

Closeout Report

of the

Director's Review Committee

NuMI Installation Plan

April 8-9, 2003

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Executive Summary

Good progress has been and is being made on the Service Buildings and Outfitting contract. The September Beneficial Occupancy date for the MI-65 area and the December Beneficial Occupancy for the MINOS area will be met within a few months.

During the short 3 week January shutdown most planned work was accomplished. This was a good experience working with the Beams Division Operations Coordinator and Mechanical Support Department and in many respects can serve as a template for the next shutdowns.

Critical Floor Manager positions and many Task Manager positions have not been filled. Filling these positions as soon as possible was a recommendation of the December 2002 NuMI Installation Director's Review. This need exists even more strongly now. NuMI has set June 1 as a goal. This goal, or preferably sooner, is urged by the committee.

The availability of sufficient personnel to carry out the orderly, efficient, safe and timely execution of the NuMI underground installation work is critical to the success of the installation phase of the NuMI Project, and requires constant attention by the top management of the Laboratory (the Directorate, Beams Division and Particle Physics Division) and the NuMI Project, in close communication and coordination with one another.

Fermilab Management reaffirmed that NuMI is a Beams Division project. Thus, Beams Division is the landlord for the entire project through project completion.

A more vigorous and expanded implementation of the Beams Division NuMI ES&H oversight is required.

Fermilab has committed and remains committed that the NuMI project will be completed on schedule.

The NuMI project needs to develop and document its project documentation system.

1.1 Main Injector, NuMI Stub, and Pre-Target Area

Findings

- The NuMI Project responded well to the shortened and shifting "October" Shutdown (Jan '03) and accomplishing almost everything on their list. The January shutdown will be used in many respects as a template for planning future shutdown activities
- Short or unscheduled shutdowns are not useful to NuMI at this point in time.
- Problems with some stand installations resulted from inadequate/incomplete review.
- Summer '03 shutdown major activities include:
 - Shield wall removal
 - Survey network
 - LCW work (complete piping in stub)
 - Install all remaining magnet stands and magnets (major magnets) in stub

These tasks are in the process of being incorporated into the BD schedule to assign task managers and avoid interference with non-NuMI work

- Summer '04 shutdown work includes:
 - Lambertson, C-magnet and kicker installation
 - Instrumentation
 - Vacuum
 - trim magnet stand and magnets
 - cable pulls
- Floor managers have not yet been appointed for MI-65 and MINOS
- The Installation Coordination Plan states that a check-in/check-out procedure is under development.

Comments

- The time required for the remaining installation is "at least" or "more than" the advertised 15 weeks of shutdown.
- The '04 shutdown in particular has numerous activities going on in parallel. This may result in conflicts due to the limited space.
- NuMI management would like to install the Lambertson magnets in '03, but BD has announced that this work will be deferred until '04.

- Manpower for the '03 shutdown has not yet been allocated. BD itself is approximately 50 technicians short, but help from PPD and TD is expected as in previous shutdowns.
- Installation of the target pile, hadron absorber and MINOS detector will require substantial manpower and support from Business Services Section and/or additional Davis-Bacon personnel. Disruption in the delivery of shielding blocks or detector planes could have significant schedule impact.

Recommendations

- The planned installation tasks for the '03 shutdown are reasonable for the duration and completion of these tasks will leave the project in a position that short unscheduled shutdowns could be used to some extent. Beams Division and Lab management should provide sufficient resources and schedule the shutdown duration to allow completion of the scheduled tasks.
- Appoint the MI-65 Floor Manager before the May DOE Review, followed by the task managers for the major installation tasks.
- Lambertson installation in '03 would allow an additional year of operating experience with the Main Injector, with minimal impact and risk, and would allow power tests to understand any stray-field impact on the Recycler. Understanding this impact earlier would allow mitigation, if needed, during the '04 shutdown. The committee encourages installation of the Lambertson magnets in '03 provided this can be done without extending the shutdown duration.
- The check-in/check-out plan needs to be completed and signed off on, and manpower requirements adjusted accordingly.
- Discussions with BSS should be initiated/continued to assure that the methods for loading, transporting and unloading are understood and agreed upon.

1.2 Target Hall and Service Rooms

Topic 1:

Finding

- Installation schedule for target hall area is as complete and is as credible as is possible at this point.

Comment

- None.

Recommendation

- None.

Topic 2:

Finding

- The project has recognized that assignment of floor managers, and to some extent task managers, is necessary at this point (even before the advertised June 1 date).

Comment

- It appears that several installation issues (such as the need for back-up transport equipment, realities of transporting shielding blocks on-site, etc.) cannot be addressed until floor managers and other task managers are assigned.

Recommendation

- Work with Beams Division. PPD and TD to assign these key roles as soon as possible.

Topic 3:

Finding

- Attachment of horns and other critical (sensitive) beam devices to their modules will take place in the hot work cell in the target hall along with installation of the modules in the target chase by a Fermilab trained technician group.

Comments

- The floor manager for the area should pay careful attention to handling work flow in the area when these operations are going on. Ideally, other installation activity in the target hall should be kept to a minimum during this critical work. Damage to a beam-line device could cause significant delay.
- The training of the technician group that does this work is not performed easily or quickly. Preservation of that core group of Target technicians will be key to performing this work correctly and efficiently. Replacement of contract technicians that are currently used in this capacity will cause quality and efficiency problems and should take place now (if at all) in order to preserve the group during the critical last stages of assembly and installation.

Recommendation

- The target tech group should be maintained intact and not disturbed by other activities. Project personnel should work with Beams Division HQ and personnel to attain assurances that this will be the case throughout the component fabrication, assembly and installation stages.

Topic 4:

Finding

- The aluminum sheeting (lining) of the Target Chase will be performed at the same time that steel shielding blocks are being installed in the Target Chase.

Comment

- Although technically feasible, there is concern that the two processes will interfere with each other and shielding block installation tasks are on the critical path.

Recommendation

- None.

Topic 5:

Finding

- Time study estimates have been made to develop a comprehensive schedule for shielding block installation in the target chase.

