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LICENSING TOPICAL REPORT

ESBWR I&C SOFTWARE DEVELOPMENT PLAN (DRAFT)

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Prepared for:
ESBWR Certification & Implementation

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1 Introduction

1.1 Purpose and Scope

This Software Development Plan (referred to as the SDP) specifies the management processes for the design and delivery activities for the I&C Essential Controls software and hardware. The scope of this project plan is limited to the activities required to support the delivery of the ESBWR I&C Controls hardware and software. Installation and Operations & Maintenance activities will be addressed separately and are not included presently in this plan. This SDP specifies the implementation of the design activities outlined in I&C Software Management Plan (referred to as the SMP) [2.1.1(3)]*, Software Configuration Management Plan (referred to as the SCMP) [2.1.1(4)], and Verification & Validation Plan (referred to as the VVP) [2.1.2(2)]. This SDP is heavily supported by the ESBWR Project Design Manual (referred to as the PDM) [2.1.1(2)], ESBWR Project Management Manual (referred to as the PMM) [2.1.1(1)], ESBWR Project Procedures [2.1.1(5) and (6)], GE ESBWR Procedures [2.1.1(7)] as noted throughout this document, and Installation Plan (referred to as IP) [2.1.1(9)].

IEEE 1058.1 specifies a standard for Software Project Management Plans, which includes specification of project organization, project scheduling processes, project risk management processes, and project budgeting processes. These processes are currently defined for the ESBWR project in the supporting PDM [2.1.1(2)], PMM [2.1.1(1)], ESBWR PROJECT PROCEDURES [2.1.1(5) and (6)], and GENERAL ESBWR PROCEDURES [2.1.1(7)] documents. Hence, reference to these documents is made frequently in this SDP.

1.2 Definitions, Acronyms, and Abbreviations

The PDM Section 2A [2.1.1(2)] specifies the valid Information Management System (IMS) codes, component function codes (CFCs), equipment/service acronyms and abbreviations for the ESBWR Project.

Acronyms and Abbreviations

The following Acronyms and Abbreviations are used in this document:

| | |
|------|---|
| CFC | Component Function Code |
| DCIS | Distributed Control & Information Systems |
| DRF | Design Record File |
| EOP | Engineering Operating Procedure |
| ESF | Engineered Safety Feature |
| GE | General Electric Company |
| GEEN | GE Energy Nuclear (Previously (GENE)) |
| HSS | Hardware/Software Specification |

* Section numbers referenced in this manner refer to the codes and standards documents listed in the Applicable Documents section (Section 2) of this document.

| | |
|---------|---|
| IMS | Information Management System |
| IP | Installation Plan |
| IPS | Instrument Performance Specification |
| BRT | Baseline Review Team |
| LDU | Local Display Unit |
| M-MIS | Man-Machine Interface System |
| O&MP | Operation & Maintenance Plan (Change Control) |
| PDM | Project Design Manual |
| PMM | Project Management Manual |
| SDP | Software Development Plan |
| DCD | Design Control Document |
| RTIF | Reactor Trip and Isolation Functions |
| SBD | System Block Diagram |
| SCMP | Software Configuration Management Plan |
| SDS | Software Design Specification |
| SMP | Software Management Plan |
| SRP | Standard Review Plan |
| SSLC | Safety System Logic & Control |
| SSP | Software Safety Plan |
| VVP | Verification and Validation Plan |
| Utility | Utility |
| V&V | Verification and Validation |

Definitions

The following definitions apply throughout this document:

- | | |
|----------------------------------|--|
| Baseline | - A set of items that have been formally reviewed and agreed upon, that thereafter serves as the basis for further development, and that can be changed only through formal change control procedures. |
| Baseline Review | - A formal baseline review, conducted at the end of each software life cycle phase, and requested by the Responsible Technical Project Engineer (RTPE). The baseline review process is under the control of the Baseline Review Team. The Baseline Review Team (appointed by the BRT Lead) performs the review. These reviews are intended to confirm adherence to the SDP (this plan), SMP [2.1.1(3)], SCMP [2.1.2(1)] and VVP [2.1.2(2)]. All Baseline Reviews are performed and documented in accordance with the SCMP. |
| Baseline Review Team | - The team responsible for judging adherence to the process for the documentation being baselined. The members of this team are appointed by the BRT Lead, and must be independent from the designers responsible for the documentation {see SCMP [2.1.2(1)]}. |
| Baseline Review Team Lead | - The person responsible for organizing the baseline review process. This person is appointed by the Manager/Technical Lead, Control/Electrical Systems {see SCMP [2.1.2(1)]}. |
| Quality Class | - The ESBWR project Quality Assurance Requirement Classification. The following QA Requirement Codes are defined in the ESBWR Quality Assurance Plan, [2.1.2(8)] S: Safety-Related N: Non Safety-Related The further breakdown of Non Safety-Related Code N to N-R (reliability) and N-G (general) |
| Design Record File | - Design Record File is the formal controlled information record for in-progress and completed engineering work which is retained and from which information can be retrieved. |

