

Surveillance Review Report

of the

Fermilab Research Alliance, LLC

Earned Value Management System (EVMS)

August 19-20, 2013

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Executive Summary:

An independent surveillance review, chartered by the Fermilab Directorate, was conducted on the certified Fermilab Research Alliance (FRA) LLC Earned Value Management System (EVMS) on August 19-20, 2013. The surveillance review was based on an examination of the previously certified FRA EVMS System Description and procedures, previous surveillance reviews, as well as the EVMS application on the NuMi Off-Axis Neutrino Appearance (NOvA) Experiment Project. While there are several Fermilab projects in the initiation and definition phase, NOvA is the only Fermilab Project, due to its size and timing, which is required to fully implement the FRA EVMS at this time. The NOvA Project is over 87% complete. The two day surveillance review took place at the Fermilab site in Batavia, Illinois. An exit briefing was held on August 20, 2013 to provide the Surveillance Review Team's preliminary conclusions. An additional two weeks, after the August 19-20, 2013 on-site surveillance review, was taken by the Surveillance Review Team to continue to examine documents and to write-up the final report. The surveillance review determined that the FRA EVMS continues to meet the ANSI/EIA-748 standard, however, with regard to implementation; the Surveillance Review Team identified six corrective actions and five continuous improvement opportunities. In addition, the Surveillance Review Team also identified best practices.

The Surveillance Review Team identified a set of root and contributing causes that, if corrected, should minimize the re-occurrence of the identified corrective action requests. The Fermilab EVMS Corrective Action Plan should address these root and contributing causes:

- 1) At least four of the six corrective actions involve the need for Fermilab management to establish clear expectations for the CAMs, providing the necessary training, and developing a process which regularly evaluates the CAM performance to ensure that project-wide implementation is occurring.
- 2) Several corrective actions were previously identified in prior surveillances. Fermilab management needs to ensure that formal close-out of corrective actions will provide for the effective implementation of the FRA EVMS as well as ensure that the results are sustainable.
- 3) While the completion of the NOvA Project relies on the collection, analysis, and reporting of the detailed detector manufacturing data, the early implementation of EVMS on the developing projects will have the more significant impact on the overall effectiveness of the FRA EVMS. The FRA EVMS Corrective Action Plan should address how the FRA EVMS will be implemented for new and developing projects.
- 4) As Fermilab moves to implement its mission through a large number of projects, the R2A2s for the Office of Project Support Services should be evaluated and then a gap analysis performed to compare with the size and make-up of this organization to ensure

that the required project management functions, both line and support, can be effectively performed.

Section 9.2 of the report discusses the root and contributing causes in more detail.

CARs (with appropriate Guidelines (GL) identified)

- CAR-01 Need for improved quality (meaningful, quantitative, complete) of variance analysis reports and records to provide effective analysis of issues and proposed corrective actions. (GL-23)
- CAR-02 Coupling between risk management, ETC, contingency, MR and UB accounts is not clearly defined and well understood across the NOvA CAMs. Some risks not quantified for cost and schedule impacts. (GL-14, GL-27)
- CAR-03 Need for additional CAM training in use of FRA EVMS policy and procedures so that system tools serve intended purpose. Training should include CAM roles, responsibilities, and accountabilities. (GL-2, GL-12, GL-14, GL-23, GL-27)
- CAR-04 Inconsistent identification and application of performance measurement techniques including LOE. (GL-12)
- CAR-05 Potential for schedule integrity issues (critical path) resulting from lags, missing logic/relationships, and constraints. (GL-6)
- CAR-06 Ensure that baseline changes to the current performance period do not occur (rubber baseline). (GL-30)

CIOs (with appropriate Guidelines (GL) identified)

With an asterisk:

- CIO-01* Clarify level of integrated impact analysis in the change control process. (GL-28)

Without an asterisk:

- CIO-01 Unclear accounting for spares and associated distribution of scope/budgets/costs. (GL-16)
- CIO-02 Limited level of detail in WBS dictionary (total scope, limited quantification). (GL-1)
- CIO-03 Reduced indirect rates for special procurements are assessed at the beginning of the contract as opposed to over the life of the contract. (GL-19)
- CIO-04 Consider consequences of routine accounting adjustments (e.g. rate adjustments) to budgets and involve CAMs directly on impact analysis. (GL-19)

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1.0 Surveillance Review Objective:

According to DOE Guide 413.3-10A, an EVMS is an integrated set of policies, procedures, and practices necessary to provide reliable and accurate project and program information to support project management as a decision making tool and a critical component of risk management. DOE Guide 413.3-10a defines a surveillance review as:

A review conducted to demonstrate continued compliance of a certified system to the ANSI/EIA-748-B, or as required by the contract, and in accordance with FAR clause 52.234-4, *EVMS*, to ensure company processes are being followed, verify the EVM data is useful, timely, and effective, and assess whether the data is used to make informed decisions. A surveillance is not intended to assess the health of the program/projects examined during the review.

The Guide states that the surveillance is to be conducted in a manner that answers the following questions:

- 1) Does the system comply with ANSI/EIA-748-B?
- 2) Is the system being used to manage the project?
- 3) Is the data accurate, timely, and reliable?
- 4) Does the data represent the entire scope?

The objective of the August 19-20, 2013 independent surveillance review is to ensure that the FRA EVMS continues to meet the ANSI/EIA-748 Standard and that implementation of the FRA EVMS system remains effective.

2.0 Prior FRA EVMS Certification and Reviews:

In January 2010, the FRA EVMS was certified by DOE-HQ OECM. This means that the FRA EVMS:

- 1) meets the requirements and intent of the ANSI/EIA-748 Standard.
- 2) as described, is fully implemented on the selected projects.
- 3) provides timely, accurate, and auditable management information for both the organization's project management and the customer.

Since the January 2010 certification, two additional internal FRA EVMS surveillance reviews were conducted. One was conducted in March 2011 and the second review was conducted in March 2012. The March 2012 surveillance review identified five CARs and five CIOs. The

“issues” that were identified in this previous surveillance were examined as part of the August 19-20, 2013 surveillance review.

3.0 Fermilab Independent EVMS Surveillance Review Team Members:

- Bob Wunderlich, Team Leader, (Consultant, Retired DOE Chicago Office Manager)
- Dennis Miner, Deputy Team Leader, (JLAB) – Organization
- Jenn O’Connor, (BNL) – Planning, Scheduling, and Budgeting
- Betsy O’Connor, (ANL) – Accounting Considerations
- Greg Capps, (ORNL) – Analysis & Management Reports
- Lynda Gauthier, (MSU) – Revisions and Data Maintenance
- Pam Utley (SLAC) – observer
- Katie Martin, (ANL) – observer
- Marc Kaducak (FNAL) -observer

Surveillance Review Team members consisted of participants from other Office of Science National Laboratories to ensure the independence of the surveillance process. The three observers were permitted to attend and participate in all of the sessions. These observers are being trained to participate as members for future EVMS surveillance reviews.

4.0 FRA EVMS Surveillance Review Plan:

A formal FRA EVMS Surveillance Review Plan was prepared prior to the start of the surveillance review, based on input from the Fermilab EVMS Surveillance Review Team Leader and Deputy Surveillance Review Team Leader. The surveillance plan includes a clear definition of the scope of surveillance, the responsibilities, methods for conducting, and the schedule. The Surveillance Review Plan was based on the FRA EVMS Surveillance and Maintenance procedure (12-PM-008) which establishes the methodology for the FRA EVMS surveillances. This procedure summarizes the approach to be used to complete the annual surveillance of the certified FRA EVMS. The DOE Fermi Site Office was notified of the planned surveillance review and planned to participate in the surveillance as observers. Responsibility for the FRA EVMS surveillance program lies with the Fermilab Office of Project Support Services (OPSS) which is an organization separate from the NOvA Project Manager’s line management.

An EVMS surveillance website was made available by Fermilab, prior to the review. This website was populated with FRA EVMS Policy and procedures, as well as NOvA specific data and prior certification and surveillance reports.

5.0 FRA EVMS Surveillance Review Scope:

The August 19-20, 2013 FRA EVMS surveillance evaluated the formal, previously certified FRA EVMS system, its processes, and its outputs. The Surveillance Review Team also examined the results of the previous surveillance conducted on March 12-14, 2012. For the August 19-20, 2013 FRA EVMS Surveillance, the Team Leader departed from a simple clinical analysis of the FRA EVMS and included three additional elements of scope to the surveillance review:

- 1) a closer examination of the issues that resulted in the Fermilab NOvA Project going “yellow” last year and the proposed solutions to the identified issues. As these issues

were related to the EVMS implementation, this gave the Surveillance Review Team additional information on which to base their judgments.

- 2) other major projects at Fermilab and the EVMS techniques they were using, or intending to use so the Surveillance Review Team could assess whether the FRA EVMS would likely be improving, maintaining the status quo, or degrading.
- 3) any Fermilab plans for their existing EVMS (e.g. system description changes, procedural changes, implementation changes). This provides a perspective concerning what Fermilab believes was not working or not working as effectively as it could/should.

The objective for including this information in the surveillance is to assess if the FRA EVMS is operating effectively (achieving its intended purpose) and, just as important, would be effective in the future. If this is not the case, then corrective actions, associated with the FRA EVMS, would be identified and included in the Surveillance report as either Corrective Action Requests or Continuous Improvement Opportunities where warranted.

An objective of the Surveillance Review Team Leader was to ensure that the review focused on the effective operation of the FRA EVMS while at the same time, did not result in a project review. Further, the Surveillance Review Team Leader considered that Fermilab may not be in violation of a particular EVMS guideline but the combined implementation of several guidelines may result in a deficiency that needs to be corrected. To the extent that these issues directly impact the effective implementation of the FRA EVMS, they were included in the report. Those issues that are outside of the FRA EVMS were not included in the report. In addition, during the review, it was noted that some of the CARs and CIOs may impact more than one guideline.

6.0 Surveillance Review Observations:

Processes (System Description and Procedures):

- 1) Fermilab provided a table of FRA EVMS Documentation Updates, dated August 14, 2013 which summarizes the changes made to the FRA EVMS System Description and Procedures since the last surveillance review.
- 2) Fermilab has not made any significant changes to their EVMS Systems Description (SD) since its certification in January 2010. However, Fermilab recently changed the ETC methodology and the definition and handling of contingency/management reserve in the SD. Both of these items were previously identified as Corrective Action Requests during the March 2012 Surveillance Reviews. These two changes were approved during the August 19-20, surveillance review.
- 3) Fermilab has modified some of their FRA EVMS procedures to respond to previous corrective actions and to reflect some improvements/clarifications.
- 4) Fermilab uses a Project Execution Plan and a Project Management Plan for each of its projects to provide additional detail on how the project is to be managed.
- 5) The Surveillance Review Team compared the NOvA implementation to the FRA EVMS procedures that were in effect prior to the review. The procedure changes that were approved the day before the on-site August 19-20, 2013 review were examined after the on-site review. This examination was to determine if these changes would ensure the FRA EVMS would be effective in the future.

