

Job Aid to Support Risk-Informing Reviews

I. INTRODUCTION

Risk considers the likelihood of an operational event and the severity of potential consequences to workers, the public, and the environment. For the purpose of this job aid, “to risk-inform” a review of an application means to consider the risk associated with a change to a System, Structure and Component (SSC) when determining the depth of the review for the requested licensing action.

The purpose of this job aid is to support risk-informing reviews of applications for licenses and Certificates of Compliance (CoCs) of spent fuel dry storage systems by using: 1) a tree diagram in a file titled, “Risk Tool Tree Diagram,” and 2) a report, titled, “Development of Dry Cask Risk Tools.” These documents are available at the following SharePoint site:

<https://usnrc.sharepoint.com/:f:/r/teams/NMSS-CSR/B/Risk%20Tool%20Working%20Group/Risk%20Tool%20-%20INL%20final%20report%20-%20general%20use%20version?csf=1&web=1&e=BftZxa>.

This job aid should be used as a starting point in assessing the scope, level of effort (see below for suggested depth of review), and the complexity of the review of the requested licensing action. However, the reviewer should keep in mind that the Standard Review Plan (SRP), NUREG-2215, still provides a general approach to establish reasonable assurance, recognizing that a greater depth of review effort should be applied for more risk significant aspects. In addition to the SRP, the reviewer should use risk information to determine the appropriate level of rigor needed to make a safety determination.



Figure 1. Considerations and purpose of the Risk Tool.

As depicted in the figure above, the Risk Tool should allow the reviewer to reach a preliminary determination on the scope, level of effort, and the complexity of the review. The Risk Tool is not expected to address all licensing requests (LR).

As discussed in Section III below, there may be aspects of a requested licensing action that would warrant adjustments to the initial assessed risk level and depth of the review. Additionally, the Risk Tool is considered a ‘living’ document, meaning that it will be updated as needed.

II. HOW TO USE THE RISK TOOL?

The staff should use the Risk Tool in the evaluation of licensing action requests. This job aid is intended to be used during the acceptance review, or in the absence of an acceptance review, as the first step in the staff's detailed technical review.

The staff should use the "Risk Tool Tree Diagram," the document "Development of Dry Cask Risk Tools," and the following worksheet and instructions tables below when implementing an acceptance review and documenting the use of the Risk Tool (See Section IV for examples of completed Risk Tool worksheets).

Table 1. Risk Tool Worksheet

	1	2	3	4	5
LR Change #	Change proposed in the LR	Present as a gate in the Risk Tool Tree Diagram? (Y/N)	LR change is adequately informed by the Risk Tool Report? (Y/N)	List the relative risk for the review.	If response to Column 3 is "N", describe why it is not addressed (e.g., the reviewer explains the rationale why stated risk is lower or higher; or the rationale in the Risk Tool has a different scope than the request).
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Table 2. Instructions for filling out Table 1.

	Question	Go to the Risk Tool Worksheet
A	What is the change to be evaluated?	Provide a brief description of change in column No. 1
B	Is the type of change requested included as a "gate" in the Risk-Informed Tool Tree Diagram?	Enter "Yes" or "No" in column No. 2 of the Worksheet. If "Yes", go to Question C . If "No", then this job aid is not applicable to the review. Proceed to column No. 5 and document that " <i>There is not a gate for this change.</i> " Then, proceed with the review according to the SRP.
C	Is the rationale discussion associated with the gate in the Risk Tool Report informative of the change requested?	Enter "Yes" or "No" in column No. 3 of the Worksheet. If "Yes" consider the risk recommendation in the preliminary plans for the depth of review. Go to Question D . If "No", use additional considerations if possible, such as provided in the right-hand column of Table 3, to determine a preliminary risk level and depth of review.

		Go to Question D , or go to Question E if the Risk Tool rationale does not apply.
D	What is the preliminary risk level?	Document the preliminary risk level in column No. 4 of the Risk Tool Worksheet (low, medium, high or undetermined). Proceed to the review according to SRP.
E	How is the change different from the description in the Risk Tool Report?	Briefly describe in column No. 5 why the requested change is out of scope of the Risk Tool Report, then proceed with the review according to SRP, applying risk informed decision making to the review.

III. LIMITATIONS OF THE RISK TOOL

The Risk Tool is not expected to address all actions requested. This job aid does not replace NRC staff experience, rather, it seeks to enhance it. There may be aspects of a licensing action request that would warrant adjustments to the assessed risk level and depth of the review. In all instances, whether the Risk Tool is applicable or not, the staff should continue to apply engineering judgment based on experience and updated knowledge in the technical areas. The table below includes examples of benefits of the Risk Tool and examples of additional information the staff must consider in adjusting the Risk Tool’s preliminary risk determination.

