required).

4.4 DC current meter with an accuracy of 1% or better

Business Sensitive

4.5 Oscilloscope with capability to indicate specified AC level of ripple. Set the bandwidth to 20 MHz.

4.6 True RMS voltmeter (as required).

4.7 Test Fixture (used when testing P/N [redacted])

5. **TEST SETUP**

The power supply shall be connected as shown in figure 1 for the function test.

6. **PROCEDURE**

6.1 Record actual specifications for unit under manufacturer's specifications section of Test Data Sheet. Items not directly specified are "N/A" and do not require testing.

6.2.1 If applicable, determine the resistance and power rating of the load resistor for full (maximum) rated current at nominal operating voltage, as specified. Record on data sheet.

6.2.2 If using the HP 6051A Electronic Load System or (ELS) Business Sensitive

1. Power up the (ELS)
2. Connect [redacted] to the power supply under test, UUT, as required. Ensure the connecting test wires are of sufficient gauge for the current being measured.
3. Program the desired current by:
    a). Selecting the channel using the "Channel↑ "or "Channel↓" keys.
    b). Select "Current" Mode by pressing the "CURR" key.
    c). Enter the current value (10 amp Max/CH) by using the "Entry" number key and then press the "Enter" key.
    d). Check the (ELS) display for results.
    e). Turn the Current input on/off by pressing the "Input on/off" key.

6.3 Use the correct frequency for the input voltage.

6.4 For three-wire, single-phase, AC input power supplies verify that ground lead is connected to power supply chassis.

6.5 For floating (isolated) outputs, verify that these connections are isolated from the input and the chassis (ground). Short all input terminals together and short all output terminals together during test. Adjust the megger or hipot tester to the specified voltage. Measure and record the insulation resistance or leakage current on the data sheet.

6.6 Measure and record on the data sheet the parameters described below. Indicate acceptance on the data sheet if the measured values are within the specified tolerances. Test for both minimum load and maximum load values as required. Minimum load for some supplies is zero current. Maximum load is sometimes referred to as full load.

NOTE: For part number [redacted] test under loaded conditions only. Test with input of [redacted]

Business Sensitive

6.6.1 Static Load Regulation: With nominal input voltage, measure the output voltage at minimum and maximum (full) load. Also record the minimum and maximum current draw used. The current used should be within 10% of the desired. Note that for some multiple output supplies, a minimum load is required on the outputs not under test.

6.6.2 Static Line Regulation: With the manufacturer's specified load(s), measure the output voltage at minimum and maximum input (line or source) voltage.

6.6.3 Ripple Voltage: With the manufacturer's specified load(s) and nominal input voltage, measure the V peak-to-peak (worst case of source, switching, noise and spike) and RMS on the output.

6.6.4 Output Voltage Adjustment Range: With the manufacturer's specified load(s) and nominal input voltage, measure the output with voltage adjustment (potentiometer) set the minimum and maximum values. For non-adjustable outputs, record the actual voltage. For tracking outputs, record the voltage when the associated output is adjusted. Adjust the supply to the desired output voltage when complete.

6.6.5 Dynamic Load Transient Regulation: With nominal input voltage, use an oscilloscope to measure the maximum output voltage deviation and the recovery time response to a step change in load.

6.6.6 Dynamic Turn On/Off Transient Regulation: With the manufacturer's specified load(s) and nominal input voltage, use an oscilloscope to measure the output voltage deviation above nominal (overshoot) when turning the supply on. Measure the output voltage deviation above nominal (overshoot) when turning the supply off.

6.6.7 Short Circuit Protection: Perform this test only on supplies that specifically state the outputs have short circuit protection. With the manufacturer's specified load(s) and nominal input voltage, use an oscilloscope to measure the recovery time for the output voltage after removing an output short circuit. For supplies that require AC power to be cycled to reset the protection circuit, only verify the supply can be restarted with short circuit removed.

6.6.8 Over Voltage Protection: With the manufacturer's specified load(s) and nominal input voltage, measure the over voltage trip setpoint by applying external voltage when necessary. Also measure the recovery time from removing the over voltage condition.

NOTE: Over voltage protection test for [redacted] power supplies:

Hook up unit under test (UUT) as shown in Figure 1. Business Sensitive

Turn off external voltage supply.

Turn on UUT with minimum load, or half load.

Adjust V_{OUT} to below minimum adjust.

Adjust V_{OUT} to above maximum adjust (this may trip the over voltage protection on the UUT, if so, turn pot CCW, turn UUT off and wait two minutes, turn UUT on, proceed with next step.) Record in Table 1 step 6.6.8 (or voltage where OVP trips)

Adjust V out to nominal voltage.

Turn off UUT.

Turn on external voltage supply.

Set external voltage supply to maximum OVP limit.

Turn off external voltage supply.

Turn on UUT, DVM should read nominal voltage.

Turn on external voltage supply, DVM should read maximum OVP limit.

Turn off external voltage supply, DVM should read about zero volts.

Turn off UUT. Wait ten seconds.

Turn on UUT, DVM should read about zero volts.

Turn off UUT. Wait two minutes.

Turn on UUT, DVM should read nominal voltage.

Turn off UUT.

CAUTION: When the power supply voltage is increased, the load resistor must be increased to avoid exceeding the maximum current.

