

Carter and Miller: On commercial quality control during new plant construction

As the U.S. nuclear power industry enters an era that is expected to see new plants being built, what more can be done to ensure the commercial success of construction projects? One answer is to establish an effective quality control program that would reduce cost overruns and schedule delays, according to the authors of a recent paper on the subject.

The authors, Jim Carter and Laura Miller, note that the nuclear industry historically has successfully managed the technical aspects of the design, fabrication, construction, testing, and operation of nuclear plants, and that rigorous requirements have been imposed to ensure that the physical plant is designed, built, and operated properly. But the time has come, they say, to turn that same careful attention to the commercial aspects of building a nuclear plant.

Carter, a professional engineer and attorney, has worked at nuclear plants during his career and has held various positions, including startup manager. Miller, a certified public accountant, has provided forensic accounting, cost review, and financial advice during con-

Under a new quality control program, nuclear plant owners and developers could benefit from a qualified, objective review of a construction project's commercial performance.



Carter



Miller

struction projects. They both currently work for Navigant Consulting, Inc.

Carter's and Miller's comments in this interview are based on their paper "Commercial Quality Control," the subject of their presentation during the session titled "Challenges for the Next Nuclear Plants" at the American Nuclear Society's Annual Meeting in Boston in June 2007. The interview, which begins on the next page, was conducted by Rick Michal, *NN* senior editor.

What is commercial quality control?

Carter: During the process of building a nuclear plant, commercial quality control would involve an independent, nonadversarial review and verification of the project management and control activities and documentation of key events as they are occurring. Commercial quality control would prove to be an asset during prudence reviews by public utility commissions, for example, because contemporaneous documentation by independent parties would have

to be well documented in accordance with a reasonable process that is executed with discipline. As costs increase on a project, management needs to know the cause of the increase in order to deal with subsequent disputes or prudence reviews by the utility commissions. We have learned that the accumulation of numerous small changes can have a fairly large impact on cost and schedule.

In the past, problems were often deferred until the last minute, when they were

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extremely difficult to solve. Contracts with vendors were occasionally ambiguous and toothless, leading to difficulty in performance and enforcement. In addition, sometimes there may have been people who were less than highly qualified working on a project, and they weren't well supervised. This wasn't true in every case, and it never compromised the safety of

more evidentiary basis than a retroactive reconstruction of the process and the issues. Those reconstruction events occurred a lot in the 1970s and 1980s when the current fleet of nuclear plants was built.

Would the use of the quality control process help avoid the problems that were experienced during the construction of the current fleet?

Carter: Yes, it would. In looking back at the history of new construction in the nuclear industry, Laura and I identified about 10 areas that were typically problematic. I'll mention just a few of them here.

Two of them—budget and schedule development practices—were influenced by the commercial interests of the various project participants, which often led to what were probably unrealistic objectives. In the '70s and '80s, contractors were at times overconfident and too aggressive in their cost-estimating and scheduling, with the result being cost overruns and delays. In the course of a project, they may have been guilty of being overoptimistic and of having a short-term focus because their goal was to get a specific task completed. They might say, “Well, we're a little behind on this but we'll catch up next week, so we're going to report it as on schedule.” Their intentions were good, but the result may have ultimately been detrimental.

Another problem was scope control, which was very limited on many projects. Scope control is not easy for a project as complex as a nuclear plant. Changes need

the plant, but it did contribute to cost and schedule problems on occasion.

How does commercial quality control differ from technical quality control?

Carter: Technical quality control has been around the nuclear industry since day one. Technical quality control consists of an independent party's verifying procedural compliance and conformance with the licensing requirements and a variety of different technical issues. The Nuclear Regulatory Commission has imposed technical quality control on the industry and the industry has accepted it, although there has been some natural reluctance because it means that somebody is looking over your shoulder. But it's been very successful in preventing errors. The same process could be applied to the commercial side of the plant—the cost, scheduling, and scope control. I think that if a utility is going to build a \$3-billion plant, it would want an effective program for controlling the construction process that might be different from the “business as usual” of the past.

Other countries are building new plants. Is this something that is used in those countries?