Definitions (Continued)

- Design Reviews** - Formal, design adequacy evaluations which are performed by knowledgeable persons other than those directly responsible and accountable for the design in accordance with GEEN EOP 40-7.00 [2.1.2(6b)]. Design reviews are used to verify that product designs meet functional, contractual, safety, regulatory, industry codes and standards, and company requirements.
- Internal Verification and Validation** - The V&V activities performed by the responsible design organization in accordance with GEEN EOPs 40-7.00 (Design Reviews) [2.1.2(6b)] or 42-6.00 (Independent Design Verification) [2.1.2(6c)] or equivalent to ensure the quality of the design process and the associated documents produced. These V&V activities are referred herein as the *Internal V&V*.
- Software Life Cycle Phase** - The Software Life Cycle is the period of time that begins when a software product is conceived and ends when the software is no longer available for use. The I&C software lifecycle is divided into eight phases, Planning, Design Definition (Requirements), Software Design (Design), Software Coding (Implementation), Integration Test (Integration), Validation Test (Validation), Installation (not applicable to microprocessor based design), Change Control (Operation & Maintenance).

2 Applicable Documents**2.1 Supporting and Supplemental Documents****2.1.1 Supporting Documents**

The following supporting documents are used as the controlling documents in the production of this plan:

| Document Title | Document Number |
|--|------------------------|
| 1. Project Management Manual (PMM) | NEDC-33216 |
| 2. Project Design Manual (PDM) | |
| 3. Software Management Plan | NEDE-33226 |
| 4. ESBWR Configuration Management Plan | |

| Document Title | Document Number |
|--|---|
| 5. ESBWR Project Procedure, Progress Reports | |
| 6. ESBWR Project Procedure, Integrated Schedule | |
| 7. Procedure for Change Control Board Submittals | |
| 8. Procedure for Use and Control of the ESBWR Codes and Standards Database | |
| 9. Installation Plan | (not applicable to microprocessor based design) |

2.1.2 Supplemental Documents

The following supplemental documents are used in conjunction with this document:

| Document Title | Document Number |
|--|------------------------|
| 1. Software Configuration Management Plan | NEDE-33227 |
| 2. Verification and Validation Plan | NEDE-33228 |
| 3. Software Test Plan | NEDE-33231 |
| 4. Software Safety Plan | NEDE-33230 |
| 5. Standard Review Plan (SRP), Chapter 7, Appendix 7-A, Branch Technical Position HICB-14, Guidance on Software Reviews for Digital Computer-Based Instrumentation and Control Systems | |
| 6. GEEN Engineering Operation Procedures | NEDE-21109 |
| a. EOP 25-5.00 Work Planning and Scheduling | |
| b. EOP 40-7.00 Design Reviews | |
| c. EOP 42-6.00 Independent Design Verification | |
| 7. Man-Machine Interface System Review Implementation Plan | NEDC-33218 |
| 8. NP-2010 COL Demonstration Project Quality Assurance Plan | NEDC-33181 |

2.2 Codes and Standards

The following codes and standards are applicable to the Software Development Plan to the extent specified herein. The applicable date/revision of the code or standard is specified in the ESBWR Certification Tier 2, Table 1.9-n.

