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Peer Review Process for the Sandia ASCI V&V Program: Version 1.0

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Peer Review Process for the Sandia ASCI V&V Program: Version 1.0

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Abstract

This report describes the initial definition of the Verification and Validation (V&V) Plan Peer Review Process at Sandia National Laboratories. V&V peer review at Sandia is intended to assess the ASCI code team V&V planning process and execution. Our peer review definition is designed to assess the V&V planning process in terms of the content specified by the Sandia Guidelines for V&V plans. Therefore, the peer review process and process for improving the Guidelines are necessarily synchronized, and form parts of a larger quality improvement process supporting the ASCI V&V program at Sandia.

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1 Introduction

1.1 Purpose and Scope

In Fiscal Year 2000, the Sandia ASCI V&V program (hereafter called the Sandia V&V program) began to implement a formal three-level peer review process for the Accelerated Strategic Computing Initiative (ASCI) verification and validation (V&V) program at Sandia. Initial attention was devoted to V&V plans developed in Fiscal Year (FY) 99 for Sandia ASCI computational codes. The purpose of the present document is to define the first version of the characteristics of this peer review process that primarily covers Level 1 and Level 2. Future evolutions of this document will provide more detailed Level 3 process information as well as updates to the refinement of the Level 1 and Level 2.

1.2 Intended Audience

This document describes the process for conducting peer reviews by the Sandia V&V Program. The peer review panel for each review will follow the process steps indicated in this document. Code team personnel can use this document as information as to their role in the peer review process. The V&V Program management can use this document to understand what feedback from the peer review process can be expected.

1.3 Benefits

The peer review process described in this report aims to contribute to the overall quality of the Sandia V&V program through the following results:

1. **Code Team Feedback:** the peer review process provides immediate feedback to individual code projects regarding their V&V plans and progress; the process seeks to insure that scientifically credible V&V plans are produced, tasks are performed, and results are obtained for each ASCI code development project at Sandia.
2. **Metrics:** the peer review process provides metric information regarding the status of code team V&V activities to the Sandia V&V program, as well as other interested stakeholders; peer review results may also be applied to V&V program and individual code team process and product improvement.
3. **Planning Information:** the peer review process provides planning information for the Sandia V&V program; the process is coordinated with ASCI budget planning activities to aid in the development of program and code team implementation plans.
4. **Independent Assessment:** the peer review process is an independent assessment that can provide evidence to Defense Programs (DP) for the use of Sandia ASCI codes in weapon system qualification activities.
5. **Coordination:** the peer review process contributes to coordination between the V&V program and experimental programs at Sandia, as well as DP.

The peer review process is also coordinated with several specific elements of the ASCI V&V program at Sandia. These elements include:

1. Program guidelines for Sandia V&V plans [V&V-GUIDE-1_0] and [V&V GUIDE-2_0];
2. V&V plans developed by individual ASCI code projects, e.g., [V&V-SACCARA];
3. Sandia V&V program V&V software quality engineering infrastructure and policy developed in FY00 [V&V-PRACTICES]; and
4. ASCI implementation planning process traditionally beginning in April and completing by the end of August of any given year.

1.4 Overview of Document

Section 1 provides an introduction to the scope and purpose of this document.

Section 2 is an overview of the peer review process.

Section 3 provides a detailed description of the peer review process for each of the three levels. The basic process steps are similar for all three levels and include training, preparation, review, and follow-up. Specific review activities, allocated time, and report information is described for each of the three levels. Responsibilities of the review panel and the code team are described along with example report content and format.

Section 4 summarizes the status of the peer review process and its intended future evolution. This document provides primarily Level 1 and 2 process information with only partial information on Level 3. It is intended that this document will evolve through a prototype Level 3 process review.

Appendix A is a description of specific conformance criteria that are required during a Level 1 peer review process. These criteria include performance self-assessment information that is requested from each code team and V&V Plan content criteria that are extracted from and mapped to the reference [V&V-GUIDE-2_0]. Lessons learned and comments from the prototype Level 1 peer review are included in this appendix.

Appendix B includes the slides from the Level 1 peer review training.

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2 Overview of the Peer Review Process

This section provides a brief overview of the peer review process evolution, its relationship to the Sandia Guidelines for V&V plans, and the three-levels of the peer review process. A detailed description of the three-levels of the peer review process is presented in Section 3.

2.1 Peer Review Process Evolution

It is helpful to distinguish the purpose of the ASCI applications program from that of the ASCI V&V program to best understand the goals in designing V&V guidelines and a peer review process.

ASCI Applications Program Purpose: To develop high performance computational tools and models to help manage the safety and reliability of the enduring nuclear stockpile.

ASCI V&V Program Purpose: To substantially increase the credible predictive content of high consequence modeling and simulation for science based stockpile stewardship.

The Sandia V&V program mission is to establish high confidence in the use of our ASCI modeling and simulation tools by:

1. advocating the use of modern software engineering practices;
2. facilitating code verification; and
3. establishing a formal validation program.

The Sandia ASCI program includes several code teams that develop a variety of computational codes to simulate physical phenomena and their interactions. Each code team may have one or more codes that they support. The approach is for each code to have a V&V Plan that describes the activities necessary to ensure the code can be used for its intended purpose. For the ASCI Program, the intended purpose is to support the Stockpile Stewardship Program for continued certification of existing weapons and planned upgrades.

The Sandia V&V program has developed a "Sandia Guidelines for V&V plans" to provide overall guidance to code teams as to the expected content, activities, and evidence to be covered in their V&V plans. To assess progress on V&V plans, a three-level peer review process has been defined. A key goal of the peer review process is to assess conformance of V&V plans and technical results to the published Guideline requirements.

The first form of these guidelines, [V&V-GUIDE-1_0], was published as a Sandia report in December, 1999. The version of the peer review process discussed in this document is primarily based upon the content of these guidelines, the lessons learned from the FY00 V&V peer review prototype based on these guidelines, and the subsequent version of these guidelines, [V&V-GUIDE-2_0]. It is the intent that the peer review process description in this document will also evolve as lessons learned from prototype use.

A conceptual diagram of the content guidelines development and relationship to the three-level peer review, as shown in Figure 2-1, emphasizes some of the environmental factors that influence the implementation of the planning and peer review cycle:

1. Factors internal to the V&V program, such as changing requirements and a developing infrastructure for software quality engineering (SQE) and V&V.
2. The evolution of code specific V&V activities as work progresses over the duration of the program.
3. External program influences, most specifically the MAVEN experimental program and DP stockpile programs.

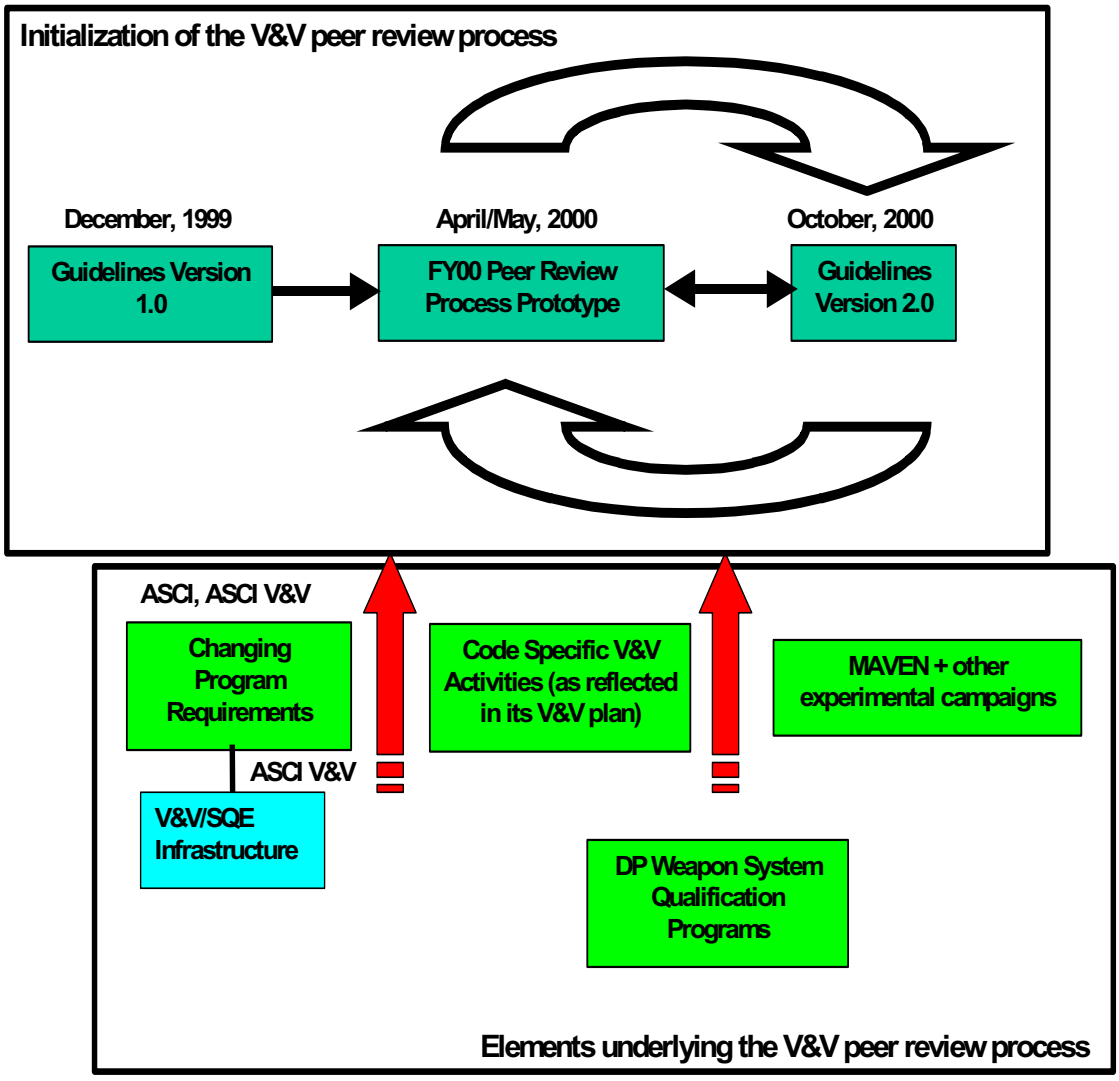

Figure 2-1. Conceptual Evolution of the V&V Peer Review Process

2.2 Peer Review Levels

The ASCI V&V program at Sandia is implementing a progressive three-level peer review process as illustrated in Figure 2-2. The levels are designed to reflect increasing depth of peer review for the V&V program at Sandia. All three of the levels are required to track the progress of the V&V program at Sandia. The levels are staged in time to reflect a promotional model of peer review. Codes, represented by their V&V teams, are expected to undergo a Level 1 review before a Level 2 review, and a Level 2 review prior to a Level 3 review. Generally, the first level – ***Level 1*** - emphasizes a programmatic review. The second level – ***Level 2*** – emphasizes technical assessment of the content and implementation of the V&V program for selected ASCI codes. The third level – ***Level 3*** – emphasizes technical assessment of the performance of the V&V program for selected ASCI codes. This latter review level should be viewed as an essential component in a certification strategy for application of Sandia ASCI codes to stockpile problems. Therefore, DP at Sandia is a stakeholder and customer for this review. The peer review process seeks to address all of these areas – programmatic, technical and results - in terms of measurement of individual ASCI code team V&V efforts at Sandia.