7. ACCEPTANCE/REJECTION CRITERIA

7.1 Visual inspection meets the requirements of QCI 100.

7.2 The power supply meets the specifications as required in paragraph 6.

7.3 Discrepant material shall be disposed of as described in QCI 100.

8. SUPERSESSION

This QCI supersedes QCI 106, Revision F, and dated 15 October 2002.

Approved: Frances McCord

Title: Director, Product Assurance

Date: October 31, 2006

FIGURE 1

CAUTION: Testing of high voltage equipment always requires good safety practices. Make certain all equipment is securely grounded. Do not touch connections unless equipment is off and internal capacitance is discharged. Do not ground yourself or work under wet or damp conditions.

Business Sensitive

[redacted]

GENERAL ATOMICS ELECTRONIC SYSTEMS

QUALITY CONTROL INSTRUCTIONS	TITLE: INSPECTION OF POWER SUPPLIES		QCI NO.: 106
	EFFECTIVITY: 31 October 2006	REV. G	Page 7 of 10

POWER SUPPLY TEST DATA SHEET

Business Sensitive

	Date 3/13/09
[redacted]	ACCEPT? (YES OR NO)
	Y or N
	Y or N
	Y or N
	Y or N
	Y or N
	Y or N
	Y or N

GENERAL ATOMICS ELECTRONIC SYSTEMS

QUALITY CONTROL INSTRUCTIONS	TITLE: INSPECTION OF POWER SUPPLIES		QCI NO.: 106
	EFFECTIVITY: 31 October 2006	REV. G	Page 8 of 10

POWER SUPPLY TEST DATA SHEET

Business Sensitive

[redacted]	Date 3/13/09
	ACCEPT? (YES OR NO)
	Y or N
	Y or N
	Y or N
	Y or N
	Y or N

GE… RAL ATOMICS ELECTRONIC SYSTEMS

QUALITY CONTROL INSTRUCTIONS	TITLE: INSPECTION OF POWER SUPPLIES		QCI NO.: 106
	EFFECTIVITY: 31 October 2006	REV. G	Page 9 of 10

POWER SUPPLY
TEST DATA SHEET

[redacted]

Date 3/13/09
ACCEPT? (YES OR NO)
Y or N
Y or N
Y or N

Business Sensitive

Test Technician Signature / Date 3/13/09

POWER SUPPLY TEST DATA SHEET

Business Sensitive

	Date 3/13/09
[redacted]	ACCEPT? (YES OR NO)
	Y or N
	Y or N
	Y or N
	Y or N
	Y or N
	Y or N
	Y or N

GENERAL ATOMICS ELECTRONIC SYSTEMS

QUALITY CONTROL INSTRUCTIONS	TITLE: INSPECTION OF POWER SUPPLIES		QCI NO.: 106
	EFFECTIVITY: 31 October 2006	REV. G	Page 8 of 10

POWER SUPPLY TEST DATA SHEET

Business Sensitive

[redacted]

[redacted]	Date 3/13/09
	ACCEPT? (YES OR NO)
	Y or N
	Y or N
	Y or N
	Y or N
	Y or N

POWER SUPPLY TEST DATA SHEET

Business Sensitive

[redacted]	Date 3/13/09
	ACCEPT? (YES OR NO)
	Y or N
	Y or N
	Y or N

Test Technician Signature / Date 3/13/09

GENERAL ATOMICS ELECTRONIC SYSTEMS

QUALITY CONTROL INSTRUCTIONS	TITLE: INSPECTION OF POWER SUPPLIES		QCI NO.: 106
	EFFECTIVITY: 31 October 2006	REV. G	Page 7 of 10

POWER SUPPLY TEST DATA SHEET

Business Sensitive

[redacted]

Date 3/13/09
ACCEPT? (YES OR NO)
Y or N
Y or N
Y or N
Y or N
Y or N
Y or N
Y or N

GENERAL ATOMICS ELECTRONIC SYSTEMS

QUALITY CONTROL INSTRUCTIONS	TITLE: INSPECTION OF POWER SUPPLIES		QCI NO.: 106
	EFFECTIVITY: 31 October 2006	REV. G	Page 8 of 10

POWER SUPPLY TEST DATA SHEET

Business Sensitive

	Date 3/13/09
[redacted]	ACCEPT? (YES OR NO)
	Y or N
	Y or N
	Y or N
	Y or N
	Y or N

GENERAL ATOMICS ELECTRONIC SYSTEMS

QUALITY CONTROL INSTRUCTIONS	TITLE: INSPECTION OF POWER SUPPLIES		QCI NO.: 106
	EFFECTIVITY: 31 October 2006	REV. G	Page 9 of 10

POWER SUPPLY TEST DATA SHEET

Business Sensitive

[redacted]

[redacted]	Date 3/13/09
	ACCEPT? (YES OR NO)
	Y or N
	Y or N
	Y or N

Test Technician Signature / Date 3/13/09

GENERAL ATOMICS ELECTRONIC SYSTEMS

QUALITY CONTROL INSTRUCTIONS	TITLE: INSPECTION OF POWER SUPPLIES		QCI NO.: 106
	EFFECTIVITY: 31 October 2006	REV. G	Page 7 of 10

POWER SUPPLY TEST DATA SHEET

Business Sensitive

[redacted]

Date 3/13/09
ACCEPT? (YES OR NO)
Y or N
Y or N
Y or N
Y or N
Y or N
Y or N
Y or N

