

**POLICY ISSUE  
(Information)**

October 31, 2008

SECY-08-0169

FOR: The Commissioners

FROM: R. W. Borchardt  
Executive Director for Operations

SUBJECT: SEMIANNUAL UPDATE OF THE RISK-INFORMED AND  
PERFORMANCE-BASED PLAN

PURPOSE:

To provide the Commission with a periodic update on activities contained in the Risk-Informed and Performance-Based Plan (RPP) including a summary of the significant accomplishments achieved over the past 6 months and anticipated for the next 6 months. This paper does not propose any new commitments or associated resource implications.

BACKGROUND:

In a staff requirements memorandum dated June 1, 2006, and available in the Agencywide Documents Access and Management System (ADAMS) under Accession No. ML061520304, the Commission directed the staff to improve upon the Risk-Informed Regulation Implementation Plan (RIRIP), by developing an integrated master plan for activities designed to help the U.S. Nuclear Regulatory Commission (NRC) achieve its goal of a holistic, risk-informed, and performance-based regulatory structure. The Commission also directed the staff to seek ways to more transparently communicate to the public and stakeholders the purpose and use of probabilistic risk assessments (PRAs) in the agency's reactor, materials, and waste regulatory programs. SECY-07-0074, "Update on the Improvements to the Risk-Informed Regulation Implementation Plan," dated April 26, 2007 (ADAMS Accession No. ML070890396), conveyed that plan, which the staff retitled as the "Risk-Informed and Performance-Based Plan." To help meet the Commission's expectations for both a risk-informed and a performance-based regulatory structure, Enclosure 1 of SECY-07-0074 included explicit criteria for the staff's review

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and consideration of performance-based approaches to help determine which initiatives should be both risk informed and performance based. In addition, the RPP provides for the performance and documentation of an effectiveness review following the completion of selected projects to assess their success in achieving the stated objectives. SECY-07-0191, "Implementation and Update of the Risk-Informed and Performance-Based Plan," dated October 31, 2007 (ADAMS Accession No. ML072700587), discussed the staff's progress in implementing the RPP. It included an updated set of objectives, bases, and goals for the reactor, materials, and waste regulatory arenas. In November 2007, the staff completed its commitment to make all aspects of the RPP, including these objectives, bases, and goals, available to the general public via the agency's public Internet site.

#### DISCUSSION:

The format of this report is similar to previous RPP reports in that most of the information is now located on NRC's public Web site. This site provides a readily accessible, comprehensive explanation and overview of the agency's risk-informed and performance-based regulatory activities and reflects the current status of the agency's risk-informed and performance-based activities.

#### Significant Accomplishments

The enclosure, "Recent Accomplishments and Near-Term Anticipated Accomplishments," summarizes the major risk-informed and performance-based initiatives that staff has completed over the past 6 months, as well as those activities planned for the next 6 months.

#### Effectiveness Reviews

The staff has not performed any effectiveness reviews since the last RPP update, SECY-08-0061, dated April 30, 2008.

#### Potential New Policy Issues

The licensing and safety basis for the next generation nuclear plant (NGNP) will follow 10 CFR 52 and will be risk informed and performance based. The staff anticipates that new policy issues associated with the development and implementation of the risk-informed and performance-based approach will arise. As new policy issues are identified, the staff will bring them to the Commission for consideration.

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COORDINATION:

The Office of the General Counsel has reviewed this paper and has no legal objection. The Office of the Chief Financial Officer has reviewed this paper for resource implications and has no objections.

*/RA Martin Virgilio for/*

R. W. Borchardt  
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Enclosure:  
Recent Accomplishments and Near-Term  
Anticipated Accomplishments

## Recent Accomplishments and Near-Term Anticipated Accomplishments

This summary highlights the major risk-informed and performance-based initiatives that the staff of the U.S. Nuclear Regulatory Commission (NRC) is currently working on or has recently completed.