Implementation (NOvA Project)

- 1) Fermilab implementation of the FRA EVMS to the NOvA Project was examined in detail. This included 3 months of prior performance data (April, May, and June 2013).
- 2) Fermilab presentations included the EVMS process as well as the performance data collection and analysis for completing the NOvA Project.
- 3) Presentations and discussions were conducted concerning the “yellow” performance rating on the NOvA Project last year and the EVMS implications.

Implementation for Other Projects

- 1) Separate discussions were held between Fermilab and the Surveillance Review Team concerning EVMS implementation on future projects such as the Long Baseline Neutrino Experiment (LBNE), CMS Detector Up-grade, and Muon g-2 Experiment which provides a longer term view of the FRA EVMS.

7.0 Surveillance Review Conclusions:

A Corrective Action is defined as: 1) non-compliance with the accepted EVMS description or procedures and 2) non-compliance with the ANSI/EIA 748B EVMS guidelines. Failure to resolve Corrective Actions reduces confidence in the ability of project management to effectively use the EVMS process to achieve project goals and objectives of the stakeholders. A Corrective Action Plan is required for each finding.

While there are no CARs that directly impact the FRA EVMS SD or procedures, there were six CARS which indicates that the FRA EVMS is not fully implemented on the NOvA project and therefore does not always provide timely, accurate, and auditable management information for both the organization’s project management and the customer.

A summary of the CARs, CIO* and CIOs are listed below with detailed supporting documentation included in the back of the report. Some of the CARs/CIO*/CIOs may affect more than one guideline. If this is the case, the CAR/CIO*/CIO will appear in more than one guideline and will address the specific violation/corrective action for that particular guideline. A cross reference of page numbers and Guidelines is also listed.

CARs (with appropriate Guidelines (GL) identified)

- CAR-01 Need for improved quality (meaningful, quantitative, complete) of variance analysis reports and records to provide effective analysis of issues and proposed corrective actions. (GL-23)
- CAR-02 Coupling between risk management, ETC, contingency, MR and UB accounts is not clearly defined and well understood across the NOvA CAMs. Some risks not quantified for cost and schedule impacts. (GL-14, GL-27)

- CAR-03 Need for additional CAM training in use of FRA EVMS policy and procedures so that system tools serve intended purpose. Training should include CAM roles, responsibilities, and accountabilities. (GL-2, GL-12, GL-14, GL-23, GL-27)
- CAR-04 Inconsistent identification and application of performance measurement techniques including LOE. (GL-12)
- CAR-05 Potential for schedule integrity issues (critical path) resulting from lags, missing logic/relationships, and constraints. (GL-6)
- CAR-06 Ensure that baseline changes to the current performance period do not occur (rubber baseline). (GL-30)

CIOs (with appropriate Guidelines (GL) identified)

Continuous Improvement Opportunities are defined as recommendations to EVM implementation. This includes enhancements such as sharing of successful practices, tools, or other items that come to their attention. Continuous Improvements, however, are not the same as Corrective Actions and, therefore, need not be tracked for closure. However, should a recommendation have an asterisk (*), the team members have elected that this practice is critical enough to require tracking to closure.

With an asterisk:

- CIO-01* Clarify level of integrated impact analysis in the change control process. (GL-28)

Without an asterisk:

- CIO-01 Unclear accounting for spares and associated distribution of scope/budgets/costs. (GL-16)
- CIO-02 Limited level of detail in WBS dictionary (total scope, limited quantification). (GL-1)
- CIO-03 Record all indirect costs which will be allocated to the project. (GL-19)
- CIO-04 Consider consequences of routine accounting adjustments (e.g. rate adjustments) to budgets and involve CAMs directly on impact analysis. (GL-19)

The Surveillance Review Team identified several best practices:

- Fermilab Laboratory Management engagement in projects (POG and PMG) is a very positive activity. These two organizations, which involve different levels of management, meet monthly to review project progress and issues. The POG involves senior management at Fermilab including the Laboratory Director. As Fermilab Project Management is heavily matrixed, these two organizations assist in ensuring that informed and timely management decisions can be made on Fermilab Projects. Fermilab is encouraged to keep this level of senior management engaged.
- There were several important initiatives ongoing that are associated with future Fermilab projects, particularly the risk management systems, early exercise of Fermilab project management systems (starting at CD#0) and use of Primavera software. These changes

are being led by the Fermilab Office of Project Support Services through the Project Managers with support from senior Fermilab Management. This is encouraging as the organization is embracing a project management culture that will help to ensure that NOvA type issues are not repeated.

- Use of outside EVMS trainers has been valuable as Fermilab does not have sufficient EVMS staff to conduct the training. This has been a cost effective approach.
- Availability of weekly time cards allows review by CAMs. In a heavily matrixed organization, this allows a check of who is charging against the project and for what purpose.

8.0 Analysis of Surveillance Results:

8.1 FRA EVMS Process and Procedures

As there were no significant changes to the previously certified FRA EVMS, the Surveillance Review Team review did not uncover any issues with the Systems Description or associated procedures. Fermilab had made some changes to the EVMS procedures, including those during the surveillance review, but these changes appeared to respond to issues from the previous EVMS Surveillances. While the Surveillance Review Team identified an issue with the timing associated with the changes, it was determined that the changes reflect improvements in the FRA EVMS operation.

8.2 Root and Contributing Causes - NOvA Implementation:

Examining the issues identified during this EVMS surveillance and previous surveillances, the Surveillance Review Team believes that there are four issues that are important in preventing Fermilab from fully implementing an effective EVMS. These management issues are:

CAM Roles, Responsibilities, Authorities and Accountabilities: CAR-01, CAR-02, CAR-03 and CAR-04 involve the need for establishing clear expectations for the CAMs, providing the necessary training, and developing a process which regularly evaluates the CAM performance to ensure that project-wide implementation is occurring. This means that Fermilab management action is needed to ensure that the CAM functions are being met (possibly screening out those who have difficulty performing the CAM functions or have them work closely with others who have a significant understanding and ability to successfully perform the CAM functions). Corrective actions concerning CAM effectiveness were identified in previous surveillances. During the interviews, the CAMs could not consistently articulate their roles and responsibilities and did not make full use of the FRA EVMS management and reporting capabilities. The net effect is that the CAMs did not necessarily “own” the baseline. Many of the CAMs understood EVMS as a reporting tool rather than a management and reporting tool. Similar issues were identified in previous surveillances. There is a need for an increased focus on the CAMs working with the Project Managers to fully develop these roles. Pro-active support from senior lab and project leadership will encourage a culture where the full EVMS process can be an effective management tool.

Repeat Issues: Several of the corrective actions identified in the August 19-20, 2013 surveillance review had been identified in previous surveillances. For example, previous

corrective actions identified the quality of the project schedules to have a negative impact on schedule integrity. The NOvA Project Manager and the Associate Laboratory Director reported that the corrective actions from the previous surveillance review had been closed. The Surveillance Review Team did not find these corrective actions to be effective. Formal close-out of corrective actions needs to ensure that the actions taken will provide for the effective implementation of the FRA EVMS as well as ensure that the results are sustainable. As an example, the development of a new procedure is only the first step of a corrective action. Effectively implementing that procedure over time is the meaningful corrective action. The Corrective Action Plan should identify responsible leads in the Fermi management structure that have a continued responsibility and accountability to ensure that corrective actions are sustainable.

Timely Implementation of the EVMS: The Surveillance Review Team noted that Fermilab Projects under development were implementing the FRA EVMS early in the developmental process. This is expected to result in continuing improvements in the implementation of the FRA EVMS. While the completion of the NOvA Project relies on the collection, analysis, and reporting of the detailed detector manufacturing data, the early implementation of EVMS on the developing projects will have the more significant impact on the overall effectiveness of the FRA EVMS for those projects. The FRA EVMS Corrective Action Plan should address how the FRA EVMS will be implemented for new and developing projects.

Ensuring an Adequate Support Function: The Surveillance Review Team noted that important EVMS activities, like modifying the EVMS Systems Description and EVMS procedures, were not completed until the surveillance review. As Fermilab moves to implement its mission through a large number of projects, the R2A2s for the Office of Project Support Services should be evaluated and then a gap analysis performed to compare with the size and make-up of this organization. It is necessary to ensure that the right mix of staff (line and support) are available to perform the EVMS functions, While the surveillance review team is not in a position to determine the correct size and mix of staff, it is important for Fermilab management to determine how they are staffed to effectively perform key project management functions.

9.0 Further Discussion of EVMS Issues

When the NOvA ETC issue was identified by Fermilab last year, Fermilab Management assembled an independent team to produce an updated ETC on the NOvA Project and identify the issues that created a low level of contingency. A report was issued in December 2012 and actions were taken to resolve the issue. While these actions were not totally effective (see CAR-02), they reduced the impact on Fermilab's inability to accurately forecast the EAC and manage contingency to complete the NOvA Project within the TPC.

The NOvA Project is approximately 87% complete. The NOvA detectors are the remaining large item (cost and schedule driver) to be assembled. This is a straight-forward repetitive manufacturing job (10,752 cells for each of the 32 modules) that is underway. This work is being conducted at three locations and includes multiple shifts for the production and assembly of the detector components. The three locations are inter-dependent and sequential in the assembly process. The scope, cost, and schedule for this work are well defined. Data is

collected at each eight hour shift and includes output, amount of waste, times allocated for each step in the process, and other parameters. This data must be, and is, analyzed in live time and steps taken to identify issues. Corrective actions are discussed and implemented after the impacts are understood. While the summarized results of the data collection will be input to the EVMS, it will not contribute much more than trend analysis. This data collection on the detector manufacturing process provides live time data on status, progress and issues. While this data collection cannot guarantee success, it does provide very detailed objective data that can be used to identify and analyze issues, as well to forecast (i.e. ETC, critical path schedule).

While the application of the FRA EVMS to the NOvA Project was not efficiently integrated, Fermilab management has taken steps to implement a more integrated EVMS very early on new projects. Discussions, during the surveillance review, with the Fermilab LBNE Project involved the early implementation of the FRA EVMS during the initiation and development stages of the project. The Surveillance Review Team was impressed with the approach to implement the FRA EVMS as early as possible. Other developing projects were also encouraged to implement the EVMS as early as possible with some further along than others.

