INDEPENDENT REVIEW SCHEDULE ANALYSIS

STANDARD OPERATING PROCEDURE

U.S. DEPARTMENT OF ENERGY

OFFICE OF PROJECT MANAGEMENT

REVISION 1.0

MARCH 2022

Control Table

1. Explanation of Changes.

Revision	Date	Purpose
1.0	March 2022	Initial Release of the IRSA SOP. - Major clarifications for routine review activities (i.*e. no new requirements introduced*) include: ○ Conducting sufficiency reviews consistently for Office of Project Management (PM) reviews using quantitative and qualitative analysis for schedule assessment. ○ Consistently and efficiently capturing schedule assessments conducted during PM reviews with a "schedule notebook". ○ Utilization of AACEI Schedule Classifications per Recommended Practice (RP) 27R-03, Schedule Classification System. ○ Utilization of an integrated evaluation methodology for meeting GAO Schedule Assessment Guide Best Practices (GAO-16-89G) and EIA-748 assessed through Guideline Attribute Tests (GAT) as contained within the PM Earned Value Management Systems Compliance Review Standard Operation Procedure (ECRSOP).

2. Location of Changes.

Page	Paragraph	Changed	To

References

Reference	Revision, Date
DOE O 413.3B, *Program and Project Management for the Acquisition of Capital Assets*	Change 6, January 12, 2021
EIA-748, *Earned Value Management Systems*	Revision D, 2018
GAO, *Cost Estimating and Assessment Guide: Best Practices for Developing and Managing Program Costs*	GAO-20-195G, March 2020
GAO, *Schedule Assessment Guide: Best Practices for Project Schedules*	GAO-16-89G, December 2015

Note: Updates to key references necessitate an immediate review and update of IRSA SOP content.

Table of Contents

Tables

Figures

1 POLICY AND AUTHORITY

Per U.S. Department of Energy (DOE) Order (O) 413.3B,[1] the Office of Project Management (PM) must perform external independent reviews (EIRs), independent cost estimates (ICEs), and independent cost reviews (ICRs) on capital asset projects larger than $50M. PM also establishes, maintains, and executes the earned value management system (EVMS) certification and surveillance review processes and serves as the executive secretariat for the Energy Systems Acquisition Advisory Board (ESAAB) and Project Management Risk Committee (PMRC).

This *Independent Review Schedule Analysis (IRSA) Standard Operating Procedure (SOP)* serves as a primary reference, collating resources and detailing schedule analysis procedures. The IRSA SOP complements other DOE guidance by detailing how PM implements the requirements in DOE O 413.3B. These processes correspond to guidance in the following:

- DOE Guide (G) 413.3 series supporting DOE O 413.3B
- Government Accountability Office (GAO) best practices[2]
- National Defense Industry Association (NDIA), *Planning & Scheduling Excellence Guide (PASEG)*
- American National Standards Institute/Electronic Industries Alliance (ANSI/EIA)-748, *Earned Value Management Systems*
- PM SOPs
- Other recognized government and industry best practices.

This SOP does *not* impose new requirements or constitute Department policy, nor is it intended to modify the processes delineated in DOE orders or policy memorandums.

Major clarifications for routine review activities include:

- Conducting sufficiency reviews consistently for Office of Project Management (PM) reviews using quantitative and qualitative analysis for schedule assessment.
- Consistently and efficiently capturing schedule assessments conducted during PM reviews with a "schedule notebook".
- Utilization of AACEI Schedule Classifications per Recommended Practice (RP) 27R-03, Schedule Classification System.
- Utilization of an integrated evaluation methodology for meeting GAO Schedule Assessment Guide Best Practices (GAO-16-89G) and EIA-748 assessed through Guideline Attribute Tests (GAT) as contained within the PM Earned Value Management Systems Compliance Review Standard Operation Procedure (ECRSOP).

[1] DOE O 413.3B, *Program and Project Management for the Acquisition of Capital Assets*, Change 6, January 12, 2021.

[2] GAO, *Cost Estimating and Assessment Guide: Best Practices for Developing and Managing Program Costs*, GAO-20-195G, March 2020; GAO, *Schedule Assessment Guide: Best Practices for Project Schedules*, GAO-16-89G, December 2015.

1.1 Applicability

This SOP applies only to PM personnel (federal and contracted support services), including those in Project Analysis (PM-20) and Project Controls (PM-30), for PM-led or initiated reviews. However, others seeking to prepare for or understand DOE-PM procedures are encouraged to use the SOP (Section 2).

During oversight activities, DOE field elements may reference this SOP. As part of the oversight assessments or in preparation for reviews, field personnel are encouraged to perform some or all of the quantitative and qualitative schedule analysis in Subsections 4.4.3 or 4.4.4.

1.2 DOE O 413.3B Review Requirements

This SOP supports the PM-specific requirements in DOE O 413.3B, including the execution of EIRs, ICEs, and ICRs, and EVMS certification and surveillance as well as ESAAB and PMRC Executive Secretariat duties as specified in DOE O 413.3B. It also supports the processes in PM SOPs and propagates the best practices in the DOE G 413.3 series supporting DOE O 413.3B.

1.3 Supersedes

This SOP is the initial release and does not supersede any other versions.

1.4 Releasability

This SOP is approved for PM use and available to other Departmental elements for awareness. This SOP is available for DOE field element reference.

1.5 Effective Date

This SOP is effective immediately.

2 SCHEDULE ANALYSIS OVERVIEW

2.1 Objective

This SOP offers a standardized, repeatable method for schedule evaluation for capital asset projects under the purview of DOE O 413.3B. Specifically, PM reviews projects per DOE O 413.3B at Critical Decisions (CD) and intermittently per leadership direction and program request. Subject matter experts (SMEs)—federal PM and other DOE staff and technical support service contractor SMEs—perform these reviews. This SOP synthesizes and documents the process methods and definitions for schedule analysis, giving the SMEs efficient and repeatable processes regardless of their background and PM review experience.

To apply to the various PM reviews, this SOP follows GAO best practices in its assessment method. Per DOE O 413.3B, the integrated master schedule (IMS) is developed, maintained, and documented using methods and best practices in GAO's *Schedule Assessment Guide* (GAO-16-89C). The requirements in the contractor requirements document are not the only ones that need to be met. "The Performance Baseline (PB) represents the Department's commitment to Congress to deliver the project's defined scope by a particular date at a specific cost,"[3] so the PB—regardless of acquisition strategy—must meet the requirements of DOE O 413.3B, while the contract for the acquisition in most cases invokes attachment 1, contractor requirements document.

The preferred alternative and acquisition strategy are not selected before CD-1. However, the PB must be consistent with GAO-16-89C methods and best practices, and the review method must meet DOE O 413.3B requirements. Before CD-2, the acquisition strategy for the capital asset may require a contractor to employ an EVMS compliant with EIA-748D (or as required by the contract) and certified compliant by PM.

Thus, this SOP documents a review method that corresponds with GAO best practices and the PM EVMS certification process. It promotes project consistency with GAO best practices in early development (before CD-2) of the PB through CD-4, while preparing projects for employment of an EIA-748–compliant EVMS when they mature. The consistent review method further supports EVMS certification for the development of performance measurement baselines (PMBs).

2.2 Analysis Approach

Planning and scheduling can use various methods, tools, and practices. As noted, the federal government invokes the standards in EIA-748C, or as required by the contract, as a foundational method for planning and scheduling, utilizing earned value for objective monitoring of performance. Although industry uses various methods for planning and scheduling, the method in this SOP supports planning and scheduling within a compliant EVMS. Also, this SOP frequently refers to the best practices in two GAO documents for the assessment of cost and schedule. Although any interested party may apply the content of this SOP, it is designed for Project Management Professionals (PMPs), especially experienced schedule practitioners, to follow in performing repeatable, consistent analysis that can be cross-checked by other practitioners and interested parties.

[3] DOE O 413.3B, Appendix C, C-4, Bullet 4.

2.3 Key References and Relationship to Other Guidance

This SOP restates the requirements and guidance for the review, evaluation, and assessment of an IMS during DOE O 413.3B–required reviews (Subsection 1.2). In priority order—from DOE O 413.3B mandatory requirements through DOE G 413.3 supporting guide project management best practices—the key references follow.

2.2.1 DOE O 413.3B Requirements

DOE O 413.3B includes main text, four appendices, and four attachments. The four appendices are as follows:

- Appendix A—Requirements
- Appendix B—Responsibilities
- Appendix C—Topical Areas
- Appendix D—Office of Environmental Management Cleanup Project Management Protocol and Implementation Standard for Demolition Projects.

The four attachments are as follows:

- Attachment 1—Contractor Requirements Document
- Attachment 2—Definitions
- Attachment 3—Acronyms
- Attachment 4—References.

The DOE O 413.3B sections that apply to (1) EVMSs and (2) planning and scheduling mostly fall under Appendices A and C and apply to the PB regardless of the acquisition strategy.

DOE O 413.3B excerpts noted for the PB include the following:

- Appendix C, C-10, Number 8

  Earned Value Management System. The Department will adopt project management control best practices equivalent to those implemented by the Department of Defense (DoD). This includes a DOE version of the DoD Integrated Program Management Report (IPMR) on projects not associated with a firm fixed-price contract.

  An EVMS is required for all projects with a TPC greater than $50M. In accordance with FAR Subpart 52.234-4, a contractor's EVMS will be reviewed for compliance with EIA-748C, or as required by the contract. (Further details on establishing, employing, and maintaining a compliant EVMS are found in DOE G 413.3-10A, EIA-748C, and DOE Integrated Program Management Report (IPMR) Data Item Description (DID)).

- Appendix C, C-17, Number 16

  Planning and Scheduling. Projects shall develop and maintain an Integrated Master Schedule (IMS). The IMS shall be developed, maintained, and documented in a manner consistent with methods and the best practices identified in the Planning and Scheduling Excellence Guide, published by the National Defense Industrial Association, and the GAO's Schedule Assessment Guide (GAO-16-89C).

DOE O 413.3B excerpts noted for the PMB include the following:

- Attachment 1, Number 1

  Except for firm fixed-price contracts, the Contractor shall:

  - Employ an Earned Value Management System (EVMS) prior to Critical Decision (CD)-2, or upon contract award, for projects greater than $50 million, unless granted an exemption from the PMSO. The system shall be compliant with EIA-748C (or as required by the contract) in accordance with contract clause FAR Subpart 52.234-4, EVMS.
  - Maintain an EVMS compliant with EIA-748C when there are applicable projects with a TPC between $50M and $100M.
  - Receive certification of EVMS compliance with EIA-748C from PM when there are applicable projects having a TPC of $100M or greater. PM must conduct the certification review process and certify the contractor's EVMS compliance with EIA-748C, or as required by the contract.
  - Receive continued surveillance of EVMS compliance with EIA-748C when there are applicable projects having a TPC of $100M or greater. PM will conduct a risk-based, data-driven surveillance during the tenure of the contract, during contract extensions, or as requested by the FPD, the Program, or the PME. Documentation of the surveillance will be provided to the Contracting Officer documenting the compliance status of the contractor's EVMS with EIA-748C, or as required by the contract.
  - Provide access to all pertinent records and data requested by the contracting officer, PM, or other duly authorized representative as necessary to permit Government surveillance to insure EVMS complies, and continues to comply, with EIA-748C.
  - Submit a request for an Over-Target Baseline (OTB) or Over-Target Schedule (OTS) to the contracting officer, when indicated by performance. The request shall include a top-level projection of cost (known as an estimate at completion) Attachment 1 DOE O 413.3B Page 2 11-29-2010 and/or schedule growth (known as an Integrated Master Schedule), a determination of whether or not performance variances will be retained, and the schedule for the implementation of the rebaselining. Refer to DOE G 413.3-20.

- Attachment 1, Page 4

  An Integrated Master Schedule (both resource loaded and with critical path) must be developed and maintained for the project. As a minimum, a resource-loaded IMS must contain labor, material and equipment costs to include unit prices and quantities. For firm fixed-price contracts, the total contract cost must be included in the integrated master schedule.

2.2.2 U.S. Government Accountability Office (GAO)

Per GAO,

> The U.S. Government Accountability Office is responsible for, among other things, assisting the Congress in its oversight of the federal government, including agencies' stewardship of public funds. To use public funds effectively, the government must employ effective management practices and processes, including the measurement of government program performance. … The GAO *Schedule Assessment Guide* develops the scheduling concepts introduced in the *Cost Estimating and Assessment Guide* and presents them as ten best practices associated with developing and maintaining a reliable, high-quality schedule. The GAO *Schedule Assessment Guide* also presents guiding principles for auditors to evaluate certain aspects of government programs.[4]

[4] GAO, *Schedule Assessment Guide: Best Practices for Project Schedules*, GAO-16-89G, December 2015.

PM applies the best practices in GAO-20-195G and GAO-16-89G as guidance in evaluating cost estimates and schedules. ICEs and ICRs, as well as EIRs, include the integrated project team's (IPT's) self-assessment and the ICE/ICR review team's assessment of whether the IPT estimate followed GAO best practices for cost estimating. In addition, GAO-16-89G contains scheduling best practices used in the ICE, ICR, and EIR evaluation of IPT proficiency in setting the schedule.

(Subsection 4.4.3 details the GAO best practice evaluation, describing a repeatable method that reviews the schedule for the behavior of the network and the planning method. The subsection is organized by the four GAO characteristics of a reliable schedule: comprehensive, well-constructed, credible, and controlled.)

2.2.3 NDIA PASEG

NDIA describes PASEG as follows:

> This joint industry and government guide is geared for the Program Leadership Team and Planning/Scheduling professionals to recognize the value of IMS by understanding scheduling concepts, promoting good scheduling processes, and realizing the consequences of poor processes. Using the PASEG document, the program team can build and maintain more robust and dynamic schedules that provide a roadmap for improved program execution.[5]

The DOE *Planning and Schedule Guide* clarifies how NDIA PASEG applies in DOE.[6]

2.2.4 DOE Planning and Scheduling Guide

Per the DOE *Planning and Scheduling Guide*,

> This guide outlines effective principles for developing and maturing project schedules at a level of detail corresponding to the Critical Decision (CD) process outlined in Department of Energy (DOE) Order 413.3B, Program and Project Management for the Acquisition of Capital Assets ("the Order"). It also guides assessments of project schedules for the same purpose. The planning addressed in this guide pertains to capital asset acquisition projects only under DOE O 413.3B. The guide does not address strategic, program, site, operations, or sustainment planning, although elements may be tailored for those functions. [7]

2.2.5 Other Guidance

Additional guidance relevant and specific to EVMS is available:

- DOE G 413.3-10B, *Integrated Project Management Using the EVMS*
- EIA-748D, *Earned Value Management Systems*
- Multiple NDIA Integrated Program Management Division (IPMD) guides, including the *EVMS Intent Guide*, *EVMS Surveillance Guide*, *EVMS Acceptance Guide*, *EVMS Application Guide*, and *EVMS Scalability Guide*.
- The DOE G 413.3 series, including DOE G 413.3-7A, *Risk Management*, and DOE G 413.3-21A, *Cost Estimating*.

[5] NIDA, *Division Guides and Resources*, https://www.ndia.org/divisions/ipmd/division-guides-and-resources.
[6] Draft DOE G 413.3-2X.
[7] Draft DOE G 413.3-2X.

2.2.6 PM SOPs

PM SOPs serve as primary references for PM staff and PM leadership, federal project directors (FPDs), and IPTs when assessing and reviewing projects under the purview of PM.

2.2.6.1 EIR SOP

Per the EIR SOP,

> The Office of Project Management (PM) performs External Independent Reviews (EIRs) to provide Project Management Executives (PMEs), senior leaders within the Department of Energy (DOE), and Congress an unbiased assessment of whether a capital asset project can be executed within proposed scope, schedule and cost commitments, while also meeting its key performance parameters and fulfilling its associated mission need. The objectives of this EIR Standard Operating Procedure (SOP) document are to clarify EIR expectations and to facilitate EIR planning and execution by PM, its support contractors, DOE Program offices and project teams.[8]

This IRSA SOP directly supports the EIR SOP and the associated lines of inquiry (LOIs) through detailed guidance on the schedule assessment.

