Department of Energy
Germantown, MD 20874-1290

JAN 20 2004

MEMORANDUM FOR: ROBIN STAFFIN
ASSOCIATE DIRECTOR OF THE OFFICE OF SCIENCE
FOR THE OFFICE OF HIGH ENERGY PHYSICS

FROM: DANIEL R. LEHMAN
CHAIRPERSON
DOE REVIEW COMMITTEE
CONSTRUCTION MANAGEMENT SUPPORT DIVISION

SUBJECT: Department of Energy Review Report on the Neutrinos at the Main Injector Project, November 2003

Attached for your consideration and use is the final report of the Department of Energy Neutrinos at the Main Injector (NuMI) project review. The NuMI review was conducted on November 13-14, 2003, at the Fermi National Accelerator Laboratory.

If you have any questions, or would like to discuss this report further, please contact me.

Attachment

cc:
L Dever, SC-80 (w/o attachment)
S. Tkaczyk, SC-81
A. Byon-Wagner, SC-223
P. Debenham, SC-224
M. Procario, SC-221
D. Sutter, SC-224
R. Lutha, Fermi Group → STEVE WEBSTER

Printed with soy ink on recycled paper

Department of Energy
Review Committee Report

on the

Technical, Cost, Schedule, and
Management Review

of the

NEUTRINOS at the MAIN INJECTOR (NuMI) PROJECT

November 2003

the May 2003 DOE review well ahead of the baseline schedule, and sees evidence that this trend will continue. There are no funding issues with the project. Both the successful installation activities in the MI Enclosure during the 2003 shutdown and progress on developing plans for commissioning the Booster and MI for NuMI operation are strong indications that Fermilab management is providing the NuMI project with adequate resources and priority to succeed in parallel with the Tevatron collider program.

CONTENTS

1. INTRODUCTION

On November 13 and 14, 2003, a Department of Energy (DOE) Review Committee conducted a technical, cost, schedule, and management review of the Neutrinos at the Main Injector (NuMI) construction project. This project provides for the design, engineering, and construction of new experimental facilities at the Fermi National Accelerator Laboratory (Fermilab) in Batavia, Illinois and at the Soudan Underground Laboratory in Soudan, Minnesota. Particle physicists will use these facilities to study the physics of neutrinos. In the Standard Model of elementary particle physics there are three types of neutrinos, all postulated to be massless. There is compelling experimental evidence of deficits of electron neutrinos produced in the sun and of muon neutrinos produced in the atmosphere. A credible explanation of these observations is that neutrinos are capable of transforming (oscillating) into neutrinos of another type and then back again. The occurrence of neutrino oscillations would demonstrate unequivocally that neutrinos have mass. The experiments that are being designed to use the NuMI facilities would be able to search for neutrino oscillations occurring in an accelerator-produced neutrino beam and hence determine if neutrinos do have mass.

The primary element of the project is a high-flux beam of neutrinos in the energy range of 1 to 40 giga-electron volts (GeV) produced using protons from the Main Injector (MI) synchrotron. The beam will be aimed at the two detectors for the Main Injector Neutrino Oscillation Search (MINOS) experiment. These detectors will be constructed in new experimental halls along the neutrino beam trajectory, one for the near detector on the Fermilab site and the other for the far detector in the Soudan Underground Laboratory. The beam line and all conventional facilities at Fermilab will be constructed using line-item project construction funds. Also included in the total project cost, but constructed using other funds, are the detectors and the new experimental hall at Soudan.

The Review Committee was composed of six DOE participants and five technical consultants with extensive experience in accelerators, beam lines, and environmental, safety and health (ES&H) issues. Daniel Lehman, Director of the Construction Management Support Division, Office of Science, chaired the Committee.

This report begins with sections on the beam line technical components, conventional construction at Fermilab, and the MINOS detectors, organized by the project work breakdown structure (WBS). The final sections cover installation, commissioning, ES&H, cost, schedule and funding, and management. The charge to the Committee is shown in Appendix A, a list of the

Review Committee membership in Appendix B, the review agenda in Appendix C, and cost tables in Appendix D. Recent change actions are given in Appendix E, project schedule tables in Appendix F, coming Level 3 milestones in Appendix G, the project funding profile in Appendix H, the project management structure in Appendix I, and action items resulting from this review in Appendix J.

2. NuMI TECHNICAL COMPONENTS (WBS 1.1)

2.1 Findings

The work in WBS 1.1 is transitioning from construction of components, which is largely completed, to installation activities. Excellent progress has been made throughout this WBS element, with the completion of many technical systems. Major installation activities have taken place in the MI area during a recent shutdown, and installation has started in the NuMI Target area. No schedule slippage occurred in the last six months. Technical changes have been minimal. Listed below are some of the key technical achievements of the last six months:

- Large magnet installation in the MI and Extraction Enclosures was completed—28 magnets have been installed, including Lambertsons, C-magnet, EPB dipoles, B2 dipoles, and 3Q quadrupoles. (WBS 1.1.1)
- Testing of horn 2 and fabrication and testing of horn 1 were completed. (WBS 1.1.2)
- Horn 1 module assembly was completed. (WBS 1.1.2)
- Transmission line design and drawings were completed. (WBS 1.1.3)
- All magnet power supply work in MI-60N and MI-62 was completed. (WBS 1.1.3)
- The hadron absorber installation plan was updated to take place concurrently with the MINOS near detector installation. (WBS 1.1.4)
- All 32 muon chambers (including 5 spares) have been constructed, and 15 of these have been tested and calibrated. (WBS 1.1.5)
- The positions of the proton beam line and magnet stands were marked in the MI and Extraction Enclosures. (WBS 1.1.6)
- The NuMI magnets in the MI Enclosure were rough-aligned. (WBS 1.1.6)
- Instrumentation and motor starters for the radioactive water cooling skids were purchased, received, and installed, and piping for the skids was completed. (WBS 1.1.7)
- New interlock hardware was installed establishing the boundary between the MI and NuMI radiation safety areas. (WBS 1.1.8)
- Approximately 50 percent of the beam-line cables were installed. (WBS 1.1.8)

The NuMI team has addressed the two recommendations of the May 2003 DOE review committee by installing the Lambertson magnets in the MI during the 2003 shutdown and holding an outside review of the decay-pipe end-cap design and installation and testing plans. The MI has since been operated with the Lambertsons installed (but not powered), and no ill effects on MI performance have been observed.

The planned installation of NuMI technical components in the MI went as scheduled; there were sufficient resources to complete this task in a timely manner. The NuMI team also had

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3. CIVIL CONSTRUCTION (WBS 1.2)

3.1 Findings and Comments

3.1.1 Tunnel and Halls

Fermilab has continued efforts to resolve open requests for equitable adjustments on the Tunnel and Halls subcontract. Negotiations have proceeded and seven Disputes Resolution Board (DRB) hearings have been held. DRB hearings have been scheduled for FY 2004 and into FY 2005 by mutual agreement of both Fermilab and the Tunnel and Halls subcontractor.

3.1.2 Surface Buildings and Outfitting

The scope of the Service Buildings and Outfitting (SB&O) subcontract includes the construction of the Target Service Building (TSB) and the MINOS Service Building (MSB), outfitting of the underground NuMI facility at Fermilab (which includes installation of the conventional mechanical and electrical systems), and completion of the pit liner in the Target Hall.

At the May 2003 DOE review the SB&O subcontract was approximately 40 percent complete, and as of this review it is 83 percent complete. Major accomplishments include: beneficial occupancy of the Target site, including the TSB; the Target Access Shaft; the Target Hall and the Carrier and Pretarget Tunnels; and completion of the MSB shell. Installation of major systems in the MSB is well underway, as are the installation of electrical and mechanical systems in the MINOS and Absorber area tunnels.

Fermilab granted its SB&O subcontractor a schedule extension of 32 calendar days (to October 20, 2003) for beneficial occupancy of the Target site, and a 50-day extension (to January 31, 2004) for beneficial occupancy of the MINOS site. Beneficial occupancy of the Target site occurred on schedule and beneficial occupancy of the MINOS site also appears to be on schedule. These dates are well in advance of the May 2004 baseline for DOE milestone L-2-11 (beneficial occupancy of service buildings at Fermilab). Beneficial occupancy of the MINOS site is no longer on the project critical path.