### 1. Fire Protection for Nuclear Power Plants

In 2004, the Commission approved a voluntary risk-informed and performance-based fire protection rule for existing nuclear power plants. The rule endorsed a National Fire Protection Association (NFPA) consensus standard, NFPA 805, "Performance-Based Standard for Fire Protection for Light Water Reactor Electric Generating Plants." In addition, the Nuclear Energy Institute (NEI) developed NEI 04-02, "Guidance for Implementing a Risk-Informed, Performance-Based Fire Protection Program Under 10 CFR 50.48(c)," dated September 30, 2005, which the staff endorsed in Regulatory Guide (RG) 1.205, "Risk-Informed, Performance-Based Fire Protection for Existing Light-Water Nuclear Power Plants," issued May 2006. The staff is working with two pilot sites (the Oconee and Shearon Harris nuclear power plants) and developed a frequently asked question (FAQ) process for resolving implementation issues. To date, 48 operating nuclear power units have submitted letters of intent to adopt NFPA 805 as their licensing basis.

The staff continues its effort to implement the risk-informed fire protection rule. During the past six months, the staff conducted a regional inspector workshop, a pilot plant observation visit, six public FAQ meetings with the NEI-805 task force, and a review of the fire probabilistic risk assessment (FPRA) for the Oconee plant and received the NFPA 805 License Amendment Requests (LARs) for Shearon Harris and Oconee.

The staff requested and obtained Commission approval to extend enforcement discretion such that certain non-pilot plants will have a 6-month window to implement lessons learned from the NFPA 805 pilot plant LARs.

Over the next several months, the staff expects to continue the review of the Shearon Harris and Oconee NFPA 805 LARs and conduct public meetings to share insights gained from the plant LARs with the non-pilot plants.

### 2. Digital Systems Probabilistic Risk Assessment

The Risk-Informing Digital Instrumentation and Control Task Working Group (TWG), in support of the Digital Instrumentation and Control Steering Committee, is addressing issues related to the risk assessment of digital systems. In this effort, the TWG is placing particular emphasis on risk-informing digital system reviews for operating plants and new reactors. The TWG efforts will be consistent with NRC's Policy Statement on Probabilistic Risk Assessment, which states in part that the agency supports the use of PRA in regulatory matters "to the extent supported by the state-of-the-art in PRA methods and data and in a manner that complements the NRC's deterministic approach and supports the NRC's traditional defense-in-depth philosophy." Toward that end, the TWG issued an updated project plan on March 14, 2008. The TWG has

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held 13 public meetings with industry stakeholders since April 2007. On December 3, 2007, the staff issued the draft interim staff guidance (ISG) for new reactors for public comment. This ISG is intended for use in reviewing current methods in modeling digital systems for design certification and combined license (COL) application PRAs. The TWG discussed the draft ISG with stakeholders in public meetings held in February, March, and May 2008 and with the Advisory Committee on Reactor Safeguards (ACRS) on March 20, 2008, and May 11, 2008. The TWG also supported a Commission brief on April 7, 2008. After addressing ACRS and industry comments, the staff issued the TWG ISG on August 11, 2008.

The ACRS also provided comments during two briefings by the staff on the application of traditional PRA methods to digital systems (April 17, 2008, and May 8, 2008). The ACRS emphasized the importance of failure mode identification, the limitations of sensitivity studies that dealt with probabilities, the usefulness of available failure rate data sources, and the current limitations of "traditional" PRAs in identifying failure modes. Given the ACRS comments and the staff's concerns, the staff is reassessing the problem statement and associated project plan on the application of current PRA methods to risk-inform specific digital systems issues for operating reactors. The concern is that given the stated limitations in PRA technology, the development and implementation of a risk-informed methodology per the current project plan using traditional PRA methods may be premature. However, the staff continues its research into PRA methodologies for assessment of digital system risk and plans to publish two NUREG-series reports—one on approaches for using traditional PRA methods for digital systems and another that benchmarks two dynamic methodologies for reliability modeling of digital systems. The staff completed the first report in August 2008 and will finish the second report in October 2008. These two reports continue the agency's overall effort to advance the state of the art in digital systems risk and reliability modeling to enable the use of risk-insights in licensing reviews of digital systems and to incorporate related models into nuclear power plant PRAs. In addition, the staff received a Nuclear Energy Institute (NEI) white paper on May 12, 2008, that compared industry approaches to modeling digital systems to draft staff criteria and review guidelines. The staff received a second NEI white paper on May 19, 2008, that assessed the benefits and risks of diverse actuation system functions. Both NEI white papers were issued in support of the project plan and will be considered as the staff continues work to identify potential review areas where risk insights from PRA modeling of digital systems may be applicable to staff reviews of operating plants and new reactors.

