

ENCLOSURE 1

**Final Report of Risk-Informed
Decision-Making Project Phase 2**

NRR RIDM Tasks 1-4

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OFFICE OF NUCLEAR REACTOR REGULATION

FINAL REPORT OF RISK-INFORMED

DECISION-MAKING PROJECT PHASE 2

1.0 EXECUTIVE SUMMARY

The U.S. Nuclear Regulatory Commission (NRC, the Commission) Office of Nuclear Reactor Regulation (NRR) staff developed the NRR Risk-Informed Decision-Making (RIDM) Action Plan (Action Plan) in 2017, ¹ to continue advancing, for the operating reactor program, NRC's longstanding commitment to increased use of RIDM. The Action Plan leveraged foundational Commission Policy and previous staff efforts while specifically addressing the NRR leadership vision to enhance the integration of risk information into the organization's decisionmaking practices and processes to improve the technical basis for regulatory activities, increase efficiency, and improve effectiveness (Reference 3). While this report documents the closure of the 2017 Action Plan, efforts to achieve this vision continue as the NRC progresses as a modern risk-informed regulator that seeks to increasingly use risk insights to holistically evaluate and inform its broad range of regulatory applications and processes.

The Action Plan was envisioned as a tactical-level tool to develop a graded approach for using risk insights in licensing reviews, to better integrate complementary insights from traditional engineering and risk assessment approaches, and to enhance guidance and training to foster a broadened understanding of the benefits that RIDM can bring to the overall regulatory approach. The Action Plan accomplished these objectives by formalizing a licensing review approach that increases collaboration between risk analysts and traditional engineering technical reviewers, by providing plans for a systematic, graded approach for expanding the use of risk insights within the existing NRC regulatory framework, and through the creation of training modules for use during the upcoming rollout of improved guidance documents and procedures. The Action Plan also laid groundwork for continued advancement of NRC and industry risk-informed initiatives and for enhanced communication and awareness of RIDM activities and opportunities amongst NRC staff and external stakeholders.

An essential element to the success of the Action Plan and to achieving the NRR leadership vision involves instilling a culture that promotes shared understanding that increased use of RIDM can further enable the NRC and industry to focus on areas of higher safety significance and potentially realize improvements in both safety and efficiency. The importance of an agencywide culture that recognizes the need to balance the regulatory principles of reliability, clarity, and efficiency in the context of risk and safety significance was prominently highlighted as part of NRC's transformation efforts in SECY-18-0060 (Reference 4) and in SECY-17-0112 (Reference 5).

By design, the 2017 Action Plan employed a systematic, two-phased approach that was developed and implemented by a diverse set of staff members with unique perspectives and technical backgrounds from across NRR and other program offices. For example, Phase 1 of

¹ The NRR RIDM Action Plan was initially issued on August 11, 2017 (Reference 1). The plan was subsequently updated on August 31 and October 17, 2017, and January 23, May 4, and August 14, 2018. The latest revision of the plan is dated November 27, 2018 (Reference 2).

the Action Plan, which consisted of evaluations, analyses, and the development of findings and recommendations, involved five working groups and over 30 staff members from multiple divisions across the agency (Reference 6). Phase 2, in which the staff obtained feedback and expanded on the Phase 1 recommendations, involved seven teams and over 40 staff members. A substantial increase in staff awareness of RIDM principles and the benefits of its use was facilitated through outreach activities (e.g., interviews, surveys, cafés, and trial period activities). These outreach activities helped inspire additional agency efforts such as a regional RIDM action plan. As the Action Plan considered how RIDM can enhance the full spectrum of licensing reviews, expanded staff involvement was required, initiating behavior changes throughout the organization. It is anticipated that as processes, guidance, and training are implemented, per the actions outlined in the Action Plan, additional staff will adopt the behaviors needed to foster a culture supportive of increased RIDM not only in licensing, but also in oversight programs.

While successful execution of the Action Plan objectives reflects a definitive step forward towards achieving the NRR leadership vision of RIDM, it was primarily focused on operating reactor licensing processes. Additional efforts are needed to realize the full benefits afforded by RIDM in other processes across the Operating Reactor Business Line. In this regard, several Action Plan activities that reinforce the importance of broad use of RIDM will support these additional efforts including: (1) the modification of the NRR staff's Elements and Standards to include expectations to employ RIDM concepts in all work activities, (2) the development of fiscal year (FY) 2019 quarterly performance review metrics and FY 2021 Congressional Budget Justification (CBJ) metrics on RIDM, and (3) additional training for staff on the concepts of RIDM and practical applications on the use of RIDM in regulatory activities.

There are several ongoing initiatives in the Operating Reactor Business Line that will complement the staff's latest progress and expand the concepts developed in the Action Plan beyond operating reactor licensing. These initiatives include: (1) reassessing the regulatory treatment of low-risk compliance issues, (2) updating the charter for the executive Risk-Informed Steering Committee to account for (a) risk considerations beyond operating reactors and (b) risk considerations beyond operating reactor licensing activities, (3) revamping the task interface agreement (TIA) process, (4) modernizing workload management to include considerations of resources and the application of new metrics to measure success in the application of RIDM concepts, and (5) incorporating additional risk considerations into the Reactor Oversight Process enhancement initiative. Each of these initiatives incorporate the following commitments:

- Apply a holistic and integrated view of safety that considers defense-in-depth, margin, engineering judgement, probabilistic risk assessment (PRA), and other technical information,
- Focus efforts on safety-significant issues,
- Disposition low-risk issues efficiently,
- Ensure reviews and conclusions use a reasonable assurance standard, and
- Apply the backfit rule appropriately and consistently.

These initiatives will reinforce the expectation to use risk insights holistically at the early stages of regulatory activities to more efficiently guide the staff's efforts. The initiatives will also help

advance the application of RIDM beyond the nuclear reactor safety program by using the mature operating reactor process(es) as an example. As the staff monitors its success towards achieving the NRR leadership RIDM vision, it is anticipated that progress in achieving the additional safety and efficiency gains afforded by RIDM will continue through the adoption of a transformative mindset that seeks continual improvement.

