Earned Value Management System (EVMS)

Corrective Action

Standard Operating Procedure

(ECASOP)

Issued by

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DEPARTMENT OF ENERGY

Earned Value Management System (EVMS) Corrective Action (CA)
Standard Operating Procedure (ECASOP)

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1. PURPOSE. This EVMS Corrective Action Standard Operating Procedure (ECASOP) serves as a primary reference for PMOA PM-1 for development of Corrective Action Requests (CARs) and Continuous Improvement Opportunities (CIOs), as well as the assessment of contractors procedures and implementation associated with Variance Analysis Reports (VARs) and Corrective Action Plans (CAPs) in accordance with the EIA-748 (current version) EVMS standard. The SOP is based on regulatory guidance and standardized processes based upon a common understanding of EVMS Industry and Government best practices for use by the Department of Energy (DOE). All information contained herein provides detailed processes to implement the requirements in DOE O 413.3 Current Version.

2. APPLICABILITY. This SOP applies to PMOA PM-1 and is available for use outside PM-1.

3. RELEASABILITY – UNLIMITED. This SOP is approved for public release.

4. EFFECTIVE DATE. This SOP is effective immediately.

1. INTRODUCTION

In its simplest form, Earned Value Management (EVM) is the discipline of successful project management. It is the planning and controlling of authorized work to achieve cost, schedule, and technical performance objectives. Special emphasis is placed on efficiency and effectiveness in the execution of work through the development and operation of an EVMS that integrates the application of people, systematic processes, and innovative tools and techniques. EVM helps project managers and their management teams operate more effectively in the execution of risky, high dollar, and complex projects. When implemented properly, EVM equips the project manager with a forward looking tool for optimal decision making and risk mitigation.

In accordance with the requirements established in DOE Order 413.3 Current Version, contractors are responsible for obtaining certification of their EVMS and for continued maintenance of their system to retain it at all times in a compliant state. PMOA is responsible for conducting compliance-based EVMS reviews, including initial Certification, Implementation, Review for Cause, and Surveillance subject to the thresholds identified in DOE Order 413.3 Current Version. When non-compliances are noted in the review process, PMOA issues Corrective Action Requests (CARs). This SOP outlines the Root Cause / Corrective Action (RCCA) process from the PMOA perspective relative to identifying, issuing, and closing CARs, and review, acceptance, and monitoring to completion the contractor's CAP. The concept and process associated with Continuous Process Improvements (CIOs) is also addressed. CIOs are issued to identify recommended improvements but are not considered non-compliances.

The RCCA process is also the key component of the Analysis section of the standard, guidelines 22 through 27. As stated in EIA-748C, para. 3.8.6 "While performance analysis necessarily involves examination of what has occurred, the focus should be on the control of current actions and assessment of future plans." Therefore, this SOP also covers RCCA from the aspect of expectations for the identification of performance variances, the content of variance analysis reports (VARs), and assessment of the management actions taken as part of the corrective action. The output of a formal closed loop root cause analysis must lead to effective and preventative corrective actions.

2. EVMS RCCA ROLES AND RESPONSIBILITIES

Effective EVMS RCCA involves all stakeholders to include PMOA, PMSO, Federal Project Director (FPD), Contracting Officer (CO), and the contractor, working together to secure the effectiveness of the system.

2.1 PMOA

PMOA is responsible for the development and implementation of policies and uniform procedures defining the EVMS compliance process and its components, which for this SOP are the Root Cause and Corrective Action process. Where PMOA is the designated Certifying Authority either per DOE O 413.3 Current Version or by request of the PMSO, PMOA is responsible for the certification and surveillance processes. The Policy and Systems Division, PM-30, is responsible for assignment of the PMOA EVMS review team lead.

In support of the responsibilities identified in Order 413.3 Current Version, PMOA is responsible for reviewing and providing feedback of the contractor's plan to implement a CAP as a result of identified non-compliance(s). The PMOA Project Analysts, the EVM Specialists, and the contract augmented support staff are responsible for working together to identify and document areas of non-compliance or continuous improvement opportunities. The PMOA review team lead is responsible for vetting the draft CARs submitted by the teams before CAR finalization.

After the CARs have been issued, PMOA will assist the contractor to ensure understanding of final CARs. This may be completed via telephone or a site visit. PMOA is responsible for reviewing the contractor's CAP, providing feedback, monitoring of the corrective actions in the plan, and final determination via verification of the CAP closure.

In accordance with the DOE O 413.3 Current Version requirements of maintaining a Central Repository of EVMS-review related documentation, PMOA is responsible for maintaining all review documentation, including those elements discussed in this SOP such as CARs with evidence attached, CIOs, the contractor's CAP, and CAP closure actions. The PMOA review team lead is responsible for ensuring all CARs are entered into the PMOA CAR database.

3.2 Project Management Support Office (PMSO)

For PMSO-led reviews subject to the dollar thresholds established in DOE O 413.3 Current Version, the PMSO is responsible for the issuance of CARs and CIOs as warranted, as well as CAP review, monitoring, and final verification of the CAP closure. In accordance with PMOA's responsibility for maintaining a Central Repository of all EVMS Review documentation, the PMSO will provide copies of complete EVMS Review reports including CARs, CIOs, the contractor's CAP, and CAP closeout actions to PMOA. This SOP is encouraged for use by the PMSOs.

3.3 Federal Project Director (FPD)

After CARs and CIOs are issued and the contractor has responded with a CAP, DOE line management (i.e., the FPD/Site Office up through the PMSO) shares in communicating the expectations that the CAP process must be championed at the highest levels of the contractor's organization and leads to the identification of those activities that must be improved to attain / retain compliance.

3.4 Contractor

The contractor is responsible for the development and implementation of CAP procedures. This includes responding to the CARs by preparing a well-developed and achievable CAP, including elements identified in this SOP including root cause analysis, and Integrated Master Schedule (IMS), corrective actions to prevent re-occurrence, and identification of objective evidence to support PMOA final verification of CAP closure. The contractor is expected to address the CARs and formulate a CAP within a reasonable timeframe following issuance of DOE CARs.

3.5 Contracting Officer

The DOE CO coordinates with PMOA to understand the impact the issued CARs and CAP progress may have to achieving or maintaining EVMS certification. If the contractor fails to show reasonable progress toward CAP completion or should the nature of the CARs be so severe that certification achievement or previously achieved certification is at risk, the CO acts on contractual actions or remedies in accordance with the Business Systems Clause and in alignment with PMOA recommendations as the certifying authority.

3. EVMS CONTINUOUS IMPROVEMENT OPPORTUNITY (CIO) PROCESS

CIOs may be issued to identify areas for process improvement. These may include suggested best practices, lessons learned, or other efficiency or effectiveness measures to streamline processes. CIOs do not require a written response from the contractor and approval by the team; however, dialog is encouraged to share thoughts and plans pertaining to the recommended suggestions.