2.2.6.2 ICR/ICE SOP

Per the ICR/ICE SOP,

> This Standard Operating Procedure (SOP) provides guidance for Department of Energy (DOE) Project Management (PM) staff and contractors performing either an Independent Cost Estimate (ICE) or an Independent Cost Review (ICR) for a capital asset project.[9]

This IRSA SOP directly supports the ICR/ICE SOP and the associated estimation through detailed guidance on the independent schedule development and assessment.

2.2.6.3 Project Peer Review SOP

Per the project peer review (PPR) SOP,

> The overall purpose of a PPR is to determine, by a non-proponent body, whether: the scope of programs, projects, or activities; the underlying assumptions regarding supporting technology; the cost and schedule estimates; the contingency provisions; and the management approach are valid and credible within Department of Energy (DOE) budgetary and administrative constraints.
>
> Reviews conducted by PM-3 are intended to reduce the risk of project failure by identifying existing and potential problems in a timely manner so that prompt and effective resolution is possible. These reviews assist the field in successfully completing the project, as well as identifying areas where respective program management needs to focus additional resources.[10]

This IRSA SOP directly supports the PPR SOP and the associated estimation through detailed guidance on the independent schedule development and assessment.

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[8] DOE-PM, *External Independent Review (EIR) Standard Operating Procedures (SOP)*, Revision 3.6, November 2019.

[9] DOE-PM, *Independent Cost Review (ICR) and Independent Cost Estimate (ICE) Standard Operating Procedure (SOP)*, Revision 4, August 27, 2018.

[10] PPR SOP, Project Peer Review Process (PPR) Standard Operating Procedure (SOP), Revision 3, April 2020

3 ROLES AND RESPONSIBILITIES

3.1 Relevance

Various SOPs define PM-30, PM-20, other PM personnel (federal and contracted support services), and DOE members roles and responsibilities in PM reviews. This SOP synthesizes the roles and responsibilities of the schedule analysis team from these other SOPs. Because it pertains to schedule analysis, and for consistency among SOPs, this SOP avoids discussing other roles and responsibilities.

3.2 Schedule Analysis Team

For PM reviews, the schedule analysis team varies with the complexity of the program and project. Current PM federal members, including those in PM-30, can analyze schedules, given the tools and expertise available. However, limited resources may necessitate the additional expertise of technical support service contractors. For PM reviews, PM-30 typically assumes the lead role in EVMS (compliance) assessments and in the project controls functional area for EIRs, ICEs, and ICRs. A team member experience and/or competencies typically should align with the senior cost/schedule engineer position category with at least15-years applicable experience. Additional preference(s) may include planning and scheduling using Oracle Primavera Project (P6) for capital asset projects utilizing an Earned Value Management System and familiarity with the DOE capital asset acquisition process, specifically the requirements for DOE O 413.3B. Professional certifications within scheduling, and/or risk analysis and cost estimating can also be preferable.

The schedule analysis team should have broad experience that facilitates evaluation of schedule mechanics, including the use of compliance testing methods. Also, the team should include resources technically fluent in scope planning and that can identify technical disconnects of the plan. (The schedule analysis team could consist of one person. When this SOP refers to the "schedule analysis team," in some cases it means the schedule SME or schedule practitioner.)

4 IMS ANALYSIS PROCESS

PM reviews should analyze IMSs in a systematic, repeatable process. This IRSA SOP contains an extremely detailed process, which, for the most part, duplicates the expert knowledge of schedule practitioners. The SOP includes this detail to represent current expertise, collate best practices, and document a repeatable processes checklist. This ensures PM reviews are executed in a systematic, repeatable manner and include processes that align with GAO schedule best practices, EIA-748D and draft DOE G 413.3-2X, Planning and Scheduling Guide.

The analysis team evaluates the schedule mechanics and qualitatively assesses the IMS. Per DOE O 413.3B, projects should employ an EIA-748–compliant EVMS prior to CD-2. The schedule mechanics approach uses the DOE quantitative testing method. PM-30 is the DOE cognizant federal authority (CFA) for EVMS certification and surveillance. As part of the PM-30 certification process as detailed in the PM Earned Value Management Systems Compliance Review Standard Operating Procedure (ECRSOP), the guideline attributes and tests (GAT) metrics[11] are cross-walked to GAO best practices. Subsection 4.4.3 is organized by the GAO characteristics of a reliable schedule and the GAT metrics; the schedule assessment should consider both.

4.1 Technical Support Services

If technical support services (contractors) are required, PM furnishes a task/statement of work (SOW) for the desired review services to the contracting officer's technical representative. The task/SOW should integrate the following elements, tailored appropriately per Critical Decision:

- Using this SOP in the schedule analysis
- Confirming the version of Oracle Primavera (P6) and its compatibility with the project submittal
- Inquiring if there is availability of Acumen Fuse and Acumen Risk (if a support service contractor does not have Acumen Fuse, confirming the availability of PM-30 to support generating the analysis)
- Confirming the availability of risk modeling software and ensuring its capacity to analyze project data and perform independent analysis and modeling

4.2 Detailed Process

4.2.1 Schedule Notebook

The analysis and evaluation process (described below and in the appendices) uses the term "schedule notebook". The "schedule notebook" is an informal, working document, this notebook includes all outputs from the analysis and processes described. (Appendix A contains a generic template of the schedule notebook as well as the accompanying checklist.) The schedule notebook should be available to the PM review lead and project controls functional area lead throughout the review and delivered electronically to the PM review lead at the end.

[11] Appendix A within the PM Earned Value Management Systems Compliance Review Standard Operating Procedure (ECRSOP) contains the Guideline Attributes and Tests Excel file for use in identifying and documenting the results of the automated and manual tests.

4.2.2 Best Practices, IMS File Transfer, Naming Nomenclature, and Storage

Before starting analysis, the schedule reviewer should ensure that the received files are exported and imported correctly:

- Most IMSs can be transferred using the pertinent collaboration page on the MAX.gov site. If the file is too large, it can be securely transferred using the MAX large file transfer, which supports files up to 2 GB (see https://drive.max.gov/).
- PM should have access to the file during the review, including working copy schedule files for analysis purposes.
- File names of .xer(s) should be logged and stored by the original name. Files should be copied and renamed as follows:
  - Project name_(BAS or FOR)_status date_date received
  - For example, an .xer file for forecast schedule of Saltstone Disposal Unit 8–10 with a status date of 01-01-2020 received 04-01-2020 should be renamed "SDU8-10_FOR_20200101_20200401".

A file storage table should be inserted into the schedule notebook (Table 1). Table 1. Schedule Files should be tailored appropriately for the CD.

Table 1. Schedule Files

	Original Name	Baseline or Forecast	IMS File Status Date	Date Received and Method	Renamed	Archive File or Analysis File	Aligns with Cost Estimate? (Yes/No)	Aligns with Risk Analysis? (Yes/No)
Description	[file name received] .xer	Baseline or forecast file	Status date	Date received and method [MAX.gov or email]	Renamed file	File kept without re-scheduling or analysis and infor-mation added	[Whether the IMS aligns with the cost estimate]	[Whether the IMS aligns with the risk analysis]
Example	SDU 8-10 Project	Forecast	1/1/2020	4/1/2020 [email]	SDU8_10 _FOR_20 200101_2 0200401	Archive	Yes	No

To the maximum extent practicable, IPTs should attempt to minimize changes to the IMS after a review (i.e. ICR/ICE/EIR/PPR/EVMS) is initiated and documents are provided to the PM review team. Updates to the submitted IMS will introduce significant inefficiencies during the review and may delay it. During reviews, multiple IMSs may be received or revised. The auditability of the review results depends on maintaining accurate records of the submitted data.

4.2.3 IMP Expectations and Review

The integrated master plan (IMP) is an event-based, top-level plan (milestone chart) consisting of a hierarchy of program or project events. Each event is divided into specific accomplishments, and each specific accomplishment is divided into specific criteria. The IMP should be completed before the IMS because it supports the development of a time-based IMS. The federal program

manager (FPM) generally builds the IMP and then uses it as a systematic approach to planning, scheduling, and execution.

The IMP

> Contains the project's approach for integrating and elaborating on the contents of the project's scope statement, project execution plan (PEP), and WBS. The IMP outlines a hierarchy of project events, including critical milestones, each supported by specific accomplishments, and each accomplishment has prerequisites, completion criteria, or both. The IMS then extends the IMP by detailing activities, each with a duration and resource needs, which can result in the accomplishments listed in the IMP. The IMP and IMS also have linkage to the EVMS, risk management, and internal and external status reviews.[12]

In DOE, IMPs are not commonly established as stand-alone documents, but it is a best practice to delineate the IMP and provides evidence that the technical scope will fulfill the mission need. At DOE, the IMP can be contained in other documents and frequently is not called or labeled as such. Check in the PEP or other federal documents, looking for three elements of the IMP:

- *Events*. A program or project assessment point that occurs at the culmination of significant program activities (CDs, beneficial occupancy, etc.).
- *Accomplishments*. The desired results before or at the completion of an event that indicate a level of program progress.
- *Criteria*. Definitive evidence that a specific goal has been accomplished, such as scope or key performance parameter (KPP).

The lack of an IMP (or similar approach demonstrating event-based, top-level plan) should be noted appropriately as a gap.

4.2.4 Sufficiency Reviews

This subsection describes the minimal actions the schedule analysis team should take in starting the schedule review. The sufficiency review steps may change depending on the review type, but the SMEs, PM review lead, FPD, and IPT should discuss and understand the sufficiency review expectations for the schedule before starting. The subsection also introduces various tool sets (P6, Empower, and Acumen) having similar analysis capabilities.

The analysis team sufficiency review of the received schedule (IMS) should verify that the content is sufficient to continue the review. The review should not proceed if there are egregious planning deficiencies that result in a low-quality, unreliable schedule. *Continuation of the review with a low-quality, unreliable schedule is wasteful and nonproductive for both the project and review teams, and the review should be paused until resolved, which may take months.*

The PM review lead and schedule SME select the tool sets to be used, considering the government resources available. Experience shows that the most efficient and accurate review process confirms the accurate import and export of the schedule into P6 (Subsection 4.3.2.1.1), performs the sufficiency review quantitative analysis in Acumen Fuse (Subsection 4.2.6), and ensures the results are similar to those viewed in data integrity and quality (DIQ) metrics and the data and quality indices (DQI) (Subsections 4.2.4.4 and 4.2.4.5). This SOP briefly introduces the

[12] Draft DOE *Planning and Scheduling Guide, DOE G 413.3-2X*, undated.

tool sets and the steps for their use (it does not encourage duplicative analysis in the various tool sets).

At the review start, all schedule information pertinent to the schedule analysis should be received in its entirety. Review resources should not be expended on locating pertinent information for schedule analysis. The information expected is as follows (Appendix A), tailored appropriately per CD:

- *IMP or other file with the same content*. Aligned with the IMSs and detailed commensurate with project maturity and CD.
- At CD-0, Class 5 baseline IMS or high-level schedule (see Table 13), post CD-0 through CD-1 approval, Class 3 (preferred alternative) and Class 4 (non-preferred) baseline IMS, Post CD-1 and thereafter, baseline and forecast IMSs at the Class 3 to Class 1 (see Table 13) with appropriate status dates for the requested period of the review (EIRs—one accounting period, EVMS reviews—three accounting periods). The status dates should align, should not vary, and be close to (less than two accounting periods from) the review date.
  - The baseline and forecast IMSs should align with the cost estimate date. If the cost estimate date varies dramatically (more than one accounting period) from the IMS, the actual cost and status is hard to ascertain without further explanation.
  - The baseline IMS has a continuous longest path from CD-1 to CD-4, the content of longest path is reasonable given topical subject matter expertise in the qualitative assessment (Subsection 4.4.4.1), and it has reasonable float (Subsection 4.4.3.2.1).
- *A resource-loaded IMS*.
- *Resources that align with and relate to the cost estimate and risk analysis*. If the cost estimate and risk analysis are disconnected from the schedule, the IPT should note it in advance. Any quantitative risk analysis should use the IMS as its source schedule.
- *Information (the project controls process or project-specific document) that reflects the coding used in the IMS*. The team should ensure this includes all coding required to identify variable definitions and legitimate metric exclusions in Acumen Fuse.
- *The IPT evaluation of the IMS, prior to submittal, per the EVM system description*.
- *Justifications for areas identified in the evaluation where thresholds were breached in metric testing or other evaluation method*.
- *A basis of schedule (BOS) document with respect to guidance to schedulers and rule sets they used in building the schedule.*

4.2.4.1 Review of Key Contract Requirements

In addition to the EVM (Earned Value Management) system description, the contract requirements relative to EVMS and reporting should be clear to the schedule analysis team before the review starts, specifically if there are any reporting requirements that should be taken into consideration.

Before the review starts, the schedule analysis team should review the EVM system description because the IMS is an integral part of the EVMS. Specifically, the schedule SME should understand the contractor's processes and expectations outlined.

If the project has an EVMS certified by DOE or another federal organization, the results from prior internal and external surveillances should be made available and reviewed. Outstanding corrective actions should be reviewed and noted and added to the applicable Lines of Inquiry (LOIs).

4.2.4.2 Codes and Project Control Documentation Review

The codes associated with the IMS should be defined and described in documentation accessible to the review team. In addition, project control documentation—including specific project control processes and, where applicable, desktop instructions—should be available to the review team before IMS evaluation.

The schedule analysis team should not have to identify and trace fields to understand how to navigate the schedule review resources before analysis. If the documentation is insufficient and additional dialog or interviews are required, the schedule SME should request clarification as soon as the deficiency is identified and it should be noted and included in the review results, where appropriate.

4.2.4.3 Empower

Empower is a commercial off-the-shelf product from Encore Analytics. In the PARS environment, its enables analysis of contractor project performance (CPP) data uploaded from their EVMS. PARS/Empower also has the capability to analyze both contractor-submitted data for the DIQ metrics (focused on the quality of the flat files as they are generated from the contractor cost and schedule systems) as well as the DQI metrics, which align with the GAT metrics found in the PM EVMS compliance review SOP.[13] Empower schedule analysis tools include many of the EVMS compliance metrics as well as the ability to review the schedule itself. The information is provided as an additional analysis toolset, although it is not expected for every PM reviews. The ability to upload Contractor Project Performance (CPP) is required post CD-3A or CD-2 approval per DOE O 413.3B.

4.2.4.3.1 DIQ

As an output of Empower, within PARS, the DIQ metrics provide an analysis of data in native tool sets of respective cost/schedule/other platforms reported to the government. DIQ has three components: (1) a crosswalk between contractors' systems and DOE required monthly data submission format, (2) a review of native files to reported files, and (3) checks between flat files for consistency and completeness. The DIQ metrics are based on the CPP uploads or comma-separated values (CSV) flat files. The DIQ assesses whether the required data are provided and whether the data conform with the CPP upload data submission requirements. The ideal analysis is for all metric *X*-values to be 0. Unfortunately, issues often arise with the uploads that need to be addressed or understood before the review begins. Some flags can have an acceptable rationale that should be noted before the review. The review of the DIQ results will be conducted by PM-30.

At the review start, a testing space within the non-production environment should be established for the project under review, if it is not reporting monthly to PARS. During the sufficiency

[13] DOE-PM, *Office of Project Management (PM) Earned Value Management Systems Compliance Review Standard Operating Procedure (ECRSOP)*, DOE-PM-SOP-04-2018, November 28, 2018.

review for CD-2 reviews, the DIQ output should be reviewed in detail. If the uploads are not complete, the reviewer should investigate and notify PM-30 of upload issues. Appropriate PM leadership, including the PM-20 and PM-30 directors, should decide whether to proceed with the review.

4.2.4.3.2 DQI

In contrast with DIQ in the PARS analytics environment, the DQI through the platform of Empower is based on compliance metrics tests (GAT metrics). The DQI addresses the quality of data coming into the government; it is part of examining the contractor in terms of EVMS compliance. During the sufficiency review for project post CD-1, the DQI should be generated from the uploaded files and investigated by the analysis team to discern the areas on which to concentrate analysis. This can be completed by the schedule SME or by PM-30.

After entering the applicable PARS environment, production or test, the schedule SME should navigate to the project and then to **Analytics**. From the Empower **Analytics** dashboard, select the **File** menu. Export the **DQI Matrix**, **DQI IMS**, and **Audit Matrix** (Figure 1). After export, evaluate the matrices for the items flagged. The **Audit Matrix** spreadsheet should be filtered, and items of interest isolated (Figure 2). The PARS basic and advanced user courses as well as PM-30 can provide additional guidance.

