Reliant Energy SCR Construction Implementation Plan

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Abstract

Reliant Energy has undertaken an aggressive construction schedule to complete 14 selective catalytic reduction (SCR) projects in the Houston area to meet State Implementation Plan (SIP) requirements that will be phased into place in April 2003 and April 2004. Babcock & Wilcox Construction Company (BWCC) was retained to construct 12 of these SCR systems. Integrating the construction plan into the overall engineering effort, Reliant has taken a strategic approach toward project completion that recognizes the availability of construction labor is critical to project success. This approach attempts to provide a predictable and stable workforce, build a learning curve, and maximize labor productivity. This paper will outline the strategy involved in the plan for completion, and key decision points.

Compliance Strategy

In response to the stringent NO_x limits for the Houston-Galveston area, and provisions contained in Texas Senate Bill 7, the Texas Electric Utility Deregulation Act, Reliant Energy has developed a plan that will result in implementation of aggressive NO_x controls in 2003.

Due to stringent regulatory requirements addressing allowable NO_x emission limits for Reliant Energy's Texas generating units, Sargent & Lundy LLC (S&L) was contracted in mid 1999 to provide a NO_x compliance assessment study for the Houston-area generating units. In the period of 1997-1999, Reliant Energy installed various NO_x reduction technologies on several Houston-area generating units to meet NO_x RACT (Reasonably Available Control Technology) requirements. NO_x RACT is an interim NO_x reduction program mandated by the Texas Natural Resource Conservation Commission (TNRCC) for ozone non-attainment areas. Because the NO_x RACT program was already in progress, S&L's compliance study was dynamic in nature, adjusting unit baseline NO_x performance as NO_x RACT modifications and tuning efforts were completed, in response to the November 1999, NOx RACT deadline.

TNRCC finalized the NO_x regulations for the Houston area in September 2001. These include the limits for 24-hour daily average, 30-day rolling average, and annual average. The compliance will be in three steps. There will be approximately a 44% reduction by April 2003, 88% reduction by April 2004, and 90% reduction by April 2007. These levels are among the most stringent reductions anywhere in the world.

S&L's compliance assessment was divided into three phases of work. Phase I of the study involved an initial review of Reliant Energy's planned load profile for each unit, existing unit NO_x emission levels, viable control technologies, expected NO_x removal efficiencies, and the development of a high level budgetary cost estimate for each control technology scenario. Since the new NO_x limits were not known at the time, three future NO_x limit scenarios were assumed and evaluated. The three scenarios were based on overall system NO_x removals of 70%, 85%, and 90%.

Phase II of the study involved the walk-down of each of the units to further review installation feasibility/requirements and to refine initial cost estimates for each chosen control technology. Several control technologies originally considered viable for specific units in Phase I were eliminated from further consideration in the Phase II study.

Phase III of the study further defined the project cost based on finalization of the TNRCC NO_x requirements and actual expenditure to date.

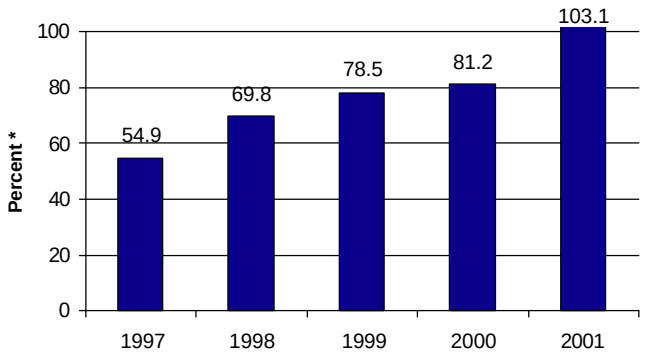
Because of the shear magnitude of the effort and time constraints, it was clear that a strategic approach toward project completion was required. From a construction standpoint, the approach had to ensure first that labor was available and used efficiently. Second, it was essential that the design include key elements of constructability to improve labor productivity, and build in predictability, and lastly that the procurement and delivery of material to the jobsites support the erection plan. Because heavy equipment would play such a critical role, these resources also had to be carefully managed.