2.0 RESULTS FROM RIDM ACTION PLAN IMPLEMENTATION ITEMS

Phase 1 of the RIDM project developed 21 recommendations for the staff to advance the use of RIDM within NRR. The 21 recommendations from Phase 1 were then condensed into 13 Implementation Items for the staff to develop actionable tasks, split among the seven teams (A through G). See Table 1 attached to this report for the groupings of the recommendations into the Implementation Items. For example, Task 2 and Task 4 both produced recommendations to conduct training. For Phase 2, these recommendations were divided into Implementation Item 6, for high-level training, and Implementation Item 7, for branch-specific training.

From July until December 2018, the seven teams developed their responses and outputs to the 13 Implementation Items derived from the Phase 1 Tasks and Recommendations. Below is a discussion of the process each team used and the outputs and outcomes:

2.1 Integrated Review Team Approach to Processing Licensing Actions

2.1.1 Objective

The objective was to conduct a trial phase of the integrated review team (IRT) approach developed in Phase 1 of the RIDM project, with the intent to obtain insights and experience on the application of the IRT approach. The lessons learned from this trial phase will be used to update the IRT process in preparation for its use by the NRR staff. Implementation Items 1, 2, 9, and 10 are related to the IRT approach to processing licensing actions (see Table 1 for more information). Implementation Item 5 on RIDM training is addressed separately in Section 2.4.1 of this report.

2.1.2 Approach

The RIDM Phase 1 report recommended implementing the proposed IRT approach on licensing actions during a trial period from July through October 2018 to obtain feedback and capture lessons learned. Because reviewing and issuing typical licensing actions is often a year-long process, Team A recognized that these licensing actions would not be completed during the trial period and acknowledged the results would be a “snap-shot” of the process but would still yield useful feedback regarding the IRT process.

Four licensing actions were reviewed using the IRT process, as described in the Phase 1 report, during the trial period. These licensing actions covered RIDM Types 1, 2, and 3 submittals and reviews that used certain aspects of the IRT process, such as the preparation of an integrated safety evaluation. In addition to the four licensing actions, a license amendment request completed just prior to the RIDM initiative was added to the list of case studies because it considered risk insights and was reviewed by a team consistent with an IRT. About 35 staff members participated in implementing the IRT process during the trial period. Along with overseeing the IRT trial period, Team A conducted training on the IRT process for Division of

Operating Reactor Licensing (DORL) staff and informally trained IRT participants in the IRT process.

After the trial period ended in October 2018, Team A sent online survey questions to staff to solicit feedback and recommendations from the IRT participants. The online survey consisted of 13 questions, addressing positive and negative IRT experiences, and soliciting suggested improvements. The survey questions requested specific details, such as any difficulties in identifying Types 1, 2, or 3 submittals, and the usefulness of the IRT checklists.

Team A also held focus group meetings for the four licensing actions to solicit feedback and recommendations from the IRT participants. The project manager, technical reviewers, and risk analyst were interviewed in the focus groups. Team A developed a list of 10 specific and open-ended questions to guide the interviews, ranging from understanding of the IRT process, to challenges in implementation, to facilitate open discussion and solicitation of comments and suggestions.

In addition, the RIDM Phase 1 report recommended implementing IRT workload management through changes to NRR's licensing/workload management software, the Replacement Reactor Program System (RRPS). Because the IRT process was not included in RRPS during the trial period, Team A did not modify that recommendation, except to include additional RRPS changes that would address related implementation issues based on the lessons learned.

In November 2018, RIDM Team A evaluated the survey and interview results to enhance the IRT process described in the RIDM Phase 1 report. In addition, Team A developed proposed actions and necessary guidance to institutionalize the IRT process based on the results of the survey and interviews.

2.1.3 Output/Outcome

The output from the trial phase was a refined IRT process. The outcome of the refined process is the integration of complementary insights from traditional engineering and risk assessment approaches. As discussed above, the NRR staff completed a 4-month trial period for the new IRT process. When using the IRT process, the staff and participants found that:

- The IRT provided cross-training opportunities between the traditional deterministic reviewers and the risk analyst to appreciate each other's insights.
- The development of new staff guidance on Types 1 and 2 reviews could facilitate their use. This suggestion resulted in part (a) of Ticket Number 2.
- The development of staff guidance could help define the scope and depth of review using risk insights. This guidance will be incorporated into a new NRR Office Instruction (OI) on RIDM, resulting in Ticket Number 1.
- The IRT flowchart was unclear regarding Types 1 and 2 submittals and it was revised accordingly.
- The participants suggested that the IRT should be considered for complex submittals, even without the need of a risk analyst. Team A revised the IRT process to address complex submittals without a risk analyst.

- The participants found the integrated safety evaluation approach efficient, but commented that the technical branch chief should approve his/her staff input to the consolidated safety evaluation. Accordingly, the technical branch chief's responsibilities were revised within the IRT process.

From the feedback received, Team A revised the IRT process, which can be found in Enclosure 3 to the cover memorandum for this report. Additionally, a summary of the lessons learned from the IRT survey and focus groups can be found in Reference 7.

As a result of the trial period, Team A staff developed input into four tickets that impose action items to fulfill Implementation Items 1, 2, 9, and 10. Ticket Number 1 directs the staff to develop a new NRR OI on RIDM. Part a) of Ticket Number 2 directs the staff to develop guidance to distinguish between Type 1 and 2 license amendment requests. Ticket Number 4 directs the staff to modify RRPS to implement the IRT process. Ticket Number 5 directs the staff to update NUREG-0800, "Standard Review Plan for the Review of Safety Analysis Reports for Nuclear Power Plants: LWR [Light-Water Reactor] Edition" (henceforth known as the SRP), for RIDM. For more information on the tickets, see Enclosure 2 to the cover memorandum for this report.

