Guide Number: SNS-QA-G01
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Title: Guide for Analyzing Risks

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Purpose

To provide guidance in documenting the major risks that concern the designers along with recommendations for addressing them. This guide is part of the implementation of SNS Project Execution Plan, Appendix C, Section 2.2.3, "Project Risk Management" and of the graded approach required by SNS Quality Assurance Plan, SNS-QA-P01, Section 4. SNS guides describe acceptable methods to implement project requirements.

Scope and Applicability

This guide is recommended for application to the systems, structures, and components (SSCs) specifically listed in SNS documents as Safety Class or Safety Significant, for other Quality Level 1 SSCs, and any other additional functions and features that the design team identifies as essential to operation or to ES&H. It is for use when considering technical risk, cost and schedule risk, dependability, and the potential for health, safety, and environmental risks. This guide may be used by all project participants. Where needed, additional risk analysis guides may be developed by the architect-engineer/construction manager (AE/CM) and the partner laboratories to govern work in their areas of responsibility.

Responsibilities

Senior Team Leader or other SNS management, each in their area of responsibility.
- Identifies the SSCs or other design work suitable for risk analysis as listed under the "Scope and Applicability" section of this guide.
- Assigns a team and a team leader to perform risk analyses as needed [in the simplest cases, the analysis may be completed by a team of one who will provide it to the QA representative (QAR) for review and concurrence].
- Includes their QAR as a team member (or reviewer for the simplest cases).
- Approves the report when properly completed.
- Assigns suitable recommendations as action items to specific persons to complete and report closure.

Entire analysis team
- Lists SSCs in the scope of their risk analysis.
- Identifies the failure modes or hazards to each listed SSC that could threaten its required reliability, safety, operability, cost, constructability and maintainability, or the project schedule.
- Lists consequences and their causes.
- Creates a narrative explaining the team's choices for the best alternatives in design or operation.
- Prepares a report input covering the recognized failure modes or causes not selected for rigorous analysis.

Analysis team leader
- Determines whether a rigorous or nonrigorous approach will be used for each mechanism of risk.
- Assembles the rigorous and nonrigorous analyses for the entire scope of the report.

Team members
- Serve as team members especially to provide information and insight to their special technical or professional area of competence and their role in the project.
- Propose alternatives in design or operation that would satisfy requirements.

QAR
- Serves as a team member especially able to provide information and insight to the risk analysis process and the quality-assurance mechanisms available to reduce risk where needed.
- Ensures that the actions resulting from analysis recommendations are tracked to closure if specifically assigned to individuals for such tracking and closure.

Risk Analyst
- Assembles estimates or historical data on probability of occurrence of failures and probability of adequate defense or detection before there are consequences.
- Explores alternatives in design or operation that would satisfy requirements.

- Creates an explanation or calculation of the risk reduction by appropriate choices.
- Prepares a report input covering the failure modes or risk mechanisms selected for rigorous analysis.

Process Flow
Follow the process shown in Appendix A.

Records
- Information used as a basis for analysis
- Analysis Reports
- Closure of any actions tracked from the analysis report recommendations

References
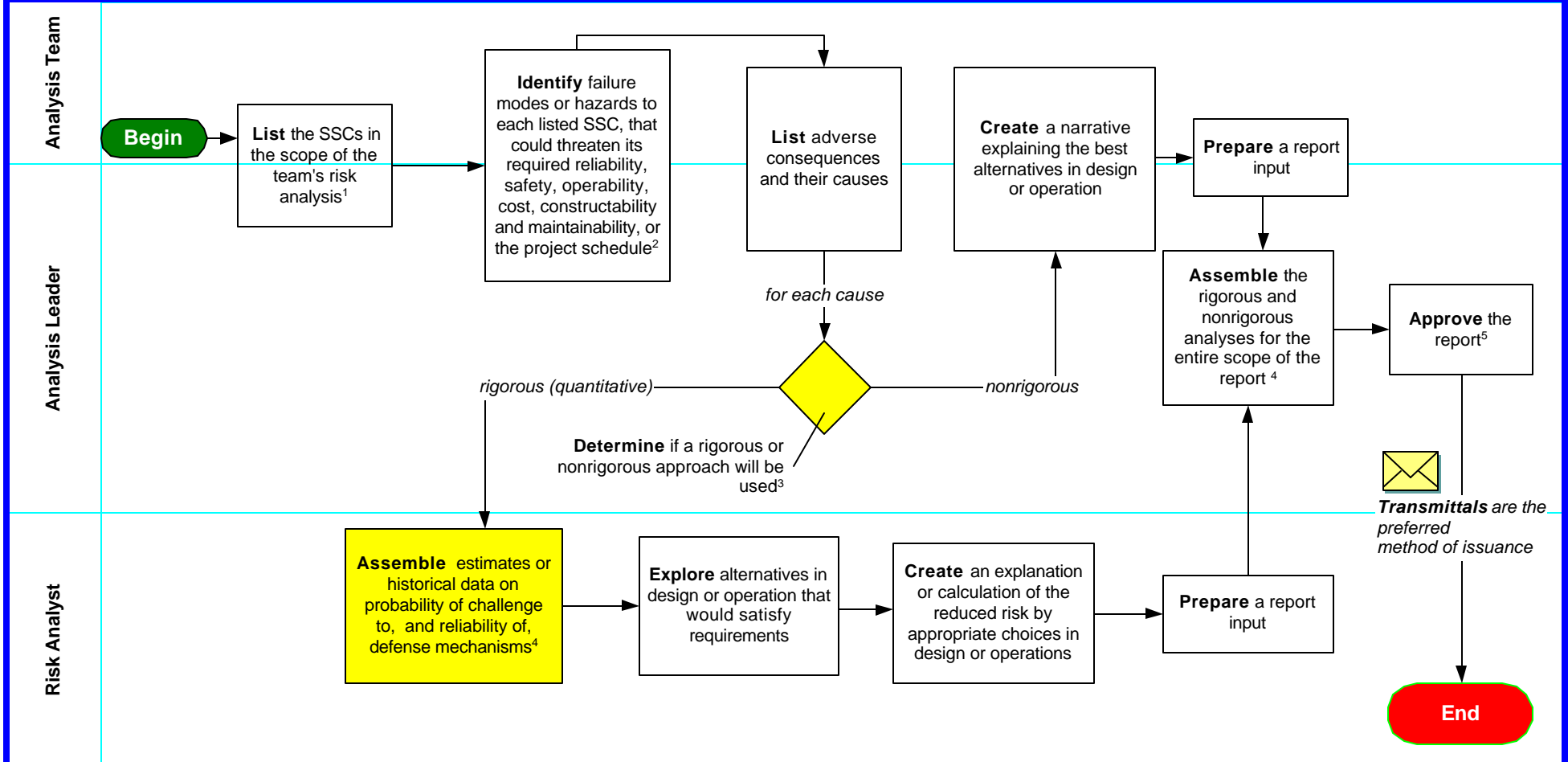- SNS-QA-P01, SNS Quality Assurance Plan
- SNS Project Execution Plan, Appendix C

