

**Taking Risk Assessment and Management to the Next Level:
Program-Level Risk Analysis to Enable Solid Decision-Making on Priorities and Funding – 11563**

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ABSTRACT

A multi-level (facility and programmatic) risk assessment was conducted for the facilities in the Nevada National Security Site (NNSS) Readiness in Technical Base and Facilities (RTBF) Program and results were included in a new Risk Management Plan (RMP), which was incorporated into the fiscal year (FY) 2010 Integrated Plans. Risks, risk events, probability, consequence(s), and mitigation strategies were identified and captured, for most scope areas (i.e., risk categories) during the facilitated risk workshops. Risk mitigations (i.e., efforts in addition to existing controls) were identified during the facilitated risk workshops when the risk event was identified. Risk mitigation strategies fell into two broad categories: threats or opportunities. Improvement projects were identified and linked to specific risks they mitigate, making the connection of risk reduction through investments for the annual Site Execution Plan.

Due to the amount of that was collected, analysis to be performed, and reports to be generated, a Risk Assessment/ Management Tool (RAMtool) database was developed to analyze the risks in real-time, at multiple levels, which reinforced the site-level risk management process and procedures. The RAMtool database was developed and designed to assist in the capturing and analysis of the key elements of risk: probability, consequence, and impact. The RAMtool calculates the facility-level and programmatic-level risk factors to enable a side-by-side comparison to see where the facility manager and program manager should focus their risk reduction efforts and funding. This enables them to make solid decisions on priorities and funding to maximize the risk reduction.

A more active risk management process was developed where risks and opportunities are actively managed, monitored, and controlled by each facility more aggressively and frequently. Risk owners have the responsibility and accountability to manage their assigned risk in real-time, using the RAMtool database.

BACKGROUND / INTRODUCTION

The Nevada National Security Site Readiness in Technical Base and Facilities (RTBF) Program directly supports/funds facilities critical to the manufacture and certification of the United States nuclear weapons stockpile.

In 2009, annual planning for the RTBF Program was consolidated into a single comprehensive Integrated Plan (IP) which combines annual fiscal year (FY) planning, budgeting, operations and management, sustainment, and outyear planning into a single plan for each facility or project. In FY 2010, the major addition to the IPs, was the risk management section, which provided the results of the facility-specific risk assessment.

In previous FYs, the risk evaluation process of existing facilities:

- Was annual at best (initially only three facilities of eight facilities were planned for evaluation in FY 2011).
- Was facility-independent with minimal cross pollination of ideas and no programmatic considerations or evaluations.
- Did not consider programmatic impacts.
- Had no readily available capability to identify trends.

In 2010, the RTBF Program implemented a commitment to improve upon existing risk management processes to:

- Move away from a “once-a-year” assessment with limited pro-active management of identified risks toward a continual, “real-time” risk management process;
- Enhance the communication and interaction between facilities and overall Program Management related to risk management; and
- Create an electronic database system for collecting risk information and, more importantly, for analyzing and monitoring implementation of mitigating actions.

This enhanced risk assessment and management process was developed consistent with U.S. Department of Energy (DOE) Order DOE O 413.3, “Program and Project Management for the Acquisition of Capital Assets¹,” DOE Guide G 413.3-7, “Risk Management Guide²,” NSTec Company Manual (CM) CM-V100.001, Project Management Risk Management Manual³ and corporate best management practices.

RISK PROCESS IMPROVEMENT OVERVIEW

The RTBF risk management process consists of planning, identifying risks, performing an analysis of those risks, developing and implementing mitigating actions, and risk monitoring. Fig. 1. provides an overview of the risk management process.