2.2 Updating Elements and Standards and Conducting Regional Risk Cafés

2.2.1 Objective

The objective of updating the elements and standards was to raise NRC staff awareness of management expectations for the use of risk information and risk insights. The expanded use of risk information and insights to evaluate licensing actions outside of those where risk is traditionally used (e.g. Regulatory Guide (RG) 1.174, Revision 3, "An Approach for Using Probabilistic Risk Assessment in Risk-Informed Decisions on Plant-Specific Changes to the Licensing Basis," January 2018 (Reference 8) reviews) was not a common practice in the evaluations produced by NRR staff until the introduction of RIDM in mid-2018. Since the NRR staff will now be required to use risk information and risk insights to enhance decisionmaking, one way to achieve this objective was to update the performance standards used to evaluate the staff's annual performance. Implementation Item 3 directed the staff to update position descriptions and performance appraisal Elements and Standards to include the use of risk information and risk insights to enhance decisionmaking (see Table 1).

Additionally, the objective of the regional risk cafés was to leverage the success of the headquarters risk cafés to identify and gain insights on how the concepts of risk and risk insights are currently understood and being used by regional inspectors, managers, and other staff. By conducting risk cafés in the regional offices and evaluating the feedback, enhancements to guidance and training can be identified to better incorporate risk information and insights into the regional offices' decisionmaking processes. Implementation Item 4 directed the staff to conduct risk cafés in the NRC regional offices (similar to the cafés conducted at headquarters), assess the café results, and evaluate their impact on guidance and training updates (see Table 1).

2.2.2 Approach

Updating Elements and Standards and Position Descriptions

Phase 1 identified that a shift in culture is needed for NRR staff to fully embrace RIDM. As suggested in Task 2, Recommendation 7, of Phase 1, and further reinforced during an

Executive Director for Operations briefing at the end of Phase 1, one way to enact the desired culture change was to add RIDM language into staff position descriptions and performance plans. This effort was defined in the Action Plan as Implementation Item 3. Toward this goal, Team B worked with the NRR Branch Chief Council to develop RIDM language that was similar and compatible with language used elsewhere in the NRR staff's Elements and Standards for use in a broad spectrum of staff positions' Elements and Standards. The resulting language was approved and inserted into NRR and Office of New Reactors (NRO) staff FY 2019 performance plans. In addition, this language also contributed to a parallel effort to update staff position descriptions in preparation for the NRR and NRO merger. Incorporating the language in pre-merger activities is anticipated to be an effective approach to ensure the RIDM concept is consistently applied and staff expectations for use of RIDM are clear.

Regional Risk Cafés

In an effort to identify and gain insights into the regional staff's current understanding and use of risk and risk insights, Team B leveraged their experiences from the NRR risk cafés to provide assistance to the Regional RIDM Task Force to plan and run the regional risk cafés.

Regional Pilot Study

A pilot study was conducted in Region II on August 14, 2018, to seven Division of Reactor Safety inspectors using draft questions modified from the NRR Phase 1 risk cafés. The goal of the pilot study was to determine the focus topics for the subsequent online survey and risk café sessions, and to obtain feedback for the draft questions to better target regional concerns. The resulting café questions can be found in Reference 9.

Regional Online Survey

To identify and gain preliminary insights into how the NRC regional office staff and managers understand the concepts of risk and risk insights, a 16-question online survey was developed and was administered using the Survey Monkey Web site. The survey questions can be found in Reference 10. The survey was open from November 5-16, 2018. A total of 277 respondents participated in the regional online survey; 78 in Region I, 65 in Region II, 79 in Region III, and 55 in Region IV.

Regional Risk Cafés

The NRC regional offices are currently in the process of conducting their regional risk cafés and are expected to finish by early 2019. Team B will be available to assist the regional offices in conducting their risk cafés and to assist in analyzing the data and making recommendations for next steps.

2.2.3 Output/Outcome

Updating Elements and Standards and Position Descriptions

The following new performance plan language was approved for the NRO/NRR Merger for insertion in the “Basic Skills” section of the NRR and NRO staff FY19 position descriptions to mirror what was inserted in the Elements and Standards.

Work products reflect the use of risk insights and a risk-informed and performance-based philosophy, as appropriate. Is familiar with pertinent elements of risk-informed and performance-based regulation, and uses risk information and risk insights to enhance decision-making without undue delay.

The following RIDM language was approved and inserted into NRR and NRO staff FY19 Elements and Standards:

Element 2 – Technical Analysis and Problem Solving

Work products reflect the use of risk insights and a risk informed and performance based philosophy, as appropriate.

Element 4 – Organizational Effectiveness Activities

Is familiar with pertinent elements of risk-informed and performance based regulation, and uses risk information and risk insights to enhance decision-making without undue delay, as appropriate.

The changes to the position descriptions and performance appraisal Elements and Standards are expected to increase awareness of RIDM among NRR and NRO staff and support the culture change to hold staff accountable for the use of risk information and risk insights in their work.

Regional Risk Cafés

A pilot study determined the focus topics and refined the questions to better target regional office staff concerns for the subsequent online survey and café sessions. The regional online survey was provided to 277 regional office staff to obtain preliminary insights on how regional office staff and managers understand and use the concepts of risk and risk insights. A preliminary analysis of the results revealed the following key findings that, in general:

- The regional staff strongly agree that the use of “risk” or “risk insights” are appropriate for inspection or inspection planning.
- The regional staff strongly agree that there is value in identifying minor and Green inspection findings.
- The regional staff agree that “risk” or “risk insights” are a form of engineering judgment.
- The regional staff tends to agree that inspection resources are focused on the most risk-significant issues.

- The regional staff tends to disagree with the statement that the use of “risk” or “risk insights” results in an unwarranted increase or decrease in the significance of inspection findings.
- The regional staff is mixed about whether they have concerns with expanding the use of “risk” or “risk insights” by the agency, whether the Reactor Oversight Process and Enforcement guidance have resulted in unintended and unreliable outcomes in dispositioning issues of concern, whether the current guidance or training is sufficient to use “risk” or “risk insights” in their decisionmaking, and whether there is a gap between management expectations and staff use of “risk” or “risk insights.”

The NRC regional offices are currently conducting their regional risk cafés and are expected to finish in early calendar year 2019. Further analysis of the free-response sections of the regional online survey, as well as further support and analysis for the regional risk cafés is ongoing. These results will be used by the Regional RIDM Task Force to inform potential changes to programs or policies to promote the use of risk in the regional offices.