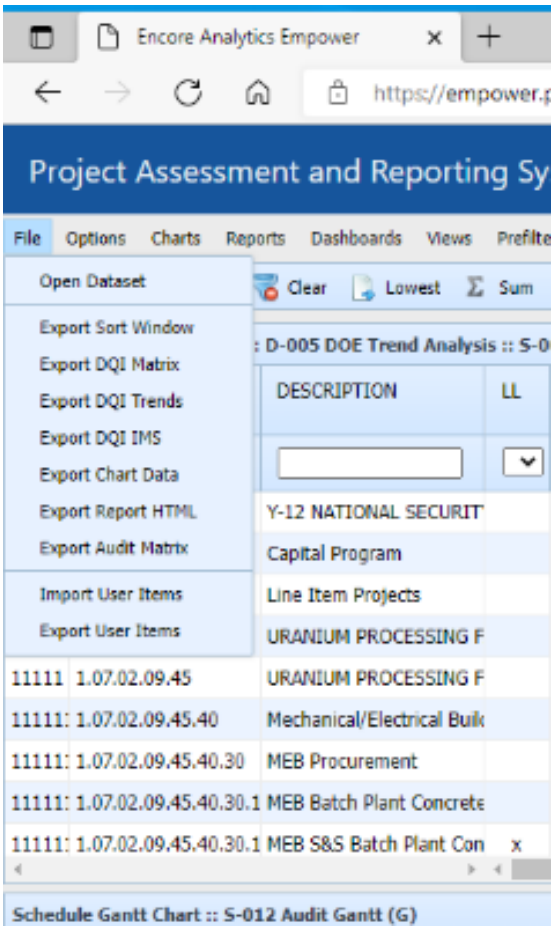
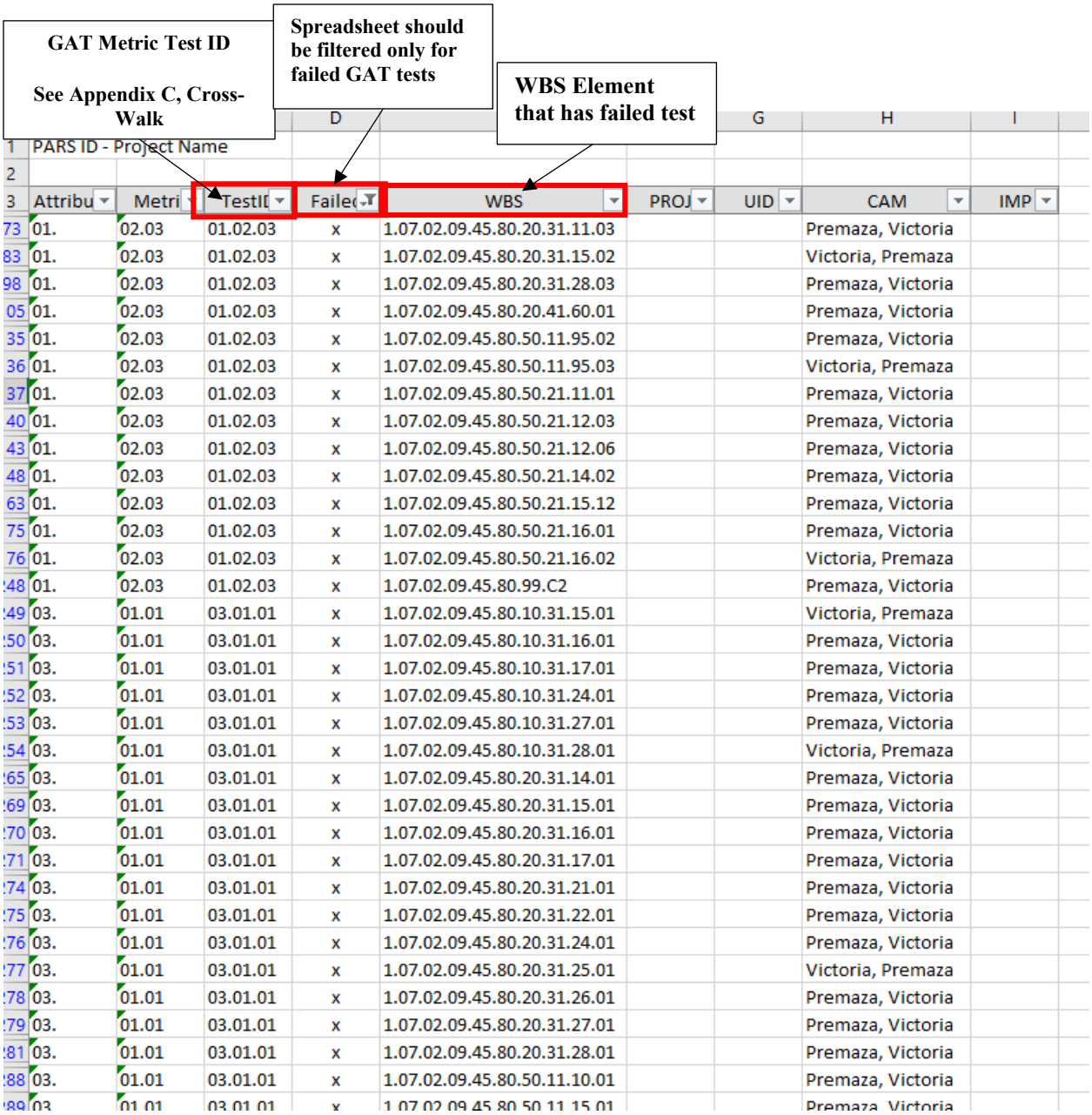


Figure 1. DQI Export Spreadsheet from Empower



	A	B	C	D	E	F	G	H	I
1	PARS ID - Project Name								
2									
3	Attribu	Metri	TestID	Failed	WBS	PROJ	UID	CAM	IMP
73	01.	02.03	01.02.03	x	1.07.02.09.45.80.20.31.11.03			Premaza, Victoria	
83	01.	02.03	01.02.03	x	1.07.02.09.45.80.20.31.15.02			Victoria, Premaza	
98	01.	02.03	01.02.03	x	1.07.02.09.45.80.20.31.28.03			Premaza, Victoria	
05	01.	02.03	01.02.03	x	1.07.02.09.45.80.20.41.60.01			Premaza, Victoria	
35	01.	02.03	01.02.03	x	1.07.02.09.45.80.50.11.95.02			Premaza, Victoria	
36	01.	02.03	01.02.03	x	1.07.02.09.45.80.50.11.95.03			Victoria, Premaza	
37	01.	02.03	01.02.03	x	1.07.02.09.45.80.50.21.11.01			Premaza, Victoria	
40	01.	02.03	01.02.03	x	1.07.02.09.45.80.50.21.12.03			Premaza, Victoria	
43	01.	02.03	01.02.03	x	1.07.02.09.45.80.50.21.12.06			Premaza, Victoria	
48	01.	02.03	01.02.03	x	1.07.02.09.45.80.50.21.14.02			Premaza, Victoria	
63	01.	02.03	01.02.03	x	1.07.02.09.45.80.50.21.15.12			Premaza, Victoria	
75	01.	02.03	01.02.03	x	1.07.02.09.45.80.50.21.16.01			Premaza, Victoria	
76	01.	02.03	01.02.03	x	1.07.02.09.45.80.50.21.16.02			Victoria, Premaza	
48	01.	02.03	01.02.03	x	1.07.02.09.45.80.99.C2			Premaza, Victoria	
49	03.	01.01	03.01.01	x	1.07.02.09.45.80.10.31.15.01			Victoria, Premaza	
50	03.	01.01	03.01.01	x	1.07.02.09.45.80.10.31.16.01			Premaza, Victoria	
51	03.	01.01	03.01.01	x	1.07.02.09.45.80.10.31.17.01			Premaza, Victoria	
52	03.	01.01	03.01.01	x	1.07.02.09.45.80.10.31.24.01			Premaza, Victoria	
53	03.	01.01	03.01.01	x	1.07.02.09.45.80.10.31.27.01			Premaza, Victoria	
54	03.	01.01	03.01.01	x	1.07.02.09.45.80.10.31.28.01			Victoria, Premaza	
65	03.	01.01	03.01.01	x	1.07.02.09.45.80.20.31.14.01			Premaza, Victoria	
69	03.	01.01	03.01.01	x	1.07.02.09.45.80.20.31.15.01			Premaza, Victoria	
70	03.	01.01	03.01.01	x	1.07.02.09.45.80.20.31.16.01			Premaza, Victoria	
71	03.	01.01	03.01.01	x	1.07.02.09.45.80.20.31.17.01			Premaza, Victoria	
74	03.	01.01	03.01.01	x	1.07.02.09.45.80.20.31.21.01			Premaza, Victoria	
75	03.	01.01	03.01.01	x	1.07.02.09.45.80.20.31.22.01			Premaza, Victoria	
76	03.	01.01	03.01.01	x	1.07.02.09.45.80.20.31.24.01			Premaza, Victoria	
77	03.	01.01	03.01.01	x	1.07.02.09.45.80.20.31.25.01			Victoria, Premaza	
78	03.	01.01	03.01.01	x	1.07.02.09.45.80.20.31.26.01			Premaza, Victoria	
79	03.	01.01	03.01.01	x	1.07.02.09.45.80.20.31.27.01			Premaza, Victoria	
81	03.	01.01	03.01.01	x	1.07.02.09.45.80.20.31.28.01			Premaza, Victoria	
88	03.	01.01	03.01.01	x	1.07.02.09.45.80.50.11.10.01			Premaza, Victoria	
89	03.	01.01	03.01.01	x	1.07.02.09.45.80.50.11.15.01			Premaza, Victoria	

Figure 2. Empower Export

As part of the sufficiency review for projects post CD-1, the schedule quality and reliability results can be cross walked to the GAO schedule best practices table (Appendix C). The metrics indicate the schedule quality and reliability, so the results should align with the findings in the IPT's self-assessment or surveillance prior to submittal. As a result of the automated testing, areas are likely to emerge that give rise to concerns to be addressed through follow-up interviews. The automated testing results help in forming LOIs, which should be done after the evaluation of and considering the automated testing results. In addition, other review functional areas or leads (such as management and technical) should be aware of the automated testing

results. (See Appendix B for the sufficiency review template, which includes the GAO schedule best practices table.)

4.2.5 Go/No-Go Requirements and Language

The schedule SME should submit sufficiency review key results to the PM lead to communicate "go/no-go" elements. The sufficiency review is a safeguard against expending inappropriate resources on reviewing incomplete project information and should be adjusted appropriately to the specific project. (See Appendix B for the sufficiency review template, which includes the GAO schedule best practices table and example language.)

4.2.6 Acumen Fuse

For analysis of the P6 files, DOE requests submittal using the .xer format (commonly referred to as the extension of the file type, .xers or xers); a P6 xer file is preferred for analysis. In addition to Empower, Acumen Fuse is a viable analysis tool for schedule analysis in PM-led reviews.

Per the PM-MAX site on MAX.Gov, "DOE PM and Deltek® now provide DOE EVMS metric tests for planning and scheduling, focused on the health of the project integrated master schedule, as part of the Deltek Acumen® software."

DOE metric tests require the user to employ Acumen version 8.6 (or later), as some of the enhancements available in version 8.6 (or later) are required to support test functionality. In addition, templates and desktop instructions are posted in the standard folder for templates provided by Acumen (Table 2). Check before each review, as these are updated when Deltek adds additional capability to Acumen.

Table 2. Acumen Fuse Instructions and Templates

File	Version	Date
DOE EVMS Basic Fuse Instructions	V5	3/31/2020
DOE EVMS Metric Template	V6	8/31/2020
DOE EVMS Workbook Template	V6	8/31/2020

The EVMS metric template and workbook provide include the baseline analysis and forecast analysis. During the sufficiency review, an Acumen Fuse analysis should be conducted using these formats at a minimum. The Acumen Fuse results should be included in the sufficiency review feedback to the PM lead and available to other review team members as appropriate. Follow the Fuse instructions (DOE EVMS Basic Fuse Instruction) closely as DOE templates require adherence to procedure steps in the instruction, specifically those for tool and user settings and identification of codes for appropriate inclusion or exclusion in individual metrics. The template and instruction are also in the public files that come with Acumen, including applicability at each CD.

Acumen Fuse also has a forensics functionality for use in identifying changes and comparative analytics between schedules. For instance, if both the baseline and forecast schedules are imported into Acumen Fuse, the forensics functionality can be used to identify changes and

perform comparative analytics. A report of the findings can be viewed and exported to Microsoft Excel.

4.3 Schedule Maturity

The following discussion of schedule maturity is presented to the reader for the purpose of providing holistic schedule expectations at various CDs. Following the description, more elaboration for quantitative and qualitative assessments are presented that should be followed while assessing the schedule during PM reviews by the schedule SME.

Throughout the project lifecycle, the schedule should be commensurate with maturity of project deliverables. (Please note project deliverables are NOT the same as design completion, with overall project deliverables being inclusive of planning documents, permitting, safety basis, and engineering and design). For the Chief Executive (CE), or the Project Management Executive (PME), to make sound and informed decisions for the approval of the Performance Baseline throughout the project lifecycles its respective schedule should reflect the appropriate schedule class for the CD.

As a general guideline, the schedule classifications from the Association for the Advancement of Cost Engineering (AACE) International is adopted for the purpose of this SOP as a methodology to classify the schedule. Throughout this SOP, the intent of content from AACE International Recommended Practice 27R-03 Schedule Classification System is reflected, albeit translated accordingly to DOE practices.

Terminology introduced includes resource informed, resource constrained, and resource leveled.

- Resource informed is defined as the overall project duration derived from summary bars supporting achievement of milestones/events and respective cost is calculated through parametric or top-down estimation of the resources required.
- Resource constrained is defined as schedule activities (including work packages, planning packages and summary level planning packages) are assigned resources, with the bottoms-up summation of the cost of resources constrained per the respective budget profile.
- Resource leveled is defined as assigned resources for activities (including work packages, planning packages and summary level planning packages) planned with realistic availability given work fronts and achievable efficiencies/unit rates/physical access integrated in planning, with the bottoms-up summation of cost of resources constrained per the respective budget profile

4.3.1 CD-0 Schedule Maturity, Class 5

At CD-0, the purpose of the schedule is to quantify the cost range of possible alternatives to fulfill the mission need in addition to communicating the ability of the Program to meet the identified gap. Typically, at CD-0, the schedule(s) provided includes either the most likely alternative that will be further developed in conceptual design and/or the alternative that is the cost range upper bound alternative that will be considered during the Analysis of Alternatives (AoA).

At CD-0, the schedule should be a Class 5 schedule that is typically represented as a Gantt or bar chart, summary bars or activities connected logically with major milestones and events. The major milestones and events are to align with DOE O 413.3B requirements and programmatic mission drivers typically included in the Mission Need document. The duration and length of the summary bars or summary activities should have a basis including subject matter expertise and/or parametric models. The schedule should be resource informed.

For GAO best practices, based on the level of project deliverable maturity, some best practices cannot be evaluated, i.e. not evaluable (NE). Generally, the GAO characteristic of comprehensive, specifically Best Practice 1 can be partially evaluated quantitatively to assess if all scope has been accounted for (at a summary level). The GAO characteristic of Credible can be partially evaluated quantitatively, specifically Best Practice 5 to validate the scheduled can be vertically traced to programmatic mission drivers and alignment with those milestones/events found in the Mission Need Statement. The GAO characteristic of Well-constructed, specifically the Best Practice 6 of "Confirming the Critical Path is Valid" can be partially evaluated quantitatively to ensure the longest path and respective schedule duration is accurately portrayed to decision makers during the approval process. Other GAO Best Practices can be fully or partially qualitatively evaluated with general exceptions of Best Practice 8, Conducting a Risk Analysis, Best Practice 9, Updating the schedule using actual progress and logic and Best Practice 10, Maintaining a baseline schedule being not evaluable (NE).

