

BUSINESS OPERATING PROCEDURE

BOP 413.9

Approved: 1-22-18

COST ANALYSIS REQUIREMENTS DESCRIPTION



NATIONAL NUCLEAR SECURITY ADMINISTRATION Office of Cost Estimating and Program Evaluation

CONTROLLED DOCUMENT

OFFICE OF PRIMARY INTEREST (OPI):

AVAILABLE ONLINE AT:

Office of Cost Estimating and Program Evaluation

<https://nnsaportal.energy.gov/intranet/na-mb/na-mb-20/pages/nnsa-policy.aspx>

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COST ANALYSIS REQUIREMENTS DESCRIPTION

1. **PURPOSE.** This Business Operating Procedure (BOP) reflects the requirements, responsibilities, and expectations relating to the Cost Analysis Requirements Description (CARD) for program and projects being executed by the National Nuclear Security Administration (NNSA).
2. **CANCELLATION.** None.
3. **APPLICABILITY.**
 - a. **Federal.** This applies to all NNSA elements.
 - b. **Contractors.** While this BOP does not apply to contractors, these principles should be used in work authorizations to streamline reconciliation of estimates.
 - c. **Equivalency.** In accordance with the responsibilities and authorities assigned by Executive Order 12344, codified at 50 United States Code (U.S.C.) sections 2406 and 2511, and to ensure consistency through the joint Navy/DOE Naval Nuclear Propulsion Program, the Deputy Administrator for Naval Reactors (Director) will implement and oversee requirements and practices pertaining to this Directive for activities under the Director's cognizance, as deemed appropriate.
4. **SUMMARY OF CHANGES.** Not applicable.
5. **BACKGROUND.** The CARD is a complete depiction of the system at a level of detail appropriate for estimating costs. It describes the key technical, programmatic, and operational characteristics of an acquisition program, and provides supporting data sources and material. It is intended to define the program to a sufficient level of detail such that no confusion exists between the many parties who may be concerned with estimating the program's cost. The Government Accountability Office (GAO) cost estimating and assessment guide affirms that:

key to developing a credible estimate is having an adequate understanding of the acquisition program, acquisition strategy, technical definition, characteristics, system design features, and technologies to be included in its design. The cost estimator can use this information to identify the technical and program parameters that will bind the cost estimate. The amount of information gathered directly affects the overall quality and flexibility of the estimate.
6. **REQUIREMENTS.** This BOP applies to programs which require an Independent Cost Estimate (ICE) or Independent Cost Review (ICR) conducted by CEPE as defined in NNSA Policy NAP-413.3 *Responsibilities for Independent Cost Estimates.*
 - a. The CARD is composed of a workbook template, data sources, and supporting material. The CARD workbook template contains explanatory notes for both individual data elements and tailoring methods to accommodate the uniqueness of

each program. Submissions must be tailored based on level of detail available at the time of the particular CARD submission.

- b. The CARD must be submitted by the Federal Program Manager (FPM). The draft CARD must be prepared to support the first ICE or ICR kickoff meeting and delivered to the Director of Cost Estimating and Program Evaluation (CEPE) for review and feedback. Final CARDS for programs must be approved by the FPM (or designated Program Office Representative) and the Director of CEPE, and signed by the FPM.
 - (1) A complete CARD is required in support of ICEs and ICRs (see Appendix 1, *Cost Analysis Requirements Description Process*).
 - (2) For ongoing programs having an existing CARD, updates are required prior to milestones in support of ICEs and ICRs (see Appendix 1, *Cost Analysis Requirements Description Process*). The updated CARD will reflect substantial changes to the program.
- c. The FPM must submit the CARD with the appropriate security classification reflective of the consolidated program data. Classified sections should be submitted as an attachment to the CARD. If the consolidated information for the other sections raises the CARD above unclassified, two versions of the CARD are requested: a complete CARD at the appropriate security level and an unclassified version for submission to the Director of CEPE for retention and historical data.
- d. All unclassified CARDS submitted to CEPE must be sent by unclassified email to the appropriate point(s) of contact. All CARDS classified *secret*, and all classified CARDS and applications must be submitted to CEPE by email through the appropriate classified network to the appropriate point(s) of contact.
- e. Level of Detail:
 - (1) The level of detail provided in the CARD depends on the maturity of the program. The CARD workbook template for a program early in the life-cycle process may contain numerous gaps in comparison to a program further along in the program life cycle. These gaps and any uncertainties in the program must be acknowledged, and quantified to the maximum extent possible. Tailoring of CARDS in support of ICEs or ICRs must be approved by the Director of CEPE.
 - (2) For uncertainties in program concepts, nominal assumptions must be specified for cost-estimating purposes. For example, if there is a technical requirement or schedule that is not yet determined, the CARD must provide nominal, but specific, assumptions (including reasoning) about the requirements or schedule.