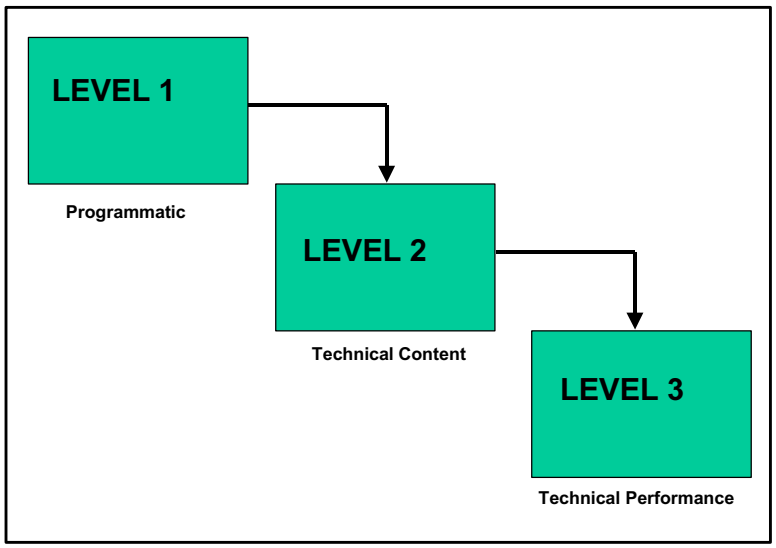

Figure 2-2. Sandia ASCI V&V Program Peer Review Levels

2.2.1 Level 1 Peer Review

The Level 1 peer review process will perform a programmatic review of the development, maintenance, and execution of as many Sandia code team V&V plans as can be accommodated at any given time. The goal of this review is acceptance of an individual code's V&V plan by the ASCI V&V program at Sandia. A group of independent panels will perform the assessments. The primary materials required for performing a Level 1

assessment are the V&V plans for the codes being assessed that have been written to conform to the most current version of the "Sandia Guidelines for V&V plans." For FY00, the primary metric used to assess the individual code plans is conformance to the FY99 V&V plan guidelines specification [V&V-GUIDE-1_0]. For FY01, the updated guidelines specification [V&V-GUIDE-2_0] will be used. The goal of the Sandia V&V program is that all ASCI-funded code projects at Sandia undertake Level 1 reviews by the end of FY01. The Level 1 review process was prototyped on two Sandia codes during April and May of 2000. The definition of the Level 1 peer review process in the following sections of this report reflects some of the lessons-learned gathered from that prototype. These lessons-learned are summarized in Appendix A.

2.2.2 Level 2 Peer Review

Once Level 1 reviews have been performed, the Level 2 review is a focused technical review of the content and implementation of the V&V processes for a selected subset of Sandia codes in any given year. The goal of this review is to determine technical credibility of the V&V project centered on an individual code and its acceptance by key code stakeholders. The details of the Level 2 review will be designed in collaboration with the specific code projects selected, as well as collaboration with the Sandia V&V program and Sandia DP. In general, it is anticipated that a review panel will consist of Sandia program participants, Sandia code team personnel, and external reviewers selected by the individual code teams as experts in the subject matter focus of the selected code. The technical content, logic, implementation and anticipated evolution of the code team's V&V process will be subject to review, along with evidence that allows the measurement of progress that may have been achieved up to the point of the review. The current goal is that at least two codes will undergo a Level 2 review of this type per year. It is desirable to coordinate selection for this review with current ASCI and DP milestone schedules. Not all codes will be appropriate for such a review in any given year. A prototype Level 2 peer review is currently planned for FY01.

2.2.3 Level 3 Peer Review

Finally, the Sandia program seeks to also support and execute a Level 3 review process. This review is currently best described as measuring performance, success, and shortcomings of the V&V process for individual codes as targeted to a specific validation for stockpile use. The ultimate goal is DP customer acceptance of the potential uses of the code for one or more defined stockpile applications. The nature of this review has not been specified in detail within this document. This review is expected to be a significant component of a weapons program certification or qualification process for Sandia ASCI codes. This means that a Level 3 review may not even be directly owned by the Sandia V&V program, but rather by DP at Sandia, or the specific DP customer base for a chosen code. It is likely that Sandia DP will be the primary customer for this level of review. It is anticipated that a prototype of this level of peer review will be conducted in FY02.

3 Detailed Description of Peer Review Process

The overall peer review process relating the V&V Plan Guidelines, V&V Plans, peer review levels, and general interfaces is illustrated in Figure 3-1.

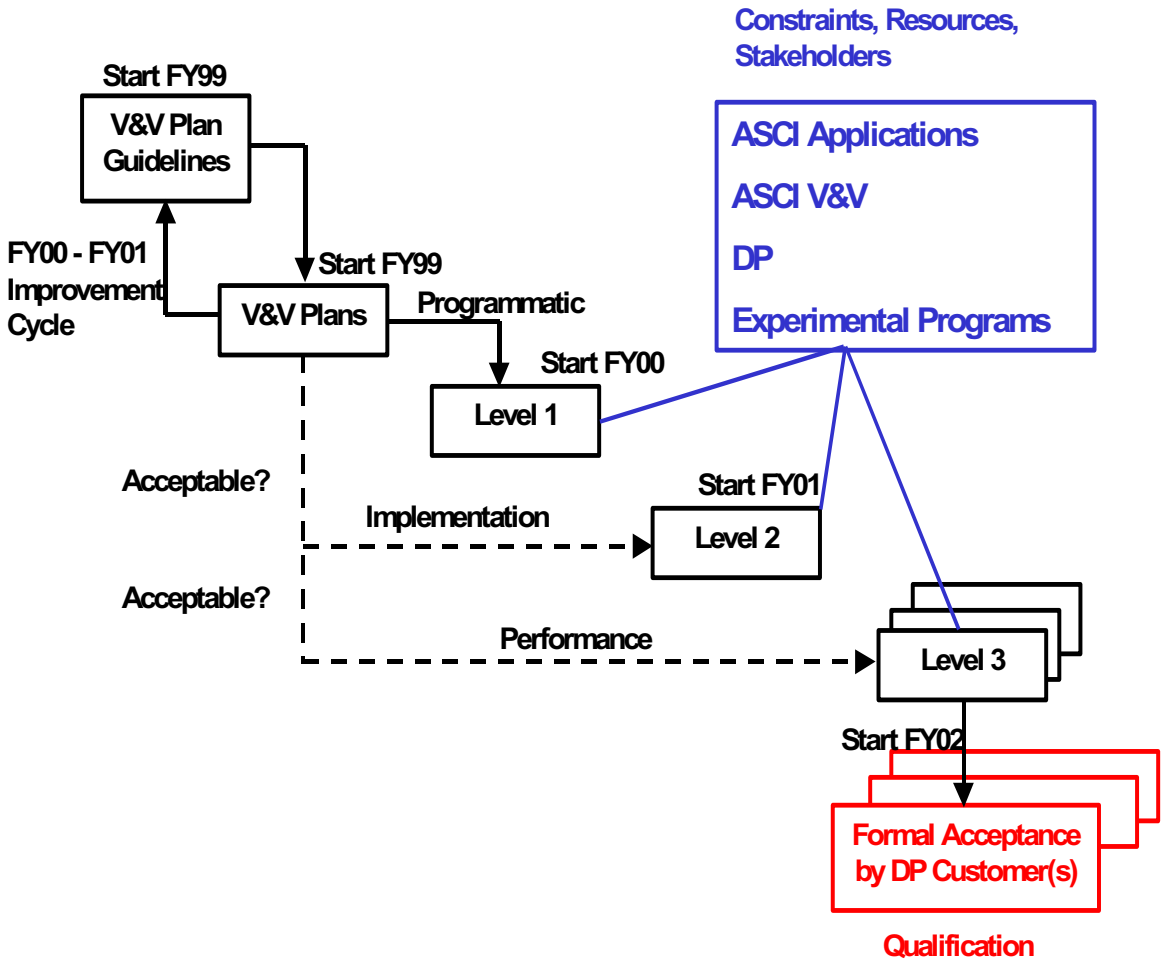

Figure 3-1. Sandia V&V Peer Review Process

The process shown in Figure 3-2 begins with the V&V planning guidelines (Version 2.0 in FY01 [V&V-GUIDE-2_0], Version 1.0 in FY00 [V&V-GUIDE-1_0]). The goal is to progress to the Level 2 and Level 3 reviews. To achieve this progression, an acceptable Level 1 review must be performed. Generally, our view is that a Level 2 review must be acceptable before progression to Level 3 can be achieved. However, because of the more specific focus of Level 3 there are clearly instances where a Level 2 review could suggest significant opportunities for improvement while still progressing a code to following

Level 3 reviews. As explained in the more detailed definition of Level 3, Figure 3-1 suggests that multiple Level 3 reviews might be required, depending on the code and the associated DP customer. The years associated with each level are the dates of planned prototype executions.

Figure 3-1 emphasizes our belief that the success of the peer review process is strongly bound to the requirements and goals of several stakeholders at Sandia. These include, but are not restricted to, the ASCI applications program, the ASCI V&V program, Sandia DP and the weapon system engineering programs, and supporting experimental and testing programs.