4.3.2 CD-1 Schedule Maturity, Class 3 (Preferred Alternative) and Class 4 (Non-preferred Alternative(s))

At CD-1, the purpose of the schedule(s) supports the AOAs and selection of the preferred option and continuation of the refinement of the cost range.

During the AOA process, dependent on the selection methodology, the alternatives being compared should have adequate maturity to complete the comparative analysis process. The alternatives should be at a minimum a Class 4 Schedule(s). The schedule should include, like CD-0, the events and milestones that align with DOE O 413.3B requirements and programmatic mission drivers. The uncertainty of the activities, work packages, planning packages and summary planning packages should be included for the determination of risk associated with the alternative(s) to be quantified and compared. The schedule(s) should be resource-informed with additional parametric or historic evaluation at discrete levels throughout the project intervals (i.e. design and construction) and overall project length and risk assessed through "cross-checks". The schedule should be resource constrained and developed using best practices in planning and scheduling, including EIA-748. Quantitative evaluation of GAO Schedule Assessment Best Practices that may be categorized as NE include discrete WBS comparisons with Work Authorization Documents (WAD), Control Account Manager (CAM) assignments, development and alignment of forecast schedules to baselines schedule, and subcontractor activity integration. The schedule some be planned and logically linked, i.e. Critical Path Method (CPM) of scheduling.

At CD-1, the preferred alternative should enable the project to continue progression into preliminary and final design immediately after CD-1 approval. As such, the rolling wave planning method should be deployed with near-term activities and Work Packages (WP) detailed, the use of planning packages (PP) and summary level planning packages (SLPP)

utilized. The schedule should be generated from an EIA-748–compliant EVMS and be resource leveled. There should be availability of a baseline and forecast schedule, as the project should be executing and be posed for further execution post approval without substantive delays because of poor planning. Quantitative evaluation of GAO Schedule Assessment Best Practices will automatically account for the project maturity. The quantitative testing methodology that utilizes thresholds, i.e. percentages, will adjust by utilizing the actual numerator and denominator (i.e. denominator being the aggregate count of the activities/WP/SLPP). The qualitative assessment will take the project maturity and adjust expectations accordingly. Additionally, the project will benefit from exercise of quantitative schedule evaluation to ensure schedule architecture including code fields are in place as the project progresses to CD-2. Quantitative evaluation of GAO Schedule Assessment Best Practices that may be categorized as NE include discrete comparison of Baseline Change Requests (BCR) to WADs, discrete WBS assignment to CAMs. The schedule should be planned and logically linked, i.e. CPM of scheduling.

4.3.3 CD-2 Schedule Maturity, Class 2

At CD-2, the project should be employing rolling wave planning method for near-term activities and WP detailed, the use of PPs and SLPPs utilized. The schedule should be generated from an EIA-748–compliant EVMS and be resource leveled. There should be availability of a baseline and forecast schedule, as the project should be executing and be posed for further execution post approval without substantive delays because of poor planning. The schedule should meet all GAO Best Practices. There should be both a baseline and forecast schedule available for evaluation.

4.3.4 CD-2/3, CD-3 Schedule Maturity, Class 1

At CD-2/3 and CD-3, the project should be similar to the CD-2 described schedule. However, as the schedule matures and is determined to be a Class 1 schedule, the uncertainty bounds should be decreased significantly. Additionally, although rolling wave planning method is still utilized for near-term activities and detailed WPs, the use of PPs should have an increased level of detail and understanding with additional planning definition for summary level planning packages (SLPP) utilized. The schedule should be generated from an EIA-748–certified EVMS and be resource leveled. A baseline and forecast schedule should be available, as the project should be executing and be posed for further execution post approval without substantive delays because of poor planning. The schedule should meet all GAO Best Practices.

4.4 Sufficiency Review Quantitative Assessment

This subsection describes the receipt and quantitative assessment of the schedule files during the sufficiency review. Advising project counterparts of this quantitative assessment before they transmit the schedules will facilitate greater communication and the process overall.

4.4.1 Relationship with Other PM Testing

As part of the sufficiency review (Subsection 4.2.4), the DIQ checks focus on the data in the contractor's native tools (cost, schedule, and other) reported to the government. After the sufficiency review and during the review initiation, the schedule SME, in conjunction with the other review team members, should ensure the DIQ flags are identified.

4.4.2 P6 Analysis

As part of the data call for the review, the review team asks the project to furnish the schedule details in multiple formats, including the native files, P6, and Portable Document Format (PDF). The P6 files are analyzed in native format. Analyzing .xml output from P6 can pose problems, so DOE does not use this file format. Although alternative methods are available for analysis, such as Acumen Fuse and Excel outputs, the schedule SME expects to import the exported .xer file independently and have the ability to view it in its native P6 environment.

4.4.2.1 Database Configuration

4.4.2.1.1 Export/Import Controls

The schedule SME creates two separate, empty databases for importing the .xer file. (Importing the schedule data into a shared database with other similar or previous schedules is usually seen as efficient, but this has caused numerous issues requiring rework of the analysis.) If the schedule SME prefers one project-specific database, with multiple .xer files (a program file), that would be allowable if the naming convention supports quality control of source and review files. A P6 Pro Standalone (SQL Lite) database that can be transferred and uploaded separately if requested is preferable.

4.4.2.1.2 Source Database

The first (source) database will remain unchanged throughout the review. This view captures the project schedule as provided. The schedule SME should ensure no changes are made, including activity names or durations. Also, the schedule should not be "rescheduled" or "F9'd." (The schedule provided should have already been "scheduled" or "F9'd" before the xer was created and received.)

- The initial import should be the forecast schedule; the baseline schedule is then imported as the primary baseline. (When an .xer is created in P6 and exported, the assigned baseline does not get transferred to the xer. The baseline data fields are populated in the .xer with planned/original data. Therefore, a separate .xer that contains the baseline information must be created. Also, this baseline .xer can then be assigned with the forecast xer inside of P6 or merged within Acumen Fuse.) A combined xer, with both sets of data, can be exported from Acumen Fuse for other uses.
- The color coding and symbols of the Primavera IMS baseline in the Primavera Gantt view should be a duplication of the project's view or the default view of Primavera.
- For the DOE EVMS metrics, the correct baseline must be created. For some of the metrics, the baseline assignment is used to identify differences between the baseline information and forecast information. Without this assignment, the analysis will not be correct.
- When the import is complete, the schedule SME begins the quality checks to ensure the additional schedule information provided aligns with that viewed in the schedule SME's P6. During the import/export process, small deviations from expectations can delay analysis and conclusions. The comparison between the P6 view and the other schedule artifacts (specifically, the PDF views) should sample the total budget in dollars, total hours, number of activities, critical path, and total float of other activities. If no artifact is available for comparison, the schedule SME should share the sampled data with the project for comparison.

4.4.2.1.3 Review Database

The second (review) database facilitates further testing and evaluation, including those stemming from the analysis changing logic, durations, sequence, risk mapping, etc. Similar to the source database, the project team's .xer should be imported. Also similar to the source database, a quality check should ensure the import/export process succeeded. The initial import should be the forecast schedule; the baseline schedule is then imported as the primary baseline. However, in this database, additional testing, including push/pull tests and revision of schedule durations, can prepare the IMS for an independent quantitative schedule risk analysis.

4.4.2.2 Review of Settings and Codes

The received scheduling P6 settings should be noted after the xer is imported, and a screenshot taken (Figure 3). These settings should also align with those in Acumen Fuse.

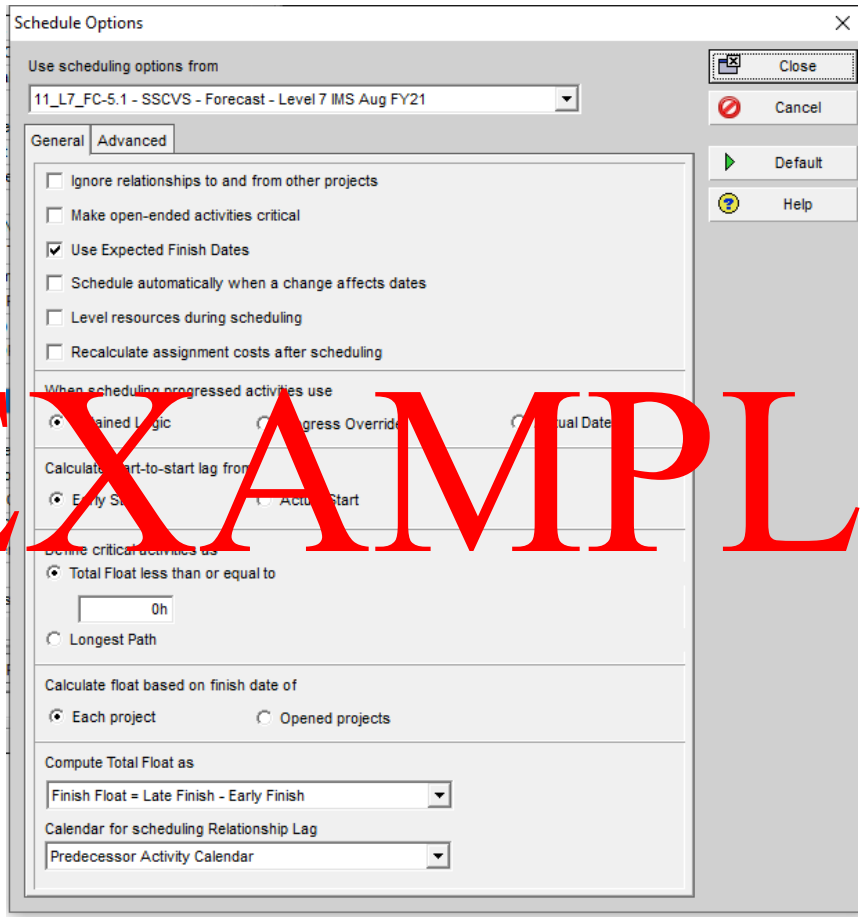


Figure 3. Schedule Setting Screenshot

The P6 settings should be compared with the EVM system description expectations or project control/schedule procedures.

4.4.3 Schedule Mechanics, Quantitative Assessment

The GAO *Schedule Assessment Guide* cites four characteristics of a reliable schedule: (1) comprehensive, (2) well-constructed, (3) credible, and (4) controlled. The GAO guide

crosswalks those characteristics to the best practices, which have "Standard Quantitative Measurements for Assessing Schedule Health" and "An Auditor's Key Questions and Documents."

This SOP crosswalks GAO best practices to the PM GAT metrics for use in identifying and documenting the results of the automated and manual tests:

- Primary GAT metrics are tests furnishing evidence of best practice implementation and align with Appendix VI of the GAO guide.
- Secondary best practices are specific to DOE and not identified in Appendix VI, but they should be evaluated for implementation.
- Tertiary best practices contribute to achieving the best practice outcome but are not the primary indicator of evidence of best practice implementation.

The SOP also crosswalks the topical areas to the draft DOE G 413.3-2X, *Planning and Scheduling*, undated.

In evaluating a schedule, the schedule analysis team should, at a minimum, perform the analysis that follows. Areas of concern or high risk—and those needing more review to ensure the PB can be validated through respective CD approvals—should undergo more detailed evaluation.

4.4.3.1 Comprehensive

A comprehensive schedule reflects all activities in the program's work breakdown structure (WBS), labor, materials, travel, facilities, equipment, and the like needed to do the work. It also shows whether those resources will be available when needed and how long each activity will take, allowing for discrete progress measurement with specific start and finish dates. This schedule characteristic aligns with the following best practices:

1. Capturing all activities.
3. Assigning resources to all activities.
4. Establishing the durations of all activities.

The GAT metrics (GAT metrics described in detail in Appendix C) of with which these align are as follows:

- Primary—A.01.05, A.05.01, B.01.01, B.05.01, B.05.02, B.05.03, B.05.04, B.05.07, B.05.08, B.06.01, I.02.08
- Secondary—N/A
- Tertiary—A.05.05, B.05.06, B.09.01, C.02.01, C.03.01, C.05.02, C.07.01, H.02.02, I.02.03, I.02.04.

4.4.3.1.1 Schedule Characteristics

The basic schedule characteristics should be noted in the baseline and forecast files. Complete a schedule characteristics table (Table 3) and include it in the schedule notebook.[14]

[14] Although noted in the GAO guide's Standard Quantitative Measurements for Assessing Schedule Health, activities with no descriptive name, with duplicate names, or marked as both a milestone and summary activity, are considered errors in DOE and should be corrected before further evaluation (and not specifically assessed).

Table 3. Basic Schedule Characteristics

Category	Baseline	Forecast
Status date		
Number of activities		
Number of milestones		
Ratio of detailed activities to milestones		
Ratio of LOE to discrete activities		
Percentage of the project schedule sequenced concurrently		
Percentage of the project schedule sequenced sequentially		

This information contained in the schedule notebook can give readers of the various review reports perspectives on the IMS. The table should not be considered an output but rather data points for reference, including information provided in narrative form where appropriate.

4.4.3.1.2 Alignment and Authorization

The contract, SOW, work authorizations, and other forms of authorization should be reviewed. In this review, the schedule SME should ensure the plan description (activities, durations, and dates) aligns with the technical scope in the WBS and IMS. Also, the periods of execution should align appropriately. The authorization artifacts reviewed should be identified and included in the schedule notebook. The information should be made available to the review team for additional SME review. This unautomated review process requires schedule SME diligence.

If significant effort is subcontracted, the schedule SME should also review and ensure the critical subcontractor work and schedules are fully integrated. The prime schedule should be at a level that defines key interfaces and how the effort will be accomplished and should align with other project documentation, including the acquisition strategy and PEP. Typically, the prime contractor subcontracts the construction, or a portion that will not be self-performed. During the acquisition, a Request For Proposal (RFP) or similar acquisition documentation is generated and provided to proposers. As part of the review, the schedule SME should be familiar with the solicitation and requirements that were defined and be aware of any misalignments. During CD approval, specifically at CD-2 and CD-2/3 approval, the subcontract schedule may not be integrated after the CD is approved (or until the subcontract is authorized). The project should facilitate review of the proposed integration of the schedule even if the subcontract is not approved or authorized. The schedule SME should assess and document the integration of the sub-contractor schedule, specifically if it is a comprehensive integration, through interface milestones, representative integration or other approach. The preferred methodology is the comprehensive approach with the entirety of the sub-contractor schedule being fully integrated. The status dates of the prime and sub-contractor schedules should be the same or minimally different.

4.4.3.1.3 Risk Mitigation Activities, High Dollar Value Items (by Activities)

In reviewing the IMS and quantitative risk analysis results, ensure that the IMS code fields of risk mitigation (RM) and high dollar value (HDV) activities can be articulated.[15] For projects requesting CD-2 approval, the schedule SME should capture the authorized RM and HDV activities and document them in the schedule notebook, citing the IMS fields from which information was captured (Table 4). If the information is not documented by the IPT in the schedule, the Review Team should consider citing this as a review finding. Compare applicable source documents or circulate them to the review team. Specifically, authorized RM steps in the IMS should align with RM activities identified by the quantitative risk analysis and defined in the risk register. RM activities should be discrete (not buried in LOE) and have been deliberately added and resourced on the basis of a business case review in the risk management process to mitigate a risk event.

Table 4. RM and HDV Activities

RM Activities	HDV Items (Activities)	IMS (Yes/No)	Risk Forms (Yes/No)
[Capture RM here]	[Capture HDV here]		

4.4.3.1.4 Resources and Durations

Per AACE International Recommended Practice (RP) 38R-06,

> Documentation of the schedule basis is an important step in reaching the objective for successful use of the project schedule. Describing the various elements of information in the schedule basis document will provide a better understanding of what is or is not included and what is specifically excluded in the project schedule. A structured approach to that schedule documentation will eliminate much of that uncertainty and provide a clearer understanding of the schedule.
>
> Documenting the basis of the cost estimate (BOE) is a generally accepted practice. That estimate basis is frequently used as a reference related to change management as the project moves forward. Many projects however, have invested less effort or have been less interested in documenting the basis of the project schedule for a variety of reasons.[16]

For general DOE application, the BOS should contain the following:

- Project description, schedule integration process
- Scope of work—WBS or organizational breakdown structure (OBS)
- Execution strategy
- Key project dates
- Planning basis
- Cost basis
- Critical path
- Path of execution

[15] This subsection primarily addresses whether the IMS captures all activities (a GAO best practice). As the risk assessment is iterative—including risk identification, quantitative risk analysis, and inclusion of risks and RM activities in the schedule—the process is assumed to be ongoing. The inclusion of RM activities should be a product of a thorough risk process resulting from quantitative risk analysis and meaningful selection of RM activities.)

