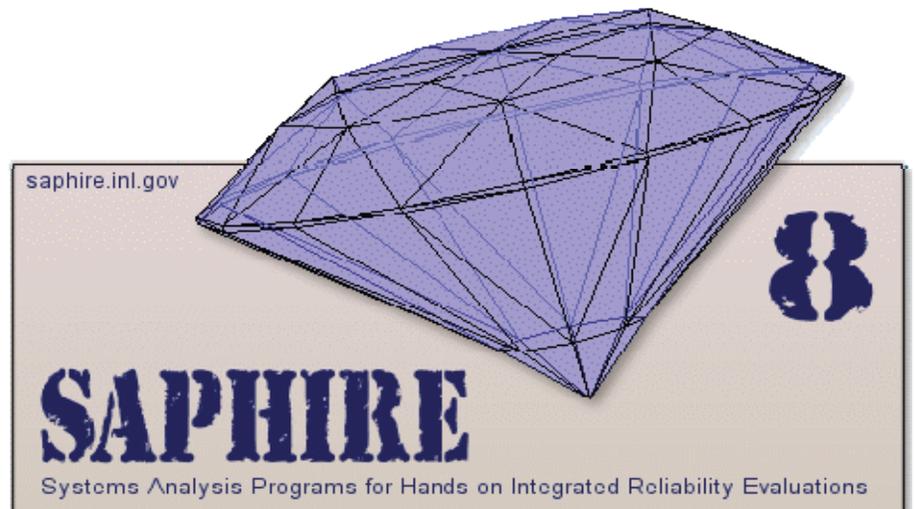


# Independent Verification and Validation of SAPHIRE 8 Software Project Plan

December 2009



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# **Independent Verification and Validation of SAPHIRE 8 Software Project Plan**

**December 2009**

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**<http://www.inl.gov>**

**Prepared for the  
U. S. Nuclear Regulatory Commission  
Washington, DC 20555  
Project No. N6423**

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## 1.0 Executive Summary

The purpose of the Independent Verification and Validation (IV&V) role in the evaluation of the SAPHIRE Project Plan is to assess the activities and practices that will be incorporated in the development of the software. The IV&V team began this endeavor after the software engineering and software development of SAPHIRE after it had already been in production. As such, IV&V reviewed the plan to evaluate the development team's methods to integrate the project management, quality assurance practices, and development methodology against the requirements specified in NUREG/BR-0167 as well as IEEE-1012-98.

The requirements for development of the plan were extracted primarily from the NUREG but also included an examination of best software engineering methods provided in the IEEE standard. IV&V developed a checklist that mapped these requirements with these standards which was used in the evaluation. The evaluation criteria and the results of the assessment are identified in Section 4 of this document.

Overall, the evaluation indicated that the SAPHIRE Project Plan met the majority of the criteria. Of those that failed to meet the criteria, they are minor and can be corrected easily. IV&V identified some major concerns as well as some exemplary practices. IV&V identified some major concerns, including the lack of peer reviews and their placement into Configuration Control, and an inadequate trace of requirements, thus putting the necessary quality of the end product into question.

Traceability of requirements is the greatest of these concerns. Requirements traceability is essential to all software development activities. Without a well documented Requirements Traceability Matrix (RTM), design components may be overlooked, and test cases missed.

For IV&V to properly evaluate the RTM to assess the mapping of the test cases to design components and to requirements as documented in SAPHIRE's Software Verification and Validation Plan (SVVP), IV&V had to obtain requirements from the Statement of Work documents (Form 189s, etc.) and develop the RTM. This action could place IV&V's "independence" role into question. IV&V is still in the process of the RTM "development" and the intent of IV&V in developing the RTM is strictly for use in evaluation and not intended for use by the development team. However, the RTM will be included as documentary evidence in the IV&V report provided to the sponsor and the INL Project Manager.

Per the requirements and document outline provided in the SAPHIRE IV&V Plan, this report and all subsequent reports will be included as attachments and/or background evidence of the evaluation as well as the results of the assessment.

## 2.0 Background Information

NUREG/BR-0167, Software Quality Assurance Program and Guidelines, requires the development of a Software Project Plan that details the process for managing the software project and to ensure that the project manager incorporates the sponsor's contractual agreements. The Software Project Plan activities that must be performed include Project Planning and Organization as well as Project Tracking and Oversight.

This report provides an evaluation of the Software Project Plan. The Software Project Plan is intended to provide the high-level direction that documents the required software activities to meet the contractual commitments prepared by the sponsor; the Nuclear Regulatory Commission.

Independent Verification and Validation (IV&V) evaluates and assesses the processes and products developed during each phase of the Software Development Life Cycle (SDLC). The SAPHIRE 8 development team is implementing a "spiral" rapid application approach to the product development. One of the roles that IV&V performs, regardless of the development methodology, is to analyze products developed throughout the development process. The intent is to provide a level of confidence to the sponsor that the quality of the software product and supporting documentation is built into the software, not tested in. Evaluating the supporting documentation for each product is one aspect of providing this level of confidence.