7. RESPONSIBILITIES.

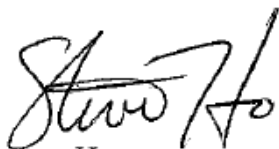
- a. Director of Cost Estimating and Program Evaluation (CEPE):
 - (1) Provides CARD guidance and template;
 - (2) Maintains this BOP and establishes instructions; and
 - (3) Approves the CARD with the FPM (or designated Program Office representative).
- b. Federal Program Manager (FPM):
 - (1) Provides data and documentation in support offices and ICRs;
 - (2) Develops a CARD; and
 - (3) Approves the CARD with the Director of CEPE (or designated Program Office representative approves with the Director of CEPE).

8. DEFINITIONS. See Appendix 3.

9. REFERENCES. See Appendix 5.

10. CONTACT. Director, Office of Cost Estimating and Program Evaluation, 202-586-6910.

BY ORDER OF THE ADMINISTRATOR:



Steven Ho
Director
Office of Cost Estimating and
Program Evaluation (CEPE)

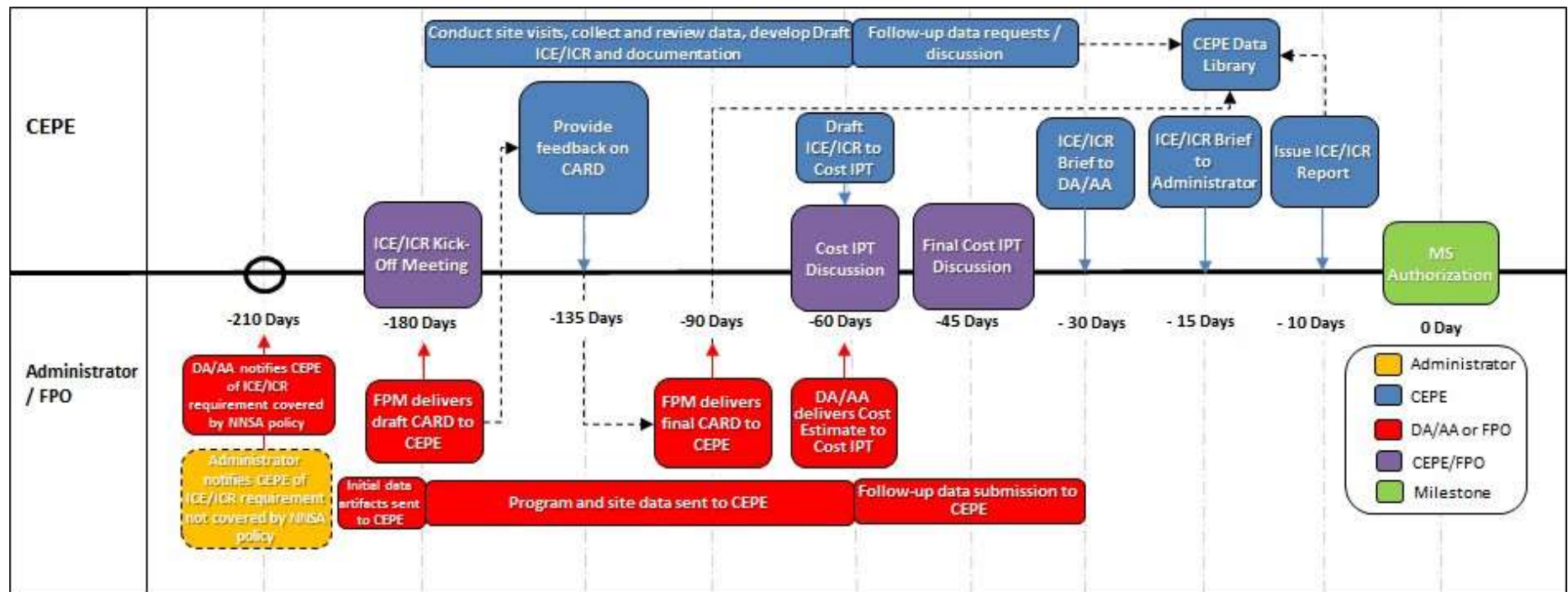
Appendixes:

- 1. Cost Analysis Requirements Description Process
- 2. Cost Analysis Requirements Description Content
- 3. Definitions
- 4. GAO 12-Step Process
- 5. References

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APPENDIX 1: COST ANALYSIS REQUIREMENTS DESCRIPTION PROCESS

Figure 1: Timeline for the Preparation of the NNSA ICE/ICR



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Cost Analysis Requirements Description (CARD) Process:

1. The Federal Program Manager (FPM) prepares and delivers the draft CARD to the Office of Cost Estimating and Program Evaluation (CEPE) no later than 180 days before the program milestone for which a CEPE Independent Cost Estimate (ICE) or Independent Cost Review (ICR) is required.
2. No later than 45 days after receipt of the draft CARD (usually 135 days before the program milestone), CEPE provides feedback informing the FPM that the CARD is sufficiently or insufficiently developed to continue with preparation of the cost estimates.
3. A final copy of the CARD must be provided to CEPE by the FPM at least 90 days before the scheduled program milestone and placed into the electronic CEPE Data Library. The Director of CEPE and the FPM must approve the final CARD.
4. CEPE uses the information submitted to the CEPE Data Library when preparing its annual report to Congress. The annual report summarizes the cost estimation and analysis activities of NNSA during the previous year and assesses the progress of NNSA in improving the accuracy of its cost estimates and analyses.

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APPENDIX 2: COST ANALYSIS REQUIREMENTS DESCRIPTION (CARD) CONTENT

The CARD content covers key technical, programmatic, and operational characteristics in Major Atomic Energy Defense Acquisition (MAEDA) and acquisition programs. Section 1 covers all MAEDA and acquisition programs. Section 2 covers additional content for Life Extension Programs (LEPs) and Alterations (Alts).

1. MAEDA AND ACQUISITION PROGRAMS.

- a. System Overview. This section provides concise background information about the system, including a system description, an explanation of the missions that the system will perform, and a summary of the system program history and predecessor systems (if applicable). It should include a discussion of any internal research and development activities performed by the contractor(s) and the associated cost(s) of the effort(s). A diagram or picture of the system should be provided.
- b. Interfaces with Other Systems. This section describes the relationships between the system and other systems within and outside NNSA, including the nature and number of any interfaces, detail of joint development efforts, and leveraging of other programs that will be required. It should also describe any associated modifications to the project, hardware, or software of the other systems. It must clearly identify the interface boundaries to other systems, programs, and subprograms.
- c. System Performance Parameters and Characteristics. This section provides a summary of the approved key performance parameters, e.g., military capabilities, size, speed, energy and water efficiency, and weight.
- d. Program Milestone Schedule or Integrated Master Schedule. This section provides a summary of the integrated master schedule including a figure or diagram that displays when major work efforts will support tasks and events for each phase over the program life cycle. This section should include the baseline schedule from the most recent milestone phase as well as the most recent schedule. Use of a standard program briefing chart is encouraged. In addition, this section should provide a discussion that explains the critical paths for the program schedule.
- e. Product Team Strategy and Structure. This section provides a summary of the team organizational structure which outlines the hierarchal structure and team member's responsibilities in the design and production of the product. This section also lists specific responsibilities within the product team based on program requirements. A product team organizational chart or equivalent table should be provided with the outlined responsibilities.