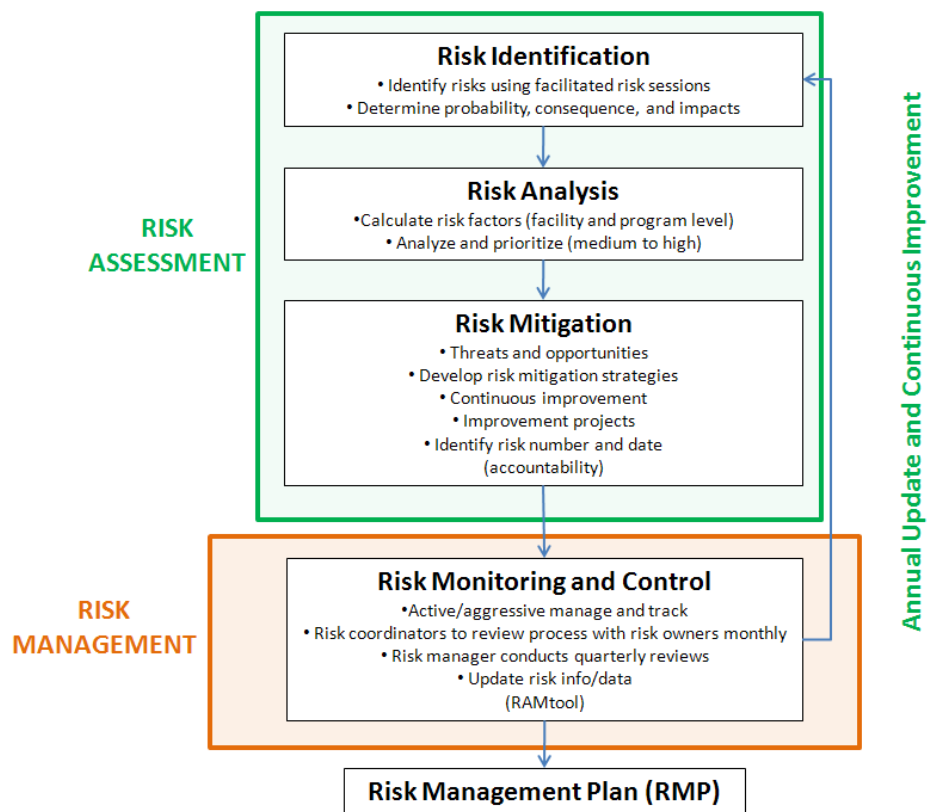


Fig. 1. Risk Management Process

RISK PLANNING

The planning process ensures that the subsequent risk management efforts are structured within the context of the project, program, or individual facility. In preparation for risk workshops, which are typically performed at the facility level, the risk probability and consequence categories and their respective threshold values are predetermined. Previously identified risks are reviewed for continued relevance and to ensure they are updated appropriately. Prompt lists, which are lists of potential risk subject areas to facilitate the brainstorming session, are generated for use in the workshops.

The development of any data capture tools to be used during the risk workshops is also performed in the planning phase. Pre-populating known values in the capture tool, such as existing risks, can save significant time during the risk workshops. For electronic tools, such as a database or spreadsheet, the relevant risk consequence categories and threshold values are set up. Regardless of the capture tool to be used during the risk workshops, it should be able to be viewed easily by all workshop participants and should be simple to use. This allows for the workshop session to focus on the brainstorming of risks, and not data entry.

In preparation for subsequent risk analysis, mitigation, monitoring, and control, the Risk Assessment/Management Tool (RAMtool), an electronic risk management database was developed. This database allows users to efficiently manage risks on a continual basis. The database becomes the risk register, with additional functionality that allows a user to perform a variety of analyses as well as generate several different reports. These reports include those identified in the NSTec, Project Management Risk Management Manual (CM-V100.001);

- Risk Screening Checklist
- Risk Analysis Worksheet
- Risk Register

RISK IDENTIFICATION

The purpose of the risk identification process is to identify areas that pose a threat to the successful execution of the project. Additionally, areas are identified that provide opportunities to improve overall project performance or success. Each area of the project scope is examined. Risk identification is ideally performed in a workshop or other setting that can provide sufficient time as well as freedom from distractions. This type of environment ensures that focused attention can be given to thinking about potential risks, free from the common interruptions that are often part of the workday.