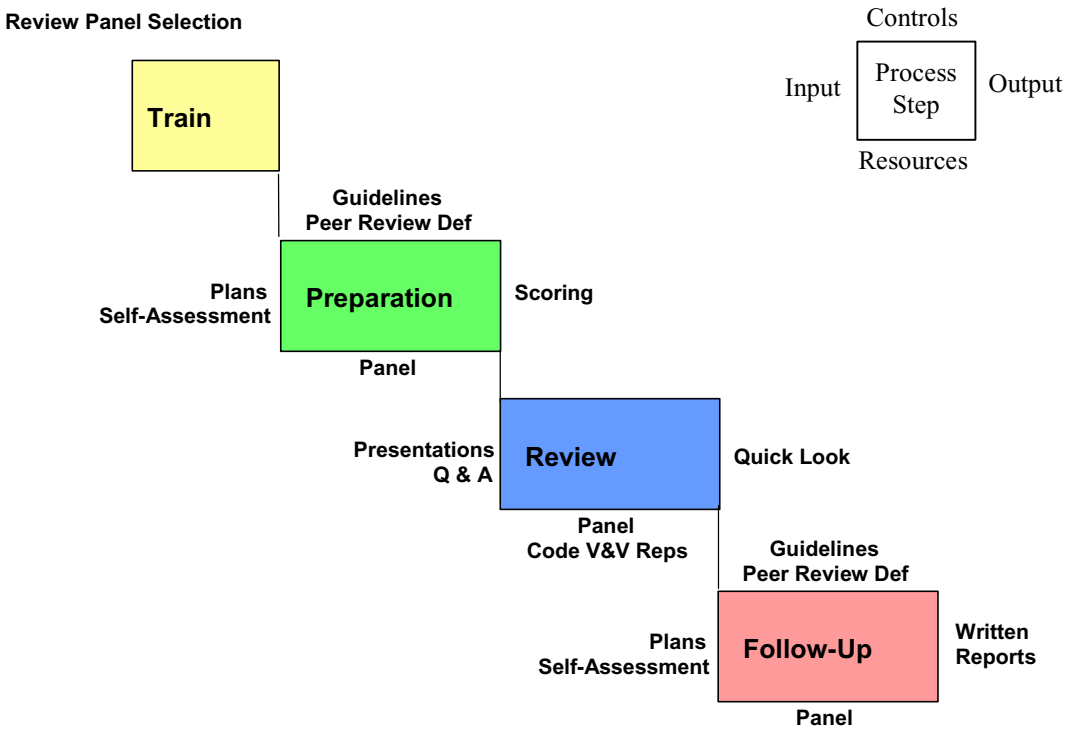

Figure 3-2. Peer Review Process Steps at Each Level.

Within each level, there is a peer review process that follows the general structure as illustrated in Figure 3-2. This general architecture is evolved from standard industry practices such as documented in reference [CBA-IPI]. The details of the review processes at each level and their interactions will be described in the following sections.

3.1 Level 1 Peer Review

The Level 1 peer review is based upon the planning guidelines [V&V-GUIDE-1_0] developed in FY99, prototype reviews held in FY00, and the most recent planning guidelines [V&V-GUIDE-2_0]. The key objectives of the Level 1 review are to assess:

1. status of the code-specific V&V activities with respect to development and maintenance of a documented V&V plan conforming to the most current published guidelines;
2. implementation status of that plan; and
3. programmatic performance or progress on that implementation.

The main areas of specific V&V plans targeted for assessment of conformance are:

1. understanding of Sandia DP stockpile requirements relevant to critical code applications and their use as drivers for the code specific V&V program;
2. development of a Phenomenology Identification and Ranking Table (PIRT);
3. implementation of a Software Quality Engineering (SQE) verification approach, and conformance of that approach to relevant programmatic SQE requirements associated with the ASCI program [V&V-PRACTICES];
4. existence of a Verification Test Plan;
5. existence of a Validation Test Plan; and
6. development of guidelines for stockpile computing applications of the code.

The precise format and content of conformance criteria has evolved from [V&V-GUIDE-1_0] to [V&V-GUIDE-2_0]. These specific criteria is extracted from [V&V-GUIDE-2_0] and listed in Appendix A. These criteria detail V&V plan content requirements in each of the six specific areas listed above. Assessing the conformance of V&V plans to these criteria is the key element in the Level 1 peer review. Content in these conformance criteria can be measured through either quantitative or qualitative means. The particular approach performed for the FY00 prototype was:

1. Qualitative and general feedback on the content of the code team's V&V plan in each of the six general content categories above.
2. Scoring of the individual criteria on a three point scale:

   0 - no content present in the current plan;

   1 - content is present but inadequate for complete assessment;

   2 - substantial content is present.

A mix of qualitative and quantitative assessment of conformance criteria is important. This approach will be implemented for the full scale Level 1 reviews of FY01. However, the scoring system used above will likely be modified.

The Level 1 review also provides a top-level measurement of the implementation status of the code team's V&V plan by reviewing the performance self-assessment with code team personnel in terms of the six general category areas. This latter was the approach selected for the FY00 prototype.

It is also important to develop some information on the code team's V&V plan performance. The Level 1 review uses the performance self-assessment by the code team. By briefly examining performance, the Level 1 review achieves a sanity check of the required alignment of the code team's V&V plan with the evolving Sandia V&V program, as well as the overall DOE ASCI V&V program.

Implementation and performance results based on the code team's V&V plan is not the major goal of a Level 1 assessment. Level 2 and Level 3 peer reviews will concentrate more fully on these areas. For a Level 1 review, the goal is to determine progress achieved to date, at the time of the review, toward accomplishing the objectives of the code team's V&V plan.

3.1.1 Review Panel Selection

A five member peer review panel will be selected by the Sandia V&V program to perform the formal Level 1 assessment of a given code team's V&V plan. The membership of this panel will be as follows:

1. **Core Members:** Three panel members will be chosen as *core* panel members. These members will have the responsibility for reviewing two or three codes that are included in the Level 1 review. These three people will be selected from the Sandia V&V program, supporting infrastructure support personnel, the ASCI Applications Program Office, and possibly from DP. One member from this group will be selected as the chairperson of the panel. It is desirable that one of the core panel members have software development or software engineering experience.
2. **Rotator Members:** Two members of the panel will be selected by the specific code project under review. Their duties extend only to that specific project. These two participants are called *rotators* for the core panel. One of the rotators will be selected as a subject matter specialist in the technical focus area of the code under review. This subject matter expert must be independent of the specific code development project. The second rotator will represent the customer community for the code. In particular, this representation could be as an analyst who is independent of the code project but likely to be a user of the code. Or, this representation could be as a DP customer for the modeling capability of the code. Ideally, the rotator who represents a customer presence for the review panel will represent the main stockpile application community that serves as the focus of the code team's V&V plan under review.
3. **Observer Member:** The V&V program will also place an observer on the panel who will function as a scribe and facilitator for panel deliberations.

A given Level 1 peer review panel will assess no more than three Sandia ASCI codes. For the full implementation of the Level 1 review in FY01, multiple panels will be formed as needed to provide complete coverage of the Sandia codes.

The chairperson of the review panel will have the responsibility for organizing and managing the delivery of the review outcomes for that particular panel, as described further below. The chairperson will also help facilitate panel deliberations. It is recommended that one member of the panel be assigned the responsibility of developing

first drafts for written work products of the panel. This assignment should be made during the panel's training session.

The Sandia V&V program will formally task the Level 1 review teams in a letter or memorandum. All Level 1 review personnel will be trained in the methods and expected outcomes of the peer review process. A copy of the training view graphs developed for the FY00 prototype is given in Appendix B.

3.1.2 Review Materials

For the Level 1 review process, the following material will be provided by each code project at the beginning (prior to the panel training session) of the review process:

1. **V&V Plan:** One electronic copy of the existing current V&V plan for the specific code under review. For FY01, this document will be assessed by the panel for compliance with Version 2.0 of the Sandia V&V plan guidelines [V&V-GUIDE-2_0]. A summary of those compliance areas is contained in Appendix A.
2. **Performance Self-Assessment:** One electronic copy of a written performance statement which concentrates on the topics outlined in Appendix A.

The electronic input from a code team will be delivered before beginning training of the applicable review panel. This will typically be no later than two weeks before the scheduled date of the Level 1 review of the code. Overall scheduling of the peer review cycle will be controlled and published by the Sandia V&V program office.

3.1.3 Review Process

Training (1/2 day):

Once selected, personnel representing the Sandia V&V program will train the panel. In addition, representatives from the code subject to review will also participate in this training. The approach applied for training for the FY00 prototype peer review is shown in Appendix B of this report. Training for panels for the FY01 full scale implementation should be expected to last at least one-half day for each panel.

Preparation (2 days per code):

At the time of training the panel members will receive written copies of the needed review materials from the participating code teams. Rotators will receive material only relevant to their specific code. The core panel members will receive material for all of the codes they are responsible for reviewing. Prior to the day of the panel review for a code the panel members will perform individual assessments of this material. Based on experience with the FY01 prototype, a level of effort of approximately two days will be required to assess the material for one code.

Review (1 day per code):

The actual review will require a full working day per code project. The overall schedule for review day for a code is as follows.

Two hours:	**Panel initial deliberations**
Two hours:	**Code presentation and panel Q&A**

Three hours:	**Panel deliberations and preparation of same day outbrief**
One hour:	**Panel outbriefs code team**

The initial two hours of the review will be devoted to transforming individual assessments and understanding into a common panel assessment and understanding. In addition, panel member input critical for developing the panel work products for the review will be developed.

The individual assessments and initial panel deliberation are anticipated to lead to further questions and issues. Therefore, an oral discovery phase has been scheduled in which the code team can present further information about the review materials and the panel can engage in an oral question and answer period with the code team. The total two hours allotted for this discovery phase is roughly one hour for the code team and one hour for the review panel. An obvious focus for the code team's V&V presentation should be the performance assessment, but this is not mandatory. The oral presentation is also an opportunity to provide further guidance on the structure of the code team's written V&V plan. It is expected that questions from the panel will target specific issues arising from their previous deliberation or from the oral presentation. The panel will not present assessment conclusions (individual or group) during the oral presentation and Q&A time.

Following the oral presentation and Q&A session, the panel has a working lunch and prepares general strength and improvement opportunity themes. Supporting evidence is derived from the individual V&V conformance criteria scores, oral discovery information, and general knowledge of the panel members. The themes and supporting evidence is drafted into a vugraph outbrief presentation (see Figure 3-3). As time permits plans for future follow-up meetings, written report development, and responsibilities can be discussed.

The final activity of the review step is the outbrief presentation to the code team participants. This one hour period is led by the chair although other panel member participation is encouraged. The objective of this presentation is to provide a quick look feedback to the code team that highlights the panel assessment of the V&V Plan conformance to [V&V-GUIDE-2_0]. Some clarification and interaction is encouraged, but detailed discussion is reserved for the follow-up review with the code team after the written report is delivered.

Follow-Up (2 weeks):

The panel is responsible for delivering several work products for each code. A detailed discussion of these work products (deliverables) is given below. Some time has been allocated for discussion and development of initial drafts of these work products by the review panel during previous process steps. One of the work products is the same day feedback briefing to the code team to give them overall panel findings. The same day feedback briefing is the primary input for the more detailed written work products. A written report will be delivered to the code team within approximately one week of the review day. A written report will be delivered to the V&V program office within approximately two weeks of the review day that summarizes general conclusions across

all the code teams that participated in that panel's peer review. In addition, the panel for each code team will be available for a follow-up meeting to discuss any clarification of the written report information and possible insight into the development of code team action plans in response to the review. Each code team is then responsible for providing to the V&V program office an action plan on their response to the assessment report and a feedback report concerning strengths or areas of improvement for the peer review process.