2.2.1 Institute of Electrical and Electronic Engineers (IEEE) Standards

1. IEEE 1058.1, IEEE Standard for Software Project Management Plans
2. IEEE 1074-1997, IEEE Standard for Developing Software Life Cycle Processes

2.2.2 Others

1. None

2.3 U.S. Nuclear Regulatory Commission (NRC) Regulatory Guides (Reg Guide)

1. R.G. 1.173-1997, Developing Software Life Cycle Processes for Digital Computer Software Used in Safety Systems of Nuclear Power Plants

2.4 NUREG

1. NUREG/CR-6101-1993, Software Reliability and Safety in Nuclear Reactor Protection Systems

3 Project Organization

3.1 Project Deliverables

The Essential Controls deliverables consist of hardware, software, and supporting specifications, analyses, and reports. The work packages, specifications, analyses, and reports to be delivered are defined in Section 6 of this plan.

The Essential Controls hardware and software will be planned to be produced in accordance with the target schedule milestones specified in the ESBWR Integrated Project Schedule produced per ESBWR Project Procedure [2.1.1(6)]. This target schedule milestone is subject to revision if the Integrated Project Schedule is revised. ESBWR Project Procedure [2.1.1(5)] specifies the requirements for developing progress reports to ensure timely and appropriate reporting of project status and progress.

Delivery processes for all equipment and documents are specified in the PDM [2.1.1(2)] and PMM [2.1.1(1)].

3.2 Evolution of Software Development Project Plan

The Configuration Management Plan [2.1.1(4)] specifies the process for control of updates to this SDP. This SDP will undergo planned updates as the Integrated Project Schedule per ESBWR Project Procedure [2.1.1(6)] is revised.

All changes to this SDP will be processed under the requirements of the Configuration Management Plan [2.1.1(4)] and the Procedure for Change Control Board Submittals [2.1.1(7)].

3.3 Process Model

The SMP [2.1.1(3)] specifies the process for the development of all ESBWR I&C equipment, and the required approvals and reviews. The SMP [2.1.1(3)] figure 3 shows a graphical representation of this process.

ESBWR Project Procedure [2.1.1(5)] specifies the requirements for developing progress reports to ensure timely and appropriate reporting of project status and progress.

3.4 Organizational Structure

The PMM [2.1.1(1)] specifies the Project Organization for the project. The SMP [2.1.1(3)] specifies the organizational structure for all I&C development groups.

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V&V will be performed by Responsible Verifiers (as specified in the VVP [2.1.2(2)]).

3.5 Organizational Boundaries and Interfaces

The PMM [2.1.1(1)] specifies overall organizational boundaries. The SMP [2.1.1(3)] the SCMP [2.1.2(1)], and the VVP [2.1.2(2)] specify organizational responsibilities for all Essential Controls Software Development, including the requirements for V&V, by Responsible Verifiers.

3.6 Organizational Resources

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3.7 Project Responsibilities

The primary duties of the organization covered by the SMP [2.1.1(3)], and of individuals within the organization are defined below. [[

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4 Managerial Process

4.1 Management Objectives and Priorities

The objective for the Essential Controls project management is to coordinate the development and realization efforts of project deliverables.

Managerial decisions shall be made using the following levels of priority (1 represents the highest level of priority).

1. Safety
2. Schedule
3. Budget

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4.2 Assumptions, Dependencies, and Constraints

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4.3 Risk Management

The risk management for the Essential Controls software development project is based on the following fundamental principle.

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4.3.1 Minimized Risks

The following risks have been identified and taken into consideration during the development of the software planning documents (SMP, SCMP, VVP and this SDP).

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The ESBWR software planning documents have adopted proven processes to mitigate these risks.

4.3.2 Prioritized Risks

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4.3.3 Risk Monitoring

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4.3.4 Reporting Risks

The PMM [2.1.1(1)] specifies the process for detecting issues representing a threat to ESBWR project budget and or the Integrated Project Schedule. Major project issues, representing risks to

ESBWR project budget or schedule, are reported to UTILITY via a monthly project progress report prepared by GE for UTILITY in accordance with the requirements of ESBWR NP-2010 COL Demonstration Project Quality Assurance Plan. Monthly project management meetings are held with UTILITY to address major project issues.

ESBWR Project Procedure [2.1.1(5)] specifies the requirements for developing progress reports to ensure timely and appropriate reporting of project status and progress.

4.4 Monitoring and Controlling Mechanisms

Bi-weekly meetings shall be held to monitor and control the Essential Controls project. The Control/Electrical Manager shall call the meeting and attendance is mandatory for the functions listed in Section 3.4 as well as SSA and software requirements representatives.