Comment

- Recent experiences with installation of the Mini-BooNE Target Pile can shed light on the realism of these estimates. This may already be happening due to the addition of Rick Ford to the Installation Management Staff.

Recommendation

- Compare time study estimates with the real-world experiences of Mini-BooNE Target Pile installation and adjust accordingly. This includes the need to shim and level blocks as well as transport of blocks from rail-head (or other source) to MI-65.

Topic 6:

Finding

- Response to December 2002 Director's Review recommendation concerning crane repair/maintenance is "The NuMI cranes are new and are rated for service exceeding their planned use. In the unlikely event the crane fails to operate during installation, we anticipate no more than a 1 week delay for repair. We deem the schedule risk minimal."

Comment

- A program of inspection and pro-active maintenance during this critical installation phase could easily avoid an admitted 1 week delay in the critical path. In addition, the normal Fermilab infrastructure for maintenance and repair of cranes may not be sufficient to limit the repair delay to 1 week.

Recommendation

- The floor manager for the area should be assigned responsibility to ensure crane inspections and maintenance is performed adequately and monitor crane usage. In addition, repair times, availability of spare parts, and inspection frequency of the normal Fermilab infrastructure for maintenance and repair of cranes should be investigated.

Topic 7:

Finding

- A mechanical support structure to lift power supply racks for the horn was identified as an item requiring mechanical review. The item was designed and built but the review has not been performed yet.

Comment

- An installation review for the power supplies has been recognized as necessary by the level 3 manager for this item. The mechanical review of the lifting structure is planned to be incorporated in that review.

Recommendation

- A mechanical review of this structure should be performed in the very near future.

Topic 8:

Finding

- A cohesive, formal plan for transmitting documentation (procedures, hazard analyses, specifications, design notes, etc.) and job knowledge to Beams Division Support Departments does not exist.

Comment

- Although assurances were made that this transfer would take place, it is our opinion that a plan should be developed that ensures this happens in a logical, efficient, and comprehensive manner.

Recommendation

- NuMI project and BD personnel work together to develop such a cohesive plan for transfer of knowledge.

Topic 9:

Finding

- An apparent gap in the Target Hall installation schedule was identified. When asked, Jim Hylen explained that the schedule shown was not the integrated schedule, but only WBS 1.1.2 tasks. When asked, he showed us the appropriate location in the integrated schedule which essentially filled the gap and showed inter-dependencies correctly.

Comment

- This shows the cohesive and complete nature of the Target Hall installation schedule.

Recommendation

- Show the integrated schedule (including all WBS level 3 tasks) in the presentation to the DOE review panel.

Topic 10:

Finding:

- A delay in the summer shutdown such that it overlaps MI-65 BO will cause over allocation of resources.

Comment

- None.

Recommendation

- None.

1.3 Absorber Area and Near Detector

Hadron Absorber Area

Findings

- The absorber has been redesigned to address issues of air activation that arose in a previous review
- The design of the special bridge crane used for installation was reviewed
- Decay pipe end caps have been fabricated
- Assembly drawings for the absorber shielding and cavern layout are in progress; work on the installation bid specification is in progress
- The management of this subproject is incomplete. The NUMI group has asked for an additional engineer and for a MINOS Floor Manager to be assigned
- The cost and schedule do not appear to be on the critical path for CD4

Comments

- We asked in detail about the level of design review of the modified Hadron Absorber. Some review has taken place but there is no record of the response to any recommendations from that review or of a signoff procedure for approving the modified designs
- The procedure for installing the Absorber includes an unspecified 'pyramid building' stage needed to install the top layer of shielding. This needs further specification and review before any contract can be let.

Recommendations

1. Implement ISM by documenting the various reviews and responses to the reviews in a systematic way.
2. Specify a review and sign-off procedure for design modifications
3. Review and document the design, installation plan, and maintenance and fault repair procedures for the Hadron Absorber
4. Identify the MINOS floor manager, preferably before the next review, even though this position may only be part time until FY04.

5. Practice assembly of the Hadron Absorber assembly crane and absorber pile above ground if possible before doing it in the tunnel. Watch for tunnel constraints during the practice assembly.

Near Detector

Findings

- The design of the near detector is very mature. The design and initial test assembly of the detector in the New Muon Lab is complete
- The near detector design was reviewed by the appropriate PPD Mechanical Safety Review committee.
- The managers have addressed how they would respond to schedule changes arising from delays in Beneficial Occupancy or dragooning of the detector installation techs during the summer 04 shutdown
- They have also asked for the assignment of a MINOS Floor Manager
- The sump pump in the near detector hall must reliably handle a very large volume of water

Comments

- We asked in detail about the level of review of the installation procedures. Some review has taken place but there is no systematic record of the response to any recommendations from that review or of a signoff procedure for approving the installation procedure.
- The manager of this task makes a persuasive argument that the techs involved in the test assembly should be made available for the final installation

Recommendations

1. Implement ISM by documenting the various reviews and responses to the reviews in a systematic way including the coordination of the PPD and Beams Division Reviews.
2. Specify a review and sign-off procedure for the proposed installation procedures
3. Actively include the Particle Physics Division in the planning and documentation of the design and installation plans, as well as maintenance and fault repair procedures, since they will eventually become the custodians of the Near Detector Hall

4. The Beams Div and the Particle Physics Div should independently review the sump pump system to ensure the reliability of the system and its backup equipment and procedures.
5. Identify the Floor Manager for the MINOS area and the Task Manager for the detector installation as soon as possible.

