

UNITED STATES NUCLEAR REGULATORY COMMISSION WASHINGTON, D.C. 20555-0001

October 22, 2012

SECRETARY

COMMISSION VOTING RECORD

DECISION ITEM: SECY-12-0081

TITLE: RISK-INFORMED REGULATORY FRAMEWORK FOR NEW REACTORS

The Commission acted on the subject paper as recorded in the Staff Requirements Memorandum (SRM) of October 22, 2012.

This Record contains a summary of voting on this matter together with the individual vote sheets, views and comments of the Commission.

Annette L. Vietti-Cook Secretary of the Commission

Attachments:

- 1. Voting Summary
- 2. Commissioner Vote Sheets
- cc: Chairman Macfarlane Commissioner Svinicki Commissioner Apostolakis Commissioner Magwood Commissioner Ostendorff OGC EDO PDR

VOTING SUMMARY - SECY-12-0081

RECORDED VOTES

	APRVD	DISAPRVD	ABSTAIN	NOT PARTICIP	COMMENTS	DATE	
CHRM. MACFARLANE	Х	Х			Х	10/1/12	
COMR. SVINICKI	х				Х	10/4/12	1
COMR. APOSTOLAKIS	Х	Х			Х	8/30/12	
COMR. MAGWOOD	Х	Х			Х	9/19/12	
COMR. OSTENDORFF	х				Х	9/13/12	

RESPONSE SHEET

TO: Annette Vietti-Cook, Secretary

FROM: Chairman Allison M. Macfarlane

SUBJECT: SECY-12-0081 – RISK-INFORMED REGULATORY FRAMEWORK FOR NEW REACTORS

Approved X Disapproved X Abstain ____

Not Participating _____

COMMENTS: Below ____ Attached X None ____

10/1/12

Entered on "STARS" Yes X No ____

Chairman Macfarlane's Comments SECY-12-0081, "Risk-Informed Regulatory Framework for New Reactors

I join my fellow Commissioners in commending the staff on the significant efforts associated with responding to the Commission's direction in the Staff Requirements Memorandum for SECY-10-0121, "Modifying the Risk-Informed Regulatory Basis for New Reactors. I would especially like to thank the staff and stakeholders that participated in the extensive series of tabletop exercises to explore the effectiveness of our current risk-informed regulatory processes when applied to new reactor designs.

I approve the staff's Recommendation 1, to address the potential gap in the Tier 2 change process associated with non-ex-vessel severe accident features for new reactors. In addition, I approve the staff's Recommendation of Option 2C, concerning the transition from Large Release Frequency to Large Early Release Frequency, for applications of the current risk-informed framework for licensing applications, at or before initial fuel load.

I disapprove the staff's recommendation of Option 3B. I share Commissioner Apostolakis' concerns with regard to the staff's recommendations regarding the Reactor Oversight Process. Inspection Manual Chapter 0308, discusses the objectives behind the development of the Reactor Oversight Process. In section 05.01, it states:

The objectives of the staff in developing the various components of this new oversight process were to provide tools for inspecting and assessing licensee performance in a manner that was more risk-informed, objective, predictable, and understandable than the previous oversight processes.

In addition, section 05.06 of Inspection Manual Chapter 0308 discusses the development of a risk-informed scale. Among the primary attributes of the concept were that "the scheme should include multiple levels with clearly defined thresholds to allow unambiguous observation and assessment of declining (or improving) performance." The staff reports in SECY-12-0081 that the tabletop exercises conducted in response to SECY-10-0121 indicated that the current action matrix is somewhat insensitive to inspection findings for new reactors noting that, "greater-than-green inspection findings would likely involve common cause failures that affect multiple systems and/or long exposures of risk-significant components."

The staff also reported in SECY-12-0081 that, "the current Mitigating System Performance Indicator (MSPI) is not adequate and would be largely ineffective in determining an appropriate regulatory response for active new designs. Furthermore, a meaningful MSPI may not even be possible for passive systems using the current formulation of the indicator." None of the other performance indicators were addressed in the paper, leaving open the question of the effectiveness of the remaining performance indicators in providing early identification of performance issues in new reactors.