4. EVMS CORRECTIVE ACTION REQUEST (CAR) PROCESS

During the course of conducting EVMS Reviews, non-compliances will be documented via a CAR. The purpose of a CAR is to formally notify the contractor of deficiencies and non-compliances with the EIA-748. A deficiency is a system weakness confirmed as differences, inconsistencies, anomalies, disparities, conflicts, or unexplained variances between facts, figures, or claims. All CARs will be documented and tracked to closure. Verbal CARs are not acceptable. The CAR process applies whenever a discrepancy is identified, even if discovered outside of a formal surveillance.

5.1 Types of CARs

Two types of EVMS non-compliances are documented in CARs. The first is a *process* non-compliance, i.e., the contractor's EVM System Description and/or supporting procedures (the 'written word') do not comply with one of the 32 EIA-748 Guidelines. Corrective actions associated with instances of *process* non-compliances require changes to the contractor's EVM System Description. They do not require RCCA.

The second type of CAR is issued for implementation non-compliance, i.e., the contractor's EVM System Description and/or implementing procedures are not being followed in practice. It is not the responsibility of the Certifying Authority, i.e. PMOA or PMSO, to determine the root cause of the non-compliance. The contractor is responsible for the RCCA. Corrective actions associated with implementation issues could include process improvement due to lack of sufficient detail, insufficient training procedures, and lack of management oversight.

Variations are possible. A compliance problem identified could have both process and implementation aspects. If both types are present on the same CAR, then the contractor only needs to address the

implementation aspects. In contrast the reverse is true. The contractor may identify in the CAP additional process clarifications as part of their corrective action.

5.2 Documenting CARs

CARs must contain a succinct description of the non-compliance, relevant guideline number, and a quote from the DOE EVMS Interpretation Handbook explaining the impact of the non-compliance. For process issues, a quote from the EVM System Description containing the non-compliant verbiage for each guideline affected must be included as evidence. For implementation issues, a quote will be included from the EVM System Description describing the process not being properly implemented, where applicable and / or available, as there may be gaps where appropriate guidance is not provided within the contractor process documents. The EVMS CAR Template used by PMOA is available on the PMOA website.

Sufficient supporting data must be submitted with each CAR as exhibits, i.e. screenshots of data to substantiate the non-compliance, where available. Exhibits must provide easy to understand screenshots of the problem, include a title describing the exhibit, and an annotation of the area of interest by circles, arrows, or any other indicator to assure clear understanding of the non-compliance.
CARs should be as clear and specific as possible when describing problems affecting implementation issues involving EVMS compliance and should contain exhibits documenting the scope of the problem identified. The CAR narrative must tie issues back to the intent and the attributes of the related EIA-748 guideline. Finally, the CAR will contain an impact statement that addresses the affected EVMS area or process. PMOA's CAR/CIO template must be used as it forms the basis of the PMOA CAR database. The determination of materiality and pervasiveness as to the systemic nature of the non-compliance is generally not determined within the CAR, but rather determined at the guideline level and conveyed in the EVMS Review report. Global CARs may be written that identify materiality or systemic concerns and/or individual CARs may reference a materiality concern if warranted based upon the deficiency.

When practical the compliance team will provide the PMOA review team lead with their completed CARs, including exhibits, prior to concluding an on-site review. The PMOA review team lead will finalize the CARs and issue them with the EVMS Review report, in accordance with the timeframes established in the PMOA review cycle times established.

CARs will be written against one single guideline; however, a guideline could have multiple CARs. The compliance review team lead will exercise discretion to combine similar discrepancies into a single CAR with all relevant supporting documentation attached rather than generating new CARs for each deficiency. When there are several qualifying expectations line of inquiry (QE LOIs) from the EVMSIH for a guideline and the discrepancies cover different aspects of discrepancies, more than one CAR per guideline may be necessary to provide specificity for root cause analysis purposes. When similar deficiencies are combined, it will be clear in the CAR that such combination occurred so as not to lose sight of the breadth and depth of the deficiency.

Additionally the CAR may reference other related guidelines that were not met. There is always a fundamental guideline that is the root problem found, however many aspects of earned value affect other guidelines in unique situations. This is limited to single issues and typically single responses required.

During the on-site EVMS Review, similar issues over several CAM interviews may be recorded in separate draft CARs as the issues are identified and consequently combined subsequently after completion of all interviews. Likewise, CARs resulting from the data analysis can be combined when the analysis is completed. Combining similar discrepancies does not imply that the root causes are identical, but rather the attributes and evidence of the non-compliance is similar. Again, the CAR will contain sufficient detail to capture the depth and breadth of the deficiencies. It is the contractor's responsibility to identify all root causes for each CAR, whether part of the initial CAR or identified as part of the CAP and its supporting RCCA process. Said another way, the RCCA process may identify issues beyond those existing in the original documentation.

During the pre-visit desk-top assessment, system description and procedures review, data integrity, data analysis, and data traces may identify clear non-compliances or concerns that require follow up during the on-site review. Review team members should draft appropriate CARs in advance of the on-site review. When no on-site verification is necessary, the CARs may be considered final.

After the visit and prior to issuance of the EVMS Review report, PMOA may send the CARs to the contractor for a factual accuracy review. The factual accuracy review is not a discussion of content, interpretation, or agreement; only an opportunity for the contractor to provide comments regarding

misstatements of factual data. This is typically limited to attachments relative to the CAR, statement of discussions, or other statements of facts. Final CARs are typically issued to the contractor with the EVMS Review report. The PMOA review team lead makes the distribution of the CARs and CIOs to the contractor, FPD, PMSO, and surveillance team.

6. CORRECTIVE ACTION PLAN (CAP) PROCESS

6.1 Corrective Action Plan (CAP) Content

The CAP process is owned by the contractor and must be fully documented in the EVMS procedures, using a disciplined, standardized approach for responding to CARs. This section describes the content of the CAP as it relates to CARs; corrective actions associated with performance variances are discussed in the next section.

The key components of the CAP include

- Problem Details
- Root Cause Analysis
- Contributing Factors
- Corrective Action Approach
- Corrective Action Plan Deliverables (proposed exit criteria)
- IMS (relating to CAP development and implementation)

Changes caused by corrective actions, such as re-planning or changes to the estimate at completion (EAC), must be documented within the EVMS and cross referenced in the CAP.

Generally, the expectation is that PMOA and the contractor work together in the creation and evaluation of the CAP. This avoids the “bring me a rock” syndrome as both are part of the solution. As the contractor proceeds with the CAP development, the PMOA surveillance team will provide an evaluation and comments to ensure all elements have been satisfactorily addressed. This is an iterative process. Some corrective actions may be straight forward responses to simple findings, others may be more complex. Either way it is important to reach a mutual agreement of the CAP approach. PMOA must also be clear on the artifacts and data set that will be delivered to support the verification process as well as the timing.