[16] AACE International, RP 38R-06, *Documenting the Schedule Basis*, July 18, 2009.

- Punchlist, turnover, and system start-up
- Issues and concerns
- Risks and opportunities
- Assumptions
- Exclusions
- Exceptions
- Schedule margin and DOE schedule contingency.

In the review of resources and durations, the schedule SME should understand the process by which the BOE and BOS are translated into the IMS. The duration should be based on the BOE/BOS, whereas the IMS could reflect resource leveling and increased apportioned efforts. Frequently, during its evolution, the IMS can deviate from the BOE and BOS, which should be documented. Also frequently, the IMS can contain merely hours for labor and dollars for non-labor. The pricing of the labor hours is completed in the EVMS cost processor. In that scenario, the dollarized time-spread should be provided for alignment review. Per DOE O 413.3B, Attachment 1, Page 4, "As a minimum, a resource-loaded IMS must contain labor, material and equipment costs to include unit prices and quantities. For firm fixed-price contracts, the total contract cost must be included in the integrated master schedule."

4.4.3.1.5 Resource Loading

DOE has a complex contract structure that frequently uses management and operating (M&O) prime contracts. The IMS resource requirements have varying interpretations due to the complexity of the work and M&O contract types. A large portion of a project's resources are quantified in dollars in the "cost processor" of the M&O contractor, incorporating indirect rates and ultimately reflecting alignment with the contract budget base. The resources in the IMS are usually direct labor resource hours and dollars without markups (and escalation) for materials and sub-contracts.

The schedule SME should do the following:

- Describe the IMS resource loading (because the interpretation of resource-loading levels varies).
- Document the resource-loading method.
- Crosswalk the implementation of resource loading with the EVM system description.

The schedule SME should also sample the BOE/BOS → IMS → cost processor → finalized WBS element within the total project cost (TPC) to ensure traceability.

The schedule SME should ensure activities that should have resources (but do not) are queried, in addition to activities that should not have resources—zero budget activities (ZBAs) or schedule visibility tasks (SVTs)—but do. Empower DQI can indicate areas for further analysis. The DOE EVMS metrics in Acumen Fuse analyze specifically for activities that should not have resources.

The resource information table should be completed and included in the schedule notebook (Table 5).

Table 5. Resource-Loading Method

Resource-Loading Method		Implementation Matches EVM System Description (Yes/No)
[Method here]		
Resource trace, sampled activities		Was the trace successful?
[List of sampled activities]		
Activities with inappropriate resource loading	Should not have resources [ZBAs, milestones, SVTs]	Should have resources [discrete, LOE]
[Activity ID and title]		

Calendars should also be evaluated and captured, including a check that the appropriate calendar is applied to the appropriate work type. Calendars and descriptions should be captured in the schedule notebook. There can be optimistic or pessimistic assumptions inherent in the chosen calendars. As such, there should be a thorough understanding and documentation of the applied calendars including risk mitigation possible options (i.e., can the schedule be "crashed" by adding an additional shift).

4.4.3.1.6 Resource Leveling/Constraints

Resource constraints due to factors such as physical space limitation or available qualified craft workers should be explored and documented. *Frequently, IMSs at the CD points reflect unconstrained planning, which is not realistic planning.* Ideally, risk is quantitatively analyzed before any resource constraining or leveling to compose a schedule with reliable activity durations for resource leveling. Without this step, the activity durations are likely underestimated, leading to an underestimation of the resources needed and of the cost of the work. The schedule SME should understand the resource leveling, if completed, and any resource constraints inherent to the IMS.

Figure 4 and Figure 5 are examples of expected screenshots that show evidence of resource evaluation.

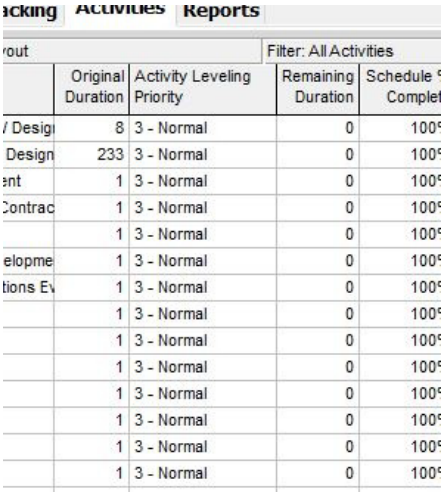


Figure 4. Resource Activity Leveling Priority

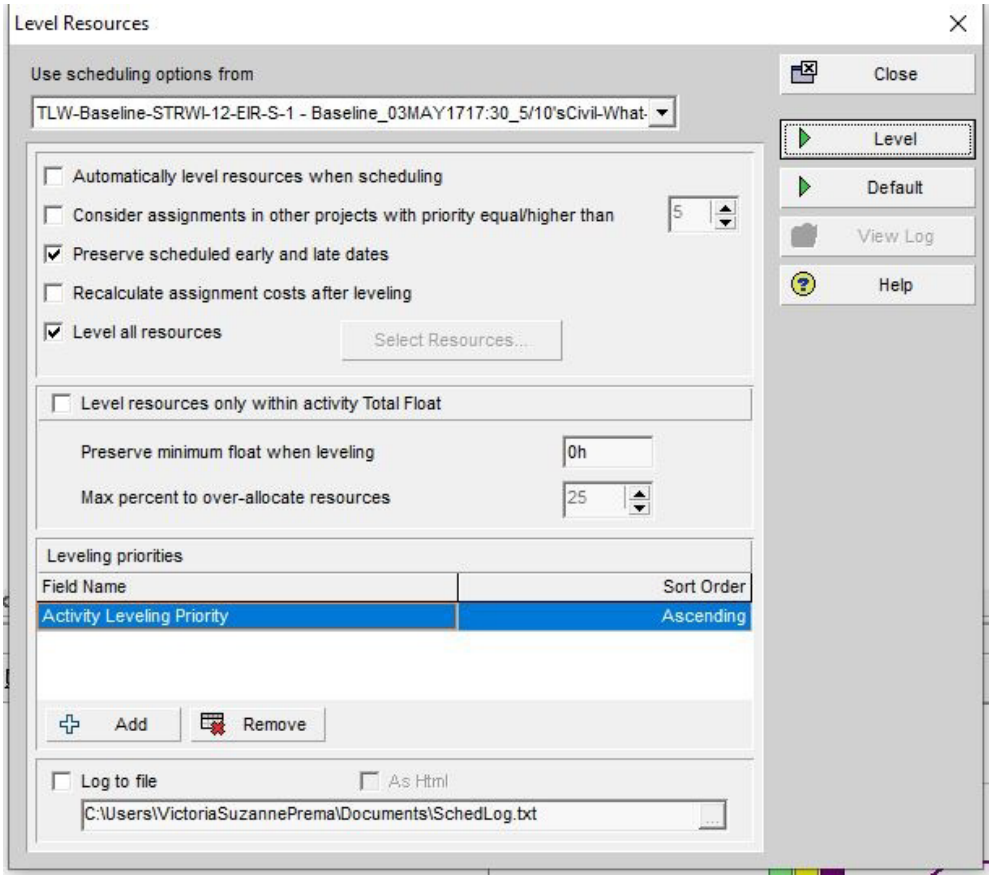


Figure 5. Resource-Leveling Options

Figure 6 is an example of various options for laying in resources over time.

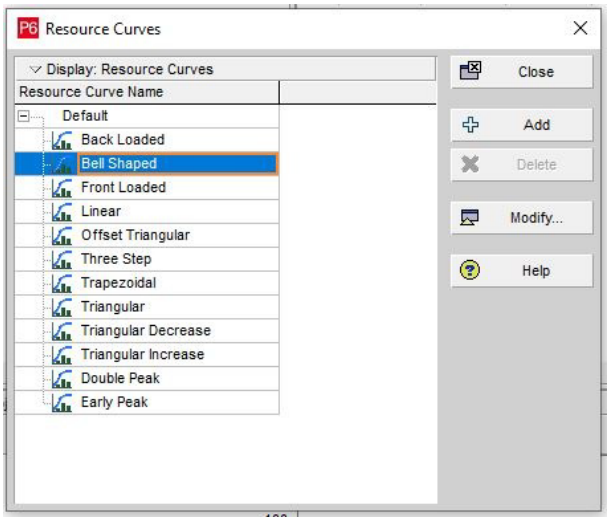


Figure 6. Resource Curves

These figures show resource leveling at the activity prioritization level. However, resource usage assessment on projects (with a resource dictionary defined) can be leveled at the "role" level. This method can be cross-checked with the current and forecast staffing plans. The application of resource curves is usually found in construction commodity installations. Due to the use of firm fixed-price (FFP) subcontractors, this scheduling feature is not always applied. Learning curves and installation rates should be considered, as well as their impact on other portions of the schedule network. Figure 7 illustrates a graph that should be reviewed for all resources.

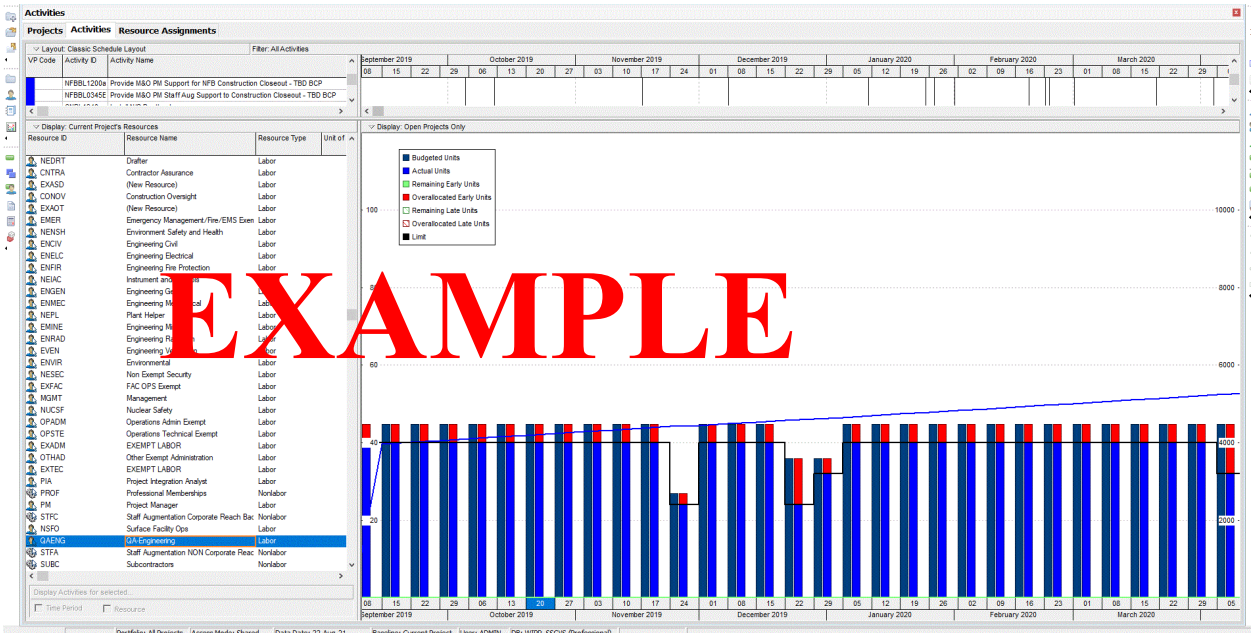


Figure 7. Resource Allocation Graph by Resource

Again, if there is no knowledge of the constraints of resources translated into the IMS, this graph will not reflect any overallocation. The schedule SME needs to consider and understand whether the resources assigned to activities are available.

Resource leveling and applicable resource constraints should be inherent in the IMS durations and resources. The schedule SME should capture the IMS resource curves for review and for other review team members. The schedule SME should select the resource curves of additional interest. Examples include resources that have typically been insufficiently planned, such as construction resources for electrical conduit installation. The resource curves should be identified and included in the schedule notebook. This information should be made available to the review team for additional SME review.

4.4.3.1.7 Relationship with BOS/BOE and Quantifiable Backup Data

Unit rates and other methods for calculating durations should be traceable. Ensure unit rates directly correlate with activity durations.

4.4.3.1.8 Larger Programmatic versus individual Project IMS

If the IMS being reviewed relates to a larger programmatic IMS, ensure the integration points align with project documentation or other programmatic IMSs. If the IMS is composed of multiple project IMSs, ensure they show a consistent network logic and schedule method.

4.4.3.2 Well-Constructed

A well-constructed schedule reflects all activities logically sequenced with predecessor and successor logic, limited and justified use of unusual or complicated logic, a critical path that determines the activities that drive the program's earliest completion date, and total float that accurately reflects the schedule's flexibility. This schedule characteristic aligns with the following best practices:

2. Sequencing all activities.
6. Confirming that the critical path is valid.
7. Ensuring reasonable total float.

The GAT metrics (GAT metrics described in detail in Appendix C) with which these align are as follows:

- Primary—B.03.01, B.03.02, B.03.05, B.03.06, B.03.07, B.03.08, B.03.11, B.03.12
- Secondary—B.03.15, B.03.16, C.06.01
- Tertiary—B.07.01, B.07.02, B.10.01, B.10.02.

This key set of requirements sets the foundation for having a reliable, high fidelity quantitative risk analysis. Any deficiencies ("junk") left in the schedule from this set of requirements will likely have to be cleaned up before the quantitative risk analysis. Addressing deficiencies before running the risk analysis saves time.

The goal of this assessment area is a valid critical path. However, once the quantitative risk modeling and analysis are completed, the list of high-priority or contributing activities is likely to differ from the original critical path. This is normal, expected, and part of a reliable analysis.

4.4.3.2.1 Float analysis

4.4.3.2.1.1 Negative Float

In reviewing float, the schedule SME should ensure no negative float is currently represented by the schedule, baseline, or forecasts. If negative float is present, the schedule SME should initially

confirm that the export/import was correct and the project was scheduled (F9'd) properly and at the correct time. Thereafter, the schedule SME should notify the PM review lead and review team for inquiry and LOI.

4.4.3.2.1.2 Excessive Float

The definition of excessive float is dynamic, but it usually constitutes total float equal to or greater than 10% of the project's remaining duration. The self-surveillance, resolution, and justification of excessive float should be consistent and available to internal contractor governance and federal oversight. First, the schedule SME should ensure the IMS has correct and complete logic between the activities. Then, if excessive float occurs, it can be properly addressed. Do the following to calculate the activities with excessive float:

1. Calculate the length of the remaining duration of the project by subtracting the current data status date from the last activity on the PMB (typically the contractor's CD-4) without schedule margin. The threshold for identifying excessive float is 10% of this remaining duration.
2. Calculate excessive float, capturing activities that breach the threshold.

Excessive float does not automatically imply a poor IMS. Excessive float of an activity signifies that it does not have to be completed within the total float value before it impacts the completion date of the project. The planning and schedule time-phases identify available resources to execute respective activities, generating resources curves that are iteratively planned until aligned with availability of funds and the resource constraints. DOE projects are complex, including constraints on job sites stemming from additional security and nuclear safety measures, so excessive float activities should not be overlooked but judiciously considered, planned, and transparently communicated:

- Identify excessive float activities, as described in the definition, and group them accordingly.
- Review the correctness and completeness of the logic associated with the high float activities. Remedy any incorrect or incomplete logic.
- Review the justifications of excessive float where validated and aligned with the approved EVM system description.

The technical SMEs and project controls, and other review team members, should review the logic, referred to as a "schedule walkdown." This crosscutting review ensures all interested parties are fully cognizant.

A merge bias indicates how complex the start of an activity is. If the number of links is greater than 15, the activity in question is likely associated with the wrong predecessor or it will be delayed due to the cumulative effect of all links having to complete on time for the activity to start on time. The merge bias may also indicate inappropriate logic links created to artificially pass testing protocols. Combined with excessive float at a merge point, this presents an area for further review as it exponentially increases risk for the schedule network. The excessive float information table should be completed and included in the schedule notebook (Table 6). This information should be included as input into the risk event identification for the quantitative risk analysis.