By supporting risk café activities in the regional offices, headquarters and regional staff and management will better understand how the regional office staff currently understands and uses risk, as well as their attitudes toward the future use of risk. This understanding will help inform inspection program changes, actions to promote the attitude and culture changes necessary to expand the use of risk in the regional offices, and to facilitate alignment between headquarters and regional staff in risk-informing their processes. Furthermore, the creation of a regional RIDM action plan and risk café activities in the regional offices, as inspired by this effort, has increased visibility and awareness of RIDM principles and the benefits of its use among staff.

2.3 Creating Guidance for NRR Staff

2.3.1 Objective

The objective was to provide the NRR staff a usable and predictable method to unlock and leverage their extensive and collective experience, as well as engineering knowledge with a systematic approach that expands their use of risk information and risk insights, all within the existing NRC regulatory framework. To date, much of the effort to risk-inform the NRC’s regulatory activities has focused on the use of PRA, and the quantification of which has typically focused on estimates of core damage frequency (CDF) and large early release frequency (LERF). However, other types of risk that do not include CDF and LERF can also be effective tools for the technical staff in their evaluations.

Implementation Item 8 recommends developing (1) guidance for these other types of risk, (2) a desktop glossary for commonly used RIDM terms, and (3) a hierarchy of RIDM documents to provide a roadmap for the staff on the application of RIDM (see Table 1).

2.3.2 Approach

On March 1, 1999, the Commission issued a white paper that defines the terms and Commission expectations regarding risk-informed and performance-based regulation (Reference 11). The term “risk insights,” as defined in the white paper, refers to the results and finding that come from a PRA, which for reactors includes identification of dominant accident sequences, estimates of CDF and LERF, and importance measures of structures, systems, and components. The central goal from Phase 1, Task 2, of the NRR RIDM project was to “broaden

the definition of risk more transparently such that all of the technical staff can see how their work embodies risk considerations—beyond core damage frequency and large early release frequency.” To promote this goal consistently and efficiently, Team C is proposing another term – “non-PRA risk information” in concert with the terms and concepts described in the Commission white paper. As used in this context, “non-PRA risk information” refers to risk information that can result from:

- Operational experience,
- Plant compensatory measures,
- Mitigating factors (both environmental and engineered),
- Probabilistic or risk information at the system, structure, or component level,
- Additional probabilistic information from traditional engineering methodologies, such as estimates of mean-time-to-failure from operational experience or fatigue curves,
- Engineering judgement, and
- Other technical information (e.g., state-of-the-art consequence analysis)

These considerations rely on credible engineering or experiential information to form a judgment of a complete risk triplet of “What can go wrong?”, “How likely is it?”, and “What are the consequences?”

To address the recommended development of guidance for an expanded use of risk principles (including for non-PRA risk information), the hierarchy of RIDM documents, and a roadmap of which RIDM documents to use, Team C is proposing the creation of the RIDM roadmap document and to update staff guidance to better incorporate RIDM principles, and to remove language that prohibits the use of risk information and risk insights. Team C is also proposing the creation of a desktop glossary to be included in the new RIDM OI to promote a common understanding and terminology of risk-related terms.

RIDM Roadmap

Task 2, Recommendation 5, directed the staff to develop guidance that identifies the hierarchy of RIDM documents, provide a roadmap on which RIDM documents to use, and complement current regulatory approaches, as appropriate. After assessing the guidance and roadmap needs for each of the review categories in the IRT process and considering that with feedback gathered from the Phase 1 risk cafés, the team concluded that the RIDM roadmap should formalize a systematic approach that helps technical reviewers to apply non-PRA risk information (as defined above) to risk-inform their work. By providing explicit guidance and concrete examples, the RIDM roadmap will help alleviate the roadblocks to the expansion of the use of risk in technical reviews.

Desktop Glossary

As identified during Phase 1, in some cases, the NRC staff’s understanding and usage of common risk terms and concepts is inconsistent, which may be detrimental to the consistent

and appropriate use of risk at the NRC. Task 2, Recommendation 3, from Phase 1 recommended the development of a desktop glossary of terms and to make it available as a quick reference guide for more commonly used RIDM terms. NUREG-2122, "Glossary of Risk-Related Terms in Support of Risk-Informed Decisionmaking," November 2013 (Reference 12), contains a significant amount of terminology regarding RIDM, which could be useful to unify staff understanding; however, the size of this 187-page document is not convenient as a quick desktop reference. A subset of these terms has been selected for inclusion in a desktop glossary, such as the fundamental definitions of a risk approach and RIDM, to create a more accessible document for staff.

Guidance Development

Two of the largest roadblocks identified during Phase 1 were (1) the need for more specific guidance on how staff can use risk, and (2) the need to remove language that prohibits the staff from using risk in their work. After assessing currently available guidance, Team C decided to focus effort on updating the SRP to provide guidance on the scope and depth of licensing reviews considering risk insights and to remove language that prohibits the use of risk in licensing reviews. Furthermore, specific guidance on how technical staff can expand the use of risk will be provided in the RIDM roadmap, as discussed above. These changes are expected to increase awareness of RIDM among NRR staff and be part of the culture change to promote staff use of risk information and risk insights in their work.

2.3.3 Output/Outcome

With the development of the appropriate guidance documents, the technical staff will have a common understanding of a systematic approach that will allow them to leverage their experience and engineering expertise with an expanded use of risk information.

The RIDM roadmap will describe a systematic approach to expand the use of risk information, within the existing NRC regulatory framework, and promote a common understanding of risk insights and risk information. This approach complements traditional deterministic methods, which rely on engineering judgment to provide a more realistic and holistic evaluation of the safety of a system, structure, or component. This guidance will be useful for technical staff concerning use of risk principles, in particular for Box 5, "no [PRA] risk information used" of the IRT process (see Enclosure 3 to the cover memorandum for this report). The RIDM roadmap Statement of Purpose can be found in Reference 13.

In the desktop glossary, terminology specific to a narrow area of review, such as fire or dose consequences, have been excluded from this quick reference guide; as have terms that are defined elsewhere (such as anticipated transient without scram and containment bypass). Definitions have been abbreviated where appropriate for use by technical reviewers. The term "non-PRA risk information," as proposed to be in the RIDM roadmap, will also be included in the desktop glossary. A draft set of definitions can be found in Reference 14.