- f. Work Breakdown Structure (WBS). This section provides a WBS used by the Federal Program Office to manage the program.
- g. Quantity Requirements. Time-phased system quantities across all life-cycle phases by major item of equipment are to be identified in the workbook's quantities spreadsheet.
- h. Technologies. This section identifies new technologies that the system will depend on to meet key performance parameters or other design goals. This section must summarize the current and projected technology readiness levels of each critical and noncritical technology as presented in the technology readiness assessment. This section identifies any critical and noncritical technologies that will not be considered mature at the anticipated time of the approval and summarize the associated technology maturation plan.
- i. Assessment of Program Risks and Risk Mitigation Measures. This section provides full descriptions of all the risks associated with the program and provides documentation via the Active Risk Management (ARM) database or a similar type of database. If an ARM database or other similar database is used, an export of the entire risk management database for the program is required and should be machine-readable in a common electronic format as specified by CEPE. In addition, this section should summarize the program's risk mitigation strategies and risk monitoring approaches.
- j. Other Program Money (OPM). This section describes interfaces where leveraging is required or dependencies exist, which is collectively termed *OPM projects or campaigns*. A general description of the interface requirements, success criteria, milestone dates, assumptions, constraints, risks, and funding profile should be provided. A copy of any Interface Requirements Agreement (IRA) should be included.
- k. Staffing Requirements. This section includes actual and forecasted staffing requirements time-phased across the period of performance for the program. Staffing plans will be presented in terms of full-time equivalents (FTEs) or similar workload equivalent. Staffing data will include updated actual and forecasted FTEs by Management and Operating (M&O), control account (CA), labor category, and fiscal year based on data availability. If applicable, actual and forecasted FTEs will be provided before the establishment of a performance measurement baseline (PMB) for mature programs that are creating the initial CARD later in the life-cycle process.
- l. Test and Evaluation. This section summarizes all local systems-level developmental and operational tests. The number, type, location, and expected duration of the tests should be identified, along with the organizations that will conduct the test programs. This section should describe any contingency or margin for test failures in the program test and evaluation plan in the notes section. A list of statements of capabilities and memorandums of understanding

between the program and the test communities should be identified in the supporting material and documentation section.

- m. Infrastructure Data. This section describes site facilities and equipment required to support the program at each M&O site that are unique to the program or are being paid for by the program as a first user. This includes new facility construction, facility retrofit, and major equipment purchases. Facilities and equipment being funded through campaigns, research, development, test and evaluation (RDT&E); infrastructure and operations (I&O); or similar should be included and described in the OPM section.
- n. Tooling. This section describes the special tooling equipment to acquire or make available in order to support the production, diagnosis, repair, rebuild, and re-acceptance of NNSA components and final assembly unique to the program.
- o. Software Description and Sizing Information Section. This section describes each computer software configuration item critical to the program which has the potential to drive or impact either cost or schedule or both. This can include, but is not limited to, system applications, support software, and firmware. Each configuration item should be described in enough detail to understand what functions will be accomplished by commercial-off-the-shelf (COTS) or government-off-the-shelf (GOTS) software, and which functions will require separate software development (including interface to other software and legacy systems). For every software product, an explanation of what contractual terms and conditions (e.g., data rights, determination of user-base, software maintenance costs) the government will be required to produce to sustain the system through the life cycle.
- p. Program Funding Profile. This section describes the program funding profile and financial resources across the program life cycle including procurement, RDT&E, and OPM.

2. ADDITIONAL CONTENT COVERING LEPS AND ALTS.

- a. Manufacturer Description. This section provides the top-level description of the manufacturer component, including parameters by major component, subassembly, subcomponent, by production and design agencies, and WBS number. Tabular presentation of data is encouraged.
- b. Testers. This section provides the top-level description of testers used for the program, including parameters by tester identification, component, and M&O production and design agencies, and WBS number. Tabular presentation of data is encouraged.
- c. Major Component Design. This section summarizes the major components of the system and identifies the percentage of reuse, redesign, and remanufacture for each component.

