

**2020 NEI Report of Project Management Lessons Learned and Best Practices  
Construction of New Nuclear Power (NNP) Plants  
32 Public Domain Reference Documents**

**2013**

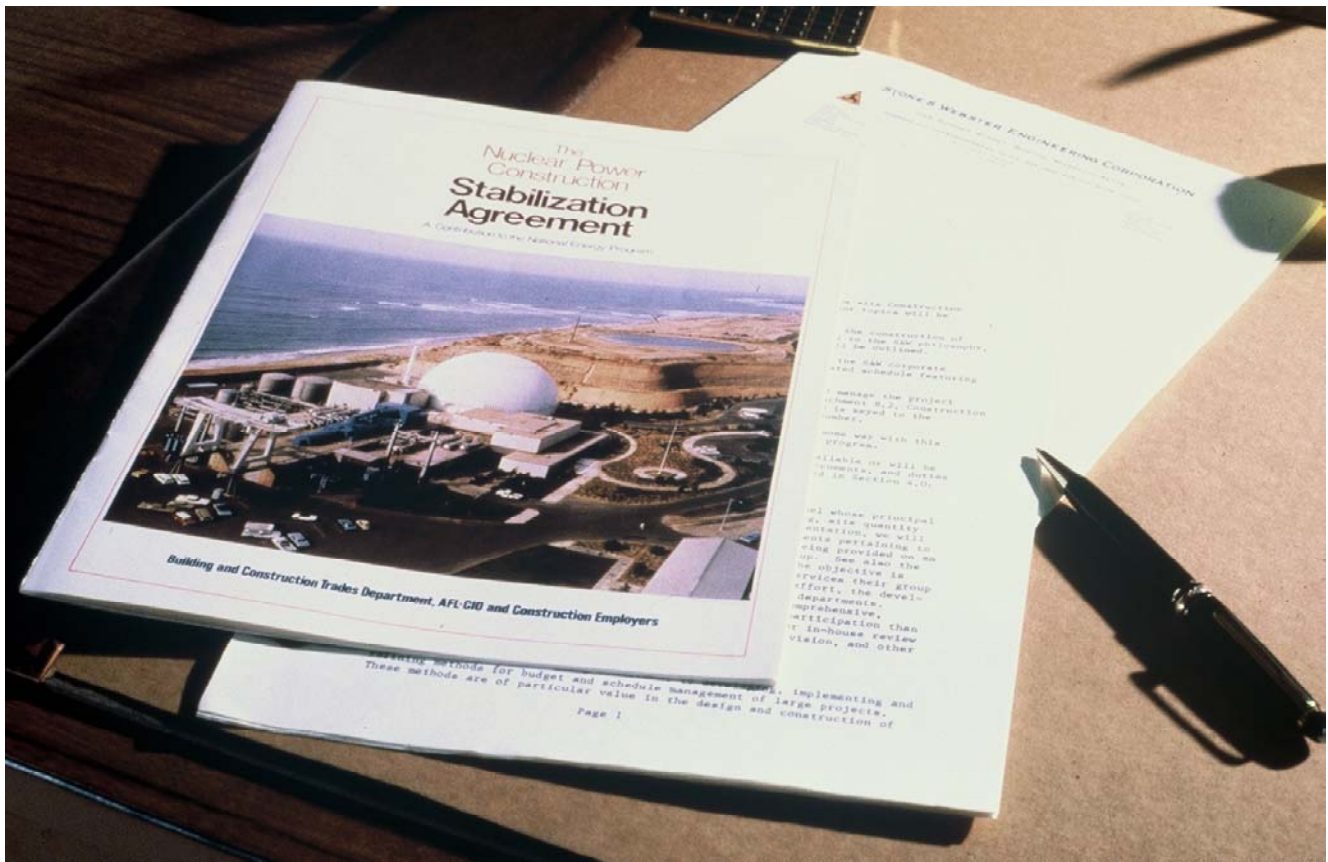
**Industry Reference Document (21) of (32)**

**Alternating 4/10's and Nuclear Power Construction  
Stabilization Agreement - Reduced Schedules & Costs  
13 pages**

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# Summary of Advantages and Challenges ©

