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Subject: **Response to Portion of NRC Request for Additional Information Letter No. 126 Related to ESBWR Design Certification Application RAI Numbers 14.3-170 and 14.3-269**

The purpose of this letter is to submit the GE Hitachi Nuclear Energy (GEH) Response to the U.S. Nuclear Regulatory Commission (NRC) Request for Additional Information (RAI) sent by NRC letter dated December 20, 2007, Reference 1.

Enclosure 1 contains the GEH response to RAI Numbers 14.3-170 and 14.3-269. The enclosed changes will be incorporated in the upcoming DCD Revision 5 submittal.

If you have any questions or require additional information, please contact me.

Sincerely,

James C. Kinsey
Vice President, ESBWR Licensing

DOUG
NRO

Reference:

1. MFN 07-718, Letter from U.S. Nuclear Regulatory Commission to Robert E. Brown, *Request For Additional Information Letter No. 126 Related To ESBWR Design Certification Application*, December 20, 2007

Enclosure:

1. Response to Portion of NRC Request for Additional Information Letter No. 126 Related to ESBWR Design Certification Application – RAI Numbers 14.3-170 and 14.3-269

cc: AE Cubbage	USNRC (with enclosure)
GB Stramback	GEH/San Jose (with enclosure)
RE Brown	GEH/Wilmington (with enclosure)
DH Hinds	GEH/Wilmington (with enclosure)
eDRF	0000-0080-5624 – RAI 14.3-170
	0000-0080-8522 – RAI 14.3-269

MFN 08-086, Supplement 44

Enclosure 1

**Response to Portion of NRC Request for Additional
Information Letter No. 126 Related to ESBWR
Design Certification Application
RAI Numbers 14.3-170 and 14.3-269**

NRC RAI 14.3-170

3.2 Software Development is in DAC process, the ITAAC table should be labeled {DAC}.

GEH RESPONSE

GEH agrees that a portion of the Software Development ITAAC items within Table 3.2-1 should be labeled as {{Design Acceptance Criteria}}. GEH has also established construction ITAAC for DAC items. GEH will incorporate a re-write of ITAAC Table 3.2-1 into ESBWR DCD Revision 5.

DCD/LTR IMPACT

ESBWR DCD Tier 1 Section 3.2 and associated ITAAC Table 3.2-1 will be revised as noted in the attached markups.

3.2 SOFTWARE DEVELOPMENT

Inspections, Tests, Analyses, and Acceptance Criteria Summary

Design Description

NUREG-0800, Branch Technical Position HICB-14 (BTP 7-14) ~~Revision 4~~, outlines activities to be considered when establishing a software development program for software-based Instrumentation and Control (I&C) systems, ~~herein defined as safety related software based products. BTP 14 HICB-14~~ divides these activities into ~~41~~ separate software development plans. The overall approach is that the software plans address and document the elements necessary to ensure the production and delivery of High Quality Software.

GEH has completed a detailed analysis of ~~the regulatory guidelines and industry standards and incorporated information from that study into the ESBWR Software Plans. In certain cases, deviation is taken from the guidelines and standards, in which case the GEH software plans will be followed.~~ Compliance with this process will provide a sound base for development of High Quality Software.

~~The ESBWR Software Management and Software Quality Assurance Plans based in part on Section 2.1 of BTP 14, have been developed and submitted to the NRC for review in support of DCD Certification. During development of the ESBWR Software Lifecycle process, Regulatory Guidelines (RG) 1.173-1997, "Developing Software Life Cycle Processes for Digital Computer Software Used in Safety Systems of Nuclear Power Plants" and RG 1.152-2006, "Criteria for Digital Computers in Safety Systems of Nuclear Power Plants", were referred to extensively to ensure compliance with BTP 7-14.~~

~~GEH has completed a detailed analysis of the regulatory guidelines and industry standards and incorporated information from that study into the ESBWR Software Plans. In certain cases, deviation is taken from the guidelines and standards, in which case the GEH software plans will be followed. Compliance with this process will provide a sound base for development of High Quality Software.~~

~~The ESBWR Cyber Security Program Plan is discussed in Item 11 of the ITAAC. While it is not required to be discussed by BTP 7-14 Revision 4, it is appropriate to include it in the Software ITAAC.~~

Software Plans and Programs

The ESBWR Instrument & Controls (I&C) Software Plans are included in two GEH documents, the ESBWR I&C Software Management Program Manual (SMPM) and the ESBWR I&C Software Quality Assurance Program Manual (SQAPM). The software plans are identified in the ESBWR Man-Machine Interface (MMI) System and Human Factor & Engineering (HFE) Implementation Plan (MMIS/HFE IP). The ESBWR Cyber Security Program Plan is further defined by a separate Licensing Topical Report, ESBWR Cyber Security Program Plan (CySP). The software plans included in the GEH ESBWR Software Management Plan document, referred to as the Software Management Plan (SMP), are:

The ESBWR I&C software program will produce requirements, design, development, and testing documents throughout the software lifecycle as described in the SMPM. Result Summary Reports, based on the software plan implementation, address the ESBWR safety-related systems described in Table 2.2.10-1 and their associated safety-related functions defined in the Task Analysis. The results summary reports are available for the NRC staff review, and are included in the list of items for Inspections, Tests, Analyses, and Acceptance Criteria.

The following is a list of the Design Commitments for the Software Development ITAAC:

- (1) Implement the Software Management Plan (SMP) for the design and development of ESBWR I&C System software.
- (2) Implement the Software Development Plan (SDP) for the design and development of ESBWR I&C System software.
- (3) Implement the Software Quality Assurance Plan (SQAP) for the design and development of ESBWR I&C System software.
- (4) Implement the Software Integration Plan (SIntP) for the design and development of ESBWR I&C System software.
- (5) Implement the Software Installation Plan (SIP) for the design and development of ESBWR I&C System software.
- (6) Implement the Software Operation and Maintenance Plan (SOMP) for the design and development of ESBWR I&C System software.
- (7) Implement the Software Training Plan (STrngP) for the design and development of ESBWR I&C System software.
- (8) Implement the Software Safety Plan (SSP) for the design and development of ESBWR I&C System software.
- (9) Implement the Software Verification & Validation Plan (SVVP) for the design and development of ESBWR I&C System software.
- (10) Implement the Software Configuration Management Plan (SCMP) for the design and development of ESBWR I&C System software.
- (11) Implement the Cyber Security Program Plan (CySP) for the design and development of ESBWR I&C System software.
- (12) Implementation of the ESBWR I&C software program satisfactorily produces Software Design Documentation (SDD).