The Surveillance Review Team was impressed by the level of involvement and ability to answer questions by the California Institute of Technology and the University of Minnesota CAMs who were included in the discussions. They are both key participants to the NOvA detector manufacturing process.

10.0 Analysis of the Previous (March 2102) Surveillance Review.

Below is a re-statement of the March 2012 CARs and CIO*s with notes concerning improvements or lack of improvements. While some improvements were noticed, most of the issues identified in March 2012 remain unresolved at the August 19-20, 2013 surveillance review. Changes in the EVMS procedure, to respond to the issues previously identified, occurred prior to and during the FRA EVMS surveillance review. This issue means that the confirmation/validation review associated with corrective action close-out needs to be more rigorous.

CAR-01 - Estimate at Completion is not Utilized/Understood/owned by CAM – FRA EVMS procedure 12-PM-006 titled “Monthly Status Reporting” section 4.5 titled “Estimate to Complete (ETC)/Estimate at Completion (EAC)” was revised to explain, in detail, the process for developing the EAC and ETC. The EVMS System Description section 5.2.6 was also modified to describe the role of CAM to develop EAC. Comment - *While there was some improvement at the NOvA Project Manager and Fermilab Management level understanding and implementation, however, the role of the CAM ownership and CAM involvement in the EAC and ETC development has not been completely corrected. Fermilab modified EVMS procedure 12 PM-006 Monthly Reporting Status (section 4.5), with the last change on 8/18/2013, to provide a more rigorous development of the ETC.*

CAR-02 – Implementation of Change Requests – Fermilab has put in place two oversight functions to assist in the implementation and oversight of the Fermilab Projects. While the PMG is not new, its role has been better defined with a formal charter. The POG and PMG roles, with respect to changes and change control, still need to be clearly articulated. *Comment – the timing of change requests has seen some improvement. There is a need to describe that the existing*

change control process involves a comprehensive analysis of changes prior to approval. Fermilab modified EVMS procedure 12 PM-007 which clarifies the roles and responsibilities for CAMs relative to change control actions. The latest revision is dated 8/18/2013. The changes involve the inclusion of a financial analyst and minimum data requirements.

CAR-03 - Timing of VARs and Quality needs improvement – Sections 5.2.2 and 5.3.2 of the FRA EVMS System Description have been modified to describe variance analysis process. FRA EVMS procedure 12-PM-006 titled “Monthly Status Reporting” was modified to say “VARs need to describe the variance in sufficient detail such that appropriate actions can be undertaken by the project.” *Comment- quality of the variance analyses still requires additional work. FRA EVMS procedure 12 PM-006 section 4.2 was revised so that CAMs cannot approve their own variance analyses. The latest revision is dated 8/18/2013.*

CAR-04 - Objective Measurement of EV for % complete method – Fermilab modified the EVMS Systems Description section 5.1.1 with additional direction. *Comment – there still remains a mixing of LOE and discrete work in the same control account but less than previous reviews.*

CAR-05 – Schedule Integrity – Fermilab modified the EVMS Systems Description section 3.4.1 to clarify responsibility of schedules and PM-0004 section 4.1 to describe the standard for schedule development. *Comment -CAM ownership of the schedule was not consistent across the NOvA CAMS. Fermilab needs to determine if this is still an issue for the remaining work? And, if it is, resolve the problem. Fermilab last modified EVMS procedure 12 PM-004 on 8/18/2013. This remains an issue during the August 2013 surveillance.*

CIO-01* - Accrual Procedure needs clarification. Fermilab modified the EVMS Systems Description section 5.1.2.1 and Procedure PM-006. *Comment – no new issues identified at the August 19-20, 2013 surveillance.*

CIO-02* - Corrective Action Log not used effectively – FRA EVMS Procedure 12-PM-006 titled “Monthly Status Reporting” was modified to say:

After accepting the (Sic. variance) analysis, the Project Manager (or designee) will note any required corrective action on the Corrective Action Log. The corrective action log status shall be monitored and updated when necessary, at least on a monthly basis until the action is closed.

Comment – some improvement identified but may not be consistently applied.

CIO-03* - Major subcontractors should be included in OBS. This issue was corrected by a change in the FRA EVMS Systems Description section 2.3.1 and modification of EVMS Procedure 12-PM-001 titled “Project WBS, OBS, RAM” which now states:

Major subcontractors are to be included in the OBS in addition to internal project organizations. For the purposes of the OBS, a major subcontractor is defined as a contractor that is responsible for 5% or \$5M (whichever is smaller) of the project’s BAC

Comment – this appears to have been implemented for the NOvA Project as both Caltech and the University of Minnesota were interviewed and satisfactorily responded to questions.

CIO-04 - Additional CAM Training – Comment- while CAM training has been conducted, additional CAM training still needs to be performed to ensure CAM understanding of their responsibilities and ensure full ownership of their control accounts (i.e. ETC, schedule, variance analysis). This can only occur through the Project Manager support and establishing clear expectations.*

Summary: While these actions were closed prior to the August 19-20, 2013 Surveillance Review, it does not appear that the corrective actions were complete or sustainable. In many cases, the corrective action was resolved through procedure modifications and additional training which does not appear to have been successfully implemented for a sustained period. Based on the Surveillance Review Team Review of documentation for developing projects, Fermilab has aggressively pursued building in the EVMS to new projects as early as possible. This allows the system to grow as the project and project team grows. It also allows a phased implementation.

Appendix: Guideline Reviews

1.0 Individual Guideline Review, Analysis, and Comments

This section covers the review and analysis of the five major EVMS categories: 1) Organization; 2) Planning, Scheduling, and Budgeting; 3) Accounting Considerations; 4) Analysis and Management Reports; and 5) Revisions and Data Maintenance

1.1 Training

Reviewer Name(s): Dennis Miner/Bob Wunderlich

Compliant with ANSI/EAI-748: **No**

An issue was identified that directly impacts Fermilab's ability to effectively implement multiple FRA EVMS System guidelines (in particular GL-2, GL-12, GL-14, GL-23, GL-27). This training issue has been classified as a Corrective Action Response.

CAR-03

Subject (Issue): Training reinforcement of policy and procedures is required to establish the FRA EVMS process as an effective management tool.

Referenced Guideline(s): ALL

Referenced Data Trace: N/A

Description of Issue: While the NOvA project CAMs acknowledged taking an initial EVMS training session with annual refresher training, the FRA EVMS management process was not being fully instituted as a culture.

The CAMs were conversant with the EVMS terminology, but some were not using the process to effectively manage their control accounts. Most CAMs treated EVMS as more of a reporting tool than as a management tool. Some CAMs had developed secondary processes for cost/schedule performance determination; the assembly metrics were quite inventive.

Note: In discussions with people from the newer Fermi projects (LHC CMS/Muon g-2), the review team received the impression that when EVMS is implemented at the start of the project cycle, confidence in its use as a valuable management process is instilled.

Recommendation: The review team recommends supplementary training to project CAMs to demonstrate how the EVMS process can be of value to the CAMs as an effective management tool. Pro-active support from senior lab and project leadership will encourage a culture where the full EVMS process can be an effective management tool.

2.0 ORGANIZATION

2.1 Guideline 1: Define the authorized work elements for the program. A work breakdown structure (WBS), tailored for effective internal management control, is commonly used in this process.

Reviewer Name(s): Dennis Miner

Compliant with ANSI/EAI-748: **Yes**

Observations and Findings:

From the FRA EVM System Description: “All projects operating under EVMS are required to develop a WBS Dictionary. The WBS Dictionary is a set of specific definitions that describe how work is carried out to develop, design, construct, equip, and manage the project. It defines each element to at least the control account (CA) level in terms of the content of the work to be performed.”

The NOvA project uses a hierarchical Work Breakdown Structure (WBS) with an associated WBS Dictionary to define the complete project work scope. Control accounts are established at appropriate levels in the WBS with sub-element work/planning packages. The WBS is used throughout the project for organizing project documents such as the Responsibility Assignment Matrix, Work Authorization Document, and project schedule. Changes to the WBS are controlled via an established Change Control process.

A data trace conducted on several control accounts showed that the WBS was consistent across the WBS Dictionary/Responsibility Assignment Matrix/Work Authorization Document/Control Account Plan.

CIO-02

Subject (Issue): Limited level of detail in WBS dictionary (total scope, limited quantification).

Referenced Guideline(s): 1

Referenced Data Trace: NOvA WBS Dictionary

Description of Issue: The level of detail in the NOvA WBS Dictionary should be improved. While some level 2 WBS elements had a general level of quantification, the detail work scope was not flowed down to the control account level of the WBS Dictionary. Several CAMs were unsure of content specified in their portion of the WBS Dictionary. WBS 2.6 through 2.9 are notable in lacking specific work scope with quantifiable equipment/device numbers.

In addition, the WBS Dictionary section of the FRA EVMS procedure on ‘Project WBS, OBS, RAM’ states:

“4.2 WBS Dictionary: The WBS Dictionary is a set of specific definitions that describe the scope of each work element identified in the WBS. It defines each element in terms of the content of the work to be performed. The WBS Dictionary also documents or references the relevant requirements that pertain to this element. The WBS Dictionary demonstrates that the scope of work for the project and the WBS are fully reconciled. Each project will have a WBS Dictionary unique to that project. A sample WBS Dictionary can be found in Appendix D. This format is not required, but the information contained must be included in any format used.”

The NOvA WBS Dictionary does not provide the complete information as annotated in the Appendix D sample: Assumptions / Relates to Requirements / Scope of Work / Deliverables.

The review team did examine the WBS Dictionaries of two new Fermilab projects (CMS and Muon g-2) and found these documents to be an improvement over the NOvA project, but still do not meet the requirements stated in the ‘Project WBS, OBS, RAM’ procedure.

Recommendation: The WBS Dictionary should be updated as specific information on equipment quantities is determined. Information as required by the ‘Project WBS, OBS, RAM’ procedure should be included in the WBS Dictionary at least to the control account level.

2.2 Guideline 2: Identify the program organizational structure including the major subcontractors responsible for accomplishing the authorized work, and define the organizational elements in which work will be planned and controlled.

Reviewer Name(s): Dennis Miner

Compliant with ANSI/EAI-748: Yes

Observations and Findings:

From the FRA EVM System Description: “The Organizational Breakdown Structure (OBS) is a project organization framework for identification of accountability, responsibility, management, and approvals of all authorized work scope. It is a direct representation and description of the hierarchy and organizations that will provide resources to plan and perform work identified in the WBS.”