IV&V supports and is complementary to the Quality Assurance, Project Management, and product development activities. To achieve this support, IV&V must also evaluate the processes identified in the documentation to ensure that the development team is implementing the processes and methodology that ensures a high-level software product.

Due to the spiral approach implemented for the software development, it is expected that the Software Project Plan will evolve as the SAPHIRE 8 product matures. Therefore, IV&V will evaluate each iteration of the Software Project Plan.

To provide direction in the evaluation process, IV&V has developed a checklist to support the requirements for the SDLC. The Software Project Plan requirements used for the analysis of the Software Project Plan is contained in a checklist that is included in the SAPHIRE 8 Software Independent Verification and Validation Plan (INL/EXT-09-15649, Revision ID: 0, Effective Date: April 1, 2009). The evaluation criteria for the Project Planning and Project Tracking Oversight have been extracted from the checklist contained in the "IV&V Plan" and included in Section 4 of this report. A summary of the findings is provided in Section 3.

### 3.0 Summary of Findings

The checklist containing the criteria for the requirements of the Software Project Plan as well as the Project Tracking and Oversight was extracted from the SAPHIRE IV&V Plan for use in evaluating the SOFTWARE PROJECT PLAN for SAPHIRE Version 8 N6423, INL/EXT-09-15853. There were thirty-eight criteria identified for the assessment. Although IV&V failed four of the criteria (11%), many of these failures can be corrected easily as they are minor. One criterion (#31) could not be assessed as there was insufficient information to assess the criteria at this time.

The following provides the corrections needed for the failed criteria in the checklist supplied in section 4.

1. Criteria 5. The Software Project Plan as of this review has not been approved by the NRC sponsor.
2. Criteria 22. IV&V could not determine if milestones for life-cycle reviews exist in the schedules contained within the Software Project Plan.
3. Criteria 32. Without peer reviews and especially code walkthroughs to assist in determining if the use of the coding standards is implemented appropriately, IV&V must fail this criterion.
4. Criteria 33. Code inspections via code walkthroughs and peer reviews are not occurring per NRC Sponsor request/requirement. Presentation materials and minutes from these formal reviews are required by the NUREG.

The following provides minor corrections for the Software Project Plan.

1. The Revision ID as specified on the cover page is REV 2. Please correct the revision in the headers throughout the document to reflect the Revision ID on the cover page.
2. Please supply a List of Tables along with a list of the Appendixes in the Table of Contents.
3. Section 1.1 Project Background and Objectives paragraph 1 uses the acronym “INL” for the first time. IV&V suggests providing the definition in front of the acronym and then enclosing the acronym in parentheses (INL).
4. Section 1.1 Project Background and Objectives paragraph 5 uses the acronym “SPAR” for the first time. IV&V suggests providing the definition in front of the acronym and then enclosing the acronym in parentheses (SPAR).
5. Section 1.2 Project Scope and Organization paragraph 6 refers to “10 CFR 830 Subpart A, Nuclear Safety Management”, 10 CFR 830 Subpart A is “Quality Assurance Requirements”.
6. Section 1.2 Project Scope and Organization paragraph 8 starts “Per LWP-13610”. I believe this should be “PDD-13610”.
7. Section 1.2 Project Scope and Organization paragraph 19 uses the acronym “RES” for the first time. IV&V suggests providing the definition in front of the acronym and then enclosing the acronym in parentheses (RES).

8. Section 2.1 Planning Approach first paragraph uses the acronym “OCOI” for the first time. IV&V suggests providing the definition in front of the acronym and then enclosing the acronym in parentheses (OCOI).
9. Section 2.1 Planning Approach, and various other sections, uses the acronyms “PCFS” and “PFCS”. IV&V suggests clarification on the acronym and providing the definition in front of the first occurrence of the acronym and then enclosing the acronym in parentheses.
10. Section 2.2 Risk Management uses the acronym “RCS” for the first time. IV&V suggests providing the definition in front of the acronym and then enclosing the acronym in parentheses (RCS).
11. Section 2.7 Configuration Management paragraph 8, the sentence “Prior to check-in, programmers must explain...” IV&V suggest changing “explain” to “document” to be consistent with the sentence in paragraph 5 “Prior to check-in, programmers must document...”
12. Section 3.4 heading has a typo. I believe “Walkthroughs” should be “Walkthroughs”.
13. Section 3.4 paragraph 1. I believe “conconformances” should be “nonconformances”.
14. Section 3.5 Quality Assessment (QA) and Improvement Approach paragraph 4, the sentence “Prior to check-in, programmers must explain...” IV&V suggest changing “explain” to “document” to be consistent with the sentences in section 2.7 Configuration Management “Prior to check-in, programmers must document...”
15. Section 3.5 Quality Assessment (QA) and Improvement Approach last paragraph uses the acronym “TV&V” for the first time. IV&V suggests providing the definition in front of the acronym and then enclosing the acronym in parentheses (TV&V).
16. Section 3.5 Quality Assessment (QA) and Improvement Approach last paragraph contains “(reference the IV&V plan document)”, the IV&V plan is “SAPHIRE 8 Software Independent Verification and Validation Plan Document ID: INL/EXT-09-15649”.
17. Section 3.7 Deliverables, the sentence “Software releases are managed via the SAPHIRE Release Management process for stored in the RCS.” Question, should the word “software” be inserted between “for” and “stored”?
18. Appendix A, Overview of SAPHIRE 8 second paragraph uses the acronym “LERF” for the first time. IV&V suggests providing the definition in front of the acronym and then enclosing the acronym in parentheses (LERF).
19. Appendix A, SAPHIRE Version 8 Development Background has a type. I believe “SAPIRE” should be “SAPHIRE”.
20. Appendix A, Detailed Task/Subtask Breakdown Last paragraph uses the acronym “ACRS” for the first time. IV&V suggests providing the definition in front of the acronym and then enclosing the acronym in parentheses (ACRS).