~~(1)Software Development Plan (SDP)~~

~~(2)Software Integration Plan (SIntP)~~

~~(3)Software Installation Plan (SIP)~~

~~(4)Software Operation and Maintenance Plan (SOMP)~~

~~(5)Software Training Plan (STrngP)~~

~~The ESBWR I&C Software Quality Assurance Plan (SQAP), herein referred to as SQAP, includes the software plans used by the Quality Assurance (QA) and the Software Project Engineering (SPE) organizations, governing the same I&C software scope identified in the MMIS/HFE IP.~~

~~(1)Software Verification & Validation Plan (SVVP)~~

~~(2)Software Safety Plan (SSP)~~

~~(3)Software Configuration Management Plan (SCMP)~~

The ESBWR Cyber Security Program Plan is further defined by a separate Licensing Topical Report, ESBWR Cyber Security Program Plan (CSPP).

The applicable Software Products (software and firmware) covered in the SMP encompass all I&C systems, as specifically defined in the MMIS/HFE IP, which perform the monitoring, control, alarming, and protection functions associated with all modes of ESBWR plant normal operation (i.e., startup, shutdown, standby, power operation, and refueling) as well as off normal, emergency, and accident conditions.

Software Management Plan

The purpose of the Software Management Plan (SMP) is to establish the managerial processes and the technical direction for the design and development activities of Digital Computer Based I&C Software within the scope of the ESBWR.

The Software Management Plan (SMP) includes the key planning documents for the Instrumentation and Controls (I&C) design team and governs the design and development activities for the Digital Computer Based I&C software for the ESBWR.

As outlined within the SMP, an organization has been established to address the control of software management and to ensure that independence is maintained between the design organization and the quality assurance, software safety, and Verification and Validation (V&V) organizations.

Software Development Plan

The Software Development Plan (SDP) describes the software engineering development process for each phase of the software products life cycle process. The phases include Planning, Requirements, Design, Implementation, Test, Installation, Operations & Maintenance (O&M), and Retirement. The SDP also addresses the preparation, execution, and documentation of software testing for software products. The SDP conforms to RG 1.173-1997 and IEEE Std. 1074-1995, except as specified in Appendix A of the Software Management Plan (SMP).

Software Quality Assurance Plan

The Software Quality Assurance Plan (SQAP) describes a systematic approach to development and implementation for ESBWR software development. This plan identifies the documentation to be prepared during the software development, verification, validation, use, and maintenance. This plan is conformed to the requirements of 10 CFR 50, Appendix B and is consistent with the requirements specified in IEEE Std. 1012-1998 "IEEE Standard for Software Verification and Validation." This plan, in conjunction with other plans described in this section, addresses the various elements described in the related guidance documents, including IEEE Std. 1012-1998 which is endorsed by RG 1.168-2004.

Software Integration Plan

The Software Integration Plan (SIntP) describes the software integration activities to be carried out during the development of software based products. This plan, in conjunction with other plans described in this section, addresses and meets the expectations of RG 1.170-1997, "Software Integration Documentation for Digital Computer Software used in Safety Systems of Nuclear Power Plants."

Software Installation Plan

The Software Installation Plan (SIP) summarizes the management, implementation, and resource characteristics required to implement the software installation program.

Software Operational and Maintenance Plan

The Software Operation and Maintenance Plan (SOMP) defines the software process and activities used to operate and maintain the software product during plant operation. The SOMP defines requirements, methods, and considerations for developing the system O&M manual. The SOMP also addresses maintenance procedures and activities to enhance, modify, and maintain software once the software is installed in the plant.

Software Training Plan

The Software Training Plan (STrngP) describes the management, implementation, and resource characteristics of the training program. The plan addresses the required the training needs for the utility plant staff, including operators and I&C engineers and technicians in operation and maintenance the software based products.

Software Safety Plan

The Software Safety Plan (SSP) establishes the processes and activities intended to ensure that the safety concerns of the software products are properly considered during the software development and are consistent with the defined system safety analyses as defined by RG 1.173-1997, "Developing Software Life Cycle Processes for Digital Computer Software Used in Safety Systems of Nuclear Power Plants". The SSP meets the guidelines specified in Chapter 7 of NUREG 0800 Standard Review Plan and the requirements outlined in section IEEE Std. 1228-1994, "IEEE Standard for Software Safety Plans".

Software Verification and Validation Plan

This Software Verification and Validation Plan (SVVP) establishes the V&V tasks for the software designed and developed for software products. This SVVP satisfies the requirements of RG 1.168-2004, except where specified in Appendix A. RG 1.168-2004 endorses IEEE Std. 1012-1998, "IEEE Standard for Verification and Validation Plans" and IEEE Std. 1028-1997, "IEEE Standard for Software Reviews and Audits".

Software Configuration Management Plan (SCMP)

The Software Configuration Management Plan (SCMP) establishes the Software Configuration Management activities for the design and development of the software products. This SCMP satisfies the requirements of RG 1.169-1997, "Configuration Management Plans for Digital Computer Software Used in Safety Systems of Nuclear Power Plants", except where specified in Appendix A of the Software Quality Assurance Plan. RG 1.169-1997 endorses IEEE Std. 828, "IEEE Standard for Software Configuration Management Plans".

Cyber Security Program Plan

The Cyber Security Program Plan (CSPP) is developed using a structured design process to protect digital assets from cyber attack, which provides for specific documentation and reviews during the following waterfall lifecycle phases:

- Planning Phase
- Requirement Phase

- Design Phase
- Implementation Phase
- Test Phase
- Installation Phase
- Operation and Maintenance Phase

~~The objective of inspecting and testing cyber security functions is to verify the process used to design the hardware and software, and to ensure that the system cyber security requirements are validated by execution of integration, system, and acceptance tests, respectively. Testing includes tests on system hardware configuration (including all external connectivity), software integration, software qualification, system integration, system qualification, and system factory acceptance.~~

Inspections, Tests, Analyses and Acceptance Criteria

Table 3.2-1 provides a definition of the inspections, tests and/or analyses, together with associated acceptance criteria, which will be applied to the safety related software life cycle software associated with ESBWR safety-related systems described in Table 2.2.10-1 and their associated safety-related functions.

