

Application of Risk Management Practices to NNSA Tritium Readiness Subprogram

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National Nuclear Security Administration

- A separately organized agency within the U.S. Department of Energy
- Established by Congress in 2000
- Responsible for enhancing national security through the military application of nuclear science
- Maintains and enhances the safety, security, reliability and performance of the U.S. nuclear weapons stockpile without nuclear testing
- Works to reduce global danger from weapons of mass destruction
- Provides the U.S. Navy with safe and effective nuclear propulsion
- Responds to nuclear and radiological emergencies in the United States and abroad

NNSA Tritium Readiness Subprogram

- One of NNSA's missions is to provide tritium to the US nuclear stockpile.
- Tritium Readiness Subprogram is to establish a system that can ensure that the inventory is maintained by producing new tritium to replace that tritium lost to radioactive decay and consumption.
- The Tritium Production System of this subprogram will produce tritium by irradiating the NNSA-designed Tritium Producing Burnable Absorber Rods (TPBARs) in reactors operated by the Tennessee Valley Authority (TVA), an independent government agency.
- These TPBARs will be manufactured commercially.
- After irradiation, the radioactive TPBARs will be removed from the reactors and transported to a new Tritium Extraction Facility (TEF) at the Savannah River Site (SRS).
- There the tritium will be removed from the rods using a special vacuum-thermal process.

Scope of TR Subprogram Risk Assessment

- An *Assessment* of NNSA Tritium Readiness Subprogram risks was conducted as part of the Risk Management Process adopted by the NNSA.
- The *goal* of this overall assessment was to identify risks to the Subprogram and to develop handling strategies with specific action items that could be scheduled and tracked to completion in order to minimize program failures.
- The issues and assumptions developed during the assessment planning stage were considered during several meetings by a team comprised of individuals representing
 - Pacific Northwest National Laboratory (PNNL),
 - WesDyne,
 - Kansas City Plant (KCP),
 - NNSA,
 - NAC,
 - Tennessee Valley Authority (TVA), and
 - Savannah River Site (SRS) in identifying risks

Risk Grading Guidelines

Likelihood (L)	Criteria
Non-Credible	Determined (through formal probability calculations) to have a probability of occurrence of $\leq 10^{-6}$ (or other non-credible probability defined for the activity)
Very Unlikely	<ul style="list-style-type: none"> •Estimated recurrence interval > 20 years (or perceived life of program); or •Will not likely occur anytime in the life cycle of the Tritium Readiness Subprogram; or •Estimated recurrence frequency < 1 (i.e., event not expected to recur); or •0% < Likelihood of single event occurrence < 15%.
Unlikely	<ul style="list-style-type: none"> •Will not likely occur in the life cycle of the Tritium Readiness Subprogram; or •10 years < Estimated recurrence interval \leq 20 years; or •1 \leq Estimated recurrence frequency < 2 (i.e., event expected to recur but not more than once); or •15% \leq Likelihood of single event occurrence < 45%.
Likely	<ul style="list-style-type: none"> •May occur sometime during the life cycle of the Tritium Readiness Subprogram; or •5 years < Estimated recurrence interval \leq 10 years; or •2 \leq Estimated recurrence frequency < 5 (i.e., event expected to recur from 2 to 4 times); or •45% \leq Likelihood of single event occurrence < 75%.
Likely Likely	<ul style="list-style-type: none"> •Will likely occur sometime during the life cycle of the Tritium Readiness Subprogram; or •Estimated recurrence interval \leq 5 years; or •Estimated recurrence frequency \geq 5 (i.e., event expected to recur more than five times); or •75% \leq Likelihood of single event occurrence < 100%.

