US HL-LHC Accelerator Upgrade Project

Handling of Discrepancies and Nonconformances

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Revision History

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1. Purpose

The purpose of this document is to provide the overall framework and expectations for how the AUP will handle Discrepancy Reports and Nonconformance Reports across the entire project. It is intended to provide additional detail from what is written in section 6.1 of the Project QA Plan[1] and section 7.5 of the Project Integration Plan[2].

2. Scope

The descriptions and requirements in this document are applicable to all Project activities (i.e. Fermilab, all collaborating institutions, and their subcontractors). Scope includes the design, fabrication, testing, and delivery of LQXFA and LQXFB magnet cryoassemblies (MQXF magnets), and Radio Frequency Dipole (RFD) dressed crab cavities.

3. Definitions

- Nonconformity/nonconformance: a condition which results in a feature or parameter not meeting a defined requirement. Typically is when a measurement falls outside the requirement or tolerance.
- Discrepancy: a condition or event which is abnormal; typically a failure, nonconformance, or deemed to be a problem related to a component or process.
- Significant nonconformance (may also be referred to as "critical", "major", or "high-risk"): a nonconformance which meets at least one of the following:
    - affects form, fit, or function in the as-found condition; or
    - is likely to trigger yellow or red schedule or cost variance reporting thresholds[3]; or
    - meets the requirements of "Moderate" or higher per the CERN Impact Matrix (for collaborations) in EDMS 1863763[4]; or
    - involves damage, or suspected damage, to the coil conductor.
- Low-risk discrepancy/nonconformance: any discrepancy or nonconformance which does not meet the definition of Significant.

4. Responsibilities

- L3 Managers are responsible for:
    - Ensuring that DRs/NCRs are generated and tracked to closure within their scope of work, when there is an issue which should trigger generating a DR/NCR
    - Dispositioning low-risk DRs/NCRs
    - Communicating significant DRs/NCRs to the L2 Manager
    - Summarizing and reporting sub-system discrepancies and nonformances at the milestones defined in section 5.2 of this document
- L2 Managers are responsible for:
    - Reviewing and authorizing the disposition proposed by the L3 for significant DRs/NCRs
    - Determining if a DR/NCR should be reviewed/authorized by another L2 and/or the Technical Board before proceeding.
- Technical Board is responsible for:
    - Reviewing all NCRs, focusing on the ones which are significant
- Project QA Manager is responsible for:
    - Assessing all DRs/NCRs and identifying the ones that should be shown/discussed at the Technical Board.
    - Communicating the appropriate NCRs to the CERN Work Package Engineer.

[1] https://us-hilumi-docdbcert.fnal.gov/cgi-bin/cert/ShowDocument?docid=80

[2] https://us-hilumi-docdbcert.fnal.gov/cgi-bin/cert/ShowDocument?docid=1166

[3] Found in the CAM e Toolbox, and in Fermilab EVMS Procedure 12.PM-006: https://ppp-docdb.fnal.gov/cgi-bin/ShowDocument?docid=1365

[4] https://edms.cern.ch/document/1863763/

5. Requirements

5.1. Notifications and Approvals

- Low risk DRs/NCRs are dispositioned by the L3's, and will be communicated*:
  - to the L2 at the end of the assembly process, e.g. when a coil is completed; and
  - to the Project Office once per month (first week of the month, covering the DRs/NCRs generated in the prior month)
- Significant DRs/NCRs need to be communicated to, and approved, by the L2 prior to proceeding with the work.
  - The L2 decides if the NCR requires approval by other L2's, and/or the Technical Board, and/or CERN, before proceeding with the work.

*NOTE: At the discretion of the L3 low-risk DR/NCRs may be elevated to the program office as soon as discovered. Such elevation shall not reclassify the nonconformance as significant but is encouraged whenever such notification is beneficial to the program office on issues or trends which may serve to improve overall QA/QC of the AUP Program.

5.2. Production/Assembly Workflow

As part of the production/assembly workflow, all DRs/NCRs will be reviewed during the applicable internal review/hold points:

- Magnets:
  - Coil selection for magnet assembly
  - Release of a magnet assembly for vertical testing
  - Selection of magnets for coldmass assembly
  - Approval of cryoassembly for horizontal testing
  - Prior to release of cryoassembly for shipment to CERN
- RFDs:
  - Per the Hold Points defined in the Manufacturing & Inspection Plan(s) (MIP)

5.3. Overall Project Management

As part of overall project management:

- All NCRs will be reviewed by the Technical Board
  - Priority/attention will be to those identified as significant
  - In general this review is not done in real time (i.e. in general the Technical Board is not authorizing the response to an NCR)
    - The exception is when an NCR is deemed significant enough that the L2(s) are not comfortable approving the disposition
  - Project QA Manager will assess them and identify the ones that should be shown/discussed at the Technical Board.
- Per the Impact Matrix for collaborations (EDMS 1863763[4]), NCRs assessed as "Moderate" or higher are communicated by the Project QA Manager to the CERN Work Package Engineer, as per the requirements in CERN document *HL Nonconformity Process for Collaborations* (EDMS 2149457[5]).

[5] https://edms.cern.ch/document/2149457/