1.4 Installation and Integrated Schedule

Integrated Installation Schedule

Findings

- The Installation coordinator and his deputy have been on project for ~6 months.
- A resource loaded schedule has been developed for the MI Stub, MI-65, and MINOS areas; resources are in process of independent review but to date look reasonable; integration with BD and PPD has not been done such that resources get leveled.
- NuMI has communicated to BD a preliminary task list for the summer '03 and '04 shutdowns, details are being worked on and need iteration. BD and NuMI need to agree upon the form that the task list should take.
- NuMI has been 'conservatively realistic' in schedule planning. Overtime, 2nd shifts, and 2nd crews have been avoided such that they can be used for fixes and makeups that will occur.
- MI-65, MINOS planning is consistent with beneficial occupancy and project milestones; at least one example has been shown where slip in the beneficial occupancy date can be accommodated with reworking of the schedule and resources.
- Delay in the summer '03 shutdown work does not directly impact MI-65 or MINOS occupancy. However, it requires more effort for 'catch up' and increases technical risk. Some potential problem areas include:
 - Fringe field effects at crossover
 - LCW and other system commissioning
 - Completion of 'trade' work such that shorter shutdowns later can be better utilized
 - 1 week of survey work which must be done before the summer '04 shutdown
 - overlapping of project resources
- The January shutdown was effectively used by the project, on short notice. Some bugs in the process were seen, and the project is working to improve them:
 - NuMI understands the need to identify and include task managers early in the process
 - NuMI developed a tracking spreadsheet to track the readiness of components for installation

- NuMI's resource needs have been communicated to BD. Direct discussions with BD, PPD, and BSS need to occur.
- The ICP specifies a framework for the organization of the installation work. Further clear definition of the roles and responsibilities needs to occur, and would be greatly helped by identification of the key personnel in the organization chart.

Comments

- In your presentations, it would help if you were to:
 - Clearly describe the base plan
 - Clearly mark the location of the MI-65 and MINOS floor manager areas

Recommendations

1. Identify as many as possible of the floor managers and task managers before the May DOE review.
2. Specifically communicate the NuMI personnel requirements to the BD, PPD, and BSS within the next month.
3. Restart the NuMI Installation Coordination Meetings before the May Lehman review.
4. Work backwards from the installation schedule to set milestones for the timely review and sign off of components to be installed in the tunnel.
5. BD needs to provide feedback to NuMI on the near term schedule.
6. BD & the Directorate should re-emphasize the importance of NuMI project completion within Beams and other Divisions.

1.5 Integrated Safety Management

Discussion:

An overview of the ES&H Program for the installation phase of the NuMI Project was presented to the Committee by Greg Bock. Highlights of Greg's presentations include the following:

- Safety across the Project remains uppermost in the minds of the NuMI Project Staff.
- The Project's safety plan emphasizes Fermilab's safe work policies.
- Throughout the Project, time is being taken to do the following: plan ahead; identify hazards; put controls in place; monitor; review; assess; and make the necessary corrections to mitigate hazards, improve controls, and revise and upgrade review and assessment processes.
- The Project takes remedial actions when necessary. (It was noted that six workers have been removed from the SBO job for violations of safety procedures.) Incidents are investigated and appropriate corrective actions are implemented. To date, there have been no reportable injuries on the SBO construction job.
- Additional ES&H staff have been added in FY 2003 to cover the increase in activities at the NuMI/MINOS sites at Fermilab, and more staff will be added as necessary as the installation plans develop.
- The Project has been working for some time on the preparation of the Shielding Assessment documentation and the Safety Assessment Document for the NuMI Project at Fermilab, and the goal is approval of these two items in April 2004.
- The Project is continuing to monitor the environmental compliance of the contractors and subcontractors. A water treatment plan is in place at the construction site.
- Beamline component ES&H reviews are continuing.
- Walkthroughs of NuMI/MINOS work sites have been instituted.
- Greg's presentation also included a 1-page chart defining the NuMI Installation Organization. This organization chart depicting the line management responsibilities, and serves as the definition of the line responsibility for safety, and its delegation down the line management structure.

The ES&H Program for the NuMI installation phase was described in further detail to the Committee by Mike Andrews, the NuMI Project ES&H Coordinator. Highlights of Mike's presentation include the following:

- ISM implementation for the NuMI installation phase is being developed consistent with Fermilab Policy and the NuMI Project Plan.
- Roles and responsibilities are defined in the NuMI Project at Fermilab Installation Coordination Plan. Competences are being defined commensurate with responsibilities.
- Training Classes have been instituted: Fermilab Underground Safety Awareness Class, Fermilab Task manager/Construction Coordinator Class, ITNA Identified Training Classes.
- The Project staff, including the ES&H Coordinator, has the job of providing Project management with accurate information about the work activity, schedule, costs, hazards, risks, and controls, during daily and weekly progress/planning meetings.
- A comprehensive ISM Implementation program and procedures web-page-based document, which includes the NuMI Project at Fermilab Installation Coordination Plan (ICP), a description of the ESH/QA reviews program that is co-ordinated by the Mike Andrews and Nancy Grossman, as well as links to other pertinent NuMI Project documentation, is in preparation.

The Work Smart Standards Set itemizes all the ES&H laws, regulations, and standards to which Fermilab, including the NuMI Project, must adhere. Details of Fermilab's ES&H Policies and procedures are documented in FESHM. Hazard controls are tailored to the work, via hazard analyses, provision of personnel protection equipment, and toolbox meetings. Work operations authorization incorporates work notification, daily work planning and hazard review, progress meetings, ES&H inspections, and ES&H/QA reviews. A (password-protected) NuMI safety documents website has been set up; it includes general reference materials, Shielding Assessment documentation references, and Safety Assessment Document (SAD) documentation references.

The Project will seek Shielding Assessment approval before the start of the SAD approval process; Radiation Safety is a large part of the SAD. Air and groundwater methodology documents are nearly ready for approval. The BD ES&H Dept has provided the Project with an outline of what needs to be in the shielding assessment. A rough draft of the Shielding Assessment has been prepared; it is planned to be complete, and ready for review/approval, by 1/04.

The Safety Assessment Document (SAD) should be complete, and ready for review/approval, by 4/04. The Project has met with all stakeholders (including representatives from DOE, Fermilab ES&H Section, BD, and PPD) to determine the overall approach for the preparation of the SAD. A rough first draft NuMI SAD has

been prepared. Timelines for the Shielding Assessment and the SAD have been discussed with the ES&H Section and with BD, and there is agreement on the proposed timelines.