The current subcontract value is approximately $20 million, which is $2 million more than the original award. The increase comprises $1.5 million of changes and $0.5 million of work that was previously budgeted elsewhere and moved into this subcontract.

There are no unresolved contractual issues on this subcontract. A DRB is contractually stipulated if either party desires it, but neither party has requested the use of a DRB, nor is this anticipated.

One open issue appears to be the access road into the MINOS site. At present, access is by a combination of existing roads and a temporary road that was constructed for this purpose. The temporary road will require upgrading if it is to provide permanent access. It is not clear that the appropriate planning has taken place.

Fermilab is doing an excellent job of managing the SB&O subcontract and is well positioned to complete this work without significant difficulty.

3.2 Recommendation

1. Continue the good work.

4. MINOS Detectors (WBS 2.0)

4.1 Findings

DOE milestone L-1-8 (far detector complete and tested) was achieved on July 9, 2003, more than nine months before the May 2004 baseline. The far detector now routinely collects cosmic ray data and is fully supported by Fermilab's operating budget.

There has been good progress on production of front-end electronics, which should be complete well before the end of the near detector (ND) plane installation. Assembly and check-out are in general proceeding smoothly. There is a mechanical problem with the card guide in the Minder crates that the vendor has tried to fix without success. MINOS collaborators at Argonne National Laboratory have fixed several crates and could, if necessary, fix all the crates in several weeks at modest cost. A successful run with the calibration detector (CalDet) in a test beam at CERN provided a valuable check of the complete system.

The assembly of ND electronics racks in the New Muon Lab is now 70 percent complete and, at the present rate of assembly, will finish in January 2004. Installation of the ND in the MINOS Hall is currently scheduled to begin in February 2004, proceed at a rate of two planes per day, and finish nine months later. The MINOS collaboration conducted an installation review at their September meeting.

Six Level 3 milestones were forecast for MINOS during the six months since the May 2003 DOE review. Five of these were accomplished. The project has completed and closed out WBS 2.1 (Magnets, Steel and Coils), WBS 2.2 (Scintillator Detector Fabrication) and WBS 2.4 (Far Detector Installation).

The current EAC is $42,407 K (U.S. funds only), an increase of $212 K since the May 2003 DOE review. This increase, which is essentially confined to WBS 2.5 (Near Detector Installation), is dominated by a $173 K addition for the acquisition of a tugger/lifter for underground transport of ND and absorber components. The remaining contingency of $3,414 K is 213 percent of the estimated cost to complete the detector, and MINOS management expects to return approximately $700 K to contingency. The contingency seems more than adequate.

4.2 Comments

The project has addressed the MINOS recommendation from the May 2003 DOE review: they now plan to alternate crane usage in the MINOS Access Shaft as needed between absorber installation and ND installation. This will allow the start of ND installation slightly earlier than previously scheduled, and will provide greater flexibility for dealing with unanticipated problems or interruptions. They can also add a second shift for ND installation at a cost of as much as several hundred thousand dollars, if this proves necessary to stay on schedule.

While CalDet provided an important test of the electronic system, it did not use the final assembled racks that will be used with the ND. MINOS management is now planning to test eight ND planes with the final system in the New Muon Lab before installation. It is very desirable to detect any problems before installation begins, and the Committee strongly endorses this test if it can be accomplished within the schedule.

4.3 Recommendations

None.

5. INSTALLATION

The project has successfully undergone a thorough test of installation readiness during the recent MI shutdown. They installed all major magnets in the MI and Extraction Enclosures and made preparations for future installation. The plans for installation are well thought out and are being implemented.

5.1 Findings

This section discusses the overall NuMI installation effort at Fermilab. Installation activities are grouped into three identified areas: 1) the MI area; 2) the Target area (Pre-target Tunnel and Target Hall); and 3) the MINOS area (Absorber Hall, Muon Alcoves, and MINOS Hall).

As noted above, the 2003 MI shutdown provided a seven-week opportunity to install NuMI hardware in the MI area. The project was able complete a substantial portion of all the installation work planned in this area.

Beneficial occupancy of the Target area was obtained in October. Technicians who had worked in the MI during the shutdown are now beginning installation work in the Target area. The project's critical path now goes through Target area installation. However, there are adequate float and resources to deal with this situation. Shielding block installation will be done using two shifts beginning in December 2003.

Beneficial occupancy of the MINOS area is expected on January 31, 2004. Installation work in this area appears to be well planned, with lessons learned from MI and Target Hall installation being incorporated.

5.2 Comments

The recommendation from the May 2003 DOE review, the laboratory's response, and this Committee's comments are given below.

Consider naming one person to lead the installation effort in the Target area similar to Cat James in the MINOS area. The project did consider this approach to installation management, but chose to implement a somewhat different scheme. Each of the three areas is

assigned a floor manager and, in the case of the Target area, a deputy floor manager. Task managers report to the floor managers. Level 3 managers are involved in weekly planning meetings, providing technical and project management oversight. The Committee feels that this arrangement is working well and is adequate to successfully complete installation.

The project has continued to implement recommendations from the Fermilab Director's review of the Installation Plan that was held just prior to the May 2003 DOE review. At that DOE review, the project was encouraged to follow through with these recommendations, and the present DOE Review Committee was shown numerous examples of these activities.

The project is positioned to effectively use the short MI shutdowns that will occur during the next ten months to continue installation, and to complete installation of NuMI equipment in the MI enclosure during the 2004 summer shutdown.

The SB&O subcontract is going well, with beneficial occupancy of the MINOS area expected on January 31, 2004. Detector installation will be done by Fermilab technicians, largely those who have been involved in assembly of the detector. The laboratory plans to award subcontracts for installation of the absorber and its associated equipment. Thus there is no overlap of installation resources with activities in the other two areas.

The April 2003 Director's review committee expressed concern that the Beams Division (BD) did not have adequate staff to both support the NuMI installation and do the required Run II work. The work done during the 2003 shutdown demonstrates that the project and the BD have resolved this problem and accomplished the work needed for both. Vigilance will be needed to maintain this cooperation during Target area installation.

Project management, in a risk analysis exercise, has allotted sufficient contingency to installation to cover conceivable problems.

5.3 Recommendations

None.

6. COMMISSIONING

6.1 Findings

The Review Committee met with the project managers and the BD managers to discuss preparations for NuMI commissioning. Since the May 2003 DOE review, the project has installed NuMI components in the MI during the shutdown and developed a MI commissioning plan for the NuMI beam. The MI Department has a key NuMI staff member as Deputy Department Head. As noted at the May 2003 DOE review, the MI has demonstrated good performance with 6 Booster batches giving 2.3 $x10^{13}$ total protons per cycle. This is close to the combined intensity goal of 3 $x10^{13}$ protons per cycle for initial MINOS physics operation concurrent with antiproton production. The effectiveness of the MI dampers has been demonstrated, and a full implementation is to be operational by April 2004. Beam commissioning to NuMI is on schedule to begin in January 2005 after critical installation occurs during the 2004 shutdown. Fermilab has reorganized the BD, moving the Beam Physics personnel into operating groups.

The laboratory has successfully addressed all four recommendations of the May 2003 DOE review committee. The three Lambertson magnets were installed during the 2003 shutdown but cannot yet be powered. The beam has successfully run in the MI with the Lambertsons installed, using an orbit bump as anticipated. Some work remains to smooth the orbit bump and check MI performance when the Lambertsons are energized after the 2004 shutdown. The stray field from these ramped magnets is small, of order 6 G-m, and expected to have only a small effect on the MI 120 GeV/c stored beam.