GENERAL ATOMICS ELECTRONIC SYSTEMS

QUALITY CONTROL INSTRUCTIONS	TITLE: INSPECTION OF POWER SUPPLIES		QCI NO.: 106
	EFFECTIVITY: 31 October 2006	REV. G	Page 8 of 10

POWER SUPPLY TEST DATA SHEET

Business Sensitive

[redacted]

Date 3/13/09
ACCEPT? (YES OR NO)
Y or N
Y or N
Y or N
Y or N
Y or N

% sec

QUALITY CONTROL INSTRUCTIONS	TITLE: INSPECTION OF POWER SUPPLIES		QCI NO.: 106
	EFFECTIVITY: 31 October 2006	REV. G	Page 9 of 10

POWER SUPPLY TEST DATA SHEET

Business Sensitive

[redacted]	Date 3/13/09
	ACCEPT? (YES OR NO)
	Y or N
	Y or N
	Y or N

Test Technician Signature / Date [signature] 3/13/09

QUALITY CONTROL INSTRUCTIONS	TITLE: INSPECTION OF POWER SUPPLIES		QCI NO.: 106
	EFFECTIVITY: 31 October 2006	REV. G	Page 7 of 10

POWER SUPPLY TEST DATA SHEET

Business Sensitive

[redacted]	Date 3/13/09
	ACCEPT? (YES OR NO)
	Y or N
	Y or N
	Y or N
	Y or N
	Y or N
	Y or N
	Y or N

GENERAL ATOMICS ELECTRONIC SYSTEMS

QUALITY CONTROL INSTRUCTIONS	TITLE: INSPECTION OF POWER SUPPLIES		QCI NO.: 106
	EFFECTIVITY: 31 October 2006	REV. G	Page 8 of 10

POWER SUPPLY TEST DATA SHEET

Business Sensitive

[redacted]	Date 3/13/09
	ACCEPT? (YES OR NO)
	Y or N
	Y or N
	Y or N
	Y or N
	Y or N

POWER SUPPLY TEST DATA SHEET

Business Sensitive

[redacted]	Date 3/13/09
	ACCEPT? (YES OR NO)
	Y or N
	Y or N
	Y or N

Test Technician Signature / Date 3/13/09

GENERAL ATOMICS ELECTRONIC SYSTEMS

QUALITY CONTROL INSTRUCTIONS	TITLE: INSPECTION OF POWER SUPPLIES		QCI NO.: 106
	EFFECTIVITY: 31 October 2006	REV. G	Page 7 of 10

POWER SUPPLY TEST DATA SHEET

Business Sensitive

[redacted]	Date 3/13/09
	ACCEPT? (YES OR NO)
	Y or N
	Y or N
	Y or N
	Y or N
	Y or N
	Y or N
	Y or N

QUALITY CONTROL INSTRUCTIONS	TITLE: INSPECTION OF POWER SUPPLIES		QCI NO.: 106
	EFFECTIVITY: 31 October 2006	REV. G	Page 8 of 10

POWER SUPPLY TEST DATA SHEET

Business Sensitive

[redacted]	Date 3/13/09
	ACCEPT? (YES OR NO)
	Y or N
	Y or N
	Y or N
	Y or N
	Y or N

QUALITY CONTROL INSTRUCTIONS	TITLE: INSPECTION OF POWER SUPPLIES		QCI NO.: 106
	EFFECTIVITY: 31 October 2006	REV. G	Page 9 of 10

POWER SUPPLY
TEST DATA SHEET

Business Sensitive

[redacted]	Date 3/13/09
	ACCEPT? (YES OR NO)
	Y or N
	Y or N
	Y or N

Test Technician Signature / Date 3/13/09

QUALITY CONTROL INSTRUCTIONS	TITLE: INSPECTION OF POWER SUPPLIES		QCI NO.: 106
	EFFECTIVITY: 31 October 2006	REV. G	Page 7 of 10

POWER SUPPLY TEST DATA SHEET

Business Sensitive

[redacted]

Date 3/13/09
ACCEPT? (YES OR NO)
Y or N
Y or N
Y or N
Y or N
Y or N
Y or N
Y or N

POWER SUPPLY TEST DATA SHEET

Business Sensitive

[redacted]	Date 3/13/09
	ACCEPT? (YES OR NO)
	Y or N
	Y or N
	Y or N
	Y or N
	Y or N

GE.. .RAL ATOMICS ELECTRONIC SYSTEMS

QUALITY CONTROL INSTRUCTIONS	TITLE: INSPECTION OF POWER SUPPLIES		QCI NO.: 106
	EFFECTIVITY: 31 October 2006	REV. G	Page 9 of 10

POWER SUPPLY
TEST DATA SHEET

Business Sensitive

[redacted]

Date 3/13/09
ACCEPT? (YES OR NO)
Y or N
Y or N
Y or N

Test Technician Signature / Date 3/13/09

GENERAL ATOMICS ELECTRONIC SYSTEMS

QUALITY CONTROL INSTRUCTIONS	TITLE: INSPECTION OF POWER SUPPLIES		QCI NO.: 106
	EFFECTIVITY: 31 October 2006	REV. G	Page 7 of 10

POWER SUPPLY TEST DATA SHEET

Business Sensitive

[redacted]	Date 3/13/09
	ACCEPT? (YES OR NO)
	Y or N
	Y or N
	Y or N
	Y or N
	Y or N
	Y or N
	Y or N