Throughout the paper, the staff proposes to utilize "deterministic backstops" to address the issues discussed above. These backstops are undefined in SECY-12-0081 and the technical basis for their efficacy in ensuring appropriate regulatory responses to performance deficiencies has not been presented. The use of these backstops also tends to result in a Reactor Oversight Process that would be more deterministic in nature as opposed to being a risk-informed process.

I recognize that this is the second time that the staff has brought this issue before the Commission in recent years. In the Staff Requirements Memorandum for SECY-10-0121. "Modifying the Risk-Informed Regulatory Guidance for New Reactors," the Commission reaffirmed that "the existing safety goals, safety performance expectations, subsidiary risk goals and associated risk guidance (such as the Commission's 2008 Advanced Reactor Policy Statement and Regulatory Guide 1.174), key principles and quantitative metrics for implementing risk-informed decision making, are sufficient for new plants."

The 1986 version of the Advanced Reactor Policy Statement stated the Commission's expectation that the next generation of light-water reactors would be safer than the existing plants. The 2008 Advanced Reactor Policy Statement modified the Commission's expectation to provide that, at a minimum, the next generation of light-water reactors would provide at least the same degree of protection of the environment and public health and safety and the common defense and security that is required for the current operating fleet. I believe that this policy shift may be driving some of the difficulties associated with applying risk metrics developed for the operating fleet to the Reactor Oversight Process for new reactors. I have concerns that the staff's recommendation of Option 3B in SECY-12-0081 will result in a Reactor Oversight Process that is less responsive to performance issues in new reactors than desirable. This concern results, in part, from the lack of information available to support the efficacy of the staff's proposed approach.

Therefore, I join Commissioner Apostolakis in requesting a Commission Paper addressing:

- 1. A technical basis for the staff's proposal for the use of deterministic backstops;
- 2. A technical evaluation of the use of relative risk measures, including a reexamination of the pros and cons listed in the staff's 2009 white paper; and
- 3. A discussion of the appropriateness of the existing performance indicators and the related thresholds for new reactors.

In addition, I join Commissioner Magwood in requesting a review of the practices and approaches developed under the Reactor Oversight Process, especially as they relate to their application to new reactors.

RESPONSE SHEET

- TO: Annette Vietti-Cook, Secretary
- FROM: COMMISSIONER SVINICKI
- SUBJECT: SECY-12-0081 RISK-INFORMED REGULATORY FRAMEWORK FOR NEW REACTORS

Approved XX Disapproved Abstain _____

Not Participating _____

COMMENTS: Below ____ Attached _XX_ None ____

10/4/12 DATE

Entered on "STARS" Yes 📈 No ____

Commissioner Svinicki's Comments on SECY-12-0081 Risk-Informed Regulatory Framework for New Reactors

I approve the staff's recommendations contained in SECY-12-0081. I join Commissioner Ostendorff in commending the staff for their diligent adherence to the Commission's prior direction in response to SECY-10-0121, "Modifying the Risk-Informed Regulatory Guidance for New Reactors." That direction, in my reading, is exceedingly clear in specifying that the current operating reactor risk metrics should apply to new reactors.

As I stated in my vote on SECY-12-0121, "From my review of relevant history, I believe the Commission has been consistent in maintaining that new reactors should not be measured against a lower quantitative risk threshold than operating reactors." Based on the information now provided, I conclude that the extensive, table-top exercises -- directed by the Commission and conducted by the staff and other participants -- have successfully validated the adequacy and appropriateness of our quantitative thresholds and metrics. I also share Commissioner Ostendorff's observation that the insights from our state-of-the-art reactor consequence analyses (SOARCA) expose the conservatisms underlying the historic application of severe accident phenomena and consequence models and substantiate the conclusion that quantitative risk thresholds need not be further lowered.

While I appreciate the fulsome input from the Commission's Advisory Committee on Reactor Safeguards, to which I have given careful weight and consideration, I do not find the Committee's arguments sufficiently persuasive to justify revising the Commission's well-ventilated and longstanding approach. Consequently:

- I approve the staff's plan to address the potential gap in the Tier 2 change process by a) ensuring that there are sufficient details on all key severe accident features in Tier 1 and b) including a change process in future design certification rulemaking in Section VIII for non-ex-vessel severe accident features similar to Section VIII.B.5.c for ex-vessel severe accident features.
- 2) I approve the staff's recommendation (Option 2C) to transition from large release frequency to large early release frequency at or before initial fuel load and discontinue regulatory use of large release frequency and conditional containment failure probability thereafter.
- 3) I approve the staff's recommendation (Option 3B) to continue to use the existing riskinformed Reactor Oversight Process tools and to augment the qualitative tools with deterministic backstops to ensure an appropriate regulatory response for the new reactor designs. These deterministic backstops will be consistent with the licensing basis and the existing defense-in-depth, safety margins, and other traditional engineering principles described in Regulatory Guide 1.174.