Strategic Approach

In order to maximize the efficiency of skilled labor and equipment (which can account for 60% or more of an SCR project cost) it was necessary to formulate a strategic plan for completion. The plan had to address Customer and Contractor needs, as well as satisfy the Engineer's requirements. Relative to Customer needs, the requirements include completion within the specified timeframe, addressing the particular plant outage needs, and meeting tight system performance requirements as well as safety and cost. In order to fully incentivize BWCC, the terms of its contract actually put a portion of its profit at risk. To realize its full potential, BWCC must complete a safe project as measured by objective means (i.e., safety statistics), on time (as the schedule dictates) and within its estimated man-hours. Failure to achieve any of these items results in a payment penalty.

Labor

An appropriate estimate of the manpower requirements would be required. Since the design was preliminary, the total was difficult to ascertain. Reliant had no recent SCR project experience. Sargent & Lundy had the capability to estimate at a high level, but not at the detail required for specific manpower requirements, and was unfamiliar with the labor in the region. Because Babcock & Wilcox had completed (or had under contract) several SCR projects, and because of its familiarity with the local labor force, its assistance was vital in accurately determining manpower for the projects. A significant portion of these projects would be executed during planned maintenance outages, meaning that total manpower requirements had to consider not only for the SCR projects, but also to support the outages planned at each unit. Therefore, recognizing the magnitude of the projects was a key first step.



*** Actual Mhrs / Active Members x 2080**

Figure 1 Boilermaker national employment levels.

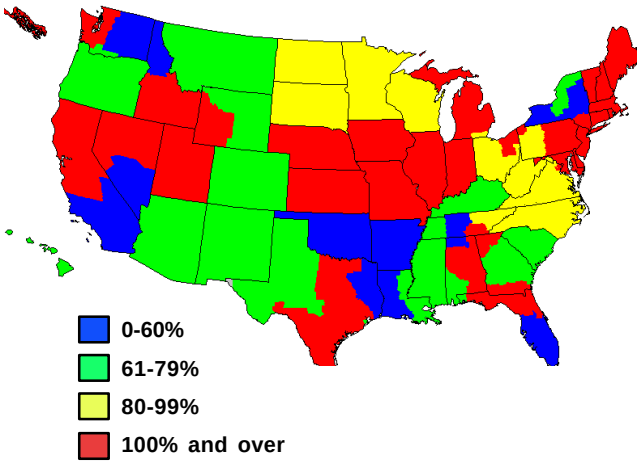


Figure 2 Boilermaker national employment 2001 (6 months).

To accomplish all of the SCR projects, as well as the maintenance planned for the system over the 3.5 year project life, it was estimated that more than 3 million man-hours would be required. This estimate was for work in the metal trades (mostly boilermakers and ironworkers). For the boilermakers, the local membership could supply in the range of 300 people to staff the jobs. If every member of the local union was sent to the job, the projects would still fall far short of the required manpower requirements.

To put things in perspective, a summary of the recent trend in the boilermaker industry is included for reference (see Figure 1). The following charts present data on boilermaker employment on both the national level over the last few years, as well as at the regional level.

Figure 1 represents the utilization of available boilermaker resources. In essence, it shows that nationally, the boilermakers have recently been at or near full employment. This fact makes it difficult to recruit members to travel for project work when there is work in their home locale. To get some sense of how this national data is represented at the regional level, see Figure 2.

Complicating matters for the Boilermaker South Central Region was the difficulty in attracting members from surrounding regions. Traditionally this has been because the wage rate in the South Central Region has been the lowest paying in the U.S. In fact, local labor would typically travel to other regions where the scale was higher to find better paying work and opportunities for overtime. Therefore, to ensure adequate labor was available for Reliant's projects, the issue of wage parity had to be addressed.

When the South Central Boilermaker contract came up for negotiation in 2000, a significant increase in the wage / fringe package was ratified. This wage rate adjustment helped to bring the local wages in line with surrounding regions and resulted in an immediate 10% adjustment.