3. TRACK TO PRIOR CARD.

The Federal Program Manager will provide updates to the CARD prior to milestones in support of Independent Cost Estimates and Independent Cost Reviews, which summarize significant changes from the previous CARD. The CARD must include changes in system performance or design, program schedule, technical baseline changes, programmatic, and all other aspects presented in Appendix 2, *Cost Analysis Requirements Description Guidance*.

APPENDIX 3: DEFINITIONS

- a. Acquisition Program – A defined duration, funded effort from conceptualization, initiation, design, development, test, contracting, production, deployment, logistics support, modification, and disposal to provide a new, improved, or continuing weapons and weapons systems or other product to satisfy NNSA mission requirements or capability gaps, intended for use in, or in support of, NNSA missions.
- b. Baseline – A quantitative definition of cost, schedule, and technical performance that serves as a base or standard for measurement and control during the performance of an effort; the established plan against which the status of resources and the effort of the overall program, field program(s), project(s), task(s), or subtask(s) are measured, assessed, and controlled. Once established, baselines are subject to change control discipline.
- c. Cost Estimating Uncertainty – The uncertainty reflects one's confidence in the point estimate. Cost estimating uncertainty arises from the inaccuracies inherent in the cost estimating methodologies.
- d. Cost Estimating Risk (CER) – The risk reflects one's confidence in the input parameters used to develop a cost estimate. Cost-estimating risk arises from the inaccuracies inherent in the programmatic assumptions or technical data used as inputs to CERs.
- e. Cost Analysis Requirements Description (CARD) – A description of the relevant features of the acquisition program or project and of the system itself. It is the common description of the technical and programmatic features of the program that is used by the teams when preparing the ICE or program office cost estimates. It is intended to define the program to a sufficient level of detail such that no confusion exists between the many parties who may be concerned with estimating the program's cost.
- f. Earned Value Management (EVM) – A project performance method that uses an integrated set of performance measurements (e.g., scope, cost, and schedule) to assess and measure project performance and progress, and estimate cost and schedule impacts at completion.
- g. Federal Program Manager (FPM) – An individual in an organizational element responsible for managing a program and its assigned projects. The FPM ensures that all the projects are properly phased, funded over time, and that each project manager is meeting assigned key milestones. FPMs are the project manager's advocate, who ensure proper resourcing, facilitate the execution process, and predict programmatic risks. FPMs also put mitigation strategies in place so that projects are not affected by those risks.
- h. Independent Cost Estimate (ICE) – A cost estimate prepared by an organization independent from the government line manager's authority, and the contractor organization responsible for the project or program, using the same detailed technical and

procurement information to develop the program or project estimate in accordance with Government Accountability Office (GAO) best practices.

- i. Independent Cost Review (ICR) – An evaluation of a program’s or project’s cost estimate that examines the reasonableness of the estimate quality, assumptions, and risks, also prepared by an organization independent from the government line manager’s authority and the contractor organization responsible for the project or program.
- j. Life-Cycle Cost Estimate (LCCE) – The cost to the government of acquisition and sustainment of a system over its useful life. It includes the cost of development, acquisition, operations, and support (to include manpower) and, where applicable, disposal. For defense systems, LCCE is also called Total Ownership Cost (TOC).
- k. Major Atomic Energy Defense Acquisition (MAEDA) Program – An atomic energy defense acquisition program of which the total project cost is more than \$500 million or the total lifetime cost is more than \$1 billion. The term major atomic energy defense acquisition program does not include a project covered by DOE Order 413.3B, Program and Project Management for the Acquisition of Capital Assets (or a successor order) for the acquisition of capital assets for atomic energy defense activities.
- l. Phase 6.X Process – Provides the framework for nuclear weapons activities (including life extension programs), such as routine maintenance, stockpile evaluation, surveillance, baselining, and annual certification.
- m. Program Office – Program Office is the organization that is led by the Federal Program Manager (FPM) who is directly responsible for managing and executing all programmatic activities on a regular basis, including cost, schedule, risk, and requirements activities.
- n. Total Lifetime Cost (TLC) – Is equivalent to the life-cycle cost for projects and programs. The TLC includes the costs of conceptualization, initiation, design, development, test, contracting, production, deployment, logistics support, modification, and disposal.
- o. Total Program Cost (TPC) – For programs following the 6.X Process, the TPC covers all costs from Phase 6.1 through Phase 6.6. For other acquisition programs, the TPC is the cost of conceptualization, initiation, design, development, test, contracting, and production prior to operation and disposal.
- p. Work Breakdown Structure (WBS) – A numeric structure incorporating logic to capture scope, cost, and schedule of work. The WBS mentioned in this document will be standardized and common across the nuclear security enterprise and will include Work for Others and other Department of Energy programs to identify total site costs and scope. A program WBS provides a framework for program and technical planning, cost estimating, resource allocations, performance measurements, and status reporting. The WBS should define the total system to be developed or produced; display the total system