Appendixes
A: Risk Analysis Flowchart
B. Risk Analysis Form

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SNS Quality Assurance Manager

Appendix A
Risk Analysis Flowchart

Analysis Team

Begin

List the SSCs in the scope of the team's risk analysis[1]

Identify failure modes or hazards to each listed SSC, that could threaten its required reliability, safety, operability, cost, constructability and maintainability, or the project schedule[2]

List adverse consequences and their causes

Create a narrative explaining the best alternatives in design or operation

Prepare a report input

Analysis Leader

for each cause

rigorous (quantitative)

Determine if a rigorous or nonrigorous approach will be used[3]

nonrigorous

Assemble the rigorous and nonrigorous analyses for the entire scope of the report [4]

Approve the report[5]

Transmittals are the preferred method of issuance

Risk Analyst

Assemble estimates or historical data on probability of challenge to, and reliability of, defense mechanisms[4]

Explore alternatives in design or operation that would satisfy requirements

Create an explanation or calculation of the reduced risk by appropriate choices in design or operations

Prepare a report input

End

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[1]**Systems, structures, or components to include**

- SSCs specifically listed in SNS documents as Safety Class or Safety Significant
- other Quality Level 1 SSCs
- additional SSCs that the team identifies as essential to operation or to ES&H

[2]**Hazards or failure modes to include**

- those listed in approved SNS documents
- those the team recognizes from past projects or otherwise known problems
- those that are anticipated by the team but not based on actual experience

[3]**Rigorous analysis** may not be feasible for failure modes or hazards where no historical data exist.

[4]**Correspondence** or a completed risk analysis form (Appendix B) may be adequate to document the report of a simple analysis.

[5]**Higher management approvals** may be needed, as well as action tracking and closure in some cases, to implement the report recommendations.

Appendix B
Risk Analysis Form

This form may be used for simple analyses covering the the failure modes or other risk mechanisms selected for rigorous analysis and the narrative explanations for any nonrigorous anaysis. This form may be also be used as an outline for the formal report of analyses requiring extensive explanation, calculation, or tables.

System, Structure, or Component Name _____ WBS or other identifier _____

Table 1. Failure Modes and Effects Analysis (FMEA)

1. Failure Mode	2. Cause	3. Consequence	4. Rel. Risk	5. Sever-ity	6. Prob-ability	7. Detect-ion	8. Recommendation	9. Expected Benefit and Cost if Known

Relative Risk = S x *P* x *D* (heading spanning columns 4–7)

Instructions for completing Table 1.

Expand or modify the table in a word processor as needed.

Column 1, consider as failure modes the loss of operability, or of the technical performance required for the subject SSC.

Column 2 is for the mechanisms by which the failures occur.

Column 3 is for the possible adverse consequences.

Column 4, relative risk, is the product of columns 5, 6, and 7.

Columns 5, 6, and 7 are the severity of the consequence on a scale such as 1-10, the probability of occurrence, and the likelihood of adequate defense or detection before harm is done.

Column 8 is the analysis team's recommendation for protecting against the failure mode.

Column 9 is the justification of the recommendation in terms of benefits and costs.

Table 2. Analysis of Risks Other than the Failure Modes of the Completed SSC

1. Requirement	2. Adverse Consequence	3. Cause	Risk (calculation or discussion)	5. Recommendation	6. Expected Benefit and Cost if Known

Instructions for completing Table 2,

Column 1. Consider as requirements the project technical performance (including constructability and maintainability), any existing cost and schedule plans, and the health, safety, and environmental performance required.

Column 2 is for the possible project execution failures related to the requirement

Column 3 is for the causes

Expand or modify this table in a word processor as needed.

Column 4 is for the calculated or text explanation of risk similar to cols. 4, 5, 6, and 7 of Table 1.

Column 5 is the analysis team's recommendation for protecting against the risk.

Column 6 is the justification of the recommendation in terms of benefits and costs.

Remarks [attach page(s) if needed]:

_____

_____

_____

_____

List of important alternatives that were considered in design or operation that would satisfy requirements but that are not recommended by this analysis

_____

_____

_____

_____

Summary explanation or calculation of the reduced risk made possible by the recommended choices:

_____

_____

_____

_____

Analysis team members who provided input:

_____   _____

_____   _____

Approvals

Title/Function	Signature	Date
Risk Analyst		
QA Representative		
Senior Team Leader (if applicable)		
Division Approver		

Additional approvers may be added if needed.