Risk Grading Guidelines

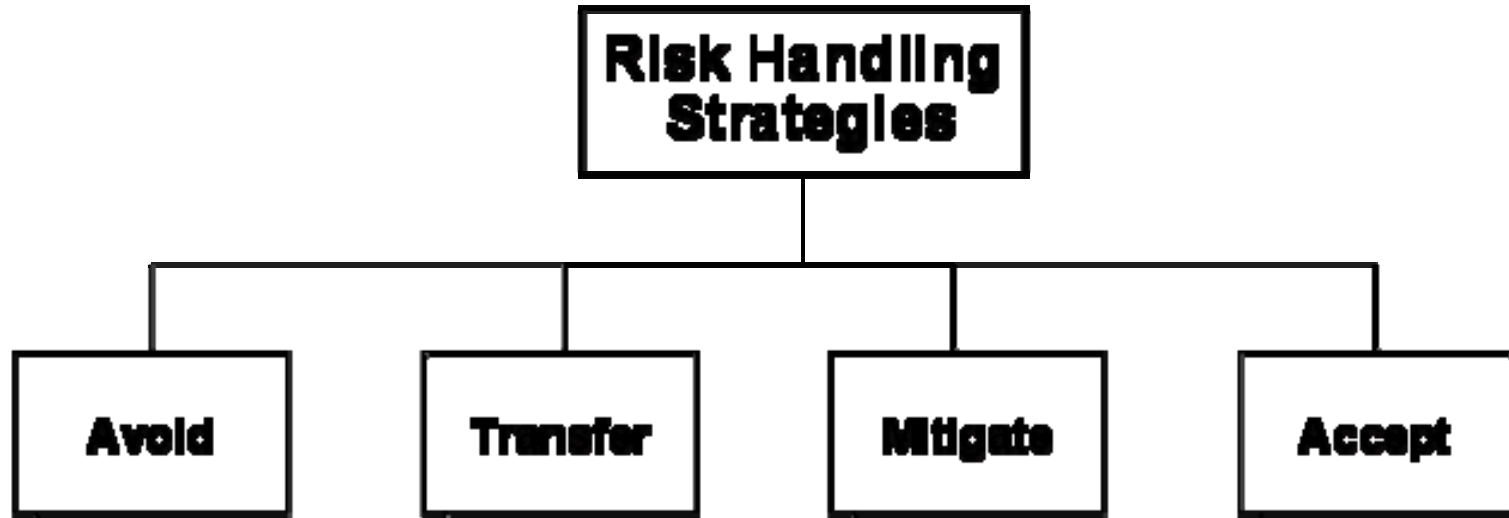
Consequence (C)	Criteria
Negligible	<ul style="list-style-type: none"> •Minimal consequences; unimportant. •Some potential transfer of money (\leq \$500K), but budget estimates not exceeded. <p>Negligible impact on program; minimal potential for schedule change; compensated by available schedule float.</p>
Marginal	<ul style="list-style-type: none"> •Small reduction in Tritium Readiness Subprogram technical performance. •Moderate threat to Tritium Readiness Subprogram mission, environment, or people; may require minor facility redesign or repair, minor environmental remediation, or first aid/minor medical intervention. •Cost estimates marginally exceed planned budget ($>$ \$500K, but \leq \$1M). •Minor slip in schedule (anything less than 3 months) with some potential adjustment to milestones required.
Significant	<ul style="list-style-type: none"> •Significant degradation in Tritium Readiness Subprogram technical performance. •Significant threat to Tritium Readiness Subprogram mission, environment, or people; requires some facility redesign or repair, significant environmental remediation, or causes injury requiring medical treatment. •Cost estimates significantly exceed planned budget ($>$ \$1M, but \leq \$5M). •Significant slip in schedule (3 months to less than 12 months) with resulting milestones changes that may affect Tritium Readiness Subprogram mission.
Critical	<ul style="list-style-type: none"> •Technical goals of Tritium Readiness Subprogram cannot be achieved. •Serious threat to Tritium Readiness Subprogram mission, environment, or people; possibly completing only portions of the mission or requiring major facility redesign or rebuilding, extensive environmental remediation, or intensive medical care for life-threatening injury. •Cost estimates seriously exceed planned budget ($>$ \$5M, but \leq \$10M). •Excessive schedule slip (12 months to \leq 18 months) unacceptably affecting overall mission of Tritium Readiness Subprogram objectives, etc.
Crisis	<ul style="list-style-type: none"> •Tritium Readiness Subprogram cannot be completed. •Cost estimates unacceptably exceed planned budget ($>$ \$10M). •Catastrophic threat to program mission; possibly causing loss of mission. •Schedule slips $>$ 18 months.