There is a program for ES&H/QA reviews that is coordinated by Mike Andrews and Nancy Grossman. Components in need of review are identified with the aid of a Component Review Spreadsheet broken down by WBS. The review process for components is initiated by the responsible level 2 or 3 manager, is coordinated by Mike Andrews and Nancy Grossman, and the reviews include independent reviewers, with expertise in safety, structural engineering, electrical engineering, and mechanical engineering. Types of reviews include conceptual design reviews, design reviews, and readiness reviews (done by BD/NuMI and PPD/MINOS safety review committees.) Recent component design reviews include: bridge crane and related lifting components at the MI-65 service building, MI NuMI Stub magnet handling cranes and magnet stands, MI-62 heat exchanger stands, MI/NuMI extraction aisle side supports.

In a break-out session, Nancy Grossman provided details of radiation safety design and review processes, including radiation safety documentation and related environmental protection documentation, also including development and documentation of methodologies for radiation safety and related environmental protection analyses.

The NuMI Project, according to Nancy Grossman, plans to review their spreadsheet listing the internal reviews (including safety reviews) of components, to determine which reviews have not been done that need to be done, and with particular attention on reviews that pertain to installation safety for technical components. The statement originally developed by Aesook Byon-Wagner of the program of reviews of technical components is planned to be updated by Nancy Grossman, including web links to the safety reviews and to other pertinent NuMI Project documentation.

Nancy Grossman also provided information on the radiation safety-related reviews that have taken place to date, including their current status.

The committee offers Findings, Comments, and Recommendations, in seven areas, as follows:

1. *Safety review processes, and their implementation and documentation;*

Finding

- An ISM implementation plan document, incorporating details of the NuMI Project ES&H program and procedures, is in preparation. This document is to include a description of the program of safety review processes that is in place, including a description of the functions of the Beams Division NuMI Safety Committee.

Comments

- Ken Stanfield reiterated to the committee during the review that the NuMI Project is a Beams Division Project. He endorsed a suggestion, made during the committee's deliberations, that the successful methodologies used by the Main Injector Project, including the safety management and safety review processes used in that project's installation phase, could serve as a useful model for how to plan and execute the NuMI Project's installation phase. He reiterated further that the Beams Division Head, as was the case for the Main Injector Project, is responsible for ES&H oversight of the NuMI Project, including of course the installation phase of the project.
- The committee is not satisfied that the activities to date of the Beams Division NuMI Safety Committee (BDNSC), have been adequate. The committee believes that the BD Head and the BDNSC needs to review its charge (dated September, 2001), and that the program of BDNSC needs to be carried in a much more pro-active manner, with impetus coming both from the BDNSC and from NuMI Project Management.
- The committee is not satisfied that the charge to the BDNSC includes an adequate set of review processes. In particular, Ken Stanfield reiterated that independent safety reviews of NuMI technical components, including sign-offs on readiness for installation as well as subsequent sign-offs for readiness for operations, need to be done. That such reviews are done is the responsibility of the BD Head, according to Ken Stanfield. The committee believes that for technical component safety reviews the BDNSC, at the determination of its Chair and/or the BD Head, should be responsible for arranging such independent reviews and sign-offs. While the discussion above pertains to reviews related to "conventional" ES&H issues, the committee notes that corresponding, appropriate processes need to be in place for radiation safety-related review processes and sign-offs and also for construction safety-related reviews and sign-offs. The processes discussed in this paragraph, in all three areas – conventional ES&H, radiation safety, and civil construction should also be reviewed, updated as appropriate, documented in the appropriate place, and promulgated as appropriate to the personnel who need to be aware of and to implement these processes
- The committee is not satisfied that the safety review activities that are already taking place are being adequately documented. This defect in the completeness of the NuMI Project documentation system needs to be rectified.
- Description of the revised and upgraded processes discussed here needs to be included in the ISM Implementation Plan document as soon as possible, well before the next accelerator shutdown; the next round of underground installation work should be done in accordance with these revised processes.

Recommendations

1. The committee recommends that the charge by the BD Head to the BDNSC be updated to reflect inclusion of independent safety reviews, including sign-offs as appropriate, in the charge to the committee.
2. The committee recommends that the Chair of the BDNSC and the NuMI Project Manager proactively and aggressively see to it that the safety review processes be fully implemented.
3. The committee recommends that the BD Head and the NuMI Project Manager should review and revise as appropriate the BD safety-review processes (including radiation safety-related review processes and construction safety-related review processes), and a description of the safety review processes should be included in the web-based ISM Implementation Plan documentation that is in preparation.
4. The committee recommends that the next round of underground installation work be done in accordance with the newly revised and upgraded, fully documented, safety review processes.

2. Safety responsibilities chain-of-command, including awareness of this by all employees and contractors;

Finding

- The line management authority and responsibility for safety has been documented.

Comments

- Both Greg Bock and Mike Andrews believe that the single-chain-of-command line management authority and responsibility for safety is understood by Project staff, accepted by them, and is being successfully executed.
- The committee is not convinced the lines of safety responsibilities follow the organization chart shown in the NuMI Project at Fermilab Installation Coordination Plan (ICP). Some members of the committee believe that Floor managers are responsible for an area, whereas Task Managers are responsible for the people working under them in the area, and that the Task Managers usually report to a different supervisor than the Floor Area manager; in that case, the words in the ICP document better reflect that reality than does the chart in the ICP.

Recommendations

- The committee recommends that the statements in the ICP, and the corresponding chart, be reviewed by NuMI Project Management in consultation with the BD and PPD managements, and revised as needed to make them consistent with one another and to accurately state the single-chain-of-command line of authority and responsibility for both the execution of the installation work and its safe performance.
- The committee recommends that the chain-of-command line of authority and responsibility must be fully understood and also must be accepted by all personnel who supervise, or perform, or advise concerning, the NuMI Project installation work, and that appropriate training to ensure this should be carried out throughout the installation phase of the NuMI Project (and that the records of such training should be appropriately documented.)

3. *ES&H staffing (including management of access control for underground areas);*

Finding

- The NuMI Project ES&H Co-ordinator believes that ES&H staffing is adequate, at the present time.