The NOvA project has an Organizational Breakdown Structure (OBS) that shows the assignment of responsibility for each segment of the project. Another DOE laboratory, four universities, and major subcontractors have been integrated into the NOvA organizational framework. Control Account Managers have been identified for all segments of the project and they understand their role within the project structure.

The review team did however have an issue with the organization EVMS training effectiveness as discussed in CAR-03.

2.3 Guideline 3: Provide for the integration of the company’s planning, scheduling, budgeting, work authorization and cost accumulation processes with each other, and as appropriate, the program work breakdown structure and the program organizational structure.

Reviewer Name(s): Dennis Miner

Compliant with ANSI/EAI-748: **Yes**

Observations and Findings:

From the FRA EVM System Description: “A control account is a natural management point for planning and control since it represents the work assigned to one responsible organizational element for one WBS element, which is the point at which the WBS and OBS intersect. The control accounts are determined by the scope of the management tasks. A single CAM is assigned to one or more of these control accounts and is responsible for the planning and control within their control account(s) and the identification, analysis, and reporting of significant variances that may occur during project execution.”

United around the WBS framework, the NOvA project has appropriately integrated the organizational elements of planning, scheduling, budgeting, work authorization and cost accumulation. The control accounts have been formed by connecting a WBS element with its associated work scope with an identified responsible organization/control account manager. The project Responsibility Assignment Matrix exhibits all project control accounts with their associated budget. CAMs are permitted to execute their portion of the project by an approved Work Authorization Document. Schedule and cost performance is measured and managed at the control account level.

2.4 Guideline 4: Identify the company organization or function responsible for controlling overhead (indirect costs).

Reviewer Name(s): Dennis Miner

Compliant with ANSI/EAI-748: **Yes**

Observations and Findings:

From the FRA EVM System Description: “Fermilab maintains a cost accounting system that allocates indirect costs to projects and tasks. Indirect costs are collected in discrete cost pools and

distributed to the individual project beneficiaries via published rates that are formally reviewed and approved by the CFO. The CAS 28 Disclosure Statement identifies all indirect cost pools with a discrete and specific set of cost objectives or beneficiaries. “

The NOvA Control Account Managers were aware that their portion of the project included both direct and indirect costs and that the Fermi CFO was the responsible organization for controlling indirect costs.

2.5 Guideline 5: Provide for integration of the program work breakdown structure and the program organizational structure in a manner that permits cost and schedule performance measurement by elements of either or both structures as needed.

Reviewer Name(s): Dennis Miner

Compliant with ANSI/EAI-748: **Yes**

Observations and Findings:

From the FRA EVM System Description: “A control account is a management control point at which budgets (resource plans) and actual costs are accumulated and compared to an objective measurement of work performed for management control purposes. The control account is the minimum level in the WBS structure where project cost and schedule performance is compared.”

The NOvA project has established control accounts at the appropriate WBS level for acceptable cost and schedule performance measurement and management control. Chargeable Task Codes have been established at certain sub-control account levels to provide greater granularity to cost performance. Work/planning packages have been generated under the control accounts/chargeable task codes. Control accounts are only opened after a Work Authorization Document has been approved. The NOvA Responsibility Assignment Matrix depicts all project control accounts (some with sub-elements with Chargeable Task Codes) cross-matched with the project Organizational Breakout Structure in a dollarized format. As the NOvA project is nearing completion, many control accounts have been closed.

3.0 PLANNING, SCHEDULING, AND BUDGETING

3.1 Guideline 6: Schedule the authorized work in a manner which describes the sequence of work and identifies significant task interdependencies required to meet the requirements of the program.

Reviewer Name(s): Jennifer O'Connor

Compliant with ANSI/EAI-748: **No**

Observations and Findings:

Discussions with NOvA CAMs and Project Scheduler revealed several activities in the project schedule with missing or insufficient logic, as well as the use of several lags and constraints. CAMs interviewed were unable to articulate the data shown in their schedules, were unaware they were on the critical path, lacked an explanation for and understanding of the existing lags and constraints, and appeared to have minimal interest in the project schedule.

CAR-05

Subject (Issue): Schedule Data Integrity

Referenced Guideline(s):

ANSI/EAI-748 Guideline 6 states: "Schedule the authorized work in a manner which describes the sequence of work and identifies significant task interdependencies required to meet the requirements of the program".

FRA EVM System Description states that development of the project schedule "involves applying schedule logic to each task which identifies the key relationships between activities that determine their proper sequencing."

FRA EVMS PM Project Scheduling Procedure 12.PM-004 states "Project schedules should be prepared using standard scheduling best practices to ensure integrity and quality. Example characteristics of high quality schedules include maintainability, transparency, vertical and horizontal traceability, a valid critical path, documented justifications for constraints and lags, and reasonable values for floats."

Referenced Data Trace: Schedule trace of various NOvA Project schedule activities, Open Plan Predecessor/Successor Constraints Sheet for June data, Open Plan Counts Info for EVMS Work Packages for June data, as well as discussions with the Project Scheduler and CAMs.

Description of Issue: The work scope on the NOvA Project does not fully utilize logically sequenced activities and interdependencies required to meet project milestones and generate critical path schedules. The project schedule contains open relationships, constraints, and lags. The CAMs could not explain and did not understand why certain constraints and lags were being used. A CIO was written in 2011 and a CAR was written in 2012 identifying some of these same issues which have not been fully resolved as of this 2013 EVMS Surveillance Review.

CAMs working with and understanding the project schedule is essential for monitoring progress, analyzing variances, and tracking corrective actions. The scheduling data is available and posted for the CAMs, but interviews revealed the data to be minimally used by CAMs. The schedule had a large percentage of activities that were not logically linked as well as many lagged and/or constrained, including some driving activities on the critical path. At the time of this review, there were 191 activities in progress, with 42 of those activities having no successors. This equates to 22% of the in-progress work having open ends. The NOvA Project has a total of 854 remaining activities either planned or in-progress. Of those 854 remaining activities, a total of 70 have no inter-dependencies. The schedule also contains 20 constraints and 78 lags which were not clearly explained or documented as to their use.

In some cases, the CAMs did not know what milestones they impact or what work outside of their WBS they may impact. They found it difficult to locate the scheduling data documents and how to use this data. Some could not identify the critical path or interfacing milestone. One CAM who has activities on the critical path was not aware that he was on the critical path. There appears to be minimal interest of the project schedule at the CAM level.

Recommendation: CAMs should be trained to understand their milestones and inter-dependencies of tasks and how they impact the project. CAMs should also be aware of and understand the reason for any constraints or lags associated with their activities, and whether or not their activities are on the critical path. The NOvA project schedule should be reviewed and revised to reduce/eliminate the number of open ends, lags and constraints. The CAMs should be more involved with the schedule, taking ownership and interest in EVMS and the tools used in support of EVMS. Project personnel should be encouraged to adopt an EVMS culture and attitude, which should be supported by Management.

3.2 Guideline 7: Identify physical products, milestones, technical performance goals, or other indicators that will be used to measure progress.

Reviewer Name(s): Jennifer O'Connor

Compliant with ANSI/EAI-748: **Yes**

Observations and Findings: The NOvA Project incorporates milestones into the schedule to ensure the goals of the project are tracked and visible. While some CAMs interviewed were not always able to identify project milestones they impact (reference CAR-04 for more information), they were able to describe how they used milestones along with physical completion of work to assess vendor progress. Progress for each activity within the control account is assessed on a monthly basis by the CAMs by completing "turn-around" reports generated by the project scheduler. To track progress, the CAMs indicated they complete the turn-around reports using 0-100, 50-50, percent complete, or other PMT. This was validated with data traces on multiple activities. However, the PMT stated was not always the method used for assessing progress (Reference CAR-05 for more information).

3.3 Guideline 8: Establish and maintain a time-phased budget baseline, at the control account level, against which program performance can be measured. Initial budgets established for performance measurement will be based on either internal management goals or the external customer negotiated target cost including estimates for authorized but undefinitized work. Budget for far-term efforts may be held in higher level accounts until an appropriate time for allocation at the control account level. On government contracts, if an over-target baseline is used for performance measurement reporting purposes; prior notification must be provided to the customer.

Reviewer Name(s): Jennifer O'Connor

Compliant with ANSI/EAI-748: **Yes**

Observations and Findings: A time-phased budget baseline at the control account level was presented, along with CAP reports and basis of estimate documents. The project utilized both work packages and planning packages. The fiscal year budget values and overall baseline total were validated against the dollarized RAM and Cost Performance Reports provided for review.

3.4 Guideline 9: Establish budgets for authorized work with identification of significant cost elements (labor, material, etc.) as needed for internal management and for control of subcontractors.

Reviewer Name(s): Jennifer O'Connor

Compliant with ANSI/EAI-748: **Yes**

Observations and Findings: The NOvA Project budgets were established using a Basis of Estimate (BOE) process. BOE documents were posted in the CAM notebooks. Work Authorization Documents (WADs) for each control account are utilized which include budget for authorized work with identification of significant cost elements such as labor and material. These WADs trace back to the PMB and are updated after change requests are processed.

3.5 Guideline 10: To the extent it is practicable to identify the authorized work in discrete work packages, establish budgets for this work in terms of dollars, hours, or other measurable units. Where the entire control account is not subdivided into work packages, identify the far term effort in larger planning packages for budget and scheduling purposes.

Reviewer Name(s): Jennifer O'Connor

Compliant with ANSI/EAI-748: **Yes**

Observations and Findings: The NOvA Project utilizes a control account structure which is further broken down to the detailed task code (activity) level. The task code packages roll up into the defined control accounts as documented on the RAM and CPRs. At the task code level, the Project uses Deltek Cobra to

establish budgets by resource in terms of units such as hours and dollars. CAMs were able to use previous project plans to develop detailed work packages. However, due to the advanced stage of the project, which is scheduled to be complete in mid-FY14, no planning packages remained. CAMs interviewed indicated they used a variety of EV techniques to accurately track progress which was validated with data traces on multiple activities. However, the PMT stated was not always the method used for assessing progress (Reference CAR-05 for more information).

3.6 Guideline 11: Provide that the sum of all work package budgets plus planning package budgets within a control account equals the control account budget.

Reviewer Name(s): Jennifer O'Connor

Compliant with ANSI/EAI-748: **Yes**

Observations and Findings: The NOvA Project provided Cost Account Plans which validated that the sum of all work package budgets within a control account equaled the control account budget as reported on the RAM.

3.7 Guideline 12: Identify and control level of effort activity by time-phased budgets established for this purpose. Only that effort which is unmeasurable or for which measurement is impracticable may be classified as level of effort.