Table 3. Risk-Informing Tool: Benefits and Additional Considerations.

Benefits	Additional Considerations
<ol style="list-style-type: none"> 1. Provides a preliminary determination of risk significance of the action requested early in the process. 2. Plan review strategy and develop safety focused RAls. 3. Start a discussion about the risk significance of the action requested with other staff reviewers and, as appropriate, branch chiefs. 	<ol style="list-style-type: none"> 1. Complexity and quality of the application. 2. Introduction of new designs. 3. New and modified methods of evaluation and/or boundary conditions. 4. New design standards. 5. Uncertainties and margins to safety criteria. 6. Experience from prior operations and licensing actions. 7. Potential for the cumulative effects of several changes to create a higher risk than that identified for each individual change.

It is important to point out that the current Risk Tool Tree Diagram has limited details for some areas. For example, Increased Burnup (Gate 2.1.1) does not expand to further sub-gates for shielding and thermal review. The reviewers should assume that Gate 2.1.1 implies that shielding and thermal reviewers should examine the risk on the impact on these areas because increased burnup will affect source terms and decay heat.

IV. ESTIMATING DEPTH OF A REVIEW

After a licensing action has been assigned a Low, Medium or High relative risk, the reviewer should follow the general guidance below to inform the appropriate level of rigor needed to make a safety determination. Level of effort input is currently provided to the PMs for consideration; this Risk Tool can help inform those considerations.

For all reviews, regardless the estimated risk level, the Technical Reviewer should review the statements provided in the application letter, proposed CoC/Technical Specifications revision, and the Safety Analysis Report (SAR) to ensure that they are consistent and meet 10 CFR Part

72 requirements. Guidance documents including the SRP should be relied on for all reviews as applicable.

To facilitate discussions on risk, the technical reviewers should maintain the worksheet with the review to support discussions on the review as appropriate.

During an acceptance review conversation with the applicant, the PM should verbally discuss the preliminary level of effort. Some language to consider includes: “The staff’s preliminary assessment of the depth of review identified these [1, 2, or 3] areas potentially warranting a more detailed review; this considered complexity and use of the Risk Tool. [List Areas]. Additionally, the NRC staff identified [1, 2, or 3] areas requiring less detail of review. [List Areas]. However, the assessments could change as the review progresses.”

Within the acceptance review letter, the PM should communicate that the pilot version of the Risk Tool was used to inform the estimated depth of review.

The review team should meet to discuss the estimated depth of the review in the various areas which would integrate the understanding among the reviewers regarding the complexity and risks associated with the review. Through the course of a review, the Branch Chiefs should maintain an awareness of the developing risk insights.

Table 4. Risk based guidance for depth of review.

<p>For items assigned a Low Risk (green gate):</p> <ul style="list-style-type: none"> a) Recognize that all ITS components and systems discussed in the Risk Tool Report need to be reviewed, even for those items that are assessed as low risk. However, the level of review should be commensurate with the risk. An item may be considered low risk because of the reasons stated in the Risk Tool Report or other reasons (e.g., there being redundancies, the amendment request change is very small from what was previously determined to be safe). b) Review should focus on verifying that the SAR contains the necessary analyses to demonstrate regulatory compliance and safety based on guidance in the SRP, and that the analytical approaches are reasonable. Guidance documents, including the SRP, are a useful resource when performing the review. c) Limited to little or no confirmatory analysis for compliance is necessary. The Technical Reviewer should generally consider the applicant’s analyses to be complete and accurate and forego independent confirmation unless the reviewer disagrees with the initial conclusions.
<p>For items assigned a Medium Risk (yellow gate):</p> <ul style="list-style-type: none"> a) The review should focus on verifying that the SAR and relevant supporting analyses are complete and correct in key areas where the amendment request change could be expected to significantly impact safety. Key methods of evaluations, input and output parameters, and boundary conditions are checked and verified that the results are reasonable based on the SRP guidance. Guidance documents, including the SRP, are a useful resource when performing the review. b) The Technical Reviewer may perform confirmatory analyses, for those items important to safety.
<p>For items assigned a High Risk (red gate):</p>

- a) The Technical Reviewer should review the SAR, any supporting analyses, verify that methods of evaluation are deemed appropriate, and, if relevant, consider previously approved licensing actions. Guidance documents, including the SRP, are a useful resource when performing the review.
- b) The Technical Reviewer should verify that the values for input parameters and boundary conditions that support the applicant's analyses are correct.
- c) The Technical Reviewer should consider performing confirmatory analyses to verify that the applicant's results are reasonable and correct.