## 4.0 IV&V Evaluation Checklists

### 4.1 Software Project Plan

<b>SOFTWARE PROJECT PLAN</b>		
<b>Criteria #1</b>	<b>Has the developer created a Software Project Plan? NUREG/BR-0167 Section 4.2 and 5.2.4</b>	
Pass	X	Comments
Fail		The Software Project Plan has been developed and details how the developer will manage the SAPHIRE 8 software project. The Software Project Plan is assigned Document ID: INL/EXT-09-15853. The Software Project Plan includes the table of contents suggested by NUREG/BR-0167. Once all approvals have been made, then an effective date can be assigned with a date AFTER the last signature date on the signature page.
N/A		
<b>Criteria #2</b>	<b>Does the Project Plan provide project background and objectives? NUREG/BR-0167 Section 5.2.4</b>	
Pass	X	Comments
Fail		Section 1.1 of the Software Project Plan provides the Project Background and Objectives for SAPHIRE 8. The plan provides an excellent background and includes objectives for the forthcoming version (SAPHIRE 8). IV&V recognizes that development began prior to the issue of the project plan and therefore, accepts activities that have already been completed although this is a plan for what will be done. Minor EDITORIAL comments: Paragraph 1 uses the acronym “INL” for the first time. IV&V suggests providing the definition in front of the acronym and then enclosing the acronym in parentheses (INL). Paragraph 5 uses the acronym “SPAR” for the first time. IV&V suggests providing the definition in front of the acronym and then enclosing the acronym in parentheses (SPAR).
N/A		
<b>Criteria #3</b>	<b>Has the Project Plan address plan scope and organization? NUREG/BR-0167 Section 5.2.4</b>	
Pass	X	Comments
Fail		Section 1.2 of the Software Project Plan provides the Project Scope and Organization for SAPHIRE 8. The author of this section should be commended on the extent of the process for the review implemented regarding DOE O 414.1C, 10 CFR 830 Subpart A, 10 CFR 835, the DEAR Integrated Safety Management System (DEAR clause), NQA-1, and the process used to determine the INL Software Quality Level/Analysis. Minor EDITORIAL comments: Paragraph 6 refers to “10 CFR 830 Subpart A, Nuclear Safety Management”, 10 CFR 830 Subpart A is “Quality Assurance Requirements”. Paragraph 8 starts “Per LWP-13610”. I believe this should be “PDD-13610”. Paragraph 19 uses the acronym “RES” for the first time. IV&V suggests providing the definition in front of the acronym and then enclosing the acronym in parentheses (RES).
N/A		
<b>Criteria #4</b>	<b>Does the Project Plan address plan maintenance (i.e., Project Plan updates)? NUREG/BR-0167 Section 5.2.4</b>	
Pass	X	Comments
Fail		Section 1.3 of the Software Project Plan provides the Plan Maintenance for SAPHIRE 8. This section states “ <i>The SPP will be updated as needed as required by the NRC Project Management</i> ”. Section 5.2.4 The Software Project Plan of NUREG/BR-0167 paragraph 2 states “ <i>Because the plan should be kept up to date, consider requiring the developer to submit any changes to the plan with the monthly progress reports</i> ”. IV&V’s concern is that the NRC Project Management will not be aware of modifications that the INL has found that reflect a need for a change to the plan unless the NRC Project Management obtains an updated copy with the monthly status reports. Please consider adding (or replacing) a statement that indicates that updates will be
N/A		

