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Docket No. 52-010

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U.S. Nuclear Regulatory Commission
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Subject: **ESBWR I&C Licensing Topical Reports – NEDO-33248 and NEDO-33249**

The following ESBWR I&C Licensing Topical Reports (LTRs) are contained in the Enclosure:

- NEDO-33248, “ESBWR I&C Operations and Maintenance Plan” – outlines software Operation and Maintenance Phase strategy and techniques as required by the Software Management Plan
- NEDO-33249, “ESBWR I&C Software Training Plan” – outlines strategy and techniques as required by the Software Management Plan to develop the software training manual.

These LTRs were identified in the Referenced letter. Please note, however, that the Referenced letter indicated that two separate LTRs would be submitted for the ESBWR I&C Operations Plan and the ESBWR I&C Maintenance Plan. These have been combined into one LTR.

DAE8

MFN 06-090

Page 2 of 2

If you have any questions about the information provided here, please let me know.

Sincerely,



David H. Hinds
Manager, ESBWR

Enclosure:

MFN 06-090 – Licensing Topical Reports

- NEDO-33248, “ESBWR I&C Operations and Maintenance Plan,” April 2006
- NEDO-33249, “ESBWR I&C Training Plan,” April 2006

Reference:

MFN 05-140, Letter from David H. Hinds to U. S. Nuclear Regulatory Commission, *Submittal Schedule for Licensing Topical Reports Related to ESBWR (TAC # MC8168)*, November 22, 2005

cc: WD Beckner USNRC (w/o enclosures)
AE Cabbage USNRC (with enclosures)
LA Dudes USNRC (w/o enclosures)
GB Stramback GE/San Jose (with enclosures)
eDRFs 0000-0052-5433, 0000-0052-5432

MFN 06-090
Enclosure

ENCLOSURE

MFN 06-090

Licensing Topical Reports

**NEDO-33248, "ESBWR I&C Operations and Maintenance
Plan," April 2006**

**NEDO-33249, "ESBWR I&C Software Training Plan,"
April 2006**



**GE Energy
Nuclear**

NEDO-33248
Class I
eDRF# 0000-0052-5433
April 2006

LICENSING TOPICAL REPORT

ESBWR I&C

SOFTWARE OPERATION AND MAINTENANCE PLAN

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This document, NEDO-33248, Rev 0, contains no proprietary information.

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Table of Contents

1	Introduction.....	4
1.1	Purpose.....	4
1.2	Scope.....	4
1.3	Acronyms, Abbreviations, and Definitions	5
1.3.1	Acronyms and Abbreviations	5
1.3.2	Definitions.....	5
1.4	Applicable Documents.....	6
1.4.1	Supporting Documents.....	6
1.4.2	Supplemental Documents	6
1.4.3	Institute of Electrical and Electronic Engineers (IEEE) Standards	7
1.4.4	Nuclear Regulations.....	7
2	Organization and Management.....	7
3	Activities.....	7
3.1	Operation Phase Activities.....	8
3.2	Maintenance Phase Activities	8
4	Procedures	8
4.1	Operation Phase Procedure.....	9
4.2	Maintenance Phase Procedures.....	9
5	Methods.....	9
5.1	Documentation and Problem Reporting.....	9
5.2	Verification and Validation Methods.....	9
5.3	Metrics	9

1 Introduction

This Software Operation and Maintenance Plan (SOMP) describes the software process/activities to be carried out during the operation of software-based equipment produced for the plant. Software operation and maintenance consists of activities that are applied to software during operation and maintenance phase.

This Plan is developed in accordance with the Software Management Plan (SMP [Ref 1.4.2(1)]) to establish procedures and guidelines necessary to operate and maintain software on software based products.

Software operation and maintenance carried out in accordance with this plan satisfies all requirements invoked by the Software Management Plan (SMP [Ref 1.4.2(1)]).