Risk Grading Matrix

Likelihood (L)	Very Likely	Low	Moderate	High	High	High
	Likely	Low	Moderate	Moderate	High	High
	Unlikely	Low	Low	Moderate	Moderate	High
	Very Unlikely	Low	Low	Low	Moderate	High
	* Non-Credible	Low				
		Negligible	Marginal	Significant	Critical	Crisis
		Consequence (C)				

* Normally limited to assessing residual risks with Crisis consequences

Risk Handling Strategies



TR Subprogram Risk Assessment Steps

- Identified total 94 risks events.
- Dispositioned 41 events as 'combined with others', 'deleted', and 'resolved'
- Performed Initial Assessment of 50 out of 53 active risk events
- Documented Assessment in the Risk Database/Risk Form
- Identified Risk Handling Strategies and Action Items
- Performed "Post-handling" Assessment of residual risks
- Performed a cost contingency analysis using "Crystal Ball" software
- Performed Risk Ranking using mean cost contingency
- Tracked Risk Handling Strategy Action Items
- Reported Risk Status during Quarterly Program Review meetings
- Re-assessed TR Subprogram Risks annually

Risk Assessment Form

ID Number: _____ Revision: _____ Last Date Evaluated: _____ Status: _____

Event Title: _____

Type: Risk _____ Category: _____

Assess. Element: _____ Title: _____

Responsible Org: _____ Contact: _____ Date Identified: _____

Statement of Event: _____

Likelihood: _____ Basis: _____

Consequence / Benefit: _____ Basis: _____

Most Significant Cost Impact (\$k): _____ Most Significant Schedule Impact (Mos): _____

Level: _____ Event Trigger: _____

Handling Strategy: _____ Description: _____

Handling Strategy Action Items: _____

HS Implementation Cost (\$K): _____ Basis: _____

HS Implementation Schedule (Mos): _____ Basis: _____

Other Handling Strategies: _____

Statement of Residual Risk: _____

Residual Likelihood: _____ Basis: _____

Residual Consequence: _____ Basis: _____

Residual Risk Level:	Moderate		Residual Impact Basis:
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Residual Cost Impact (\$K):	<u>Best Case</u>	<u>Most Likely</u>	<u>Worst Case</u>	
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Residual Schedule Impact (Mos):				
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Impacted Scope of Work: _____