The establishment of the CAP with the concomitant entrance and exit criteria represents the initial understanding of the items that led to the documented non-conformances. As the non-conformance is decomposed into its constituent parts greater understanding of its drivers may be revealed and identified, in fact the breadth and depth of the non-compliance may reach to areas not identified within the documented deficiency. It is this natural revisiting of the deficiency, the iterative nature of the process, the mapping of its effects during the CAP process that will drive the CAP itself to be revised to capture these new insights and document their particular entrance and exit criteria. When reviewing the contractor's procedures for the CAP process and when engaging in the review and approval of the CAP, the following are basic steps that should be addressed and implemented:

(1) **Initial Post CAR Discussions**

Prior to developing a corrective action in response to a CAR, the first step is to ensure that both the contractor and the DOE review team have a mutual understanding of the non-compliance. PMOA will offer assistance, either via telecom or visit, to facilitate understanding. Well-written CARs with sufficient exhibits of non-compliances provide clarity and minimize these discussions. The intent is not to engage in a debate or to imply consensus is a requirement, but rather to ensure the contractor understands the context of the non-compliance in order to focus their efforts to identify root cause and appropriate corrective action. If the contractor believes a CAR to be an error, then it is incumbent upon that contractor to respond to the PMOA review team lead in writing or to bring additional artifacts and/or relevant facts for discussion.

(2) **Organize for successful CAP management**

Once a mutual understanding has been reached on the non-compliances, the contractor proceeds by assigning responsibility for the CAP effort. It is critical that the process of corrective action has the support at the highest levels of the organization. The role of senior management is not to "steer" the process but rather to facilitate dialogue, provide resources as required, remove road blocks and champion the CAP process and attainment / re-attainment of the Earned Value Management System and its importance to the organization. Each organization may decide the manner in which best fits its management style to facilitate the CAP to success. Regardless of the method the following concepts should be embedded into the process:

- Ensure a CAP is developed and supported by a structured CAR resolution process;

- Assign an individual from the responsible organization to lead the corrective action efforts;
- Review the proposed schedule for the CAP, and monitor progress towards CAP closure;
- Review and approve all CAR root cause assessments and proposed corrective action including the closure criteria;
- Serve as the primary point of contact with the PMOA for CAR resolution and closure.

(3) **Thorough RCA**

Root cause analysis has been an identified weakness across DOE contractors. A temptation at this stage may be to identify a quick fix for the immediate issue. This may be acceptable for findings such as typos, formula errors, incorrect data runs, etc.; however, often findings require a more in-depth approach to ensure that the underlying drivers, i.e. the process inadequacies, of the issue are being addressed. Another tempting reason often used is 'lack of training'; training is not considered a root cause but it may be part of the corrective actions. Further, it is important to remember that the approach to root cause analysis must be from the EVMS perspective, not from the project or example contained in the exhibit. The focus needs to be on what in the system allowed this incident to happen, that is what process(es) were insufficient, did not exist, or what 'escape mechanisms' exist that contributed to departure from sufficiently written and support processes.

PMOA's review of the CAP, its development, including the RCA process, and an understanding of the contractor's proposed path toward compliance provide the framework from which a collaborative environment is critically important to provide a platform for success. The contractor must demonstrate they are following a process driven approach and conducting a gap analysis. Tools such as "The 5 Whys" and the Ishikawa Fishbone Diagram are common methods for identifying the root causes. These tools and processes are extremely effective in uncovering the sources of the problem. For more complex issues, the contractor may need to engage in more sophisticated methods of root cause analysis. Most organizations have employees who are specialized in root cause analysis, such as Six Sigma, Lean process improvement, and ISO (International Organization of Standards) 9000 trained advisors.

Root cause analysis is the identification of people, process, and tools that if fixed would prohibit the error from reoccurring. This is the opposite of just fixing the error. For example inadequate root causes:

- Incorporation of an OBS was excluded in XXX's EVMS graded approach approved by DOE.
- CAM did not identify the issues
- The root cause for this CAR is that CAM information presented to PMOA was not easily understood.

The common themes in the above examples are blaming the data, people, or how the review was conducted. Better examples, if justified in the RCCA process and tools, include:

- The root cause of this CAR is that Program Controls considered the variances introduced by level planning these work packages to be insignificant and therefore did not enforce consistent planning with the fiscal calendar.
- Inadequate formal review of the EAC occurred on a regular basis. Tools were not use to trigger mandatory EAC reviews. PM and CAMS were unaware of the significant roles they play in the EAC process.
- Inadequate and informed review of the IMS baseline, failure to use and understand common schedule health metrics, the lack of routine and systemic monthly schedule reviews. Lack of PM driving the schedule quality.

Common themes notes in the better examples indicate that when the problem is addressed in more detail, and if fixed, would prevent error reoccur. All elements are considered, i.e. people, processes, and tools.

The intent of the adequate root cause is to address the proper corrective action and be able to eliminate the problem from reoccurrence. A weak root cause process will not drive adequate root cause identification and lead to future compliance failures. It is much less expensive to fix a problem once than to spend a lot on corrective action only to find failure. Many examples of experience can be found on the internet from FAA, NASA, and other agencies. For example, successful root cause and corrective action is largely credited for the success at FAA to reduce the frequency of accidents from the 1970's to current state. (www.brighthubpm.com/risk management/123244-how-has-the-root-cause analysis-evolved-since-inception)

The RCCA process is more than just initial identification. If the RCCA stops there, repeat failures are inevitable. Effective RCA is identified as being formal and closed loop; that is the process and methodologies, to include support tools as identified above, are defined and utilized, and the process is

monitored through time. It is the resampling or revisiting of the RCCA through time, generally at plus one (1), plus three (3), plus six(6) and plus twelve (12) months from implementation of the "root cause" fix. While the times provided are notional, key is a defined process to resample through time and then declare the RCCA closed and effective.

It is often the case that when a more thorough root cause analysis is conducted by the contractor team, they may uncover additional issues that need to be addressed and corrected. The contractor's obligation to DOE is to provide full visibility regarding the corrective actions associated with those findings identified in the CARs.

Basically the contractor's focus in RCA is to determine what happened and why it happened. The supporting steps may include but are not limited to:

- Identify the specific problem(s)/issue(s) to be analyzed
- Select RCA trained individual(s) to perform the analysis
- Identify the RCA method/tool/approach
- Identify the contributing factors
- Identify the root cause(s)
- Document analysis results (maintain all working papers)
- Fact check the results
- Distribute draft results for review to all impacted parties
- Finalize the RCA with any appropriate review edits and use as the basis for the CAP development
- Establish, modify, and revise, as required, the contractor's tool set that identifies, stores, controls, analyzes and documents the CAR process. Particular attention should be paid to how CARs are identified, that is "racked and stacked" to particular drivers and those "high bar" drivers are worked prior to becoming a systemic failure.

(4) **Develop / evaluate the Corrective Action Plan**

This step is iterative as it may evolve as actions are taken. Therefore, PMOA will coordinate with the contractor as necessary to provide feedback along the way. This is not a one-step approval but rather a coordinated effort.