Comments

- The committee recognizes that it is desirable to add ES&H staff as necessary as the installation plans develop, as the technical components and detector installations get underway underground, and as necessary for the timely completion of Project ES&H documentation requirements.
- The committee believes that the NuMI Project Management needs to add an additional high-level person as soon as possible to the NuMI ES&H staff; this person's responsibilities would be to see to it that the various ES&H-related procedures, review processes, plans for ES&H oversight/inspection of the NuMI installation work, and other ES&H-related activities that are discussed in other sections of this Director's Review Report and in particular in other parts of this Section 1.5 (Integrated Safety Management) of the Review Report, the documentation of all these items, the training of people in the implementation of all these items, and the co-ordination of the implementations of all these items, be successfully accomplished.
- The NuMI Project ISM implementation, in its present form, does not include an adequate description, and implementation, of the system (and staffing) that the Project will use to control, manage, and monitor access to the underground Target and MINOS areas during the installation phase.
- The person assigned the responsibility to control access to the MI65 shaft should be present at the shaft at all times during scheduled work periods; similar to the Duty assistant in the MCR. This person is the front line individual keeping untrained personnel from gaining access and assures occupancy limitations are not exceeded. A similar arrangement should be put in place for access control for installation through the MINOS shaft.

Recommendations

- The committee recommends that, in consultation with the BD Operations Department, the NuMI Project develop, document, and put in place an appropriate access control, monitoring, and management process for installation through the MI-65 and MINOS access shafts, prior to the commencement of technical components and detector installation through those two shafts.

- The committee recommends that the NuMI Project Management add an additional high-level person as soon as possible to the NuMI ES&H staff. This person's responsibilities would include the following:
 1. Development of ES&H procedures and processes for the oversight/inspection of the NuMI installation work,
 2. Development of procedures and processes of additional ES&H-related activities that are discussed in other sections of this Director's Review Report and in particular in other parts of this Section 1.5 (Integrated Safety Management) of the Review Report,
 3. Assurance that the documentation required to implement all the items noted above are properly completed and maintained,
 4. Development of the required training for the procedures and processes noted above,
 5. Implementation or coordination of implementation of all the items noted above and assure successful accomplishment of these activities.

4. Completeness and availability of documentation, including ES&H documentation;

Finding

- Much of the necessary documentation of ES&H-related and design review-related matters is available on the Web.

Comment

- A description of what is the Project documentation system, its documentation processes, and the documents that exist should be better organized into a single web site.

Recommendation

- The committee recommends that a description of NuMI Project's Documentation System be developed and the process documented. This process should identify the types of documents within in the scope of the documentation system, which would include all ES&H related documentation. Links to documents themselves should be better organized and linked to a single web site. Also, a person should be assigned the responsibility to assure proper implementation of the process.

5. Visits to other facilities by the NuMI Project ES&H Co-ordinator;

Finding

- The ES&H Coordinator plans to visit LLNL-NIF to review the NIF Leadership Program which was utilized during their installation phase, in response to a DOE Review Recommendation to that effect.

Comment

- The committee supports this plan. The committee notes also that a similar visit by the ES&H Coordinator to the Soudan Far Detector MINOS site may be useful.

Recommendation

- None.

6. Applicability of existing BD policies and practices to the NuMI installation work; and

Finding

- Fermilab, and in particular the Beams division, already has in place many good and effective safety policies and practices for employees and contractors.

Comment

- These safety policies and practices have been developed principally by Dave Augustine, a member of this review committee, who has written to the committee as follows:

Fermilab already has very good in-place safety policies and practices for employees and contractors. During the January 2003 shutdown we took the time to meet with everyone involved in shutdown activities. We introduced everyone to everyone else who was assigned to the same work group. We then went into a detailed discussion of the work, the work hours, and just what had to be done, and what type of equipment would be used and what safety equipment (PPE) was required. Task Managers that were responsible for fitters, iron workers, or carpenters were expected to do the same thing. I personally went to all of the divisions and met with the mid to high level Division management to explain what we were trying to accomplish. Each Division met with their employees as well, before they sent them to work on the shutdown activities.

Before the shutdown started, we invited management from Taft and SEA mechanical (iron workers and pipe fitters), to explain to them what the goals

were, to help analyze the jobs, and explain what our policies are, and what we expected. The T&M office was involved in this as well. This worked famously. Everybody was on board right from the start. It took me four months to set all this up properly.

All Hazard Analyses that were written for specific tasks were reviewed in detail with all affected people. The attitude that this was important was continually enforced by engineers, supervisors, and lead personnel. We took advice from contractors and Fermilab personnel alike on their suggestions to purchase or obtain specific appropriate equipment from other areas of the Fermilab site. In short, we got the work force involved in the program and helped them to make it theirs.

Fermilab has these things in place. These are the types of thing that people expect, and should expect, at all levels of management. This is what the employees come to believe in. The ones who don't buy into this program, and do stupid things, are disciplined. I have had to terminate one person for unsafe acts. Fermilab's program does have teeth.

The NuMI enclosures add another level of complexity. It's hard to get help in, and get people out. We will work just as diligently to get people to understand this, and what to do in the event of an emergency. The work will be planned to the same level of detail as in the January 2003 shutdown. We will do our best to explain all of the expected tasks to all involved. People do better work when they know what's going on anyway. I don't know if the committee is aware of this, but during the January shutdown we got more work done than expected, and had no injuries. This was not an accident. It was the result of good planning, and great communication.

- The committee believes, along with Augustine, that the NUMI Project can learn from, and benefit from, and adopt to the extent judged feasible and appropriate, the safety management methodology and practices that were followed by the BD Mechanical and Operations Departments during the January 2003 accelerator complex shutdown.

Recommendation

- None

7. Procedures and line of command for MINOS collaborators who participate in the NuMI/MINOS installation work

Finding

- How the MINOS collaborators will be melded into the various special safety programs and needs associated with the NuMI underground installation work was not covered in detail in this review.