Because the I&C Systems technology is continually advancing, details of the system design may not be complete before the NRC issuance of a design certification. Therefore, the portions of the system design needed to complete the acceptance criteria are marked as {{Design Acceptance Criteria}}.

Table 3.2-1
ITAAC For Software Development

Design Commitment	Inspections, Tests, Analyses	Acceptance Criteria
<p>1. <u>Implement the Software Management Plan (SMP) for the design and development of ESBWR I&C System software. The Software Management Plan (SMP) defines the managerial processes necessary to accomplish the design and development of the ESBWR software based products and defines the management, implementation and resource software characteristics.</u></p>	<p>i. <u>An inspection is performed on the SMP results summary report(s).</u> }}Design Acceptance Criteria}}A Results Analysis of the Software Management Plan (SMP) will be performed.</p>	<p>i. <u>A results summary report(s) exists and it shall demonstrate that the SMP satisfactorily addresses the managerial, implementation and resource characteristics to support the ESBWR I&C Systems development.</u> <u>The results summary report(s) address the ESBWR safety-related systems described in Table 2.2.10-1 and their associated safety-related functions. A results summary report shall be developed and it shall verify that the Software Management Plan (SMP) satisfactorily addresses all of the managerial, implementation and resource characteristics necessary to accomplish the design and development of the ESBWR software based products. The report shall also verify that assessments of the quality of vendor efforts are acceptable.</u> }}Design Acceptance Criteria}}</p>
	<p>ii. <u>An inspection is performed on the SMP process results summary report(s).</u></p>	<p>ii. <u>A results summary report(s) exists and concludes that the SMP process defines the organizational responsibilities, activities, and management controls and demonstrates the following process characteristics: consistency, style, traceability, unambiguity</u></p>

Table 3.2-1
ITAAC For Software Development

Design Commitment	Inspections, Tests, Analyses	Acceptance Criteria
		<p><u>and verifiability. The report shall also verify that assessments of the quality of vendor efforts are acceptable.</u></p> <p>The results summary report(s) address the <u>ESBWR safety-related systems described in Table 2.2.10-1 and their associated safety-related functions.</u></p>
<p>2. <u>Implement the Software Development Plan (SDP) for the design and development of ESBWR I&C System software. The Software Development Plan (SDP) describes the management of the ESBWR software development and defines the management, implementation and resource software characteristics.</u></p>	<p>i. <u>An inspection is performed on the SDP results summary report(s). A Results Analysis of the Software Development Plan (SDP) will be performed.</u> {{Design Acceptance Criteria}}</p>	<p>i. <u>A results summary report(s) exists and it shall demonstrate that the SDP satisfactorily addresses the managerial, implementation and resource characteristics to support the ESBWR I&C Systems development. The report shall verify that the software plan defines which tasks are associated with each life cycle phase and that inputs and outputs are defined. The report shall also ensure that methods of review, verification and validation of outputs are defined in an acceptable manor.</u></p> <p><u>The results summary report(s) address the ESBWR safety-related systems described in Table 2.2.10-1 and their associated safety-related functions.</u></p> <p> {{Design Acceptance Criteria}} A results </p>

**Table 3.2-1
ITAAC For Software Development**

Design Commitment	Inspections, Tests, Analyses	Acceptance Criteria
		<p>summary report shall be developed and it shall verify that the Software Development Plan (SDP) satisfactorily addresses all of the managerial, implementation and resource characteristics necessary to accomplish the design and development of the ESBWR software based products. The report shall verify that the software plan defines which tasks are associated with each life cycle phase and that inputs and outputs are defined. The report shall also ensure that methods of review, verification and validation of outputs are defined in an acceptable manner.</p>
	<p>ii. <u>An inspection is performed on the SDP process results summary report(s).</u></p>	<p>ii. <u>A results summary report(s) exists and concludes that the SDP process defines the organizational responsibilities, activities, and management controls and demonstrates the following process characteristics: consistency, style, traceability, unambiguity and verifiability. The results summary report(s) address the ESBWR safety-related systems described in Table 2.2.10-1 and their associated safety-related functions.</u></p>

**Table 3.2-1
ITAAC For Software Development**

Design Commitment	Inspections, Tests, Analyses	Acceptance Criteria
<p>3. <u>Implement the Software Quality Assurance Plan (SQAP) for the design and development of ESBWR I&C System software. The Software Quality Assurance Plan (SQAP) describes a systematic approach to the development and use of ESBWR software. It also defines the management, implementation and resource software characteristics.</u></p>	<p>i. <u>An inspection is performed on the SQAP results summary report(s). A Results Analysis of the Software Quality Assurance Plan (SQAP) will be performed.</u> {{Design Acceptance Criteria}}</p>	<p>i. <u>A results summary report(s) exists and it shall demonstrate that the SQAP satisfactorily addresses the managerial, implementation and resource characteristics to support the ESBWR I&C Systems development.</u> The results summary report(s) address the ESBWR safety-related systems described in Table 2.2.10-1 and their associated safety-related functions. {{Design Acceptance Criteria}} A results summary report shall be developed and it shall verify that the Software Quality Assurance Plan (SQAP) satisfactorily addresses all of the managerial, implementation and resource characteristics necessary to accomplish the design and development of the ESBWR software based products. The report shall also verify that high quality software, which performs all intended safety functions, is produced as a result of plan execution.</p>
	<p>ii. <u>An inspection is performed on the SQAP process results summary report(s).</u></p>	<p>ii. <u>A results summary report(s) exists and concludes that the SQAP process defines the organizational responsibilities, activities, and management controls and</u></p>

Table 3.2-1
ITAAC For Software Development

Design Commitment	Inspections, Tests, Analyses	Acceptance Criteria
		<p><u>demonstrates the following process characteristics: consistency, style, traceability, unambiguity and verifiability. The report shall also verify that high quality software, which performs all intended safety functions, is produced as a result of plan execution.</u></p> <p><u>The results summary report(s) address the ESBWR safety-related systems described in Table 2.2.10-1 and their associated safety-related functions.</u></p>
<p>4. <u>Implement the Software Integration Plan (SIntP) for the design and development of ESBWR I&C System software. The Software Integration Plan (SIntP) summarizes the management, implementation, and resource characteristics of the integration program. It also defines the management, implementation and resource software characteristics.</u></p>	<p>i. <u>An inspection is performed on the SIntP results summary report(s). A Results Analysis of the Software Integration Plan (SIntP) will be performed.</u> <u>{{Design Acceptance Criteria}}</u></p>	<p>i. <u>A results summary report(s) exists and it shall demonstrate that the SIntP satisfactorily addresses the managerial, implementation and resource characteristics to support the ESBWR I&C Systems development.</u></p> <p><u>The results summary report(s) address the ESBWR safety-related systems described in Table 2.2.10-1 and their associated safety-related functions.</u></p> <p><u>{{Design Acceptance Criteria}}</u> <u>A results summary report shall be developed and it shall verify that the Software Integration Plan (SIntP) satisfactorily addresses all of the managerial, implementation and resource characteristics necessary to</u></p>