1.1 Purpose

This Plan is used in conjunction with the software installation plan (SIP). This Plan defines any additional requirements and methods to use while developing the System Operation Manual. This Plan defines maintenance procedures and activities to modify and maintain software once the software is placed in service.

1.2 Scope

The scope of this plan is to outline software Operation and Maintenance Phase strategy and techniques as required by the SMP. Activities associated with distribution (as defined by IEEE Standard 1074) as well as plant specific operation procedures are beyond the scope of this plan.

The software quality assurance requirements shall be defined in the Software Quality Assurance Plan (SQAP [Ref 1.4.2(5)]). These requirements are provided from several sources, including:

1. The Man-Machine Interface System and Human Factors Engineering Design Implementation Plan [Ref 1.4.1(2)];
2. 10 CFR 50, Appendix B pertaining to software; and
3. Conforming to IEEE Standard 730, the IEEE Standard for Software Quality Assurance Plan.

The Software Configuration Management Plan (SCMP [Ref 1.4.2(2)]) defines methods used for control of documentation (defined as configurable items).

The Software Management Plan (SMP [Ref 1.4.2(1)]) defines the scope of the design documentation requirements.

This quality plan (SOMP) shall define the required documentation for the Operation and Maintenance Phases.

The Software Verification and Validation Plan (SVVP [Ref 1.4.2(3)]) defines the scope of and requirements for verification and validation (V&V).

Software safety analysis continues through the Operations and Maintenance Phase, based on the Software Safety Plan (SSP [Ref 1.4.2(4)]).

1.3 Acronyms, Abbreviations, and Definitions

1.3.1 Acronyms and Abbreviations

The following Acronyms and Abbreviations are used in this document:

EOP	Engineering Operating Procedure
GE	General Electric Company
GEEN	GE Energy Nuclear (Previously GENE)
HFE	Human Factors Engineering
MMIS	Man-Machine Interface System
O&M	Operation and Maintenance
Reg. Guide	Regulatory Guide
SCMP	Software Configuration Management Plan
SIP	Software Installation Plan
SMP	Software Management Plan
SOMP	Software Operations and Maintenance Plan
SQA	Software Quality Assurance
SQAP	Software Quality Assurance Plan
SSP	Software Safety Plan
SVVP	Software Validation and Verification Plan
V&V	Verification and Validation

1.3.2 Definitions

The following definitions apply throughout this document:

Documentation - The formal output generated by a task for a particular case (e.g., design output).

- Embedded System - A specialized computer system that is part of a larger system or machine. Typically, an embedded system is housed on a single microprocessor board with the programs stored in ROM (Firmware).
- Firmware - Software not running on the main processor of a computer will be considered as firmware, i.e., as software embedded in a black box device that can be used and assessed only through the device in which it is embedded.
- Instrument - A hardware device used for analytical or control functions and usually containing an embedded microprocessor(s).

1.4 Applicable Documents

Applicable documents include supporting, supplemental, and reference and are given in this section. Support documents provide the input requirements to this quality plan. Supplemental documents are used in conjunction with this quality plan. Reference documents are documents that lend support, but supply no input requirements.

1.4.1 Supporting Documents

The following supporting documents were used as the controlling documents in the production of this plan. These documents form the design basis traceability for the requirements outlined in this plan.

Document Title	Document Number
1. Quality Assurance Plan	NEDO-33181
2. Man-Machine Interface System and Human Factors Engineering Design Implementation Plan	NEDO-33217

1.4.2 Supplemental Documents

Supplemental documents are those documents that are used in conjunction with this document.