Carter: No, not that I'm aware of. This concept of an independent and objective verification of commercial matters is new in the nuclear industry, to my knowledge.

How has project management improved since the last round of nuclear plant construction?

Carter: There are much more advanced computer systems capable of tracking costs and schedules, identifying problems, tracking problem resolutions, and assigning responsibilities for problem resolutions. These are integrated into comprehensive document control systems. A big problem in the past was tying everything together. For example, if you needed documentation on a particular piece of equipment or a system, someone would have to dig through file cabinets to find the information. Nowadays, that information is available on a computer. With some of the three-dimensional CAD systems that have relational databases associated with them, someone could go in, click on a component, and all the data regarding that component would come up on the computer screen. It makes the control of the project much more effective in terms of data access and integration. Also, the scheduling and cost-accounting tools that we have today are much more effective, efficient, and user-friendly.

Miller: Also, the people who are running the projects and managing them are accustomed to this technology and the extent of information that is available. In the past, the cost side was often a separate world from the schedule side. Today, project managers and the construction management team are used to being able to tie information together to cross-check the various measures of progress and performance.

You use the term “outside the box” in your paper with regard to commercial quality control. What does that term mean when discussing project management, and conversely, what would be “inside-the-box” type of thinking?

Carter: Let's start with “inside the box.” I would consider that to be the process of applying traditional tools, techniques, and processes, or perhaps sticking to the programs employed on many conventional projects. Nuclear projects are extremely complex. They not only require extensive construction and engineering effort, but also rigorous technical quality control. It's very different from building a school or a commercial office facility. Stakeholders need to ask whether more cost and schedule controls can be effectively employed. I also think that with “inside-the-box” thinking, there is limited accountability. In certain instances, there may be tolerance for chronic low performance. That's an extreme statement, but it's probably accurate in some situations.

Now, “outside the box” is basically continuous due diligence. There would be aggressive risk identification and management and aggressive project management. The decision-making process has to be timely and effective, considering the appropriate risks. When you operate in an “outside-the-box” program, there's much more focus up

front on risk—what could go wrong and how the risks could be mitigated.

In the past, even in some of the nuclear jobs, the project management may have been somewhat tolerant of delays and cost overruns, but extremely intolerant of technical inaccuracies. Why not be similarly aggressive in managing cost and schedule? It

any cost increase or schedule delay, it would be clearly articulated to avoid contract disputes and to support regulatory prudence reviews.

Can the nuclear industry learn anything from the project risk management experiences of other industries?

Miller: I think so.

One thing we've seen in other industries is that the success of this type of program depends on the strength of the owner or the financier to take control and establish a buy-in from all the parties involved. The parties in these types of projects typically have very different

interests. Sometimes it can be difficult to convince them that a commercial quality control program is what is needed.

Could you give me an example of varying interests in a project?

Miller: Yes. For instance, the construction manager has a financial interest in his own business entity. There is the NRC, which has an interest in the safety and integrity of the technical aspects of the project. There is the owner, whose interest is to get the project up and running in compliance with the license. There are all sorts of different people who would potentially pull in opposing directions for different reasons. This is true in any project, not just for nuclear. It's a matter of the owner's taking control and establishing a procedure to which he will hold everyone accountable all the way through.

What are some of the commercial checks and balances used by other industries that the nuclear industry could use?

Miller: I think some of the most significant procedures involve the checks to the areas that used to be only within the realm of the construction manager. Or in the case of the owner, whatever group within the owner's company that is setting up the contracts—they're establishing the deal, if you will. Those parties each had their own territory into which no one else would enter. For instance, the owner's contract group would determine how the contracts were worded, how the general conditions would be laid out, how change orders would be priced, and how the payments would be

made. In the case of the construction manager, his realm was typically the project schedule, the sequence of work, how unforeseen events would be dealt with to mitigate delays, etc.

Those were very typical things, and other industries have begun to use the independent third party to break down those barriers into those territories. That third party would put another set of eyes on a contract, on the general conditions, to see if there are any issues lurking that might not have been thought of previously, based on the third party's experience in dealing with projects that have had problems.