Comment

- The committee believes that, in consultation with Beams Division and Particle Physics Division managements, the NuMI Project Management should identify, make known to all affected parties, and document, the procedures and lines of command that include the safety aspects of work done during the NuMI installation phase by MINOS Collaborators who are not Fermilab employees. (These remarks concerning MINOS Collaborators are implicitly included in earlier comments and recommendations, but are re-stated here for emphasis.)

Recommendation

- The committee recommends that, with the approval of the BD Head, and after consultation with Beams Division and Particle Physics Division management personnel, the NuMI Project Management should identify, make known to all affected parties, including the Collaboration Spokespersons and Collaboration organizations, and document the procedures and lines of command that include the safety aspects of work done during the NuMI installation phase by MINOS Collaborators who are not Fermilab employees. (This recommendation concerning MINOS Collaborators is implicitly included in earlier recommendations, but is re-stated here for emphasis.)

(The reader is advised to attach no particular significance to the order in which the ES&H-related findings/comments/recommendations are presented.)

We note that many of the findings, comments, and recommendations that are included in other sections of this NuMI Installation Review report, also concern significant ES&H-related issues. This seems to the committee to constitute evidence that the Integrated Safety Management culture is indeed a living reality at Fermilab.

1.6 Management

Finding

- Fermilab has committed and remains committed that the NuMI project will be completed on schedule.

Comment

- This commitment requires, among other things, that the lengths of the 03 and 04 shutdowns and the resources be such that the NuMI installation activities are completed along with other BD programs such as Run II upgrades.

Recommendation

- NuMI coordinate closely with Beams Division Operations and others on planning the duration of installation activities and resource requirements for these activities.

Finding

- Fermilab Management reaffirmed that NuMI is a Beams Division project. Thus, Beams Division is the landlord for the entire project through project completion.

Comment

- This has implications with regard to policies and procedures used on the NuMI project such as design reviews, safety reviews, and work procedures, etcetera. To first order BD policies and procedures apply to NuMI. NuMI has begun a complete listing of technical components and the reviews that have been held on each component. They will identify any additional reviews that are needed and assure they are completed. This is part of the Installation Quality Assurance procedure NuMI is implementing.

Recommendation

- NuMI should complete the technical component list with review status and implement their Installation QA procedure as planned.

Comment

- One thing the BD Head might do regarding landlord responsibility is having the NuMI project, in the person of the Project Manger, act as landlord during construction for the new spaces created. However, Beams Division independent oversight on ES&H matters in these areas would continue to be the responsibility of the BD Head, who will be assisted and advised, as

determined by him, by appropriate BD staff; in particular, by BD committees that are appointed by and report to him.

Recommendation

- The BD Head should determine and appropriately document how he plans to discharge his landlord responsibilities in the newly created NuMI project areas.

Finding

- The September 13, 2001 letter appointing Peter Garbcincius chair of the BD NuMI Safety Committee was presented in Executive Session by Peter along with his interpretation of this charter. This was augmented by a statement from the Deputy Director that "BD is responsible for NuMI safety." This may require a more active independent safety review than has been the case to date. The Director of Beams Division accepted this responsibility.

Recommendation

- The NuMI Project Manager should work with the BD Head to appropriately implement BD NuMI safety oversight.

Finding

- Critical Floor Manager and many Task Manager positions have not been filled. Filling these positions as soon as possible was a recommendation of the December 2002 NuMI Installation Director's Review.

Comment

- This need exists even more strongly now. NuMI has set June 1 as a goal. This goal or sooner is urged by the committee.

Recommendation

- NuMI Project Director should work with appropriate Fermilab management to fill the key NuMI Installation Management positions as soon as possible.

Finding

- Significant numbers of additional personnel will be required by the NuMI Project to plan, supervise, oversee (for ES&H matters), and execute the NuMI Project underground installation work in a timely and safe manner. This will include, among others: floor managers, task managers, workers, ES&H personnel, access control personnel, subcontractor personnel, and MINOS Collaborators.

Comments

- Without the availability of the necessary personnel to carry out the NuMI Project underground installation work, the orderly, efficient, safe and timely execution of the work will not be possible. This includes necessarily the availability of these personnel for pre-installation ES&H-related indoctrination and training, and for their familiarization with the work and with the people with whom and under whose supervision/direction the work will be carried out.

Recommendation

- The committee recommends that the Deputy Director/PMG Chair, BD Head, NuMI Project Manager, and others as appropriate, should meet regularly and frequently, from now until the NuMI installation work is completed, to review, plan and coordinate the availability of the personnel required for the orderly, efficient, safe, and timely execution of the NuMI installation work, especially the installation work that will be done underground.

1.7 Action Item

- The next NuMI Director's Review, including installation, should be carried out in October 2003.
- Review NuMI responses to recommendations made in this report (see Appendix D) during the October Director's Review.

Appendix A

Charge to the Review Committee

Charge for NuMI Director's Review on Installation

April 8-9, 2003

This Director's Review will focus on installation planning for NuMI. Since the next major activity is the 2003 shutdown, some emphasis will be placed on installation planning for the extraction and primary beam systems in the Summer 2003 and Summer 2004 shutdowns. However, one goal of this Director's Review is to be sure the NuMI team is well prepared for the DOE Review to be held in late May. That review is expected to cover all NuMI installation activities. Therefore the NuMI presentations will include discussions of the stub, carrier tunnel and pre-target area, target hall and service rooms, absorber area and near detector with the inclusion of safety considerations for each area. The committee is requested to comment on the plans outlined by the presentations including the following topics:

- The technical and schedule risks inherent in the installation plan that could jeopardize the start of beam operations in January 2005.
- An assessment of the plans for meeting resource requirements to complete NuMI beam installation while simultaneously meeting accelerator operations and maintenance needs (this may be especially difficult during the two summer shutdowns).
- NuMI plans for managing the installation effort, i.e. sources of manpower and (NuMI/)/BD/PPD landlord/tenant relationships.
- Overall safety issues should be assessed, including plans for implementation of ISM – Integrated Safety Management, into the NuMI installation activities. Eg. “Some mechanism for discussing with workers what they are to do, what hazards are to be faced, and how these are to be mitigated.”