Document Title	Document Number
1. Software Management Plan	NEDO-33226
2. Software Configuration Management Plan	NEDO-33227
3. Software Verification and Validation Plan	NEDO-33228
4. Software Safety Plan	NEDO-33230

Document Title	Document Number
5. Software Quality Assurance Plan	NEDO-33245
6. GEEN Engineering Operation Procedures	NEDE-21109
a. 40-7.00 Design Review	
b. 42-6.00 Independent Design Verification	
c. 42-10.00 Design Record File	
d. 45-2.00 Procurement of Engineering Services	
e. 25-5.00 Work Planning and Scheduling	
f. 75-5.0 Operation And Maintenance Instruction Manuals	
7. Software Installation Plan	NEDO-33247

1.4.3 Institute of Electrical and Electronic Engineers (IEEE) Standards

1. IEEE Std. 1074, "IEEE Standard for Software Developing Life Cycle Processes".

1.4.4 Nuclear Regulations

1. NUREG-0800, Chapter 7, Branch Technical Position HICB-14, for Software Safety Plans.

2 Organization and Management

The software operation and maintenance activities are performed under the software development organization, defined in Software Management Plan (SMP [Ref 1.4.2(1)]).

Management, including definition of interfaces, scheduling, roles, responsibilities, qualifications, planning resources, contingency planning, and training shall be carried out in accordance with EOP 45-2.00 Procurement of Engineering Services and EOP 25-5.00 Work Planning and Scheduling.

3 Activities

The plans, procedures, processes, and activities for software corrections and for software enhancements in the Operation and Maintenance Phase are exactly the same as those used in the Planning, Requirements, Design, Implementation, Integration, Validation, and Installation Phases.

This section defines the activities to be performed during the Operation and Maintenance Phase of the software lifecycle. These activities are described in the following sections.

3.1 Operation Phase Activities

Plant specific operation procedures (as defined by IEEE Standard 1074) are considered post-development activities and as such are beyond the scope of this plan. The Operation Manual developed in the Installation Phase defines procedures for specific recommended activities to be performed during the operation of the system in which the software is installed. The Software Installation Plan (SIP [Ref 1.4.2(7)]) defines the requirements of the O&M Manual. The Operation and Maintenance (O&M) manual may be used to develop plant specific procedures, which include:

1. Monitoring the software to detect security breaches, including penetration or attempted penetration of the system,
2. Measuring, recording, root cause evaluating, analyzing, and reporting system error rates,
3. Surveillance procedures for ensuring that
 - a. The system is operating correctly and calibrated,
 - b. The software state is consistent with the plant operating mode at all times, and
 - c. For Quality Class Q software, the system is ready and able to perform its safety-related function.
4. Backup and restore procedures for configuration, data, and code.
5. Calibration procedures.

3.2 Maintenance Phase Activities

Maintenance or software engineering change control is the process used to control, authorize, and implement changes to engineering controlled documents. The same software plans, processes, and procedures used to correct errors in the software during the initial life cycle phases will be used to make corrections to the software after the system is installed in the plant. The owner/user (licensed applicant) shall maintain continuity with the original software project life cycle development plans through contractual obligations with the designer and software developer at or before system turnover to operations and maintenance. The reactor operator's plans, processes, and procedures will provide any additional required installation, commissioning, and testing procedures for the revised system. The reactor operator's plans, processes, and procedures will augment the integration and testing provided by GEEN.

4 Procedures

The following sections define the procedural requirements for each Operation and Maintenance Phase activity.

4.1 Operation Phase Procedure

Generic operating procedures of the software-based product shall be defined in the Operation Manual as required by the Software Installation Plan (SIP [Ref 1.4.2(7)]). Plant specific procedures shall be developed, using the generic procedures supplied by the operation, maintenance, and training manuals, which are the responsibility of the operator.. Both GEEN and the operator shall have a 10cfr 50 and part 21 reporting system in place to notify each other promptly of any nonconformance of the software.

4.2 Maintenance Phase Procedures

Maintenance is the process of modifying a software design output to repair nonconforming items or to implement pre-planned actions necessary to maintain performance. All maintenance procedures shall follow the entire life cycle, from planning through re-installation as defined by the SMP [Ref 1.4.2(1)].

5 Methods

Methods, tools, software, and hardware used to perform software operation and maintenance shall be defined in each appropriate manual as required for each software package.