**Alternating 4/10's Shift Approach (4/10's) and the  
Nuclear Power Construction Stabilization Agreement (NPCSA)  
versus  
Conventional 5/8's or 5/10's with Second Shifting and Overtime**



## Preface

- *Large and complex mega-projects involving many years, dollars, and labor hours face numerous challenges and risks that can negatively impact cost and schedule performance. The commercial nuclear power industry and various US Department of Energy (DOE) programs and projects have experienced this all too well.*
- *A nation-wide labor/management partnership in 1978/1979 worked together to establish a policy framework for planning and executing large commercial nuclear projects. The Nuclear Power Construction Stabilization Agreement (NPCSA) and Alternating 4/10's Shift Work approach was developed as a result of this labor/management initiative.*
- *It was successfully implemented with significantly improved results for construction/commissioning of the River Bend Station (RBS) Commercial Nuclear Project in Louisiana, and initial construction/project Baselineing for the DOE Clinch River Breeder Reactor Project (CRBRP) in Tennessee. **River Bend construction/startup was completed in 72 months, representing a 40-month schedule savings compared to industry norms of the time. This reduced schedule avoided over one billion dollars in cost expenditures related to escalation, interest during construction, and indirect/distributable activities driven by project duration, while also reducing exposure to risk impacts.***
- *This approach and these successful project experiences offered great promise to large commercial nuclear and government projects. However, further application was quelled by policy, political, and economic events following the March 1979 Three Mile Island Nuclear Station accident.*
- *Given recent world and domestic energy developments regarding the supply of oil and concerns over global warming, the potential for advanced design commercial nuclear power plants coming to fruition in the US in the near future is very real.*
- *High Bridge Associates, Inc. (HBA) prepared the following NPCSA and Alternating 4/10's Overview or "White Paper" to update industry and administration decision makers regarding the benefits and challenges associated with applying this approach to large commercial and government projects. **Utilization of this approach can result in overall total project cost savings of 10% to 20% and schedule savings of 25% to 35%.***

## **Key Benefits of the Alternating 4/10's Work Shift Approach**

**1. Overall construction schedule duration is reduced by 25% to 35%.**

This is a result of having 40% more work days, i.e., 360 days/year vs. 260 days/year.

**2. Schedule confidence is improved.**

Schedule risks are reduced, and the framework is created for enhanced schedule recovery ability to respond with work around plans to mitigate problems that develop.

**3. Craft staffing levels and congestion on day shifts are reduced by 35% to 40%.**

This is a result of A and B day shifts having roughly equal craft staffing levels, compared to a traditional day/night shift approach where the day shift represents 70/80% of total staffing and night shift represents 20/30% of total staffing, which creates day shift congestion peaks.

**4. Modularization and sub-assembly opportunities (both off-site and on-site) are maximized.**

This is a result of taking advantage of the accelerated pace and pressure on engineering, design, and procurement, thereby optimizing craft labor installation efficiencies and productivity.

**5. Crane and heavy equipment is better utilized.**

This is a result of equipment being in productive support of labor installation for 7 days vs. 5 days per week, and being on the project site for 25% to 35% less overall duration.

**6. Engineering, design, and vendor material/information deficiencies are better managed.**

This is a result of identifying issues sooner due to the accelerated pace, which allows for earlier resolution, fewer major problems, and more opportunities for corrective action.

**7. Longer/improved sustained daily work periods and production momentum are achieved.**

Better work force utilization and less idle time as a per cent of the day results, since there are two work starts and two work stops per day for every 10 hours instead of every 8 hours, which creates longer/optimum morning and afternoon production work periods.

**8. Shift change frequency and associated inefficiencies are reduced.**

The alternating 4/10's approach offers the advantage and efficiency of 2 shift changes every 8 days/80 hours, whereas the traditional day/night shift approach involves 10 shift changes every 10 days/80 hours.

**9. Work force morale is improved, job fatigue is reduced, and production is enhanced.**The

crafts enthusiastically support this 4/10/s approach with 180 versus 104 weekend days off/year, which tends to attract higher skilled, dedicated, and quality conscious resources.