The MI Department presented a list of MI beam studies, complete with the names of participants and the scheduled completion dates. Time for studies is based on available time between antiproton stacks. Studies are approved by the BD Associate Head for Accelerators. Studies in the Booster are ongoing and driven by the total laboratory proton needs. The commissioning plan dated October 2002 continues as the document detailing the NuMI checkout. It delineates three commissioning stages: 1) subsystem checkout; 2) achieving the CD-4 goal of $1x10^{12}$ protons per pulse (ppp) on target; and 3) commissioning for physics with $2.5x10^{13}$ ppp on target. In the next six months, management plans to hold a commissioning workshop with the parties involved as preparation for the checkout activities.

The laboratory presented a plan for shielding the Recycler from NuMI extraction dipole magnet fields. A calculation shows an adequate field reduction factor of 35. The design is being

prototyped so a measurement can check the calculation, and mechanical design for final production remains to be done.

Booster intensity is presently limited by residual radiation on components which require maintenance. Booster studies are addressing this limitation, with the expectation of allowing operation at higher currents. It is possible that the MI will have similar limitations. A plan to quantify losses is part of the MI studies plan.

6.2 Comments

Given recent performance of beam in the MI and the plan of studies presented, physics running with 2.5×10^{13} ppp on target should be achievable. In particular, commissioning to the CD-4 level of 1×10^{12} ppp on target appears under control. The Committee was not shown a path to intensities beyond 2.5×10^{13} ppp. A study by the "Proton Team," dated October 26, 2003, outlines several possibilities for increasing the intensity of the injector chain. The study is under review, and a plan will be generated based on physics needs and possible upgraded machine performance. NuMI management should consider the impact of commissioning to some higher intensity, such as 5×10^{13} ppp, or operating with a shorter cycle time, consistent with the plan developed for the injector chain. At the next review, the project should discuss the impact of these plans.

Previous review committees have commented, and the present one agrees, that the task of commissioning the primary transport for CD-4 can be done in the scheduled time of roughly one month. However, the project anticipates, and the Committee agrees, that managing conflicts with the ongoing collider program will remain a challenge. In particular, the shutdown in 2004 (reported to need eight weeks) is critical for installation and checkout of NuMI extraction components. The 2003 shutdown was very successful, and current beam study time is deemed adequate.

While additional manpower has been found for commissioning activities, the plan for the coming year has a sizeable amount to be accomplished in the MI. Additional staff to help with beam studies could well pay off in a more rapid turn-on of high-intensity beams at the physics level of 2.5×10^{13} ppp. The Committee also encourages involving an operations specialist to a greater extent.

6.3 Recommendations

None.

7. ENVIRONMENT, SAFETY and HEALTH

7.1 Findings

NuMI construction subcontractors have generally improved the quality of their job hazard analysis, coordination of work with other trades, and pre-shift coordination/safety briefings since the December 2002 review. Since that review, Fermilab has adopted the job hazard analysis and work coordination practices used on the NuMI project for its facility installation activities and general Fermilab construction activities.

The DOE Fermi Area Office (FAO) and Fermilab NuMI ES&H staff continues to regularly attend pre-shift meetings conducted by Fermilab and its SB&O subcontractor, RBI. Construction area inspections are conducted by members of the NuMI management team, the Fermilab ES&H section, and the FAO. Members of the Review Committee were able to participate in several of these activities and were satisfied that they were focused and were conducted effectively.

Five of the last six safety incidents on the NuMI project have involved employees of RBI's electrical subcontractor, Divane. All five incidents were due to inattention to detail and ineffective work planning. Divane management has successfully overcome the initial difficulties with their safety program and has been attempting to promote an effective safety program. As a whole, the craft personnel are very appreciative of Fermilab's efforts to provide them with a safe work environment. The individuals interviewed by the Committee volunteered that they felt that Fermilab is the safest place they have had the opportunity to work. However, it is not uncommon in the construction industry to find a few individuals who are resistive to following safety rules. On two recent occasions, Divane management has terminated employees who were unwilling to work to the safety expectations of the NuMI project, and NuMI management was aware of these actions. There are apparently some unresolved communication difficulties between RBI and Divane field supervision that appear to be contributing to the problems that have resulted in the aforementioned safety incidents. NuMI management is aware of these difficulties and is working toward resolving them.

The NuMI Radiation Safety Coordinator presented the status of the NuMI Safety Assessment Document (SAD), shielding assessment, and Accelerator Readiness Review (ARR) process to the Committee, and answered questions on the schedule, status, content, and review process for each topic.

SAD—The NuMI SAD is scheduled to be completed in May 2004, when it will be submitted to the FAO for review and approval. The project team has scheduled appropriate reviews of the document and should be able to complete it on schedule.

Shielding Assessment—The shielding assessment review is well structured. The process includes weekly meetings and reviews by laboratory stakeholders, including NuMI personnel, a BD shielding committee, and Fermilab's Radiation Safety Officer.

Readiness and Commissioning—An ARR is scheduled for September 2004. This should provide sufficient time to complete the review and obtain the requisite approvals to allow NuMI commissioning to begin in January 2005.

7.2 Comments

Work planning and safety observations are key elements of a successful safety program. The NuMI project has effectively implemented the job hazard analysis and associated work coordination process. Their application of these principles to the installation activities in the Target area and to oversight of the involved subcontractors is well managed. As a result the Target area is neat and organized. The individual managing this operation is evidently on the lookout for, and is correcting, factors that could potentially lead to unsafe conditions. One example is stemming the seepage of water that could result in slipping hazards. However, there is room for improvement in the safety inspection and observation of NuMI construction activities. Currently, the Deputy Project Manager for Civil Construction, the Fermilab SB&O Manager, the field construction coordinator, and project ESH personnel conduct NuMI site inspections. However, there appears to be a heavy reliance on the project ESH personnel to identify and correct field safety concerns.

Key subcontractor personnel and NuMI management should set aside time each week to walk the jobsite to identify and address safety issues. These inspections should focus on the leading indicators at this point in the project's life cycle, such as housekeeping, material storage, work practices, and potential slip and trip hazards. This observation process will reinforce management's safety expectations. The workforce seeing project management identify unsafe work practices and conditions will lead to greater buy-in to the safety process. The message that must be conveyed is that doing work safely the first time is more important than shaving time off the schedule by cutting corners.

Subcontractor superintendents are a critical link in the field safety process. A strong superintendent who has "bought-into" safety is crucial to a successful safety program. The superintendent should be identified as a "key person" in construction subcontracts. Fermilab project management should participate in the selection of this critical management position.

7.3 Recommendations

1. Conduct weekly joint safety walks with construction subcontractor "key personnel" and NuMI team members to add "fresh eyes" for evaluating work conditions, and take corrective actions as necessary. **(Immediately)**

2. Retain a consultant to advise DOE-FAO on their construction oversight program. **(Immediately)**

3. At the next review, present the status and plans for the SAD, shielding assessment review, and ARR.

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2. Retain a consultant to advise DOE-FAO on their construction oversight program. **(Immediately)**

3. At the next review, present the status and plans for the SAD, shielding assessment review, and ARR.

8. COST

8.1 Findings

On December 21, 2001, the Deputy Secretary approved a Level 0 baseline change that established a new Total Project Cost (TPC) of $171.4 million for the NuMI project. At subsequent DOE reviews, the project presented changes to the baseline that required contingency utilization but left the TPC fixed. At the current review, additional contingency activity was presented, but the TPC still remains unchanged. Table 8-1 provides a summary of the TPC evolution from the December 2001 re-baseline to this current review. Additional cost details can be found in Appendix D.

Table 8-1. Changes to Baseline Cost Estimate (in $K)

WBS	Description	December 2001 Baseline	May 2003 Review	Changes since May 2003 Review	November 2003 Review
1.1	Technical Components	27962	26219	550	26768
1.2	Facility Construction	60493	67059	988	68047
1.3	Project Management	4788	4430	(100)	4330
	Contingency on TEC	15999	11534	(1437)	10097
1.0	**Total Estimated Cost (TEC)**	**109242**	**109242**	**0**	**109242**
2.0	MINOS	38776	42195	212	42407
3.0	Project Support	16109	16377	1	16378
	Contingency on OPC	7315	3628	(213)	3415
	Other Project Costs (OPC)	**62200**	**62200**	**0**	**62200**
	Total Project Cost (TPC)	**171442**	**171442**	**0**	**171442**

Since the May 2003 DOE review, the contingency for the TEC was reduced by $1.4 million. This is primarily due to change orders and budget adjustments to the SB&O subcontract ($1.0 million) and labor cost overruns in the design of technical components ($0.6 million). Contingency for OPC decreased by $213,000 due primarily to increases in detector installation costs. A list of the change requests and their descriptions is included in Appendix E.