Reviewer Name(s): Jennifer O'Connor

Compliant with ANSI/EAI-748: **No**

Observations and Findings: The NOvA Project has work packages that contain Level of Effort work scope. While most of these are project management/contract management type activities which represent the accurate use of LOE, some control accounts contain higher LOE values than is recommended for accuracy of EVM reporting. During CAM interviews, the CAMs could not explain their LOE percentages. Some CAMs could not explain which PMT they were using to assess progress. CAMs often stated they were not concerned with PMT at all. There appeared to be no ownership of PMT by the CAMs interviewed.

CAR-04

Subject (Issue): Inconsistent Identification and Application of Level of Effort (LOE) and other Performance Measurement Techniques (PMTs)

Referenced Guideline(s): ANSI/EAI-748 Guideline 12 states "Identify and control level of effort activity by time-phased budgets established for this purpose. Only that effort which is unmeasurable or for which measurement is impracticable may be classified as level of effort."

Referenced Data Trace: Control Accounts 1.4, 2.4.4, 2.6.4, 2.7.3, 2.7.10, 2.8.5, and 2.9.6

Description of Issue: The project's Responsibility Assignment Matrix (RAM) highlights the percentage of

LOE budget in each control account and indicates 34 control accounts where the LOE percentage is something other than 0 or 100. This is an issue as LOE can mask project performance.

The FRA EVM System Description states “Within a control account, the mixing of LOE activities with discrete effort activities should be minimized to prevent distortions of the performance measurement data at the control account level. When unavoidable and LOE work is combined with discrete work within the same control account, segregated work packages should be established for the discrete and LOE portions. LOE activities bias the project data toward an on schedule condition. For this reason, LOE PMT should be used conservatively.” While there was no specific ratio for the percentage of LOE and discrete portions documented, three control accounts were identified as having a significant percent of LOE work mixed with discrete work (from 43% to 50%). In two control accounts the percentage of LOE exceeded 100% while in another the percentage of LOE was a negative value:

Control Acct	Title	LOE %
2.4.4	Production Quality Assurance	44.16%
2.6.4	Management Electronics Construction	-9.23%
2.7.3	Integration DAQ	43.60%
2.7.10	DAQ Ops	100.72%
2.8.5	Management Near Detector Assy	109.51%
2.9.6	Other Univ of Minn Far Detector Assy	50.08%

The FRA EVM System Description goes on to state that “the PMT is specified by the CAM”. During CAM interviews, the CAMs did not understand why the PMT for LOE was at the percentage it was, while some CAMs had no knowledge at all of what PMT was being used on their activities. CAMs stated they were only concerned with doing the work, not the PMT assigned. There appeared to be no ownership of PMT by the CAMs interviewed. Owing to the CAMs confusion towards their LOE percentages, the Financial Manager stated that retroactive rate adjustments, as well as credits for spares, are made to budgets without the direct involvement of the CAMs responsible for those control accounts, and without fully analyzing the impact of the adjustments (Reference CIO-01 and CIO-05 for more information).

The FRA EVM System Description also states “PMTs should be consistently applied to similar work packages across a project”. A data trace of control account 2.4.4 revealed similar work packages using different PMTs:

In addition, a data accounts 1.4 and PMT method being inconsistent with (EV) was actually several activities:	Activity	Title	PMT	trace of control 2.4.4 showed the used was how earned value being taken on
	2.4.4.4	Data Taking & Analysis FY11	% Complete	
	2.4.4.5	Data Taking & Analysis FY12	LOE	
	2.4.4.9	Ship Samples for QA FY12	% Complete	
	2.4.4.10	Ship Samples for QA FY13	LOE	

Activity	Title	PMT	Assumptions
1.4.1.2.3.5	Characterize impact properties of PVC Compounds	% Complete	50% H extrusion characterized & documented; 50% V extrusions characterized & documented
1.4.1.3.14	Perform mechanical tests for quality assurance	% Complete	50% test all planned short vertical extrusions; 50% test all planned long vertical extrusions
1.4.1.3.15	Perform reflectivity tests for quality assurance	% Complete	50% test all planned short vertical extrusions; 50% test all planned long vertical extrusions
1.4.1.3.16	Investigate additional QA equipment	% Complete	50% analyze effectiveness of pressure, vacuum and buckling techniques; 50% compare results of QA prototype hardware with expected analysis
1.4.1.3.17	Purchase additional QA equipment	% Complete	50% build hardware based on aforementioned analysis; 50% build final prototype hardware
1.4.1.3.18	Perform QA on prototype extrusions	% Complete	50% QA performed on short vertical extrusions; 50% QA performed on long vertical extrusions
1.4.4.15	Document shipping & handling plan	% Complete	50% shipping & handling hardware analyzed to engineering standards & drawings complete; 50% shipping document written
1.4.5.1	Adapt QA hardware for preproduction	% Complete	50% half of new hardware adapted; 50% remaining new hardware adapted
1.4.5.2	Purchase new QA hardware for preproduction	% Complete	50% half of new hardware purchased; 50% remaining new hardware purchased
2.4.4.10	Ship Samples for QA FY13	LOE	% Complete based on fraction of total extrusions planned to be shipped for the year

Recommendation: Evaluate all remaining work packages to ensure the correct EV method is documented and assessed. Revise EV methods based on Lab EVM System Description. Policies and procedures should be revised to document an appropriate percentage of split between LOE and discreet work activities. Routine accounting adjustments to budgets should require a full impact analysis and involve CAMs directly (Reference CIO-01 and CIO-03 for more information). Additional training of CAMs and Project Scheduler with a focus on utilizing a consistent and documented PMT approach that is enforced by routine data integrity checks would be beneficial.

3.8 Guideline 13: Establish overhead budgets for each significant organizational component of the company for expenses which will become indirect costs. Reflect in the program budgets, at the appropriate level, the amounts in overhead pools that are planned to be allocated to the program as indirect costs.

Reviewer Name(s): Jennifer O'Connor

Compliant with ANSI/EAI-748: **Yes**

Observations and Findings: Indirect expenses are calculated and reflected in the budget according to NOVA Project practices and procedures. Rates for overheads were demonstrated in the accounting tool. The NOVA Project should consider modification of overhead to assess as benefits are received as compared to only at the beginning of the contract (Reference CIO-02 for further information).

3.9 Guideline 14: Identify management reserves and undistributed budget.

Reviewer Name(s): Gregory Capps (Lead), Lynda Gauthier, Jennifer O'Connor

Compliant with ANSI/EAI-748: **No**

- **Observations and Findings:** This ANSI Guideline is facilitated at Fermilab by requirements in the Fermilab EVM System Description (Version 5, 12Jan2010, Sections 5.2, 5.3) and supporting procedure (Monthly Status Reporting, 12.PM-006, 17Sep09, specifically sections 4.5).
- For Guideline 27, the NOVA Project is NOT compliant with the ANSI Guideline and the Fermilab EVM System Description and procedure.
- The method and tools used by the project to collect and manage the ETC, determine the EAC, and evaluate the available contingency was very confusing to the committee which generated several concerns. The practices that were most disconcerting were:
 - The project maintains an ETC Analysis Log of costs that are not included in the official project ETC, and the subsequent EAC reported to DOE.
 - The project is “assigning contingency” to the ETC; however, it was unclear to the committee if (1) these values were removed from the available contingency (2) and are they reflected in the official project ETC, and the subsequent EAC reported to DOE.
 - MR and UB logs did not include running totals (starting and ending values) therefore it was not possible to validate if MR and UB being identified and controlled properly.
 - The Risk Register does not contain any specific cost and schedule impacts; therefore it is not possible to determine if the remaining contingency is sufficient to cover the remaining project risks.
- They CAMs were not able to explain clearly and consistently the methodology for evaluating the ETC/EAC or the use and interaction between the ETC Analysis Log, the practice of “assigned contingency”, the inclusion of mitigation costs for risks in the risk register, and how the project evaluated remaining contingency.
- During the interviews, the CAMs frequently did not appear confident that their assessment of the ETC for their Control Account was in the final project ETC/EAC documents.

CAR-02

- Subject (Issue): Coupling between risk management, ETC, contingency, MR and UB is not clearly defined or well understood across the NOvA CAMs.
- Referenced Guideline(s):
 - ANSI/EAI-748 2.4f (Guideline 27) states:
 - “Develop revised ...estimates of future conditions”
 - “...identify variances at completion important to company management and any applicable customer reporting requirements including statements of funding requirements.”
 - Fermilab Procedure 12.PM-006, 4.6 states:
 - “An ETC revision is performed whenever the current ETC does not accurately reflect the cost and schedule for the remaining work to a degree that the difference would significantly impact the final cost”
 - The ETC shall take into consideration any cost or schedule variances to date, as well as estimates for pending changes (including field change orders) and mitigation of risk events.
 - Fermilab EVMS Refresher Training, April 2013, page 24 states:
 - “CAMs are to ensure that the EAC continuously reflects a valid projection of project costs. CAMs review the status of expended effort and the achievability of the remaining forecasted work using all available information to arrive at the best possible EAC.”
 - “When substantive changes to the ETC appear on the horizon, CAMs submit the necessary changes to the PM for approval and for subsequent incorporation into the working/forecast schedule and Cobra by Project Controls.”
- Referenced Data Trace: June Monthly report, Risk Register, EAC Analysis Log, J. Cooper Presentation, CAM interviews
- Description of Issue: The EAC is not inclusive of all upcoming costs; therefore it is very difficult to conduct an accurate assessment of the remaining contingency.
 - The following calculations appear to be used by the project to generate the June 2013 Monthly Report submitted to the DOE AE:
 - $AC + ETC = EAC$ (\$273.0M)
 - The ETC does not include the total of the ETC Analysis Log, therefore this EAC is understated.
 - It is unclear if the ETC contains the “assigned contingency”, which also potentially understates the EAC.
 - It is unclear if the mitigation costs for remaining risks are included in the ETC, which if they are would understate the EAC.
 - CAM understanding and confidence in the ETC process further questions the

accuracy of the EAC.