### 3. Human Reliability Analysis

The staff is addressing issues associated with the differences in the many human reliability analysis (HRA) methods available for quantifying human failure events in a PRA. In addition to supporting the agency's plan to stabilize and enhance PRA quality, the staff also is following up on a Commission staff requirements memorandum (SRM) (M061020) to evaluate different HRA models in an effort either to identify a single one as acceptable for use or to provide guidance as to when each should be used. The staff supports and participates in the International HRA Empirical Study, an experimental study performed collaboratively by about a dozen regulatory and industry organizations and members of the Halden Reactor Project. This study involves the collection of reactor operator crew performance observations and comparison with the results of different HRA methods used to evaluate the actions involved in simulated scenarios. The pilot phase of this study was documented in the draft NUREG/IA-0216/HWR-844. The staff expects the study will be completed by December 2010. The staff plans to document the methodology and results of the study in a final NUREG/IA to be submitted for publication in December 2011.

The staff also has established a Memorandum of Understanding (MOU) with the Electric Power Research Institute (EPRI) to work together to identify areas where HRA has a significant impact on regulatory decisionmaking. Since the Commission directed the Advisory Committee on Reactor Safeguards (ACRS) in SRM (M061020) to “work with the staff and external stakeholders to evaluate the different human reliability models in an effort to propose a single model for the agency to use or guidance on which model(s) should be used in specific circumstances,” the staff will present its findings to the ACRS for their review.

#### 4. Risk-Informed Technical Specifications

The staff continues to work on the risk-informed technical specifications initiatives to add a risk-informed component to the standard technical specifications (STS). The following summaries highlight the major accomplishments in this area:

- Initiative 1, “Modified End States,” would allow licensees to repair equipment during hot-shutdown rather than cold-shutdown. The topical reports supporting this initiative for boiling-water reactor (BWR), Combustion Engineering (CE), and Babcock & Wilcox (B&W) plants have been approved, and revisions to the BWR and CE STS have been made available. The Westinghouse topical report submitted in September 2005 is currently under review and we anticipate that the review will be completed in fall 2008, while revisions to the B&W STS are expected to be issued in fall 2008.
- Initiative 4b, “Risk-Informed Completion Times,” modifies technical specification completion times to reflect a configuration risk management approach that is more consistent with the approach described in the Maintenance Rule, as specified in Title 10, Section 50.65(a)(4), of the *Code of Federal Regulations*. As reported previously in SECY-07-0191, “Implementation and Update of the Risk-Informed and Performance-Based Plan,” dated October 31, 2007, the staff issued the license amendment for the first pilot plant, South Texas Project, in July 2007. The staff expects the submittal for the second pilot plant, Fort Calhoun Station, in fall 2008.
- Initiative 5b, “Risk-Informed Surveillance Frequencies,” relocates surveillance test intervals to a licensee-controlled document and provides a risk-informed method to change the intervals. The staff approved the industry’s guidance document (Revision 0 of NEI 04-10, “Risk-Informed Technical Specifications Initiative 5B, Risk-Informed Method for Control of Surveillance Frequencies”) in September 2006, along with the license amendment for the pilot plant, Limerick Generating Station. Revision 1 of NEI 04-10, which relocates staggered testing requirements and makes other administrative changes, was approved in September 2007. In addition, the staff is currently reviewing the associated Technical Specification Task Force guidance (TSTF-425) to revise the STS, which the staff expects to approve and make available via the consolidated line item improvement process in fall 2008.
- Initiative 6, “Modification of Limiting Condition for Operation (LCO) 3.0.3, ‘Actions and Completion Times,’” revises the surveillance requirement LCO by requiring that risk be considered in determining the correct course of action. A revised CE topical report was submitted for staff review in December 2007. That topical report if approved would support a future revision of the CE STS to incorporate this initiative.

## 5. Risk-Informed Rulemaking and Related Activities Currently in Progress

The staff continues to work on several risk-informed rulemaking initiatives. The following summary highlights major accomplishments.