**Table 3.2-1
ITAAC For Software Development**

Design Commitment	Inspections, Tests, Analyses	Acceptance Criteria
		<p>accomplish the integration of the ESBWR software based products. This report shall also verify that methods of software integration between commercial off the shelf (COTS), as well as previously developed software (PDS) and newly developed software are satisfactory.</p>
	<p>ii. <u>An inspection is performed on the SIntP process results summary report(s).</u></p>	<p>ii. <u>A results summary report(s) exists and concludes that the SIntP process defines the organizational responsibilities, activities, and management controls and demonstrates the following process characteristics: consistency, style, traceability, unambiguity and verifiability. This report(s) shall also verify that methods of software integration between commercial off the shelf (COTS), as well as previously developed software (PDS) and newly developed software are satisfactory.</u></p> <p><u>The results summary report(s) address the ESBWR safety-related systems described in Table 2.2.10-1 and their associated safety-related functions.</u></p>
<p>5. <u>Implement the Software Installation Plan (SIP) for the design and development of ESBWR I&C System software. The</u></p>	<p>i. <u>An inspection is performed on the SIP results summary report(s). A Results Analysis of the Software Integration Plan</u></p>	<p>i. <u>A results summary report(s) and it shall demonstrate that the SIP satisfactorily addresses the managerial, implementation</u></p>

**Table 3.2-1
ITAAC For Software Development**

Design Commitment	Inspections, Tests, Analyses	Acceptance Criteria
<p>Software Installation Plan (SIP) summarizes the management, implementation of software operations maintenance, and resource characteristics of the installation program. It also defines the management, implementation and resource software characteristics.</p>	<p>(SIP) will be performed: <u>Design Acceptance Criteria</u></p>	<p>and resource characteristics to support the ESBWR I&C Systems development. A Results Summary Report shall be developed and it shall verify that the Software Installation Plan (SIP) satisfactorily addresses all of the managerial, implementation and resource characteristics necessary to accomplish the installation of the ESBWR software based products. The results summary report(s) address the ESBWR safety-related systems described in Table 2.2.10-1 and their associated safety-related functions. <u>Design Acceptance Criteria</u></p>
	<p>ii. <u>An inspection is performed on the SIP process results summary report(s).</u></p>	<p>ii. <u>A results summary report(s) exists and concludes that the SIP process defines the organizational responsibilities, activities, and management controls and demonstrates the following process characteristics: consistency, style, traceability, unambiguity and verifiability.</u> The results summary report(s) address the ESBWR safety-related systems described in Table 2.2.10-1 and their associated safety-related functions.</p>

Table 3.2-1
ITAAC For Software Development

Design Commitment	Inspections, Tests, Analyses	Acceptance Criteria
<p>6. <u>Implement the Software Operations and Maintenance Plan (SOMP) for the design and development of ESBWR I&C System software. The Software Operations and Maintenance Plan (SOMP), which provides an acceptance approach for management and execution of the software operations and maintenance activities, will be established for software based products. The SOMP also defines the management, implementation and resource software characteristics.</u></p>	<p>i. <u>An inspection is performed on the SOMP results summary report(s). A Results Analysis of the Software Operations and Maintenance Plan (SOMP) will be performed.</u> {} Design Acceptance Criteria {}</p>	<p>i. <u>A results summary report(s) exists and it shall demonstrate that the SOMP satisfactorily addresses the managerial, implementation and resource characteristics to support the ESBWR I&C Systems development.</u> <u>The results summary report(s) address the ESBWR safety-related systems described in Table 2.2.10-1 and their associated safety-related functions.</u> {} Design Acceptance Criteria {} A Results Summary Report shall be developed and it shall verify that the Software Operations and Maintenance Plan (SOMP) satisfactorily addresses all of the managerial, implementation and resource characteristics necessary to accomplish the operations and maintenance tasks associated with ESBWR software based products. This report shall specify the methods of performing software operations and maintenance functions following turn over to the COL holder. This report shall also provide an assessment of the system's operational security by verifying the existence of a means to ensure that no unauthorized</p>

**Table 3.2-1
ITAAC For Software Development**

Design Commitment	Inspections, Tests, Analyses	Acceptance Criteria
		<p>changes to hardware, software, and system parameters can be made. The report shall demonstrate existence of a monitoring program to detect penetration (or attempted penetration) of the system.</p>
	<p>ii. <u>An inspection is performed on the Software SOMP process results summary report(s).</u></p>	<p>ii. <u>A results summary report(s) exists and concludes that the SOMP process defines the organizational responsibilities, activities, and management controls and demonstrates the following process characteristics: consistency, style, traceability, unambiguity and verifiability. This report shall specify the methods of performing software operations and maintenance functions following turn over to the COL holder.</u> <u>The results summary report(s) address the ESBWR safety-related systems described in Table 2.2.10-1 and their associated safety-related functions.</u></p>
<p>7. <u>Implement the Software Training Plan (STrngP) for the design and development of ESBWR I&C System software. The Software Training Plan (STrngP) addresses the required training for staff working in the design, development, peer review, and testing of</u></p>	<p>i. <u>An inspection is performed on the STrngP results summary report(s). A Results Analysis of the Software Training Plan (STrngP) will be performed.</u> <u>{{Design Acceptance Criteria}}</u></p>	<p>i. <u>A results summary report(s) exists and it shall demonstrate that the STrngP satisfactorily addresses the managerial, implementation and resource characteristics to accomplish the training tasks for staff working in the design of the software based products. A Results</u></p>