The project is 92 percent complete (TPC) through September 2003. The remaining contingency for the TPC is $13.5 million, which is 101 percent of the ETC. Table 8-2 summarizes the NuMI project contingency.

Table 8-2. Project Contingency Status (in millions of dollars)

	Baseline	ETC	Contingency
TEC	109.2	11.8	10.1
OPC	62.2	1.6	3.4
TPC	171.4	13.4	13.5

8.2 Comments

The contingency remaining is a significant percent of the ETC. However, there are remaining cost risks within the project. The project will incur additional costs if any of the 238 days of float in the schedule (see Section 9) are required for completion. The project has conducted an exercise in risk assessment and management that was discussed at the review. The conclusion was that the project is manageable within the boundaries of the current cost baseline. The Committee concurs with this conclusion.

8.3 Recommendations

None.

9. SCHEDULE and FUNDING

9.1 Findings

The project presented a master schedule and a list of DOE milestones with associated schedule float relative to the project's internal schedule (see Appendix F). Milestone L-1-9 (Start commissioning beam line) is projected to occur on December 28, 2004. This would be followed by the milestone L-0-3 (CD-4: Start of operations) on February 4, 2005. There would be 238 days of float remaining until the baseline CD-4 date of September 30, 2005. This compares to 259 days as presented in the May 2003 DOE review.

Milestone L-2-17 (Complete installation of horn power supply) is forecast for February 6, 2004, which is 208 days ahead of the baseline date. This is four months later than forecast at the May 2003 DOE review but is not a critical path item.

Milestone L-2-18 (Target Service Building shell complete) occurred on June 17, 2003. Milestone L-2-11 (beneficial occupancy of service buildings at Fermilab) is projected for January 31, 2004, 5 weeks later than forecast at the last review. However, this date is 122 days ahead of the baseline.

For the detectors, Milestone L-1-8 (Far detector complete and tested) occurred on July 9, 2003, 291 days ahead of the baseline schedule. Milestone L-2-14 (near detector complete and tested) is forecast for December 28, 2004, 93 days ahead of the baseline.

The project achieved 40 of the 44 Level 3 milestones scheduled for completion since the May 2003 DOE review on their internal schedule. In addition they achieved seven that were scheduled for completion after this review. Appendix G lists the Level 3 milestones scheduled for completion in the next six months.

The funding profile for the project (Appendix H) supports the internal schedule.

9.2 Comments

The Committee commends the project for accomplishing DOE and Level 3 milestones since the May 2003 DOE review—well ahead of the baseline schedule, and sees evidence that this trend will continue. There are no funding issues with the project.

9.3 Recommendations

None.

10. MANAGEMENT

10.1 Findings

The project is being well managed to meet technical scope, cost, and schedule baselines. During the last six months $15 million of progress has been made, with $13 million remaining. The majority of the remaining work is installation; most technical components have been delivered.

The successful installation activities in the MI Enclosure during the 2003 shutdown illustrate that management has resolved the issues associated with supporting both the NuMI project and collider needs. The commissioning plans also indicate that the operational needs of NuMI are well integrated into the BD priorities without significant impact on collider objectives.

The project has a risk evaluation system in place and is keeping it up to date. Various areas are identified where there will likely be cost and/or schedule impacts. These are being closely managed.

Two DOE milestones were met in the last six months (Target service building shell complete, and far detector complete and tested).

10.2 Comments

Fermilab has evaluated its overall proton needs for the next several decades. While it is early in the planning process, this sort of long-term, strategic planning will benefit NuMI. Progress is being made in addressing NuMI needs in the near term with studies and with improvements being realized in both the Booster and the MI.

As noted in the section on ES&H, there have been several injuries in the last week. The Committee felt that management is committed to safety and is aggressively looking for solutions. The Committee has one management recommendation related to ES&H.

10.3 Recommendation

1. Management at all levels should perform regular, documented safety walks with the intention of identifying leading indicators, and addressing problems.

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APPENDIX A

CHARGE MEMORANDUM

United States Government Department of Energy

memorandum

DATE: OCT 7 2003

REPLY TO ATTN OF: SC-224

SUBJECT: NuMI Semiannual Review

TO: Daniel Lehman, Director of the Construction Management Support Division, SC-81

I would like to thank you for agreeing to chair the next semiannual review of the Neutrinos at the Main Injector (NuMI) project. The review is scheduled to be held on November 13 and 14, 2003, on-site at Fermilab. The purpose of the review is to examine the technical, cost, schedule, and management aspects of the project. A more detailed articulation of the questions that your review committee is to address in making these assessments is provided in the attached charge. I would appreciate it if you could provide a completed report of your review to me no later than December 19, 2003.

As you know, Phil Debenham, of this office, will serve as Executive Secretary to the review committee, consistent with his role as the program manager for this project. It is my understanding that you are working with him and members of the Fermilab staff to prepare for the review.

Again, I wish to thank you for agreeing to chair this review. I look forward to receiving your Committee's report.

David F. Sutter

for Robin Staffin
Associate Director for the
Office of High Energy Physics

Attachment:
Charge to Committee

cc:
A. Byon-Wagner, SC-223
P. Debenham, SC-224
L. Dever, SC-80
R. Lutha, CH/FERMI
M. Procario, SC-221
D. Sutter, SC-224
S. Tkaczyk, SC-81

Department of Energy
Review of the NuMI Project
November 13-14, 2003

CHARGE to the COMMITTEE

This is the twelfth Department of Energy (DOE) review of the Neutrinos at the Main Injector (NuMI) project. The review, which is being requested by the Associate Director for the Office of High Energy Physics, will consider the technical, cost, schedule, and management aspects of the project. The last review was held in May 2003.

A written report on the review is due to the Associate Director by December 19, 2003. The review committee is asked to address in the report the following specific points.

1. Assess the project's response to the comments and recommendations of the last review committee.

   a) How has laboratory management responded to concerns raised at previous reviews about the adequacy of resources for commissioning the NuMI beam for CD-4, in the context of the ongoing collider program?

   b) Assess the laboratory's plans and schedule for commissioning the NuMI beam for initial MINOS physics.

2. The remaining active elements of the project are NuMI technical components, civil construction, the MINOS detectors, and installation. For each of these:

   a) Assess the progress made since the last review, and the status of the DOE and project milestones.

   b) Identify any changes made to the project baseline (technical, cost, and schedule) since the last review, and discuss their impact.

   c) What remains to be done in this area to complete the project? Evaluate the project's estimate of the cost and schedule to complete this work.