See Figure 3 for information on the wage adjustment. This figure shows the annual wage variations starting in 1998. The

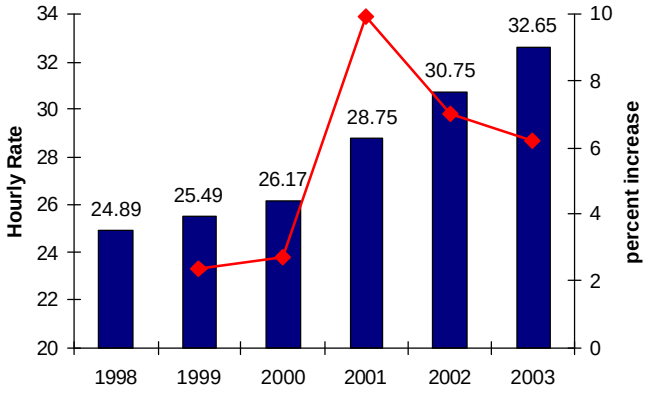


Figure 3 Annual wage variations; Houston Local 74.

left side of the graph is the hourly rate. Evident is the jump starting in the year 2001 to boost the wage / fringe package. The scale on the right side of the graph is the percentage increase each year of the contract.

In addition to the wage / fringe modifier, enticements were added to lure prospective talent into the region. It was determined early on that some jobs would offer an extended workweek and pay a bonus premium to those who worked during periods of peak labor demand. The 50-hour workweek was used where needed to ensure labor availability, labor retention and schedule commitments. During the scheduled maintenance outages, additional overtime was required.

As a final enticement during peak labor demand periods, a subsistence package would be offered in the amount of $35 per day to those working the job. The need for the subsistence package would be continually evaluated to determine its effectiveness. As priorities change, the evaluation takes into account the cost of the program versus the benefits to the project.

With all of these items combined, the net effect has been that an adequate labor supply has been available. This is a recognized accomplishment of the Owner, Contractor and Labor to ensure the success of these projects.

Refer to Figure 4 for a summary of the manpower requirements for the Reliant Houston projects.

Equipment

In addition to the labor issues previously discussed, a critical need for the success of these projects has entailed optimizing the equipment required and ensuring it is available for use. Just one SCR project alone represents a significant commitment and expense relative to equipment. Twelve are a true management challenge.

Early on, the construction plan was to fabricate the largest possible components on the ground and lift them into place after assembly. This approach offers several advantages. The difficult task is deciding what the optimal component or module size is, and thus the required crane for the job. Site geography and access can limit crane size and therefore module size will be limited by the available hook capacity. If access is available, a higher capacity crane will enable fabrication of larger modules. This information is vital to ensure the engineering design reflects the intended rigging scheme. This element of constructability can pay large dividends for the project by creating cost-saving opportunities and limiting the work at elevation.

For this project, the challenge early on was to identify the crane requirements, anticipate when and where they would be needed, and to plan to use them as efficiently as possible. High capacity cranes are in great demand in the current market. They need to be utilized efficiently to justify the cost. Large, high capacity cranes can rent for $100,000 per month and are costly to receive and set up. If the requirements for specific cranes are late in developing, there is a likelihood that the right crane may not be available in the timeframe required. The best crane for the job might just end up somewhere else on another project. Refer to Figure 5.

Material Logistics

Finally, key to ensuring project success is the timely delivery of materials in support of the completion plan. After evaluating options, Reliant decided the best approach for delivery of bulk items (structural steel and fabricated platework) was to place the responsibility for procurement in the erector's hands, the motivation being that BWCC was best able to expedite deliveries in support of its erection plan. In addition, Babcock & Wilcox had

