Project Hanford Lessons Learned

Title: Increased Vulnerabilities Associated with Fast-track Projects

Date: September 29, 2005

Identifier: 2005-RL-HNF-0034

Lessons Learned Summary:
"Fast-track" projects should be approached with awareness that vulnerabilities increase with compressed schedules and management of subcontractors needs to be rigorous to avoid an over-reliance on their ability and performance. Reduction of design deliverables or reviews needs appropriate offsetting compensatory measures, such as contractual terms or alternative additional oversight, to ensure design standards are met. Planning should address additional resources necessary to support accelerated schedules, consistent with the scope and complexity of the design.

Discussion of Activities:
An assessment of the K East to K West hose-in-hose (HIH) sludge transfer system included design and fabrication issues that were attributed to the project being "fast-track". In this context, "fast track" means a project in which the schedule is compressed (shorter than typical for the scope) and procurement and fabrication proceed prior to completion of final approved design and safety analysis. Drivers of a compressed project schedule may be a pre-established completion date, delayed start without equivalent extension of completion date, or delay in defining the project's end state or functional requirements. This Lessons Learned does not address issues driving the compressed project schedule. A fast-track project approach is not uncommon in commercial practice, where construction may begin at or near the 60% design phase for large projects, however it does present vulnerabilities that must be proactively managed, such as those observed and discussed here.

Analysis:
1) Design reviews and deliverables for intermediate design phases were reduced. Elimination or reduction of design reviews or deliverables at intermediate design phases, intended to help meet an aggressive design schedule, in effect deferred schedule slip, and compounded the impact of a less than adequate design on the remainder of the project. A 60% design package was not required to be submitted for review, due to the compressed schedule with short duration between 30% and 90% phases. Submittal of equipment data sheets was not required until 90% design. At that point, when contractor concerns with the booster pump selection were raised, the remaining project schedule precluded pursuing an alternative pump design that was potentially far more suitable for the application.

   The reduction of deliverables and reviews equated to an over-reliance on satisfactory performance by the subcontracted designer. Subcontractors are also vulnerable to schedule pressure and a fast-track mentality. As an example in this case, the design subcontractor

deleted a requirement for the pump vendor to perform testing, without Design Authority (DA) approval or knowledge, in order to accelerate pump delivery.

2) Client design review comments were not efficiently screened or consolidated, in order to expedite transmittal to the design subcontractor. Numerous comments on the subcontractor design package were received from many reviewers in addition to the team of engineers designated for the client design review. In order to provide design review comments to the design subcontractor for disposition within an abbreviated turnaround time in the schedule, the comments were provided directly to the design subcontractor instead of taking the time to consolidate them and eliminate duplicate comments from each discipline. Resolution of these comments required more resources than if they had been screened through the design review team.

3) Design package submittals with inadequate quality were allowed to be corrected in the next phase design package, in lieu of requiring resubmittal. At the 30% design review phase, the quality and content of the submittal was recognized as symptomatic of design that was not at the level of maturity for the specified design phase. However, to maintain the subsequent 90% design submittal on schedule, many submittals were accepted with numerous comments to be incorporated in the 90% design, in lieu of rejecting and requiring resubmittals.

4) Actual material properties were not available early enough in design to realize the full benefit in operational margin. The hose vendor's pressure rating for the hose material drove system design pressure. In order to establish a higher pressure rating, the vendor would have needed to procure and assemble the hose and fittings and perform testing. Lead time for the material would have delayed design several months, and incur a cost obligation with no guarantee of beneficial results. Actual results from testing performed later did demonstrate that a 50% higher design pressure would have been supported. This could have enhanced the margin between operating pressure and overpressure protection setpoints, which was a significant concern for the operation of this system. However, to avoid an unacceptable schedule delay, the existing hose pressure rating was used for design.

5) Design changes during fabrication or after final design impacted ongoing procurement, fabrication and safety analysis activities and documents. Vendor testing of the initial booster station pump, as modified by the vendor to meet procurement specifications for erosion allowance, identified that larger motors were required to maintain the pump performance requirements. The resulting change required a quick redesign of the electrical supply system and incorporation into safety analyses, procurement, and fabrication documents. A good practice was noted in the integration of nuclear safety with engineering to ensure that the safety analysis was kept current with, and supported, design changes.

6) Alignment of resources was insufficient to support considerable number of documentation reviews required of the DA. Although not noted as part of the assessment, further evaluation of assessment observations for future improvement also recognized that the DA concept supports operating facilities well by providing technical ownership of SSCs, but is not adequate alone for large Engineering, Procurement, and Construction (EPC) projects. The DA for the HIH project was designated at the beginning of the project design cycle, so there

was very good continuity and depth of understanding the design. However, the volume of design/fabrication document reviews and approvals for this scope were overwhelming for a single individual representing one discipline. Adding resources to the same position to recover schedule has limited benefit and tends to dilute the accountability/responsibility of key individuals on the project. For example, multiple DA's could be assigned to improve the approval cycle of submittals and design reviews, but ensuring that all have the same knowledge of constraints and assumptions is nearly impossible. Similarly, having multiple individuals from each functional area (QA, Rad Con, Safety, etc.) does not ensure that all reviewers/approvers have the same understanding.

Recommended Actions:

1) Reduction of design reviews or submittals should be considered very conservatively. Projects should implement offsetting oversight measures, such as increasing "over-the-shoulder" reviews, to ensure poor or unacceptable decisions that impact the ability to implement the best technical solution are prevented.

2) Design review comments should be focused through the respective discipline lead on a dedicated design review team. Time should be allowed for compiling comments, eliminating duplicates and resolving conflicts prior to submitting an efficient package to the design subcontractor for disposition.

3) Inadequate submittals should be reviewed carefully to determine if re-submittal should be required or if the corrections can be deferred with confidence into the next phase of the project. When a project recognizes that a subcontractor is not delivering at the rate of progress or level of quality expected, effective measures must be available and exercised to restore confidence. This begins with establishing the contract structure, Statement of Work requirements, and incentive fee terms, and dispositioning submittals consistent with the contract.

4) Projects should consider how any key design parameters may be driven by, or limited by, an accelerated schedule and consider options to perform early product qualification testing to support maximized design parameters and operating margins.

5) Integration of nuclear safety with engineering will ensure that the safety analysis are kept current with, and support, design changes.

6) For large scale EPC work, the DA must be supported by engineers in various disciplines – depending on the design scope very early in the project and certainly by the 30% design review phase. Expectations for reviews of submittals must be clearly communicated by Project Management and the DA.

Estimated Savings/Cost Avoidance: Not evaluated

Priority Descriptor: BLUE/Information

Work / Function: Engineering/Project Management

Hanford Functional Categories: Associated Causal Factors - A1B2C05, "Design input not addressed in design output".

Hazard: N/A

ISM Core Function: Perform Work, Feedback and Improvement

Originator: Fluor Hanford, Inc., Submitted by Gene Roosendaal

Contact: Project Hanford Lessons Learned Coordinator; *(509) 372-2166; e-mail: PHMC_Lessons_Learned@rl.gov*

Authorized Derivative Classifier: Not required

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References: A-05-SED-SNF-011, Technical Assessment Of FH Hose-In-Hose Sludge Transfer Project