APPENDIX B

REVIEW PARTICIPANTS

Department of Energy Review
of the
Neutrinos at the Main Injector (NuMI) Project
November 13-14, 2003

REVIEW COMMITTEE PARTICIPANTS

Department of Energy

Daniel Lehman, DOE/SC, Chair
Philip Debenham, DOE/SC, Ex. Secretary
Richard Imlay, DOE/SC detailee
Ronald Lutha, DOE/Fermi Group
Stephen Tkaczyk, DOE/SC
Stephen Webster, DOE/Fermi Group

Consultants

Roy Cutler, ORNL
Stan Ecklund, SLAC
Rod Gerig, ANL
Rich Hislop, ANL
Jim Lang, ANL

Observers

Jane Monhart, DOE/Fermi Group

APPENDIX C

REVIEW AGENDA

Department of Energy Review
of the
Neutrino at the Main Injector (NuMI) Project

AGENDA

Thursday, November 13, 2003 – Comitium

8:00 am	DOE Executive Session ..... D. Lehman
9:00 am	Opening Remarks..... M. Witherell
9:15 am	Project Overview ..... G. Bock
9:45 am	Safety on Service Buildings and Outfitting Project..... E. McCluskey
10:15 am	Break
10:30 am	Parallel Discussions

- Technical Components—WH12NE
- MINOS—Snakepit (a.m.)/Blackhole (p.m.)
- Installation and Commissioning—WH12NE
- Civil Construction—1 North
- Management—Comitium
- ES&H—1 East

12:00 pm	Lunch
12:30 pm	Continue Parallel Sessions
4:30 pm	DOE Executive Session
6:30 pm	Adjourn

Friday, November 14, 2003 – Comitium

8:00 am	Subcommittee Working Sessions
10:30 am	DOE Executive Session Closeout Dry Run
12:00 pm	Lunch
2:00 pm	Closeout Presentation with NuMI Management
3:00 pm	Adjourn

APPENDIX D

COST TABLES

NuMI Project Budget in $'s - Nov-03 Lehman Review

($000's Omitted)

WBS	Item	NuMI Project Baseline - Burdened												Baseline Change		FNAL (Soft) Obligations	
		Nov-98	Sep-99	Mar-00	Sep-00	Mar-01	Sep-01	Oct-01	Dec-01	Mar-02	Sep-02	Mar-03	Sep-03	Sep-03 to Mar-03		Thru 03/03	Thru 09/03
	1.0 Total Estimated Cost	**$76,198**	**$76,198**	**$76,200**	**$76,200**	**$76,149**	**$76,149**	**$109,242**	**$109,242**	**$109,242**	**$109,242**	**$109,242**	**$109,242**	**$0**	**0.0%**	**88,117**	**91,356**
	1.1 Technical Components	15,254	15,882	17,740	18,541	18,656	18,656	27,962	26,432	27,260	26,160	26,219	26,768	550	2.0%	19,057	20,682
	1.2 Facility Construction	45,256	45,814	51,965	51,971	54,248	54,282	60,494	63,381	62,650	66,867	67,059	68,047	988	1.6%	66,658	68,040
	1.3 Project Management	2,825	2,825	2,825	2,825	3,046	3,046	4,788	4,430	4,430	4,430	4,430	4,330	(100)	-2.1%	2,402	2,634
	Indirects	0	0	0	0	0	0	0	0	0	0	0	0	0			
	Escalation	0	0	0	0	0	0	0	0	0	0	0	0	0			
	Contingency	12,863	11,677	3,670	2,863	199	166	15,998	14,999	14,902	11,785	11,534	10,097	(1,437)	-9.0%		
	% Contingency	20.3%	18.1%	5.1%	3.9%	0.3%	0.2%	17.2%	15.9%	15.8%	12.1%	11.8%	10.2%				
	2.0 Minos Detector	**$33,530**	**$32,664**	**$37,089**	**$37,401**	**$38,638**	**$38,776**	**$38,776**	**$38,044**	**$41,159**	**$42,583**	**$42,195**	**$42,407**	**$212**	**0.5%**	**39,034**	**41,105**
	2.1 Magnets: Steel and Coils	8,229	7,396	7,937	7,497	7,546	7,706	7,706	7,508	7,679	7,566	7,566	7,540	(26)	-0.3%	7,555	7,695
	2.2 Scintillator Detector Fabrication	17,469	17,201	19,343	18,665	18,674	18,652	18,652	18,576	20,153	20,153	19,561	19,540	(21)	-0.1%	19,559	19,571
	2.3 Electronics, DAQ & Database	3,994	4,943	6,684	7,016	7,084	7,084	7,084	7,008	8,529	8,618	9,222	9,222	0	0.0%	8,385	8,865
	2.4 Far Detector Installation	4,746	4,792	4,792	5,574	6,173	6,173	6,173	6,114	5,077	5,077	5,077	5,077	0	0.0%	3,646	4,579
	2.5 Near Detector Installation	2,050	2,073	2,073	2,389	2,762	2,762	2,762	2,564	3,448	4,896	4,495	4,753	259	9.4%	3,155	3,593
	2.6 Project Management	1,532	1,532	1,532	1,532	1,670	1,670	1,670	1,546	1,546	1,546	1,546	1,546	0	0.0%	1,469	1,603
	Indirects	0	0	0	0	0	0	0	0	0	0	0	0	0			
	Escalation	0	0	0	0	0	0	0	0	0	0	0	0	0			
	UK In-Kind Contribution	(4,510)	(5,272)	(5,272)	(5,272)	(5,272)	(5,272)	(5,272)	(5,272)	(5,272)	(5,272)	(5,272)	(5,272)	(0)	0.0%	(4,734)	(4,801)
	3.0 Project Support	**$10,343**	**$12,483**	**$12,551**	**$15,126**	**$16,108**	**$16,108**	**$16,108**	**$16,218**	**$16,218**	**$16,218**	**$16,377**	**$16,378**	**$1**	**0.0%**	**16,142**	**16,142**
	3.1 NuMI Conceptual Design	1,835	1,869	1,869	1,869	1,934	1,934	1,934	1,933	1,933	1,933	1,933	1,934	1	0.1%	1,928	1,928
	3.2 MINOS Detector R&D	1,604	1,780	1,780	1,780	1,780	1,780	1,780	1,780	1,780	1,780	1,780	1,780	0	0.0%	1,768	1,768
	3.3 MINOS Cavern	9,153	11,043	11,111	13,686	14,416	14,416	14,416	14,527	14,527	14,527	14,527	14,527	(0)	0.0%	14,527	14,527
	3.4 Soudan/Minos Operating	1,509	1,550	1,550	1,550	1,737	1,737	1,737	1,737	1,737	1,737	1,896	1,896	0	0.0%	1,678	1,678
	Indirects	0	0	0	0	0	0	0	0	0	0	0	0	0			
	Escalation	0	0	0	0	0	0	0	0	0	0	0	0	0			
	Minnesota Funds	(3,758)	(3,758)	(3,758)	(3,758)	(3,758)	(3,758)	(3,758)	(3,758)	(3,758)	(3,758)	(3,758)	(3,758)	0	0.0%	(3,758)	(3,758)
	Contingency	$16,027	$14,753	$10,260	$7,373	$7,454	$7,315	$7,315	$7,938	$4,822	$3,399	$3,628	$3,414	(214)	-2.9%		
	% Contingency	36.5%	32.7%	20.7%	14.0%	13.6%	13.3%	13.3%	14.6%	8.4%	5.8%	6.2%	5.8%				
	1.0 Total Estimated Cost	$76,198	$76,198	$76,200	$76,200	$76,149	$76,149	$109,242	$109,242	$109,242	$109,242	$109,242	$109,242	$0	0.0%	88,117	91,356
	2.0 & 3.0 Other Project Costs	59,900	59,900	59,900	59,900	62,200	62,200	62,200	62,200	62,200	62,200	62,200	62,200	(0)	0.0%	55,177	57,248
	Total Project Costs	**136,098**	**136,098**	**136,100**	**136,100**	**138,349**	**138,349**	**171,442**	**171,442**	**171,442**	**171,442**	**171,442**	**171,442**	**0**	**0.0%**	**143,293**	**148,604**