Table 6. Float Analysis

Activity ID	Activity Name	Excessive Float Values	Justification Provided		Merge Point (Yes/No)	Review Completed (Yes/No)
			Reviewed	Satisfactory		
[Activity grouping (such as construction subcontract, safety basis)]						

4.4.3.2.2 Relationships

Relationships throughout the network need to be examined to ensure integrity from a schedule network mechanics perspective. Specifically, obvious deviations from expectations—including lack of relationships and excessive start-to-start (SS) or finish-to-finish (FF) relationships (see GAT metric tests B.03.05 and B.03.06)—need to be reviewed and explored further if the population is beyond the GAT metric threshold or if the relationship is not relevant. (If it is an LOE hammock with an SS and an FF, do not double-count activity.) In addition to a schedule network mechanics review, this evaluation permits identification and review by other team members with differing technical and project management acumen. This review should identify any relationships that need further review and validation. The relationship table should be completed and included in the schedule notebook (Table 7).

Table 7. Relationships

Activity ID	Activity Name	Relationship Type/ Justification for Further Review	Review Completed (Yes/No)
[Activity grouping (such as inappropriate SS relationships or tangler activity with no relationships)]			

4.4.3.2.3 Critical Path Analysis

The critical path, and near-critical paths, drive most of the investigation during schedule analysis and assessment. The correct identification of the critical path—the longest path from project start (or time now) to finish with the least amount of float—also is pivotal in appropriately capturing the correct risk profile. As such, the critical path warrants review for major errors in schedule network mechanics. In addition, as discussed in Subsection 4.3.2.2, if the schedule options–calculated critical path differs significantly from expectations, further discussion and review is needed. If logic is missing, incorrect, or incomplete, or significant activity definition is missing, it could cause a different longest path to be identified. Also, the critical path is likely to change during the quantitative risk modeling and analysis as it considers all of the combinations and permutations for activity durations and external risk events. The initial critical path is a single view of the schedule, but the quantitative risk analysis will provide results over many possible views.

Although discussed separately, the interconnection between the schedule mechanics of constraints/lags/leads, LOE, excessive float, and push/pull testing (Subsection 4.3.3.3.1) contributes to an understanding of the validity of the critical path.

Often IPTs have identified the critical path and have coded it as such in the IMS. However, the schedule network logic produces an alternative critical path from that identified by the IPT. In addition, during project execution, the change control process could have identified additional activities that alter the critical path or longest path of the project. In addition, the quantitative risk analysis identifies activities that *most* contribute to schedule extension—whether or not they are on the original longest path. For this reason, the longest path resulting from a quantitative risk analysis (risk-adjusted schedule) is the most reliable.

Near-critical paths are also pivotal items in the schedule analysis and evaluation. This SOP calls for the schedule SME to furnish five near-critical paths (taking a graded approach that depends on the specifics of the IMS reviewed). The near-critical paths should be based on the risk-adjusted schedule.

The critical path tables should be completed and included in the schedule notebook (Table 8 and Table 9). Portions can be produced as a P6 output with a Gantt chart or an export to Excel.

Table 8. Critical Path Definitions, Code Fields, and Deviations

Critical Path Definition in EVM system description (or Project-Specific Processes)	
[Provide information and cite document numbers.]	
Critical Path Code Fields	
[Provide P6 code field designators.]	
Activity ID/Names	**Longest Path Activities Not Aligned with Critical Path Code Fields**

Table 9. Critical Path Activities Listing

Activity ID	Activity Name	Baseline Start	Baseline Finish	Activity Type	Relationship with Predecessor	Relationship with Successor

4.4.3.2.4 Constraints/Lags/Leads

Constraints, lags, and leads should be used judiciously. Although the IPT may have justification for some use, DOE employs the Critical Path Method (CPM) of scheduling, and excessive use of any of these scheduling options invalidates the calculation of the schedule network. Thus, constraints, lags, and leads need to be documented and have ample justification. As with other items in the P6 evaluation, justification is only an initial indicator. The schedule SME must

review the justification and explore the evidence that it is correct and wholly embraces the realized impact of the additional schedule network manipulation. Also, only one hard constraint is permissible on the CD-4 milestone.

The lead/lag/constraint information table should be completed and included in the schedule notebook (Table 10). In addition, code fields associated with each schedule network manipulation (lead/lag/constraint) should also be included in the narrative.

Table 10. Constraints, Lags, and Leads

Activity ID	Activity Name	Lead	Lag	Constraint	Justification Provided	Cause

If the IMS will undergo a quantitative risk analysis, the requirements for its quality increase. All leads must be removed (usually meaning that activities must be added and the logic reworked) because leads cause mathematical problems with quantitative risk analysis tools. All lags must be converted into activities because risk modeling can only be defined for activities and not lags (most quantitative risk analysis tools can do the conversion).

The quantitative risk analysis strives to show possible project outcomes, so constraints that override the IMS logic must be removed or replaced. All hard constraints must be removed or converted into constraints that do not affect the finish of the activity. Typically, they are converted into start-on-or-after or finish-on-or-after constraints. As-late-as-possible constraints must be removed to avoid their negative impact on the driver analysis—which relies on logical predecessors for its results. Only *real* start-on-or-after or finish-on-or-after constraints should remain in the IMS for risk modeling. These could include a vendor delivery, a resource availability, etc. Although these further constraint requirements do not have to be met in the P6 IMS, they must be met before the quantitative risk analysis. If they are not met in the P6 IMS, additional effort will be required to understand the differences in the P6 IMS delivery dates and the risk-modeled IMS delivery dates.

4.4.3.2.5 LOE

Review the IMS and ensure that LOE is identified consistently throughout. The definition of LOE should coincide with the EVM system description and be coded in the schedule as such. This excludes “hammocks” and concentrates on the activity type of LOE. Review titles, code fields, and activity types and ensure consistency. Review the LOE expectations as clarified in the EVM system description. Ensure that there are no network logic errors regarding LOE, including incorporating LOE with discrete activities in the logic or misplacing obvious discrete activities as LOE activity types. Places that require further evaluation for inappropriately designated LOE include Title III, start-up, and commissioning activities (as opposed to identified discrete activities such as start-up procedures) and nuclear safety basis activities (as opposed to identified discrete activities such as safety evaluation reports). Ensure LOE is not on the critical path.

4.4.3.3 Credible

A credible schedule reflects the order of events necessary to achieve aggregated products or outcomes, varying levels of activity, supporting activity, and subtasks; a level of confidence in meeting a program's completion date based on data about risks for the program; and necessary schedule contingency and prioritized risks based on a robust quantitative schedule risk analysis. This schedule characteristic aligns with the following best practices:

5. Verifying that the schedule can be traced horizontally and vertically.
8. Conducting a schedule risk analysis.

The GAT metrics (GAT metrics described in detail in Appendix C) with which these align are as follows:

- Primary—B.04.01, B.04.02, B.04.03, B.07.01, B.07.02, B.10.01, B.10.02
- Secondary—B.08.01, B.08.02, B.08.03
- Tertiary—I.02.06, I.02.07.

4.4.3.3.1 Push/Pull Test

Push/pull tests, which should be run against the risk-adjusted schedule, ensure the schedule network integrity reacts as expected (i.e. constraints, excessive float, etc. are not prohibiting the network from reacting as expected). Nuances may cause the push/pull test to fail, so all interested parties need to be aware of the nuances that can cause the network to not move as expected. Both tests examine the baseline IMS critical path's reaction to changes in activity durations.

The push test can be done in Acumen Fuse. Do the following to perform a push test:

- Constrain CD-4 or the end of the project with a finish-on-or-after constraint.
- Choose a discrete activity scheduled to start within 6 months (longest path to be tested and documented separately) that has between 10 and 100 days of float (or more, depending on the project's remaining duration).
- Add 500 days (more or less, depending on the project's remaining duration) to the selected activity's duration.
- Reschedule the project and verify the following:
  - The reduction of float by 500 (or more) days (more or less, depending on the project's remaining duration)
  - The advancement of the end milestone by 500 days (or by the number of days added) less the previous total float
  - A change in the critical path, along with successor activities, to the selected activity
  - No LOE activities becoming critical or appearing on the longest path.
- Choose another activity in a different WBS and repeat the assessment.

Do the following to perform the pull test:

- Change the CD-4 or end-of-project constraint date to the current status date.
- Reschedule the project and verify the following:
  - No discrete activities having zero or positive float
  - No change in the critical path.

- Change the start date of an LOE activity that has not started yet to the current status date.
- Reschedule the project and verify that the start and finish dates of discrete activities have not changed.

The pass/fail of the push/pull tests is only the initial step for the schedule SME. The schedule SME should then investigate and understand the cause of the failed test. Also, the sample of push/pull tests should be no less than 25 activities chosen throughout the schedule network. The push/pull information table should be completed and included in the schedule notebook (Table 11 and Table 12).

Table 11. Push/Pull Test Results for Activities on Critical Paths

Activity ID	Activity Name	Baseline Start	Baseline Finish	CD-4 Prior to Push/Pull	CD-4 After to Push/Pull	Pass/Fail	Cause

Table 12. Push/Pull Test Results for Activities on Near-Critical Paths

Activity ID	Activity Name	Baseline Start	Baseline Finish	CD-4 Prior to Push/Pull	CD-4 After to Push/Pull	Pass/Fail

4.4.3.3.2 Schedule Risk Analysis (SRA)

The schedule SME should ensure the quantitative risk analysis was completed, and the IMS reflects the results in the activity durations of schedule margin and schedule contingency. The schedule margin (also known as schedule reserve) should be a separate activity prior to the completion of the contractor's PMB, and DOE schedule contingency should be a separate activity prior to the CD-4 milestone. The schedule SME should ensure the IMS used for the schedule risk analysis was reliable and of sufficient quality.

Validation of the completion and alignment of the SRA is merely the first step in evaluation of the SRA. The adequacy of the SRA should be a coordinated assessment with the risk SME on the review team and other applicable review team members. The review of the SRA is outside the scope of this SOP.

4.4.3.4 Controlled

A controlled schedule reflects regular updates by schedulers trained in CPM scheduling, is statused using actual progress and logic to realistically forecast dates for program activities and includes a narrative that describes updates to the current schedule. It has been compared with a baseline schedule to determine variances from the plan; is accompanied by a corresponding basis document that explains the overall approach to the program, defines assumptions, and describes

unique features of the schedule; and is subject to a configuration management control process. This schedule characteristic aligns with the following best practices:

9. Updating the schedule using actual progress and logic.
10. Maintaining a baseline schedule.

The GAT metrics (GAT metrics described in detail in Appendix C) with which these align are as follows:

- Primary—N/A
- Secondary—N/A
- Tertiary—GAO Best Practice 9, C.07.02, C.07.03, C.08.02, C.08.03, C.08.04, C.08.05.

4.4.3.4.1 Review of Schedule Options

The schedule SME should review the schedule options and ensure that retained logic is selected (Figure 8). Other evidence that the schedule progress is not accurate should be documented.

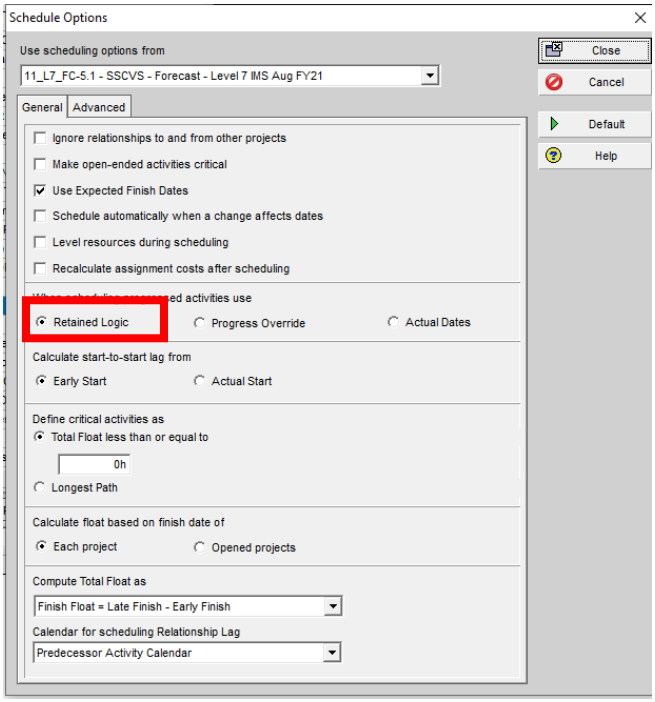


Figure 8. Review of Schedule Options for Retained Logic

4.4.4 Qualitative Assessment

Qualitative assessment is as (or more) important in evaluating the reliability and quality of the schedule as quantitative. The subsections that follow cover three minimal areas for qualitative assessment: (1) critical and near-critical paths,[17] (2) network logic, and (3) BOS and BOE. The schedule SME should, in addition to reviewing the quantitatively assessment results, assess the

[17] As noted, once the quantitative risk modeling and analysis are completed, the high priority or contributing activities are likely to differ from the original critical path. This is normal, expected, and part of a reliable analysis.

schedule by applying experience and common sense, to isolate unrealistic planning. This SOP expands on the schedule lines of inquiry contained in other PM review SOPs.

4.4.4.1 Critical Paths

Critical paths of various project types have similar logic and are identifiable by experienced IPT members, FPDs, and SMEs, with common foundational elements of DOE O 413.3B requirements. The critical paths should be evaluated by tapping into the experience of those who have executed analogous projects to ensure the critical path is appropriately identified. However, historical bias can also distort the outcome: the IMS should not be manipulated to produce an expected outcome.

DOE O 413.3B has a logical sequence of milestones, including CD approvals and their discrete requirements. Commonly, the approval milestones are merge points on the critical path. The critical path and near-critical paths should also clearly exemplify the engineering and physical work (including the long-lead procurements) having the longest durations and posing the greatest risk to project success. The sensitivity of the near-critical paths should also be quantitively and qualitatively assessed, and the IPT, as well as decision makers, should be advised of the results. For these reasons, and to ensure that proper durations are included and risk events considered, critical paths and near-critical paths should be evaluated from the desired P-value schedule developed from the quantitative risk analysis. If this evaluation uses the P6 IMS, it will be using a schedule that is highly unlikely to be accomplished (typically less than 5% probability of delivery).

4.4.4.2 Network Logic

Like the critical and near-critical paths, the qualitative review of the network logic is paramount in schedule analysis and assessment. The schedule SME should exercise the schedule analysis team expertise and experience in concert with quantitative schedule evaluation results. The quantitative network evaluation is only an initial indicator where additional information is necessary to understand the network logic and planning method. In addition, the schedule SME should facilitate discussion with the other review team members in their functional areas, explaining and clarifying observations of the quantitative schedule assessment results in "non-scheduler lingo."

As reflected in AACE International 48R-06, *Schedule Constructability Review*, additional areas to be considered in the network logic review that may or may not be isolated for further improvement during a quantitative assessment of schedule mechanics include the following:

> *Staffing and manpower planning.* A review of the manpower loading and craft staffing levels is an important element of the (review) SCR (schedule constructability review). Consider the field craft manpower requirements in relation to the schedule and prioritize the engineering sequence of design releases to improve leveling of critical labor peaks. The required craft skills for the various phases of the project need to be compared with the local craft labor availability during the planned construction phase. Other projects in the area that might compete for craft resources also need to be considered.
>
> *Optimum sequencing.* The construction sequence should be optimized so that there are not any engineering or procurement constraints. In other words, the project schedule should be construction driven and the engineering and procurement activities should support that construction schedule.

Additional areas of review for the qualitative assessment of network logic (also in AACE International 48R-06):

- Completeness and reasonableness of the work sequence
- Coordination of the schedule with the various engineering disciplines
- Coordination of the schedule with the requirements for efficient start-up and commissioning
- Adequacy of lead time for material and equipment procurement
- Site restrictions and adequacy of site access
- Physical limitations of the work site
- Material and equipment "laydown" and storage area requirements
- Availability of job site utilities
- Interfaces with the public domain, other construction contractors, and other entities
- Availability and completeness of design documents and drawings
- Limitations and restrictions on hours of operation
- Seasonal influences on the work; local holidays and other factors affecting productivity rates
- Physical limitations of construction equipment
- Physical limitations and "handle-ability" of construction components
- Availability of labor, equipment and materials; long-lead time equipment items
- All DOE requirements contained and appropriately linked in the IMS.