GENERAL ATOMICS ELECTRONIC SYSTEMS

QUALITY CONTROL INSTRUCTIONS	TITLE: INSPECTION OF POWER SUPPLIES		QCI NO.: 106
	EFFECTIVITY: 31 October 2006	REV. G	Page 8 of 10

POWER SUPPLY TEST DATA SHEET

Business Sensitive

	Date 3/13/09
[redacted]	ACCEPT? (YES OR NO)
	Y or N
	Y or N
	Y or N
	Y or N
	Y or N

POWER SUPPLY
TEST DATA SHEET

Business Sensitive

[redacted]	Date 3/13/09
	ACCEPT? (YES OR NO)
	Y or N
	Y or N
	Y or N

Test Technician Signature / Date 3/13/09

POWER SUPPLY TEST DATA SHEET

Business Sensitive

[redacted]	Date 3/13/09
	ACCEPT? (YES OR NO)
	Y or N
	Y or N
	Y or N
	Y or N
	Y or N
	Y or N
	Y or N

GENERAL ATOMICS ELECTRONIC SYSTEMS

QUALITY CONTROL INSTRUCTIONS	TITLE: INSPECTION OF POWER SUPPLIES		QCI NO.: 106
	EFFECTIVITY: 31 October 2006	REV. G	Page 8 of 10

POWER SUPPLY TEST DATA SHEET

Business Sensitive

[redacted]	Date 3/13/09
	ACCEPT? (YES OR NO)
	Y or N
	Y or N
	Y or N
	Y or N
	Y or N

GENERAL ATOMICS ELECTRONIC SYSTEMS

QUALITY CONTROL INSTRUCTIONS	TITLE: INSPECTION OF POWER SUPPLIES		QCI NO.: 106
	EFFECTIVITY: 31 October 2006	REV. G	Page 9 of 10

POWER SUPPLY TEST DATA SHEET

Business Sensitive

[redacted]	Date 3/13/09
	ACCEPT? (YES OR NO)
	Y or N
	Y or N
	Y or N

Test Technician Signature / Date 3/13/09

GENERAL ATOMICS ELECTRONIC SYSTEMS

QUALITY CONTROL INSTRUCTIONS	TITLE: INSPECTION OF POWER SUPPLIES		QCI NO.: 106
	EFFECTIVITY: 31 October 2006	REV. G	

POWER SUPPLY TEST DATA SHEET

Business Sensitive

[redacted]

Date 3/13/09
ACCEPT? (YES OR NO)
Y or N
Y or N
Y or N
Y or N
Y or N
Y or N
Y or N

GENERAL ATOMICS ELECTRONIC SYSTEMS

QUALITY CONTROL INSTRUCTIONS	TITLE: INSPECTION OF POWER SUPPLIES		QCI NO.: 106
	EFFECTIVITY: 31 October 2006	REV. G	Page 8 of 10

POWER SUPPLY TEST DATA SHEET

Business Sensitive

[redacted]	Date 3/13/09
	ACCEPT? (YES OR NO)
	Y or N
	Y or N
	Y or N
	Y or N
	Y or N

QUALITY CONTROL INSTRUCTIONS	TITLE: INSPECTION OF POWER SUPPLIES		QCI NO.: 106
	EFFECTIVITY: 31 October 2006	REV. G	Page 9 of 10

POWER SUPPLY TEST DATA SHEET

Business Sensitive

[redacted]	Date 3/13/09
	ACCEPT? (YES OR NO)
	Y or N
	Y or N
	Y or N

Test Technician Signature / Date 3/13/09

GENERAL ATOMICS ELECTRONIC SYSTEMS

QUALITY CONTROL INSTRUCTIONS	TITLE: INSPECTION OF POWER SUPPLIES		QCI NO.: 106
	EFFECTIVITY: 31 October 2006	REV. G	Page 7 of 10

POWER SUPPLY TEST DATA SHEET

Business Sensitive

[redacted]

Date 3/13/09
ACCEPT? (YES OR NO)
Y or N
Y or N
Y or N
Y or N
Y or N
Y or N
Y or N

GENERAL ATOMICS ELECTRONIC SYSTEMS

QUALITY CONTROL INSTRUCTIONS	TITLE: INSPECTION OF POWER SUPPLIES		QCI NO.: 106
	EFFECTIVITY: 31 October 2006	REV. G	Page 8 of 10

POWER SUPPLY TEST DATA SHEET

Business Sensitive

[redacted]	Date 3/13/09
	ACCEPT? (YES OR NO)
	Y or N
	Y or N
	Y or N
	Y or N
	Y or N

POWER SUPPLY TEST DATA SHEET

Business Sensitive

[redacted]	Date 3/13/09
[redacted]	ACCEPT? (YES OR NO)
[redacted]	Y or N
[redacted]	Y or N
[redacted]	Y or N

Test Technician Signature / Date 3/13/09

GENERAL ATOMICS ELECTRONIC SYSTEMS

QUALITY CONTROL INSTRUCTIONS	TITLE: INSPECTION OF POWER SUPPLIES		QCI NO.: 106
	EFFECTIVITY: 31 October 2006	REV. G	Page 7 of 10

POWER SUPPLY
TEST DATA SHEET

Business Sensitive

[redacted]	Date 3/13/09
	ACCEPT? (YES OR NO)
	Y or N
	Y or N
	Y or N
	Y or N
	Y or N
	Y or N
	Y or N