**Key Benefits of the Alternating 4/10's Work Shift Approach (continued)**

**10. A larger travel radius and expanded labor resource pool is created.**

The 4 day weekend allows more travel/off time that attracts higher quality crafts locally, an expanded resource pool of craft travelers, competes effectively with other construction projects, and reduces nights away from home.

**11. The annual workday/jobsite travel round trips are reduced significantly for each shift.**

There are 80 round trips avoided per year, as a result of each shift working 180 days versus 260 days, a reduction of 80 days/year or 31%.

**12. Craft labor absenteeism is reduced and daily work plans are supported more effectively.**

This is a result of the work force liking the 4-day off approach, coupled with the fact they are ready to return to work and are less likely to skip one work-day that is 10 hours of wages vs. 8.

**13. Local project traffic congestion and community service impacts are reduced.**

This is a result of fewer personnel on site during the day, off-peak reporting and quitting work hours, and fewer crafts living in the local area with their families.

**14. Project revenue streams and/or program mission goals are achieved sooner.**

This is a result of the overall construction schedule being reduced by 25% to 35%.

**15. Material and labor escalation/inflation costs are significantly reduced.**

This is a result of the overall construction schedule being reduced by 25% to 35%.

**16. Interest during construction costs are significantly reduced.**

This is a result of the overall construction schedule being reduced by 25% to 35%.

**17. Overall total project costs are reduced by 10% to 20%.**

This is a result of the overall construction schedule being reduced by 25% to 35%, which decreases various time dependent costs. This includes the reduced escalation and interest costs mentioned above, and the avoided project/site infrastructure "hotel load" for indirect and distributable activities related to design, procurement, licensing, ES&H, construction management, startup, commissioning, operations management, and other support functions.

**Key Benefits of the Nuclear Power Construction Stabilization Agreement (NPCSA)**

**18. Disruptive and costly work stoppages and schedule delays are eliminated.**

Labor and management agree to prohibit strikes, walkouts, picketing, and lockouts.

**19. Work assignments are better controlled directly by the supervisor.**

This is a result of more standardized jurisdiction rules and the elimination of the union steward from the work assignment process.

**20. The labor grievance resolution process is more streamlined, efficient, and mutually effective.**

This is a result of more standardized jurisdiction rules, a graded grievance approach, and the elimination of the union steward from the work assignment process.

**21. Fewer grievances become major problems.**

This is a result of more standardized jurisdiction rules, a graded grievance approach, and administering the process locally/on the job with international labor representative support.

**22. Administering labor benefit plans and premium time rules is improved and more efficient.**

This is the result of all NPCSA signatory craft organizations adopting uniform policies.