- The staff prepared a proposed rule containing emergency core cooling system evaluation requirements, which could be used as an alternative to the current requirements in 10 CFR 50.46, "Acceptance Criteria for Emergency Core Cooling Systems (ECCS) for Light-Water Nuclear Power Reactors." That proposed rulemaking is designed to redefine the large-break loss-of-coolant accident (LOCA) requirements to provide a risk-informed alternative maximum break size. In October 2006, the staff produced a draft final rule and briefed the ACRS. In response, the ACRS recommended that the Commission should not issue the proposed rule in its present form. As a result, the staff prepared SECY-07-0082, "Rulemaking To Make Risk-Informed Changes to Loss-of-Coolant Accident Technical Requirements: 10 CFR 50.46a, 'Alternative Acceptance Criteria for Emergency Core Cooling Systems for Light-Water Nuclear Power Reactors,'" dated May 16, 2007, which provided a plan (including resource and schedule estimates) for responding to the ACRS recommendation and related comments. Then, in an SRM related to SECY-07-0082 dated August 10, 2007, the Commission agreed with the staff's recommendation that completing the rulemaking should be assigned a medium priority. Nonetheless, the SRM also directed that the staff continue to make progress on the 10 CFR 50.46 rulemaking and to apply resources to the effort in FY 2008. On April 1, 2008, the Executive Director for Operations provided the staff's schedule for completing the final rule to the Commission. The staff currently intends to provide a final rule to the Commission in September 2009, but this may be delayed by six months to address public comments.
- On October 3, 2007, the staff published a proposed rulemaking on "Alternate Fracture Toughness Requirements for Protection Against Pressurized Thermal Shock Events." The proposed rule contains a new paragraph 10 CFR 50.61a that will provide new requirements that a pressurized-water reactor licensee could voluntarily use as an alternative to complying with the existing requirements. NRC received over 40 comments during the public comment period that ended on December 17, 2007. Some comments recommend major changes to the rule such as deleting the requirements that licensees identify and document the distribution of flaws in their reactor vessel and use a data-based trend curve contained in the rule. The use of the trend curve in the rule was changed and the rule re-noticed on August 11, 2008 (73-FR-46557). Three comments were received during the comment period which closed September 10, 2008. The final rule is scheduled to be provided to the Executive Director for Operations in March 2009.
- By letter dated January 26, 2006, the Westinghouse Owners Group, later the Pressurized-Water Reactor Owners Group (PWROG), submitted topical report WCAP-16168-NP, Revision 1, "Risk-Informed Extension of the Reactor Vessel In-Service Inspection Interval." The PWROG topical report provides the technical and regulatory basis for decreasing the frequency of inspections by extending the American Society of Mechanical Engineers Boiler and Pressure Vessel Code (ASME Code) Section XI in-service inspection interval for reactor vessel welds from the current 10 years to 20 years for ASME Code Section XI, Category B-A and B-D, reactor vessel welds. The staff completed its review of the topical report and issued its final safety evaluation on May 8, 2008 (ADAMS Accession No. ML081060053).

## 6. Analytical Tools for Risk Applications

The Systems Analysis Programs for Hands-on Integrated Reliability Evaluations (SAPHIRE) is a software application developed for performing PRA using a personal computer running the Windows operating system. SAPHIRE is used to model a plant's response to initiating events or conditions and to quantify associated consequential outcome frequencies. Over the past 6 months, SAPHIRE Version 8 was released for beta testing. SAPHIRE Version 8 features and capabilities address new code requirements in support of risk-informed programs, including the development of a user interface for significance determination process (SDP) Phase 2 assessments. Also, an improved common-cause failure module contained in Version 7 was completed in September 2008.

## 7. Reactor Performance Data Collection

The Industry Trends Program Support program uses data collected from Licensee Event Reports, the Institute of Nuclear Power Operations' Equipment Performance and Information Exchange (EPIX) System, and Monthly Operating Reports to develop current estimates of industry and plant-specific system and component reliabilities, initiating event frequencies, common-cause failure parameters, and fire event frequencies. These types of data are important for implementing a performance-based approach to regulation. In the coming months, the staff will update NRC's public Internet site with the 2007 estimates, trends, charts, graphs, and summary tables for the industrywide data. In addition to the previous system and component studies published on the Web site, the staff will provide reliability data for over 50 components and initiating events that are used in the Standard Plant Analysis Risk Models. New studies that will be added as part of the annual update will be a loss of offsite power frequency study and a relief valve reliability study.