GENERAL ATOMICS ELECTRONIC SYSTEMS

QUALITY CONTROL INSTRUCTIONS	TITLE: INSPECTION OF POWER SUPPLIES		QCI NO.: 106
	EFFECTIVITY: 31 October 2006	REV. G	Page 8 of 10

POWER SUPPLY TEST DATA SHEET

Business Sensitive

[redacted]

Date 3/13/09
ACCEPT? (YES OR NO)
Y or N
Y or N
Y or N
Y or N
Y or N

GE... RAL ATOMICS ELECTRONIC SYSTEMS

QUALITY CONTROL INSTRUCTIONS	TITLE: INSPECTION OF POWER SUPPLIES		QCI NO.: 106
	EFFECTIVITY: 31 October 2006	REV. G	Page 9 of 10

POWER SUPPLY TEST DATA SHEET

Business Sensitive

[redacted]	Date 3/13/09
	ACCEPT? (YES OR NO)
	Y or N
	Y or N
	Y or N

Test Technician Signature / Date 3/13/09

POWER SUPPLY TEST DATA SHEET

Business Sensitive

[redacted]	Date 3/13/09
	ACCEPT? (YES OR NO)
	Y or N
	Y or N
	Y or N
	Y or N
	Y or N
	Y or N
	Y or N

GENERAL ATOMICS ELECTRONIC SYSTEMS

QUALITY CONTROL INSTRUCTIONS	TITLE: INSPECTION OF POWER SUPPLIES		QCI NO.: 106
	EFFECTIVITY: 31 October 2006	REV. G	Page 8 of 10

POWER SUPPLY TEST DATA SHEET

Business Sensitive

[redacted]	Date
	3/13/09
	ACCEPT? (YES OR NO)
	Y or N
	Y or N
	Y or N
	Y or N
	Y or N

GE[illegible]RAL ATOMICS ELECTRONIC SYSTEMS

QUALITY CONTROL INSTRUCTIONS	TITLE: INSPECTION OF POWER SUPPLIES		QCI NO.: 106
	EFFECTIVITY: 31 October 2006	REV. G	Page 9 of 10

POWER SUPPLY TEST DATA SHEET

Business Sensitive

	Date 3/13/09
[redacted]	ACCEPT? (YES OR NO)
	Y or N
	Y or N
	Y or N

Test Technician Signature / Date 3/13/09

GE[illegible]RAL ATOMICS ELECTRONIC SYSTEMS

QUALITY CONTROL INSTRUCTIONS	TITLE: INSPECTION OF POWER SUPPLIES		QCI NO.: 106
	EFFECTIVITY: 31 October 2006	REV. G	Page 7 of 10

POWER SUPPLY TEST DATA SHEET

Business Sensitive

[redacted]

Date 3/13/09
ACCEPT? (YES OR NO)
Y or N
Y or N
Y or N
Y or N
Y or N
Y or N
Y or N

GENERAL ATOMICS ELECTRONIC SYSTEMS

QUALITY CONTROL INSTRUCTIONS	TITLE: INSPECTION OF POWER SUPPLIES		QCI NO.: 106
	EFFECTIVITY: 31 October 2006	REV. G	Page 8 of 10

POWER SUPPLY TEST DATA SHEET

Business Sensitive

[redacted]

Date 3/13/09
ACCEPT? (YES OR NO)
Y or N
Y or N
Y or N
Y or N
Y or N

POWER SUPPLY TEST DATA SHEET

Business Sensitive

[redacted]	Date 3/13/09
	ACCEPT? (YES OR NO)
	Y or N
	Y or N
	Y or N

3/13/09

Test Technician Signature / Date

GENERAL ATOMICS ELECTRONIC SYSTEMS

QUALITY CONTROL INSTRUCTIONS	TITLE: INSPECTION OF POWER SUPPLIES		QCI NO.: 106
	EFFECTIVITY: 31 October 2006	REV. G	Page 7 of 10

POWER SUPPLY TEST DATA SHEET

Business Sensitive

[redacted]

Date 3/13/09
ACCEPT? (YES OR NO)
Y or N
Y or N
Y or N
Y or N
Y or N
Y or N
Y or N

POWER SUPPLY TEST DATA SHEET

Business Sensitive

[redacted]	Date 3/13/09
[redacted]	ACCEPT? (YES OR NO)
[redacted]	Y or N
[redacted]	Y or N
[redacted]	Y or N
[redacted]	Y or N
[redacted]	Y or N

POWER SUPPLY TEST DATA SHEET

Business Sensitive

[redacted]	Date 3/13/09
[redacted]	ACCEPT? (YES OR NO)
[redacted]	Y or N
[redacted]	Y or N
[redacted]	Y or N

Test Technician Signature / Date 3/13/09

POWER SUPPLY TEST DATA SHEET

Business Sensitive

[redacted]

Date 3/13/09
ACCEPT? (YES OR NO)
Y or N
Y or N
Y or N
Y or N
Y or N
Y or N
Y or N

GENERAL ATOMICS ELECTRONIC SYSTEMS

QUALITY CONTROL INSTRUCTIONS	TITLE: INSPECTION OF POWER SUPPLIES		QCI NO.: 106
	EFFECTIVITY: 31 October 2006	REV. G	

POWER SUPPLY TEST DATA SHEET

Business Sensitive

[redacted]	Date 3/13/09
	ACCEPT? (YES OR NO)
	Y or N
	Y or N
	Y or N
	Y or N
	Y or N