This Director's Review should assess how well the NuMI team has addressed the recommendations made in the December 2nd Review including:

- Identify Floor Managers and Task Managers/Technical Group Leaders for input into installation planning
- Provide total project installation schedule showing primary (and near) critical path(s)

- Provide details of summer shutdown IP
- Update balance of project IP
- Status of Service Buildings and Outfitting (SB&O) schedule and contractor performance

Appendix B

NuMI Director's Review on Installation April 8-9, 2003

Review Participants

Reviewers

Dave Augustine
Chuck Brown
Dave Capista
Dean Hoffer
Jim Kerby
Phil Martin
Bob Mau
Lincoln Read
Ed Temple (Chair)

NuMI Project Participants

Mike Andrews
Rich Andrews
Bruce Baller
Greg Bock
Dixon Bogert
Bob Ducar
Rick Ford
Nancy Grossman
Jim Hylan
Catherine James
Rob Plunkett
Dave Pushka
Gina Rameika
Jonathan Thron

Appendix C

Updated – 04/08/03

DIRECTOR'S REVIEW OF INSTALLATION (April 8th & 9th)

April 8, 2003 – West Wing Conf. Room –10 NW

- 8:30 Executive Session
- 9:00 Introduction & Project Status ([Greg Bock](#))
- 9:30 Installation Overview ([Rich Andrews](#))
- 10:00 Break
- 10:15 Main Injector Installation ([Rick Ford](#))
- 11:15 Status of Civil Construction ([Dixon Bogert](#))
- 11:30 Lunch
- 1:00 MI- 65: Pre-Target Hall and Target Hall ([Dave Pushka/Jim Hylan](#))
- 1:40 MINOS: Absorber/Near Detector ([Rich Andrews/Cat James](#))
- 2:30 Installation ES&H Plan for NuMI ([Mike Andrews](#))
- 2:50 Break
- 3:15 Tour followed by Breakout Sessions
- 5:00 Executive Session

April 9, 2003 – One North Conf. Room

- 8:30 Wrap Up/Summary (Greg Bock)
- 3:00 Closeout

Appendix D

Recommendations from the Director's Review of NuMI Installation Plan
April 8-9, 2003

No	Responsible	Recommendations	Status	Date
		<i>Section 1.1 – Main Injector, NuMI Stub, and Pre-Target Area</i>		
1.1.1		The planned installation tasks for the '03 shutdown are reasonable for the duration and completion of these tasks will leave the project in a position that short unscheduled shutdowns could be used to some extent. Beams Division and Lab management should provide sufficient resources and schedule the shutdown duration to allow completion of the scheduled tasks.		
1.1.2		Appoint the MI-65 Floor Manager before the May DOE Review, followed by the task managers for the major installation tasks.		
1.1.3		Lambertson installation in '03 would allow an additional year of operating experience with the Main Injector, with minimal impact and risk, and would allow power tests to understand any stray-field impact on the Recycler. Understanding this impact earlier would allow mitigation, if needed, during the '04 shutdown. The committee encourages installation of the Lambertson magnets in '03 provided this can be done without extending the shutdown duration.		
1.1.4		The check-in/check-out plan needs to be completed and signed off on, and manpower requirements adjusted accordingly.		
1.1.5		Discussions with BSS should be initiated/continued to assure that the methods for loading, transporting and unloading are understood and agreed upon.		
No	Responsible	Recommendations	Status	Date
		<i>Section 1.2 – Target Hall and Service Rooms</i>		
		Topic 1 – None		
		Topic 2		

Recommendations from the Director's Review of NuMI Installation Plan
April 8-9, 2003

1.2.1		Work with Beams Division, PPD, and TD to assign these key roles as soon as possible.		
		Topic 3		
1.2.2		The target tech group should be maintained intact and not disturbed by other activities. Project personnel should work with Beams Division HQ and personnel to attain assurances that this will be the case throughout the component fabrication, assembly and installation stages.		
		Topic 4 – None		
		Topic 5		
1.2.3		Compare time study estimates with the real-world experiences of Mini-BooNE Target Pile installation and adjust accordingly. This includes the need to shim and level blocks as well as transport of blocks from rail-head (or other source) to MI-65.		
		Topic 6		
1.2.4		The floor manager for the area should be assigned responsibility to ensure crane inspections and maintenance is performed adequately and monitor crane usage. In addition, repair times, availability of spare parts, and inspection frequency of the normal Fermilab infrastructure for maintenance and repair of cranes should be investigated.		
		Topic 7		
1.2.5		A mechanical review of this structure should be performed in the very near future.		
		Topic 8		
1.2.6		NuMI project and BD personnel work together to develop such a cohesive plan for transfer of knowledge.		
		Topic 9		
1.2.7		Show the integrated schedule (including all WBS level 3 tasks) in the presentation to the DOE review panel.		
		Topic 10 - None		

Recommendations from the Director's Review of NuMI Installation Plan
April 8-9, 2003

No	Responsible	Recommendations	Status	Date
<i>Section 1.3 – Absorber Area</i>				
1.3.1		Implement ISM by documenting the various reviews and responses to the reviews in a systematic way.		
1.3.2		Specify a review and sign-off procedure for design modifications		
1.3.3		Review and document the design, installation plan, and maintenance and fault repair procedures for the Hadron Absorber		
1.3.4		Identify the MINOS floor manager, preferably before the next review, even though this position may only be part time until FY04.		
1.3.5		Preassemble the Hadron Absorber assembly crane and absorber pile above ground if possible.		
No	Responsible	Recommendations	Status	Date
<i>Section 1.3 – Near Detector</i>				
1.3.6		Implement ISM by documenting the various reviews and responses to the reviews in a systematic way including the coordination of the PPD and Beams Division Reviews.		
1.3.7		Specify a review and sign-off procedure for the proposed installation procedures		
1.3.8		Actively include the Particle Physics Division in the planning and documentation of the design and installation plans, as well as maintenance and fault repair procedures, since they will eventually become the custodians of the Near Detector Hall		
1.3.9		The Beams Div and the Particle Physics Div should independently review the sump pump system to ensure the reliability of the system and its backup equipment and procedures.		
1.3.10		Identify the Floor Manager for the MINOS area and the Task Manager for the detector installation as soon as possible.		