Updates to the SRP will provide guidance on the scope and depth of licensing reviews considering risk insights and remove prohibitive language. The development of the RIDM roadmap will provide guidance for technical staff concerning the use of risk principles. These two guidance development outputs will help to address the roadblocks identified in Phase 1 for more specific guidance on how staff can use risk and the need to remove prohibitive language that prevents the staff from using risk in their work.

The Team C staff developed input into three tickets that impose action items to fulfill Implementation Item 8. Part b) to Ticket Number 2 directs the staff to create the RIDM roadmap and the desktop glossary. Ticket Number 5 directs the staff to update guidance to remove prohibitive language. Ticket Number 6 directs the staff to review and update guidance for other licensing activities to encourage the use of RIDM and risk insights.

2.4 Training for NRR Staff

2.4.1 Objective

The objective was to provide enhanced training that fosters a broader common understanding of the use of risk information in the evaluation of licensing actions. The desired understanding includes improved consistency in the application of risk information both within the traditionally risk-informed reviews, such as per RG 1.174, and as part of deterministic or prescriptive regulatory reviews. The creation and enhancement of training helps to facilitate the expanded use of risk insights within the NRC regulatory framework. New training modules, for use concurrent with the update of guidance documents, will improve understanding and allow staff to more efficiently and effectively implement risk insights into regulatory reviews.

Implementation Items 6 and 7 direct the staff to develop high-level and branch-specific training, respectively, on RG 1.174; RG 1.200, Revision 2, "An Approach For Determining The Technical Adequacy of Probabilistic Risk Assessment Results for Risk-Informed Activities," March 2009 (Reference 15); RG 1.177, Revision 1, "An Approach for Plant-Specific, Risk-Informed Decisionmaking: Technical Specifications," May 2011 (Reference 16); NUREG-2122; and RIDM (see Table 1).

Team D developed training for technical and risk analyst staff to (1) promote culture change and to (2) implement processes that use the IRT approach or a similar approach using risk insights.

2.4.2 Approach

A three-component approach was applied to training.

- 1) Ensure a basic understanding of risk information,
- 2) Connect the basic understanding of risk information to the RIDM effort, and
- 3) Present success stories related to collaboration between risk and technical reviewers as part of RIDM activities.

The first component, developed in concert with Phase 1, resulted in a web-based training titled "Integrating Risk into Regulatory Reviews" Course_ID 427162. The course provides a primer on the use of risk information to those with no risk background. The second component is also within Course_ID 427162 and uses that primer as a foundation to explain how risk insights may be used in regulatory reviews. Team D staff reviewed the training and administered the training to several NRR staff, who then provided feedback. The third component includes a high-level discussion of how risk information can be integrated into regulatory decisions in the context of the overall RIDM efforts. The third component is documented as case studies (see Reference 17) and was submitted to the *NRC Reporter* to support a wide communication of successes in using risk information.

Team D reviewed the Phase 1 recommendation to provide training on RG 1.174, RG 1.200, RG 1.177, and NUREG-2122, and discussed the necessity of the in-depth risk training involved for those documents for general NRR staff. Team D concluded that training on those guidance documents would not be helpful for staff outside of dedicated PRA analysts and staff currently involved in Type 3 IRT reviews. The information in the RGs is not applicable to most staff reviews and, therefore, detailed training on these RGs would not be an efficient use of staff time. Additionally, RG 1.200 relates primarily to PRA adequacy, which is solely the purview of the NRR Division of Risk Assessment (DRA) and is not reviewed by other organizations. Furthermore, the information in NUREG-2122 was used in the development of Course_ID 427162 and will be used in the RIDM Roadmap. Team D considers Course_ID 427162 to use appropriate information from the above documents (except for RG 1.200), and the training developed consistent with the new RIDM OI to be sufficient for the staff to incorporate risk insights into their future work.

2.4.3 Output/Outcome

After receiving feedback from DRA staff regarding Course_ID 427162, Team D found that no immediate edits were necessary to the training, but a few suggestions could be incorporated in the future. Team D also determined that the training be should available, but not required, for NRR staff because a full suite of training will occur for the IRT process as it is incorporated in the new RIDM OI. In addition, the case studies were submitted to the *NRC Reporter* for publishing (expected in February 2019) and an NRR announcement staff may be pursued to notify the staff of the case studies.

The case studies demonstrate that integrating risk information into technical reviews can add value to the reviews. Conversely, expert technical reviewer input can also add value to risk reviews. The case studies show successful examples of the application of RIDM. These examples are intended to help staff understand how RIDM adds value without creating unnecessary staff burden.

NRR officewide training will be needed for the new NRR OI that details RIDM and the IRT process. The Team D staff developed a ticket to fulfill Implementation Items 6 and 7. Ticket Number 3 directs the staff to develop training on the revised IRT process and the new ways to acceptably use risk in technical reviews.

Beyond the RIDM action plan, the staff continues to pursue training on risk at several levels. The staff plans to hold a risk workshop for managers in summer 2019, and has planned an agencywide seminar to discuss examples of RIDM in early 2019. Additionally, the staff initiated new training and an updated qualification program for Reliability & Risk Analysts, with the goal of training all NRR/DRA staff as Reliability & Risk Analysts to address the increase in workload necessitating PRA expertise.

2.5 Use of IRT for other NRR Processes

2.5.1 Objective

The objective was to evaluate NRR Operating Reactor Business Line processes outside of license amendments and relief requests (which were covered by the IRT trial phase) to determine if they could benefit from use of the IRT approach or a similar approach using risk insights. Implementation Item 11 directed the staff to identify other processes that could be

enhanced using the IRT approach or similar process and update the NRR OIs, guidance documents, and training for those processes (see Table 1).