This program also produces guidance and data for the Risk Assessment Standardization Project (RASP). The RASP is developing standard procedures and methods for risk assessment of inspection findings and reactor incidents. Such procedures and methods can be used to implement the performance-based aspects of the NRC's regulatory practice in activities such as the reactor oversight process. In the coming months, the staff plans to issue the following NUREG series reports to provide guidance for RASP:

- "Estimating Pipe Break Loss-of-Coolant Accident Frequencies Using NUREG-1829 Information."
- "Common-Cause Failure Analysis in Event Assessment."
- "Data Guidance for the Risk Assessment Standardization Project."

Over the past 6 months, the staff updated the Nuclear Plant Reliability Data System with FY 2008 data and incorporated the latest licensee event reports (LERs) into the LERSearch database so that it now reflects LERs from 1981 through June 2008. The staff has enhanced LERSearch, the LER search system on the NRC internal Web site, to provide additional search options and provide more risk-related operational data.

## 8. SPAR Model Development and Risk Assessment Standardization Project

Standardized plant analysis risk (SPAR) models are plant-specific PRA models that model accident sequence progression, plant systems and components, and plant operator actions.

The standardized models represent the as-built, as-operated plant and, as such, permit the staff to perform risk-informed regulatory activities by independently assessing the risk of events or degraded conditions at operating nuclear power plants. Over the past 6 months, the staff accomplished the following:

- Completed initial cutset-level review of all SPAR models (except four models held back because of licensee delays in updating their models).
- Initiated revised Level 2/large early release frequency (LERF) model development for selected plant types. The staff has incorporated containment systems and plant damage states for five Level 1 SPAR models in support of level 2 model development. The staff plans on completing three level 2 models in January 2009.
- Continued the cooperative research activities under the Office of Nuclear Regulatory Research/EPRI MOU addendum to address resolution of key technical issues with the industry. The staff, working with industry, plans to jointly issue the first guidance document on Support System Initiating Events in January 2009.
- Completed data update of all SPAR models based on NUREG/CR-6928, "Industry-Average Performance for Components and Initiating Events at U.S. Commercial Nuclear Power Plants," issued February 2007.
- Completed new next-generation low-power/shutdown (LP/SD) models for two plants.
- Completed and made publicly available the RASP Handbook Volume 1, Part 1 "Internal Events Analysis"; Volume 2, "External Events Analysis"; and Volume 3, "SPAR Model Reviews" (checklists).
- Made operational the RASP Tool Box Web page that provides Web links to tools and access to references for senior reactor analysts and others.

In FY 2009, the staff plans to continue implementing enhancements to the Revision 3 SPAR models and to complete additional external events and LP/SD models to support the Accident Sequence Precursor (ASP) Program and the Significance Determination Process.

The staff has begun the development of new reactor SPAR models in response to a recent user need from the Office of New Reactors (NRO), "Development of Standardized Plant Analysis Risk Models for New Reactors," dated March 25, 2008. Prior to new plant operation, the NRC staff may need to perform risk assessments to evaluate risk-informed applications after COL issuance.

## 9. Phased Approach to Probabilistic Risk Assessment Quality

The increased use of PRAs in NRC's regulatory decisionmaking process requires consistency in the quality, scope, methodology, and data used in such analyses. A key aspect of implementing a phased approach to PRA quality is the development of PRA standards and related guidance documents. To achieve that objective, professional societies, the nuclear industry, and the staff have undertaken initiatives to develop national consensus standards and guidance on the use

of PRA in regulatory decisionmaking. Since ASME and ANS recognize the importance of a NRC endorsed PRA standard for risk-informed regulation, they requested, in a letter dated October 6, 2008, that the Commission extend the public review and comment period to the end of December 2008.

ASME and ANS recently published a joint PRA standard, "Level 1 and Large Early Release Frequency (LERF) PRA Standard" (ASME/ANS RA-S-2008), which applies to at-power internal events, internal fire events, and external events for operating reactors. In addition, NEI recently published Revision 1 to NEI 05-04 ("Process for Performing Follow-on PRA Peer Reviews Using the ASME PRA Standard") and Revision 0, Version F of NEI 07-12 ("Fire Probabilistic Risk Assessment [FPRA] Peer Review Process Guidelines").