3.1.4 Review Deliverables

A high priority has been placed on achieving timely relevant outcomes from this peer review process. The outcomes, or work products, of the Level 1 review consist of the items shown in Table 3-1. The panel review team is responsible for the first three products, both the code team and the panel for the fourth product, and the code team for the fifth and sixth products.

The scheduling of the Level 1 peer reviews will be compatible with the V&V Implementation Plan (IP) development process for FY02. The work products that are delivered by these reviews as detailed above should make major contributions to the IP process for individual codes. These work products may be useful as quantitative performance metrics for the ASCI V&V program at Sandia, and thus are also potentially useful as metrics for DOE HQ assessment of the overall V&V program. The specific form of these products may be adjusted to maximize this utility at the time of the FY01 review.

An individual panel member will need a total level of effort estimated to be approximately one week per code for a complete Level 1 peer review. This estimate is based on experience with the FY00 prototype peer review. This one week of labor effort is typically spread over several weeks.

Table 3-1. Level 1 Peer Review Deliverables

Product	Prepared By	Deliver To	Description	Rationale	Template
#1 - Quick Look Feedback	Review Panel Team	Code Team	Panel provides outbrief presentation to the code team at the end of the review day	Initial feedback to a specific code team is very advantageous. It forces some completion of the panel assessment process while the most recent inputs from the code team are fresh on the mind of the panel members. It also provides a quick reward for the work of the code team in preparing for the review.	Fig 3-3
#2 - Code Team Written Assessment Report	Review Panel Team	Code Team	Panel provides a written feedback report to each code team typically one week after the date of the formal review. This information will be shared with the Sandia V&V program office.	Written feedback allows more detailed presentation of panel findings to the code team. This format is also more appropriate for sharing findings of the review with the V&V program office. The week allowed for developing the final report increases the probability of accurate statements.	Fig 3-4
#3 - V&V Program Written Assessment Report	Review Panel Team (primarily core members)	SNL V&V Program Office	Panel provides a written feedback report on important findings of the review panel to the Sandia V&V program office on a fast time scale (typically two weeks after the panel's last code review). The chairmen of the review panel is responsible for delivery.	This product summarizes and evaluates the progress, strengths, and opportunities for improvement of the Sandia V&V program as determined by the panel from the individual Level 1 code reviews. This is critical information for planning and guiding the V&V program at Sandia.	Fig 3-5
#4 - Follow-Up Meeting With Code Team	Review Panel Team	Code Team	An oral follow-up meeting with the code team will be held by the panel to discuss the contents of the written feedback report.	This is one more opportunity for clarification of panel findings and code team responses to those finding.	Not performed for FY00 prototype.
#5 - Code Team Action Plan	Code Team	SNL V&V Program Office & Code Review Panel	The code team will develop a formal action plan (memo or more extensive written response) to the findings of the panel. This work product is delivered to the program office and members of the review panel for that code.	The V&V program office needs a formal sense that the code team's V&V planning activity will progress based upon the results of the Level 1 review. This provides valuable "return on investment" status for the V&V activity. This work product also provides additional justification for the hard work of the panel by demonstrating action to their findings is possible.	Not developed for FY00 prototype.
#6 - Code Team Feedback Report	Code Team	SNL V&V Program Office	The code team provides feedback on the peer review process to the V&V program office.	The V&V program office will use feedback from the panel, the code team's, and the program's own observers to continually improve the peer review process.	Fig 3-6

Quick Look Feedback Form (*VV-PR-00-02)*

The purpose of this feedback is to provide a "quick look" to the code V&V plan representatives of the views of the panel regarding their V&V plan and performance. The required content here is exactly the same as that for the written feedback, but is intended to be less extensive, while more timely. This information may be communicated in written or oral form to the code project. The template could be used to directly provide written feedback. Or, it could be used to simply guide thinking for oral feedback. The peer review panel determines the specific feedback mechanism.

V&V Plan Content
What were the observed strengths of the V&V plan?
What was confusing?
What are some opportunities for improvement?
Provide miscellaneous comments from the panel.

V&V Plan Performance Self-Assessment
Has there been progress on code V&V that conforms to the planned activity?
Have metrics been formulated to assess success and have they been applied?
What is the panel's view of the challenges for executing the written V&V plan in the light of the stated performance?
Provide miscellaneous comments from the panel.

Figure 3-3. Level 1 - Quick Look Peer Review Feedback to Code Team

Code Specific Written Final Report *(VV-PR-00-03)*

The purpose of this feedback is to provide a written feedback report to the code V&V plan representatives. It provides in formal form the views of the panel in regard to the V&V plan and performance as determined from the peer review.

CODE NAME:
Code V&V Plan Owner:
Date of Review:
Panel Members:
Member 1
Member 2
Member 3
Member 4
Member 5

V&V Plan Content
General comments
Report the observed strengths of the V&V plan.
What sections would benefit from fixing confusing writing?
What are some opportunities for improvement?
Provide miscellaneous comments and any recommendations from the panel.
Score Sheet
Provide a copy of a summary score sheet with the following information:
- Each panel members scoring item by item (maximum of five scores per item)
- Collected general comments from each panel member for each general section of the score sheet

V&V Plan Performance Self-Assessment
Summarize the performance on the code V&V plan that you uncovered by reading the performance self-assessment and from the oral presentation.
Have there been successes? Was any success measured using metrics?
What is the panel's view of the challenges for executing the written V&V plan in the light of the stated performance?
Provide miscellaneous comments and recommendations from the panel.

Figure 3-4. Level 1 – Written Peer Review Report to Code Team

Program Report Form (*VV-PR-00-04)*

The purpose of this feedback is to provide the Sandia ASCI V&V program office with a summary assessment of what the panel learned in the peer review process.

Codes Reviewed:
Dates of Review:
Panel Members:
Member 1
Member 2
Member 3
Member 4
Member 5

V&V Plan Content
Give an assessment of the conformance of the plans you heard to the V&V Guidelines.
Rollup the observed strengths of the V&V plans.
Rollup the opportunities for improvement.
What is the panel's perception of the state of performance on Sandia V&V plans based on their reviews?
Provide miscellaneous comments and any recommendations from the panel.

Comments on the Guidelines
Provide any comments the panel prefers to forward regarding the version of the V&V Guidelines used in their Level I peer reviews.

Observations on the Level I Peer Review Process
What are strengths of this process?
Provide any recommendations for improvement of the process based on the panel's experience.
Was the training useful? What else would help prepare the panel for the peer review task?

Figure 3-5. Level 1 - Written Peer Review Report to V&V Program Office

3.1.5 Review Expectations

The Level 1 review is expected to be a metric for the quality of the V&V planning process at Sandia. This review will mainly provide input for programmatic planning at both the code project and Sandia V&V program levels. The review is expected to primarily assesses conformance to the most recent published Sandia V&V planning guidelines. While code teams will most certainly benefit from this review, the Sandia V&V program itself is also a customer for this review.

3.2 Level 2 Peer Review

The Level 2 peer review is intended to be performed as the next stage of peer review for the Sandia ASCI codes. This review process will be structured similar to the Level 1 peer review, but will be a more technically oriented review of the subject matter content and implementation of V&V plans. Focus areas for a Level 2 review will include, but are not restricted to:

1. technical content and implementation of the code team's V&V plan;
2. technical progress toward achieving the main goals of the V&V plan for the code;
3. benchmarking of the technical V&V activities of the specific code project as compared to other code projects; benchmarking should concentrate on codes with

similar subject matter emphasis; benchmarking may require both consideration of codes within Sandia and external to Sandia for comparison;

4. technical risks and holes (such as needed experiments) in the V&V plan; and
5. best practices and approaches that could be shared across the Sandia V&V community, and possibly the larger Tri-Lab ASCI V&V community.

The codes selected for a Level 2 review are expected to have undergone a previous Level 1 review. Therefore, codes entering a Level 2 review are expected to manifest greater maturity in the implementation and execution of their V&V plan. Level 2 reviews should

V&V Peer Review Code V&V Team Feedback Report *(VV-PR-00-05B)*

The purpose of this information is to provide the Sandia ASCI V&V program office with feedback regarding the FY00 V&V Peer Review process for your code. Please answer the following questions in whatever detail you care to. You may enter the information directly into this document as a template and forward the information electronically.

Comments on the Peer Review Process

How much effort (time, people) did you devote to preparing for the specific V&V Level 1 peer review for your code? Person Hours: _____ Calendar Time Period: _____

What do you believe are strengths of the peer review process?

What do you believe are opportunities for improvements in the peer review process?

Was the review information (same day briefing, written report) provided in a timely manner?

What did you gain by participating in the peer review process?

What did you lose by participating in the peer review process?

Do you have any recommendations for changing the current peer review panel membership (three core members, one code specific subject matter expert, one code specific customer)?

Provide any other comments you may have about the peer review process.

Comments on the Sandia V&V Guidelines, Version 1.0

In what ways were the published V&V guidelines, Version 1.0, relevant to the Level 1 Peer Review process?

What are strengths of the Version 1.0 Guidelines?

What are opportunities for improvement of the Version 1.0 Guidelines?

Provide any other comments you may have on the Version 1.0 Guidelines, especially based on your experience about the Version 1.0 Guidelines guidelines?

Comments on the Sandia V&V Program

What comments do you have on the use of a formal peer review process by the Sandia V&V program? For example, is it needed? Is the program better because of it?

Figure 3-6. Level 1 – Code Team Feedback on Peer Review Process

be coordinated with scheduled milestone activities associated with the ASCI Applications program and DP at Sandia. A Level 2 prototype is scheduled to occur in FY01 to validate the process presented in this document. Prototyping will likely lead to some changes and increased detail in the definition.

3.2.1 Review Panel Selection

A more technically-oriented review panel will be selected and trained for a Level 2 review. This panel will be responsible for reviewing only one code. Members of a Level 2 review panel will be selected as follows:

1. one representative of the Sandia V&V program or ASCI Applications program selected by the V&V program;
2. one DP customer representing the stockpile focus area of the code project selected by the Sandia V&V program;
3. one technical reviewer selected by the Sandia V&V program from a separate Sandia ASCI code project distinct from the code undergoing the Level 2 review;
4. two or three technical reviewers selected by the code team whose code is undergoing review; these reviewers should clearly be external to the code team and also possibly external to Sandia; the selection depends upon the specifics of the code project and the availability of technically knowledgeable experts within Sandia in the subject matter focus of the code; and
5. one observer selected by the Sandia V&V program who will also act as a scribe and resource for the panel, as well as facilitator for panel deliberations.