**Table 3.2-1
ITAAC For Software Development**

Design Commitment	Inspections, Tests, Analyses	Acceptance Criteria
<p>the software based products, as well as requirements for the training program for the utility operating and maintaining the software based products. It also defines the management, implementation and resource software characteristics.</p>		<p>Summary Report shall be developed and it shall verify that the Software Training Plan (STmgP) satisfactorily addresses all of the managerial, implementation and resource characteristics necessary to accomplish the training tasks for staff working in the design, development, peer review, and testing of the software based products. This includes requirements for the training program of the utility operating and maintaining the software-based products.</p> <p><u>The results summary report(s) address the ESBWR safety-related systems described in Table 2.2.10-1 and their associated safety-related functions.</u></p> <p><u>{{Design Acceptance Criteria}}</u></p>

**Table 3.2-1
ITAAC For Software Development**

Design Commitment	Inspections, Tests, Analyses	Acceptance Criteria
	<p>ii. <u>An inspection is performed on the STRngP process results summary report(s).</u></p>	<p>ii. <u>A results summary report(s) exists and concludes that the STRngP process defines the organizational responsibilities, activities, and management controls and demonstrates the following process characteristics: consistency, style, traceability, unambiguity and verifiability. This report(s) shall also verify the training tasks for staff working in the design, development, peer review, and testing of the software based products. This includes requirements for the training program of the utility operating and maintaining the software-based products. The results summary report(s) address the ESBWR safety-related systems described in Table 2.2.10-1 and their associated safety-related functions.</u></p>

Table 3.2-1
ITAAC For Software Development

Design Commitment	Inspections, Tests, Analyses	Acceptance Criteria
<p>8. <u>Implement the Software Safety Plan (SSP) for the design and development of ESBWR I&C System software. The Software Safety Plan (SSP) establishes the processes and activities intended to ensure the safety of the safety-related software for the software-based product and to address the potential software risks. It also defines the management, implementation and resource software characteristics.</u></p>	<p>i. <u>An inspection is performed on the SSP results summary report(s). A Results Analysis of the Software Safety Plan (SSP) will be performed. A Safety Analysis shall be performed for all Safety Related Software at prescribed points in the Software Life Cycle as defined in the SMP.</u> <u>{{Design Acceptance Criteria}}</u></p>	<p>i. <u>A results summary report(s) exists and it shall demonstrate that the SSP satisfactorily addresses the managerial, implementation and resource characteristics to support the ESBWR I&C Systems development.</u> <u>The results summary report(s) address the ESBWR safety-related systems described in Table 2.2.10-1 and their associated safety-related functions.</u> <u>{{Design Acceptance Criteria}}</u> <u>A Results Summary Report shall be developed and it shall verify that the Software Safety Plan (SSP) satisfactorily addresses all of the managerial, implementation and resource characteristics necessary to accomplish the design and development tasks associated with ESBWR software-based products. Safety Analysis Reports shall demonstrate that management, implementation, and resource characteristics are maintained throughout the SW Life Cycle process.</u></p>

**Table 3.2-1
ITAAC For Software Development**

Design Commitment	Inspections, Tests, Analyses	Acceptance Criteria
	<p>ii. <u>An inspection is performed on the SSP process results summary report(s).</u></p>	<p>ii. <u>A results summary report(s) exists and concludes that the SSP process defines the organizational responsibilities, activities, and management controls and demonstrates the following process characteristics: consistency, style, traceability, unambiguity and verifiability.</u></p> <p><u>This report(s) shall also verify Safety Analysis Reports demonstrate that management, implementation, and resource characteristics are maintained throughout the Software Life Cycle process.</u></p> <p><u>The results summary report(s) address the ESBWR safety-related systems described in Table 2.2.10-1 and their associated safety-related functions.</u></p>
<p>9. <u>Implement the Software Verification and Validation Plan (SVVP) for the design and development of ESBWR I&C System software. The Software Verification and Validation Plan (SVVP) describes the Independent V&V organization responsible for executing the V&V tasks to ensure that the design requirements of each life cycle phase are traceable to a relevant requirement defined in the previous phase, and that the developed</u></p>	<p>i. <u>An inspection is performed on the SVVP results summary report(s).</u></p> <p>}}Design Acceptance Criteria}} A Results Analysis of the Software Verification and Validation Plan (SVVP) will be performed. A Verification and Validation Analysis shall be performed for all Safety Related Software at prescribed points in the Software Life Cycle as defined in the SMP. A Requirements Traceability</p>	<p>i. <u>A results summary report(s) exists and it shall demonstrate that the SVVP satisfactorily addresses the managerial, implementation and resource characteristics to support the ESBWR I&C Systems development. The report shall verify that the organizational, scheduling, and financial independence is maintained throughout the development process.</u></p>

Table 3.2-1
ITAAC For Software Development

Design Commitment	Inspections, Tests, Analyses	Acceptance Criteria
<p>software based product meets its specified requirements, performs its intended functions correctly and performs no unintended functions. The SVVP also defines the management, implementation and resource software characteristics.</p>	<p>Analysis (RTA) shall be performed for all Q and N3 Software.</p>	<p>The results summary report(s) address the ESBWR safety-related systems described in Table 2.2.10-1 and their associated safety-related functions.</p> <p>{{Design Acceptance Criteria}} A Results Summary Report shall be developed and it shall verify that the Software Verification and Validation Plan (SVVP) satisfactorily addresses all of the managerial, implementation and resource characteristics necessary to accomplish the design and development tasks associated with ESBWR software based products. The report shall verify that the organizational, scheduling, and financial independence is maintained throughout the development process. V & V Reports shall demonstrate that management, implementation, and resource characteristics are maintained throughout the SW Life Cycle process. The Requirements Traceability Matrix shall demonstrate that management, implementation, and resource characteristics are maintained throughout the SW Life Cycle process.</p>
	<p><u>ii. An inspection is performed on the SVVP process results summary report(s).</u></p>	<p><u>ii. A results summary report(s) exists and concludes that the SVVP process defines the organizational responsibilities.</u></p>