I look forward to the paper, to be provided by the staff one year before the scheduled implementation of these changes, to describe any proposed guidance modifications within the Reactor Oversight Process.

istine L. Svinicki

RESPONSE SHEET

- TO: Annette Vietti-Cook, Secretary
- FROM: Commissioner Apostolakis

SUBJECT: SECY-12-0081 – RISK-INFORMED REGULATORY FRAMEWORK FOR NEW REACTORS

- Approved X Disapproved X Abstain _____
- Not Participating _____
- COMMENTS: Below ____ Attached X_ None ____

SIGNATI

	8/3	0/12		
DA	TE			

Entered on "STARS" Yes x No ____

Commissioner Apostolakis' Comments on SECY-12-0081 Risk-Informed Regulatory Framework for New Reactors

I acknowledge the significant work the staff has performed to implement the Commission's guidance in the SRM for SECY-10-0121 on the regulatory framework for new reactors. In particular, the extensive effort put forth by the staff to develop and conduct the tabletop exercises is impressive.

I approve the staff's recommendations related to the Tier 2 change process for new reactors and the transition from large release frequency to large early release frequency, LERF (Option 2C).

With regard to the issue of how to apply the risk-informed regulatory framework of the Reactor Oversight Process (ROP) to new reactors, I cannot, without a stronger technical basis, support the staff's recommendation to use the existing risk-informed ROP tools, augmented by deterministic backstops, to ensure an appropriate regulatory response for the new reactor designs. In current risk-informed initiatives, backstops are used as defense-in-depth measures. It is far from clear what role they would play in an oversight process.

In SECY-12-0081, the staff stated that the tabletops demonstrated that current risk thresholds for determining the significance of inspection findings are generally acceptable. Furthermore, although greater-than-green thresholds could be crossed for new reactors, these greater-than-green inspection findings would likely involve common-cause failures that affect multiple systems and/or long exposures of risk-significant components. The implication is that crossing the threshold from green to white would be very rare, contrary to the objective of an effective oversight process. The staff also found that the existing process does not always ensure an appropriate regulatory response for degradation of passive components and barriers. The staff concluded that the Significance Determination Process (SDP) analyses could be augmented with additional qualitative considerations (such as deterministic backstops) to appropriately address performance issues. The staff has not provided a sufficient technical basis for this proposal.

In SECY-12-0081, the staff lists the following as some of the key tenets of the ROP: "(1) to improve the objectivity of the oversight processes so that subjective decisionmaking is minimized, (2) to improve the scrutability and predictability of U.S. Nuclear Regulatory Commission (NRC) actions so that regulatory response has a clear tie to licensee performance, and (3) to risk-inform the processes so that NRC and licensee resources are focused on performance issues with the greatest impact on safe plant operation."

Another key tenet of the ROP is to ensure that the staff has the ability to respond appropriately to any significant change in a plant's risk profile (core damage frequency, CDF, and LERF). As the NRC website states: "The NRC determines its regulatory response in accordance with an Action Matrix that provides for a range of actions commensurate with the significance of the PI and inspection results." It is not clear that the staff's proposed use of deterministic backstops would meet this objective.

The ROP structure was founded on the current generation light-water reactor (LWR) risk assessments and operational experience. The thresholds were developed considering the range of CDFs that was known at the time. These thresholds are absolute values that are intimately tied to current generation LWRs. The question then arises as to why this construct should also apply to reactors with significantly lower CDFs¹.

Similarly, the performance indicators are based on current LWR experience and risk assessments. Inspection Manual Chapter 308, Attachment 1, "Technical Basis for Performance Indicators," notes:

PI thresholds in some instances could be directly tied to probabilistic risk assessment data, such as those for scrams and safety system unavailability. A sample of plants with probabilistic risk analysis (PRA) models available was selected to cover a spectrum of "typical" designs. Normal performance ranges were identified and core damage frequency sensitivity analyses were performed to evaluate the effects of departures from normal performance. This information was used to set PI threshold values that corresponded to the nominal and declining performance bands.