		provided to the NRC Project Management for approval in the monthly status reports, as needed.
<b>Criteria #5</b>	<b>Has the Project Plan been approved by the NRC sponsor? NUREG/BR-0167 Section 5.2.4</b>	
Pass		Comments
Fail	X	The Software Project Plan Section 2.1 Planning Approach last paragraph states, “ <i>The signed NRC Form 173 authorizes the transfer of funds from the NRC to DOE-ID and serves as the official authorization to commence work...</i> ”. This approves the funding authorization, not the approval of the Project Plan. The Software Project Plan as of this review has not been approved by the NRC sponsor.
N/A		
<b>Criteria #6</b>	<b>Does the Project Plan describe the approach used to plan the project? NUREG/BR-0167 Section 5.2.4.1</b>	
Pass	X	Comments
Fail		Section 2.1 Planning Approach of the Software Project Plan provides the information required by Section 5.2.4.1 of the NUREG. Minor EDITORIAL comments: Section 2.1 Planning Approach first paragraph uses the acronym “OCOI” for the first time. IV&V suggests providing the definition in front of the acronym and then enclosing the acronym in parentheses (OCOI). Section 2.1 Planning Approach, and various other sections, uses the acronyms “PCFS” and “PFCS”. IV&V suggests clarification on the acronym and providing the definition in front of the first occurrence of the acronym and then enclosing the acronym in parentheses.
N/A		
<b>Criteria #7</b>	<b>Does the Project Plan describe the approach used to track technical progress? NUREG/BR-0167 Section 5.2.4.2</b>	
Pass	X	Comments
Fail		Sections 1.2 Project Scope and Organization, 1.5 Security, 2.1 Planning Approach, 2.2 Risk Management, 2.3 Tracking and Oversight Approach, 2.5 Scheduling, 3.1 Implementing the Life cycle Tasks of the Statement of Work and 3.6 Use of Project Metrics of the Software Project Plan provide the information required by Section 5.2.4.2 of the NUREG. Minor EDITORIAL comments: Section 2.2 Risk Management uses the acronym RCS for the first time. IV&V suggests providing the definition in front of the acronym and then enclosing the acronym in parentheses (RCS).
N/A		
<b>Criteria #8</b>	<b>Does the Project Plan describe the approach used to track conformance to the planned schedule? NUREG/BR-0167 Section 5.2.4.2</b>	
Pass	X	Comments
Fail		Sections 1.4 Schedule, 2.1 Planning Approach, 2.3 Tracking and Oversight Approach and 2.5 Scheduling of the Software Project Plan provides the information required by Section 5.2.4.2 of the NUREG.
N/A		
<b>Criteria #9</b>	<b>Does the Project Plan describe the approach used to track costs as related to actual work performed? NUREG/BR-0167 Section 5.2.4.2</b>	
Pass	X	Comments
Fail		Sections 2.1 Planning Approach, 2.3 Tracking and Oversight Approach, 2.6 Resources and 3.6 Use of Project Metrics of the Software Project Plan provides the information required by Section 5.2.4.2 of the NUREG.
N/A		
<b>Criteria #10</b>	<b>Does the Project Plan describe the approach used to track metrics? NUREG/BR-0167 Section 5.2.4.2</b>	
Pass	X	Comments
Fail		Section 3.6 Use of Project Metrics of the Software Project Plan provides the information required by Section 5.2.4.2 of the NUREG.
N/A		
<b>Criteria #11</b>	<b>Does the Project Plan describe the approach used to track security? NUREG/BR-0167 Section 5.2.4.2</b>	
Pass	X	Comments
Fail		Section 1.5 Security of the Software Project Plan provides the information required by Section 5.2.4.2 of the NUREG.
N/A		

<b>Criteria #12</b>	<b>Does the Project Plan describe the approach to track risk? NUREG/BR-0167 Section 5.2.4.2</b>	
Pass	X	Comments
Fail		Section 2.2 Risk Management of the Software Project Plan provides the information required by Section 5.2.4.2 of the NUREG.
N/A		
<b>Criteria #13</b>	<b>Does the Project Plan address the organization, tasks, and responsibilities (i.e., Show how the tasks in the SOW are assigned to responsible elements of the project organization?) NUREG/BR-0167 Section 5.2.4.3</b>	
Pass	X	Comments
Fail		Section 2.4 Organization, Tasks, and Responsibilities of the Software Project Plan provides a discussion of the Organization, Tasks, and Responsibilities. There is a discussion indicating that the PI “makes all technical and administrative work assignments”. It is assumed that the PI makes these assignments based upon the requirements in the SOW and Requirements Specification. Therefore, IV&V will Pass this requirement at this time. Code walkthroughs and Peer Reviews would assist in making this determination apparent but IV&V has not identified evidence that these requirements/reviews have been performed (they are not under Configuration Control). IV&V has been directed to attend these reviews but it does not appear that these reviews are being performed.
N/A		
<b>Criteria #14</b>	<b>Does the Project Plan provide the initial, top-level project schedule and the rationale for arriving at this schedule? NUREG/BR-0167 Section 5.2.4.4</b>	
Pass	X	Comments
Fail		A high level schedule is provided in Section 2.5 Scheduling of the Software Project Plan. It provides the schedule for the Beta release dates and final version release date.
N/A		
<b>Criteria #15</b>	<b>Does the Project Plan identify project resources including staffing, software engineering environment, and support tools? NUREG/BR-0167 Section 5.2.4.5</b>	
Pass	X	Comments
Fail		Section 2.6 Resources of the Software Project Plan provides an excellent breakout of the various project resources; including processes for status reporting of funding, Estimate at Completion, responsibilities of higher level management, software engineering requirements for staff and PIs, overall staffing levels and team resumes. It also includes the process for obtaining subcontractors, if needed.
N/A		
<b>Criteria #16</b>	<b>Does the Project Plan address Configuration Management, specifically, project baselines, change control, baseline status, proposed changes, implemented changes, software development library, and documentation and code? Has the Change Control Process/Procedure been identified? NUREG/BR-0167 Section 5.2.4.6 – Software Best Practices</b>	
Pass	X	Comments
Fail		Section 2.7 Configuration Management of the Software Project Plan provides the information required by Section 5.2.4.6 of the NUREG. Configuration Management and Change Control processes are described in detail in Section 2.7 of the plan. Minor EDITORIAL comment: Paragraph 8, the sentence “Prior to check-in, programmers must explain...”. IV&V suggest changing “explain” to “document” to be consistent with the sentence in paragraph 5 “Prior to check-in, programmers must document...”.
N/A		
<b>Criteria #17</b>	<b>Does the Project Plan describe how each major life-cycle task of the SOW work will be implemented? NUREG/BR-0167 Section 5.2.4</b>	
Pass	X	Comments
Fail		Sections 3.1 Implementing the Life Cycle Tasks of the Statement of Work, 3.2 Verification and Validation Approach and Appendix A SAPHIRE 8 Work Development Plan provides the information required by Section 5.2.4 of the NUREG. Section 3.1 of the plan states, “an extensive discussion of the Software Requirement[s] have been specified in the ... SVVP document” which was developed by SQA prior to IV&V
N/A		