GE[illegible]RAL ATOMICS ELECTRONIC SYSTEMS

QUALITY CONTROL INSTRUCTIONS	TITLE: INSPECTION OF POWER SUPPLIES		QCI NO.: 106
	EFFECTIVITY: 31 October 2006	REV. G	Page 9 of 10

POWER SUPPLY
TEST DATA SHEET

Business Sensitive

[redacted]	Date 3/13/09
[redacted]	ACCEPT? (YES OR NO)
[redacted]	Y or N
[redacted]	Y or N
[redacted]	Y or N

Test Technician Signature / Date 3/13/09

POWER SUPPLY TEST DATA SHEET

Business Sensitive

[redacted]	Date 3/13/09
	ACCEPT? (YES OR NO)
	Y or N
	Y or N
	Y or N
	Y or N
	Y or N
	Y or N
	Y or N

GENERAL ATOMICS ELECTRONIC SYSTEMS

QUALITY CONTROL INSTRUCTIONS	TITLE: INSPECTION OF POWER SUPPLIES		QCI NO.: 106
	EFFECTIVITY: 31 October 2006	REV. G	Page 8 of 10

POWER SUPPLY TEST DATA SHEET

Business Sensitive

[redacted]	Date 3/13/09
	ACCEPT? (YES OR NO)
	Y or N
	Y or N
	Y or N
	Y or N
	Y or N

GE... RAL ATOMICS ELECTRONIC SYSTEMS

QUALITY CONTROL INSTRUCTIONS	TITLE: INSPECTION OF POWER SUPPLIES		QCI NO.: 106
	EFFECTIVITY: 31 October 2006	REV. G	Page 9 of 10

POWER SUPPLY
TEST DATA SHEET

Business Sensitive

[redacted]

Date
3/13/09
ACCEPT? (YES OR NO)
Y or N
Y or N
Y or N

Test Technician Signature / Date 3/13/09

GENERAL ATOMICS ELECTRONIC SYSTEMS

QUALITY CONTROL INSTRUCTIONS	TITLE: INSPECTION OF POWER SUPPLIES		QCI NO.: 106
	EFFECTIVITY: 31 October 2006	REV. G	Page 7 of 10

POWER SUPPLY TEST DATA SHEET

Business Sensitive

[redacted]	Date 3/13/09
	ACCEPT? (YES OR NO)
	Y or N
	Y or N
	Y or N
	Y or N
	Y or N
	Y or N
	Y or N

POWER SUPPLY TEST DATA SHEET

Business Sensitive

[redacted]	Date 3/13/09
	ACCEPT? (YES OR NO)
	Y or N
	Y or N
	Y or N
	Y or N
	Y or N

GE… RAL ATOMICS ELECTRONIC SYSTEMS

QUALITY CONTROL INSTRUCTIONS	TITLE: INSPECTION OF POWER SUPPLIES		QCI NO.: 106
	EFFECTIVITY: 31 October 2006	REV. G	Page 9 of 10

POWER SUPPLY
TEST DATA SHEET
Business Sensitive

[redacted]

Date 3/13/09
ACCEPT? (YES OR NO)
Y or N
Y or N
Y or N

Test Technician Signature / Date 3/13/09

GENERAL ATOMICS ELECTRONIC SYSTEMS

QUALITY CONTROL INSTRUCTIONS	TITLE: INSPECTION OF POWER SUPPLIES		QCI NO.: 106
	EFFECTIVITY: 31 October 2006	REV. G	Page 7 of 10

POWER SUPPLY TEST DATA SHEET

Business Sensitive

[redacted]

Date 3/13/09
ACCEPT? (YES OR NO)
Y or N
Y or N
Y or N
Y or N
Y or N
Y or N
Y or N

POWER SUPPLY TEST DATA SHEET

Business Sensitive

[redacted]

Date 3/13/09
ACCEPT? (YES OR NO)
Y or N
Y or N
Y or N
Y or N
Y or N

GE... RAL ATOMICS ELECTRONIC SYSTEMS

QUALITY CONTROL INSTRUCTIONS	TITLE: INSPECTION OF POWER SUPPLIES		QCI NO.: 106
	EFFECTIVITY: 31 October 2006	REV. G	Page 9 of 10

POWER SUPPLY TEST DATA SHEET

Business Sensitive

[redacted]	Date 3/13/09
	ACCEPT? (YES OR NO)
	Y or N
	Y or N
	Y or N

Test Technician Signature / Date 3/13/09

POWER SUPPLY TEST DATA SHEET

Business Sensitive

[redacted]	Date 3/13/09
	ACCEPT? (YES OR NO)
	Y or N
	Y or N
	Y or N
	Y or N
	Y or N
	Y or N
	Y or N

POWER SUPPLY TEST DATA SHEET

Business Sensitive

[redacted]	Date 3/13/09
[redacted]	ACCEPT? (YES OR NO)
[redacted]	Y or N
[redacted]	Y or N
[redacted]	Y or N
[redacted]	Y or N
[redacted]	Y or N

GE... RAL ATOMICS ELECTRONIC SYSTEMS

QUALITY CONTROL INSTRUCTIONS	TITLE: INSPECTION OF POWER SUPPLIES		QCI NO.: 106
	EFFECTIVITY: 31 October 2006	REV. G	Page 9 of 10