WBS Item	Project Estimate			DOE Assessment					Variance	Comments
	To Date	To Go		To Date	To Go	Contingency				
	Cost	Cost	Total	Cost	Cost	$	%	Total		
1.1 Technical Components	**$19,209**	**$7,559**	**$26,768**	**$19,209**	**$7,559**	**$0**	**0%**	**$26,768**	**$0**	
1.1.1 Extraction & Primary Beam	3,769	1,117	4,887	3,769	1,117		0%	4,887	0	
1.1.2 Neutrino Beam Devices	7,790	2,223	10,012	7,790	2,223		0%	10,012	0	
1.1.3 Power Supply System	3,991	746	4,738	3,991	746		0%	4,738	0	
1.1.4 Hadron Decay and Absorber	689	642	1,332	689	642		0%	1,332	0	
1.1.5 Neutrino Beam Monitoring	283	198	481	283	198		0%	481	0	
1.1.6 Alignment Systems	190	118	308	190	118		0%	308	0	
1.1.7 Water, Vacuum & Gas Systems	1,371	814	2,185	1,371	814		0%	2,185	0	
1.1.8 Installation and Integration	1,063	1,701	2,764	1,063	1,701		0%	2,764	0	
1.1.9 Hadronic Hose	63	(1)	62	63	(1)	0	Done	62	0	
1.2 Facility Construction	**$64,975**	**$3,072**	**$68,047**	**$64,975**	**$3,072**	**$0**	**0%**	**$68,047**	**$0**	
1.2.1 Facility Physics Design	70	(0)	70	70	(0)	0	Done	70	0	
1.2.2 Facility Const Title I Design	1,437	1	1,438	1,437	1	0	Done	1,438	0	
1.2.3 Facility Const Title II Design	2,974	1	2,975	2,974	1	0	Done	2,975	0	
1.2.4 Facility Construction Phase	60,493	3,070	63,563	60,493	3,070		0%	63,563	0	
1.3 Project Management	**$2,634**	**$1,696**	**$4,330**	**$2,634**	**$1,696**	**($707)**	**0%**	**$3,622**	**($707)**	
1.3.1 FY 98 Project Management	141	133	275	141	133	(133)	Done	141	(133)	
1.3.2 FY 99 Project Management	661	(102)	560	661	(102)	102	Done	661	102	
1.3.3 FY 00 Project Management	663	(88)	575	663	(88)	88	Done	663	88	
1.3.4 FY 01 Project Management	423	265	688	423	265	(265)	Done	423	(265)	
1.3.5 FY 02 Project Management	324	378	703	324	378	(378)	Done	324	(378)	
1.3.6 FY 03 Project Management	421	120	541	421	120	(120)	Done	421	(120)	
1.3.7 FY 04 Project Management	0	658	658	0	658		0%	658	0	
1.3.8 FY 05 Project Management	0	330	330	0	330		0%	330	0	
Contingency	0	10,097	10,097	0	10,097			10,097	0	
Total Estimated Cost	**$86,818**	**$22,424**	**$109,242**	**$86,818**	**$22,424**	**($707)**	**0%**	**$108,535**	**($707)**	
2.0 MINOS Detector	**$44,552**	**$3,127**	**$47,679**	**$40,072**	**$7,395**	**$0**	**0%**	**$47,466**	**($212)**	
2.1 Magnets: Steel & Coils	7,622	(81)	7,540	7,413	153		0%	7,566	26	
2.2 Scintillator Detector Fabrication	19,525	15	19,540	19,224	337		0%	19,561	21	
2.3 Electronics, DAQ & Database	8,628	595	9,222	7,318	1,905		0%	9,222	(0)	
2.4 Far Detector Installation	4,369	707	5,077	3,632	1,445		0%	5,077	0	
2.5 Near Detector Installation	2,805	1,949	4,753	1,015	3,480		0%	4,495	(259)	
2.6 MINOS Project Management	1,603	(58)	1,546	1,469	76		0%	1,546	0	

WBS Item	Project Estimate			DOE Assessment					Variance	Comments
	To Date	To Go		To Date	To Go	Contingency				
	Cost	Cost	Total	Cost	Cost	$	%	Total		
3.0 Project Support	$19,900	$237	$20,136	$19,675	$460	($16)	-4%	$20,119	($18)	
3.1 NuMI Conceptual Design	1,928	6	1,934	1,928	5	(5)	Done	1,928	(6)	
3.2 MINOS Detector R&D	1,768	12	1,780	1,768	12	(12)	Done	1,768	(12)	
3.3 MINOS Cavern	14,527	(0)	14,527	14,527	(0)	0	Done	14,527	0	
3.4 Soudan/MINOS Operating	1,677	219	1,896	1,452	444	0	0%	1,896	(0)	
Sub Total - All Funds	$64,452	$3,363	$67,815	$59,747	$7,855	($16)	0%	$67,585	($230)	
Contingency	0	3,414	3,414	0	3,628			3,628	214	
Total NuMI Other Project Costs	$64,452	$6,778	$71,230	$59,747	$11,483	($16)	0%	$71,213	($16)	
UK In-Kind Contribution	(4,734)	(537)	(5,272)	(4,734)	(537)	0	0%	(5,272)	0	
Minnesota Preconstruction Funds	(758)	0	(758)	(758)	0	0	0%	(758)	0	
Minnesota Construction Funds FY99	(3,000)	0	(3,000)	(3,000)	0	0	0%	(3,000)	0	
Total US Funds	$55,959	$6,241	$62,200	$51,254	$10,946	($16)	0%	$62,184	($16)	
Total Project Cost	$142,778	$28,664	$171,442	$138,073	$33,369	($724)	-2%	$170,718	($724)	

Variance Summary Table

(Cumulative to Date as of 9/30/03)

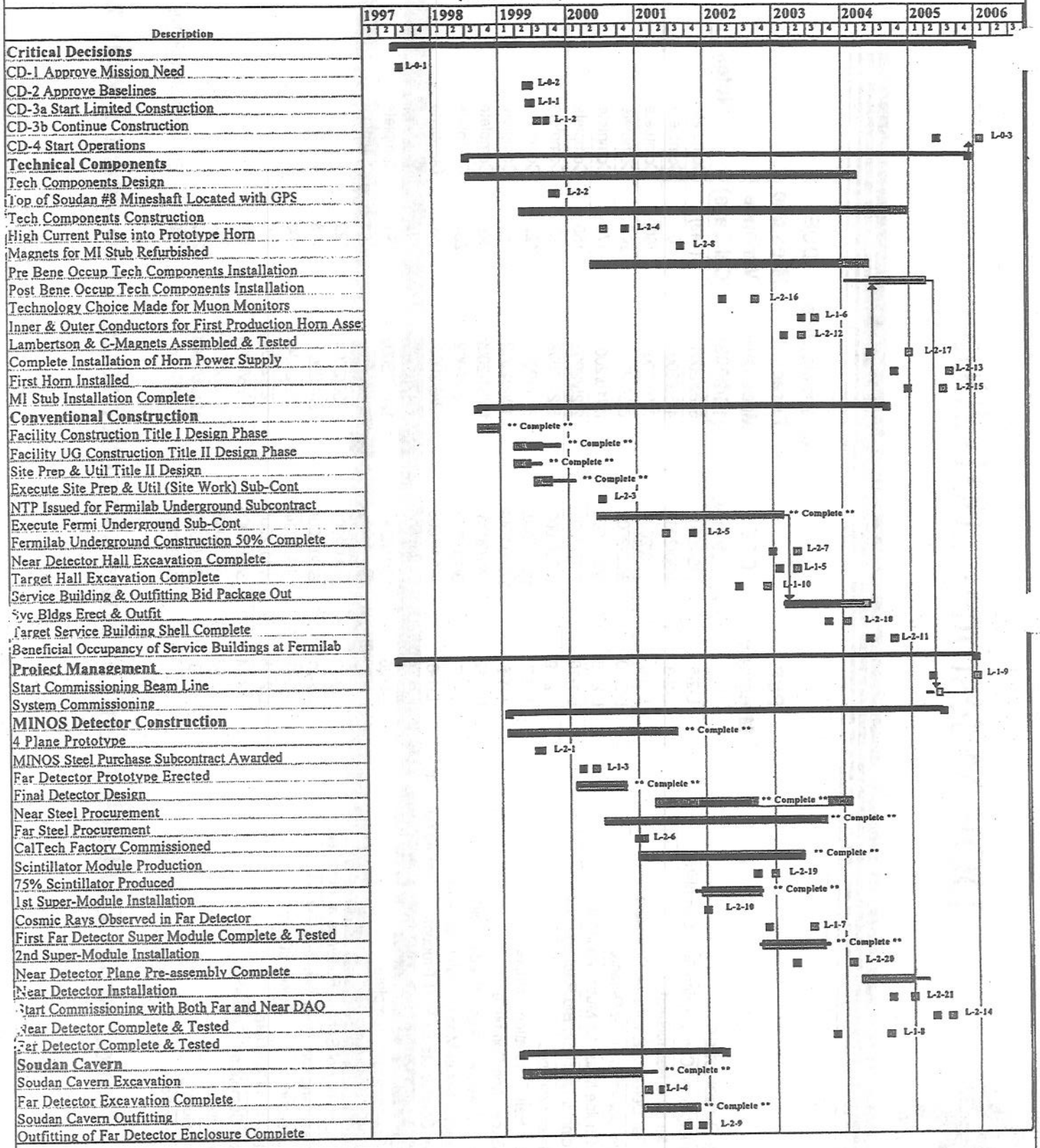
WBS / Description	Budgeted Cost		Actual Cost	Variance	
	Work Scheduled	Work Performed	Work Performed	Schedule	Cost
1.1 Technical Components	17,781	18,928	19,209	1,147	(281)
1.2 Facility Construction	67,035	65,113	64,975	(1,921)	138
1.3 Project Management	3,341	3,341	2,634	0	707
1.0 TEC Total	88,157	87,383	86,818	(775)	564
2.1 Magnets: Steel & Coils	7,539	7,540	7,622	1	(81)
2.2 Scintillator Detector Fabrication	19,535	19,540	19,525	5	15
2.3 Electronics, DAQ & Database	9,017	9,018	8,628	1	391
2.4 Far Detector Installation	5,077	5,077	4,369	0	707
2.5 Near Detector Installation	3,206	2,886	2,805	(320)	82
2.6 MINOS Project Management	1,546	1,546	1,603	0	(58)
UK In-Kind Contribution	(4,797)	(4,801)	(4,801)	(4)	0
2.0 MINOS Detector	41,123	40,806	39,751	(317)	1,055
3.1. NuMI Conceptual Design	1,934	1,934	1,928	0	6
3.2 MINOS Detector R&D	1,780	1,780	1,768	(0)	12
3.3 MINOS Cavern	14,527	14,527	14,527	0	0
3.4 Soudan/MINOS Operating	1,896	1,896	1,677	(0)	219
Minnesota Preconstruction Funds	(758)	(758)	(758)	0	0
Minnesota Contruction Funds FY99	(3,000)	(3,000)	(3,000)	0	0
3.0 NuMI Project Support	16,378	16,378	16,142	0	237
OPC Total	57,501	57,185	55,893	(317)	1,292
TPC Total	145,659	144,568	142,711	(1,091)	1,856