External vendors shall submit Progress Reports to facilitate project monitoring. Internal vendors shall be monitored by use of established GEEN reporting procedures.

ESBWR Project Procedure [2.1.1(5)] specifies the requirements for developing progress reports to ensure timely and appropriate reporting of project status and progress.

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4.5 Staffing Plan

The SMP [2.1.1(3)] summarizes the responsibilities for each member of the software development team. Detailed responsibilities are specified in the staffing plan.

The design team shall be composed of experienced individuals whose collective expertise covers a broad range of disciplines relevant to the design and implementation process. These disciplines shall include technical project management, systems engineering, nuclear engineering, electrical engineering and control and instrument engineering. Table 2A in the M-MIS Review Implementation Plan [2.1.2(7)] defines the acceptance criteria for the required skill levels for these disciplines.

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Methods for obtaining, training, and retraining are defined in internal GE human resource policies.

5 Technical Process

5.1 Methods, Tools and Techniques

The methods, tools, and techniques used in the design and development of ESBWR I&C Controls equipment are specified in the SMP [2.1.1(3)], SCMP [2.1.2(1)], VVP [2.1.2(2)] and SSP [2.1.2(4)] as follows:

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5.2 Software Documentation

Documentation to be produced is specified in:

1. The SMP [2.1.1(3)] specifies the documentation to be produced in each engineering work package and the requirements to be met in each applicable engineering document.
2. Section 6 specifies the work packages to be produced.

The SCMP [2.1.2(1)] specifies the configuration control activities, baseline review activities, document naming conventions, configuration management methods, tools, resources and configuration management responsibilities.

VVP [2.1.2(2)] specifies the Internal V&V methods, tools and activities.

5.3 Project Support Functions

Project support functions are specified in the PDM [2.1.1(2)] and PMM [2.1.1(1)].

Configuration Management Activities are specified in the:

1. Configuration Management Plan [2.1.1(4)]
2. Software Configuration Management Plan [2.1.2(1)]

Software V&V activities are specified in the VVP [2.1.2(2)].

Project scheduling and budgeting processes are specified in Sections 2.3 and 2.4 of the PMM [2.1.1(1)].

6 Work Packages, Schedule and Budget

6.1 Work Packages and Schedule

Work packages for the ESBWR I&C Controls consists of two types:

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This section or the project schedule will specify the planned target schedule dates for work packages to be produced. Target schedule dates shall be assigned for the completion of each software life-cycle phase exclusive of the SSA and BRT reports/records. Thus the dates to be provided are those dates when the entire set of design documentation for that phase for that work package is ready for submittal to both the SSA and Baseline Review Teams. Time shall be allocated in the assigned dates to allow for the completion of all work activity associated with the life-cycles phase (engineering, reviews, verifications) as well as additional margin to allow for recovery from unanticipated problems. Details of the ESBWR project scheduling and budgeting processes are specified in Sections 2.3 and 2.4 of the PMM [2.1.1(1)].

A detailed Work Plan shall be developed for each work package in accordance with GEEN EOP 25-5.00 [2.1.2(6a)]. The Manager and the Engineer responsible for the work package shall do this.

Note marks in the following work package summary refer to endnotes on the last page of the document.

Schedules for these work packages are outside of this document scope and will be provided during the project scheduling activity for that phase.

6.1.1 Generic Work Packages

6.1.1.1 Planning Phase

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6.1.1.2 Design Definition Phase

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6.1.1.3 Software Design Phase

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6.1.1.4 Software Coding Phase

1. There will be no generic documents produced in the Software Coding Phase.

6.1.1.5 Integration Test Phase

There will be no generic documents produced in the Integration Test phase.

6.1.1.6 Validation Test Phase

There will be no generic documents produced in the Validation Test Phase.

6.1.2 Neutron Monitoring System (NMS)

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6.1.2.1 Average Power Range Monitor (APRM) Sub-system

6.1.2.1.1 Planning Phase

No documentation will be produced for the APRM sub-system in the Planning Phase.

6.1.2.1.2 Design Definition Phase

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6.1.2.1.3 Software Design Phase

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6.1.2.1.4 Software Coding Phase

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6.1.2.1.5 Integration Test Phase

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6.1.2.1.6 Validation Test Phase

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6.1.2.2 Startup Range Neutron Monitor (SRNM) Sub-system

6.1.2.2.1 Planning Phase

No documentation will be produced for the SRNM sub-system in the Planning Phase.