- TPC-EAC = Remaining Contingency (\$5.1M)
 - The Remaining Contingency could be significantly overstated, see above.
 - Without a total cost and schedule impact within the Risk Register, it is not known if the remaining contingency is sufficient to cover the remaining risks.
- This method of ETC/EAC calculation seems to violate the intent of the ANSI/EIA 748 2.4f guideline as it does not include the full “estimate of future conditions” and understates the likely sponsor “funding requirements”. Additionally, this method also seems to violate the Fermilab EVM System, Procedure and Training documents for essentially the same reasons
- There was no way to validate that MR and UB were being identified and controlled properly based on the documents posted for review. The logs presented did not include starting and ending totals so there was no way to trace back the data to ensure the budgets tied out properly. The CAMs interviewed were not able to explain the methodology for when UB/MR is incorporated into the PMB and the process used to accomplish this was not clear to CAMs.
- **Recommendation:**
 - Make certain the ETC reflects the full cost of work remaining on the project. Clearly document the function and interaction of the ETC Analysis Log, “assigned contingency”, and risk mitigation actions to make certain the ETC is complete and draws on contingency are fully accounted for.
 - CAM training should be conducted to ensure understanding of ETC/EAC process. Additionally, the CAMs must be more involved with the ETC process and take full ownership of their control account ETC.
 - Create cost and schedule impacts of each current and future risk, both pre and post mitigation, to assist in determining if the remaining contingency is sufficient to cover the risks. Additionally, document which risks have mitigation costs included in the BAC and/or EAC.
 - Develop and implement a method for managing and tracking MR and UB.

3.10 Guideline 15: Provide that the program target cost goal is reconciled with the sum of all internal program budgets and management reserves.

Reviewer Name(s): Jennifer O’Connor

Compliant with ANSI/EAI-748: **Yes**

Observations and Findings: The NOvA total project values were reconciled with the sum of all control account budgets. The project CPR Format 1 accurately reflected costs at the control account level.

4.0 ACCOUNTING CONSIDERATIONS

4.1 Guideline 16: Record direct costs in a manner consistent with the budgets in a formal system controlled by the general books of account.

Reviewer Name(s): Betsy O'Connor

Compliant with ANSI/EAI-748: **Yes**

Observations and Findings:

Discussions with Fermilab's Finance Office and project controls personnel confirmed the development of the project budgets in the EVMS is in accordance with the Lab's official financial system, as did observance of the budget information in the EVMS reports. Fermilab uses Oracle's electronic business suite and the project accounting module to record all costs in the general ledger whereby the actual Control Account (and lower level if applicable) is used as the chargeable task code. Fermilab's budget manager worked in project controls on their LBNE project for several years and clearly understands the budget requirements for EVMS reporting.

CIO-01

Subject (Issue): Unclear accounting for spares and associated distribution of scope/budget/costs.

Referenced Guideline(s): 16

Referenced Data Trace:

Control Account 2.6.4 Management – Electronics – Constructions

Control Account 2.8.5 Management – Near Detector Assembly – Construction

Description of Issue: Several Control Accounts include the production of spare parts, such as power supplies and crane supplies. Original Control Account budgets included the purchase of these parts and over the course of the project; the spare parts were purchased and charged to the Control Accounts. Due to other financial considerations, it was determined that the spare parts would be sold back to the Lab's inventory account, resulting in a credit to the Control Accounts. However, the anticipated credit for the sales of the spares is budgeted in a separate Control Account, in effect, inflating the actual project cost in the Control Account that purchased the spares. In addition, CAMs were unable to explain and did not have a clear understanding of the spares transactions impacting their Control Accounts.

Recommendation: Consider moving the budget for the sales of the spare parts to inventory into the appropriate Control Account or, at a minimum, in the future, budget and account for the purchase and sale of spare parts in the same Control Account.

4.2 Guideline 17: When a work breakdown structure is used, summarize direct costs from control accounts into the work breakdown structure without allocation of a single control account to two or more work breakdown structure elements.

Reviewer Name(s): Betsy O'Connor

Compliant with ANSI/EAI-748: **Yes**

Observations and Findings:

The WBS is used as the chargeable task code and is consistent with the WBS listing in the RAM. When looking at the cost detail, the Accounting staff entered the WBS/chargeable task code into the Lab's financial system to retrieve the information for review. Using the WBS as the chargeable task code assures the consistency between the financial system and the EVMS.

4.3 Guideline 18: Summarize direct costs from the control accounts into the contractor's organizational elements without allocation of a single control account to two or more organizational elements.

Reviewer Name(s): Betsy O'Connor

Compliant with ANSI/EAI-748: **Yes**

Observations and Findings:

Each chargeable task code reviewed was traced and verified to the dollarized RAM. The financial statements produced were traced and tied to the information in the EVMS reports. The cost of the hours charged to a specific WBS was traced from the Kronos time card system, indicating the employee and number of hours charged to the WBS. The hours charged were priced out using actual pay rates as expected per the Lab's Disclosure Statement and the cost was entered into the Oracle general ledger. The cost was traced to the Lab's financial statement which also showed the appropriate allocation of indirect expense. Materials are recorded when received, in accordance with EVMS guidelines and Generally Accepted Accounting Principles. The accruals observed were reasonable and no variances reported were related to accrual errors.

4.4 Guideline 19: Record all indirect costs which will be allocated to the project.

Reviewer Name(s): Betsy O'Connor

Compliant with ANSI/EAI-748: **Yes**

Observations and Findings:

Indirect costs were applied in accordance with the Lab's CAS Disclosure Statement. In June,

retroactive adjustments were made to the indirect rates and the fringe rate to reduce variances. Retroactive adjustments are also in accordance with the Disclosure Statement, the EVMS System Description and the corresponding assumptions document.

CIO-03

Subject (Issue): Reduced indirect rates for special procurements are assessed at the beginning of the contract as opposed to over the life of the contract.

Referenced Guideline(s):

ANSI / EIA 748 B Section 2.3 a) Intent Guideline 19

Cost Accounting Standard 418, 9904.418-20 Purpose, "...to provide guidance relating to the selection of allocation measures based on the beneficial or causal relationship between an indirect cost pool and cost objectives."

Referenced Data Trace:

Control Account 2.2.1 Mineral Oil, Task Transaction Detail ACT070

Description of Issue: In discussions with the Fermilab Chief Financial Officer and per the Lab's CAS Disclosure Statement, a special, reduced indirect rate is allowed for collaborative and large procurements with a lifetime value greater than \$500K. When the reduced rate is approved by the CFO, the indirect expense is assessed at the beginning of the contract. Though much of the procurement work may take place before the award is made, that work benefits the project over the life of the contract, not just at the beginning. In addition, contract modifications, monitoring vendor performance, invoice handling and payment, etc., are on-going indirect support costs that are not assessed once the \$500K cap is realized, thus shifting the cost of these indirect activities to other unrelated projects.

Recommendation: The Lab should consider modifying the application of indirect expense to assess the overhead as the benefit is received as opposed to application only at the beginning of the contract. The indirect assessment could be estimated at the start of the contract and then applied over the life of the contract or project. Another option would be to restart the \$500K procurement cap at the beginning of the fiscal year to recognize that certain procurement and financial support activities are required throughout the life of the award.

CIO-04

Subject (Issue): Consequences of routine accounting adjustments (e.g. rate adjustments) to budgets and involvement of CAMs directly on impact analysis.

Referenced Guideline(s):

ANSI / EIA 748 B Section 2.3 a) Intent Guideline 19

Referenced Data Trace:

Control Account 2.8.1 Near Detector Site Preparation

Description of Issue: In reviewing the EVMS reports, several current month budgets for effort were credits. In the Control Account referenced above, the effort cost was significantly over budget already, yet an adjustment was recorded to reduce the budget, further increasing the variance. The adjustment also resulted in erroneous Level Of Effort percentages (i.e., LOE greater than 100%). Project Controls personnel explained that the budget was modified to reflect the routine effort and indirect rate changes recorded in June and that they did not consider the consequences of the changes or other options such as reflecting the change in the Estimate To Complete. Also, the CAM's were not involved in the Change Request.

Recommendation: Project Controls should consider the impact of the budget changes on the EVMS reporting and consider other options, such as modification of the ETC, for these types of accounting adjustments. The CAMs should be involved in and have a clear understanding of all Change Requests impacting their Control Accounts.

4.5 Guideline 20: Identify unit costs, equivalent unit costs, or lot costs when needed.

Reviewer Name(s): Betsy O'Connor
Compliant with ANSI/EAI-748: **Not Applicable**

Observations and Findings:

This guideline applies to manufacturing processes. Fermilab is an R&D facility and does not need to implement procedures for this guideline.

4.6 Guideline 21: For EVMS, the material accounting system will provide for:

- **Accurate cost accumulation and assignment of costs to control accounts in a manner consistent with the budgets using recognized, acceptable, costing techniques.**
- **Cost performance measurement at the point in time most suitable for the category of material involved, but no earlier than the time of progress payments or actual receipt of material.**
- **Full accountability of all material purchased for the project including the residual inventory.**

Reviewer Name(s): Betsy O'Connor
Compliant with ANSI/EAI-748: **Not Applicable**

Observations and Findings:

This guideline applies to manufacturing processes. Fermilab is an R&D facility and does not need to implement procedures for this guideline.

5.0 ANALYSIS AND MANAGEMENT REPORTS

5.1 Guideline 22: At least on a monthly basis, generate the following information at the control account and other levels as necessary for management control using actual cost data from, or reconcilable with, the accounting system:

- **Comparison of the amount of planned budget and the amount of budget earned for work accomplished. This comparison provides the schedule variance.**
- **Comparison of the amount of the budget earned and the actual (applied where appropriate) direct costs for the same work. This comparison provides the cost variance.**

Reviewer Name(s): Gregory Capps

Compliant with ANSI/EAI-748: **Yes**

Observations and Findings :

- This ANSI Guideline is facilitated at Fermilab by requirements in Sections 5.1, 5.2, 5.3 of the Fermilab EVM System Description (Version 5, 12Jan2010) and in the supporting procedure(s): Monthly Status Reporting (12.PM-006, 17Sep09).
- For Guideline 22, the NOvA Project is compliant with both the ANSI Guideline, and the Fermilab EVM System Description and procedure.
- The project is producing a monthly report at the control account level that includes the Planned Values (PV), Earned Value (EV), and Actual Cost (AC). Additionally the Schedule Variance (SV) and Cost Variances (CV) are calculated and included in the report.
- The CAMs were familiar with the monthly reporting process as described in the Fermilab procedures, the monthly report, and appeared knowledgeable in the interpretation of the SV & CV information.

5.2 Guideline 23: Identify, at least monthly, the significant differences between both planned and actual schedule performance and planned and actual cost performance, and provide the reasons for the variances in the detail needed by program management.

Reviewer Name(s): Gregory Capps

Compliant with ANSI/EAI-748: **No**

Observations and Findings :

- This ANSI Guideline is facilitated at Fermilab by requirements in Sections 5.1, 5.2, 5.3 of the Fermilab EVM System Description (Version 5, 12Jan2010) and in Sections 4.2 & 4.3 of the

supporting procedure(s): Monthly Status Reporting (12.PM-006, 17Sep09).