A total number of between six and seven participants are expected for a Level 2 peer review panel. One of the above will be selected to act as the chairperson of the panel. The chairperson will have the same responsibilities as the chairperson for a Level 1 review.

3.2.2 Review Materials

For the Level 2 review process, the following material will be presented by each code project to the V&V program at the beginning (prior to the panel training session) of the review process. This will typically be no later than two weeks before the scheduled date of the Level 2 review of the code. Overall scheduling of the peer review cycle will be controlled and published by the Sandia V&V program.

1. **V&V Plan:** One electronic copy of the most current V&V plan for the code. This should not be distinct from the plan that was used for the Level 1 review, but rather an evolved and improved version.
2. **Technical Support Material:** Electronic copies (or references to the location) of supplemental technical material associated with the content, implementation and progress of the verification testing and validation testing campaigns for the code project (verification problem definitions, testing processes, validation calculation documentation, Sandia reports describing successful experimental interactions, and so on). The choice of this material is up to the code team. The intent is to provide evidence of the technical aspects of the V&V plan. Not all evidence needs

to be delivered to the panel. But, the code team should be prepared to respond to addition requests for material referenced but not present in the initial documentation.

3. **Performance Self-Assessment:** One electronic copy of a written performance statement which concentrates on the following :
   a. evaluation of the success of the existing verification testing plan, with attention paid to the definition and application of metrics;
   b. evaluation of the success of the ongoing validation activities, with attention paid to the definition and application of metrics;
   c. description of technology issues underlying the approach to verification and validation testing (such as the use of uncertainty quantification), if any;
   d. appraisal of the experimental activities either associated with the code validation effort, or needed in the future;
   e. description of evolving challenges, especially for validation; and
   f. planned revision of V&V technical deliverables, if any.

3.2.3 Review Process

Training (1/2 day):

Once selected, personnel from the Sandia V&V program will train the panel. In addition, representatives from the code subject to review will also participate in this training. The particular training approach relevant for Level 2 peer reviews will be similar to the training for the Level 1 peer reviews, with some differences in the technical content that have not been defined at this time. Training for each Level 2 peer review panel is expected to take at least half a day.

Preparation (1 week):

At the time of training the panel members will receive written copies of the needed review materials from the code project selected for review. Prior to panel review of the code, each panel member will perform individual assessments of the review materials. A week or more of effort for each panel member will be required to perform individual assessments of the relevant material.

Review (2 days):

The actual review will require roughly two working days per code project. The overall schedule for these review days for a code is estimated to be as follows.

Two hours:	**Panel initial deliberations**
Six hours:	**Code team presentations, panel Q&A, additional discovery activities**
Six hours:	**Panel deliberations and preparation of quick-look outbriefing**
Two hours:	**Panel outbriefs code team**

The initial two hours of the review will be devoted to transforming individual assessments and understanding into a common panel assessment and understanding. In addition, panel member input critical for developing the panel work products for the review will begin to be developed.

The individual assessments and initial panel deliberation are anticipated to lead to further questions and issues. Therefore, an oral discovery phase has been scheduled in which the code team can present further information about the review materials and the panel can engage in an oral question and answer period with the code team. The total six hours allotted for this discovery phase is roughly three hours for the code team and three hours for the review panel. The decision has not yet been made as to the proper balance between code team presentations and panel question and answer and additional evidence discovery. An obvious focus for the code team's V&V presentation should be the performance assessment, but this is not mandatory. The oral presentation is also an opportunity to provide further guidance on the results of implementing the code team's written V&V plan. It is expected that questions from the panel will target specific issues arising from their previous deliberation or from the oral presentation. The panel does not present assessment conclusions (individual or group) during the oral presentation and Q&A time.

On the second day, the panel has a six-hour period to prepare general strength and improvement opportunity themes, discuss potential technical risks and deficiencies, and begin preparation of the deliverable work products from the panel. Supporting evidence is derived from the individual V&V conformance criteria assessment, oral discovery information, and general knowledge of the panel members. The themes and supporting evidence will be drafted into a view graph outbrief presentation. As time permits plans for future follow-up meetings, written report development, and responsibilities can be discussed. The stated balance between panel discovery and panel deliberations on the second day is tentative.

The final activity of the review step is the outbrief presentation to the code team participants. The chair leads this two-hour period although other panel member participation is encouraged. The objective of this presentation is to provide quick feedback to the code team that highlights the panel assessment of the V&V Plan technical implementation conformance to [V&V-GUIDE-2_0]. Some clarification and interaction is encouraged. Time is allocated for some detailed technical discussion on the V&V activities, in particular related to potential technical deficiencies and risks with the existing V&V Plan and its implementation. More detailed technical discussion is reserved for the follow-up review with the code team after the written report is delivered.

Follow-Up (1 month):

The panel is responsible for delivering several work products for each code. A detailed discussion of these work products (deliverables) is given below. A larger time has been allocated for discussion and development of initial drafts of these work products by the review panel during previous process steps. One of the work products is the quick look feedback briefing to the code team to give them overall panel findings. The quick look

feedback briefing is the primary input for the more detailed written work products. A written report will be delivered to the code team within approximately one month of the review, and will be shared with the V&V program office. In addition, the panel will be available for a follow-up review to discuss any clarification of the written report information and possible insight into the code team action plans. The code team is then responsible for providing to the V&V program office an action plan on their response to the assessment report and a feedback report concerning strengths or areas of improvement for the Level 2 peer review process.

3.2.4 Review Deliverables

A high priority has been placed on achieving timely relevant outcomes from this peer review process. The outcomes, or work products, of the Level 2 review consist of the items shown in Table 3-2. The panel review team is responsible for the first two products, both the code team and the panel for the third product, and the code team for the fourth and fifth products.

The scheduling of the Level 2 peer reviews will be compatible with the V&V Implementation Plan (IP) development process for FY01 and FY02. The work products that are delivered by these reviews as detailed above should make major contributions to the IP process for individual codes. These work products may be useful as quantitative performance metrics for the ASCI V&V program at Sandia, and thus also potentially useful as metrics for DOE HQ assessment of the overall V&V program. The specific form of these products may be adjusted to maximize this utility at the time of the FY01 review.

An individual panel member will need a total level of effort estimated to be approximately two weeks per code for a complete Level 2 peer review. This estimate will be appropriately adjusted based on experience with the FY01 prototype peer review. This two weeks of labor effort is typically spread over two months.

3.2.5 Review Expectations

Level 2 reviews are designed to provide specific technical value to the selected code projects. In addition, results of more general value to the Sandia V&V program, the ASCI Applications program, and Sandia DP will also emerge.

Table 3-2. Level 2 Peer Review Deliverables

Product	Prepared By	Deliver To	Description	Rationale	Template
#1 - Quick Look Feedback	Review Panel Team	Code Team	Panel provides outbrief presentation to the code team at the end of the 2nd review day	Initial feedback to a specific code team is very advantageous. It forces some completion of the panel assessment process while the most recent inputs from the code team are fresh on the mind of the panel members. It also provides a quick reward for the work of the code team in preparing for the review.	Similar to Fig 3-3
#2 - Code Team Written Assessment Report	Review Panel Team	Code Team	Panel provides a written feedback report to each code team typically one month after the date of the formal review. This information will be shared with the Sandia V&V program office.	Written feedback allows more detailed presentation of panel findings to the code team. This format is also more appropriate for sharing findings of the review with the V&V program office. The month allowed for developing the final report increases the probability of accurate technical depth.	Similar to Fig 3-4
#3 - Follow-Up Meeting With Code Team	Review Panel Team	Code Team	An oral follow-up meeting with the code team will be held by the panel to discuss the contents of the written feedback report.	This is one more opportunity for clarification of panel findings and code team responses to those finding.	Similar to Level 1 product.
#4 - Code Team Action Plan	Code Team	SNL V&V Program Office & Code Review Panel	The code team will develop a formal action plan (memo or more extensive written response) to the findings of the panel. This work product is delivered to the program office and members of the review panel.	The V&V program office needs a formal sense that the implementation of the code team's V&V planning activity is progressing based upon the results of the Level 2 review. This provides valuable "return on investment" status for the V&V activity. This work product also provides additional justification for the hard work of the panel by demonstrating action to their findings is possible.	Similar to Level 1 product.
#5 - Code Team Feedback Report	Code Team	SNL V&V Program Office	The code team provides feedback on the peer review process to the V&V program office.	The V&V program office will use feedback from the panel, the code team's, and the program's own observers to continually improve the peer review process.	Similar to Fig 3-6

3.3 Level 3 Peer Review

A Level 3 peer review will focus on performance of the V&V plan for a specific code that will be used in a Stockpile Life Extension Program (SLEP) activity. The major goal of a Level 3 peer review is that it should be an important contribution to an overall certification, accreditation, or qualification process for the application of the code to its identified stockpile application. Defense Programs at Sandia is a primary customer for such a review. Such a review may constitute the dominant component of a model-based qualification process for the selected stockpile application. It is believed that this decision must be fully coordinated with DP planning and needs, and is not a decision of the ASCI V&V program at Sandia. Such a model qualification process is a defined part of the Nuclear Weapons Complex system of Technical Business Practice (TBPs). See references [TBP-PRP], [TBP-000], [TBP-100], [TBP-307] and [TBP-306].

The Level 3 peer review may be expedited by the Sandia V&V program, yet fully owned by a non-ASCI component of DP at Sandia. It may also be the case that recurrent reviews of this type, rather than a single such review, may be more appropriate depending upon the specific DP customer requirements. This factor would influence the potential length of the review. If one or two such reviews were major stages on a weapon system certification path, it is clear that the details and length of the review would be similar or greater than those of the Level 2 review.

The Level 3 peer review process provides an understanding of how well the general code V&V Plan, V&V implementation evidence and, perhaps, specialized validation modeling/experimental evidence supports the validated use of the code in the qualification process for a SLEP customer application. The Level 3 peer review process results can be referenced as part of the evidence that the code, as used to model a specific aspect of a weapon product in a specified environment, is “qualified” or “sufficiently valid” for that specific application. The previous Level 1 and 2 peer reviews would provide additional evidence as well that the V&V activities provide adequate assurance for the intended use of the code model.

3.3.1 Review Panel Selection

It is expected that the responsible SLEP weapon product activity Product Realization Team (PRT) will establish an appropriate Level 3 peer review panel (task group) in cooperation with the Sandia V&V program and responsible code team. This task group will be able to use the review process to be defined in this document in the near future to support the qualified use of a code within the weapon product qualification process.