Contractor considerations in developing the CAP include several elements. For example, a single CAR may have numerous corrective actions identified in the solution process. Often a single problem may have corrective actions that necessitate changes in processes, training, tools, or management approach, or any combination of these. Regardless, it is important to identify corrective actions that will prevent recurrence of similar outcomes, and will not cause or introduce other new or additional problems. In instances where the deficiency is identified to a particular project, the contractor is required to identify how the non-compliance has been mapped across the entire portfolio to ensure that the remedy is not specific to a particular project but that the "cure" has been applied across the site.

One important benefit when the contractor includes senior management embedded within the CAP process is the capability to reach beyond the owners of a particular CAP to influence other stakeholders in the organization who have the responsibility to incorporate corrective actions or who may be impacted by the solutions being identified. This is a key concept -- the role of management is not to be engaged in the process, or to create "steering" committees. Management serves one and only one role and that is to provide all required resources necessary to produce a successful outcome.

It is important to remember that a CAR is against the EVMS – not necessarily against one project or control account. Therefore the corrective action needs to consider not just correcting the issue but preventing it from happening again for this is the essence and definition of the RCCA. Repeat findings over time and across differing components of the contractors EVMS indicate a deficient RCAA process, implementation and ownership.

Components of the contractor's CAP should include:

- Root Cause Analysis
- Contributing Factors
- Corrective Action Approach
- Corrective Action Plan Deliverables (proposed exit criteria)
- IMS

In addition to items mentioned previously, the contractor's CAP should also address:

- Ownership assigned, i.e. who is responsible for what
- Establish and track dates for CAP actions
- Identify repeat or similar non-compliances by reviewing internal CAR databases (including internal, local FPD, or DOE PMOA findings) to identify if non-compliance is a first or repeat (2^{nd}, 3^{rd}, etc.) finding. Repeat findings indicate ineffective controls, processes, corrective actions, and monitoring.
- Both the root cause analysis and the corrective actions are assigned tracking numbers from their respective systems. This ties the CAR to the root cause / corrective action along with all relevant documents; for example an Ishikawa Fishbone Diagram, 5 Why's, Six Sigma, etc.
- The contributing / causal factors need to be clearly identified with sufficient detail to understand what led to the root cause.

Refer to Figure 1 for a sample CAP. While the actual format of the CAP is up to the contractor, this sample is provided as a good model to ensure completeness of the critical elements of the CAP.
Said a different way the root cause is the substance of the problem identified in the original CAR and the corrective action is the proof that the root cause has been addressed so it can never reasonably reoccur.

After evaluation, PMOA will provide feedback to the contractor to communicate any areas of concern in the CAP development.

(5) **Develop / evaluate verification closure steps**

The contractor develops and the DOE PMOA review team lead will evaluate the CAP for the following areas relating to CAP verification closure actions. It is critical that verification methods, objective measures, metrics, artifacts, and evidential products are identified that will verify that the corrective actions are effective. This includes any exit criteria for any activities in the CAP Integrated Master Schedule (IMS) that are critical to CAP success. On data driven findings, the criteria for verification often involves producing several accounting periods of results as evidence that the corrective actions were effective. In these cases, trending the data will provide evidence that corrective actions have targeted the root cause, are effective, and are producing improving results. The contractor is responsible for reviewing the status of the exit criteria, and verifying that the required objective measures have been satisfied prior to notification to PMOA.

One topic that must be addressed with the contractor is a cutoff date for data corrections. It is important to identify the time frame in which improving results are identified. The analysis of the data will then provide that trending that indicates where the non-compliance existed; that is where corrective actions were initiated to "turn" the trend and most importantly where the deficiency was removed. The review team will then analyze the results of the data, interviews with CAMs and review of documentation to ensure that "old" deficiencies, those to the right of the implementation date, are not re-identified as a new compliance in future reviews or surveillance.

(6) **Develop / evaluate a detailed Integrated Master Schedule (IMS) for CAP implementation**

A critical component of any project, including corrective action development and implementation, is a method to establish and document the plan. Typically this would be accomplished within a detailed IMS containing the scope and the required dates of completion. The contractor should identify a unique IMS for each CAP that includes: 1) Root Cause Analysis; 2) Changes to processes, tools, training, and other required system adjustments; 3) Management Review and regular team meetings; 4) Responsibility assignment for each activity; 4) Development of products and artifacts which will demonstrate effectiveness; and 5) Validation and Verification steps with Closure Criteria. The PMOA issued CAR provides the initial entrance criteria; the contractor's CAP and IMS should provide the exit or closure criteria. One deviation would be where, as part of the RCCA, the contractor review team in executing the process identifies the breadth of the issue permeates into areas not identified by the review team and/or not part of the original CAR. In these cases the CAP is expanded and formally revised to document the additional time and steps needed. Increases and scope may push closure of the CAP to right so it is important to capture, document, and forecast effects within the IMS.

Resource loading the IMS is an important process, as it communicates to the management team the required personnel to accomplish implementation of the Corrective Action Plans, and can serve as a commitment on its part to support the process until closure. The concept here is that resource assignments should be made and documented to provide clear ownership of responsibility and performance. The contractor may choose several methods to accomplish. If there is a lack of available resources available to support the process, this may impact the completion dates established for the corrective actions. All tasks should be logically networked (with predecessors and successors) without

any constraints. Progress should be clear and without subjective interpretation. As mentioned above, data validation normally requires several months of data submittals, and these deliveries should be milestones in the IMS driven by the requisite fixes. Completion milestones should include notifying DOE of corrective action implementation and confirmation by the PMOA review team lead that the implementation is complete. Each activity should also have fields which identify the CAR number, the EV Process Area and Guideline, the responsible manager for the CAP, and a unique ID number for each task. Data driven CARs will be validated through testing of the system.

PMOA will evaluate the IMS and provide feedback as necessary.

(7) **Implement Corrective Action Plan and track progress to successful completion**

PMOA will monitor the progress made against the approved CAP via regularly scheduled conference calls and/or on-site working group meetings, data sampling, etc. The contractor will track progress through the IMS. Many organizations discover that the actual implementation of the approved corrective actions is the most difficult part of the process. Sometimes a successful plan will include interim modifications or fixes in the short term, with long term changes identified as well. It is important to have CAP solutions that not only resolve the findings, but also can also be implemented in an acceptable period of time. It is also important that the contractor meets interim commitments of data, processes, or any agreed to delivery of an artifact. If the execution of a CAP will be delayed for any reason, the contractor should communicate this quickly to PMOA and is part of the statusing of the CAP IMS.

A key component in determining completion is the understanding that CAM knowledge or technological improvements may progress at different rates. It is important to measure success with both components in sync and in support of each other. In many cases one component may outpace the other, the contractor team may feel they are ready for the review only to find out that CAM knowledge and the supporting data are not in phase.