APPENDIX E

CHANGE ACTIONS

10/17/03

NuMI Project
(Fiscal Years)



Project: NuMI_Master_Sched
Date: 10/17/03

Baseline Task
Critical Task
Summary Task
DOE Baseline Milestone
FNAL Current Projection
Milestone Complete
FNAL Forecast
Task Status

NuMI

MINOS

DOE Milestones 2001-2005

Milestone Description	PEP Milestone #	DOE Milestones	Current Month's Forecast Milestone (10/2003)	DOE Milestone Variance (Cal Days)	Notes
Fermilab Underground Construction 50% Complete	L-2-5	2/6/2001	6/29/2001	(143)	Complete
Magnets for MI Stub Refurbished	L-2-8	4/30/2001	4/30/2001	0	Complete
Outfitting of Far Detector Enclosure Complete	L-2-9	4/30/2001	7/19/2001	(80)	Complete
Cosmic Rays Observed in Far Detector	L-2-10	3/22/2002	8/31/2001	203	Complete
Technology Choice Made for Muon Monitors	L-2-16	5/30/2002	12/10/2001	171	Complete
Service Building & Outfitting Bid Package Out	L-1-10	7/30/2002	2/25/2002	155	Complete
75% Scintillator Produced	L-2-19	8/30/2002	5/24/2002	98	Complete
Near Detector Hall Excavation Complete	L-2-7	12/30/2002	8/30/2002	122	Complete
Target Hall Excavation Complete	L-1-5	12/30/2002	10/4/2002	87	Complete
Lambertson & C-Magnets Assembled & Tested	L-2-12	2/1/2003	10/31/2002	93	Complete
First Far Detector Super Mod Complete & Tested	L-1-7	3/15/2003	7/24/2002	234	Complete
Inner & Outer Conductors for First Production Horn Assembled	L-1-6	4/14/2003	2/5/2003	68	Complete
Target Service Building Shell Complete	L-2-18	9/30/2003	6/17/2003	105	Complete
Near Plane Pre-assembly Complete	L-2-20	10/10/2003	12/17/2002	297	Complete
Far Detector Complete & Tested	L-1-8	4/25/2004	7/9/2003	291	Complete
Beneficial Occupancy of Service Buildings at Fermilab	L-2-11	5/31/2004	1/30/2004	122	
Start Commissioning with Both Near and Far DAQ	L-2-21	8/30/2004	5/4/2004	118	
Complete Installation of Horn Power Supply	L-2-17	9/1/2004	2/6/2004	208	
MI Stub Installation Complete	L-2-15	3/11/2005	8/23/2004	200	
Near Detector Complete & Tested	L-2-14	3/31/2005	12/28/2004	93	
First Horn Installed	L-2-13	4/7/2005	6/15/2004	296	
Start Commissioning	L-1-9	9/1/2005	12/28/2004	247	
CD-4 Start Operations	L-0-3	9/30/2005	2/4/2005	238	End of Commissioning

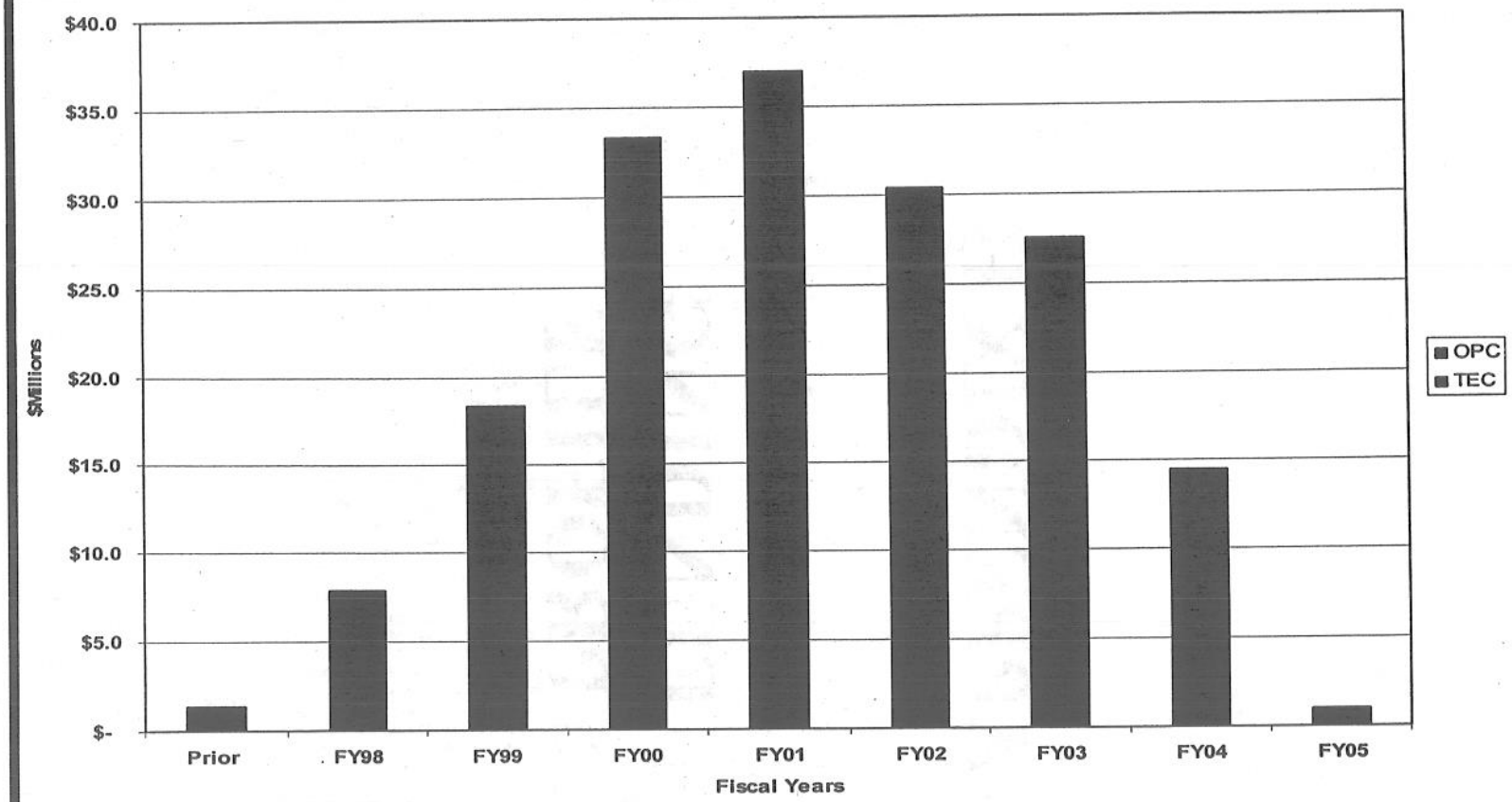
Forecasting CD4 achievement 3 weeks earlier than we forecast 1 year ago