- For Guideline 23, the NOvA Project is questionably compliant with the ANSI Guideline, and is not compliant with the Fermilab EVM System Description and procedure.
- The project is identifying monthly schedule and cost variances using the DOE Format 1 report at the Control Account level and creating an internal Management Analysis Report that not only identifies the variances, but color codes them by variance threshold. The project further reports on the monthly variances using DOE Format 5 Variance Analysis Report.
- While the CAMs were familiar with reports identifying the variances and could explain their variances, the information in the Variance Analysis Reports was incomplete, imprecise, and/or contradictory to the efforts described by the CAM.
- Additionally, the CAM's were not conversant about their Critical Path, float or variance impacts on their detailed schedule or milestones. While this information is not produced via EVM calculations, it is extremely important for the CAM to understand and monitor as it can be more useful than EV variance information as a project approaches CD-4.

CAR-01

Subject (Issue): Variance Analysis Reports inadequate for effective project management purposes

Referenced Guideline(s):

- ANSI/EAI-748 2.4b (Guideline 23) states: "provide reasons for the variances in the detail needed by program management"
- Fermilab Procedure 12.PM-006, 4.6 states: "VARs need to describe the variance in sufficient detail such that appropriate actions can be undertaken by the project."

Referenced Data Trace: Review of VAR's for April – June 2013

Description of Issue: VAR's are being generated monthly, however the information contained in the documents is so inadequate that the VAR has very limited usefulness to program management:

- The majority of the VARs were missing very significant variance information. For example, out of 28 VARs produced for June only one had a corrective action noted. However, during the interviews many of the CAMs described their corrective actions to address their variances. Additionally, the majority of the VARs were missing any description of impacts the variances would have upon the project.
- Imprecise information was noticed in the vast majority of the VARs. Explanations were extremely vague or generic, and were insufficient to explain the reason for the variance to anyone that was not personally involved with the control account.
- Several of the VARs for June were created in August. This seems very untimely especially with the project approaching CD-4 and needing to be careful with contingency.
- The VARs did not have any information about impacts to the detailed schedule, milestones,

Critical Path/Float. While a VAR is focused on explaining the EV metrics, it is very important to understand and articulate the impacts of the variances to future schedule activities, milestones, and float.

- The issue addressed in this CAR was also noted as CAR-03 in the March 2011 Fermilab EVMS Review and CAR-03 in the March 2012 Fermilab EVMS Review.

Recommendation:

- VAR explanation, impact and corrective actions should be complete and fully descriptive of the situation. If this information is complete, the Corrective Action Log can be fully utilized to assist the CAM and management in tracking corrective actions.
- VARs should be timely.
- VAR explanations should also include references to how the variance impacts schedule activities, milestones, floats, and critical or near-critical paths.

5.3 Guideline 24: Identify budgeted and applied (or actual) indirect costs at the level and frequency needed by management for effective control, along with the reasons for any significant variances.

Reviewer Name(s): Gregory Capps

Compliant with ANSI/EAI-748: **Yes.**

Observations and Findings:

- This ANSI Guideline is facilitated at Fermilab by requirements in Sections 3.5, 4.2, 5.2, specifically Section 5.2.6, of the Fermilab EVM System Description (Version 5, 12Jan2010) and in Section 4.2 of the supporting procedure(s): Monthly Status Reporting (12.PM-006, 17Sep09).
- For Guideline 24, the NOvA Project is compliant with both the ANSI Guideline, and the Fermilab EVM System Description and procedure.
- The CAMs were familiar with the definition and existence of indirect costs and were aware that cost variances could occur due to the changes in these rates. The CAMs did depend on the project office/project controls staff to notify them when indirect rates were changing and incorporate the changes.

5.4 Guideline 25: Summarize the data elements and associated variances through the program organization and/or work breakdown structure to support management needs and any customer reporting specified in the project.

Reviewer Name(s): Gregory Capps

Compliant with ANSI/EAI-748: **Yes**

Observations and Findings:

- This ANSI Guideline is facilitated at Fermilab by requirements found in Section 5.3 discussing CPR's of the Fermilab EVM System Description (Version 5, 12Jan2010) and in Section 4.7 "Monthly Reporting Format" of the supporting procedure(s): Monthly Status Reporting (12.PM-006, 17Sep09).
- For Guideline 25, the NOvA Project is compliant with both the ANSI Guideline, and the Fermilab EVM System Description and procedure.
- The project is producing monthly DOE Format 1 and 5 reports at both summary and Control Account levels. The project submits a monthly report to the Acquisition Executive that summarizes the performance information, and the project reports into PARS II monthly. The NOvA Project is currently identified as YELLOW on the DOE Project Dashboard.
- Additionally the project issues a Management Analysis Report at both the summarized project level and at the Control account level that color-codes the variance information. This report seemed very useful.
- The CAMs were familiar with the detailed and summarized monthly reports. They appeared more comfortable using the Management Analysis Report rather than the DOE Format 1 reports to explain their performance data.

5.5 Guideline 26: Implement managerial action taken as the result of earned value information.

Reviewer Name(s): Gregory Capps

Compliant with ANSI/EAI-748: **Yes**

Observations and Findings:

- This ANSI Guideline is facilitated at Fermilab by requirements found in Section 5.3.2 of the Fermilab EVM System Description (Version 5, 12Jan2010,) and in Section 3 regarding Responsibilities of the supporting procedure(s): Monthly Status Reporting (12.PM-006, 17Sep09).
- For Guideline 26, the NOvA Project is compliant with both the ANSI Guideline, and the Fermilab EVM System Description and procedure.
- The project management was very aware and very active in addressing schedule and cost variances. There is considerable monitoring of the monthly project information by the project staff and DOE as the project approaches completion and available contingency is very limited.
- The CAMs were all very aware and very active in addressing schedule and cost variances

within their Control Accounts. Most CAMs had alternate methods of identifying schedule and costs slips, and used the EV tools to loosely confirm what their primary spreadsheets, websites, or databases were indicating. Some of these alternative tracking tools were very impressive!

- Due to the inadequate information in the Variance Analysis Reports (as noted in CAR-01), the use of the Corrective Action Log appears very limited. If the VARs were more completely filled out, the Corrective Action Log would contain more actions and would provide management a quick summary of necessary action and manage them to completion. Currently, corrective actions are verbally addressed with the project management during weekly meetings.

5.6 Guideline 27: Develop revised estimates of cost at completion based on performance to date, commitment values for material, and estimates of future conditions. Compare this information with the performance measurement baseline to identify variances at completion important to company management and any applicable customer reporting requirements including statements of funding requirements.

Reviewer Name(s): Gregory Capps (Lead), Lynda Gauthier, Jennifer O'Connor

Compliant with ANSI/EAI-748: **No**

Observations and Findings :

- This ANSI Guideline is facilitated at Fermilab by requirements in Sections 5.2, 5.3 of the Fermilab EVM System Description (Version 5, 12Jan2010) and in Section 4.5 of the supporting procedure(s): Monthly Status Reporting (12.PM-006, 17Sep09).
- For Guideline 27, the NOvA Project is not compliant with both the ANSI Guideline and the Fermilab EVM System Description and procedure.
- The method and tools used by the project to collect and manage the ETC, determine the EAC, and evaluate the available contingency was very confusing to the committee and generated several concerns. The practices that were most disconcerting were:
 - The project maintains an ETC Analysis Log of costs that are not included in the official project ETC, and the subsequent EAC reported to DOE.
 - The project is “assigning contingency” to the ETC; however, it was unclear to the committee if (1) these values were removed from the available contingency (2) and are they reflected in the official project ETC and the subsequent EAC reported to DOE.
 - MR and UB logs did not include running totals (starting and ending values) therefore it was not possible to validate if MR and UB were being identified and controlled properly.
 - The Risk Register does not contain any specific cost and schedule impacts; therefore it

is not possible to determine quantitatively if the remaining contingency is sufficient to cover the remaining project risks in the register.

- The CAMs were not able to explain clearly and consistently the methodology for evaluating the ETC/EAC, the use and interaction between the ETC Analysis Log, the practice of “assigned contingency”, the inclusion of mitigation costs for risks in the risk register, and how the project evaluated remaining contingency.
- During the interviews, the CAMs frequently did not appear confident that their assessment of the ETC for their Control Account was in the final project ETC/EAC documents.

CAR-02 (also associated with Guideline 14)

Subject (Issue): Coupling between risk management, ETC/EAC, contingency, MR and UB is not clearly defined or well understood across the NOVA CAMs.

Referenced Guideline(s):

- ANSI/EAI-748 2.4f (Guideline 27) states:
 - “Develop revised ... estimates of future conditions”
 - “...identify variances at completion important to company management and any applicable customer reporting requirements including statements of funding requirements.”
- Fermilab Procedure 12.PM-006, 4.6 states:
 - “An ETC revision is performed whenever the current ETC does not accurately reflect the cost and schedule for the remaining work to a degree that the difference would significantly impact the final cost”
 - “The ETC shall take into consideration any cost or schedule variances to date, as well as estimates for pending changes (including field change orders) and mitigation of risk events.”
- Fermilab EVMS Refresher Training, April 2013, page 24 states:
 - “CAMs are to ensure that the EAC continuously reflects a valid projection of project costs. CAMs review the status of expended effort and the achievability of the remaining forecasted work using all available information to arrive at the best possible EAC.”
 - “When substantive changes to the ETC appear on the horizon, CAMs submit the necessary changes to the PM for approval and for subsequent incorporation into the working/forecast schedule and Cobra by Project Controls.”

Referenced Data Trace: June Monthly report, Risk Register, EAC Analysis Log, J. Cooper Presentation, CAM interviews

Description of Issue: The EAC is not inclusive of all upcoming costs; therefore it is very difficult to conduct an accurate assessment of the remaining contingency.

- The following calculations appear to be used by the project to generate the June 2013 Monthly Report submitted to the DOE AE:
 - $AC + ETC = EAC$ (\$273.0M)
 - The ETC does not include the total of the ETC Analysis Log, therefore this EAC is understated.
 - It is unclear if the ETC contains the “assigned contingency”, which also potentially understates the EAC.
 - It is unclear if the mitigation costs for remaining risks are included in the ETC, which if they are would understate the EAC.
 - CAM understanding and confidence in the ETC process further questions the accuracy of the EAC.
 - $TPC - EAC = \text{Remaining Contingency}$ (\$5.1M)
 - The amount of Remaining Contingency could be significantly overstated; see above.
 - Without a total cost and schedule impact within the Risk Register, it is not known if the remaining contingency is sufficient to cover the remaining risks.
- This method of ETC/EAC calculation seems to violate the intent of the ANSI/EIA 748 2.4f guideline as it does not include the full “estimate of future conditions” and understates the likely sponsor “funding requirements”. Additionally, this method also seems to violate the Fermilab EVM System, Procedure and Training documents for essentially the same reasons.
- There was no way to validate that MR and UB were being identified and controlled properly based on the documents posted for review. The logs presented did not include starting and ending totals so there was no way to trace back the data to ensure the budgets tied out properly. The CAMs interviewed were not able to explain the methodology for when UB/MR is incorporated into the PMB and the process used to accomplish this was not clear to CAMs.