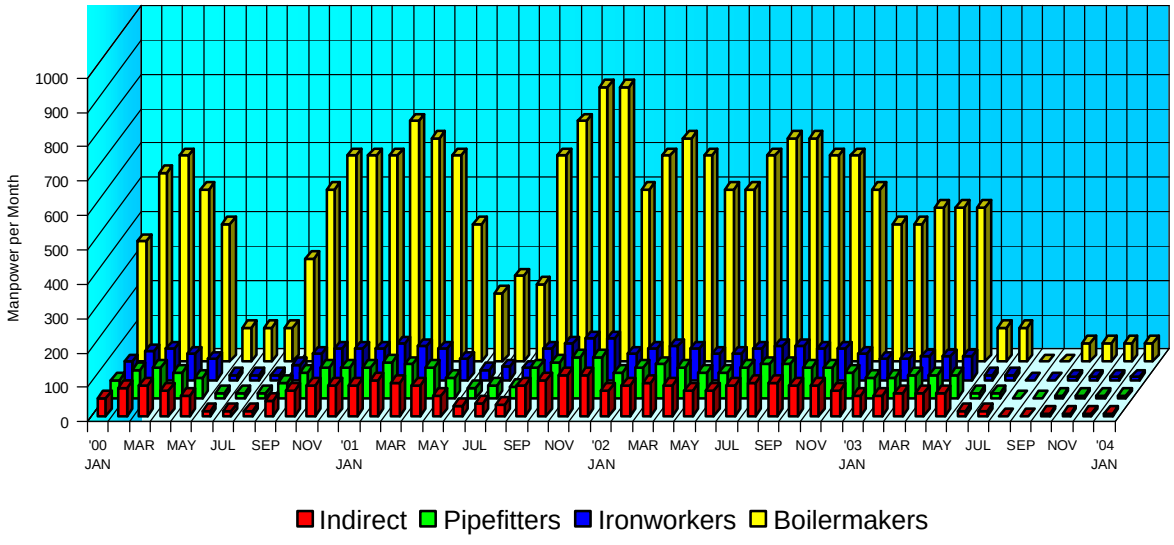


Figure 4 Projected manpower graph; 2000 through 2004.