Table 3.2-1
ITAAC For Software Development

Design Commitment	Inspections, Tests, Analyses	Acceptance Criteria
		<p><u>activities, and management controls and demonstrates the following process characteristics: consistency, style, traceability, unambiguity and verifiability.</u></p> <p><u>V & V Reports shall demonstrate that management, implementation, and resource characteristics are maintained throughout the SW Life Cycle process.</u></p> <p><u>The Requirements Traceability Matrix (RTM) shall demonstrate that management, implementation, and resource characteristics are maintained throughout the Software Life Cycle process.</u></p> <p><u>The results summary report(s) address the ESBWR safety-related systems described in Table 2.2.10-1 and their associated safety-related functions.</u></p>
<p>10. <u>Implement the Software Configuration Management Plan (SCMP) for the design and development of ESBWR I&C System software. The Software Configuration Management Plan (SCMP) defines the management, the implementation of the configuration control, and the specific documents, files and systems to which it is applicable. It also defines the management, implementation and</u></p>	<p>i. <u>An inspection is performed on the SCMP results summary report(s). A Results Analysis of the Software Configuration Management Plan (SCMP) will be performed.</u></p> <p><u>{}Design Acceptance Criteria{} A Configuration Management analysis shall be performed for all Safety Related Software during the Baseline Review for each Software Life Cycle phase.</u></p>	<p>i. <u>A results summary report(s) exists and it shall demonstrate that the SCMP satisfactorily addresses the managerial, implementation and resource characteristics to support the ESBWR I&C Systems development.</u></p> <p><u>The results summary report(s) address the ESBWR safety-related systems described in Table 2.2.10-1 and their associated</u></p>

**Table 3.2-1
ITAAC For Software Development**

Design Commitment	Inspections, Tests, Analyses	Acceptance Criteria
<p>resource software characteristics.</p>		<p>safety-related functions. A Results Summary Report shall be developed and it shall verify that the Software Configuration Management Plan (SCMP) satisfactorily addresses all of the managerial, implementation and resource characteristics necessary to accomplish the design and development tasks associated with ESBWR software based products.</p> <p>{{Design Acceptance Criteria}} In addition, the report shall verify that the following items are being maintained under the control of an organization that is responsible for processing and archiving the various versions of the software as well as supporting documentation:</p> <ol style="list-style-type: none"> 1. Software requirements, designs, and code 2. Support software used in development 3. Libraries of software components essential to safety 4. Software plans that could affect quality 5. Test software requirements, designs, or

**Table 3.2-1
ITAAC For Software Development**

Design Commitment	Inspections, Tests, Analyses	Acceptance Criteria
		<p>code used in testing</p> <p>6. Test results and analyses used to qualify software</p> <p>7. Software documentation</p> <p>8. Databases and software configuration data</p> <p>9. Pre-developed software items that are safety system software</p> <p>10. Software change documentation</p> <p>11. Tools used in the software project for management, development, or assurance</p> <p>CM Reports shall demonstrate that management, implementation, and resource characteristics are maintained throughout the SW Life Cycle process.</p>
	<p>ii. <u>An inspection is performed on the SCMP process results summary report(s).</u></p>	<p>ii. <u>A results summary report(s) exists and concludes that the SCMP process defines the organizational responsibilities, activities, and management controls and demonstrates the following process characteristics: consistency, style, traceability, unambiguity and verifiability.</u></p>

**Table 3.2-1
ITAAC For Software Development**

Design Commitment	Inspections, Tests, Analyses	Acceptance Criteria
		<p><u>In addition, the report(s) shall verify that the following items are being maintained under the control of an organization that is responsible for processing and archiving the various versions of the software as well as supporting documentation.</u></p> <ul style="list-style-type: none"> • <u>Software requirements, designs, and code</u> • <u>Support software used in development</u> • <u>Libraries of software components essential to safety</u> • <u>Software plans that could affect quality</u> • <u>Test software requirements, designs, or code used in testing</u> • <u>Test results and analyses used to qualify software</u> • <u>Software documentation</u> • <u>Databases and software configuration data</u> • <u>Pre-developed software items that are safety system software</u> • <u>Software change documentation</u> • <u>Tools used in the software project for management, development, or assurance</u> <p><u>The results summary report(s) address the</u></p>

Table 3.2-1
ITAAC For Software Development

Design Commitment	Inspections, Tests, Analyses	Acceptance Criteria
		<u>ESBWR safety-related systems described in Table 2.2.10-1 and their associated safety-related functions.</u>
<p>11. <u>Implement the Cyber Security Program Plan (CySP) for the design and development of ESBWR I&C System software. The Cyber Security Program Plan (CSPP) developed using a structured design process to protect digital assets from cyber attack. The CSPP provides specific documentation and reviews during the following lifecycle phases:</u></p> <ol style="list-style-type: none"> 1.Planning Phase 2.Requirements Phase 3.Design Phase 4.Implementation Phase 5.Test Phase 6.Installation Phase 7.Operation and Maintenance Phase 	<p>i. <u>An inspection is performed on the CySP results summary report(s)The following are performed:</u></p> <p><u>Inspection of the process used to design the hardware and software.</u></p> <p><u>☐Tests on system hardware configuration (including all external connectivity), software integration, software qualification, system integration, system qualification, and factory acceptance. {{Design Acceptance Criteria}}</u></p>	<p>i. <u>A results summary report(s) exists and it shall demonstrate that the CySP satisfactorily addresses the managerial, implementation and resource characteristics to support the ESBWR I&C Systems development. Inspection and test reports exist and conclude(s) that the Cyber Security Program Plan (CSPP) is developed using a structured design process to protect digital assets from cyber attack. The CSPP provides specific documentation and reviews during the following lifecycle phases:</u></p> <p><u>The results summary report(s) address the ESBWR safety-related systems described in Table 2.2.10-1 and their associated safety-related functions.</u></p> <p><u>1.{{Design Acceptance Criteria}}Planning Phase</u></p> <p><u>2.Requirements Phase</u></p>

**Table 3.2-1
ITAAC For Software Development**

Design Commitment	Inspections, Tests, Analyses	Acceptance Criteria
		<p>3.Design Phase 4.Implementation Phase 5.Test Phase 6.Installation Phase 7.Operation and Maintenance Phase</p>
	<p>ii. <u>An inspection is performed on the CySP process results summary report(s).</u></p>	<p>ii. <u>A results summary report(s) exists and concludes that the CySP process defines the organizational responsibilities, activities, and management controls and demonstrates the following process characteristics: consistency, style, traceability, unambiguity and verifiability. The results summary report(s) address the ESBWR safety-related systems described in Table 2.2.10-1 and their associated safety-related functions.</u></p>
<p>12. <u>Implementation of the ESBWR I&C software program satisfactorily produces Software Design Documentation (SDD). Software Design Documentation (SDD) is information recorded about a specific life cycle activity. Documentation includes software life cycle design outputs</u></p>	<p>i. <u>An inspection is performed on the SDD results summary report(s). A Baseline Review Analysis, which includes a configuration management report, shall be performed at each SW lifecycle phase. {{Design Acceptance Criteria}}</u></p>	<p>i. <u>A results summary report(s) exists and it shall demonstrate that the SW DD satisfactorily addresses the managerial, implementation and resource characteristics to support the ESBWR I&C Systems development. The results summary report(s) address the</u></p>