5.1 Documentation and Problem Reporting

The method used for documentation and problem reporting during the Operation and Maintenance Phase shall be defined in respective system operation or maintenance manuals.

5.2 Verification and Validation Methods

All Operation and Maintenance Phase outputs shall be verified in accordance with the Software Verification and Validation Plan (SVVP [Ref 1.4.2(3)]), and the Software Safety Plan (SSP [Ref 1.4.2(4)]) for Quality class Q software.

5.3 Metrics

Metrics shall be collected and used as defined by the SQAP [Ref 1.4.2(5)].



**GE Energy
Nuclear**

NEDO-33249
Class I
eDRF# 0000-0052-5432
April 2006

LICENSING TOPICAL REPORT

ESBWR I&C SOFTWARE TRAINING PLAN

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Table of Contents

1	Introduction.....	4
1.1	Purpose.....	4
1.2	Scope.....	4
1.3	Acronyms, Abbreviations, and Definitions	5
1.3.1	Acronyms and Abbreviations	5
1.3.2	Definitions.....	5
1.4	Applicable Documents.....	6
1.4.1	Supporting Documents.....	6
1.4.2	Supplemental Documents	6
1.4.3	Institute of Electrical and Electronic Engineers (IEEE) Standards	7
1.4.4	Nuclear Regulation	7
2	Organization and Management.....	7
2.1	Training Organization.....	7
2.2	Trainer Qualifications	8
3	Training Activities	9
4	Procedures	10
4.1	Training Manual Procedures.....	10
5	Methods.....	11
5.1	Documentation and Problem Reporting.....	11
5.2	Verification and Validation Methods.....	11
5.3	Metrics	11

1 Introduction

This Software Training Plan (STrngP) describes the software training activities to be carried out before and during the operation of software-based equipment produced for the plant. Software training is performed prior to the physical installation of the software and during the Operation and Maintenance Phase of the software life cycle.

This Software Training Plan (STrngP) is developed in accordance with the Software Management Plan (SMP [Ref 1.4.2(1)]). The STrngP establishes procedures and guidelines necessary to train personnel on correct operation of software based products.

Software training carried out in accordance with this plan satisfies all requirements invoked by the Software Management Plan (SMP [Ref 1.4.2(1)]).

1.1 Purpose

This Software Training Plan (STrngP) is used in conjunction with Software Installation Plan (SIP [Ref 1.4.2(7)]). The STrngP defines:

- additional requirements and methods not in the SIP to use while developing the training manual,
- the organization supporting the software-based product training effort, and
- organizational interfaces and responsibilities.

1.2 Scope

The scope of this plan is to outline strategy and techniques as required by the SMP to develop the software training manual. Activities associated with distribution (as defined by IEEE Standard 1074) as well as plant specific operation procedures are considered as post development activities and as such are the responsibility of the reactor operator.

The software quality assurance requirements shall be defined in the Software Quality Assurance Plan (SQAP [Ref 1.4.2(5)]). These requirements are provided from several sources, including:

1. The Man-Machine Interface System and Human Factors Engineering Design Implementation Plan [Ref 1.4.1(2)];
2. 10 CFR 50, Appendix B pertaining to software; and
3. Conforming to IEEE Standard 730, the IEEE Standard for Software Quality Assurance Plan.

The Software Configuration Management Plan (SCMP [Ref 1.4.2(2)]) defines methods used for control of documentation (defined as configurable items).

The Software Management Plan (SMP [Ref 1.4.2(1)]) defines the scope of the design documentation requirements.

This quality plan (STrngP) shall define the required documentation for software training activities.

The Software Verification and Validation Plan (SVVP [Ref 1.4.2(3)]) define the scope of and requirements for verification and validation (V&V).

