



Contact: Eric Cochran, Eric.Cochran@em.doe.gov

Date: 5/20/2016

Statement:

In the past, the Office of Environmental Management (EM) and National Nuclear Security Administration (NNSA) had drawn particular attention to their cost estimating practices. Together both offices are managing capital asset projects with approximately \$70 billion in combined Total Project Costs. The Government Accountability Office (GAO) had noted that DOE and NNSA under-estimated the costs of projects and then requested additional project funds through the budget process. To address the identified weaknesses, DOE and EM implemented significant enhancements in cost estimating practices.

Discussion:

In GAO-10-199, *“Department of Energy, Actions Needed to Develop High-Quality Cost Estimates for Construction and Environmental Cleanup Projects,”* the GAO noted that DOE needed to establish better cost estimating guidance and utilize independent cost estimates to achieve high-quality cost estimates. DOE updated DOE G 413.3-21, *“Cost Estimating Guide,”* in May 2011 with guidance to meet the following characteristics of a high quality estimate:

- *Credible* when it has been cross-checked with an Independent Cost Estimate (ICE), the level of confidence associated with the point estimate has been identified through the use of risk and uncertainty analysis, and a sensitivity analysis has been conducted.
- *Well-documented* when supporting documentation is accompanied by a narrative explaining the process, sources, and methods used to create the estimate and contains the underlying data used to develop the estimate; likely to be incurred.
- *Accurate* when it is not overly conservative or too optimistic, and based on an assessment of the costs most likely to be incurred.
- *Comprehensive* when it accounts for all possible costs associated with a project, it contains a cost estimating structure in sufficient detail to ensure that costs are neither omitted nor double-counted, and the estimating teams’ composition is commensurate with the assignment.

In GAO 15-29, *“Project and Program Management, DOE Needs to Revise Requirements and Guidance for Cost Estimating and Related Reviews,”* GAO analyzed DOE projects against Best Practices identified in GAO-09-3SP, *“Cost Estimating and Assessment Guide,”* and found the majority of DOE cost estimating weaknesses were due to not fully implementing 4 of the 12 Best Practices. Those four practices were:

1. Determining the estimate structure
2. Identifying ground rules and assumptions
3. Conducting risk and uncertainty analysis
4. Documenting the estimate.

DOE has recently developed DOE O 413.3b Change 2, which mandates use of the GAO *“Cost Estimating and Assessment Guide”* for DOE cost estimates. A high-quality cost estimate developed in accordance with the GAO Best Practices, provides for a strongly supported cost basis, process, approach, uniformity, and level of detail to provide confidence that the project cost forecast is accurate.

Over the last few years, EM has taken several steps to implement best practices to provide the basis for improving EM's cost estimates. Some of the notable EM improvements include:

- Issued the EM *“Cost Estimate Development Handbook”* which incorporates the GAO 12 Best Practices for application to EM cost estimates
- Established a new Corporate Program and Policy Division within the EM Consolidated Business Center (EMCBC) Office of Cost Estimating and Project Management Support, tasked with oversight to ensure that EM estimates are completed as “high quality” estimates in accordance with GAO guidance and to establish and implement policies and procedures to review and certify contractor cost estimating systems in accordance with *DOE Acquisition Letter (AL) 2013-11*. An EM *“Cost Estimating System Review Handbook”* has been developed and submitted to the HCA drop box for solicitation of comments.
- Increased the number and qualification of cost estimation staff across EM. In FY 2015 and FY 2016, a total of 19- federal cost estimators have been added.
- Developed the Environmental Cost Analysis System (ECAS) which is a searchable database for historic DOE EM project costs.
- As of September 2015, EMCBC completed 99 Independent Government Cost Estimates to support procurement actions with an aggregate value of over \$4 billion.
- The EM Applied Cost Estimating (ACE) team was re-established in FY 2014 and has continued with regular meetings that include cost estimating topics of interest, sharing of best practices and lessons learned, as well as any emerging issues. Representatives include cost estimators from EM sites, EM-Headquarters staff, and DOE Office of Project Management Oversight and Assessments (PM) staff.