as a product-oriented family tree composed of hardware, software, services, data, and facilities; and relate the elements of work to each other and to the end product.

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APPENDIX 4: GOVERNMENT ACCOUNTABILITY OFFICE (GAO) 12 STEP PROCESS

GAO's 12 Steps of a High Quality Cost Estimating Process

The GAO Cost Estimating Process consists of 12 steps. Each step builds upon each other to develop a comprehensive and complete cost estimate. Each of the 12 steps is important for ensuring that high-quality cost estimates are developed and delivered in time to support important decisions.

Step 1: Define estimate's purpose

- Determine estimate's purpose, required level of detail, and overall scope; and
- Determine who will receive the estimate.

Step 2: Develop estimating plan

- Determine the cost estimating team and develop its master schedule;
- Determine who will do the Independent Cost Estimate (ICE);
- Outline the cost estimating approach; and
- Develop the estimate timeline.

Step 3: Define program characteristics

In a technical baseline description document,

- Identify the program's purpose and its system and performance characteristics and all system configurations;
 - Any technology implications;
 - Its program acquisition schedule and acquisition strategy;
 - Its relationship to other existing systems, including predecessor or similar legacy systems;
 - Support (manpower, training, etc.) and security needs and risk items;
 - System quantities for development, test, and production; and
 - Deployment and maintenance plans.

Step 4: Determine estimating structure

- Define a Work Breakdown Structure (WBS) and describe each element in a WBS dictionary (a major automated information system may have only a cost element structure);
- Choose the best estimating method for each WBS element;
- Identify potential cross-checks for likely cost and schedule drivers; and
- Develop a cost-estimating checklist.

Step 5: Identify ground rules and assumptions

- Clearly define what the estimate includes and excludes;
- Identify global and program-specific assumptions, such as the estimate's base year, including time-phasing and life cycle;
- Identify program schedule information by phase and program acquisition strategy;
- Identify any schedule or budget constraints, inflation assumptions, and travel costs;
- Specify equipment the government is to furnish as well as the use of existing facilities or new modification or development;
- Identify prime contractor and major subcontractors;
- Determine technology refresh cycles, technology assumptions, and new technology to be developed;
- Define commonality with legacy systems and assumed heritage savings; and
- Describe effects of new ways of doing business.

Step 6: Obtain data

- Create a data collection plan with emphasis on collecting current and relevant technical, programmatic, cost, and risk data;
- Investigate possible data sources;
- Collect data and normalize them for cost accounting, inflation, learning, and quantity adjustments;
- Analyze the data for cost drivers, trends, and outliers and compare results against

rules of thumb and standard factors derived from historical data;

- Interview data sources and document all pertinent information, including an assessment of data reliability and accuracy; and
- Store data for future estimates.

Step 7: Develop point estimate and compare it to an ICE

- Develop the cost model, estimating each WBS element, using the best methodology from the data collected, and including all estimating assumptions;
- Express costs in constant year dollars;
- Time-phase the results by spreading costs in the years they are expected to occur, based on the program schedule;
- Sum the WBS elements to develop the overall point estimate;
- Validate the estimate by looking for errors like double-counting and omitted costs;
- Compare estimate against the ICE and examine where and why there are differences;
- Perform cross-checks on cost drivers to see if results are similar; and
- Update the model as more data becomes available or as changes occur, and compare results against previous estimates.