6.1.2.2.2 Design Definition Phase

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6.1.2.2.3 Software Design Phase

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6.1.2.2.4 Software Coding Phase

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6.1.2.2.5 Integration Test Phase

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6.1.2.2.6 Validation Test Phase

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6.1.2.3 Automatic Fixed In-core Probe (AFIP) Sub-system

6.1.2.3.1 Planning Phase

No documentation will be produced for the AFIP sub-system in the Planning Phase.

6.1.2.3.2 Design Definition Phase

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6.1.2.3.3 Software Design Phase

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6.1.2.3.4 Software Coding Phase

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6.1.2.3.5 Integration Test Phase

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6.1.2.3.6 Validation Test Phase

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6.1.2.4 Multi-channel Rod Block Monitor (MRBM) Sub-system

6.1.2.4.1 Planning Phase

No documentation will be produced for the MRBM sub-system in the Planning Phase.

6.1.2.4.2 Design Definition Phase

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6.1.2.4.3 Software Design Phase

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6.1.2.4.4 Software Coding Phase

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6.1.2.4.5 Integration Test Phase

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6.1.2.4.6 Validation Test Phase

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6.1.3 Safety System Logic & Control (SSLC)

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6.1.3.1.1

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6.1.3.1.1.1 Planning Phase

No documentation will be produced for the RTIF CIM in the Planning Phase.

6.1.3.1.1.2 Design Definition Phase

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6.1.3.1.1.3 Software Design Phase

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6.1.3.1.1.4 Software Coding Phase

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6.1.3.1.1.5 Integration Test Phase

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6.1.3.1.1.6 Validation Test Phase

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6.1.3.1.2 RTIF Digital Trip Module (DTM)

6.1.3.1.2.1 Planning Phase

No documentation will be produced for the RTIF DTM in the Planning Phase.

6.1.3.1.2.2 Design Definition Phase

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6.1.3.1.2.3 Software Design Phase

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6.1.3.1.2.4 Software Coding Phase

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6.1.3.1.2.5 Integration Test Phase

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6.1.3.1.2.6 Validation Test Phase

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6.1.3.1.3 RTIF Remote Multiplexing Unit (RMU)

6.1.3.1.3.1 Planning Phase

No documentation will be produced for the RTIF RMU in the Planning Phase.

6.1.3.1.3.2 Design Definition Phase

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6.1.3.1.3.3 Software Design Phase

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6.1.3.1.3.4 Software Coding Phase

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6.1.3.1.3.5 Integration Test Phase

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6.1.3.1.3.6 Validation Test Phase

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6.1.3.1.4 RTIF Trip Logic Unit (TLU)

6.1.3.1.4.1 Planning Phase

No documentation will be produced for the RTIF TLU in the Planning Phase. .

6.1.3.1.4.2 Design Definition Phase

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6.1.3.1.4.3 Software Design Phase

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6.1.3.1.4.4 Software Coding Phase

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6.1.3.1.4.5 Integration Test Phase

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6.1.3.1.4.6 Validation Test Phase

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6.1.3.2 Engineered Safety Features (ESF) Sub-system

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6.1.3.2.1 Generic Work Package

6.1.3.2.1.1 Generic Planning Phase

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6.1.3.2.1.2 Generic Software Requirements Phase

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6.1.3.2.1.3 Generic Software Design Phase

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6.1.3.2.1.4 Generic Software Implementation Phase

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6.1.3.2.1.5 Generic Software Test Phase

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6.1.3.2.1.6 Generic Installation and Checkout Phase

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6.1.3.2.2 Control Operating System (COS)

6.1.3.2.2.1 COS Planning Phase

No specific documents will be produced for the COS in the Planning Phase

6.1.3.2.2.2 COS Requirements Phase

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6.1.3.2.2.3 COS Design Phase

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6.1.3.2.2.4 COS Implementation Phase

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6.1.3.2.2.5 COS Test Phase

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6.1.3.2.2.6 COS Installation and Checkout Phase

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6.1.3.2.3

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6.1.3.2.3.1 CIM Planning Phase

No specific documents will be produced for the CIM in the Planning Phase

6.1.3.2.3.2 CIM Requirements Phase

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6.1.3.2.3.3 CIM Design Phase