4.4.4.3 BOE and BOS and Additional Exchange with Technical SMEs

The cost estimators and the scheduler, exercising the EVMS, determine the BOS durations and resources using an iterative process. As described in the GAO schedule guide, the basis for the durations should have an associated documented process. This process may also include the basis for duration uncertainty used in the quantitative risk analysis. The BOS should cite the resources used for estimation, including subject matter expertise. It should be revision controlled and traceable through the BOE. The BOS should correspond with the activity durations in the IMS.

In coordination with the Cost SME, specific review of the unit rate installations should also be investigated. Frequently the BOE and BOS have optimistic unit rates, translated in the IMS. This optimism translates into IMS activity durations that are too short and eventually translates into a larger "ask" for schedule margin and contingency.

4.4.5 Review-Specific Considerations

PM reviews have separate and distinct SOPs, including the EIR SOP and ICR/ICE SOP. Although the review perspectives slightly differ, the schedule assessment method is predominantly the same. In every review, the schedule assessment evaluates and makes conclusions using the GAO schedule characteristics: (1) comprehensive, (2) well-constructed, (3) credible, and (4) controlled. This SOP renders guidance segmented by these characteristics to support schedule assessments consistent among reviews.

4.4.5.1 EVMS Certifications and Surveillances

EVMS certification and surveillance follows the guidance available in the *Office of Project Management (PM) Earned Value Management Systems Compliance Review Standard Operating Procedure* (ECRSOP) and tests for all GAT metrics (Appendix C contains a crosswalk).

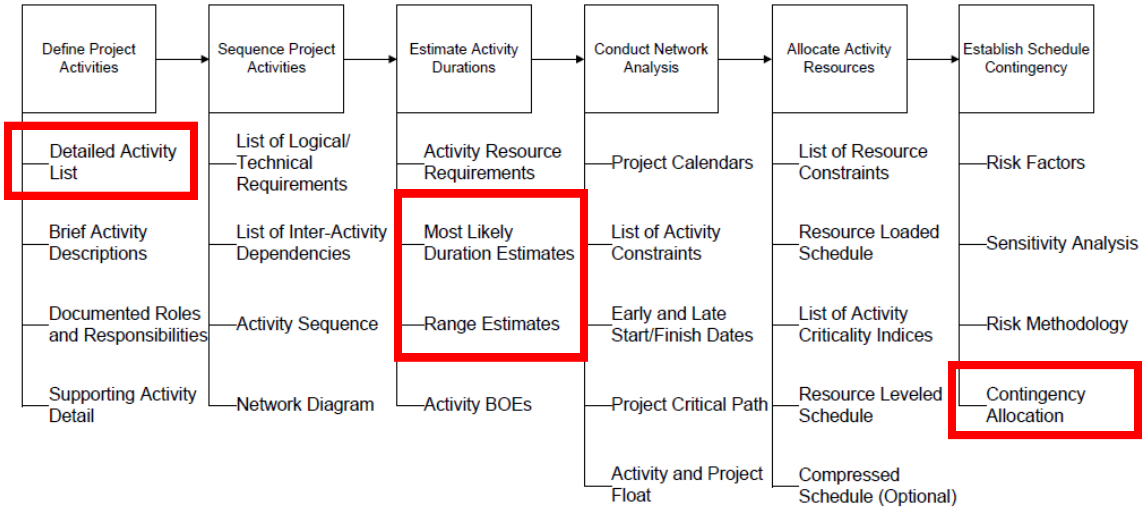
4.4.5.2 ICEs and ICRs

ICEs and ICRs follow the guidance available in the ICR/ICE SOP. This subsection augments this guidance in a "desktop instruction" format for schedule analysis.

The PM ICR/ICE SOP applies best practices for government and industry, GAO assessment guides, and various AACE International RPs. The 12 steps of a reliable cost estimate described in the GAO *Cost Estimating and Assessment Guide* (GAO-20-195G) and the 10 best practices of high-quality and reliable schedule described in its *Schedule Assessment Guide* (GAO-16-89G) are evaluated, assessed, and included in PM ICR/ICE reports. AACE International publishes RPs in its total cost management framework, which PM applies as appropriate, including RP 18R-97, the cost estimate classification system used to establish cost ranges for ICEs and ICRs. This SOP references the RP 27R-03 schedule classification system to complement the schedule analysis completed during the ICE or ICR (Table 13).

Generally, and to support the analysis of alternatives, the preferred alternative IMS prior to CD-1 contains detailed near-term activities and work packages progressing from conceptual design to preliminary design, planning packages (PPs) thereafter to final design, with top-down planning using summary-level planning packages (SLPPs) that requires iterative engineering with relationships of other scope elements. The dynamic, iterative planning and scheduling process will continue to mature throughout the project. In applying the IRSA SOP to ICEs/ICRs, the process delineated by the DOE 413.3 guides and DOE EVMS certification SOPs is expected to be followed, acknowledging that scope is detailed in a rolling wave process executed after CD-1 approval.

The schedule baseline development process is the same throughout the project. The ICR can specifically explore the qualitative processes and quantifiable outputs results of the red boxes (Figure 9). The ICE may independently quantify these portions of the IMS (or other portions as appropriate). However, the planning and scheduling process remains intact, with the expectation that the schedule network reflects this process and the best practices that apply.



Source: Adapted from DOE G 413.3-5A, *U.S. Department of Energy Performance Baseline Guide*, October 22, 2015.

Figure 9. Schedule Baseline Development

Table 13. AACE International and DOE Estimate and Schedule Classes

Estimate/Schedule Class	Class 5	Class 4	Class 3	Class 2	Class 1
Maturity Level of Project Definition Deliverables (%)	0 to 2	1 to 15	10 to 40	30 to 75	65 to 100
End Usage	Concept screening	Feasibility study	Budget, authorization, or control	Control or bid/tender	Check estimate or bid/tender
Typical Estimating Method	Capacity factored, parametric models, judgment, or analogy	Equipment factored or parametric models	Semi-detailed unit costs with assembly-level line items	Detailed unit cost with forced detailed take-off	Detailed unit cost with detailed take-off
Expected Accuracy Range (%)	L: –20 to –50 H: +30 to +100	L: –15 to –30 H: +20 to +50	L: –10 to –20 H: +10 to +30	L: –5 to –15 H: +5 to +20	L: –3 to –10 H: +3 to +15
AACE International–Recommended Schedule Methods Used	Top-down planning using high-level milestones and key project events	Top-down planning using high-level milestones and key project events; semi-detailed	"Package" top-down planning using key events; semi-detailed	Bottom-up planning; detailed	Bottom-up planning; detailed
CD	**CD-0**	**CD-1 Non-Preferred Option**	**CD-1 Preferred Option**	**CD-2**	**CD-2/3 or CD-3**
DOE Schedule Methods	Top-down planning using high-level milestones aligning with the mission need statement. Major planning assumptions established.	Top-down planning using high-level milestones and key project events (preliminary/final design, CD approvals, etc.) to support analyzing alternatives (see DOE G 413.3-22).	SLPPs and PPs, top-down planning, scope aligned with initial KPPs. Sufficient detail for budget formulation and DOE O 413.3B CD-1 requirements (see DOE O 413.3B, Table 2.1).	Rolling wave planning employed. Bottom-up planning to develop detailed logic and sequencing. Alignment within the EVMS, including scope, cost, schedule.	Rolling wave planning employed. Bottom-up planning to develop detailed logic and sequencing. Alignment within the EVMS, including scope, cost, schedule.
BOS Estimation	Historic and parametric estimation of analogous programs/projects; overall project length and risk assessed.	Resource-informed[1], historic, and parametric estimation of project intervals (design and construction) and overall project length and risk assessed.	Resource constrained[2], utilization of estimation tools (RSMeans and corporate databases), historic and parametric estimation, SME opinion, discrete estimation, and cross-checks of overall project length.	Resource leveled[3], utilization of estimation tools (RSMeans and corporate databases), discrete estimation, historic performance evaluated, cross-checks of overall project length.	Resource leveled[3], utilization of estimation tools (RSMeans and corporate databases), discrete estimation, historic performance evaluated, cross-checks of overall project length.
EIA-748 Employment	Best practices in planning and scheduling employed.	IMS and estimates generated using best practices in planning and scheduling, including EIA-748.	IMS and estimates generated from an EIA-748–compliant EVMS.	IMS and estimates generated from a EIA-748–compliant EVMS.	IMS and estimates generated from a *certified* EIA-748–compliant EVMS.

Source: Adapted from AACE International RPs 18R-97 and 27R-03.

[1]Resource informed is defined as the overall project duration derived from summary bars supporting achievement of milestones/events and respective cost is calculated through parametric or top-down estimation of the resources required.

[2]Resource constrained is defined as schedule activities (including work packages, planning packages and summary level planning packages) are assigned resources, with the bottoms-up summation of the cost of resources constrained per the respective budget profile.

[3]Resource leveled is defined as assigned resources for activities (including work packages, planning packages and summary level planning packages) are leveled with realistic availability given work fronts and achievable efficiencies/unit rates/physical access integrated in planning, with the bottoms-up summation of cost of resources constrained per the respective budget profile

4.4.5.2.1 Using IRSA SOP at CD-1

Additional LOIs for the ICR/ICE (beyond the ICR/ICE SOP LOIs and coordinating with the IRSA SOP process) for schedules prior to CD-1 are as follows:

- Do the IMS processes and coding facilitate the continued maturation of the IMS in coordination with the design?
- Are there code fields in the IMS that align with PARS upload requirements, in addition to the ECRSOP and GAT testing method?
  - Risk event IDs
  - RM codes
  - SVTs
  - HDV tasks[18]
  - LOE
  - Schedule margin.
- Is a change control process in place?
- Is there evidence of SLPPs and PPs and that durations and uncertainties are traceable in the BOE and BOS, following through to the contingency allocation?
- Do the activity BOEs and BOSs for the IMS match?
- Does the duration uncertainty have a documented basis?
- Does the cost uncertainty align with the AACE International estimate type resulting from project maturity?
- Are resource-level constraints considered and integrated in the current schedule?
- Does the resource loading reflect known conditions, including resource (available labor) and physical (size of physical facility) constraints?

4.4.5.3 External Independent Reviews

EIRs follow the guidance available in the EIR SOP, which has been updated to include LOIs crosswalked to the GAO guide and best practices as well an additional GAO schedule assessment table to be included in every EIR report.

The EIR team schedule SME should follow guidance in this SOP and produce a schedule notebook to be archived as part of the EIR and report (Appendix C contains a crosswalk of the GAT metrics).

4.4.5.4 PPRs

PPRs follow the guidance in the PPR SOP. The PPR schedule SME should follow guidance in this SOP and produce a schedule notebook to be archived as part of the PPR and report. Regardless of the point in the project life cycle, the IMS should reflect best practices. However, unlike the EIR and ICR/ICE reviews, the PPR should provide recommendations to assist in maturing the IMS and institute best practices in planning and scheduling.

[18] To verify the code field exists, not to define the HDV activities.

4.4.6 Reporting Results

The results of the schedule assessment are prepared in a form that corresponds with the particular review. The schedule SME conclusions need to be in a narrative form that non-schedulers can understand regarding the importance of the assessment and the impact on the project's outcome. The schedule notebook is kept as a separate deliverable, which is submitted to the review lead, for all CDs.

The IMS may exhibit deficiencies that increase risk to the government and prevent its acceptance. In this case, a provisional acceptance of the IMS is prudent. In other cases, the IMS may exhibit a deficiency that poses unacceptable risk to the government and is unacceptable. The subsections that follow offer example language (see Appendix B).

4.4.6.1.1 Provisional Acceptance of IMS

Example text: "From the review of the data listed [provide artifact name and description], the IMS and supporting documentation are not deemed reasonable as provided. However, given the following areas of note and continual revision, the IMS is accepted for the progression of the [EIR/ICE/PPR]."

4.4.6.1.2 Rejection of IMS

Example text: "From the review of the data listed, the IMS and supporting documentation is not deemed reasonable. PM does not support the continuation of the review."

4.4.7 Lessons Learned

The schedule SME will identify and/or solicit from fellow review team and IPT Members lessons learned as they relate to review planning and execution as well as the contents of this SOP. Examples may include unclear guidance or conflicting information. Please send lessons learned to the owner of this SOP in PM-30, who currently is Victoria Premaza, Victoria.premaza@hq.doe.gov.

Appendix A. Analysis Checklists and Schedule Notebook

For convenience, the "Analysis Checklists and Schedule Notebook" is included hereafter but resides as a separate stand-along document. Although presented in MS Word format, the schedule SME can complete the documentation in the most appropriate format available including Excel and screenshots from the Oracle Primavera Project (P6) software.

The "Analysis Checklist and Schedule Notebook" is contained in PM-MAX at: https://community.max.gov/x/VYj2hw. Further details for each subsection is contained within the narrative of the IRSA SOP document.

Analysis Checklist

(Subsection 4.4.2, Sufficiency Review)

☐ Was an integrated master plan received?

☐ Was a baseline and forecast IMS received?

☐ Does the status date of the IMS align with the actual costs to date contained in the cost estimate?

☐ Is the IMS resource loaded?

☐ Do resources in the IMS align with the cost estimate and quantitative risk analysis?

☐ Does the information provided (project controls process or project-specific document) reflect the codes found in the IMS?

☐ Are internal surveillances, including Acumen Fuse evaluations, conducted prior to the IMS submittal per the EVM system description?

☐ Were justifications provided for areas identified in the schedule evaluation that breached metric testing by the IPT?

☐ Was the contract reviewed, specifically for knowledge of EVMS and reporting requirements?

☐ Is the EVM system description reviewed for schedule-specific processes and expectations?

☐ Does the capability to generate flat files exist?

☐ Are results of Acumen Fuse analysis, using DOE EVMS templates for baseline and forecast analysis, produced and evaluated?

❖ **Schedule Notebook**

☐ Were all open items identified in the sufficiency review addressed, including receipt of all source data and information?

☐ Were the received .xer files imported into source and review databases.

☐ Were the imported schedule views of the received schedule artifacts (critical path PDF) re-created, including the grouping and filters?

☐ Were the schedule settings compared with the EVM system description and other applicable processes or procedures?

☐ Were the DIQ flags resolved?

☐ Were the automated test results from Empower produced and made available?

☐ Are the results of Acumen Fuse analysis, using DOE EVMS templates for baseline and forecast analysis, available to the review team?