Identifying risks begins with a brainstorming session that includes enough individuals such that every aspect of the project (or program or facility) is adequately represented. A facilitator specifically trained in the risk management process is recommended. The use of outside personnel (defined here as those not permanently assigned to the project) can also be useful in providing unbiased and fresh perspectives. The brainstorming session results in a list of potential risks. In order to adequately describe a risk, two items must be identified:

- Risk Event
- Consequence

Once the risk is adequately described within the project context, any current controls that are in place to either reduce the probability of the risk event occurring or to mitigate the consequences should the risk event occur, are identified and listed. These controls may fall into several categories, such as engineered controls and administrative controls.

Prompt lists can be used to help participants consider a wide range of areas that may have project risks associated with them. Both standard and customized prompt lists can be valuable.

If risks have already been identified, either from a prior workshop or some other means, these risks should be reviewed for continued applicability. Although the risk may still apply, the risk event, the consequence, or the current controls may need to be updated.

The determination of probability and consequence severity are also performed during the risk identification process. The probability of each risk event occurring is determined. The definitions of several probability levels are agreed upon by the project team in advance or at the beginning of the risk workshop. The assignment of probability assumes that current controls that are in place.

Next, the severity of the consequence is determined. Like probability, different severity levels should be agreed upon by the project team in advance or at the beginning of the risk workshop. There are several perspectives that should be considered when looking at consequence severity. These different areas should be pre-determined, with appropriate definitions in place to allow for various levels of impact. Examples of areas that should be considered are cost impact, schedule impact, safety impact, and reputational impact. There are others, and each management team should determine the appropriate impact categories for the particular project.

Fig. 2. represents the probability and consequence severity tables used for the RTBF risk assessment.