**23. Local labor management/rank and file members are more enthusiastic and supportive.**

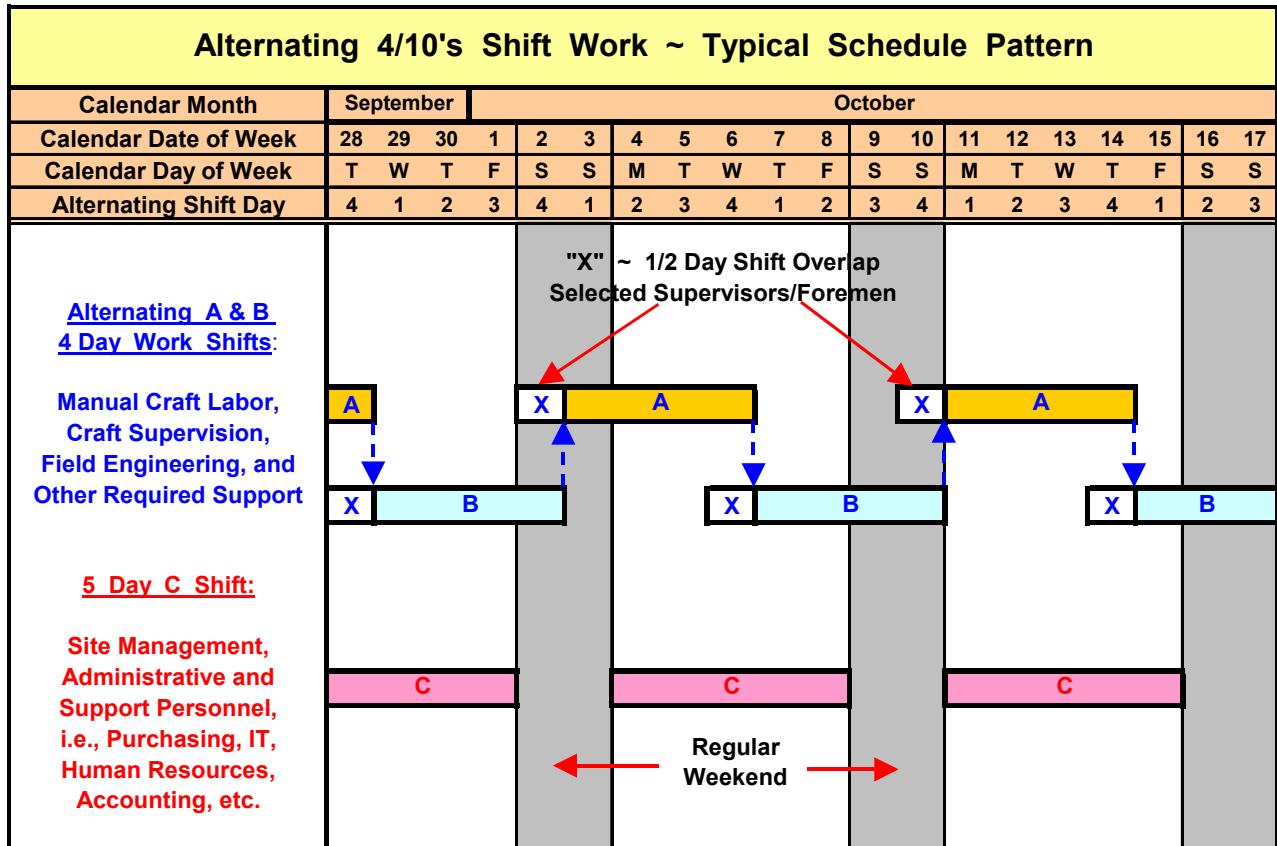
Full support from all international representatives instills a local spirit of cooperation.

**24. A higher ratio of non-journeyman/apprentice craft participation in the work force helps to lower the average wage rate and provide a broader labor pool of support.**

This is a result of a key strategic element of the international labor/management approach to build harmony and flexibility to support large projects with cost effective measures.

**Issues and Challenges Related to the Alternating 4/10's and NPCSA Approach**

- A. Production installation is performed on both A and B day shifts, with different crews working the same tasks.
- B. Job management on C shift must have leadership skills and tenacity to demand and enforce a mutually respectful teamwork approach from A and B shift management teams.
- C. Weekends don't exist for work-around/catch-up production goals, only the night shift
- D. Weekends don't exist for project support and infrastructure/equipment maintenance, only the night shift.
- E. The majority of site non-manual and craft personnel work out of step with the normal Saturday/Sunday weekend paradigm, causing varying degrees of professional, personal, and social life disruption and inconvenience.
- F. Site non-manual staffing levels and overall related labor costs for management, supervision, field technical, design authority, and other support groups are increased approximately 50%.
- G. Site facilities and infrastructure required for increased non-manual staffing levels are also increased for various cost elements like office space, desks, phones, computers, parking, etc.