V. Examples of Risk Tool Applications and Work Sheets

Example Application of Risk Tool #1

Materials Review: Change that increases the service temperature of a concrete overpack

The Risk Tool (Gates 1.2.1.1 and 1.2.1.2) assigns the overpack shield as MEDIUM risk. This is the initial "raw" risk assessment.

The Risk Tool rationale for the overpack shield being a medium risk:

- Concrete directly protects personnel and public from radiation
- Safety margins typically large
- Routine radiation monitoring activities likely to catch significant degradation.

Considerations:

The validity of this raw risk assessment must be considered against whether the Risk Tool technical basis is fully applicable to the proposed change, as well as whether there is any operating experience or other insights that might change that conclusion, such as:

- Changes in concrete properties at high temperature is a known phenomenon (e.g., see NUREG/CR-6900).
- Potential for elevated temperatures to enhance degradation mechanisms during extended storage terms.

Summary:

Based on the above considerations, the increase in the concrete overpack temperature supports the Risk Tool's initial assessment of a MEDIUM level of effort in the technical review.

In this case, the review focuses on verifying that the SAR is complete and correct in **key areas** where the change could be expected to significantly impact safety. Key analytical methods, input parameters, and boundary conditions are checked and verified to be reasonable based on the SRP guidance. In this example, the reviewer may:

- Verify concrete temperatures conform to ACI Code.
- Ensure that test data supports operating at higher temperatures than allowed in ACI Code.
- Consider value of inspection/monitoring activities in making a safety finding.

Risk Tool Worksheet for application example #1

	1	2	3	4	5
LR Change #	Change Proposed in the LR	Present as a gate in the Risk Tool Tree Diagram? (Y/N)	LR change is adequately informed by the Risk Tool Report? (Y/N)	If response to Column 3 is "Y", list the relative risk	If response to Column 3 is "N", describe why it is not addressed (e.g., the reviewer explains the rationale why stated risk is lower or higher; or the rationale in the Risk Tool has a different scope than the request).
1	Increase temperature exposure for concrete overpack	Yes, Gates 1.2.1.1 and 1.2.1.2	Yes	MEDIUM	Not applicable; However, staff may include the additional considerations in future revisions of the Risk Tool rationale discussion.

Example Application of Risk Tool #2

An amendment that includes changing an already approved finned canister such that Alloy B fin material is used rather than the original Alloy A.

The Risk Tool (Gate 1.2.2.1) assigns a fin component as "medium" risk. This is the initial "raw" risk assessment.

The applicant proposes to use Alloy B because of reduced material cost and easier weld procedures. However, Alloy B thermal conductivity is reduced by 2%. Currently, there is 50-degree F peak cladding temperature margin with allowable temperatures.

Considerations:

What is the risk and level of effort for reviewing this portion of an application? Content has not changed from the previously reviewed amendments. Likewise, decay heat has not increased. The thermal model of the finned canister storage system has already been reviewed during previous submittals. The previous submittal had a 50 degree F margin with allowable temperatures.

Although thermal conductivity of the fin material is lower than previously analyzed, and therefore, heat transfer performance is lower, using Alloy B should not significantly impact thermal phenomena from the previously reviewed thermal model. It is reasonable to conclude that the thermal model would predict the revised thermal performance so that the reviewer could

assess the impact of ITS component temperatures and the extent that allowable temperature margins have changed.

Summary:

Based on the above considerations, the risk significance of the change is considered low with a corresponding level of review effort.

Risk Tool Worksheet for application example #2

	1	2	3	4	5
LR Change #	Change Proposed in the LR	Present as a gate in the Risk Tool Tree Diagram? (Y/N)	LR change is adequately informed by the Risk Tool Report? (Y/N)	If response to Column 3 is "Y", list the relative risk	If response to Column 3 is "N", describe why it is not addressed (e.g., the reviewer explains the rationale why stated risk is lower or higher; or the rationale in the Risk Tool has a different scope than the request).
1	Change to alloy used for cannister fin	Yes, Gate 1.2.2.1	Yes.	MEDIUM	Not applicable. However, reviewer will perform this review as a "LOW" review based on reviewer judgement that Alloy B should not significantly impact thermal phenomena from the previously reviewed thermal model.

Additional examples of how the Risk Tool is used in preliminary evaluations are provided at the following SharePoint site:

<https://usnrc.sharepoint.com/:f/r/teams/NMSS-CSRBRisk%20Tool%20Working%20Group/Examples%20of%20Applying%20Risk%20Tool?csf=1&web=1&e=p7ScGo>

VI. ABBREVIATION

COC – Certificate of Compliance
 ITS – Important to Safety
 LR – Licensing Request
 PM – Project Manager

SAR – Safety Analysis Report
 SSC – Structures, Systems and Components
 SRP – Standard Review Plan