Recommendations from the Director's Review of NuMI Installation Plan
April 8-9, 2003

No	Responsible	Recommendations	Status	Date
<i>Section 1.4 Integrated Schedule</i>				
1.4.1		Identify as many as possible of the floor managers and task managers before the May DOE review.		
1.4.2		Specifically communicate the NuMI personnel requirements to the BD, PPD, and BSS within the next month.		
1.4.3		Restart the NuMI Installation Coordination Meetings before the May Lehman review.		
1.4.4		Work backwards from the installation schedule to set milestones for the timely review and sign off of components to be installed in the tunnel.		
1.4.5		BD needs to provide feedback to NuMI on the near term schedule.		
1.4.6		BD & the Directorate should re-emphasize the importance of NuMI project completion.		
No	Responsible	Recommendations	Status	Date
<i>Section 1.5 Integrated Safety Management</i>				
<i>1. Safety review processes, and their implementation and documentation</i>				
1.5.1		The committee recommends that the charge by the BD Head to the BDNSC be updated to reflect inclusion of independent safety reviews, including sign-offs as appropriate, in the charge to the committee.		
1.5.2		The committee recommends that the Chair of the BDNSC and the NuMI Project Manager proactively and aggressively see to it that the safety reviews processes be fully implemented.		
1.5.3		The committee recommends that the BD Head and the NuMI Project Manager should review and revise as appropriate the BD safety-review processes (including radiation safety-related review processes and construction safety-related review processes), and a description of the safety review processes should be included in the web-based ISM Implementation		

Recommendations from the Director's Review of NuMI Installation Plan
April 8-9, 2003

		Plan documentation that is in preparation.		
1.5.4		The committee recommends that the next round of underground installation work be done in accordance with the newly revised and upgraded, fully documented, safety review processes.		
		2. Safety Responsibilities chain-of-command, including awareness of this by all employees and contractors		
1.5.5		The committee recommends that the statements in the ICP, and the corresponding chart, be reviewed by NuMI Project Management in consultation with the BD and PPD managements, and revised as needed to make them consistent with one another and to accurately state the single-chain-of-command line of authority and responsibility for both the execution of the installation work and its safe performance.		
1.5.6		The committee recommends that the chain-of-command line of authority and responsibility must be fully understood and also must be accepted by all personnel who supervise, or perform, or advise concerning, the NuMI Project installation work, and that appropriate training to ensure this should be carried out throughout the installation phase of the NuMI Project (and that the records of such training should be appropriately documented.)		
		3. ES&H staffing (including management of access control for underground areas);		
1.5.7		The committee recommends that, in consultation with the BD Operations Department, the NuMI Project develop, document, and put in place an appropriate access control, monitoring, and management process for installation through the MI-65 and MINOS access shafts, prior to the commencement of technical components and detector installation through those two shafts.		
1.5.8		The committee recommends that the NuMI Project Management add an additional high-level person as soon as		

Recommendations from the Director's Review of NuMI Installation Plan
April 8-9, 2003

		<p>possible to the NuMI ES&H staff. This person's responsibilities would include the following:</p> <ol style="list-style-type: none"> 1. Development of ES&H procedures and processes for the oversight/inspection of the NuMI installation work, 2. Development of procedures and processes of additional ES&H-related activities that are discussed in other sections of this Director's Review Report and in particular in other parts of this Section 1.5 (Integrated Safety Management) of the Review Report, 3. Assure that the documentation required to implement all the items noted above are properly completed and maintained, 4. Development of the required training for the procedures and processes noted above, 5. Implementation or coordination of implementation of all the items noted above and assure successful accomplishment of these activities. 		
		4. Completeness and availability of documentation, including ES&H documentation		
1.5.9		The committee recommends that a description of NuMI Project's Documentation System be developed and the process documented. This process should identify the types of documents within in the scope of the documentation system, which would include all ES&H related documentation. Links to documents themselves should be better organized and linked to a single web site. Also, a person should be assigned the responsibility to assure proper implementation of the process.		
		5. Visits to other facilities by the NuMI Project ES&H Co-ordinator None		
		6. Applicability of existing BD policies and practices to the NuMI installation work; and		

Recommendations from the Director's Review of NuMI Installation Plan
April 8-9, 2003

		None		
		7. Procedures and line of command, for MINOS collaborators who participate in the NuMI/MINOS installation work.		
1.5.10		The committee recommends that, with the approval of the BD Head, and after consultation with Beams Division and Particle Physics Division management personnel, the NuMI Project Management should identify, make known to all affected parties, and document, the procedures and lines of command that include the safety aspects of work done during the NuMI installation phase by MINOS Collaborators who are not Fermilab employees. (This recommendation concerning MINOS Collaborators is implicitly included in earlier recommendations, but is re-stated here for emphasis.)		
No	Responsible	Recommendations	Status	Date
		<i>1.6 Management</i>		
1.6.1		NuMI coordinate closely with Beam Operations on planning the duration of installation activities and resource requirements for these activities.		
1.6.2		NuMI should complete the technical component list with review status and implement their Installation QA procedure as planned.		
1.6.3		The BD Head should determine and appropriately document how he plans to discharge his landlord responsibilities in the newly created NuMI project areas.		
1.6.4		The NuMI Project Director should work with the BD Director to appropriately implement BD NuMI safety oversight.		
1.6.5		NuMI Project Director should work with appropriate Fermilab management to fill the key NuMI Installation Management positions as soon as possible.		
1.6.6		The committee recommends that the Deputy Director/PMG Chair, BD Head, NuMI Project Manager, and others as appropriate, should meet regularly and frequently, from now until the NuMI installation work is completed, to review, plan		

Recommendations from the Director's Review of NuMI Installation Plan
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		and coordinate the availability of the personnel required for the orderly, efficient, safe, and timely execution of the NuMI installation work, especially the installation work that will be done underground.		