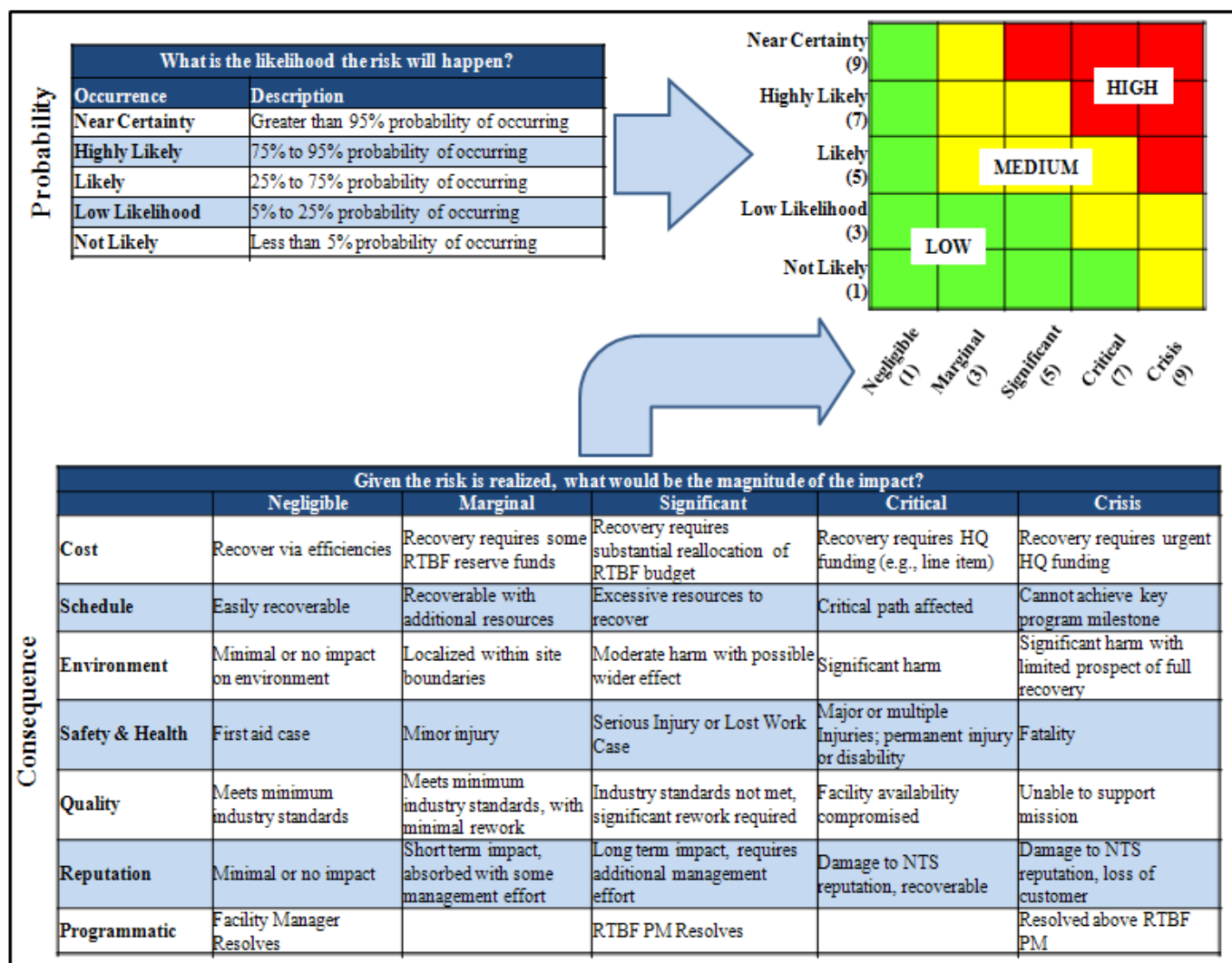


Fig. 2. Risk Assessment Matrix

RISK ANALYSIS

After the brainstorming session, when the list of risks has been generated (each with a list of current controls, probability, and severity), the risk analysis process is initiated. Although both qualitative and quantitative techniques are available, the projects and facilities associated with the RTBF Program can be thoroughly analyzed to the degree needed using only qualitative techniques; therefore, only these techniques will be discussed.

Qualitative risk analysis techniques are used to effectively prioritize risk items so that those risks with the most impact on the success of the project are emphasized. To measure the relative importance of each project risk identified, a risk value, or risk factor, is determined.

Using the risk probability and consequence obtained during risk identification, the RAMtool database determines a facility risk factor using the following calculation (this calculation is graphically represented in (Fig. 2.)):

$$\frac{\text{Facility Risk Factor}}{\text{Risk}} = \frac{\text{Risk Probability}}{\text{Facility Consequence}} \times \text{Facility Risk Factor}$$

After a facility risk factor is assigned to all risks, they can then be prioritized by risk factor. Those risks with risk factors of “High” demand the highest priority. It should be noted that the risk levels are relative measures of risk, designed so that limited resources can be allocated to the highest risks.

For the RTBF Program it was desirable to consider not just how each risk might impact an individual facility but also how the risk might impact the program as a whole. To facilitate this evaluation a second consequence table was prepared (See Table I.)