		involvement. Section 3.2 of the project plan also discusses the SVVP and how it will ensure that ALL requirements are implemented and that it is a consolidated document used for tracking software development, testing, and implementation. The Project Plan does a good job in identifying how the SVVP should be used. The SAPHIRE team has developed an internal Work Development Plan and is provided in Appendix A of the Project Plan. The Work Development provides an excellent description of the tasks and subtask breakdown, and an estimated level-of-effort.
<b>Criteria #18</b>	<b>Does the Project Plan describe the nonconformance reporting and corrective action process, including nonconformance detection and reporting, impact assessment and corrective action and tracking, and tracking and management reports? NUREG/BR-0167 Section 5.2.4</b>	
Pass	X	Comments
Fail		Section 3.3 Nonconformance Reporting and Corrective Action of the Software Project Plan provide the information required by Section 5.2.4 of the NUREG.
N/A		
<b>Criteria #19</b>	<b>Does the Project Plan identify all deliverables and the dates they are due? NUREG/BR-0167 Section 5.2.4</b>	
Pass	X	Comments
Fail		The NUREG states “Provide the initial, top-level project schedule and the rationale for arriving at this schedule”. Per section 1.4 Schedule of the plan, it is stated that each JCN has its own start and end dates on Form 189 and Form 173. No rationale is provided but it is assumed that the rationale is contained in these NRC forms. However, Appendix A, the SAPHIRE 8 Work Development Plan dated almost 2 years ago has 6 subtasks that are described as well as a schedule, level of effort, etc. that has preliminary dates for beta releases. As this is a plan, there is no issue with these dates as they are expected to change as work progresses and updates to the Project Plan are made.
N/A		
<b>Criteria #20</b>	<b>Does the Project Plan address standards, procedures, conventions and metrics to be used? This includes product standards, such as documentation standards and coding standards and process standards, including inspection and review procedures. NUREG/BR-0167 Section 5.2.4 – Software Best Practices</b>	
Pass	X	Comments
Fail		Section 1.2 Project Scope and Organization references: NRC Directive 11.7 NRC Procedures for Placement and Monitoring of Work with the Department of Energy. NRC Directive 11.7 establishes a controlled and monitored process for requesting services of a national lab, work planning, work authorization and initiation, work progress monitoring, reporting, work termination and project closeout; DOE Order 414.1C Quality Assurance, 10 CFR 830 Subpart A Quality Assurance Requirements, ASME NQA-1-200 Quality Assurance Requirements for Nuclear Facility Applications, PDD-13610 Software Quality Assurance Program, LRD-13600 Software Quality Assurance, LWP-13620 Software Quality Assurance for software quality assurance requirements; LWP-4001 Material Acquisitions, LWP-4002 Service Acquisitions, LWP-13014 Determining Quality Levels, LWP-1202 Records Management Plan; NUREG/BR-0167 Software Quality Assurance Program and Guidance. Section 1. Introduction also addresses Plan Maintenance, Schedule and Security. Section 2. Management Approach addresses standards, procedures, and conventions for the Planning Approach, Risk Management, Tracking and Oversight Approach, Organization, Tasks, and Responsibilities, Scheduling, Resources and Configuration Management. Section 3. Technical Approach addresses standards, procedures, and conventions for Implementing the Life Cycle Tasks of the Statement of Work, Verification and Validation Approach, Nonconformance Reporting and Corrective Action, Peer Reviews and Code Walkthroughs, Quality Assessment (QA) and Improvement Approach, Use of Project Metrics and Deliverables. Section 1.5 Security specifies the INL agrees to safeguard information in accordance with 10 Code of Federal Regulations (CFR) 2.790. Section 2.1 Planning Approach specifies overall Project Control and Reporting for NRC
N/A		