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6.1.3.2.3.4 CIM Implementation Phase

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6.1.3.2.3.5 CIM Test Phase

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6.1.3.2.3.6 CIM Installation and Checkout Phase

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6.1.3.2.4 Functional Interconnection Diagram Compiler (FIDC)

6.1.3.2.4.1 FIDC Planning Phase

No specific documents will be produced for the FIDC in the Planning Phase

6.1.3.2.4.2 FIDC Requirements Phase

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6.1.3.2.4.3 FIDC Design Phase

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6.1.3.2.4.4 FIDC Implementation Phase

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6.1.3.2.4.5 FIDC Test Phase

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6.1.3.2.4.6 FIDC Installation and Checkout Phase

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6.1.3.2.5 Video Display Unit (VDU) Software

6.1.3.2.5.1 VDU Software Planning Phase

No specific documents will be produced for the VDU Software in the Planning Phase

6.1.3.2.5.2 VDU Software Requirements Phase

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6.1.3.2.5.3 VDU Software Design Phase

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6.1.3.2.5.4 VDU Software Implementation Phase

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6.1.3.2.5.5 VDU Software Test Phase

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6.1.3.2.5.6 VDU Software Installation and Checkout Phase

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6.1.3.2.6 Video Display Unit (VDU) Screen

6.1.3.2.6.1 VDU Screen Planning Phase

No specific documents will be produced for the VDU Screen in the Planning Phase

6.1.3.2.6.2 VDU Screen Requirements Phase

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6.1.3.2.6.3 VDU Screen Design Phase

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6.1.3.2.6.4 VDU Screen Implementation Phase

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6.1.3.2.6.5 VDU Screen Test Phase

The following documentation will be produced for the VDU Screen portion of the SSLC in the Test Phase.

1. VDU Screen Software Test Report
2. VDU Screen Traceability Matrix
3. VDU Screen Software V&V Summary Report²¹
4. VDU Screen Software Safety Analysis Test Report

6.1.3.2.6.6 VDU Screen Installation and Checkout Phase

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6.1.3.3 Anticipated Transient Without Scram (ATWS) Sub-system

6.1.3.3.1 Planning Phase

No documentation will be produced for the ATWS portion of the SSLC in the Planning Phase.

6.1.3.3.2 Design Definition Phase

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6.1.3.3.3 Software Design Phase

The ATWS sub-system will not contain software. Thus no documents will be produced for the ATWS sub-system in the Software Design Phase.

6.1.3.3.4 Software Coding Phase

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6.1.3.3.5 Integration Test Phase

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6.1.3.3.6 Validation Test Phase

This phase does not apply to hardware instruments. Verification is performed per EOP 42-6.0 [2.1.2.7(c)]. Engineering reports are filed in the DRF.

6.1.4 Rod Control & Information System (RCIS) Interface Instruments

The main RCIS system is not within the scope of this development effort. Essential Controls development effort covers only the RWM, ATLM and RAPI Interface Unit subsystems of the RCIS system. The work package schedules outlined in this section (the RCIS section) are those required to complete the development of these three instruments:

1. Rod Worth Minimizer (RWM)
2. Automatic Thermal Limit Monitor (ATLM)
3. Rod Action and Position Information (RAPI) Interface Unit

The RCIS Interface Instruments are non-safety related (Quality Class N-R).

The only safety related portion of the RCIS is the monitoring of the Control Rod Separation Switches. These signals are landed in the SSLC RMU cabinets and hence are processed by that system. No discrete safety related work activity will be required for the RCIS system.

6.1.4.1 Rod Worth Minimizer (RWM)

6.1.4.1.1 Planning Phase

No documentation will be produced for the RWM sub-system in the Planning Phase.

6.1.4.1.2 Design Definition Phase

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6.1.4.1.3 Software Design Phase

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6.1.4.1.4 Software Coding Phase

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6.1.4.1.5 Integration Test Phase

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6.1.4.1.6 Validation Test Phase

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6.1.4.2 Automatic Thermal Limit Monitor (ATLM)

6.1.4.2.1 Planning Phase

No documentation will be produced for the ATLM sub-system in the Planning Phase.