Table I. Programmatic Risk Consequence Table

Given the risk is realized, what would be the magnitude of the Programmatic Impact?					
Category	Negligible	Marginal	Significant	Critical	Crisis
Mission	Little to no impact on current mission (easy recovery)	Minor impact on current mission	Significant temporary impact to current mission	Major impact to current mission	Loss of current mission and/or shutdown at one or more facilities
Financial	<\$1M loss	\$1M–2M loss	\$2M–3M loss	\$3M– 5M loss	>\$5M loss
Facility Availability	<1 week loss of facility availability (resulting in >90% facility availability) or operations	1 week–1 month loss of facility availability (resulting in >80% facility availability)	1–3 month loss of facility availability (resulting in >70% facility availability)	3–6 month loss of facility availability (single or multiple, which threatens loss of mission)	>6 months loss of facility availability or operations at an MC facility
Infrastructure and Equipment Sustainment	Minor equipment repair may be required, minor incident	Downtime associated with equipment failure (<1 month) which impacts facility capability or experiment	Downtime associated with equipment failure and replacement delaying planned experiment for >1 month	Major equipment/facility failure requiring <\$1M to repair/replace	Major structural or critical piece of equipment failure requiring expenditures of over \$2M to repair/replace
Operational Efficiency	No lost time, minor loss of quality – plan revision may be required	Requires mods to a procedure or operating process, or minor security issue resulting in decreased efficiency	Required modification to several plans, procedures, or processes	Significant conduct of operations issue requiring significant changes to operations	Conduct of operation issue requiring facility stand-down until plans and procedures are modified
Milestones (Commitments)	No missed program milestones	Potential to not achieve program milestone, but recovery plan in place	Lost-time accident and/or compliance-related finding or event	Reportable accident and/or compliance violation	Fatality, compliance violation resulting in fine

The RAMtool database was developed and designed to assist in the capturing and analysis of the key elements of risk: probability, consequence, and impact. The RAMtool calculates the facility-level and programmatic-level risk factors to enable a side-by-side comparison to see where the facility manager and program manager should focus their risk reduction efforts and funding. This enables them to make solid decisions on priorities and funding to maximize the risk reduction. The RAMtool also provides the required risk documentation, such as the Risk Screening Checklist, Risk Summary Worksheet, and Risk Register. These reports assist in further analysis of the risk data.

RISK MITIGATION

Thus far in the process, nothing to address any of the risks has been performed. Risks have been identified, had their impacts determined, and risk factors assigned. It is during the risk mitigation process that actions are determined and a response is necessary. There are four basic response strategies:

- Avoidance – this strategy seeks to eliminate the source of risk. This can occur through a fundamental change in requirements or by avoiding the activity altogether. Avoiding the activity is generally not an option.
- Transfer – this strategy involves the reallocating of all or part of the risk to another party or by taking collateral actions to move the risk to another part of the project.
- Control – this strategy either decreases the probability of occurrence of the risk or mitigates the consequences should the risk be realized. Most risk management action is of this type, owing to its wide ranging forms of application and the core nature of risk as a fundamental reality of conducting projects. Controlling risks is only successful with continual visibility, updating, and active management of identified risks.
- Acceptance – this strategy is an acknowledgement that the risk exists and represents a conscious decision to accept the risk without undertaking directed actions to confront or mitigate it. Acceptance of risk most often applies to risks rated “Low” or for situations that are beyond the ability to control.

For each risk, one of the four basic responses is selected. For those risks that will be controlled, one or more controls are identified. This is referred to as the mitigation strategy. For previously identified risks that have current controls, further controls or mitigation strategies are considered. For each control or mitigation strategy, a risk owner is assigned. Additionally, the date by which the control should be in place or the mitigation strategy will be completed should be recorded. These dates will become important measurements in the risk monitoring and control phase of risk management.

After all additional controls and mitigation strategies have been identified, the probability and consequence severity should be evaluated again, this time taking into account any additional or newly identified controls or mitigation strategies. Once these are determined, a new risk factor can be determined. The new risk factor can be compared to the risk factor without the new controls or mitigation strategies to see if the strategies developed result in a lower risk factor. It should be noted that there are instances where risk mitigation strategies do lower the risk; however, the changes are not large enough to result in a different risk factor.

RISK MONITORING AND CONTROL

All of the effort aimed at identifying risks, analyzing and prioritizing risks, and developing mitigation strategies can quickly become wasted if risks are not managed on a continual basis. Through the life of a project, risks typically decrease, as risks begin to go away and their likelihoods become smaller as the project nears completion. However, new risks can and do surface up until the very end of any project. Managing project risk in a proactive manner ensures that new risks are identified, resources and management attention are focused on those events that could jeopardize the project, and mitigation strategies are evaluated for effectiveness.