1.3 Acronyms, Abbreviations, and Definitions

1.3.1 Acronyms and Abbreviations

The following Acronyms and Abbreviations are used in this document:

EOP	Engineering Operating Procedure
GE	General Electric Company
GEEN	GE Energy Nuclear (Previously GENE)
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SCMP	Software Configuration Management Plan
SIP	Software Installation Plan
SMP	Software Management Plan
SQA	Software Quality Assurance
SQAP	Software Quality Assurance Plan
SSP	Software Safety Plan
STrngP	Software Training Plan
SVVP	Software Validation and Verification Plan
V&V	Verification and Validation

1.3.2 Definitions

The following definitions apply throughout this document:

Application Software Package	- A collection of software modules brought together to form a single software application, e.g., an instrument (see also System Software Package and Package).
------------------------------	--

- Documentation - The formal output generated by a task for a particular case (e.g., design output).
- Embedded System - A specialized computer system that is part of a larger system or machine. Typically, an embedded system is housed on a single microprocessor board with the programs stored in ROM (Firmware).
- Firmware - Software not running on the main processor of a computer will be considered as firmware, i.e., as software embedded in a black box device that can be used and assessed only through the device in which it is embedded.
- Instrument - A hardware device used for analytical or control functions and usually containing an embedded microprocessor(s).

1.4 Applicable Documents

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a. 40-7.00 Design Review	
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c. 42-10.00 Design Record File	
d. 45-2.00 Procurement of Engineering Services	
e. 25-5.00 Work Planning and Scheduling	
7. Software Installation Plan	NEDO-33247

1.4.3 Institute of Electrical and Electronic Engineers (IEEE) Standards

1. IEEE Std. 1074, "IEEE Standard for Software Developing Life Cycle Processes."

1.4.4 Nuclear Regulation

1. NUREG-0800, Chapter 7, Branch Technical Position HICB-14, for Software Safety Plans.

2 Organization and Management

Software training activities are performed under the training organization, defined in this document.

Management, including definition of interfaces, scheduling, roles, responsibilities, qualifications, planning resources, contingency planning, and training shall be carried out in accordance with EOP 45-2.00 Procurement of Engineering Services and EOP 25-5.00 Work Planning and Scheduling as part of the installation activities

2.1 Training Organization

This section provides a description of the organization supporting the software-based system training effort as well as organizational interfaces and responsibilities.

Figure 1 shows the training organization as well as its relation to the rest of the ESBWR organization.

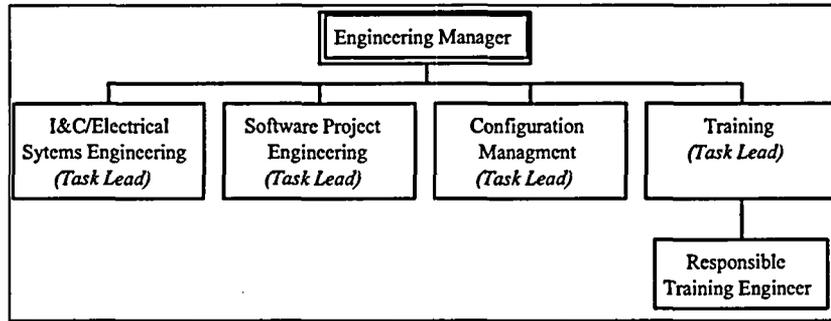


Figure 1, Training Organization

The training organization interfaces with I&C/Electrical Systems Engineering, Configuration Management, and Software Project Engineering (SPE) organizations as needed to complete the training activities outlined in this plan as well as the SIP [Ref 1.4.2(7)].

Organizational responsibilities are defined as:

- Training Task Lead - The person responsible for organizing the overall training process, including scheduling, budgeting, and resource allocation. The ESBWR Engineering Manager appoints this person.
- Responsible Training Engineer - The person responsible for a given technical training item (e.g., the design and development of the training manual or other training documentation). The Training Task Lead appoints each Responsible Training Engineer.

2.2 Trainer Qualifications

This section defines the qualification of individual carrying out each training module and personnel assignments for performing the training.

Responsible Training Engineers shall be qualified for their respective tasks. The following table defines the minimum qualifications for each activity.