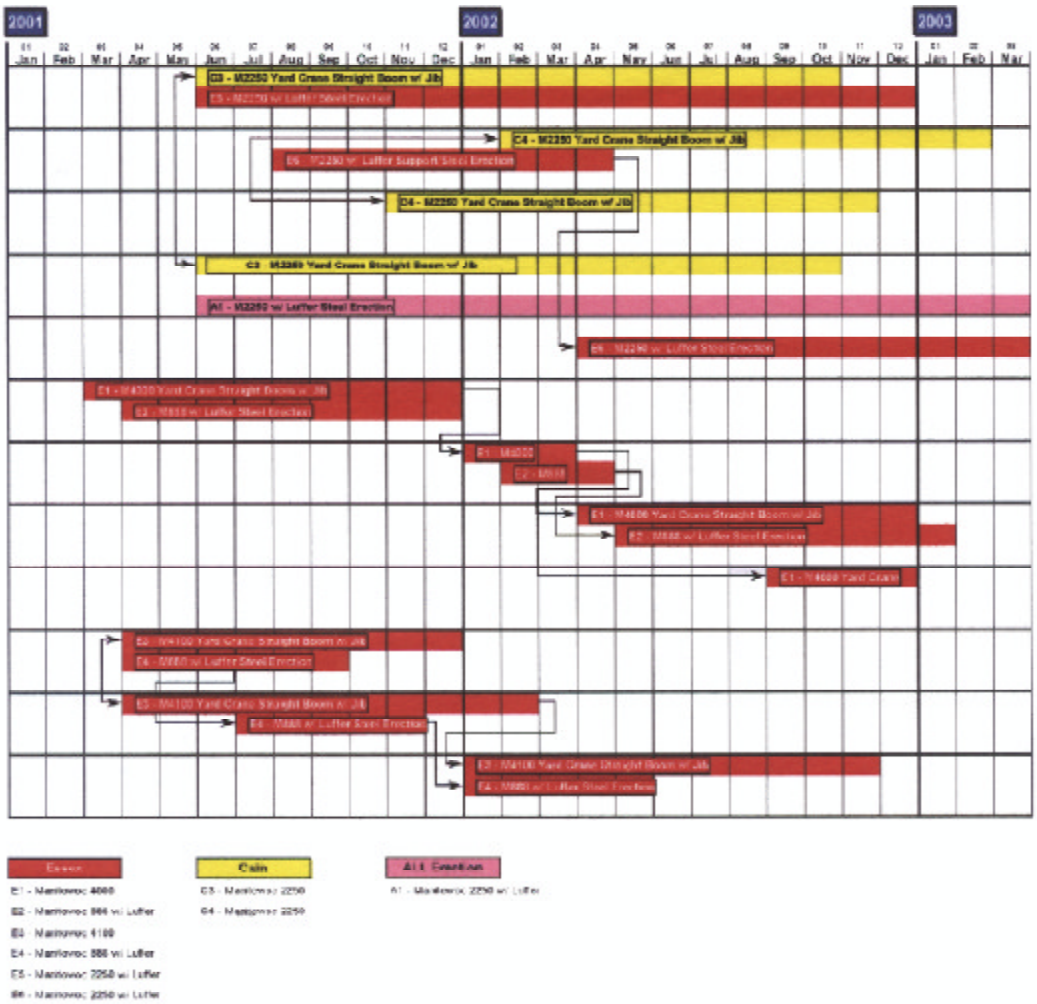


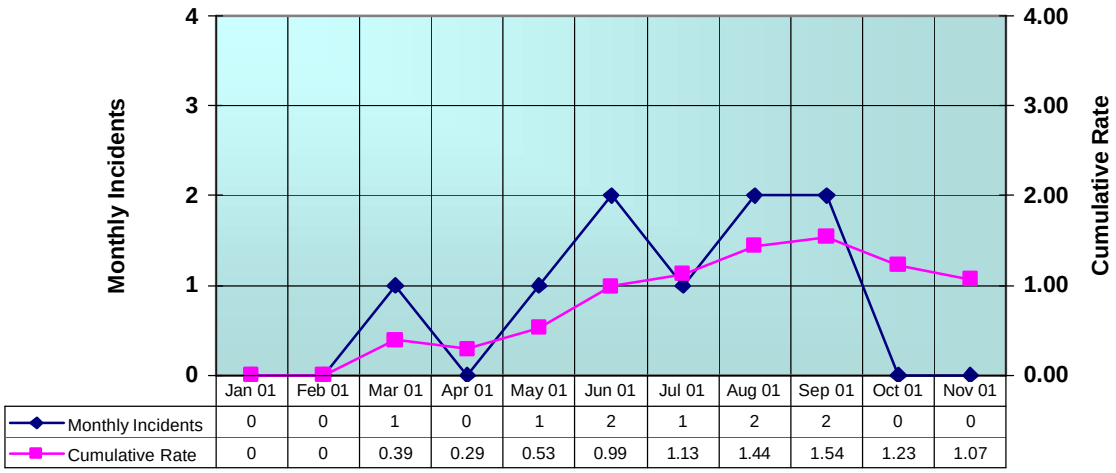
Figure 5 Schedule of small cranes, developed for Reliant System Projects in Houston.

at the time several key vendors supplying steel for Babcock & Wilcox on other projects. Reliant received the advantage of Babcock & Wilcox's world sourcing capability and the volume pricing opportunities it provided. Having a third party responsible for procurement adds layers of communication and the potential for contractual pitfalls. This is especially true of this project, considering that the procurement process will span years and is critical to maintaining a productive workforce. It was known that because the construction plan would involve tie-ins and bypass flues to be worked during scheduled outages, the focus of material procurement would vary as work progressed toward completion and priorities would change. Partial releases of the structure would be timed to coincide with outages and erection priorities. This procurement philosophy provides BWCC the opportunity and flexibility to redirect efforts as required and focus attention on items that potentially offer a payback on labor issues, and minimize the downside impacts of changing priorities.