2.5.2 Approach

Team E compiled and prioritized the list of Operating Reactor Business Line processes to evaluate potential expansion of use of IRTs and increased risk insights. This activity included a review of related guidance documents and informal discussions with NRR staff and managers. Team E identified 16 NRR processes and targeted the following nine processes for further evaluation: license renewal, topical reports, power uprates, environmental reviews, generic communications, orders, backfits, technical specification task force travelers (TSTFs), and task interface agreements (TIAs). These processes were selected for detailed evaluation based on their ongoing nature, potential for evaluating safety-significant issues, and a qualitative evaluation of the potential for benefits from RIDM. The processes not selected for detailed evaluation included improved standard technical specification conversions; reviews of security, emergency, and quality assurance plans; National Fire Protection Association Standard 805 transitions; research and test reactor licensing; research and test reactor inspection; Fukushima orders; and financial reviews.

To explore the use of risk insights within the nine selected processes, Team E identified subject matter experts and process owners to interview regarding the applicability of an IRT or if additional risk insights would provide benefits to the processes. Before the interviews, each interviewee was provided background information on RIDM and a set of 12 questions related to the IRT approach and the use of risk insights (Reference 18). Interviews included one to two subject matter experts and typically two members of Team E. In all, Team E interviewed 24 current and former NRR staff. Team E also held follow-up discussions with the interviewees to clarify the interview notes and address any additional questions.

Based on the results of the interviews, additional review of the related guidance, and team discussions, Team E formulated preliminary recommendations for process improvements. The recommendations were grouped into three categories. The first category focused on the use of additional risk insights, the second on use of the IRT approach, and the third on process improvements and other actions outside the scope of RIDM Phase 2. Team E discussed the preliminary recommendations with the various process stakeholders (including project managers, technical reviewers, branch chiefs, and in some cases, division managers) to obtain feedback and revise the recommendations accordingly. In several instances, these discussions resulted in some preliminary recommendations being included that were outside the scope of Phase 2 (see Enclosure 4 to the cover memorandum for this report), rather than being developed into formal tickets, and in other instances, Team E removed some preliminary recommendations entirely.

Team E identified five processes that could potentially benefit from implementing an IRT approach and four processes that could potentially benefit from increasing the use of risk insights. Team E used the preliminary recommendations related to increasing the use of risk insights and using the IRT approach as the bases for developing the tickets discussed below. Enclosure 5 to the cover memorandum for this report provides summaries of the interview results and the preliminary recommendations related to each of the processes evaluated in detail.

The main challenge with Team E's work was the breadth of the mandate (i.e., evaluate "other processes" for the use of IRT and increased use of risk insights). This required Team E to focus

on identifying processes that could potentially benefit from RIDM, without doing a detailed cost analysis, quantifying the potential safety benefits, or developing any of the recommended guidance. Team E managed the workload by assigning smaller teams within Team E to evaluate each process and by using teleconferences and online collaboration (SharePoint). While this allowed Team E to evaluate eight out of the nine processes initially targeted (orders were not evaluated in detail), the lack of detailed cost/benefit analyses resulted in some of the preliminary recommendations not being mature enough to proceed to ticketing and hesitation on the part of several process owners to commit the resources needed to implement other preliminary recommendations without well-defined benefits.

2.5.3 Output/Outcome

Consistent with the description of Implementation Item 11, Team E completed an analysis of several NRR processes and developed recommendations for the update of several processes to consider incorporation of the RIDM philosophy into those processes. Specifically, Ticket Number 6 tasked NRR divisions to (1) update their processes to include use of additional risk insights and (2) to provide input into the new RIDM OI on how to use the IRT approach for their process. The ticket directs the staff to review and update guidance for other licensing activities to allow the increased use of risk insights, ensure that any prohibitive language inhibiting the staff from using risk insights is removed, and add sentence(s) pointing to the SRP and new RIDM OI. Additionally, the ticket directs the staff to develop an IRT approach for four processes (power uprates, backfits, generic communications, and TSTF travelers). The components of the ticket related to the use of the IRT approach are different from the RIDM Phase 1 report (Reference 6) in that the ticket will contribute to a single NRR RIDM OI, as opposed to updates to the existing guidance for each of the processes. See Enclosure 2 to the cover memorandum for this report for more information regarding Ticket Number 6.

Based on the interviews and discussions with process stakeholders, Team E also developed recommendations for process enhancements and other actions that are beyond the scope of RIDM Phase 2 (see Enclosure 4 to the cover memorandum for this report). Implementing these recommendations may require coordination between multiple offices, updating Management Directives, or other steps that are not conducive to ticketing a single NRR division. In other cases, the recommendations relate to process improvements that do not involve risk insights or an IRT approach and are therefore outside the scope of RIDM Phase 2, but could nonetheless potentially enhance the efficiency of NRC processes.

The immediate outcome of Team E's work was increased awareness among NRR staff and process owners of the current use of risk information in NRR processes and the potential benefits of increasing the use of RIDM and the IRT approach. In the longer term, the expanded use of risk insights in other NRR processes is expected to focus review efforts on issues with the greatest safety significance. The extension of the IRT approach to additional NRR processes is expected to improve the quality of regulatory products and the efficiency of NRR processes, and, in some cases, reduce the time needed to complete regulatory actions. This will be accomplished through early collaboration between technical reviewers, risk analysts, and other members of the multidisciplinary review teams.

The recommendations in Enclosure 4 to the cover memorandum for this report could be addressed as part of the agency's efforts to further expand RIDM beyond NRR processes, NRR's regular reviews and updates of its processes, or the activities of the Transformation Team.

2.6 Revision of Branch Technical Position 8-8, SRP Section 16.1, and RG 1.177

2.6.1 Objective

The objective was to revise the appropriate guidance documents to clarify the use and application of risk information in licensing actions. This activity was largely shaped by the Phase 1 NRR Office Director's expectations memorandum, dated May 31, 2018 (Reference 19). The memorandum was a follow-up action, in part, regarding two Differing Professional Opinions (DPO-2017-001 and DPO-2017-002) that were received on December 28, 2016, and January 9, 2017, respectively (Reference 20), concerning two NRC staff approved emergency license amendments for Palo Verde Nuclear Generating Station, Unit 2, related to a failed emergency diesel generator. Stemming from these concerns were inconsistent interpretations of technical specification completion times related to the Branch Technical Position (BTP) 8-8, "Onsite Emergency Diesel Generators and Offsite Power Sources Allowed Outage Times Extensions," February 2012 (Reference 21). Additionally, SRP Section 16.1, "Risk Informed Decision Making: Technical Specification," March 2007 (Reference 22), and RG 1.177 will need revision regarding guidance to technical specification completion times. Implementation Item 12 recommends revising BTP 8-8, SRP Section 16.1, and RG 1.177 (see Table 1).