**Table 3.2-1
ITAAC For Software Development**

Design Commitment	Inspections, Tests, Analyses	Acceptance Criteria
<p>and software life cycle process documentation.</p>		<p><u>ESBWR safety-related systems described in Table 2.2.10-1 and their associated safety-related functions.</u></p> <p>{}Design Acceptance Criteria{} A Results Summary Report shall be developed and it shall verify that that the SW Design Documentation satisfactorily addresses all of the managerial, implementation and resource characteristics necessary to accomplish the design and development tasks associated with ESBWR software based products.</p>
	<p><u>ii. An inspection is performed on the SDD process results summary report(s).</u></p>	<p><u>ii. A results summary report(s) exists and concludes that the SDD processes define the organizational responsibilities, activities, and configuration management controls and demonstrates the following process characteristics: consistency, style, traceability, unambiguity and verifiability.</u></p> <p><u>The SDD includes the following software lifecycle design outputs and software life cycle process documentation:</u></p> <ul style="list-style-type: none"> <u>• Specification of functional requirements.</u> <u>• Documentation and review of hardware and software.</u>

Table 3.2-1
ITAAC For Software Development

Design Commitment	Inspections, Tests, Analyses	Acceptance Criteria
		<ul style="list-style-type: none">• <u>Performance of system tests and the documentation of system test results.</u>• <u>Performance of installation tests and inspections.</u> <p><u>The results summary report(s) address the ESBWR safety-related systems described in Table 2.2.10-1 and their associated safety-related functions.</u></p>

NRC RAI 14.3-269

1. Please properly identify which ITAAC under this section are DAC.
2. There are multiple ITAAC/DAC plans listed. However, based on submitted Topical Reports, there will be three umbrella plans (SMP, SQAP and Cyber Security), which will provide guidance for the application specific implementation plans detailed in the ITAAC/DAC. Three of the umbrella plans have the same name as the plans to be developed and listed as per the ITAAC/DAC. Please clarify the naming convention for the umbrella/template versus application specific implementation plans and explain the expected hierarchy of the plans. For example, the currently submitted high level umbrella/template SMP shows several of the other listed plans as actually being its components. It is somewhat unclear which plans are to be standalone and which are subparts of other plans. And please confirm Staff understanding of the utilization of the umbrella/template plan versus application specific implementation plans as discussed here.

Response to RAI 14.3-269

1. For GEH DAC/ITAAC discussion see response to RAI 14.3-107, also included in this letter.
2. The Submitted License Topical Reports (NEDE33245P and NEDE33226P) contain high level planning documents for the ESBWR software development and quality assurance processes. These are not implementation procedures. Implementation procedures will be developed as subordinate documents to these plans. The implementation procedures will be written once the NRC approves the License Topical Reports. As such, they will be in full compliance with the governing plans. The purpose of the subject License Topical Reports is to provide a traceable and verifiable licensing basis for the development of implementation procedures that will be used for the development and maintenance of all ESBWR class Q, N3, and N2 software applications.

To ensure that compliance is maintained throughout the procedure development process, GEH will maintain a Requirements Traceability Matrix, which will be verified via Requirements Traceability Analyses process.

The Names of the subject Software License Topical Reports will be changed as follows;

License Topical Report NEDE33245P ESBWR I&C Software Quality Assurance Plan will become the ESBWR I&C Software Quality Assurance Program Manual and will contain the following software plans;

1. Software Quality Assurance Plan
2. Software Verification and Validation Plan
3. Software Test Plan
4. Software Safety Plan

5. Software Configuration Management Plan

License Topical Report_NEDE33226P ESBWR I&C Software Management Plan will become the ESBWR I&C Software Management Program Manual and will contain the following software plans;

1. Software Management Plan
2. Software Development Plan
3. Software Integration Plan
4. Software Installation Plan
5. Software Operation and Maintenance Plan
6. Software Training Plan

Figure 1 represents the hierarchal structure of these documents and shows the intended implementation path forward. This figure is informational only and will not be included in the subject License Topical Reports.

DCD/LTR Impact:

See attached DCD Tier 2 mark-up (Attachment 5 is an example mark-up of the software manual name changes.)

All references to and within LTR NEDE33226P ESBWR I&C Software Management Program Manual will be revised to reflect the new document title. (Attachments 1 and 2 are example mark-ups of the SMPM.)

All references to and within LTR NEDE33245P ESBWR I&C Software Quality Assurance Program Manual will be revised to reflect the new document title. (Attachments 3 and 4 are example mark-ups of the SQAPM.)

No changes in name or content will be made to the Cyber Security Program Plan License Topical Report.

ESBWR DCD Tier 1, Section 3.2, Software Development ITAAC, will be revised to reflect the name change. Reference RAI 14.3-170 response included in this letter.