6.1.4.2.2 Design Definition Phase

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6.1.4.2.3 Software Design Phase

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6.1.4.2.4 Software Coding Phase

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6.1.4.2.5 Integration Test Phase

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6.1.4.2.6 Validation Test Phase

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6.1.4.3 Rod Action and Position Information (RAPI) Interface Unit

6.1.4.3.1 Planning Phase

No documentation will be produced for the RAPI Interface Unit in the Planning Phase.

6.1.4.3.2 Design Definition Phase

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6.1.4.3.3 Software Design Phase

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6.1.4.3.4 Software Coding Phase

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6.1.4.3.5 Integration Test Phase

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6.1.4.3.6 Validation Test Phase

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6.1.5 Essential DCIS System (E-DCIS)

There are no separate work packages being developed for the Essential (Quality Class S) portion of the DCIS. The Quality Class S portions of the DCIS (C63) have been incorporated into the NMS, SSLC/RTIF and SSLC/ESF development efforts.

The documentation for the E-DCIS sub-system is limited to interface specifications produced during Design Definition Phases belonging to the NMS, SSLC/RTIF and SSLC/ESF work packages.

6.1.5.1 Planning Phase

There will be no documents produced specifically for the E-DCIS system in the Planning Phase since this system is incorporated into the NMS, SSLC/RTIF and SSLC/ESF development efforts.

6.1.5.2 Design Definition Phase

There will be no documents produced specifically for the E-DCIS system in the Design Definition Phase since this system is incorporated into the NMS, SSLC/RTIF and SSLC/ESF development efforts.

6.1.5.3 Software Design Phase

There will be no documents produced specifically for the E-DCIS system in the Software Design Phase since this system is incorporated into the NMS, SSLC/RTIF and SSLC/ESF development efforts.

6.1.5.4 Software Coding Phase

There will be no documents produced specifically for the E-DCIS system in the Software Coding Phase since this system is incorporated into the NMS, SSLC/RTIF and SSLC/ESF development efforts.

6.1.5.5 Integration Test Phase

There will be no documents produced specifically for the E-DCIS system in the Integration Test Phase since this system is incorporated into the NMS, SSLC/RTIF and SSLC/ESF development efforts.

6.1.5.6 Validation Test Phase

There will be no documents produced specifically for the E-DCIS system in the Validation Test Phase since this system is incorporated into the NMS, SSLC/RTIF and SSLC/ESF development efforts.

6.1.6 Process Radiation Monitoring (PRM)

For the PRM system, two separate work packages will be developed:

1. Main Steamline Logarithmic Radiation Monitoring (LRM MS)
2. Reactor Building Ventilation Radiation Monitoring (RBVRM)

6.1.6.1 Logarithmic Radiation Monitoring (LRM MS)

6.1.6.1.1 Planning Phase

No documentation will be produced for the LRM MS sub-system in the Planning Phase.

6.1.6.1.2 Design Definition Phase

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6.1.6.1.3 Software Design Phase

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6.1.6.1.4 Software Coding Phase

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6.1.6.1.5 Integration Test Phase

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6.1.6.1.6 Validation Test Phase

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6.1.6.2 Reactor Building Ventilation Radiation Monitoring (RBVRM)

6.1.6.2.1 Planning Phase

No documentation will be produced for the RBVRM sub-system in the Planning Phase.

6.1.6.2.2 Design Definition Phase

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6.1.6.2.3 Software Design Phase

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6.1.6.2.4 Software Coding Phase

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6.1.6.2.5 Integration Test Phase

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6.1.6.2.6 Validation Test Phase

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6.1.7 Containment Monitoring System (CMS)

For the CMS system, one work package will be developed:

1. Containment Area monitoring System (CAMS) Logarithmic Radiation Monitoring (LRM CAMS)

6.1.7.1 Logarithmic Radiation Monitoring (LRM CAMS)

6.1.7.1.1 Planning Phase

No documentation will be produced for the LRM CAMS sub-system in the Planning Phase.

6.1.7.1.2 Design Definition Phase

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6.1.7.1.3 Software Design Phase

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6.1.7.1.4 Software Coding Phase

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6.1.7.1.5 Integration Test Phase

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6.1.7.1.6 Validation Test Phase

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6.1.8 Diverse Protection System (DPS)

6.1.8.1 Planning

No documentation will be produced for the Diverse Protection System (DPS) in the Planning Phase.