(8) **CAR closure and follow-up**

All corrective actions must be verified through follow up actions. The PMOA review team lead will plan, schedule, and approve all verification follow up actions and closure of CARs. Verification of corrective action is based on the following:

- Inspection of supporting documentation and/or on-site visual inspection of corrective actions
- Compliance of the corrective action in satisfying the guideline(s)

As part of the CAP verification, the surveillance team documents the CAR closure criteria. The closure criteria should contain those actions required to be successfully accomplish CAR closure. The PMOA review team lead is responsible for ensuring that the closure criteria are verified and a mutual understanding has been reached. As part of closure criteria verification, the team should consider the following:

- Is the guideline being met?
- How is this different from when the guideline was not being met?
- Are internal controls in place to prevent guideline non-compliance from recurring?
- Does this CAR affect the contractor being compliant with other guidelines?
- Are other projects affected by the CAR? If so, will they be compliant with the guidelines?
- If applicable, have fixes been implemented beyond a particular project
- Is the contractor performing analysis from within its RCCA tools to prevent and/or mitigate future non-compliance issues

If the PMOA review team lead determines that verification is not necessary, then the surveillance team documents the status of the closure verification. If the verification follow-up results in continued non-compliance or new deficiencies outside of the defined CAP, then the PMOA review team lead will make a determination as to the effectiveness of CAP closure and completion, and recommend other courses of action which may include immediate certification withdrawal.

When PMOA is satisfied that the contractor's corrective actions are appropriate to prevent recurrence of the non-compliance, and the solutions have been verified to be effective, the PMOA review team lead will notify the contractor that the CAR is considered closed. Even after closure, the areas identified as needing improvement are often targeted for periodic follow-on reviews; so it is important that management attention is maintained to sustain the corrective action. A well organized and disciplined internal surveillance program is often the best safeguard against future discrepancy reports. It is the expectation of future government review teams that contractor monitoring, particularly the RCCA closed loop piece, is being performed and will be demonstrated as part of future reviews and / or

surveillance. Demonstration will include the contractor's internal identification of deficiencies and working those "high bar" drivers to process fixes.

DOE's closure of a CAR may be done remotely or on-site, depending on the nature of the verification.

6.2 Corrective Action Plan (CAP) Sample

The contractor will identify a format of the CAP in their procedures. Provided in Figure 1 for sample purposes is a well-formatted CAP that includes necessary elements to fully meet the intent of the corrective action process. This format is considered a best practice by DOE PMOA.

Corrective Action Plan			
Team	Revisions and Data Maintenance	**Problem Source References**	
Problem Number	CAR047 –Changes to the PMB Do Not Reconcile Between the CPR, CBB/MR and UB Logs (GL 32)	**Related PMOA CAR #s**	
Problem Area	Change Incorporation	**Self-Assessment Finding #**	
Problem Details	Two baselines are being maintained through the Contract Budget Baseline (CBB) Log and neither one of them reconciles to the PMB in the Contract Performance Report (CPR). The August CBB Log shows two baselines are maintained separately, one ties to budgets as approved in BCRs and the other is what was implemented in Cobra from the BCRs, and it is called Cobra PMB (Exhibit 1). Neither one of the PMBs in the CBB Log ties to the PMB in the CPR (Exhibit 2). The Cobra baseline shows a PMB of $194,847K while the other baseline in the CBB log, which ties to BCRs, shows $194,539K. The CPR reports a PMB of $194,466K. Furthermore, the Total Allocated Budget in the CBB Log is higher than the August 2012 CPR CBB by $57K. The CBB Log also shows two different MR values as of month end August and these values do not match the reported MR in the CPR. The log shows a MR balance of $6,575K and this balance is tied to the BCRs, while the Cobra MR shows a balance of $4,321K (Exhibit 1). Neither of the MR values in the CBB Log ties to the August 2012 CPR MR of $6,591K. The MR Log (Exhibit 3) shows a balance of $6,591K which matched the CPR MR only after the incorporation of BCR "TBD". This BCR "TBD" has not been assigned a number and it is not recorded in the CBB Log. The CBB Log shows UB of -$10,561 while the CPR (Exhibit 2) and UB Log (Exhibit 4) show -$121K. Because budget must be tied to scope, there can never be negative UB. The CBB Log documents Authorized Unpriced Work (AUW) of $46,710 and a Negotiated Cost Value of $200,809K. These values are not traceable to the August 2012 CPR Block 5c and 5b which shows $0 for AUW and $201,057K. The Log shows Contract Budget Base of $200,856K. (Exhibit 1). This does not reconcile to the CPR CBB of $201,057K. (Exhibit 2).	**Guideline Trace Step #**	
		Other	

Problem Number	CAR047 –Changes to the PMB Do Not Reconcile Between the CPR, CBB/MR and UB Logs (GL 32)			
Phase 1: Root Cause Analysis		**Phase 2: Proposed Corrective Action Approach (CAP 5.6)**		
RC #	**Root Cause Identification**	**Contributing Factors**	**Corrective Action (CA) Approach**	**Corrective Action Plan (CAP) Deliverables**

Problem Number	CAR047 –Changes to the PMB Do Not Reconcile Between the CPR, CBB/MR and UB Logs (GL 32)				
Phase 1: Root Cause Analysis		**Phase 2: Proposed Corrective Action Approach (CAP 5.6)**			
RC #	**Root Cause Identification**	**Contributing Factors**		**Corrective Action (CA) Approach**	**Corrective Action Plan (CAP) Deliverables**
1.	Gaps in COMPANY X's processes as well as errors in the manual updating of the Excel-based Contract Budget File result in inconsistencies and errors in the data. Note: The manual, Excel-based Contract Budget File was submitted to PMOA as the CBB in the data call.	**X**	**Process**	(1) Revise COMPANY X's processes and Work Instructions that involve the Contract Budget Base and associated logs. The process revisions include • Steps to reconcile the BCR values to the Contract Budget File and Cobra log in a timely manner. • The steps to revise/correct the data when differences occur. • Analyzing the benefits of replacing the manual Contract Budget File with the Project Audit log report after conversion to Cobra 5.1. (2) Summarize the revised processes related to the EVM logs in the EVM Processing Work Instructions, then revise the applicable EVM System Description sections.	(1) Revised the EVM Processing Work Instructions related to the EVM logs, then revise the applicable EVM System Description sections. (2) Updated EVM System Description sections related to the revised EVM Log Work Instructions. (3) Automate the process to incorporate all logs into a database that eliminates human mistakes and automatically reconciles all budget values from the work package to total contract
			Data		
			Leadership		
		X	**Training**	(4) Update the EVM Log training materials. (5) Conduct EVM Log training for Cost Analysts.	(3) Updated EVM Log training Materials. (4) EVM Log Training for Cost Analysts.
			Other		
			Evidence that Problem is Resolved	(5) Review and reconcile three months of BCRs to EVM logs.	(6) Submit three months of evidence showing that BCRs are visible in the EVM logs.
			Surveillance to Ensure Problem does not Recur	(7) Review and revise, if necessary, COMPANY X's EVM System Surveillance Work Instruction (611-117-01) to ensure an audit of the BCR to EVM log reconciliation process.	(6) Update the EVM Surveillance Work Instruction to include an audit, ensure an audit of the BCR to EVM log reconciliation process.
			Implementation Strategy	(7) Implement on all SHIP Programs	(7) SHIP 5 Implementation Complete (8) SHIP 7 Implementation