Another avenue is the use of an independent party to provide periodic checks of the progress and changes to the schedule. A common way to try to hide an emerging delay problem is to adjust schedule logic later on. Suddenly, six months later, a problem pops up that could have been dealt with and resolved much earlier. Those are some things that are being used in other industries.

What happens when the third party makes a finding or a suggestion during its reviews?

Carter: That depends on the nature of the particular project and the policies in place. Generally, they would advise designated parties of the concern. The owner would likely be the ultimate decision-maker on all significant matters. The owner may want the contractor's project manager to make certain decisions. There may be thresholds established whereby issues that are affecting the schedule by more than X

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was a different era when the last round of nuclear plants was built in this country. I think we have a new mindset today, with an aggressive attitude to do it better. Look at the construction of the gas turbine power plants in recent years and the fact that several contractors went bankrupt. That clearly creates a heightened awareness of the importance of aggressive management, which may categorize today's project management attitude as “outside the box.”

Miller: Problem anticipation is another aspect of this. Not reactive, but proactive. Anticipating what could go wrong and preventing it is outside the box. I know of at least one utility that is several years away from building a nuclear plant and is looking at what it needs to do with its processes now to be ready to start building. So there is proactive thinking on the processes.

How often would the independent third party meet with the project managers?

Carter: It would depend on the particular project and what the parties wanted. I envision that the independent third party would have at least one senior person on site who would attend the project meetings, which may be quarterly meetings at first, then at some point monthly, then weekly, and eventually daily. There would also be third-party staff on hand consisting of qualified and trained individuals who would selectively review schedule-reporting and budget-reporting activities. As a simple example: If the schedule reported that the piping was installed from Point A to Point B, the commercial quality control person would verify that it was indeed installed from Point A to Point B. Such verification would likely be a spot check and would not apply to every scheduled activity. In addition, scope changes and the cause for those changes would be documented contemporaneously with the event so that if there were

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days or the budget by more than X dollars will rise to a review committee or something like that. Reporting protocols will vary.

Could you give an example of how commercial quality control has benefited another industry?

Miller: We've seen it used in many different types of industries. For instance, we've been involved in a project at a major U.S. airport. They did this in a very proactive way, saying that over the next five years they want to undertake improvements across the board at the airport. They want to plan it in such a way that inconvenience to passengers would be minimized and the risk of project delays and passenger delays would be reduced. The last thing they want is to end up in a negative report on the 6 o'clock news. They've had good success

in using these procedures to improve their baggage-handling and to change gate configurations. They've used this for each phase of the improvement process and it's worked very well for them.

When you talk with people about the tangible benefits of the process, what they say and what we've seen is that the benefit of a good commercial quality control program is more in what you don't see than what you do see. When the key people in the project have a good program going, there are no major cost overruns, no big delays, and no disputes and court battles that last for years and cost a lot of money.

Do the lenders encourage this process?

Carter: Absolutely. Lenders clearly have an interest in seeing a plant come on line and generate revenue to pay off the debt.

The NRC is awaiting applications for combined construction and operating licenses (COL). How early in the process should a COL applicant become invested in a commercial quality control program?

Carter: I think they should start talking about it very early in the process. It makes sense to get involved with the early estimating of the costs to build a new plant, the early scheduling, and the contracting. There doesn't have to be a fully established program in place at that time, but it helps to set the stage for what's going to happen later.

Miller: We've spoken with people who are taking it a step further, asking how they should organize their company to handle a new nuclear project. They want to know how best to organize their internal groups that will be responsible for the various aspects of the project to better position themselves to manage the inherent risks. They are being proactive and very forward-thinking in this.

Who is going to be the independent third party?

Carter: You want people who are familiar with the design and building of a nuclear power plant to focus on project management issues. You want people who know what's going on. The last thing a nuclear project team needs is inexperienced and unqualified individuals second-guessing their effort. One of the advantages of commercial quality control is that it can assist the project team to be successful by leveraging select resources to enhance reporting accuracy and improve the project's commercial performance. I think that in time we're going to have a large nuclear building program throughout the country. There's going to be a scarcity of good, qualified resources. How else can you leverage the available resources and still manage the project effectively? A commercial quality control program is one way to do it. **■**