		<p>work is governed by NRC Directive 11.7. The Program Manager will assure that the NRC Customer Relationship Manager is sufficiently informed of the proposed work to meet the requirements of the NRC OCOI Mitigation Plan.</p> <p>Section 2.2 Risk Management specifies prior to starting the SAPHIRE 8 development project, and INL Proposal Risk and Evaluation Preparation System (PREPS) entry was created.</p> <p>Section 2.3 Tracking and Oversight Approach specifies work scope management is maintained through NRC Directive 11.7 process.</p> <p>Section 2.4 Organization, Tasks, and Responsibilities specifies the graded approach integrates the INL software management processes, standard, and procedures.</p> <p>Section 2.5 Scheduling specifies schedules for development work to be performed are documented in the project NRC Form 189.</p> <p>Section 2.6 Resources specifies all NRC work is under the supervision and direction of the Nuclear Safety and Regulation Division Director who serves as the NRC Customer Relationship Manager. This section also specifies developers of the SAPHIRE team need to be familiar with DELPHI © Version 7 IDE, Modula-2 IDE, DOS batch files and scripting, and use of the Microsoft Windows platforms.</p> <p>Section 2.7 Configuration Management specifies Records Management will be performed for all NRC projects in accordance with LWP-1201 (Document Management), LWP-1202 (Records Management), and the Records Management Plan for Nuclear Programs, PLN-2224. This section also specifies that each formal release of SAPHIRE will have passed an acceptance test described in the Software Acceptance Test Plan (INL/EXT-09-16236).</p> <p>Section 3. Technical Approach addresses Implementing the Life Cycle Tasks of the Statement of Work, Verification and Validation Approach, Nonconformance Reporting and Corrective Action, Peer Reviews and Code Walkthroughs, Quality Assessment (QA) and Improvement Approach, Use of Project Metrics and Deliverables.</p> <p>Section 3.1 Implementing the Life Cycle Tasks of the Statement of Work specifies to assist in managing the technical work, a SAPHIRE specific Work Development Plan has been developed that guides the general aspect of the work. The most current version of the plan is included in Appendix A of the Software Project Plan. This section also specifies that Technical documentation to be published as a NUREG/CR follows guidance in NUREG-0650, Revision 2, Preparing NUREG Series Publications.</p> <p>Section 3.2 Verification and Validation Approach specifies the SAPHIRE product development team uses the SVVP to track, verify and validate requirements to ensure that all requirements are implemented and that all requirements are included in the automated test scripts and test results.</p> <p>Section 3.3 Nonconformance Reporting and Corrective Action specifies project-level nonconformance and associated corrective actions will be reported to the NRC via the MLSR.</p> <p>Section 3.4 Peer Reviews and Code Walkthroughs specifies the team will perform and document, as appropriate, periodic peer reviews and code walkthroughs, including reviews of preliminary and critical designs proposals. This section also specifies the guidance for external peer reviews is found in the NRC's office instruction, PRM-10, Revision 0, Peer Review of RES Projects, dated March 19, 2007.</p> <p>Section 3.5 Quality Assessment (QA) and Improvement Approach specifies each JCN will have a quality level determination made by a Quality Level Analyst in accordance with LWP-13014 and documented on INL Form 414.A89.</p> <p>Section 3.7 Deliverables specifies software releases are managed via the SAPHIRE Release Management process. Section 3.7 also specifies project closure will be accomplished in accordance with NRC Directive 11.7.</p>
<b>Criteria #21</b>		<b>Does the Software Project Plan provide information on tracking and oversight? NUREG/BR-0167 Figure 5-1</b>
Pass	X	Comments
Fail		Section 2.3 Tracking and Oversight Approach of the Software Project Plan provide the information required by NUREG.
N/A		