Figure 1 Corrective Action Plan Sample Format

7. VARIANCE ANALYSIS AND CORRECTIVE ACTION

A requirement of the Analysis section of the EIA-748 guidelines 22 through 27 includes the identification of variances, managerial actions to monitor and implement corrective actions, and to adjust the Estimate at

Completion (EAC) when necessary. The essence of performance measurement is the establishment and implementation of a baselined plan and then measuring cost and schedule performance against that plan is to identify variances. With this information, early course corrections can be made to minimize the impact to stay on track in terms of cost and schedule. This information also provides the necessary insight for predicting a reasonable and accurate EAC. Variances are identified both in terms of current period and cumulative to date and updated as part of the EAC process

Thresholds are identified either contractually or via the approved contractor procedures and are reportable to the Government when the threshold is breached. What is important here is that visibility exists that provide indication of a pending breach. Typically internal thresholds below those reported to the government are identified and managed to, however, other methods are also available and at the contractors discretion. Written procedures must require formal variance analysis for those variances from the "plan" that exceed established cost and schedule variance thresholds at the cost account and other appropriate levels. Thresholds should be established at several levels since it is also possible for small variances that exist at the cost account level to have a significant effect on higher level Work Breakdown Structure (WBS)/Organizational Breakdown Structure (OBS) elements, contract milestones, cost goals, or technical parameters. Significant variances at the higher levels must also be isolated and analyzed. As noted above, often contractors have internal thresholds set tighter than the reporting thresholds to identify variances that may be corrected before they breach the external threshold.

Variance analysis is not only a component of EVMS Reviews, but as stated in DOE PMOA's EPASOP, analysis of variances is a PMOA Project Analyst's responsibility when conducting monthly project analysis. Several PARS II reports are available to assist the Project Analyst in identification and significance of variances. The Project Analyst should then ensure that the contractor has submitted VARs for those that exceed the agreed upon reporting thresholds. In addition, the contractor's procedures must clearly document the VAR process.

VAR content must include the following items at a minimum. Figure 2 is a sample VAR format.

- **Current and Cumulative Cost, Schedule, and VAC information:** The header including the current and cumulative EV data identifying the variances in terms of cost, schedule, and variance at completion. Typically the VARs are auto-generated from the contractor's EVMS tools with the

header completed as a notification to the Control Account Manager (CAM) that a VAR must be completed.

- **Problem Analysis:** This section includes the CAM's root cause analysis to identify the cause or causes of the current/cumulative cost/schedule variances and variance at completion.
- **Impact**: In this section the CAM identifies how the problem is impacting not only this Control Account but also the impact on other Control Accounts, the critical path, and the estimate to complete.
- **Corrective Action Plan:** When proper root cause analysis is conducted, corrective actions can be identified to remedy the problem, minimize the impact, prevent it from reoccurrence, etc. Prevention may include updates to procedures. Corrective actions should be documented, normally in a corrective action log, and managed through completion. At the project and EVM system level, repeat root causes should be carefully identified in order to develop a corrective action that does not repeat past actions and indeed addresses the root cause(s) so it will not happen again. Again, the identification of repeat failures is an indication of a non-compliant RCCA. The corrective action plan must include the WBS, the description, date identified, person assigned for implementation and verification, status, status date, and closure date. The Corrective Action Log should be statused at least monthly. The contractor must have, and follow, procedures for monitoring corrective action plans from their inception until they are closed-out. Corrective action plans reflect the existence of a variance considered significant by management. They must be monitored closely and given additional management visibility and attention until resolved so as to not further jeopardize the success of the project.
- **Estimate at Completion Justification**: This section is where the CAM, based on the problem and impact, identifies if an increase in the Estimate to Complete is necessary, and if not, why not. This step relates to the contractor's Estimate at Completion change process as identified in their EVM System Description. That process needs to tie any changes in the EAC to the increase required based on the problem statement and to the work authorized as supported by the basis of estimate (BOE) for the baseline for the remaining scope and as compared to those original assumptions that identified the BOEs and as well as their particular Elements of Cost (EOC) that formulated the time phased plan and associated budgets.
- **Approvals:** Approvals are required in accordance with the contractor's EVMS, typically the signature/date of the CAM and the signature/date of the Project Manager.

WBS:						Manager:	
Desc:						Charge #:	
(EAC = Actuals + ETC)							
BURDEN	BCWS	BCWP	ACWP	SCHED-VAR	%	COST-VAR	%
Mon Hours							
Cum Hours							
Mon Dollars							
Cum Dollars							
BAC Hours		EAC Hours			VAC:		
BAC Dollars		EAC Dollars			VAC:		
PROBLEM ANALYSIS:							
Overview of Work Scope							
Cum SV:							
Cum CV:							
VAC:							
TASK/PROJECT IMPACT:							
Cum SV:							
Cum CV:							
VAC:							
CORRECTIVE ACTION PLAN:							
ESTIMATE AT COMPLETION IMPACT:							
YES	NO	WHY?					
Preparer:		Dept:		Initials:		Date:	
Approval:		Dept:		Initials:		Date:	

Figure 2 Variance Analysis Report Sample Format

Attachments include supporting documents such as logs and IMS screenshots.

Assessment of the variances, corrective action plans, and estimate at completions submitted by the contractor for reasonableness and identification of project concerns will assist PMOA in preparation of the narrative for the PARS II Project Monthly Assessment.

8. EVMS CORRECTIVE ACTION DOCUMENTATION

8.1 EVMS Review Documentation

PMOA will retain copies of the information pertinent to the EVMS Review including but not limited to CARs with exhibits, CIOs, and the CAP analysis, approval, and closeout documentation.

8.2 CAR/CIO Database

The DOE EVMS CAR/CIO Database provides a repository of data useful in providing historical information and identifying emerging areas of concern. The PMOA review team lead ensures CARs are documented and their status updated in the CAR/CIO database. Information tracked via the database includes affected guideline, process area, problem, author, reviewer, contractor, project, date, type of surveillance, and whether it is a CAR or CIO.

9. ADDITIONAL RESOURCES

Electronic Industries Alliance (EIA) 748 (latest version)

DOE Project Management, Oversight, and Assessment Earned Value Management website. http://energy.gov/management/office-management/operational-management/project-management/earned-value-management

DOE, *Program and Project Management for the Acquisition of Capital Assets*, DOE O 413.3B (or Current Version), Washington, DC: 11-29-2010.