In June 2008, the staff completed draft guide (DG-1200) and issued it for public review and comment. DG-1200, when finalized, will be Revision 2 of RG 1.200, "An Approach for Determining the Technical Adequacy of Probabilistic Risk Assessment Results for Risk-Informed Activities." This revision will endorse the joint ASME/ANS PRA standard (RA-S-2008) and the NEI guidance documents.

In conjunction with development of Revision 2 of RG 1.200, the staff has been developing a Web-based training on RG 1.200. It is scheduled to be available on the same time frame as Revision 2.

ASME and ANS continue to work on other PRA standards:

- Level 1/LERF standard for internal events at low-power and shutdown conditions for operating reactors.
- Level 1 and Large Release Frequency for at-power internal and external events for new reactors.
- Level 2 and Level 3 for at-power internal events for operating reactors.
- Levels 1, 2, and 3 for internal and external events for all operating modes for advanced non-light-water reactors.

The staff is supporting these efforts and will consider endorsing these standards, once issued, in a future revision to Regulatory Guide 1.200.

The staff also is working with ASME in development of training on the ASME/ANS PRA standard. The Web-based training will be available in late 2008, with classroom training to follow.

In November 2007, the staff issued draft NUREG-1855, "Treatment of Uncertainties from PRAs in Risk-Informed Decision-Making," for public review and comment. The NRC report and a complimentary EPRI report are meant to provide guidance on meeting the requirements in the ASME/ANS PRA standard on uncertainties and to provide guidance on how to treat the results from the uncertainty analyses in decisionmaking for risk-informed activities. The staff held two public meetings and plans to issue a final version in late 2008.

## 10. New Reactor License Application Reviews

In June 2008, the staff issued an ISG (ADAMS Accession No. ML081430675) on PRA information necessary to support design certification and combined license applications. This ISG was the result of public meetings held during 2007 and is intended to clarify new PRA regulatory changes and the associated regulatory guidance. The staff reviewed public comments and held an additional public meeting in May 2008 to support issuing the final ISG.

## 11. Advanced Reactor Regulatory Structure

The staff issued NUREG-1860, "Feasibility Study for a Risk-Informed and Performance-Based Regulatory Structure for Future Plant Licensing," Volumes 1 and 2, in December 2007. This NUREG documents a framework that provides an approach, scope, and criteria that could be used to develop an alternative set of risk-informed and performance-based requirements to 10 CFR Part 50, "Domestic Licensing of Production and Utilization Facilities," for future nuclear power plants. Part of the framework establishes a probabilistic approach for identifying design basis events (i.e., Anticipated Operational Occurrences and Design Basis Accidents). The staff is developing a draft regulatory guide using the approach from the framework. This draft guide is scheduled to be complete for internal NRC review at the end of 2008.

The licensing strategy for the next generation nuclear plant (NGNP) that was issued on August 14, 2008, also includes a discussion regarding the use of risk insights during the licensing of the NGNP prototype facility. The information obtained during these limited activities may be useful during the formulation of the staff's recommendation to the Commission in 2009 on developing risk-informed and performance-based requirements for advanced reactors.

## 12. HRA Development for Fire PRA

Under a joint MOU, NRC's Office of Nuclear Regulatory Research and EPRI have embarked on a cooperative program to improve the state-of-the-art in fire risk studies. This program produced a joint document, EPRI 1011989 & NUREG/CR-6850, entitled "Fire PRA Methodology for Nuclear Power Facilities" that addresses fire risk for at-power operations. Because this joint NRC/EPRI report does not describe a methodology for developing best-estimate human failure probabilities, a new effort is underway to develop such a methodology and associated guidance, including peer review and testing. The results of this HRA methodology development effort is expected to support the NFPA 805 transition initiative and possible resolution of other regulatory issues, such as multiple spurious operation and operator manual actions.

Over the past 6 months, a draft report was issued in May 2008 and the first peer review was performed in June 2008. Testing on the selected plants was initiated in August 2008. Over the next 6 months the staff will respond to peer review comments and results from testing, and perform an internal NRC review.