The EM *“Cost Estimate Development Handbook”* references the 12 Best Practices that the GAO. Those 12 best practices are summarized as follows:

1. **Define estimate's purpose** – determine required level of detail; determine overall scope and who will receive the estimate.
2. **Develop estimating plan** – plan estimating team and schedule; determine who will perform independent cost estimate.
3. **Define program characteristics** – Identify program's purpose, technology implications, acquisition strategy; system quantities for development, test and production; and deployment and maintenance plans.
4. **Determine estimating structure** – define WBS, best estimating method for each WBS element, potential cross-checks for cost/schedule drivers, estimating checklist.
5. **Identify ground rules and assumptions** – define what estimate includes and excludes; identify specific assumptions regarding schedule, budget, technology; specify government furnished equipment; identify major prime and subcontractors.
6. **Obtain data** – create data collection plan; normalize data for inflation, quantity adjustments; analyze data for cost drivers, trends, outliers and compare to historical data; interview data sources and document/store information.
7. **Develop point estimate and compare it to an independent cost estimate** – develop cost model; time-phase results by schedule year; sum WBS elements to develop point estimate; compare estimate against independent cost estimate and explore variances; perform cross-checks on cost drivers; update model as more data is available.
8. **Conduct sensitivity analysis** – test sensitivity of cost elements; identify effects of schedule or quantity changes; determine which assumptions are cost drivers.
9. **Conduct risk and uncertainty analysis** – determine the level of cost, schedule and technical risk associated with WBS element; analyze risk for severity/probability; develop minimum, maximum and most likely for risk

elements; use statistical analysis method to develop confidence interval around point estimate; identify contingency funding.

10. **Document the estimate** – document all steps including purpose, estimate team, baseline schedule, assumptions; describe estimating methodology for WBS elements; describe results of risk analysis; compare to previous estimates.
11. **Present estimate to management for approval** – develop briefing that shows lifecycle costs, explanation of technical and schedule baseline; compare estimate to ICE, estimate to the budget; focus on cost drivers; document feedback and acceptance of estimate.
12. **Update the estimate to reflect actual costs and changes** – update estimate for changes in technical or program assumptions; use EAC to replace estimates when determined; document lessons learned from elements that varied from estimate; document changes to program and how affected estimate.

Actions:

EM projects should implement the best practices for developing well supported cost estimates using a common approach which will provide significant benefit for future cost estimates based on historical costs. Recommended practices include:

- **Utilize the *EM Cost Estimate Development Handbook*.** These practices have been demonstrated across many government agencies to be a benchmarked source for the development of estimates.
- **Conduct Independent Cost Estimates.** When appropriate, these will provide an objective and unbiased assessment of whether the estimate can be achieved.
- **Perform Root Cause Analysis.** Effective solutions should come from strong root cause analysis. By determining the causes of exceeding the baseline(s) (cost, schedule, scope) then effective corrective action through development of detailed bases of schedules, cost estimates, or scope statements can be executed.
- **Validate the estimating methodology.** There are several ways to estimate; however, select the methodology that is appropriate for the specific cost estimate phase.
- **Ensure that Work Breakdown Structure is integrated at all levels of the project.** Integrated WBS allows for all scope to be capture and represented. Costs can then be appropriated accordingly.
- **Ensure estimate updates are performed.** Scope changes cost, time changes resource needs and cost, staffing plans adjust due to time and scope. To manage a project, estimates require updates.
- **Utilize the Environmental Cost Analysis System.** Accessible historic costs are a fundamental resource for building strong and reliable estimates.
- **Review Lessons Learned.** As a Federal Project Director, cost engineer, project controls engineer or any team member, the importance of reviewing the strengths and weaknesses of previous projects is a key activity for successful projects.

Critical Decision(s): CD-1 to CD-4

Facility Type(s): All

Work Functions(s): Contracts, Project Management

Technical Discipline(s): All

References:

1. GAO-09-3SP, GAO Cost Estimating and Assessment Guide, Best Practices for Developing and Managing Capital Program Costs, March 2009
2. GAO-10-199, Department of Energy, Actions Needed to Develop High-Quality Cost Estimates for Construction and Environmental Cleanup Projects, January 2010

3. GAO-15-29, Project and Program Management, DOE Needs to Revise Requirements and Guidance for Cost Estimating and Related Reviews, November 2014
4. GAO-15-182, Nuclear Waste, DOE Needs to Improve Cost Estimates for Transuranic Waste Projects at Los Alamos, February 2015
5. GAO-13-510T, DOE Observation on Project and Program Cost Estimating in NNSA and EM, May 2013
6. DOE Report, Improving Project Management, Report of the Contract and Project Management and Working Group, November 2014
7. DOE G 413.3-21, Cost Estimating Guide, May 2011
8. DOE O 413.3B Change 2, Signed May 2016 (awaiting publication).
9. EM Cost Estimate Development Handbook, February 2015
10. EM Cost Estimating System Review Handbook (Draft)