For an order of magnitude of this procurement effort, refer to Table 1. The quantities are significant. It is estimated that approximately 18,000 tons of galvanized structural steel will be required to complete the projects. In addition, another 14,000 tons of fabricated platework will be required. To ensure potential project risks are minimized, BWCC has contracted with several key suppliers to ensure that no single vendor is overwhelmed with one order, and that potential impacts from any particular

Table 1
Reliant Energy — SCR Retrofit Projects
Estimated Tonnage Quantities from Study

Plant	Unit	Structural Steel	Ductwork	SCR
Cedar Bayou				
	1	1,200	670	250
	2	1,200	670	250
	3	1,600	1,050	250
Sub-Total		4,000	2,390	750
P.H. Robinson				
	1	600	550	150
	2	600	550	150
	3	800	550	200
	4	1,200	650	250
Sub-Total		3,200	2,300	750
Parish				
	4	750	585	100
	5	2,300	810	1,100
	6	2,300	810	1,100
	7	2,800	733	900
	8	3,100	783	1,000
Sub-Total		11,250	3,721	4,200
Grand Total		18,450	8,411	5,700



	Jan 01	Feb 01	Mar 01	Apr 01	May 01	Jun 01	Jul 01	Aug 01	Sep 01	Oct 01	Nov 01
Monthly Incidents	0	0	1	0	1	2	1	2	2	0	0
Cumulative Rate	0	0	0.39	0.29	0.53	0.99	1.13	1.44	1.54	1.23	1.07

Figure 6 Reliant Energy project safety data, January 2001 to present.

vendor failing to comply with its delivery requirements have no devastating effects on the projects. To date, this approach has worked to everyone's satisfaction.

For the delivery of other components for the SCR project, including mechanical and electrical equipment, regular meetings are held between the Owner, Engineer and Subcontractors to determine procurement and delivery requirements in support of the construction schedule. This effort involves many lower tier subcontractors and vendors. All engineered equipment was procured by Reliant Energy. Sargent & Lundy developed specifications and prepared bid evaluations for Reliant to use in the procurement process. As should be evident, timely delivery is essential to project success. Coordination for delivery of these items falls into Sargent & Lundy's scope of responsibility, but the effort is collaborative in determining the project needs. Sometimes, the delivery drives the construction plan or is the critical path, and at other times, items are expedited in support of a critical path activity. To date, the procurement effort has been a major success on this project.

Designing for Constructability

A major key to achieving success in the construction plan is the timely release of key engineering outputs. Throughout the project, Reliant, BWCC and Sargent & Lundy have worked hand in hand to ensure those requirements are met. At times, this has required expediting portions of the engineering effort to support procurement, delivery or construction activities deemed essential to keeping the plan on track. At other times, it has entailed redirecting the focus of construction activities when necessary to support the engineering effort.

Communication has been essential toward this end. Regular meetings are held to convey motivations for focusing efforts of the construction plan. Prior to the issuance of important design outputs, meetings are held to review the pending release, and provide construction an opportunity to review and comment prior to release. In this way, when items such as opportunities for modularization or subtle changes to engineering details are identified that can save man-hours or improve labor productivity, they can be communicated. On a fast track project, the construction plan needs to drive these key project releases. When the team members share a common vision of the opportunities or risks on a project, designing for constructability is a result.

For this project, all of the team members have demonstrated an ability to leverage core competencies to achieve the project goals. This team-based approach has worked well in comparison with a more traditional approach to contracting arrangements. From the outset, the team's expectations have been that project needs come first.

Project Update

To date, a little more than 18 months into the project, the following statistics can be reported:

- Approximately 2 million man-hours worked to date
- Approximately 8,100 tons of structural steel delivered and erected
- Approximately 6,300 tons of fabricated fluework delivered and erected.

In addition, the safety record for the entire system-wide effort continues to be a source of pride. With nearly 2 million man-hours worked, the recordable incident rate (which is a measure of recordable incidents per 200,000 man-hours worked) continues to be below Babcock & Wilcox Construction Company goals. With Safety Management playing such a key role in the project success, tracking of safety data takes on great importance. Figure 6 is an example of some recent safety data for the Reliant projects.

Currently, from a construction standpoint, the overall project stands at approximately 45% complete. While much remains to be completed within a relatively short window of opportunity, the results to date are encouraging and provide great anticipation that the work will finish within the targets set for completion. The success to date is due in large part to the team approach taken for the Reliant Houston projects, which builds upon the skills and strengths of the individual members to create a team that is greater than the sum of its individual parts.