Recommendation:

- Make certain the ETC reflects the full cost of work remaining on the project. Clearly document the function and interaction of the ETC Analysis Log, “assigned contingency”, and risk mitigation actions to make certain the ETC is complete and draws on contingency are fully accounted for.
- CAM training should be conducted to ensure understanding of ETC/EAC process. Additionally, the CAMs must be more involved with the ETC process and take full ownership of their control account ETC.
- Create cost and schedule impacts of each current and future risk, both pre and post mitigation, to assist in determining if the remaining contingency is sufficient to cover the risks. Additionally, document which risks have mitigation costs included in the BAC and/or EAC.
- Develop and implement a method for managing and tracking MR and UB.

6.0 REVISIONS AND DATA MAINTENANCE

6.1 Guideline 28: Incorporate authorized changes in a timely manner, recording the effects of such changes in the budgets and schedules. In the directed effort prior to negotiation of a change, base such revisions on the amount estimated and budgeted to the program organizations.

Reviewer Name(s): Lynda Gauthier

Compliant with ANSI/EAI-748: **Yes**

Observations and Findings:

Section 6.1.2, *Change Documentation*, of the Fermilab Earned Value Management System Description, version 6, states, “All change requests to the performance measurement baseline made as a result of contractual changes, formal reprogramming, internal replanning, or the use of the contingency are documented and reported to the customer, as required.” Section 6.1.5, *Internal Changes*, states, “Approved changes are incorporated into the performance measurement baseline in a timely manner, usually before the end of the next reporting period.”

The change control procedure is documented in EVMS Procedure 12.PM-007, Change Control. Section 4.5.2, *Disposition of Change Request*, of this procedure states, “The CAM must work with Project Controls to update all affected CAP and Project documents that reflect scope, schedule and budget information and assure that these updates are consistent with the approved CR. This must be accomplished in a timely manner, typically within 30 days, and preferably within the same reporting period.”

Three CRs were selected from the change log and were reviewed to validate each change was processed in a timely manner and the associated impacts to budgets and schedules were clearly documented indicating that the project baseline is current. The following data points were reviewed: date of approval, approval level, reporting month of implementation, supporting documentation showing the schedule and budget changes, before and after Cost Performance Reports (CPR), Work Authorization Documents (WAD), and the master schedule via a live demonstration.

1. Change Request Log, as of August 20, 2013.
2. Project Change Request (CR) forms:
 - a. CR643
 - b. CR641
 - c. CR644
3. Contract Performance Report (CPR)
 - a. April, 2013
 - b. May, 2013
 - c. June, 2013
4. Control Account Plan (CAP) – Responsibility Assignment Matrix (RAM)
 - a. CA-2.8.4-Before and After

- b. CA-2.4.4-Before and After
 - c. CA-2.8.7-Before and After
 - d. Hours (HRS)-CA-2.8.4-Before
 - e. Hours (HRS)-CA-2.8.4-After
5. Work Authorization Documents
- a. CA-2.8.4
 - b. CA-2.4.4
 - c. CA-2.8.7
6. Schedule Impact
- a. CR643_Details_Spreadsheet
 - b. Before & After schedule views for CR641
 - c. CR644_Details_Spreadsheet
 - d. Live Open Plan demo

The traces performed demonstrated that each CR was implemented in a timely manner and all applicable project documents were properly updated revealing no discrepancies.

Fermilab appears to have adequately addressed CAR-02 from the 2012 Surveillance Review. Each CR traced was implemented into the baseline after final approval was received.

CIO-01*

Subject (Issue): Level of integrated impact analysis in the change control process (no operating CCB)

Referenced Guideline(s): 28

Referenced Data Trace: N/A

Description of Issue: The effects of a proposed Change Request cannot fully be assessed without a cross functional evaluation conducted by the project management team. While document traces and CAM interviews revealed that changes for the NOvA project are evaluated within the management line of the Control Account Manager owning the change, management outside of this line is not consulted or made aware of the change.

The review team considers the use of a Change Control Board (CCB) with members representing the project cross functionally as a best practice to employ in an effective change control process. Board members typically include divisional management, project management, environmental, safety, health, quality, facilities engineering services and any other key areas supporting the project.

NOvA has a Project Management Group (PMG) in place which meets regularly to coordinate problem solving with project team members, collaborators and the laboratory. Membership of the

PMG is consistent with a typical CCB. While Change Requests are normally a topic raised during PMG meetings, the purpose of the discussion is not to fully assess the effects of a proposed Change Request.

Recommendation: Consider employing the Project Management Group as a Change Control Board by including proposed Changes Requests as a regular agenda item. This will allow for a thorough and effective cross functional and cross divisional analysis of each proposed Change Request resulting in reduced risk for the project.

6.2 Guideline 29: Reconcile current budgets to prior budgets in terms of changes to the authorized work and internal replanning in the detail needed by management for effective control.

Reviewer Name(s): Lynda Gauthier

Compliant with ANSI/EAI-748: **Yes**

Observations and Findings:

Section 6.1.2, *Change Documentation*, of the Fermilab Earned Value Management System Description, version 6, states, “Full control and accountability must be maintained over the performance measurement baseline (PMB). A detailed change log is maintained to record all changes to authorized work and to reconcile original budgets and schedules with all changes for the WBS elements.”

Fermilab maintains adequate documentation for each Change Request (CR) processed on the NOvA project. Documentation provides a basis for reconciliation to the original budget in the baseline prior to the CR. Reconciliations were performed at the Control Account level allowing for validation and verification for the intended changes. Budget changes were traced from the CR form, through to the Control Account Plan, Work Authorization Document and to the Contract Performance Report. A change log is maintained for NOvA and contingency/management reserve usage is tracked.

Note: While the log meets the requirements of Guideline 29, the committee has noted in CAR-02 that the log does not include starting and ending totals for contingency and management reserve.

6.3 Guideline 30: Control retroactive changes to records pertaining to work performed that would change previously reported amounts for actual costs, earned value, or budgets. Adjustments should be made only for correction of errors, routine accounting adjustments, effects of customer or management directed changes, or to improve the baseline integrity and accuracy of performance measurement data.

Reviewer Name(s): Lynda Gauthier

Compliant with ANSI/EAI-748: **No**

CAR-06

Subject (Issue): Baseline changes occurring during the current performance period (rubber baseline).

Referenced Guideline(s): 30

Referenced Data Trace:

1. CR Log of Baseline Changes for Monthly Report; June, 2013
2. Project Change Request (CR) #643, Add Tasks and Budget for Near Detector Electronics Installation Support
3. Contract Performance Report (CPR)
 - a. May, 2013
 - b. June, 2013
4. Control Account Plan (CAP) – Responsibility Assignment Matrix (RAM)
 - a. Control Account (CA)-2.8.4-Before
 - b. Control Account (CA)-2.8.4-After
 - c. Hours (HRS)-CA-2.8.4-Before
 - d. Hours (HRS)-CA-2.8.4-After
5. Work Authorization Document for Control Account 2.8.4
6. Schedule Impact
 - a. CR643_Details_Spreadsheet
 - b. Live Open Plan demo

Description of Issue: Paragraph 2, section 6.1.5, *Internal Changes*, of the Fermilab Earned Value Management System Description, Version 6, states the following:

1. “Internal replanning is intended for in-scope changes that relate to future work, i.e. work to be performed beyond the current performance period.”
2. “The start date for any work package, opened or unopened, can only be changed on future work that has not started as of the current performance period.”
3. “Changes shall not be implemented until the approval process described in the PEP has been completed.”

Paragraph 3, section 4.1, *Internal Replanning and Changes*, of EVMS Procedure 12.PM-007, Change Control, states the following:

“Only the future portion, i.e. portion of work to be performed beyond the current performance period, of open work packages may be changed. The start date for any work package, opened or unopened can only be changed on future work that has not yet started as of the current performance period.”

The approval process for the subject CR was completed on June 20, 2013 and all required signatures based on the thresholds defined in the PEP were obtained. However, additional work tasks were added to the baseline schedule with start dates falling within the current performance period (June, 2013). Specifically, a new work package was added with a start date within the current performance period. This practice is not in agreement with the defined process as stated above.

Recommendation: Ensure that the above referenced sections within the documented Fermilab processes and procedures are strictly followed.

6.4 Guideline 31: Prevent revisions to the program budget except for authorized changes.

Reviewer Name(s): Lynda Gauthier

Compliant with ANSI/EAI-748: **Yes**

Observations and Findings:

Section 6.1.5, *Internal Changes*, of the Fermilab Earned Value Management System Description, version 6, states, “Changes shall not be implemented until the approval process described in the PEP has been completed.” Section 6.1.1, *Objective*, states, “Change control has the following objectives:

- Delineates the methods used to ensure the integrity of the project’s cost, schedule, and work scope baseline.
- Enables the implementation for timely and auditable changes to the baseline.
- Ensure that no work is performed without prior authorization.”

Traces performed on two Change Requests implemented in June, 2013 and one Change Request implemented in May, 2013, produced no evidence that budgets for the Nova project were revised without an approved and implemented CR. Each CR had the management approvals needed for the assigned threshold as defined in the PEP.

6.5 Guideline 32: Document changes to the performance measurement baseline.

Reviewer Name(s): Lynda Gauthier

Compliant with ANSI/EAI-748: **Yes**

Observations and Findings:

Section 6.1.3, *Change Implementation*, of the Fermilab Earned Value Management System Description, version 6, states, “All changes are recorded and tracked through the change control process”. Section 6.1.1, *Objective*, states, “Change control has the following objectives:

- Delineates the methods used to ensure the integrity of the project’s cost, schedule, and work scope baseline.
- Enables the implementation for timely and auditable changes to the baseline.
- Ensure that no work is performed without prior authorization.”

Traces performed on Change Requests indicated that all schedule and budget revisions are well documented and traceable, validating that the integrity of the performance measurement for the baseline is maintained. Control Account Plans and Work Authorization Documents were found to be current. Control Account Managers interviewed generally understood that work could not commence prior to obtaining a revised Work Authorization Document after implementation of an approved Change Request.