2.6.2 Approach

The responsible reviewers and process owners were provided with the recommended changes to BTP 8-8 stated in the Phase 1 report, which were to clarify the use and application of risk information. Additionally, the responsible reviewers and process owners followed the expectations memorandum (Reference 19) for SRP Section 16.1 and RG 1.177 to ensure consistency with related guidance and address long-duration completion times for one-time extensions and backstop completion times. All the proposed changes are consistent with those prescribed in the Phase 1 report.

2.6.3 Output/Outcome

Ticket Number 7 was developed to update BTP 8-8, SRP Section 16.1, and RG 1.177 and to publish the revised documents in the *Federal Register*. The revision of those three documents will unify the NRR staff's understanding of the appropriate use of risk information in licensing applications. This effort will increase the staff's understanding of risk and risk tools and align NRR staff on the proper use of NRC guidance.

2.7 Metrics for NRR RIDM

2.7.1 Objective

The objective was to build accountability for using the RIDM philosophy in NRC processes, procedures, and staff interactions. Metrics help hold the staff accountable to achieve the vision of enhancing the use of RIDM in decisionmaking practices and improving the technical basis for regulatory activities.

Implementation Item 13 was first introduced in the August 2018 update of the RIDM Action Plan (Reference 23). Though it was not part of the original scope of the RIDM Action Plan, the staff included it due to the synergy with an effort being led by the Office of the Executive Director for Operations (OEDO) to update the metrics in the FY 2022 Congressional Budget Justification

(CBJ). The OEDO effort encouraged the staff to develop metrics and support a cultural change to embrace RIDM.

2.7.2 Approach

The NRC revises its strategic plan every 5 years and the most recent was completed in February 2018 (Reference 24). The new strategic plan covers FYs 2018-2022 and contains several strategies that will enable the NRC to fulfill its safety and security goals. Specifically, Safety Strategy 2 is to:

Further risk-inform the current regulatory framework in response to advances in science and technology, policy decisions, and other factors, including prioritizing efforts to focus on the most safety-significant issues.

Complimentary to the use of the NRC Strategic Plan, the NRC develops metrics for the CBJ and an effort is underway to more closely align the CBJ metrics with the safety and security strategies in the NRC Strategic Plan. Therefore, Team G focused on the development of a CBJ metric that supports Safety Strategy 2 as well as developing different methods to implement the CBJ metric within NRR.

Team G convened a small group of subject matter experts in risk to develop a draft metric, which was then shared with representatives from impacted business lines across the agency and later presented to office-level and OEDO management at the Performance Improvement Panel for comment. The intent of this collaboration was to ensure the metric could be implemented across the agency and would be a meaningful measure of the agency's success in risk-informing the current regulatory framework.

2.7.3 Output/Outcome

The output of this effort was a draft metric to support Safety Strategy 2 of the CBJ. This draft metric has been provided to OEDO; however, it may be subject to further review and comment by OEDO. The draft metric is:

The use of risk insights in agency processes is evaluated to assess effectiveness of risk-informed considerations and appropriate process updates/enhancements are made or planned in support of agency decisions.

Through the implementation of this metric supporting Safety Strategy 2, the intended outcome is to increase the use of risk insights in the NRC regulatory processes and decisionmaking. This metric will enable all the business lines to be cognizant of the need to increase the use of risk considerations in business line processes and decisionmaking.

For the purposes of the RIDM Action Plan, this action is complete; however, the OEDO plans to finalize approval of all new CBJ metrics and pilot the metrics for 6 months to determine if further refinements are required. Refinements may be needed to ensure implementation of the metric works in practice. As part of the pilot implementation, each business line will need to develop lower level, or leading metrics, to support the CBJ metric. The final metric will be used for the development of the FY 2022 CBJ.

2.8 Summary of Tickets

Ticket #	Subject	Due Date	Division
1	New NRR Office Instruction (OI) on RIDM	2/28/2019	DORL
2	New Staff Guidance for RIDM for Inclusion in the new RIDM OI	7/31/2019	DRA/DE
3	Training on NRR RIDM Office Instruction	6/30/2019	DORL/DRA
4	RRPS Modifications	3/15/2019	DORL
5	Update NUREG-0800 to Account for the Adoption of RIDM	3/31/2019	NRO
6	Update the Guidance and develop IRT approaches for Other Licensing Activities to Allow for Increased Use of Risk Insights	7/31/2019	Multiple Divisions
7	Revise BTP 8-8, SRP Section 16.1, and RG 1.177 to address RIDM Task 4 Phase 1 Recommendations	4/24/2019 and 9/31/2019 (for FR publishing)	DE/DSS/DRA

3.0 COMMUNICATIONS WITH STAKEHOLDERS

During Phase 1 and 2, the staff leveraged various communication tools to ensure that all stakeholders are aware of new and enhanced risk training courses and guidance, ongoing RIDM initiatives, and plans and experience using risk information.

The internal and external stakeholders for the RIDM project were informed of the progress through multiple tools employed by the NRR staff. These tools were also used to identify gaps in the staff's understanding of the use of risk and train the staff on the use of RIDM.

3.1 Internal Communication Tools

In an effort to reinforce the expectation to use insights in regulatory activities, the staff used several tools to discuss RIDM with the internal stakeholders and to inform the staff of the application of RIDM to their daily work.

Workshops: The NRR staff held "Risk-Informed Thinking Workshops" on April 24, August 2, and November 13, 2017, and January 23, March 12, May 17, and November 15, 2018. This classroom course provided participants hands-on experience applying the RIDM framework to scenarios that replicate real-life agency situations.

Risk Cafés: Risk cafés were used to gain a broad spectrum of the staff's (technical reviewers and risk analysts) understanding on how risk is used in the agency's decisionmaking activities. The cafés were held at NRC headquarters during Phase 1 of the RIDM project. During Phase 2, the cafés were held in the Regional Offices and the processing of the data during the Phase 2 cafés is expected to be completed by the end of February 2019.

