Risk Management Plan
for
The Proton Improvement Plan-II Project
at
Fermi National Accelerator Laboratory

For the U.S. Department of Energy
Office of Science
Office of High Energy Physics (SC-25)

November 24, 2018
## APPROVALS AND SIGNATURES

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<th>Date</th>
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<tbody>
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CHANGE LOG

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<th>Date</th>
<th>Person Responsible</th>
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<tr>
<td>PIP-II-doc-163-v1</td>
<td>Jan 2017</td>
<td>Shekhar Mishra</td>
<td>Original document, Written following the Fermilab Risk Management Procedure for Projects Version 1.1</td>
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<tr>
<td>PIP-II-doc-163-v2</td>
<td>Nov 2017</td>
<td>Shekhar Mishra</td>
<td>Updated to match the current WBS and include Technical Risk Impact</td>
</tr>
<tr>
<td></td>
<td>Nov 2018</td>
<td>Marc Kaducak</td>
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1 PIP-II PROJECT

1.1 Introduction

The Proton Improvement Plan-II (PIP-II) Project is Fermilab's plan for providing powerful, high-intensity proton beams to the laboratory's experiments. PIP-II Project includes construction of a new 800-MeV superconducting linear accelerator. It also includes modest improvements to Fermilab's existing Booster, Main Injector and Recycler accelerators.

This PIP-II Risk Management Plan (RMP) is developed following the guidelines of the Fermilab Risk Management Procedure for Projects (FRMP). This document does not modify the Fermilab Risk Management Procedure but only describes how PIP-II Project is implementing the procedure and wherever possible provides links for easy access to relevant information for the Project. It describes the risk thresholds and procedures specific and unique to the PIP-II project. Subsequent sections either state that PIP-II is using FRMP or note deviations from it.

1.1 Risk Process Plan for CD-1 (section 1.3 of FRMP)

Fig 1.1 outlines the development of the Risk registry and Resource Loaded Schedule (RLS) process. This includes identifying risks, documenting the risks in the PIP-II (WBS 121) risk register and performing a Qualitative and Quantitative Risk Analysis using the Primavera Risk Analysis tool. The PIP-II risk register resides at https://fermipoint.fnal.gov/organization/ocoo/ippm/Lists/Risk%20Register/PIP-II-Project-Risks.aspx. The Resource Loaded Schedule is maintained in Primavera P6.

![Fig 1.1 Risk Management process in the context of the overall planning process.](image-url)
2 “PLAN RISK MANAGEMENT” PROCESS

2.2 Roles and Responsibilities

Risk management roles and responsibilities for the PIP-II Project are consistent with the responsibilities as documented in the Fermilab Risk Management Procedure for Projects.

The PIP-II Project Director (PD) chairs the Risk Management Board (RMB) and has the ultimate responsibility for all aspects of the project risk management. The PD also works with Fermilab and DOE-HEP on the Enterprise and International collaboration risks.

The RMB membership will include the project manager, technical director, project scientist, L2 Managers, ESH manager, and Quality Assurance Manager. PIP-II Federal Project Director will be an observer member to RMB. The RMB will meet once a month. The RMB approves risks for inclusion in the development of the Resource Loaded Schedule and the analysis of their impacts on the PIP-II Project.

The Level 3 Managers (L3M) and Control Account Manager (CAM) are typically the Risk Owners for the PIP-II Project. Risk Owners are responsible for developing the Risk Register, analyze the risks, and developing and managing the risk mitigation plans. The Risk Owners will also report these risks and progress towards their mitigation plan to RMB.

The risk management Responsibility Assignment Matrix (RAM) (Table 1 in FRMPP) remains as described in the FRMPP.
3 “IDENTIFY RISKS” PROCESS

3.1 Risk Breakdown Structure

The Fermilab Risk Breakdown Structure and its definition is listed at
The PIP-II Project uses the same Risk Breakdown structure.

PIP-II Superconducting Linac is being built with significant international contribution. It is assumed that
international collaborators will deliver. “International Collaborator Risks” associated with non-delivery
will not be used in the either the qualitative or quantitative analysis in developing RLS and will be
treated separately at the laboratory management level.