POWER SUPPLY TEST DATA SHEET

Business Sensitive

[redacted]	Date 3/13/09
[redacted]	ACCEPT? (YES OR NO)
[redacted]	Y or N
[redacted]	Y or N
[redacted]	Y or N

Test Technician Signature / Date 3/13/09

GENERAL ATOMICS ELECTRONIC SYSTEMS

QUALITY CONTROL INSTRUCTIONS	TITLE: INSPECTION OF POWER SUPPLIES		QCI NO.: 106
	EFFECTIVITY: 31 October 2006	REV. G	Page 7 of 10

POWER SUPPLY TEST DATA SHEET

Business Sensitive

[redacted]

Date 3/13/09
ACCEPT? (YES OR NO)
Y or N
Y or N
Y or N
Y or N
Y or N
Y or N
Y or N

GENERAL ATOMICS ELECTRONIC SYSTEMS

QUALITY CONTROL INSTRUCTIONS	TITLE: INSPECTION OF POWER SUPPLIES		QCI NO.: 106
	EFFECTIVITY: 31 October 2006	REV. G	Page 8 of 10

POWER SUPPLY TEST DATA SHEET

Business Sensitive

[redacted]	Date 3/13/09
	ACCEPT? (YES OR NO)
	Y or N
	Y or N
	Y or N
	Y or N
	Y or N

GE. .RAL ATOMICS ELECTRONIC SYSTEMS

QUALITY CONTROL INSTRUCTIONS	TITLE: INSPECTION OF POWER SUPPLIES		QCI NO.: 106
	EFFECTIVITY: 31 October 2006	REV. G	Page 9 of 10

POWER SUPPLY TEST DATA SHEET

Business Sensitive

[redacted]

Date 3/13/09
ACCEPT? (YES OR NO)
Y or N
Y or N
Y or N

Test Technician Signature / Date 3/13/09

GENERAL ATOMICS ELECTRONIC SYSTEMS

QUALITY CONTROL INSTRUCTIONS	TITLE: INSPECTION OF POWER SUPPLIES		QCI NO.: 106
	EFFECTIVITY: 31 October 2006	REV. G	Page 7 of 10

POWER SUPPLY TEST DATA SHEET

Business Sensitive

[redacted]

[redacted]	Date 3/13/09
[redacted]	ACCEPT? (YES OR NO)
[redacted]	Y or N
[redacted]	Y or N
[redacted]	Y or N
[redacted]	
[redacted]	Y or N
[redacted]	Y or N
[redacted]	Y or N
[redacted]	Y or N

POWER SUPPLY TEST DATA SHEET

Business Sensitive

[redacted]

Date 3/13/09
ACCEPT? (YES OR NO)
Y or N
Y or N
Y or N
Y or N
Y or N

POWER SUPPLY TEST DATA SHEET

Business Sensitive

[redacted]	Date 3/13/09
[redacted]	ACCEPT? (YES OR NO)
[redacted]	Y or N
[redacted]	Y or N
[redacted]	Y or N

3/13/09

Test Technician Signature / Date

POWER SUPPLY TEST DATA SHEET

Business Sensitive

[redacted]	Date 3/13/09
	ACCEPT? (YES OR NO)
	Y or N
	Y or N
	Y or N
	Y or N
	Y or N
	Y or N
	Y or N

GENERAL ATOMICS ELECTRONIC SYSTEMS

QUALITY CONTROL INSTRUCTIONS	TITLE: INSPECTION OF POWER SUPPLIES		QCI NO.: 106
	EFFECTIVITY: 31 October 2006	REV. G	Page 8 of 10

POWER SUPPLY TEST DATA SHEET

Business Sensitive

[redacted]	Date 3/13/09
	ACCEPT? (YES OR NO)
	Y or N
	Y or N
	Y or N
	Y or N
	Y or N

GE... RAL ATOMICS ELECTRONIC SYSTEMS

QUALITY CONTROL INSTRUCTIONS	TITLE: INSPECTION OF POWER SUPPLIES		QCI NO.: 106
	EFFECTIVITY: 31 October 2006	REV. G	Page 9 of 10

POWER SUPPLY TEST DATA SHEET

Business Sensitive

[redacted]	Date 3/13/09
	ACCEPT? (YES OR NO)
	Y or N
	Y or N
	Y or N

3/13/09

Test Technician Signature / Date

GENERAL ATOMICS ELECTRONIC SYSTEMS

QUALITY CONTROL INSTRUCTIONS	TITLE: INSPECTION OF POWER SUPPLIES		QCI NO.: 106
	EFFECTIVITY: 31 October 2006	REV. G	Page 7 of 10

POWER SUPPLY TEST DATA SHEET

Business Sensitive

[redacted]	Date 3/13/09
	ACCEPT? (YES OR NO)
	Y or N
	Y or N
	Y or N
	Y or N
	Y or N
	Y or N
	Y or N

QUALITY CONTROL INSTRUCTIONS	TITLE: INSPECTION OF POWER SUPPLIES		QCI NO.: 106
	EFFECTIVITY: 31 October 2006	REV. G	Page 8 of 10

POWER SUPPLY TEST DATA SHEET

Business Sensitive

[redacted]	Date 3/13/09
	ACCEPT? (YES OR NO)
	Y or N
	Y or N
	Y or N
	Y or N
	Y or N