DOE Guide 413.3-10A, *Earned Value Management Systems*

DOE Guide 413.3-20, *Change Control Management*

DOE PMOA, *EVMS Compliance Review Standard Operating Procedure* (ECSOP)

DOE PMOA, *EVMS Project Analysis Standard Operating Procedure* (EPASOP)

DOE PMOA, *EVMS Surveillance Standard Operating Procedure* (ESSOP)

Federal Acquisition Regulations 34.2 and 52.234, Earned Value Management Systems

OMB Circular A-11, Part 7, *Capital Programming Guide*

10. ACRONYM S

CAM	Control Account Manager
CAP	Corrective Action Plan or Control Account Plan, depending on context
CAR	Corrective Action Request
CIO	Continuous Improvement Opportunity
CO	Contracting Officer
CPR	Contract Performance Report
DMAIC	Define, Measure, Analyze, Improve, Control
DOD	Department of Defense
DOE	Department of Energy
EAC	Estimate at Completion
ECSOP	EVMS Compliance Standard Operating Procedure
EFCOG	Energy Facility Contractor's Group
EIA	Electronics Industries Alliance
EPASOP	EVMS Project Analysis Standard Operating Procedure
ESSOP	EVMS Surveillance Standard Operating Procedure
ETC	Estimate to Complete
EV	Earned Value
EVMS	Earned Value Management System
EVMSIH	EVMS Interpretation Handbook
FAA	Federal Aviation Administration
FAR	Federal Acquisition Regulations
FPD	Federal Project Director
GAO	Government Accountability Office
QE LOI	Qualifying Expectation Lines of Inquiry
GLE	Guideline Evaluation
ISO	International Organization of Standards

NASA	National Aeronautics and Space Administration
NDIA	National Defense Industry Association
OMB	Office of Management and Budget
PARS II	Project Assessment and Reporting System II
PDCA	Plan, Do, Check, Act
PMCDP	Project Management Career Development Program
PMOA	Project Management, Oversight, and Assessment (PM-1)
PMSO	Project Management Support Office
RCA	Root Cause Analysis
RCCA	Root Cause / Corrective Action
SOP	Standard Operating Procedure
TPC	Total Project Cost
VAR	Variance Analysis Report
WBS	Work Breakdown Structure

11. TEMPLATES

Additional guidance and templates referred to or supporting this SOP are available at:

http://energy.gov/management/office-management/operational-management/project-management/earned-value-management.

Note: Templates on the website may be added, deleted, or updated based on need.

CAR/CIO Template

CAP (Sample only; contractor versions may vary)

Guideline Evaluation (GLE) Templates

12. DOE PMOA ARTICLES

Provided as additional reference materials are two articles written for DOE's Project Management Career Development Program (PMCDP), available on DOE's intranet via https://powerpedia.energy.gov/wiki/Acquisition and Project Management Newsletters. Due to the particular relevance to this SOP, they are provided below.

12.1 Continuous Process Improvement: The Relationship to EVMS, Part 1: The Basics

Tom Bruder, PE, PMP, CCP, Project Systems Division, MA-632, and
Karen Urschel, EVP, H&A contract support to Project Systems Division, MA-632

Continuous improvement of a contractor's Earned Value Management System (EVMS) is a basic tenet of demonstrating that a system is compliant and maintained compliant with EIA-748. Unfortunately, since many of the Corrective Action Requests (CAR) issued by the Office of Acquisition and Project Management or via contractor internal surveillance continue to be repeats of earlier issues, and since many Corrective Action Plans are deficient in identifying and addressing root causes, this appears to be an indicator that the process of continuous improvement and root cause analysis is not being effectively implemented within the EVMS realm.

Given this apparent deficiency, it seems prudent to address both the root cause analysis and the continuous improvement process in relation to EVMS CARs, CAPs, and contractor internal surveillance in a series of Newsletter articles. So that all readers have a common basis of understanding, this article, which is the first in a series, will discuss the basics of root cause analysis and continuous process improvement.

In its basic concept, continuous process improvement is an ongoing process. We solve problems and improve processes that affect our lives nearly every day- often without giving it a second thought. For example, if we were to plot over time your arrival time at work each day, we would see it varies. That is because the process of your getting to work each day has variation built into it. When the variation becomes too great or your arrival time is not acceptable, you subconsciously invoke process improvement. You immediately begin to assess the situation and determine what is causing you to arrive late and what you can do to eliminate the cause or causes to ensure your arrival time is acceptable. You determine if the tardiness was the result of a special cause (an accident) or common cause (a new traffic pattern). How you eliminate each type of variation is different.

Continuous process improvement taken to a higher level, while not rocket science, is a process science. There is structure to the process and methodologies directly applicable to process improvement. Because this effort is continuous, is a process unto itself, and follows specific steps, documentation is key. The process used to improve a process must be well documented, repeatable, and capable of producing a consistent predictable output just like the process it is trying to improve.

Continuous process improvement can be done with functioning business processes and systems to produce higher quality, efficiency, etc., via a continuous process improvement model. Two of the more familiar models are the Shewhart cycle of Plan-Do-Check-Act (PDCA) and the Define, Measure, Analyze, Improve, Control, (DMAIC).

In the case of system compliance and assessments, the model employed must focus on improvement from the point of an identified problem or failure of the system to comply with the EIA-748 Guidelines. The process improvement technique that works well in this situation is the Root Cause Analysis Process. This technique forces the users to avoid the common trap of finding the quick fix, which inevitably only fixes the symptom. The problem will likely reoccur down the road. Instead, the focus is on the determining what happened, why it happened, and how to reduce the likelihood that it will happen again. The focus is on the underlying systems and processes, not just what is on the surface.

There are usually three basic types of causes that will be found:

1. Physical causes – Tangible, material items failed in some way (e.g. software failure).
2. Human causes – People did not follow the process or made a mistake.
3. Organizational causes – A system, process, or procedure is faulty.

The Root Cause Analysis Process consists of five identifiable steps.

Step One: Define the Problem
Step Two: Collect Data
Step Three: Identify Possible Causal Factors
Step Four: Identify the Root Cause(s)
Step Five: Recommend and Implement Solutions

12.2 Continuous Process Improvement: The Relationship to EVMS, Part 2: The Mechanics of Root Cause Analysis and Corrective Action Plan (CAP) Development

Mike Beattie, Deputy Chief, Project Systems Division, MA-632, and
Karen Urschel, EVP, H&A contract support to Project Systems Division, MA-632

Last month we provided some basic information about the relationship of EVMS and continuous process improvement. This month we will elaborate on expectations and details when applying the 5 Step Root Cause Corrective Action (RCCA) approach to focus on improvement from the point of an identified problem or failure of the EVMS through development of the Corrective Action Plan.

The contractor is expected to have a formal, documented process for conducting RCCA. A RCCA process would include supporting databases from which pro-active analysis occurs, not just reactive as in the case of CARs generated during an EVMS Review. Identification of a repeat issue that was previously addressed is an indication of a failure within the system. There must be a feedback loop that is time based, so that at predefined periods a review of the RCCA is conducted to look for the existence of casual factors that contributed to the root cause. These are indications that the problem was not corrected or that it may be farther reaching than the analysis identified, again a system failure.

A suggested approach mentioned in the previous article is the 5 Step RCCA. Step 1 is to define the problem. To assist in understanding the five step approach, a scenario is provided with the problem statement “The EAC is Unrealistic”. This could have been identified by the contractor or the Government via monthly EVMS data analysis.