One of the key elements of risk monitoring and control is the continuous process of identifying new risks. When risks are successfully identified, evaluated through the project, and controlled in a manner commensurate with their impact on the project, resources are spent efficiently and risk is reduced.

Risks, and opportunities, are actively managed, monitored, and controlled. During the risk assessment process, Risk Owners were identified for each risk. Risk Owners are accountable for updating the risk event information, consequence, probability, impacts, and status of mitigation strategies/actions on a monthly basis.

Risks and opportunities were captured and are currently maintained in a consolidated risk worksheet for each facility. The RAMtool database was developed to assist/provide Risk Owners with the ability to actively manage these risks in real-time and provide continuous updates, making next year's risk management assessment/update take less time, money, and effort, thereby improving quality/management of risks. The RAMtool also identifies the risk owner and due date for each mitigation strategy identified and provides the ability for the risk owner to update the risk information as mitigation strategies are completed. The RAMtool provides the data and the format for an annual RMP. Risk Owners, risk coordinators, and risk managers, can see real-time the current status of risks and the effects of mitigation actions, and they can recommend additional action as probability, consequence, or impacts increase.

Facility-specific risk coordinators are designated for each RTBF facility to review the facility-specific risks monthly and meet with the Risk Owners quarterly, or more frequently as required. When risks and opportunities are updated in RAMtool, then they are automatically recorded and accessible for status updates at the RTBF Program-level.

A RTBF Program risk manager is designated and manages risks at a programmatic-level. The risk manager reviews the risks with medium and high-level programmatic impacts on a monthly basis for any changes and provides an update to the RTBF Program Managers. Risks with low programmatic impacts will be reviewed quarterly. The risk manager will determine and/or recommend additional mitigating actions that may be taken to manage a risk that is emerging, imminent, or may have a significant cost, schedule, safety, or programmatic impact if realized. The risk manager will share lessons learned, RTBF complex-wide knowledge relating to mitigating risks and risk management and will foster accountability with the risk coordinators and Risk Owners to ensure risks are aggressively and actively managed throughout the fiscal year.

The risk manager, with input from the Risk Owners and risk coordinators, will update the RTBF Program annual RMP, prior to the integrated planning effort (as it provides content to the IPs). If necessary, an annual review of the facility-specific risk may be performed to update the risks and opportunities from a programmatic level; however, the goal is to actively manage risks and mitigations on a more frequent, regular basis, as part of the normal work, in lieu of only once a year. The RAMtool will assist Risk Owners, coordinators, and managers in conducting regular updates and performing real-time risk analysis.

The risk manager will also provide the RTBF Program Manager with quarterly updates and/or real-time analysis and recommendations for risk or opportunity that the event trigger has

happened or has a very high likelihood of occurring in the next 3 months. Monthly, a report is be made available to the RTBF Program Manager to ensure visibility of risks is maintained and provide any recommendations.

Risks and opportunities facilitate the need for both strengthening current controls and proposing improvement projects to mitigate (reduce or eliminate) major risks. Risks with existing controls will be reviewed semi-annually with the facility-specific risk manager, to evaluate effectiveness and brainstorm new or updated controls as necessary. Risks requiring an improvement project (and therefore associated/new funding) will be identified and improvement project information (scope, cost, schedule, risk reduction) will be recorded on an improvement project data sheet (using the RAMtool or separately) and included in the improvement project listing for prioritization annually during integrated planning.

Risk Registers, and other risk forms, now become an output for an ongoing, actively maintained risk management process and can be immediately updated in hard copy for the annual RMP.

RISK RESULTS

The RTBF facilities identified a total of 154 risks, comprised of 68 low, 66 medium, and 20 high facility risk factors. Risks were identified in all five of the risk categories with 46 falling in the Facilities, Equipment and Infrastructure category; 30 in Scope, Cost and Schedule; 45 in Business Practices; 30 in Environment, Safety, Health and Quality; and 3 in Requirements and Compliance (See Fig. 3).