GENERAL ATOMICS ELECTRONIC SYSTEMS

QUALITY CONTROL INSTRUCTIONS	TITLE: INSPECTION OF POWER SUPPLIES		QCI NO.: 106
	EFFECTIVITY: 31 October 2006	REV. G	Page 9 of 10

POWER SUPPLY TEST DATA SHEET

Business Sensitive

[redacted]	Date 3/13/09
[redacted]	ACCEPT? (YES OR NO)
[redacted]	Y or N
[redacted]	Y or N
[redacted]	Y or N

Test Technician Signature / Date 3/13/09

GENERAL ATOMICS ELECTRONIC SYSTEMS

QUALITY CONTROL INSTRUCTIONS	TITLE: INSPECTION OF POWER SUPPLIES		QCI NO.: 106
	EFFECTIVITY: 31 October 2006	REV. G	Page 10 of 10

TEST EQUIPMENT RECORD

DESCRIPTION	MANUFAC-TURER	MODEL	CCN OR SERIAL NO.	CALIBRATION DATE LAST	CALIBRATION DATE DUE
DVM	[redacted]	[redacted]	07-1-B1	15 OCT 08	15 APR 09
DVM	[redacted]	[redacted]	07-1-1P	16 FEB 09	16 AUG 09
OSCILLOSCOPE	[redacted]	[redacted]	03-3-80	12 FEB 09	12 AUG 09
VARIAC	[redacted]	[redacted]	N/A	NOT REQUIRED	
	Business Sensitive				

DATE OF TEST: 3/13/09

TEST OPERATOR SIGNATURE:

QC SIGNATURE OR STAMP: 13 MAR 09

REMARKS: [redacted]

P.O. 124787

Business Sensitive

<u>Attachment 18</u>

Non-proprietary Ametek letter "Affidavit of Withholding from Public Disclosure for TR-1136 Environmental Qualifications Document," Dated January 13, 2012 (Letter Item 5)

AMETEK
POWER INSTRUMENTS

Sensors Business Group
255 North Union Street
Telephone: 585-238-4054
Fax: 215-323-9558
E-mail: greg.bray@ametek.com
www.ametekpower.com

25402-011-V1C-JQ08-00002-001
Ametek JQ08
Affidavit of Withholding from Public Disclosure for TR-1136 Environmental Qualifications Document

BECHTEL POWER CORPORATION										Job Number: 25402
SUPPLIER DOCUMENT REVIEW STATUS										
STATUS CODE: 1 ☐ Work may proceed. 1C ☐ Work may proceed. Editorial comments need only be incorporated if revised for other purposes. 2 ☐ Revise and resubmit. Work may proceed subject to incorporation of changes indicated. 3 ☐ Rejected. Revise and resubmit. 4 ☒ Review not required. Work may proceed. **PO 237663**										
Permission to proceed does not constitute acceptance or approval of design details, calculations, analysis, test methods, or materials developed or selected by the Supplier and does not relieve the Supplier from full compliance with contractual obligations.										
Reviewed by	Arch	Civil	CS	Elect	Mech	MET	PD	Constr	Startup	STE
	NA	NA	MWL	NA	NA	NA	NA	NA	NA	NA
Status By: M.S. Clark M M Clark							DATE 1/18/12			

January 13, 2012

Watts Bar Nuclear Plant
TVA WATTS BAR MAIL CTR
1270 Highway 68
Attention: U2 Records Management
Spring City, TN
37381

TVA Purchase Order: 237663-25402-011-MRA-JQ08-00002

Subject: Affidavit of Withholding from Public Disclosure for TR-1136 Environmental Qualifications Document

Ametek Power Instruments (Ametek) requests that the U.S. Nuclear Regulatory Commission (NRC) withhold from public disclosure, pursuant to Title 10 of the *Code of Federal Regulations* (10 CFR) 2.390, certain security-related information contained within TR-1136 Environmental Qualification Review Package.

This affidavit states that the original document should be considered exempt from mandatory public disclosure for the following reasons amongst others:

1. The information that we request protection from disclosure has been held in confidence with Ametek.
2. The information sought to be withheld is of a type that is customarily held in confidence by Ametek.
3. The information sought to be withheld is not available in public sources to the best of Ametek's knowledge and belief.
4. The information sought is being provided to TVA in confidence; and, under the provisions of 10 CFR 2.390, it is to be received in confidence by the NRC and TVA / Bechtel.
5. The information in the proprietary version of Ametek TR-1136 Qualification

Report was obtained at considerable expense to Gulton Statham and the release of which could seriously affect our competitive position.

6. Disclosure of this sensitive, confidential proprietary information could provide our competitors with a competitive advantage as well as disclose trade secrets that could be very damaging to Ametek.

To allow public disclosure of that data that is deemed reasonable and prudent for release for the public, Ametek has developed a non-proprietary version of this documentation. This version is a direct copy of the original complete qualification document with those sections of data determined by Ametek to be of a sensitive nature removed. Attached with this letter is a documentation package containing the non-proprietary version of the TR-1136 environmental qualification documentation Revision C which may be given to the NRC for public disclosure if required.

AMETEK Power Instruments remains committed to its customers and providing products and service to meet and exceed their needs and expectations. We thank you for your past business and look forward to working with you in the future. If you have any questions, please feel free to contact me directly at (585) 238-4054 or e-mail at greg.bray@ametek.com.

Best Regards,

Gregory L. Bray
Sensors Business Manager