Depending upon the significance of the use of the code product in the modeling activity, a separate PRT might be formed to qualify the code product for its specified use. In this case, this PRT could be the owner of the Level 3 peer review and use the review as a qualification activity. In any case, the responsible PRT would have the task of identifying when such reviews would be useful and the general composition of the review panel.

3.3.2 Review Materials

The Levels 1,2, peer review materials and results would be included in the review materials for a Level 3 peer review. Any specialized code model verification and validation activities and results for the specific stockpile application use that may have been added to the existing V&V Plan and implementation would be part of the review materials. In general, any V&V activities and results that are reported as a part of a code product qualification plan would be candidate review materials. If the code product is qualified for use as part of a more general qualification process, then the peer review and V&V evidence as a referenced part of the qualification process activity and results would be candidate review materials.

3.3.3 Review Process

A Level 3 peer review process is envisioned to be an integrated part of a stockpile weapon qualification activity. See references [TBP-PRP], [TBP-000], and [TBP-100] for top level guidance concerning weapon qualification as part of the product realization process. The peer review process, model-based qualification, and weapon product qualification activity relationships are illustrated in Figure 3-7.

In Figure 3-7, the Level 3 peer reviews could occur at any weapon product life cycle phase and associated qualification stage for which the ASCI code product is needed as a validated model. Although the figure illustrates the typical full life cycle Phases 1 through 7 for new weapon product, the same figure applies in a similar manner to the Phase 6.X Process (Stockpile Life Extension) and its subphases 1 to 6. Weapon product may be at a system, subsystem, or component level. The figure illustrates the use of the Level 3 peer review results for two purposes:

1. qualification of the code model for specified use during a weapon product life cycle; and
2. qualification of the code modeling process and analysis results for specified use during a weapon product life cycle.

The Level 3 peer reviews could be applied to a modeling and simulation activity depending on the criticality of the activity in relation to the weapon qualification. In the first case above, if the modeling and simulation code model use is critical to the design of or qualification acceptability of the weapon product, then it may be necessary to qualify the code product itself for a specified modeling and simulation use. In the second case, if the weapon capability is not uniquely dependent upon code results, it may not be necessary to qualify the code product. Rather, it may be as effective to qualify the analysis results through a “process qualification” approach where the code and its results are considered one part of the process of a weapon product qualification.

If a separate PRT has been formed to qualify the code product for its specified use, then this PRT would be the owner of the Level 3 peer review and would use the review as a qualification activity. Code team members could be part of the PRT or simply “task member” who are specifically tasked to provide the V&V Plan, its implementation V&V activities, and results. The Levels 1,2, and 3 peer review results as well as the V&V results would then be reported as a part of the code product qualification plan.

If the code product is qualified for use as part of a more general qualification process, then the peer review results and V&V evidence can be referenced as part of the qualification process activity and results. The analytical results and the process to obtain those results would be reviewed as part of the weapon product qualification evidence included in the weapon product qualification plan. In this case, a Level 3 peer review could provide the requisite evidence for this weapon qualification activity.

As illustrated in Figure 7, the Level 3 peer review results could be part of qualification evidence released in any of the product realization process stages. Qualification evidence is released through an Information Engineering Release (IER) or as part of the final weapon product release for operational use through a Qualification Engineering Release (QER). Whether the results of the code V&V activity provide adequate evidence of assurance is dependent upon establishing appropriate acceptance measures. These measures would normally be established by the responsible PRT in coordination with the ASCI V&V program office, applicable code team participants, and directly affected DP customers.

With these important considerations of how the Level 3 peer review process might be organized, owned, and used it is still envisioned that there will be basic peer review process steps of training, preparation, review, and follow-up. Specific details of these steps will be defined in a future version of this document.

3.3.4 Review Deliverables

The results of the Level 3 peer review process will consist of an analysis report on the performance of the code model V&V Plan and implementation results. This analysis report will summarize evidence from all V&V activity specifically targeted to verifying and validating the intended use of the code model for the specified weapon product SLEP activity. An indication of how well the code model satisfies its acceptance criteria will be provided along with a recommendation as to the code's validation/qualification status for this specified use.

A specific format and more detailed description of expected contents of the Level 3 peer review V&V analysis report will be defined in a future iteration of this document.

3.3.5 Review Expectations

Level 3 reviews are expected to provide specific recommendations to DP customers on the valid use of a code in a specified SLEP activity validity based on the results of the code V&V results. In addition, results of more general value to the Sandia V&V program, the ASCI Applications program, and Sandia DP will also emerge.

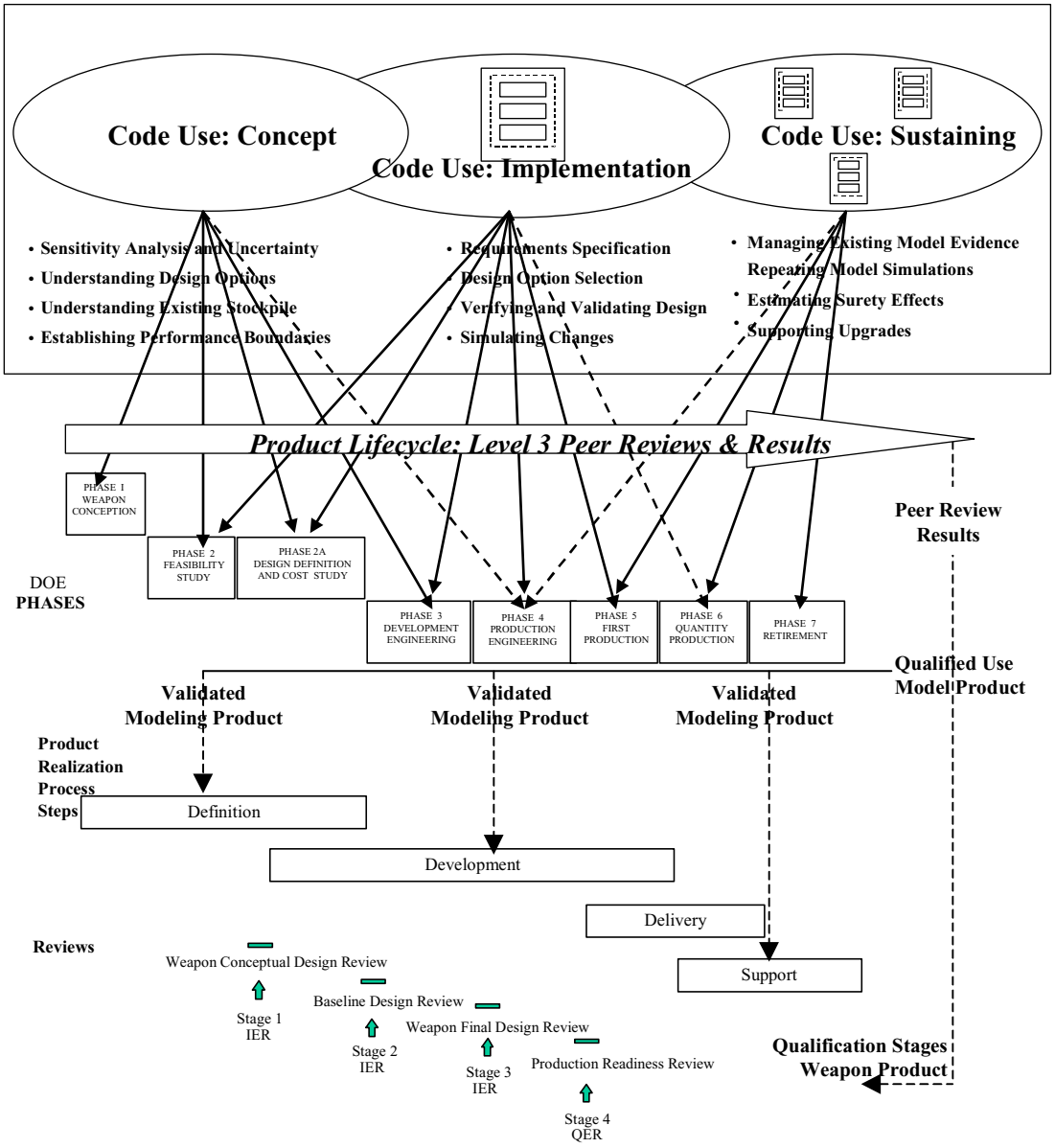

Figure 3-7. Level 3 Peer Review Process and Weapon Product Qualification

4 Future Implementation of the Peer Review Process

This report has discussed some of the underlying philosophy of implementing a peer review process for the ASCI V&V program at Sandia. The primary purpose of this document has been to describe the overall process, its three-level approach, and the detailed process steps. The peer review process is progressive and constructive. That is, the process is designed to move Sandia ASCI codes from one level of peer review to another more extensive level. This progression measures increased confidence in the application of the code to specific stockpile problems of interest to Defense Programs at Sandia.

The most detailed description included in this report is for the Level 1 process. This process has the main goal of performing a programmatic assessment of the V&V plan for specific ASCI codes at Sandia. The intention is to assure programmatic acceptance of the specific code's V&V plan. This process has been prototyped in FY00, and the definition here was based on the results of that prototype. The goal is to execute the Level 1 peer review described here for most or all Sandia ASCI codes in FY01.

The Level 2 process has the main goal of performing a technical assessment of the content and implementation features of the V&V plans for Sandia ASCI codes. This review is considerably more complex than the Level 1 review, with a much deeper technical emphasis. The intention of this review is to secure technical acceptance of the content and implementation details of the code by the V&V program as well as the potential stockpile customers for the code. This process has not been prototyped, so the included description can not be considered to be final. A Level 2 peer review prototype is planned for FY01. The next version of this document will reflect this prototype with a considerably more detailed description of the Level 2 process.

Only the philosophy underlying the Level 3 peer review process has been presented. The goal of this process is to assess actual performance of the V&V plan activities. This performance assessment will be used quantitatively in a qualification, accreditation or certification process owned by DP at Sandia for the application of the code to stockpile programs. The next version of this document will contain a complete definition of this process. It is hoped to prototype the Level 3 peer review process in FY02.

Peer review is an essential instrument for measuring the formulation, progress, and impact of the Sandia V&V program on the major stated vision of the ASCI V&V program – to increase confidence in the application of ASCI codes to critical stockpile programs as part of the Stockpile Stewardship Program. The implementation of this peer review process is fundamental to the belief that the Sandia V&V program should be an integral component in the overall quality improvement of the codes that are developed under the ASCI program at Sandia.