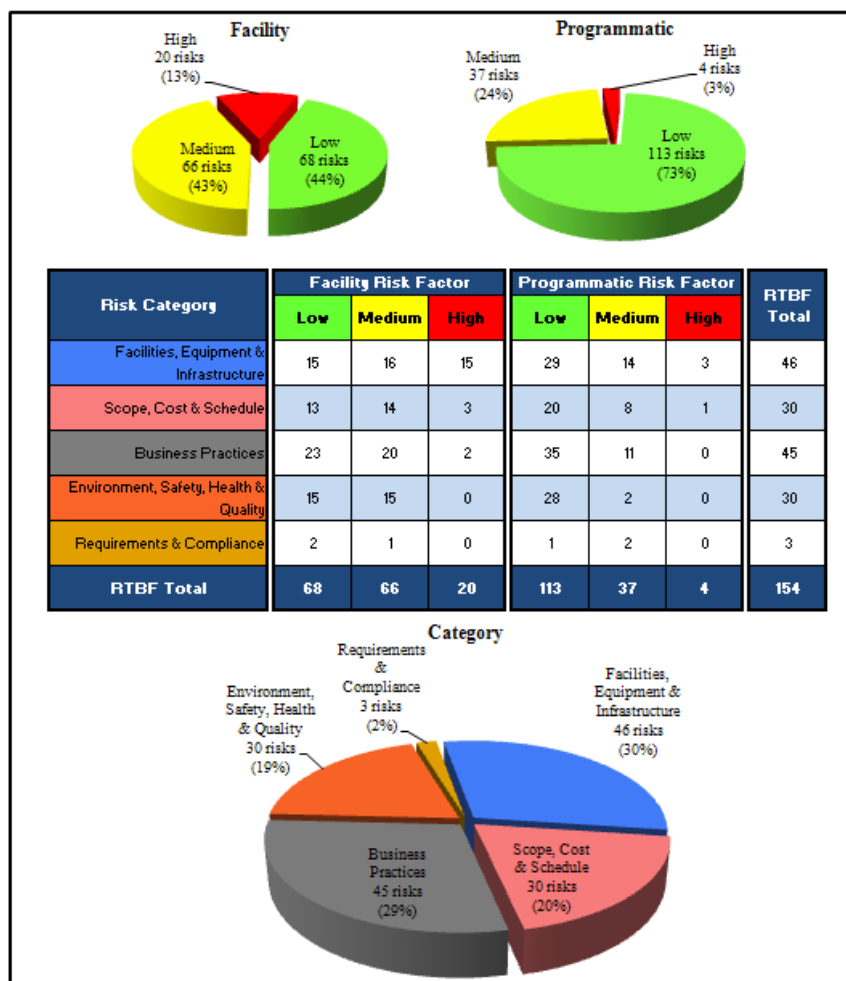


Fig. 3. RTBF Program - Summary of Risks

When the identified risks were evaluated for potential programmatic impacts (i.e., based on a programmatic consequence table) the distribution was composed of 113 low, 37 medium and 4 high programmatic risk factors.

Risk owners and coordinators will review the risks monthly to monitor risks that can adversely impacts cost and schedule. The RTBF Program monitors to the likelihood of multiple risks being trigger simultaneously as a combination of cost and schedule impacts for multiple risks can add up quickly to multi-million dollar impacts, significant schedule delays, lost fee, or other serious and/or catastrophic environmental and safety impacts.

Risk mitigation actions fell into one of two major categories: (1) Continuous improvement efforts (which are funded using base operating dollars) and (2) Improvement/Investment Projects which require additional, direct project funding to mitigate these actions. Investment projects effectively buydown the risk levels. Through the programmatic risk evaluation process, nearly 50% of the current risks can be effectively mitigated by selected improvement projects, although the site has not been provided adequate funding to perform these projects and therefore continue to accept these risks. Risk reduction is a major driver for performing and ranking selected investment projects for consideration for future year funding.