Step 2 is the collection of data to provide a basis for the problem identified in step 1. The focus is on proving a problem exists, and if so, determination of how long it has existed and an assessment of the impact of the problem. In our example, analysis of the PARS II reports may provide evidence that a problem exists. The first check should be to determine if there are data integrity errors, such as an EAC greater than the actual cost of work performed (ACWP) yet there is no Estimate to Complete (ETC) in the forecast or an EAC less than the cumulative ACWP. A review of the EAC best case, worst case, and most likely EAC formulas will show if the bottom up EAC prepared by the Control Account Manager is within the thresholds. A review of the Cost Performance Index (CPI) compared to the To Complete Performance Index (TCPI) based on the CAM’s EAC will indicate whether the EAC is realistic. A review of the data will identify how long the problem has existed and by drilling down, the source(s) of the problem can be identified along with its impact on the overall problem.

Step 3 is the identification of causal factors such as:

What sequence of events leads to the problem?
What conditions allow the problem to occur?
What other problems surround the occurrence of the central problem?

Identification of the cause or causes is critically important. Often the instinct is to identify the most obvious cause and focus on it; however, it is important to identify all causes because together, they can have a cumulative serious impact. Commonly used tools that can be used to identify causal factors include:

- Cause and Effect Diagram: used to identify all of the possible causes of the effect, i.e. the problem
- 5 Whys: a method of asking 'Why?' until you come to the root of the problem
- DMAIC (*Define, Measure, Analyze, Improve and Control:* a data-driven improvement cycle used for improving, optimizing and stabilizing business processes and designs.

In our example, there could be a variety of issues such as:

- Training or Discipline Issue, i.e. root cause ties to a failure of the process to adequately train and/or manage personnel
- Failure of the Processes, i.e. CAM followed the process for a legitimate update of the ETC; however, the update was not approved or it was approved but not updated in the system
- Failure of the System; i.e. errors in the data generated which caused false indicators

Step 4 is the identification of the root cause(s). From the causal factors identified in step 3, determine why the causal factor exists and identify the roots of each factor. Look for causes that appear repeatedly, identify sources of variation, use collected data that substantiates a potential root cause, and rank the root causes to identify those contributing the most to the failure. For example, tracking the flow of the update ETC request could reveal more than one root cause, such as a breakdown in a) handoffs relevant to approval levels, b) implementation by project controls, c) failure of the CAM to follow up, and d) time constraints in the Contract Performance Report production cycle.

The last is Step 5, recommend and implement solutions. The goal is to determine what can be done to prevent reoccurrence to achieve process success. If this is a repeat issue, then RCCA process deficiencies are present. Identify why the deficiency reoccurred, perform a RCCA on the reoccurrence as well as the deficiency. Determine if the problem has happened before, what was done to correct it, and what is different this time. Generate potential solutions as solution statements including: 1) the action to be taken; 2) what or whom the action will involve; and 3) what the desired effect will be. In our example, the solutions may include update to processes, training, and responsibilities.

The implementation plan for EVMS related problems often takes the form of the Corrective Action Plan (CAP). It is critical that verification methods, objective measures, metrics, artifacts, and evidential products are identified that will verify that the corrective actions are effective. This includes any exit criteria for any activities in the CAP that are critical to CAP success. The CAP should include: 1) problem, 2) root cause analysis; 3) contributing factors; 4) changes to processes, tools, training, and other required system adjustments; 5) timeline; 6) management review and regular team meetings; 7) responsibility assignment for each activity; 8) development of products and artifacts which will demonstrate effectiveness; and 9) validation and verification steps with closure criteria. The CAP must tie to the CARs, Root Cause Analysis, and contain clear entrance and exit criteria.

12.3 Continuous Process Improvement: The Relationship to EVMS, Part 3: Making It All Work

Tom Bruder, Project Systems Division, MA-632, and
Humphreys and Associates, Contract Support to Project Systems Division, MA-632

This is the last of three articles on continuous process improvement (CPI) and how the principles and practices of CPI can be applied to improve and control the performance of an earned value management system (EVMS). The first article in the August 2014 edition provided some basic information about the relationship of continuous process improvement to earned value management. The second article in the September 2014 edition elaborated on the expectations and details of applying a 5 Step Root Cause Corrective Action (RCCA) approach to focus on improvement from the point of an identified problem or failure of the EVMS through development of the Corrective Action Plan.

Using any formal process improvement model can yield significant increases in output quality. Understanding and using a model also fosters a deeper understanding of statistical process control, system thinking, and causal/correlation relationships. The data collected on each process key measure will tell you how a particular process is performing. The ability to monitor the health of your EVMS on a routine basis and to have meaningful data to support process changes to ensure EVMS remains compliant is invaluable. A process owner should have all relevant performance information, should not have to rely on an outside entity to assess whether a process is performing satisfactorily, or invoke process changes without having data to understand how a process is performing.

This month we discuss making it all work by using an Eight-Step Improvement Model.

Before we can begin to use the model and unlock its power, a brief discussion on process control is warranted.

Process Control: Systems are either in control or they are not. They are either capable (of meeting requirements) or they are not. Systems are out of control and/or not capable (of meeting requirements) because of variation. A system can be:

- In control and capable
- Output is predictable, consistent and meets requirements
- Reduce common cause variation, costs, and improve performance
- In control and not capable
- Output is predictable, consistent but cannot meet requirements
- Reduce common cause variation, costs, and improve performance
- Out of control and capable
- Output is unpredictable, erratic and inconsistently meets requirements
- Reduce/eliminate special cause variation, reduce common cause variation, costs, and improve performance
- Out of control and not capable
- Output is unpredictable, erratic and cannot meet requirements
- Reduce/eliminate special cause variation, reduce common cause variation, costs, and improve performance.

Eight-Step Improvement Model

1. Review the Big Picture
    - Apply systems thinking
    - Establish where this process fits into the overall mission
    - Identify external customers/suppliers impacted or impacting the process.
2. Develop a Flow Chart of the Process
    - Develop a flowchart of the *existing* process
    - Develop a flowchart of the EVMS eight subsystems.
3. Identify Process Parameters
    - Identify process inputs and outputs
    - Identify process customers/suppliers.
4. Identify Process Key Measures
    - Survey Customers
    - Identify all Key Measures.
5. Begin Collecting Data on Key Measures
    - Measurement system must be capable and unbiased.
    - The data must be available.
6. Make the Process Stable
    - Identify and remove special causes
    - Keep asking "why" until you get to the root cause(s).
7. Make the Process Capable
    - Analyze process performance
    - Use statistical quality control tools to modify the process if necessary.
8. Continue to Improve the Process
    - Reduce common cause variation
    - Use a Plan, Do, Check, Act model.

Following the 8-step process can yield significant increases in output quality (Suitability, Accuracy, Cost Effectiveness and Timeliness). Understanding and using the eight-step model will foster a deeper understanding of statistical process control, system thinking, and causal/correlation relationships. The data collected on each process key measure will tell you when a particular process has too much variation. The ability to monitor the health of your EVMS on a routine basis and have meaningful data to support process changes to ensure your EVMS remains compliant is invaluable.