6.1.8.2 Design Definition

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6.1.8.3 Software Design

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6.1.8.4 Software Coding

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6.1.8.5 Integration Test

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6.1.8.6 Validation Test

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6.1.9 Standby Liquid Control System (SLC)

6.1.9.1 Planning

No documentation will be produced for the SLC system in the Planning Phase.

6.1.9.2 Design Definition

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6.1.9.3 Software Design

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6.1.9.4 Software Coding

The following documentation will be produced for the SLC system in the Software Coding Phase.

1. SLC Source Code
2. SLC Software Module Test Report
3. Additional Software Reports (as required)⁵
4. SLC Software Safety Analysis Code Evaluation Report
5. SLC Software Coding Baseline Review Record

6.1.9.5 Integration Test

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6.1.9.6 Validation Test

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6.2 Dependencies

Work packages are to be developed in the phases specified in Section 6.1 and per Figure 3 of the SMP [2.1.1(3)].

All dependencies to interfacing organizations are defined in the Integrated Project Schedule per ESBWR Project Procedure [2.1.1(6)]. Dependencies between work elements are defined and tracked using the scheduling methods defined in ESBWR Project Procedure [2.1.1(6)] and the PMM [2.1.1(1)].

6.3 Resource Requirements

The SMP [2.1.1(3)] specifies the organizational responsibilities for each member of the project team serving in a lead capacity.

Table 2A in the M-MIS Review Implementation Plan [2.1.2(7)] defines the acceptance criteria for the skill levels for the engineering disciplines required for the design team (see Section 4.5).

Start times, duration of need, and manpower loading needs across time are defined using the Project Schedule and Project Cost Reporting processes specified in the PMM [2.1.1(1)].

6.4 Budget and Resource Allocation

Project scheduling and budgeting processes are specified in the PMM [2.1.1(1)]

Endnotes

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- ⁱ The NMS HSS provides the requirements for the APRM, SRNM, AFIP and MRBM sub-systems, hence this document appears in multiple places in this work package summary.
 - ⁱⁱ A single NMS SBD covers the APRM and SRNM subsystems. Hence this document appears in multiple places in this work package summary.
 - ⁱⁱⁱ The production of the document may be deferred to a later development phase in accordance with the direction given in the Software Management Plan.
 - ^{iv} Additional software reports may or may not be produced at this lifecycle phase. The baseline Review Report will identify the complete software documentation package produced, including any additional software reports.
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- ^v The SSLC RTIF HSS provides the requirements for the RTIF: CIM, DTM, TLU, RMU, and ATWS subsystems, hence this document appears in multiple places in this work package summary.
 - ^{vi} A single SSLC RTIF SBD covers the CIM, DTM, RMU and TLU subsystems. Hence this document appears in multiple places in this work package summary.
 - ^{vii} This communication specification is common to the CIM, DTM, RMU and TLU subsystems, hence this document appears multiple places in the work package summary.
 - ^{viii} A single SSLC RTIF User's Manual covers the CIM, DTM, TLU and RMU subsystems. Hence this document appears in multiple places in this work package summary.
 - ^{ix} The ATWS and the SLC subsystems are combined into one SBD, hence this document appears in multiple places in this work package summary.
 - ^x The RCIS HSS provides requirements for the RWM, ATLM and RAPI Interface Unit subsystems, hence this document appears in multiple places in this work package summary.
 - ^{xi} The Process Radiation Monitoring system HSS provides requirements for the LRM MS and the RBVRM subsystems, hence this document appears in multiple places in this work package summary.
 - ^{xii} This document is common between the LRM MS and the LRM CAMS designs, hence it appears in multiple places in this work package summary.
 - ^{xiii} The CMS HSS provides requirements for the LRM CAMS subsystems.
 - ¹⁵ These communications specifications are common to the APRM and SRNM subsystems, hence these documents appear in multiple places in this work package summary.
 - ¹⁶ This document has been deleted from the Project Plan because it is not necessary for supporting the Essential Controls design.
 - ¹⁷ This document is common between the LRM MS and the RBVRM subsystems, hence it appears in multiple places in this work package summary.

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¹⁹ Deleted

²⁰ This document has been deleted because this instrument is not a software-based product.

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²² There is no user interface associated with the software in this instrument.

²³ There is no internal communication associated with this instrument.