Step 8: Conduct sensitivity analysis

- Test the sensitivity of cost elements to changes in estimating input values and key assumptions;
- Identify effects on the overall estimate of changing the program schedule or quantities; and
- Determine which assumptions are key cost drivers and which cost elements are affected most by changes.

Step 9: Conduct risk and uncertainty analysis

- Determine and discuss with technical experts the level of cost, schedule, and technical risk associated with each WBS element;
- Analyze each risk for its severity and probability;

- Develop minimum, most likely, and maximum ranges for each risk element;
- Determine type of risk distributions and reason for their use;
- Ensure that risks are correlated;
- Use an acceptable statistical analysis method (e.g., Monte Carlo simulation) to develop a confidence interval around the point estimate;
- Identify the confidence level of the point estimate;
- Identify the amount of contingency funding and add this to the point estimate to determine the risk-adjusted cost estimate; and
- Recommend that the project or program office develop a risk management plan to track and mitigate risks.

Step 10: Document the estimate

- Document all steps used to develop the estimate so that a cost analyst unfamiliar with the program can recreate it quickly and produce the same result;
- Document the purpose of the estimate, the team that prepared it, and who approved the estimate and on what date;
- Describe the program, its schedule, and the technical baseline used to create the estimate;
- Present the program's time-phased life-cycle cost;
- Discuss all ground rules and assumptions;
- Include auditable and traceable data sources for each cost element and document for all data sources how the data were normalized;
- Describe in detail the estimating methodology and rationale used to derive each WBS element's cost (prefer more detail over less);
- Describe the results of the risk, uncertainty, and sensitivity analyses and whether any contingency funds were identified;
- Document how the estimate compares to the funding profile; and
- Track how this estimate compares to any previous estimates.

Step 11: Present estimate to management for approval

- Develop a briefing that presents the documented Life-Cycle Cost Estimate (LCCE);
- Include an explanation of the technical and programmatic baseline and any uncertainties;
- Compare the estimate to an ICE and explain any differences;
- Compare the estimate (LCCE) or ICE to the budget with enough detail to easily defend it by showing how it is accurate, complete, and definitive;
- Focus in a logical manner on the largest cost elements and cost drivers;
- Make the content clear and complete so that those who are unfamiliar with it can easily comprehend the competence that underlies the estimate results;
- Make backup slides available for more probing questions;
- Act on and document feedback from management; and
- Request acceptance of the estimate.

Step 12: Update the estimate to reflect actual costs and changes

- Update the estimate to reflect changes in technical or program assumptions or keep it current as the program passes through new phases or milestones;
- Replace estimates with Earned Value Management (EVM), Estimate at Completion (EAC), and independent EAC from the integrated EVM system;
- Report progress on meeting cost and schedule estimates;
- Perform a postmortem and document lessons learned for elements whose actual costs or schedules differ from the estimate; and
- Document all changes to the program and how they affect the cost estimate.

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APPENDIX 5: REFERENCES

a. Federal Laws and Regulations:

- (1) 50 U.S.C. 2411, *Director for Cost Estimating and Program Evaluation*.
- (2) 50 U.S.C. 2537, *Selected Acquisition Reports and independent cost estimates and reviews certain programs and facilities*.
- (3) 50 U.S.C. 2753, *Notification of cost overruns for certain Department of Energy projects*.

b. Government Accountability Office:

GAO-09-3SP, *GAO Cost Estimating and Assessment Guide*, March 2009.

c. Nuclear Weapons Council:

Procedural Guideline for the Phase 6.X Process, dated 4-19-00.

d. DOE:

DOE Order 413.3B Chg 4, *Program and Project Management for the Acquisition of Capital Assets*, dated 10-13-17

e. NNSA:

- (1) NAP 413.3, *Responsibilities for Independent Cost Estimates*, dated 2-13-19.
- (2) BOP 413.3, *Independent Cost Estimates Procedure*, dated 02-27-14.