There is no discussion in SECY-12-0081 of the applicability of the current performance indicators, other than Mitigating System Performance Index (MSPI), and the associated thresholds to new reactors.

The ACRS proposed an alternative for addressing new reactors under the ROP in its letters dated April 26 and July 17, 2012. The Committee recommended that an additional option be developed that would employ relative measures of the change in risk as a metric for significance, rather than the absolute measures that were applied during the tabletop exercises. The ACRS proposal does provide greater flexibility to reactors with low CDF and LERF, a property the Commission desires.

With regard to the ACRS suggestion, the staff stated that an approach involving relative measures was previously considered but was not pursued for a number of reasons. The staff stated that it considered the merits of a relative risk metric in its February 2009 white paper but that impediments to this approach were identified by both internal and external stakeholders. Therefore, the staff did not consider this option further and did not include it in SECY-10-0121. The staff further stated that, in its SRM to SECY-10-0121, the Commission did not approve the development of lower numerical thresholds for new reactors in which the staff believed the ACRS recommendation would effectively result. However, that SRM stated that the tabletop exercises should either confirm the adequacy of the existing regulatory tools "or identify areas

¹ The current estimates of CDF and LERF for new reactors will most likely increase as the PRAs are augmented to include additional contributors such as external events. It is also a fact that the CDF and LERF of current-generation LWRs, which were the basis for the current ROP, have shifted toward lower values as a result of numerous safety improvements implemented since the ROP thresholds were set. For these reasons, the gap in risk metrics between operating and new reactors is likely to decrease.

for improvement, such as potential adjustments to the Reactor Oversight Process." The SRM does not preclude consideration by the staff of the ACRS proposal.

Although I am not endorsing the specifics of the ACRS proposal², it is my view that the ACRS recommendation for the use of relative risk measures should be given more serious consideration. The staff objects, in part, based on its view that the Commission did not approve the development of lower numerical thresholds for new reactors. However, the use of deterministic backstops is just a different form of a new threshold. The staff also stated that it pursued options that "do not infringe upon the greater operational flexibility afforded by the enhanced safety margins of the new reactor designs," in accordance with Commission direction in SRM to SECY-10-0121. It is not clear to me whether the staff's proposal to use deterministic backstops or other qualitative considerations would provide more or less operational flexibility than a structure using relative risk measures.

As noted by the ACRS, "the development and use of additional deterministic backstops or other qualitative considerations to characterize the significance of reactor safety inspection findings, as proposed by the staff, would depart from the risk-informed decision process that is working well in the ROP and other regulatory applications." PRA information has been used in the design and licensing of new reactors to improve their safety profiles. It would be unfortunate to abandon the use of that information in our oversight of these same reactors. This would be a step in the wrong direction. Therefore, the staff should give additional consideration to the use of relative risk metrics, or other options, that would provide a more risk-informed approach to the determination of the significance of inspection findings for new reactors. If the staff believes that this is not a viable option for new reactor oversight, it should provide a technical basis for its conclusions.

The staff should provide the Commission with a notation vote paper within nine months of the date of the SRM for SECY-12-0081 that would provide:

- 1. A technical basis for the staff's proposal for the use of deterministic backstops, including examples;
- 2. A technical evaluation of the use of relative risk measures, including a reexamination of the pros and cons listed in the staff's 2009 white paper;
- 3. A discussion of the appropriateness of the existing performance indicators and the related thresholds for new reactors.

George Apostolakis 8/30/12

² Variations other than the straight lines in the ACRS proposal may provide a better balance between the desired increased operational flexibility and ease of implementation of the ROP.