The actual results of the programmatic risk assessment are business sensitive and official use only; and therefore are not presented, in detail, in this paper. However, for these improvement projects (over 26 were identified), they are identified, estimated, and proposed for funding in the annual programming cycle for FY 2011 – FY 2015; however, they are subject to DOE funding limits.

Large improvement projects range from infrastructure and equipment repair and replacement, to modifications and renovations to the development of some site-wide systems to adequately mitigate and/or buydown significant risks. In some cases, based on the nature of the operations in the facilities. These risks have significant programmatic impact. The linkage of risk to a specific investment project provides clear mitigation strategies; however, legacy risk is continued to be accepted. Interestingly, during the analysis it was found that some high-facility risks were actually low programmatic risk, some low level facility risks were actually higher level programmatic risks, and some mitigation strategies and proposed projects cost significantly more than the outcome of the risk if it were realized.

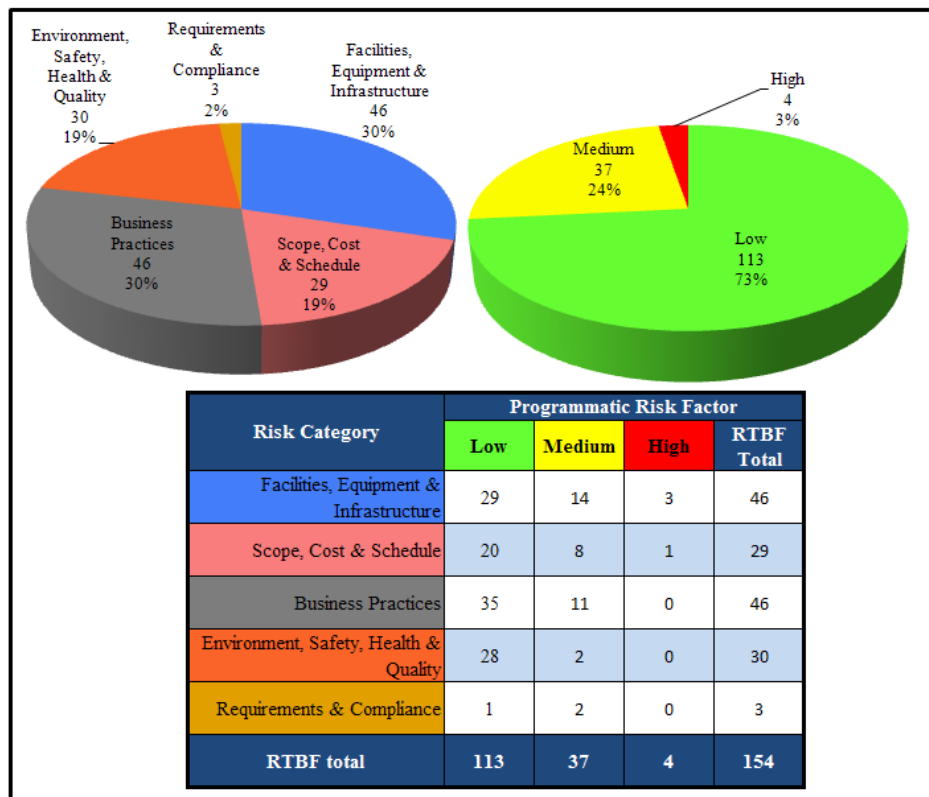


Fig.4. RTBF Program - Programmatic Risk Breakdown

ACKNOWLEDGMENTS

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REFERENCES

¹DOE O 413.3, “Program and Project Management for the Acquisition of Capital Assets

²DOE Guide G 413.3-7, “Risk Management Guide”

³NSTec Company Manual (CM) CM-V100.001, Project Management Risk Management Manual, National Security Technologies

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