Questionnaires:	The online surveys asked how the NRC staff and managers understand the concepts of risk and risk insights. In Phase 1, a questionnaire was provided to NRR staff and 107 staff participated in the survey. In Phase 2, a questionnaire was provided to the regional office staff. Throughout the four regional offices, a total of 277 staff participated in the survey.
<i>NRC Reporter</i> :	An article on the Risk-Informed Thinking Workshop was published in the December 6, 2018, edition of the <i>NRC Reporter</i> newsletter.
NRR Announcements:	NRR-wide announcements were used to announce the questionnaires, risk cafés, and the upcoming RIDM training for NRR staff.
Division and Executives:	Presentations during division meetings, NRR Executive Team Significant Topics meetings, and NRO Executive Team meetings provided updates on the progress of this project. The presentations during division meetings also provided training to the staff.
Regional Counterpart Meetings:	Presentations during the counterpart meetings provided updates on the progress of the RIDM project and training. Regional risk cafés were held during the regional counterpart meetings.
Phase 1 and 2 Reports and Action Plan Updates:	At the conclusion of Phase 1 of the project, the RIDM team produced a findings and recommendations report (Reference 6). Enclosures 1-5 to the cover memorandum for this report provide the conclusion of Phase 2 of the project. Both reports are publicly available and can also be used as an external communication tool. Additionally, the staff produced quarterly updates to the RIDM Action Plan throughout Phase 1 and 2.

3.2 External Communication Tools

External stakeholders have expressed an interest in the staff's progress towards a more holistic and integrated view of regulatory activities that includes a RIDM approach. To that end, the staff prioritized several opportunities to make the RIDM effort known to external stakeholders, as well as gather external stakeholders' insights.

Public Meetings:	<p>A Category II Public Meeting was held on September 14, 2018 during Phase 2. The meeting summary is available at Reference 25. At the public meeting, the RIDM Team provided an update to the industry on the RIDM Action Plan Phase 1 recommendations and Phase 2 implementation plan. The team also discussed the new IRT licensing process with industry, including an explanation of Type 1, 2, and 3 applications.</p> <p>Consistent with Phase 1, following the conclusion of Phase 2, the staff will use the quarterly risk-informed steering committee (RISC) public meetings to update licensees, NEI, and members of the</p>
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public on the results of the project and ongoing efforts to incorporate RIDM into NRR decision making. Since the RISC public meetings are typically attended by NRC and licensee executives, independent staff level public meetings will be scheduled, as needed, to discuss working level items.

Phase 1 and 2 Reports: At the conclusion of Phase 1 of the project, the RIDM team produced a findings and recommendations report (Reference 6). Enclosures 1-5 to the cover memorandum for this report provide the conclusion of Phase 2 of the project. Both reports are publicly available.

Due to the several ongoing RIDM initiatives and the issuance of the Phase 2 tickets, communications with stakeholders regarding the progress of current RIDM activities will continue well after the completion of Phase 2. In addition to the ongoing initiatives, new activities that arise will also require informing stakeholders of the expansion of the scope of RIDM. The staff will continue to build on the current communication strategies employed to ensure that all stakeholders continue to remain informed regarding all RIDM initiatives.

4.0 RISK-INFORMED DECISIONMAKING PATH FORWARD

Throughout FYs 2019 and 2020, key personnel from the RIDM teams will continue to monitor the progress of the ticketed activities that are issued at the completion of Phase 2. The lead RIDM project manager will maintain a database of all tickets issued as a result of the project, as well as the expected timeframe for completion of each. Phase 2 Team Leaders will maintain an awareness of the status of the tickets issued as a result of their individual activities. On a quarterly basis, the Phase 2 team leaders will report to the lead RIDM project manager on the status of the tickets, until completion of all tasks. The deputy division directors of the NRR Division of Engineering, Division of Safety Systems, DRA, and DORL, as the steering committee for the RIDM project, will continue to their oversight of the tickets and other RIDM-related activities until their completion.

Development of the ticket responses within the NRR line organizations increases awareness of RIDM activities and provides opportunities amongst NRC staff to be involved in building and promoting a culture that embraces the use of RIDM.

5.0 SUCCESS CRITERIA FOR PHASE 2

The November 2018 update of the RIDM action plan (Reference 2) states that Phase 2 will be considered successful if at least 17 of the 21 (greater than 80 percent) recommendations are implemented as a result of NRR RIDM team efforts. Upon review of the actions taken and the seven tickets produced at the end of Phase 2, the intent of all 21 (100 percent) recommendations were met.

6.0 CONTACT

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Attachment

Table 1: Phase 2 Implementation Items

Attachment

Table 1: Phase 2 Implementation Items

Table 1: Phase 2 Implementation Items

Implementation Item #	Assigned Team	Description	Phase 1 Task	Phase 1 Recommendation
1	A	Define Type 1, 2, and 3 applications	Task 1/3	1
2	A	IRT roles & responsibilities trial basis, obtain feedback and assess	Task 1/3	2/3/4
3	B	Augment position descriptions and performance appraisal Elements and Standards	Task 2	7
4	B	Regional Cafes	Task 2	
5	A	Training on IRT	Task 1/3	4
6	D	High- Level Training on RG 1.174, RG 1.200, RG 1.177, NUREG-2122, risk insights, expectation memo	Task 2/2/4/4/4	1/6/1/5/6
7	D	Branch-Specific Training on RG 1.174, RG 1.200, RG 1.177, NUREG-2122, risk insights, expectation memo	Task 2/2/4/4/4	1/6/1/5/6
8	C	Guidance for use of risk principles, desktop glossary, hierarchy of documents	Task 2	2/3/5
9	A	Update OIs to reflect Type 1, 2, 3 applications and IRT roles/responsibilities/process	Task (1/3)/(1/3)/2	1/4/4
10	A	Update RRPS to reflect IRT	Task 1/3	5
11	E	Identify other processes that could use IRTs. Update OIs, guidance, training for other processes	Task 1/3	6
12	F	Revise BTP 8-8, SRP 16.1, RG 1.177	Task 4	2/3/4
13	G	Update Metrics	--	--