<u>Training Activity</u>	<u>Responsible Training Engineer Qualifications</u>
Training Plan Development	- Training plan developers should be knowledgeable in the software quality assurance techniques, Nuclear regulatory requirements, operation and maintenance of software-based systems, the specific ESBWR quality assurance plans, and GEEN training EOPs.

- | | |
|--|---|
| <p>Training Manual Development</p> | <ul style="list-style-type: none"> - Training manual developers shall be knowledgeable in the requirements of the ESBWR quality assurance plans, with specific attention to requirements of training EOPs and plans such as this STrngP. Training manual developers shall also be knowledgeable in the operation and maintenance of the specific software-based system and in the operation of and procedures employed in commercial nuclear power plants. |
| <p>Training Manual Review</p> | <ul style="list-style-type: none"> - Training manual reviewers shall have sufficient independence from the developed training manual as well as knowledge of the specific nuclear requirements and the system platform, and in the operation of and procedures employed in commercial nuclear power plants. |
| <p>Training Class/Teaching Plan Development</p> | <ul style="list-style-type: none"> - Training class/teaching plan developers shall have sufficient knowledge of the specific subject matter, manual, and systems for which the training course material is to be developed as well as in the operation of and procedures employed in commercial nuclear power plants. |
| <p>Training</p> | <ul style="list-style-type: none"> - Qualified trainers shall have sufficient knowledge of the specific subject matter, manual, systems, and course material for which the training course is presented as well as in the operation of and procedures employed in commercial nuclear power plants. |

3 Training Activities

This section defines the additional training activities to be performed during the Installation Phase of the software lifecycle as well as training activities to be performed before or during the operation of the software package.

Plant specific training procedures (as defined by IEEE 1074) are post development activities and are the responsibility of the reactor operator.

Training activities include:

1. Development and maintenance of software training plans (this plan),
2. Development and review of the training manual,

3. Development of training courses, and
4. Training.

The Training Manual, developed in the Installation Phase, defines procedures for specific recommended training activities for system and software operation. The Software Installation Plan (SIP [Ref 1.4.2(7)]) describes the training procedure requirements and should include:

1. Startup,
2. Shutdown,
3. Installation,
4. Backup,
5. Restoration,
6. Configuration,
7. Calibration,
8. Replacing failed modules,
9. Plant modes (including alarm and indicator responses),
10. Training Assessment,
11. Operating Specific Scenarios, and
12. Recommended Surveillance Testing.

4 Procedures

The following sections define the procedural requirements for each training activity.

4.1 Training Manual Procedures

Generic operating procedures for the software-based product shall be defined in the Operation Manual as required by the Software Installation Plan (SIP [Ref 1.4.2(7)]).

The end user will develop the plant specific procedures and training courses, using the generic procedures supplied by the operation, maintenance, and training manuals. These procedures and courses are the responsibility of the reactor operator. The materials created by this plan shall be sufficient for a competent end-user Training Department to create, offer, and maintain their own training courses to support the software-based systems for Operations, Maintenance, and Engineering staff.

Training courses and training shall be carried out in accordance with applicable GEEN EOPs.

5 Methods

Methods, tools, software, and hardware used to perform software training shall be defined in each appropriate manual as required for each software package. A qualified training engineer shall determine each training course's content and methods. The Training Task Lead shall approve all course content and methods.

5.1 Documentation and Problem Reporting

The method used for documentation and problem reporting during the training activities shall be defined in respective system training manuals. Training activities should cumulate with written test or assessment activities that demonstrate the student's knowledge as it relates to the objectives. This covers test and/or quiz that relates directly to the subject material presented to the student.

5.2 Verification and Validation Methods

All Training Manual outputs shall be verified in accordance with the Software Verification and Validation Plan (SVVP [Ref 1.4.2(3)]), and the Software Safety Plan (SSP [Ref 1.4.2(4)]) for Quality class Q software.

5.3 Metrics

Metrics shall be collected and used as defined by the SQAP [Ref 1.4.2(5)].