<b>Criteria #22</b>	<b>Does the schedule include milestones for life-cycle reviews, such as requirements reviews, preliminary design reviews, and critical design reviews for IV&amp;V review? NUREG/BR-0167 Section 3.</b>	
Pass		Comments
Fail	X	Section 3.4 Peer Reviews and Code Walkthroughs states “As part of the SAPHIRE 8 development, the team will perform and document, as appropriate, periodic peer reviews and code walkthroughs, including reviews of preliminary and critical designs proposals.”, and “Peer reviews and code walkthroughs will be reviewed independently when possible by IV&V members. The guidance for external peer reviews is found in the NRC’s office instruction, PRM-10, Revision 0, Peer Review of RES Projects, dated March 19, 2007.” Appendix A, Quality Assurance Recommendations of the Software Project Plan b) discuss products associated with each formal review, c) V&V activities to be performed by a functionally independent V&V person and the time frame for performing independent V&V activities. Table 3-2 of NUREG/BR-0167 summarizes the formal major life cycle reviews and audits by major life-cycle activities. IV&V could not determine if milestones for life-cycle reviews exist in the schedules contained within the Software Project Plan.
N/A		
<b>Criteria #23</b>	<b>Does the Software Project Plan map the tasks in the SOW to elements in the WBS? Has the WBS been developed and under CM control? NUREG/BR-0167 Section 1.4, Section 5.2, Software Best Practices</b>	
Pass	X	Comments
Fail		Section 2.1 Planning Approach addresses the Statement of Work (SOW) which “provides all the pertinent information required for the PI to prepare an NRC Form 189 proposal: Project Title, JCN, Budget and Reporting number, NRC issuing office, NRC Project Manager’s name and contact information, NRC Technical Monitor’s name and contact information, project background, project objectives, scope of work, deliverables and schedules, period of performance, reporting requirements, and so on.” Section 2.5 Scheduling addresses the Work Breakdown Structure (WBS) which provides the budgetary control for the schedule. Supporting the WBS is a budget Basis of Estimate document that reflects the level of effort specified in the NRC Form 189 for the project. Appendix A Work Development plan in the Software Project Plan contains the Detailed Task/SubTask Breakdown. This includes information related to technical activities for the tasks and subtasks to finish the beta and general-released version of SAPHIRE 8.
N/A		
<b>Criteria #24</b>	<b>Does the Software Project Plan provide a project schedule, such as a GANTT chart, and rationale for tasks identified in the project schedule? NUREG/BR-0167 Figure 5-1</b>	
Pass	X	Comments
Fail		Appendix A SAPHIRE 8 Work Development Plan contains a high level schedule.
N/A		
<b>Criteria #25</b>	<b>Does the Software Project Plan identify resources needed (equipment, personnel, tools)? NUREG/BR-0167 Section 2.5</b>	
Pass	X	Comments
Fail		Section 2.6 Resources provides information on funding, management direction, staffing levels and staff requirements needed to be part of the development team, and developer requirements/qualifications. Section 3.7 Deliverables discusses project closeout and the identification (and return) of remaining fund and NRC owned equipment.
N/A		
<b>Criteria #26</b>	<b>Does the Software Project Plan describe nonconformance reporting and corrective action processes (nonconformance detection and reporting)? NUREG/BR-0167 Figure 5-1 and Section 3 of the PMP</b>	
Pass	X	Comments
Fail		Section 3.3 Nonconformance Reporting and Corrective Action of the Software Project Plan provide the information required by the NUREG
N/A		
<b>Criteria #27</b>	<b>Is an impact assessment performed on nonconformance items and corrective actions identified? NUREG/BR-0167 Section 7</b>	

Pass	X	Comments
Fail		Section 3.3 Nonconformance Reporting and Corrective Action of the Software Project Plan provide the information required by the NUREG.
N/A		
<b>Criteria #28</b>	<b>How are nonconformance items, their related reports, and corrective actions tracked (e.g., DBMS, Excel Spreadsheet, Configuration Management, etc.)? NUREG/BR-0167 Section 7</b>	
Pass	X	Comments
Fail		Section 3.3 Nonconformance Reporting and Corrective Action specify “ <i>Testing- and QA-related nonconformances are reported through the SVVP and the Change Request tracking systems.</i> ”
N/A		
<b>Criteria #29</b>	<b>Is the quality assessment approach and improvement approach been described? NUREG/BR-0167 Section 5.2, Section 8</b>	
Pass	X	Comments
Fail		This is described in Section 3.5 of the plan. The section provides an excellent discussion on how the developers, etc. will implement a quality approach and process improvement strategy. This is implicitly stated as being in a forthcoming QA Plan. A good discussion on bug fixes is also discussed where the developer obtains information regarding the severity of the bug and actions taken for bug correction/workaround/future release. However, further discussion on bug reporting should be implemented. Bugs should be part of the anomaly reporting process, which includes recording the bug on an anomaly report/form (template), to “document” information and the actions taken for the bug “correction”. Each form should be placed under configuration control. Metrics regarding these bug corrections (such as a trending report or a Pareto diagram) should be implemented to determine areas of the code, etc. where issues continually appear. For example, if bugs are found and corrected continually in one or two modules/objects, there is an indication that a module(s) is very complex and should be modified and tested to avoid the category of bug reoccurring.
N/A		
<b>Criteria #30</b>	<b>Are deliverables and dates due identified? (Also in the project schedule)? NUREG/BR-0167 Section 1.2 and Table 8.1</b>	
Pass	X	Comments
Fail		Section 2.5 Scheduling and 3.7 Deliverables provides the discussion on deliverables (documented in NRC Form 189 and Form 173). The anticipated schedule is also documented in a table at the end of section 2.5.
N/A		
<b>Criteria #31</b>	<b>Are standards used for documentation identified and adhered to? NUREG/BR-0167 Section 5.2.1</b>	
Pass		Comments
Fail		Section 3.1 Implementing the Life Cycle Tasks of the Statement of Work last paragraph specifies “ <i>QA-related documentation for the project should adhere to standards identified in NUREG/BR-0167, Software Quality Assurance Program and Guidelines.</i> ” <i>Technical documentation to be published as a NUREG/CR follows guidance in NUREG-0650, Revision 2, Preparing NUREG-Series Publications.</i> ” As the documents have yet to be developed or updated, IV&V cannot determine at this time if the “adherence” to the standards are correctly implemented. <b>Therefore, IV&amp;V can neither pass nor fail</b> this criterion until provided the developed/updated documents.
N/A		
<b>Criteria #32</b>	<b>Are coding conventions standards identified and adhered to? NUREG/BR-0167 Section 5.2.1</b>	
Pass		Comments
Fail	X	Section 2.6 Resources paragraph 5 specifies “ <i>Developers of the SAPHIRE team need to be familiar with DELPHI © Version 7 IDE, Modula-2 IDE, DOS batch files and scripting, and use of the Microsoft Windows platforms to support the interface upgrade and the functional improvement development and testing effort.</i> ” However, without peer reviews and especially code walkthroughs to assist in determining if the use of the coding standards is implemented appropriately, IV&V must fail this criterion. In addition, the NUREG/BR-0167 Section 5.2.1, Required Inputs to the Contract specifically states that the list of deliverables should contain not only the software end
N/A		