RESPONSE SHEET

то:	Annette Vietti-Cook, Secretary
FROM:	COMMISSIONER MAGWOOD
SUBJECT:	SECY-12-0081 – RISK-INFORMED REGULATORY FRAMEWORK FOR NEW REACTORS
Approved X	Disapproved X Abstain
Not Participatin	9
COMMENTS:	Below Attached _X None

Will &

19 September 2012 DATE

Entered on "STARS" Yes <u>×</u> No ____

¥

Commissioner Magwood's Comments on <u>SECY-12-0081, "Risk-Informed Regulatory Framework for New Reactors"</u>

I appreciate the thought and work the staff has invested in this subject and the limitations placed on their analysis by past Commission decisions. The subject of how best to incorporate new, Generation III+ reactors into our regulatory framework is one that has led to considerable discussion and debate. One suspects that this may be an issue for which there is no single "correct" path; therefore, staff's recommendations are an attempt to address the matter in the most practical fashion, based on the imperative to provide the agency with a consistent regulatory response to inspection findings at U.S. nuclear plants.

Nevertheless, I am concerned with several aspects of the staff's recommendation and find that the scope of their consideration was overly narrow. To the degree that this has been the result of past Commission decisions, I believe we should correct course now.

Let me first thank the staff and all participating stakeholders for the successful and informative Reactor Oversight Program (ROP) Tabletop Exercises. These activities provided confidence that the current system can be applied to new reactors without the need for major modifications such as establishing a separate safety goal for new reactors—a step the Commission rejected in SECY-10-0121. Nevertheless, it is clear that concerns persist regarding the ability of the current framework to fully reflect the far lower safety risks inherent in Generation III+ designs. These concerns lead to staff's central recommendation in SECY-12-0081, which is to develop new deterministic criteria for initiating reactive inspections and determining the appropriate regulatory responses to events at nuclear power plants—*i.e.*, the establishment of "deterministic backstops."

I find staff's suggested approach problematic. It is unclear to me that the current framework does not provide for an adequate response to degraded plant conditions without introducing new deterministic criteria into our risk-informed approach. Were a situation at a nuclear plant to come to the agency's attention today that represented a degradation of barrier integrity, the. NRC has tools outside of the ROP that would allow it to respond in order to assure the protection of public health and safety. Staff makes a fair argument that the development of backstops as part of the ROP would assure greater consistency, but the fact that conditions that would trigger the suggested backstops are presumably rare and unusual blunt the force of this argument. Rather than reverse the continuing evolution of NRC regulation toward increasingly risk-informed and risk-based decision-making, I would prefer that no modification be made to the ROP and other, already available, regulatory tools be applied to provide for an agency response to degraded conditions.

That said, I am persuaded by the ACRS's argument that we could benefit from a broader consideration of the use of relative risk to determine safety significance. While I believe the evidence supports the continued application of metrics based on absolute risk, I support our continued investigation of the alternative preferred by the ACRS. Further, despite my current

reservations, I am also willing to review additional staff work regarding the concept of deterministic backstops.

For these and other reasons reflected in his vote, I subscribe to the entirety of the comments and recommendations provided by Commissioner Apostolakis in his August 30, 2012 vote with the following additional comments and suggestions.

I approve staff's recommendation regarding the transition from the large release frequency (LRF) metric used in COL applications to the more standard large early release frequency (LERF) metric for plant operations purposes. However, I believe that interest in LRF as a metric—including the interest expressed by of many of our public stakeholders, such as the Union of Concerned Scientists—is valid and reasonable. This is particularly true in the post-Fukushima era. LRF has the potential to capture the full effect of severe accidents over time as an analog of anticipated containment performance. I therefore recommend that staff provide an information paper to the Commission that reviews the history of the NRC's use and consideration of LRF. This paper should also provide staff's views regarding the pros and cons of requiring the use of LRF, possibly in addition to LERF, for all operating reactors.

Finally, the core of SECY-12-0081 involves the application of the ROP to new reactors. While I have considerable confidence in the program's staff and we have good cause to celebrate the ROP's effectiveness, I believe the Commission would benefit from a fresh review of the practices and approaches the NRC has developed for this program over the course of years. I suggest that the ACRS undertake an independent review of the program's objectives and implementation, including the relative roles of headquarters and regional staff, our interactions with industry over performance indicator assessments, and the effectiveness of NRC's assessment of substantive cross-cutting issues. Such an assessment would provide a reinforced foundation upon which the agency can plan for the operational review of new nuclear power plants based on Generation III+ reactor technology.