APPENDIX G

LEVEL 3 MILESTONES

WBS	L3 Milestone Number	Name	Definition	FNAL Current Projection	Previous Projection	FNAL Baseline Date	Float*	Previous Float	Status
1.1.8	L-3-234	Fiber Optic Cable Installation Complete	NuMI fiber optic cable that installation consists of 36 multimode fiber trunk cable for controls and 24 singlemode fiber trunk cable for networking. This milestone means connections between : MI-62 SB to MI-65 SB; MI-65 SB to Target Hall Support Room; MiniBooNE Detector Bldg to MINOS SB; MINOS SB to Near Detector Hall; and Near Detector Hall to Upstream End of Absorber Access Tunnel. This milestone does not include terminations. Completion of this milestone means notification by the NuMI Project Engineers that such connections have occured.	3/25/04	3/25/04	4/26/04	3.5	3.45	
SB&O Civil Construction Milestones									
WBS	**L3 Milestone Number**	**Name**	**Definition**	**FNAL Current Projection**	**Previous Projection**	**FNAL Baseline Date**	**Float***	**Previous Float**	**Status**
1.2.4	L-3-211	MSB Complete	Completion of contractually specified items including, but not limited to, structural, mechanical, electrical, and fire protection systems. Completion of this milestone means notification by the SB&O subcontractor that contractual milestone MS8 has been met.	1/30/04	1/30/04	12/25/03	1.0	1.0	Detailed task status is provided in weekly updates
1.2.4	L-3-218	**Beneficial Occupancy of Minos Shaft, Absorber, Minos Access Tunnel, and Minos Hall**	Occupancy, with completion of contractually specified items, of Minos Shaft, Absorber, Minos Access Tunnel, and Minos Hall. Completion of this milestone means notification by the SB&O subcontractor that contractual milestone MS9 has been met.	**1/30/04**	**1/30/04**	**2/12/04**	1.0	1.0	Detailed task status is provided in weekly updates

Funding Profile

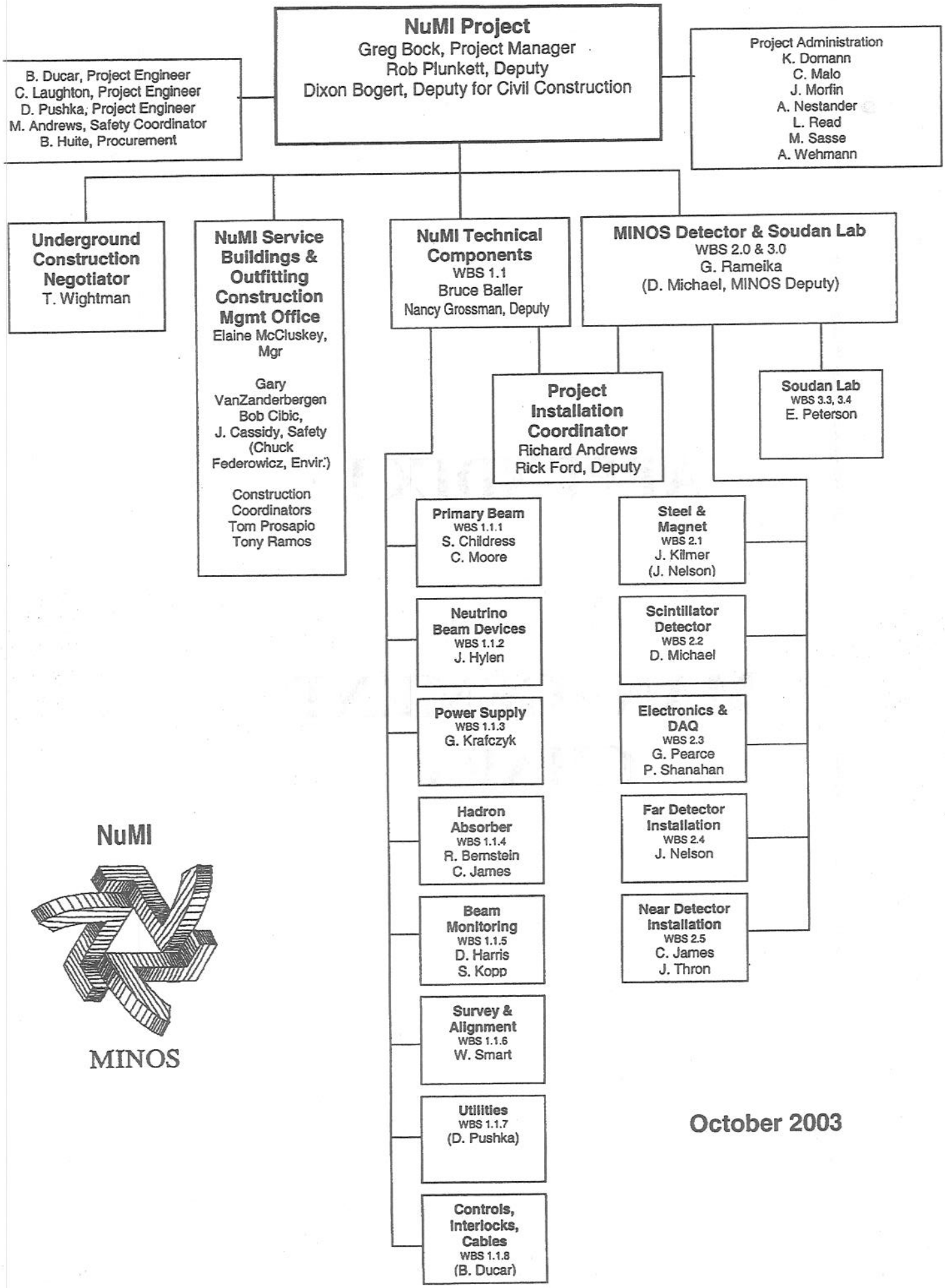


TEC*	$ -	$ 5.500	$ 14.300	$ 22.000	$ 22.949	$ 11.400	$ 19.842	$ 12.500	$ 0.751	$ 109.242
OPC	$ 1.417	$ 2.348	$ 4.114	$ 11.324	$ 14.062	$ 19.000	$ 7.435	$ 2.000	$ 0.500	$ 62.200
TPC	$ 1.417	$ 7.848	$ 18.414	$ 33.324	$ 37.011	$ 30.400	$ 27.277	$ 14.500	$ 1.251	$ 171.442

*TEC accounts for FY-03 recission of $250K

APPENDIX I

MANAGEMENT CHART



NuMI

MINOS

October 2003

APPENDIX J

ACTION IEMS

Action Items

Resulting from the November 13-14, 2003
Department of Energy Review of the

Neutrinos at the Main Injector (NuMI) Project

Action	Responsibility	Due Date
Conduct Semi-Annual Review	DOE/Fermilab	May, 2004

G. Bock
NuMI Project Manager
Fermilab

S. Webster
DOE/NuMI Acting PM
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