		products but also presentation materials and minutes from formal reviews. It also states that identification of applicable standards must be identified, which include programming language standards, coding standards, and documentation standards.
<b>Criteria #33</b>	<b>Are code and documentation inspections and reviews identified, recorded, and under CM Control?</b> <b>NUREG/BR-0167 Section 3.2.3</b>	
Pass		Comments
Fail	X	Code inspections via code walkthroughs and peer reviews are not occurring per NRC Sponsor request/requirement. Presentation materials and minutes from these formal reviews are required by the NUREG.
N/A		

## 4.2 Project Tracking and Oversight

<b>PROJECT TRACKING AND OVERSIGHT</b>		
<b>Criteria #34</b>	<b>Is monitoring, assessing, and reporting technical progress performed and actual results and performance tracked against the Software Project Plan?</b> NUREG/BR-0167 Section 5.3	
Pass	X	Comments
Fail		Information on monitoring, assessing and reporting performance is discussed in Section 2.3 Tracking and Oversight Approach of the Software Project Plan.
N/A		
<b>Criteria #35</b>	<b>Is monitoring progress performed on an ongoing basis to maintain communications at all levels of the developer and sponsor organizations? Is there a record of this activity (reviews, reports, meetings, brainstorming sessions) and the information placed under configuration control?</b> NUREG/BR-0167 Section 5.3	
Pass	X	Comments
Fail		Section 5.3 Project Tracking and Oversight of the NUREG states “Implementation of planned verification and validation, <b>configuration management</b> , and quality assessment and implementation activities are part of the ordinary tracking and oversight functions”. Configuration Management is not discussed in section 2.3 Tracking and Oversight Approach. However, it is discussed in Section 2.7 Configuration Management.
N/A		
<b>Criteria #36</b>	<b>Are technical progress, costs, critical target computing resources, schedule, and risks tracked quantitatively?</b> NUREG/BR-0167 Section 5.3	
Pass	X	Comments
Fail		Technical progress, costs and schedule variances, etc. are reported in Section 2.3 Tracking and Oversight Approach of the plan. Section 2.6 Resources of the Project Plan states, “Personnel from the INL’s Risk, Reliability, and NRC Programs Department shall be responsible <b>for risk assessment support</b> and for development and maintenance of the SAPHIRE software”.
N/A		
<b>Criteria #37</b>	<b>Does the PM determine and report schedule, cost status of variances from the baseline plan? (Is there a baseline Plan and is it under CM Control?)</b> NUREG/BR-0167 Section 5.3	
Pass	X	Comments
Fail		Baselines are discussed in Section 2.1 Planning Approach and also discussed in Section 2.3 Tracking and Oversight Approach as follows: “The task-oriented schedule and budget for each project is established by the PI in conjunction with the financial controls person. The PI will determine if there is a <b>need to re-baseline</b> the schedule and/or budget”. Baselines are identified in Section 2.4 Organization, Tasks, and Responsibilities as follows: “Configuration Management and Change Control to monitor and uniquely identify baselines, changes that are requested, evaluated, approved, and tested, as well as backup and recovery actions”.
N/A		
<b>Criteria #38</b>	<b>Are corrective actions implemented when actual results and performance issues indicate significant deviations between the Software Project Plan and current schedule, including but not limited to adding staff, extending work week, and or changing the skill mix?</b> NUREG/BR-0167 Section 5.3	
Pass	X	Comments
Fail		This information is found in section 2.3 Tacking and Oversight Approach of the Software Project plan.
N/A		