Evaluation Comments: _____

Event Comments: _____

Risk Handling Strategies & Their Impact

Avoid	4
Transfer	0
Mitigate	31
Accept	13

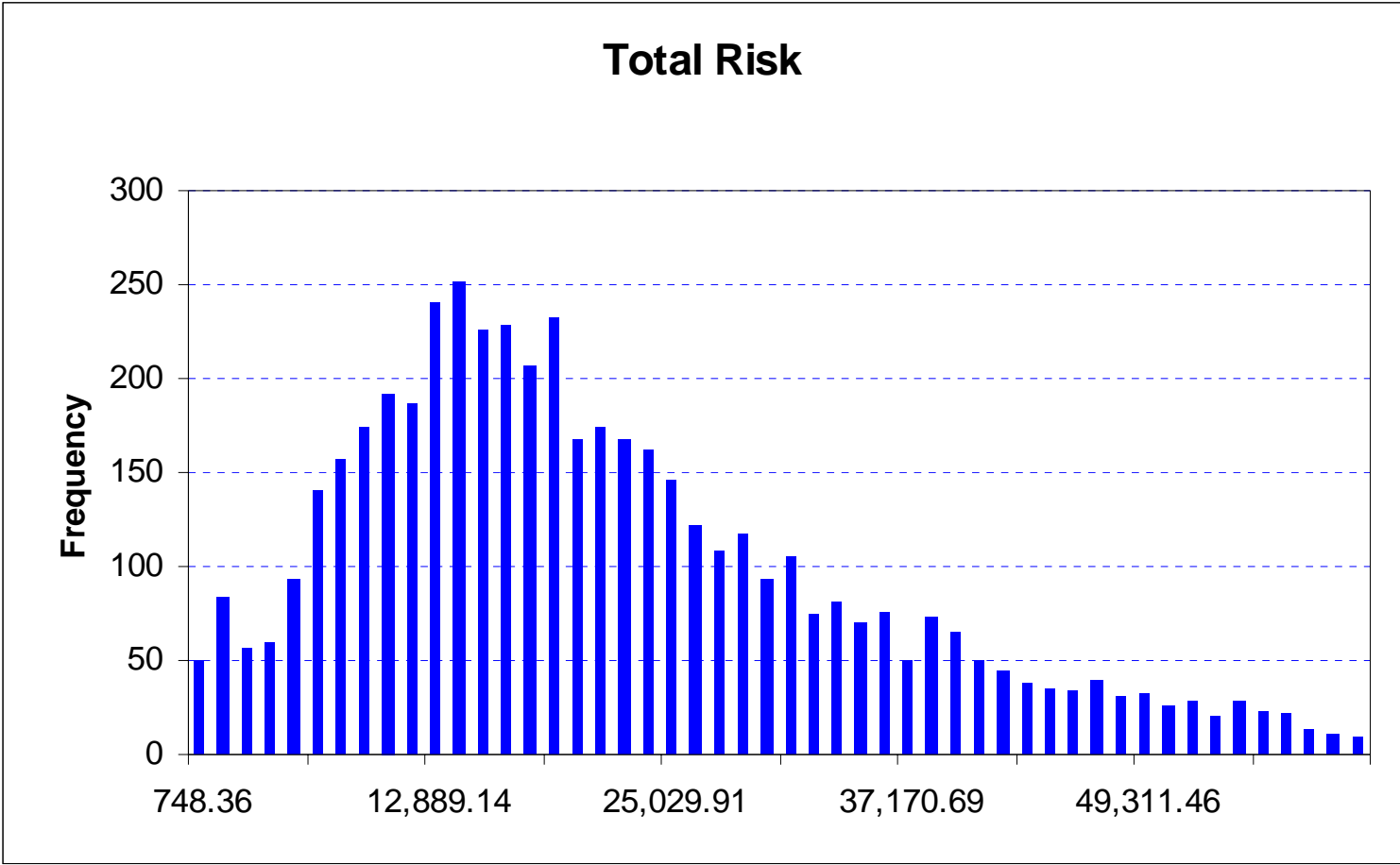
Risk Level	Initial	Residual
High	21	7
Moderate	22	16
Low	7	20

Risk Ranking & Cost Contingency

Ranking	Risk ID	Title	Mean Contingency \$K	Mean-Total Contingency \$K	%
1	40	Equipment Design Change	6,181.11	22,284	27.74
2	38	Impacts of Costing Factors Outside Program's Control	3,329.46	22,284	14.94
3	77	Yield Impacts Production Success	2,259.09	22,284	10.14
4	8	Loss of Vendor A as a Long-Term Supplier	2,162.99	22,284	9.71
5	33	Equipment Consolidation Process Design	1,746.17	22,284	7.84
6	4	Loss of Vendor B as a Long-Term Supplier	1,523.00	22,284	6.83
7	23	Loss of Testing Capability	800.46	22,284	3.59
8	48	Unable to Reduce Uncertainties to Meet Program Needs	520.48	22,284	2.34
9	41	Equipment Performance impact	506.85	22,284	2.27
10	92	Excessive impurities in Materials	493.01	22,284	2.21

Total Cost Contingency	
Percentiles	Contingency (\$K)
60%	22,470
80%	32,511

Cumulative Residual Risk-Based Cost Contingency



Benefits of Risk Management Process

- Quarterly review and update of the Risk Management Database
- Risk status and handling strategy action item tracking mechanism
- Generation of risk handling strategy cost & schedule
- Generation of a risk-based cost contingency estimate