3.2 Risk Registry and Risk Form

PIP-II Project Risk Register is located at the Fermilab Office of Project Support Services SharePoint site. A
new risk will be entered by the Risk Owner using the form at the following link.
https://fermipoint.fnal.gov/organization/ocoo/ippm/Lists/Risk%20Register/NewForm.aspx

The details of making entry in the Risk Register is outlined at http://ppp-docdb.fnal.gov/cgi-bin/RetrieveFile?docid=144&filename=2016-12-01---Fermilab-Risk-Register---Lucas-Taylor.pdf&version=1

The PIP-II Project will use the following format for the “Unique Risk Identifier” (RI-ID):
RT – 121 - Level 2 WBS -Risk Number in that L2

In the Risk Register the PIP-II Project will be categorized risk according to Six L2 areas (WBS/Ops Lab
Activity) of the Project. They are

121.01 Project Management
121.02 SRF and Cryogenics
121.03 Accelerator Systems
121.04 Linac Installation and Commissioning
121.05 Accelerator Complex Upgrades
121.06 Conventional Facilities
4 “PERFORM QUALITATIVE RISK ANALYSIS” PROCESS

4.1 Risk Ranking

PIP-II Project will use the matrix of risk probability vs impacts shown in Fig 4.1.

<table>
<thead>
<tr>
<th>PIP-II Risk Impact Scoring</th>
<th>Low Impact</th>
<th>Medium Impact</th>
<th>High Impact</th>
</tr>
</thead>
<tbody>
<tr>
<td>Technical Impact</td>
<td>Somewhat sub-standard</td>
<td>Significantly sub-standard</td>
<td>Extremely sub-standard or KPP in jeopardy</td>
</tr>
<tr>
<td>Cost Impact</td>
<td>(0.1 – 0.5) M$</td>
<td>(0.5 – 5) M$</td>
<td>&gt; 5 M$</td>
</tr>
<tr>
<td>Schedule Impact</td>
<td>&lt; 6 months</td>
<td>(6–12) months</td>
<td>&gt; 12 months</td>
</tr>
</tbody>
</table>

Risk ranking matrix (Probability vs. Impact)

<table>
<thead>
<tr>
<th>Probability</th>
<th>Low Impact</th>
<th>Medium Impact</th>
<th>High Impact</th>
</tr>
</thead>
<tbody>
<tr>
<td>Very High</td>
<td>Medium Rank</td>
<td>High Rank</td>
<td>High Rank</td>
</tr>
<tr>
<td>High</td>
<td>Medium Rank</td>
<td>High Rank</td>
<td>High Rank</td>
</tr>
<tr>
<td>Medium</td>
<td>Low Rank</td>
<td>Medium Rank</td>
<td>High Rank</td>
</tr>
<tr>
<td>Low</td>
<td>Low Rank</td>
<td>Low Rank</td>
<td>Medium Rank</td>
</tr>
<tr>
<td>Very low</td>
<td>Low Rank</td>
<td>Low Rank</td>
<td>Medium Rank</td>
</tr>
</tbody>
</table>

Table 4.1 PIP-II Project Risk

The technical impact assignments are done following the procedure described in the FRMP based on the assessments made by the PIP-II Project Engineers and L2 Managers of the risk impacting the project goals.

1. **Extremely Sub-Standard**: The risks may impact the laboratory’s physics goals, of say delivering 1.2 MW beam to LBNF/DUNE target.
2. **Significantly Sub-Standard**: If not mitigated may impact projects ability to meet the Key Project Parameters.
3. **Somewhat Sub-Standard**: If not mitigated may have impact on the quality of beam and performance of the overall project.
There will be risks which may fall in the negligible impact categories per WBS, but collectively over several WBS they could have impact on the project. Risk Owners will retain a sub-project level risk watch list and make them aware to the Risk Manager and PIP-II Project team in regular meetings.

5. "Perform Quantitative Risk Analysis” Process

PIP-II Project will follow the Fermilab Risk Management Procedure for Projects.

6. "Plan Risk Responses” Process

PIP-II Project will follow the Fermilab Risk Management Procedure for Projects.

7. "Monitor and Control Risk” Process

PIP-II Project will follow the Fermilab Risk Management Procedure for Projects.