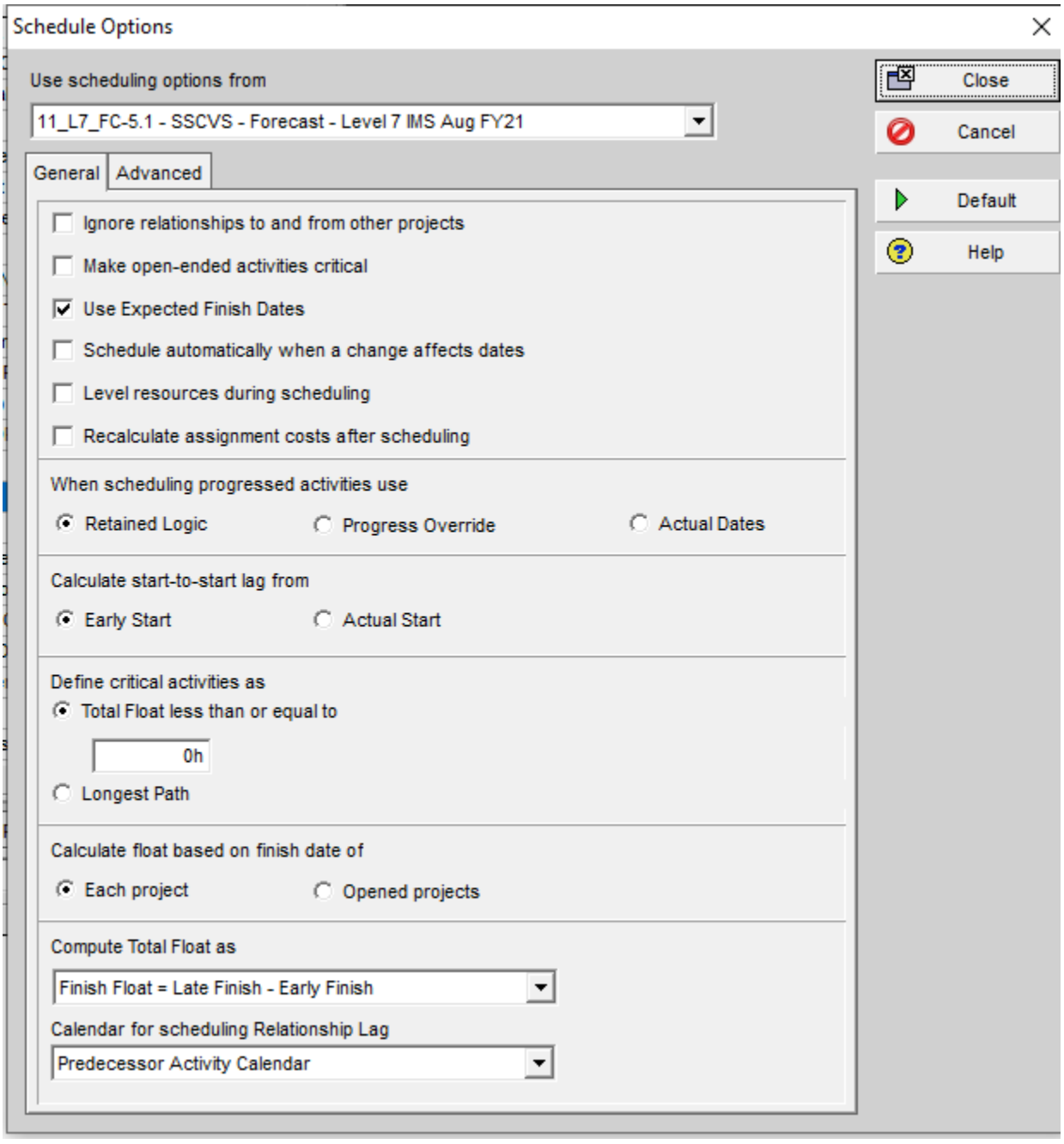
Original Name	Baseline or Forecast	IMS File Status Date	Date Received and Method	Renamed	Archive File or Analysis File	Aligns with Cost Estimate (Yes/No)	Aligns with Risk Analysis (Yes/No)
[.xer file name received]	Baseline or forecast file	Status date	Date received and method [MAX.gov or email]	Renamed File	File kept without rescheduling or analysis and information added	[Whether the IMS aligns with the cost estimate]	[Whether the IMS aligns with the risk analysis]

Analysis Using Primavera Project

☐ Are schedule characteristics captured?

Category	Baseline	Forecast
Status date		
Number of activities		
Number of milestones		
Ratio of detail activities to milestones		
Ratio of LOE to discrete activities		
Percentage of the project schedule sequenced concurrently		
Percentage of the project schedule sequenced sequentially		

☐ Capture screenshot of scheduling settings and insert.



☐ Is the entire scope of work in the schedule?

☐ Are all government obligations (government-furnished equipment and information) delineated in the project schedule?

☐ Are the alignment and authorization reviewed for the WBS elements?

☐ Note authorization documents reviewed, including contract terms, AFP, SOW, WAD, etc., and compared with the WBS/IMS. Do all activities in the IMS have WBS assignments?

Title of Contract and Work Authorization Artifacts Reviewed	Aligned with WBS/IMS? (Yes/No)	Provided to Review Team? (Yes/No)

☐ Are RM activities and HDV or critical item activities captured and documented, with the citation of the P6 fields? Were these activities compared with the WBS or risk plan?

RM Activities	HDV Items (Activities)	WBS (Yes/No)	Risk Forms (Yes/No)
[Capture RM here]	[Capture HDV here]		

☐ Are interdependencies (key handoffs) identified to other control accounts and subcontractor work?

☐ Are the necessary deliverables identified?

☐ Is the IMS integrated with a larger programmatic IMS? If so, cite the integration method and listing of P6 code fields if applicable.

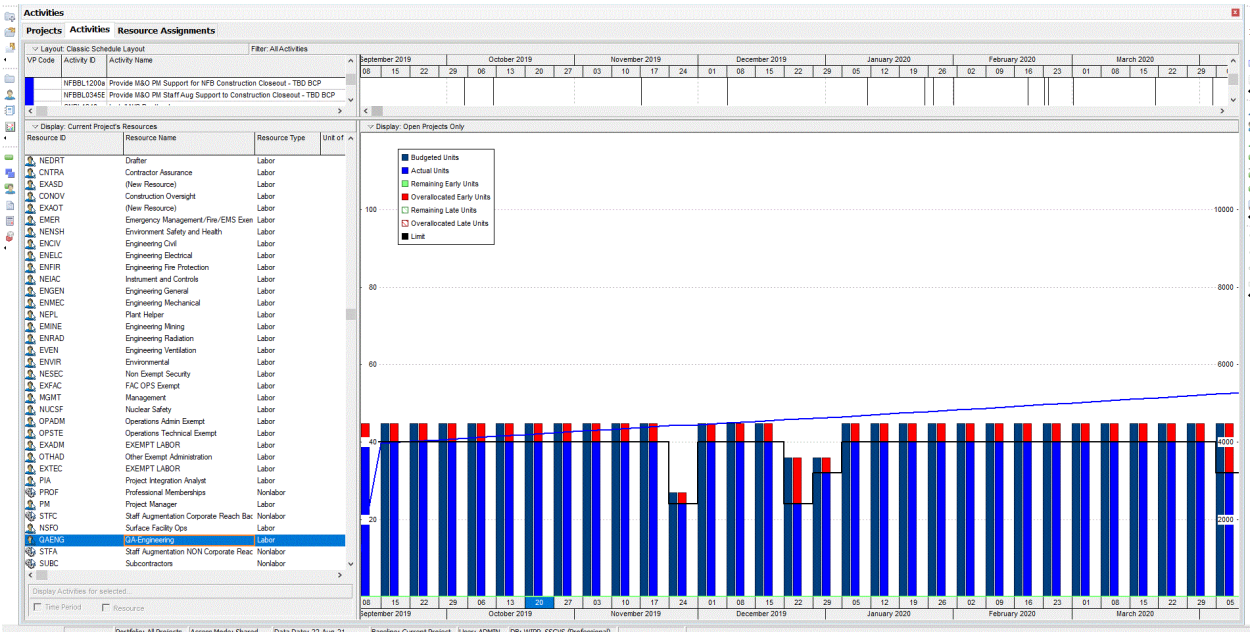
☐ Are resources reasonable?

☐ Are activity durations sufficient to complete the work? How do the durations reflect the results of the quantitative risk analysis?

☐ If activities are concurrent, is adequate resourcing across these activities available?

Resource-Loading Method		Implementation Matches EVM System Description (Yes/No)
[Method here]		
Resource trace, sampled activities		Was the trace successful?
[List of sampled activities]		
Activities with inappropriate resource loading	Should not have resources [ZBAs, milestones, SVTs]	Should have resources [discrete, LOE]
[Activity ID and title]		

☐ Capture and insert resource curves that apply for review.



☐ Document the calendars and capture the application of the differing calendar types.

☐ Compute excessive float calculated using definition and complete table.

☐ Does the rationale provided for constraints, leads, and lags make sense?

☐ Do any of the items left in create a fidelity issue in a quantitative risk analysis?

Activity ID	Activity Name	Excessive Float Values	Justification Provided		Merge Point (Yes/No)	Review Completed (Yes/No)
			Reviewed	Satisfactory		
[Activity grouping (such as construction subcontract, safety basis)]						

☐ Were relationships that were not reasonable identified and reviewed further?

☐ Does the project schedule contain a logical sequence of design and construction activities from start to finish capable of meeting the scope specifications and requirements?

Activity ID	Activity Name	Relationship Type/ Justification for Further Review	Review Completed (Yes/No)
[Activity grouping (such as inappropriate SS relationships or tangler activity with no relationships)]			

☐ Is the critical path correctly identified and logically linked appropriately?

☐ Does the scheduling process calculate a project critical path being the longest path, with the least amount of float from start (or status period) to finish?

☐ Is this longest path before or after the quantitative risk analysis?

Critical Path Definition in EVM System Description (or Project-Specific Processes)	
[Provide information and cite document numbers.]	
Critical Path Code Fields	
[Provide P6 code field designators.]	
Activity ID/Names	**Longest Path Activities Not Aligned with Critical Path Code Fields**

☐ Critical path tables completed and included in the schedule notebook. Portions can be produced as a P6 output with a Gantt chart or an export to Excel.

Activity ID	Activity Name	Baseline Start	Baseline Finish	Activity Type	Relationship with Predecessor	Relationship with Successor

☐ Push/pull test results with activities on critical paths.

Activity ID	Activity Name	Baseline Start	Baseline Finish	CD-4 Prior to Push/Pull	CD-4 After to Push/Pull	Pass/Fail	Cause

☐ Push/pull test results with activities on near-critical paths.

Activity ID	Activity Name	Baseline Start	Baseline Finish	CD-4 Prior to Push/Pull	CD-4 After to Push/Pull	Pass/Fail	Cause

☐ Are leads, lags and constraints appropriately justified? Are code fields used also included?

Activity ID	Activity Name	Lead	Lag	Constraint	Justification Provided	Cause

☐ Perform push/pull tests (Subsection 4.4.3.3.1). Document the results, including the schedule SME review of the cause.

Activity ID	Activity Name	Baseline Start	Baseline Finish	CD-4 Prior to Push/Pull	CD-4 After to Push/Pull	Pass/Fail	Cause

Attached:

☐ Initial Acumen Fuse results as part of the sufficiency review and sufficiency review checklist.

☐ Acumen Fuse results as part of the review.

Appendix B. Review Results and GAO Schedule Assessment Best Practice Tables

Review Results:

Sufficiency Review Template

PM Review Lead:
Schedule SME:
From the review of the data listed, the IMS and supporting documentation are deemed (reasonable/not reasonable) and the progression of the review (is/is not) appropriate.

Review Template (Provisional Acceptance)

Provisional Acceptance

PM Review Lead:
Schedule SME:
From the review of the data listed, the IMS and supporting documentation are not deemed reasonable as provided. However, given the following areas of note and continual revision, the IMS is accepted for the progression of the [EIR/ICE/PPR].

Review Template (Rejection)

PM Review Lead:
Schedule SME:
From the review of the data listed, the IMS and supporting documentation are not deemed reasonable. PM does not support the continuation of the review.

.

Appendix C. Additional Guidance and Crosswalks

Guidance and templates referred to or supporting the PM ISRA SOP are available at: https://community.max.gov/x/VYj2hw. The templates below may change as needed to add, remove, or update.

Name	Description
GAO Schedule Assessment Best Practice Table	Provides a template for the GAO Schedule Assessment Best Practices that guides schedule SMEs to IRSA SOP Section numbers and applicable GAT metrics.
GAT Metric Cross Walk	Crosswalks the Guideline Attribute Testing (GAT) metrics to the GAO schedule assessment best practices (GAO-16-89G) as articulated in Appendix IV, Standard Quantitative Measurements for Assessing Schedule Health.
AACEI Schedule Classification Cross Walk	Crosswalks the AACE International Schedule Classifications per Recommended Practice (RP) 27R-03 to the Guideline Attribute Testing (GAT) metrics to the GAO schedule assessment best practices (GAO-16-89G) as articulated in Appendix IV, Standard Quantitative Measurements for Assessing Schedule Health.
GAT metric List	This file contains the entire listing of all DOE EVMS GAT metrics organized by Process Area and Attribute.
GAT metric Specification Legend	This file is the legend for all metric specification sheets. It explains what each block on the sheets contain for easy reference.
GAT metric Specification	This file contains the DOE EVMS GAT metric specifications.

Appendix D. Abbreviations

AACE	Association for the Advancement of Cost Engineering [International]
ANSI	American National Standards Institute
BAS	Baseline
BOE	Basis of Estimate
BOS	Basis of Schedule
CD	Critical Decision
CFA	Cognizant Federal Authority
CPM	Critical Path Method
CPP	Contractor Project Performance
DOE	Department of Energy
CSV	Comma-Separated Values
DID	Data Item Description
DIQ	Data Integrity and Quality
DOE	U.S. Department of Energy
DQI	Data and Quality Indices
ECRSOP	Earned Value Management Systems Compliance Review Standard Operating Procedure
EIA	Electronic Industries Association
EIR	External Independent Review
ESAAB	Energy Systems Acquisition Advisory Board
EVMS	Earned Value Management System
FAR	Federal Acquisition Regulation
FF	Finish to Finish
FFP	Firm Fixed-Price

FOR	Forecast
FPD	Federal Project Director
FPM	Federal Project Manager
G	Guide
GAO	Government Accountability Office
GAT	Guideline Attribute Test
GL	Guideline
HDV	High Dollar Value [Material]
ICE	Independent Cost Estimate
ICR	Independent Cost Review
IMP	Integrated Master Plan
IMS	Integrated Master Schedule
IPMD	Integrated Program Management Division [of NDIA]
IPMR	Integrated Project Management Report
IPT	Integrated Product Team
IRSA	Independent Review Schedule Analysis
KPP	Key Performance Parameter
LOE	Level of Effort
LOI	Line of Inquiry
M&O	Management and Operating (M&O)
NDIA	National Defense Industry Association
NTE	Not to Exceed
O	Order
OBS	Organizational Breakdown Structure
OMB	Office of Management and Budget

OTB	Over Target Baseline
OTS	Over Target Schedule
PARS	Project Assessment and Reporting System
PASEG	Planning & Scheduling Excellence Guide
PB	Performance Baseline
PEP	Project Execution Plan
PM	Office of Project Management
PM-20	Project Analysis Division
PM-30	Project Controls Division
PMB	Performance Measurement Baseline
PME	Project Management Executive
PMRC	Project Management Risk Committee
PMSO	Project Management Support Office
PP	Planning Package
PPR	Project Peer Review
QBD	Quantifiable Backup Data
SLPP	Summary-Level Planning Package
SM	Schedule Margin
SME	Subject Matter Expert
SOP	Standard Operating Procedure
SOW	Statement of Work
SS	Start to Start
SVT	Schedule Visibility Task
TPC	Total Project Costs
WBS	Work Breakdown Structure

ZBA	Zero Budget Activity

Appendix E. References

References

- AACE International Recommended Practices (RPs)
  - 17R-97, *Cost Estimate Classification System*
  - 18R-97, *Cost Estimate Classification System—As applied in Engineering, Procurements, and Construction for the Process Industries*
  - 27R-03, *Schedule Classification System*
  - 29R-03, *Forensic Schedule Analysis*
  - 32R-04, *Determining Activity Durations*
  - 38R-06, *Document the Schedule Basis*
  - 48R-06, *Schedule Constructability Review*
  - 54R-07, *Recovery Scheduling*
- DOE G 413.3-10B, *Integrated Project Management Using the Earned Value Management Systems*
- DOE G 413.3-20, *Change Control Management*
- DOE O 413.3B, *Program and Project Management for the Acquisition of Capital Assets*, November 29, 2010
- EIA-748, *Earned Value Management Systems,* http://standards.sae.org/eia748c/
- FAR 34.2 and 52.234, Earned Value Management Systems
- GAO *Cost Estimating and Assessment Guide*, GAO-20-195 G, March 2020
- GAO *Schedule Assessment Guide*, GAO-16-89G, December 22, 2015
- NDIA, *Planning & Scheduling Excellence Guide* (PASEG) V3.0, *EIA-748 Intent Guide*, *EVMS Acceptance Guide*, *EVMS Application Guide*, *Integrated Baseline Review (IBR) Guide*, *Surveillance Guide*
- OMB Circular A-11, Part 7, Capital Programming Guide Supplement to Office of Management and Budget Circular A –1, Part 7: Planning, Budgeting, and Acquisition of Capital Assets
- PM, *EVMS & Project Analysis Standard Operating Procedure (EPASOP)*
- PM, *External Independent Review (EIR) Standard Operating Procedure (EIRSOP)*
- PM, *Independent Cost Review (ICR) and Independent Cost Estimate (ICE) Standard Operating Procedure (ICR/ICE SOP)*.