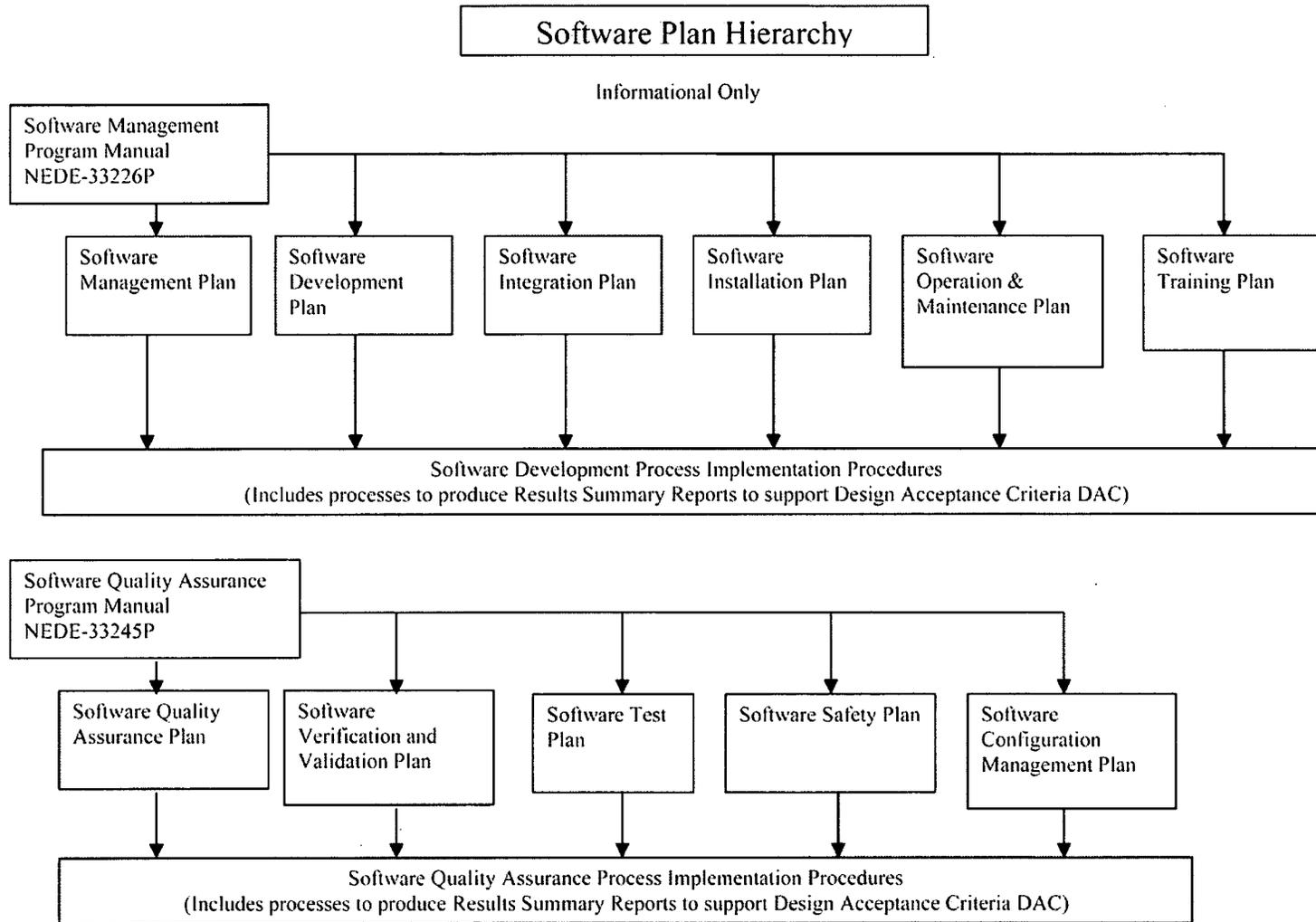


Figure 1

7B. SOFTWARE QUALITY PROGRAM FOR SOFTWARE DESIGN AND DEVELOPMENT – DELETED

Appendix 7B was deleted, and Software Quality Program for Software Design and Development is discussed in the following two Licensing Topical Reports:

(1) ESBWR I&C Software Management ~~Plan~~-Program Manual, NEDO-33226 NEDE-33226P;
and

(2) ESBWR I&C Software Quality Assurance ~~Plan~~-Program Manual, NEDO-33245 NEDE-33245P.



**GE Energy
Nuclear**

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NEDO-33226

Revision 2 3

Class I

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LICENSING TOPICAL REPORT
ESBWR I&C SOFTWARE MANAGEMENT ~~PLAN~~ PROGRAM MANUAL
(SMPM)

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1.0 INTRODUCTION

1.1 Overview

The Software Management ~~Plan~~ Program Manual (SMPM) includes the key planning documents for the Instrumentation and Controls (I&C) design team and governs the design and development activities for the Digital Computer-Based I&C software for the ESBWR.

1.2 Purpose and Scope

The scope of the SMPM includes software products with the software classifications of Software Class Q, N3, and N2. The definitions for software classifications are defined in Appendix C. Unless otherwise specified, non-safety systems are referenced as Software Class N in the SMPM.

The software plans are identified in the ESBWR Man-Machine Interface (MMI) System and Human Factor & Engineering (HFE) Implementation Plan [2.1(1)]. The software plans included in this SMPM document, referred to as the Software Management ~~Plan~~ Program Manual, are:

- | | |
|---|---------------|
| 1. <u>Software Management Plan (SMP)</u> | [Section 3.0] |
| 2. Software Development Plan (SDP) | [Section 5.0] |
| 3. Software Integration Plan (SIntP) | [Section 6.0] |
| 4. Software Installation Plan (SIP) | [Section 7.0] |
| 5. Software Operation and Maintenance Plan (SOMP) | [Section 8.0] |
| 6. Software Training Plan (STrngP) | [Section 9.0] |

The ESBWR I&C Software Quality Assurance ~~Plan~~ Program Manual (SQAPM) [2.3(1)], herein referred to as SQAPM, includes the software plans used by the Quality Assurance (QA) and the Software Project Engineering (SPE) organizations, governing the same I&C software scope identified in the MMIS/HFE IP.

- | | |
|--|--------------------------------------|
| 1. <u>Software Quality Assurance Plan (SQAP)</u> | [2.3(1) Section 3.0] |
| 1. <u>2. Software Verification & Validation Plan (SVVP)</u> | [2.3(1) Section 7.0 5.0] |
| 2. <u>3. Software Safety Plan (SSP)</u> | [2.3(1) Section 9.0 4.0] |
| 3. <u>4. Software Configuration Management Plan (SCMP)</u> | [2.3(1) Section 10.0 6.0] |
| 5. <u>Software Test Plan (STP)</u> | [2.3(1) Section 7.0] |

Together, the SMPM and the SQAPM include all the software plans identified in Reference 2.1(1) and conform to the guidance provided by NUREG 0800, Standard Review Plan [2.2.1].

This SMPM shall be in force during all phases of the software life cycle.

The applicable Software Products (software and firmware) covered in this SMPM encompass all I&C systems, as specifically defined in the MMIS/HFE IP [2.1(1)] (Subsection 1.2.4 only), which perform the monitoring, control, alarming, and protection functions associated with all modes of ESBWR plant normal operation (i.e., startup, shutdown, standby, power operation, and

refueling) as well as off-normal, emergency, and accident conditions.