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Appendix A. Conformance Criteria for Level 1 Peer Review

A.1. Performance Self-Assessment

The Sandia V&V program requests as part of a Level 1 peer review that a brief (six pages or less) performance self-assessment document be generated with the following specific format:

> Section 1. Overview of V&V activity in the current FY (or going back to when you first wrote the document);
>
> Section 2. Successes and how success is measured; and,
>
> Section 3. Challenges and Lessons-Learned.

The performance self-assessment is to be generated by the responsible code team owner of the V&V process. The following recommended checklist might be useful in determining possible input to the self-assessment:

1. Have you written a V&V plan?
2. Have you done any work on V&V besides write a plan?
3. Is the work you have done in the plan?
4. What is working?
5. What has failed?
6. What is still an open issue?
7. How did you measure success and failure?
8. What are priorities for work following the review?
9. What are your critical needs?
10. Can you describe this in written form?
11. Can you restrict this write-up to less than or equal to six pages?

Section 1 should address overall progress to date including individual task success and project success. One key issue is whether the code team's V&V plan is progressing to a satisfactory extent from the point of view of the code project. Another concern is whether progress on the important individual elements of the V&V plan is contributing to the overall progress.

Section 2 of the self-assessment should discuss possible V&V success metrics. The key issue here is to elucidate how the code team measures (or intends to measure) success in its implemented V&V activities.

Section 3 of the self-assessment should address current or anticipated deviations of the code specific V&V activities from the baseline plan, including schedule and task deviations. Clear statements should be included about where revisions in the current plan might be needed or desirable, especially if the implementation is perceived to be behind schedule. What planned work is proving to be difficult to execute in the current written V&V plan? What are critical time or resource bottlenecks in implementing the current

V&V plan? How are these factors believed to influence the evolution of the current V&V plan? What are lessons learned?

A.2. Conformance Criteria for V&V Plan Content

The following conformance criteria for evaluating adherence of V&V plans to the Version 2.0 content guidelines have been discussed in [V&V-GUIDE-2_0]. We list them here for convenience.

For the Level 1 review, each reviewer individually scores the code's V&V plan against these criteria. Each of the items is given a score. (For the FY00 prototype, the scoring was: 0 – information not present; 1 – information present but incomplete; 2 – information present and complete. The scores were accumulated from all the panel members and presented to the code team as part of the final written assessment work product. There was no attempt to combine scores or present statistics – five raw scores for each criterion are delivered.) The observer member of the panel does not score the criteria.

A.2.1. General Guidelines

PR1	The V&V plan authorship includes the V&V process owner, and experimenter, and a DP customer representative.
PR2	The plan is compatible with the format specified in the Version 2.0 guidelines.
PR3	A single stockpile driver for the V&V plan is identified.
PR4	The V&V planning process is described.

A.2.2. Stockpile Drivers and DP Customer Requirements

PR3	A single stockpile driver for the V&V plan is identified.
DP1	The appropriate customers and constraints associated with the stockpile driver have been identified.
DP2	The detailed stockpile requirements been extracted from the stockpile driver.
DP3	The stockpile requirements have been mapped to M&S needs and requirements.
DP4	There are sufficient requirements to allow the development of a useful PIRT.

A.2.3. Phenomena Identification and Ranking Table (PIRT)

PIRT1	The PIRT is present in the V&V plan
PIRT2	The PIRT process methodology is described.
PIRT3	Phenomena in the PIRT are ranked by a rational scoring system.
PIRT4	Current M&S status (capability) for each of the phenomena in the PIRT is presented.

A.2.4. Software Quality Engineering

SQE	Content required by DOE and Sandia SQE policy documents is present.
SQE1	Software V&V
SQE2	Software Engineering
SQE3	Project Management

A.2.5. Verification Testing

VERTS	A Verification Test Suite has been constructed and documented.
VERTS1	The structure and logic of the VERTS is addressed.
VERTS1	The construction of the VERTS is addressed.

VERTS1	The acceptance metrics for the VERTS are addressed.

A.2.6. Validation Plan

VAL1	The relation between validation activities and the PIRT is defined.
VAL2	The data requirements associated with the validation activity are described.
VAL3	The known dependence of assessment of the fidelity of the code physical models upon experimental data is described.
VAL4	The opportunities and obligation for experimental investigation of the assumptions underlying the implemented physical models are discussed.
VAL5	The dependence of the code models upon experimentally measured quantities is discussed.
VAL6	The prioritized experimental needs are described.
VAL7	The anticipated use of technologies like uncertainty quantification in the validation activities is described.
VALTS	A Validation Test Suite is constructed and documented.
VALTS1	The structure of the VALTS is described. The structure is compatible with the PIRT and the four-tiered approach described in these guidelines.
VALTS2	The construction of the VALTS is addressed.
VALTS3	The acceptance metrics for the VALTS are addressed.

A.2.7. Stockpile Computing Guidance

GSC	Guidance for stockpile computing using the code is provided.
GSC1	Technical guidance for code application is provided.
GSC2	Process guidance for code application to the associated stockpile driver is provided.

A.3. Lessons Learned from FY00 Prototype Level 1 Peer Review Process

A.3.1. Comments on the FY00 prototype Level 1 reviews.

The Level 1 peer review panels were selected in March of 2000. Once formed, the panels were tasked with a memo that provided a schedule of peer review related activities and a list of work products to be delivered as part of the prototype peer review process. A particular element in the schedule was a formal training session.

That session lasted approximately two hours. The intent of the training was to prepare panel members for the specific peer review activities and provide them with guidance as to how to accomplish those activities. At the time of training, the input material required for the two prototype reviews – V&V plans and self-assessment performance documents – was given to the panel members. In addition, hard copies of the training material and work product templates were also distributed. (Work product templates were also provided electronically to facilitate their development during and after the peer review.)

Work products were delivered roughly on the anticipated schedule. Final development of the formal written feedback to the code teams and the final written report to the Sandia V&V program required additional meetings of the review panels after the actual days of the reviews. These extra meeting totaled less than one day of effort.

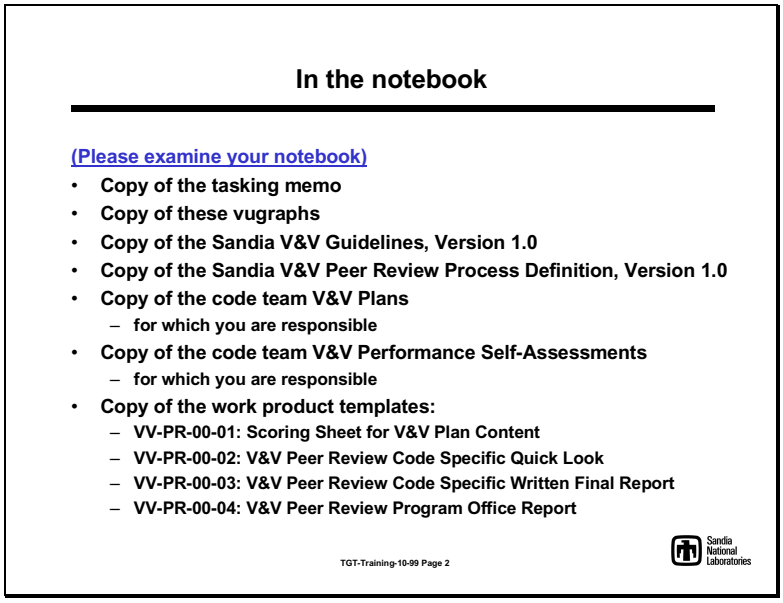
FY00 PEER REVIEW PROCESS FOR THE SANDIA V&V PROGRAM

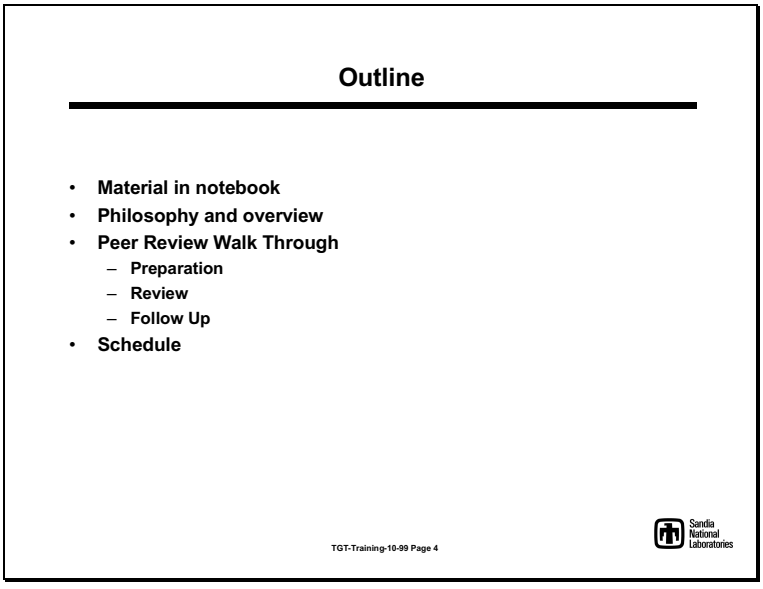
Representatives of the Sandia V&V program carefully observed the prototype reviews held in April 2000. A detailed set of recommendations based on lessons-learned was transmitted to the Sandia V&V program to aid in further refinement of the peer review process for its full scale Level 1 implementation in 2001. These recommendations also took into account the formal work product delivered to the program office by the review panels and the specific code team feedback regarding the peer review process. Below we include some of the specific recommendations that influenced the definition of the peer review processes in this report:

1. **Prototyping is Important:** One of the most important observations included here is that prototyping peer review processes is very important. Only Level 1 of the process has undergone a prototype at the time of writing of this report, and this observation is strongly based on the known influence that prototype had on the final Level 1 process defined here. It is expected that the prototypes of the Level 2 and Level 3 processes beginning in FY01 will influence the current definitions of these processes too.
2. **Training is Critical:** The prototype Level 1 process underscored the fact that careful training of the peer review panel is critical to the success of the peer review. The training material included here will be modified for the production implementation of the Level 1 in FY01 because of observed weaknesses in the training for the FY00 prototype.
3. **Scoring System was Confusing:** The scoring system for the conformance criteria defined above for the Level 1 peer review is known to be confusing. Part of the weakness of the system used for the prototype Level 1 review was that the conformance criteria were extracted from Version 1.0 of the V&V planning guidelines that did not specifically list these criteria. The planned Version 2.0 of the guidelines will correct this defect. In addition, it was observed that this scoring system was confusing to the code teams. However, it was also observed to be useful to the review panel in their deliberations. Earlier reviews of V&V plans were performed by the Sandia V&V program. In addition to scoring the same conformance criteria as defined in this appendix, this early review also provided itemized written comments for most of these criteria. This approach was not used in the Level 1 prototype, but may prove useful for future Level 1 reviews.
4. **Reviews Useful to DP Customer Participant:** The prototype Level 1 process gave major evidence that these reviews are a useful communication vehicle for the intended customers of the code. The opportunity for a DP customer representative to participate in the review is an important feature of the definition of this review.
5. **Review Process is Time Consuming:** A formal peer review process is time consuming. It is very clear that this is time that is very well spent if the process is as efficient as possible. The prototype Level 1 process demonstrated that the participation of personnel knowledgeable about the goals and processes of the Sandia V&V program is very important. In particular, it was observed that facilitation of panel activities by these personnel greatly increased the efficiency of the review activities.