- 9/19/12 (1)4600

William D. Magwood, IV

Date

RESPONSE SHEET

- TO: Annette Vietti-Cook, Secretary
- FROM: COMMISSIONER OSTENDORFF

SUBJECT: SECY-12-0081 – RISK-INFORMED REGULATORY FRAMEWORK FOR NEW REACTORS

Approved XX Disapproved Abstain _____

Not Participating _____

COMMENTS: Below ____ Attached _XX_ None ____

SIGNATURE _____

9/13/12 DATE

Entered on "STARS" Yes XX No ____

Commissioner Ostendorff's Vote Comments on SECY-12-0081, "Risk-Informed Regulatory Framework for New Reactors"

I approve the staff's recommendations in SECY-12-0081. I commend the staff for its execution of the Commission's explicit direction on SECY-10-0121, "Modifying the Risk-Informed Regulatory Guidance for New Reactors." The staff diligently and systematically implemented the Commission's clear directions on this complex topic. The staff met my expectations that the current operating reactor risk metrics should apply equally to both current operating reactors and new reactors. Using 185 realistic test cases, the staff and external stakeholders conducted intensive tabletop exercises and workshops that confirmed the adequacy of those quantitative thresholds and metrics. Furthermore, I note that the research insights from the now completed state-of-the-art reactor consequence analyses (SOARCA) project indicate previously held perceptions of severe accident phenomena and public consequences have been very conservative, meaning our subsidiary risk goals and derivative standards are highly conservative. These factors affirm that it is unnecessary for the Commission to lower the quantitative thresholds that characterize risk significance of issues for proposed licensing basis changes or inspection findings.

Regarding the Reactor Oversight Process (ROP), I support the staff's effort to develop qualitative criteria to supplement the ROP for new reactors. I am mindful that the ROP is a mature and robust process. Agency professionals will continue to leverage this vast experience when assessing the performance of new reactor facilities. In addition, the ROP already has a built-in mechanism to allow for deviations from the ROP Action Matrix (with EDO approval) which affords another layer of protection to ensure appropriate regulatory oversight of a new nuclear plant, if necessary. Moving forward, it is my understanding that the NRC staff experts and external stakeholders are aligned to develop qualitative criteria to augment the existing ROP. This path forward appears to be consistent with Fukushima Near-Term Task Force Recommendation No. 12 which called for increased consideration of defense-in-depth characteristics of inspection findings that, in my opinion, would complement the risk-based information. With modest ROP adjustments as envisioned by the staff, I am fully confident that the NRC will have appropriate oversight of these new generation nuclear plants.

In the matter of the ACRS's proposal that the ROP for new reactors use a "relative risk" approach, I have assessed Option 3D noted in the staff's paper and associated ACRS letters. First, I appreciated the ACRS's candid views on the risk-framework for new reactors. My fellow colleague Commissioner Apostolakis has raised the level of conversation through his thoughtful vote comments on SECY-12-0081, which persuaded me to give the Committee's viewpoints additional consideration. I have also reviewed the recent three-year history on the topic, which includes a Commission memorandum, two Commission policy papers, and many supporting white papers. At this time, I cannot justify tasking the staff to further explore an approach that categorically lowers the performance risk thresholds currently used in the ROP Reactor Safety cornerstones, an approach that is inherently in conflict with the Commission's direction given on SECY-10-0121. Fundamentally, I find the staff's approach to be very consistent with the ROP tenet that risk-informed outcomes allow NRC and licensee resources to be focused on performance issues with the greatest impact on safe plant operation. However, I do agree with Commissioner Apostolakis that the staff will need to develop an appropriate technical basis for limited use of qualitative factors to augment the ROP for new reactors. I also agree with

Commissioner Apostolakis that the Commission would benefit from a fuller discussion of the appropriateness of the existing performance indicators applicability to new reactors.

Given the above, the staff should inform the Commission when sufficient progress has been made in developing ROP qualitative criteria (e.g., backstops) and guidance defining the exceptional circumstances where such considerations would be appropriate for NRC decision-makers. Because the table top exercises demonstrated with realistic cases that new reactor inspection findings could be significant, including potential Red inspection findings, the staff should focus its initial efforts on cases where risk determinations would be considered of very low safety significance but substantially erode defense-in-depth or passive system reliability. The paper should also summarize the staff's (1) determination of the appropriateness of the current ROP performance indicators applicability to new reactors, (2) plans to address challenges or alternatives to the Mitigating Systems Performance Index, and (3) plans to adjust the inspection program.