APPENDIX B. Training Material for Level 1 Peer Review

Copies of most of the presentation material used at the Level 1 prototype training session are given below. This material has been sanitized to remove specific references to codes and personnel who participated in that prototype and will serve as the basis for future Level 1 peer review training.





Philosophy

- Goals:
  - Measure conformance of the V&V plans to the published guidelines
  - Assess performance on the execution of the plan
  - Provide feedback to the code project
  - Provide feedback to the V&V program office

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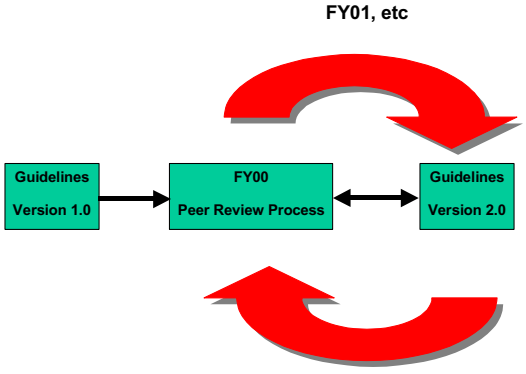
V&V Plans and Peer Review form a quality process of the Sandia ASCI V&V Program



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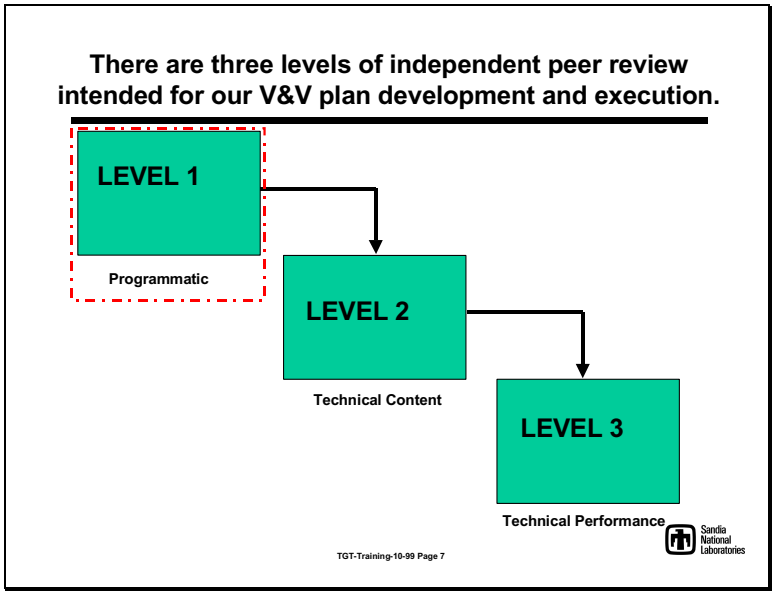
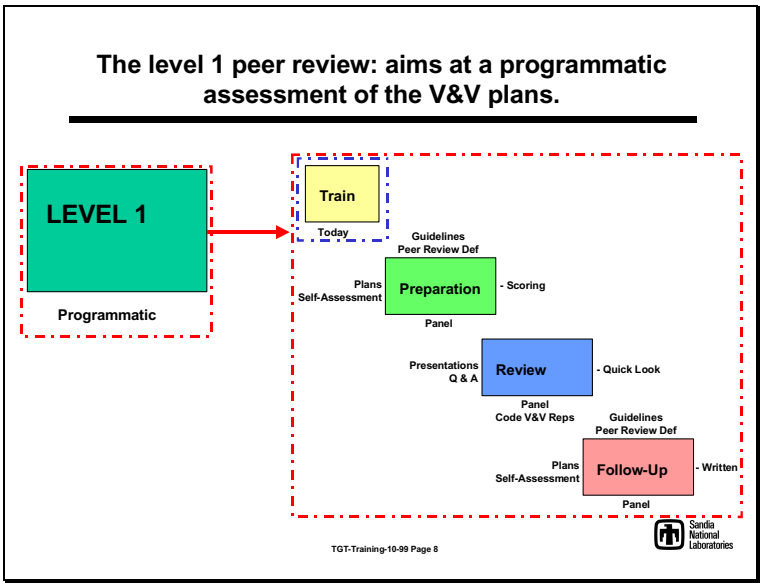
FY00 PEER REVIEW PROCESS FOR THE SANDIA V&V PROGRAM





Level 1 Peer Review: What and When

Codes to be reviewed
Code specific review materials
Dates for specific codes and their deliverable work products

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Level 1 Peer Review: Who

Core panel members
Rotating panel members (rotators)
Observers
Stakeholders

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Level 1 Peer Review: Roles and Responsibilities

- **Core members:**
  - **Tasked to assess both codes and develop work products for both codes**
  - **The chairman is responsible for**
    - **Facilitating the actual peer review and the delivery of the oral feedback work product**
    - **Integrating the panel feedback and leading the panel in the delivery of the written work products**
- **Rotators:**
  - **Tasked to assess their own code V&V Plan and develop associated work products**
- **Observers:**
  - **Tasked to perform an independent appraisal of the peer review process**
- **Program manager:**
  - **Overall authority for the peer review process and direct customer for the Program Office work product**

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Level I Peer Review Input: The Sandia V&V Guidelines recommend that V&V plans have content in the following areas:

- **V&V Programmatic Requirements**
- **Stockpile Drivers**
- **Phenomena Importance and Ranking Table (PIRT)**
- **Software Quality Engineering**
- **Verification plan**
- **Validation plan**

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Level 1 Peer Review Input: The Sandia V&V Peer Review Process Definition document describes the details of the review process

Given:

- Code V&V plans and performance self-assessments

The goals are:

- Assess the status of the code V&V projects with respect to development and maintenance of a documented V&V plan conforming to the published guidelines
- Assess the implementation status of that plan
- Assess programmatic performance or progress of the code on that implementation

The results are:

- Work products:
  - Score sheets
  - Quick look feedback to each code team
  - Written report to each code team
  - Written report to V&V program office (Martin Pilch, 9133)

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The Code Team V&V Performance Self-assessment is a device for measuring progress in implementing the plan:

The self-assessment should provide:

- An overview of V&V activity in FY00 (or FY99)
- Successes of the V&V plan and how success is measured (metrics)
- Challenges and lessons-learned for the V&V plan
- Future directions for the V&V activity

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Level 1 Peer Review Input: Summary

- Tasking provided you with:
  - Tasking memo
  - Sandia V&V Guidelines, Version 1.0
  - Sandia V&V Peer Review Process Definition, Version 1.0 (Draft)
- Training provides you with:
  - Copies of code V&V plans
  - Copies of code Performance Self-Assessments
  - Copies of training vugraphs
  - Copies (hard and electronic) of work product templates

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Level 1 Peer Review: Preparation

- The first steps in preparation are:
  - Reading the guidelines and peer review process definition document
  - Participation in the training
- The second steps in preparation are:
  - The panel members are responsible for reading the V&V plans and the performance self-assessments
  - Each individual panel member is responsible for scoring the V&V plans using the scoring sheet
  - Each individual panel member is responsible for developing preliminary input for the work product templates
- We estimate that it will take at least two working days per code to read the background material, study the plans, and perform individual scoring and individual work product template inputs.
- This preparation work must be performed prior to the actual peer review dates.

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Level 1 Peer Review: Review

- The anticipated review schedule is:

07:30 - 08:00 AM	Continental Breakfast (provided)
08:00 - 09:45 AM	Panel team meeting
09:45 - 10:00 AM	Break
10:00 - 12:00 Noon	Code presentation/Q&A
12:00 - 01:00 PM	Lunch (provided)
01:00 - 03:00 PM	Quick look feedback development
03:00 - 04:00 PM	Quick look feedback to code

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Level 1 Peer Review: Review Quick Look Oral Report

(Please turn to the template in your notebook)

- The purpose of this work product is to provide "Quick Look" feedback to the code project:
  - This is a preliminary summary version of the written feedback to the code projects.
  - No formal record of this feedback is required by the program office.
  - Must be accomplished the day of the review

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Level 1 Peer Review: Follow-up Scoring

(Please turn to the template in your notebook)

- Guidelines score sheet
  - We desire individual scoring of the V&V plans according to a three point scale.
  - We also desire general comments as applicable.
  - We would like individual scores and comments reported on the final scoring feedback to each code team.
  - Integrated scoring will be given to each code team
    - Each panel member's scores will be reported per item (no average statistics)
    - Integrated comments will be reported per item
  - Use the electronic scoring sheet template
    - Does anybody have trouble with using Microsoft Word?

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Level 1 Peer Review: Follow-up Code Team Written Reports

(Please turn to the template in your notebook)

- The purpose of this work product is to provide a final written report to the code project. It will be developed and communicated within approximately one week from the time of the review. It will consist of:
  - Score sheet roll up
  - General assessment of conformance to guidelines
  - General feedback on the performance self-assessment
  - Recommendations
  - Use the electronic template

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Level 1 Peer Review: Follow-up Program Office Written Report

(Please turn to the template in your notebook)

- The purpose of this work product is to provide written feedback to program office regarding the outcomes of the review:
  - General assessment of conformance to guidelines
  - General feedback on strengths and improvement areas for the V&V planning process
  - General feedback on strengths and improvement areas for the peer review process
  - General recommendations
  - Use the electronic work product template
- The program office will use your feedback to:
  - Improve the Guidelines
  - Improve the peer review process
- The Sandia V&V program is committed to long-term peer review as an essential measuring instrument for the V&V program at Sandia. Your feed back is a crucial component of our quality improvement process.

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Level 1 Peer Review: Process Summary

- Tasking and training
- Preparation
  - We estimate that it will take at least two working days to read the background material, study the plans, and perform individual scoring and comments.
  - This preparation work must be performed prior to the actual peer review dates of April 25 and 26.
- Review:
  - Approximately one day in duration
  - Required work products are quick look oral reports to each code team
- Follow-up
  - Required work products are written report for each code team and a summary written report to the program office.
  - Additional panel time will probably be required the week following the review to integrate individual inputs into the written work products.

The chairman will facilitate the review process to best achieve these outcomes.

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