**NPCSA Establishes Commitment for Labor/Management Harmony Organizations and Management Co-Signatories to Agreement**

Bechtel Power

Bricklayers

Painters

Ebasco

Carpenters and Joiners

Cement Masons and Plasterers

Stone and Webster

Electrical Workers

Tile and Composition Roofers

United Engineers

Operating Engineers

Sheet Metal Workers

AFL/CIO Building and Construction Trades

Structural/Ornamental Ironworkers

Terrazzo Finishers

Insulators and Asbestos Workers

Laborers

Plumbers and Pipe Fitters

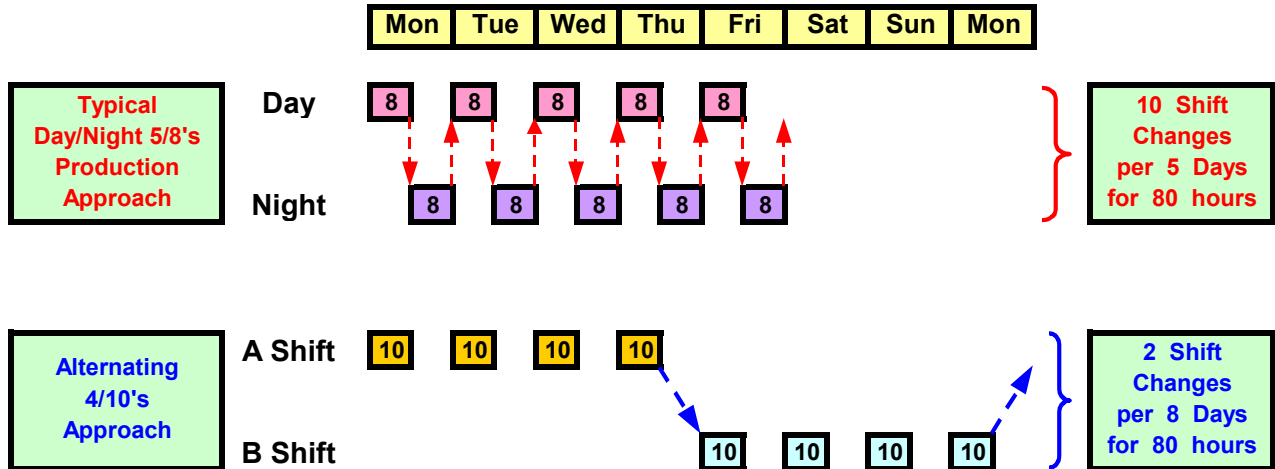
Boilermakers and Blacksmiths

Wood and Metal Lathers

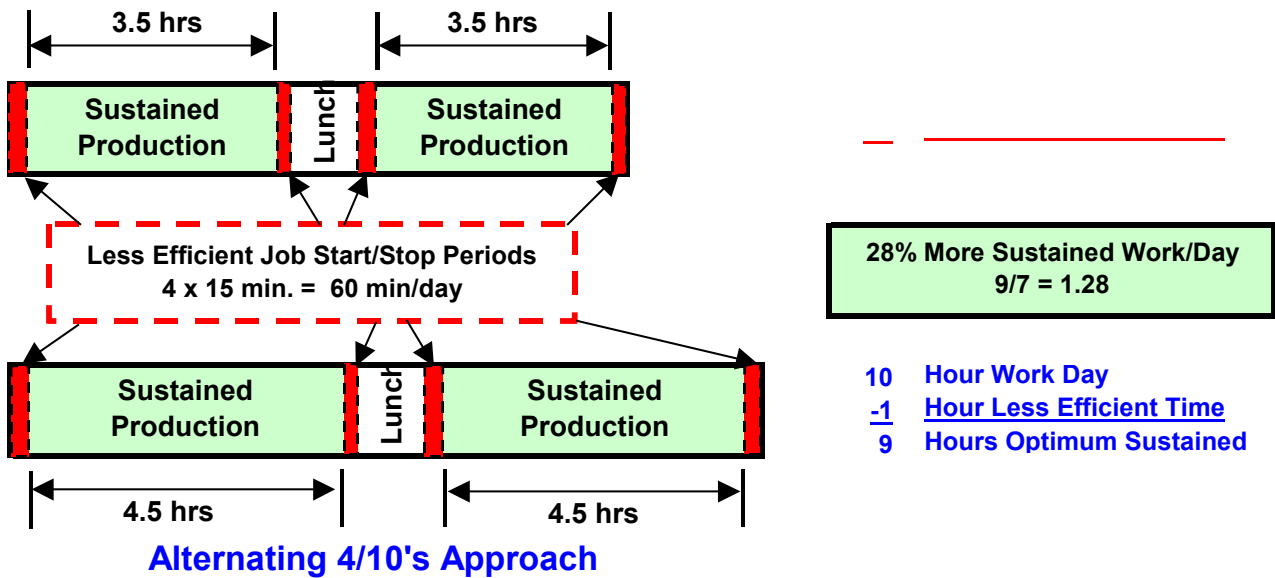
Teamsters and Warehousemen



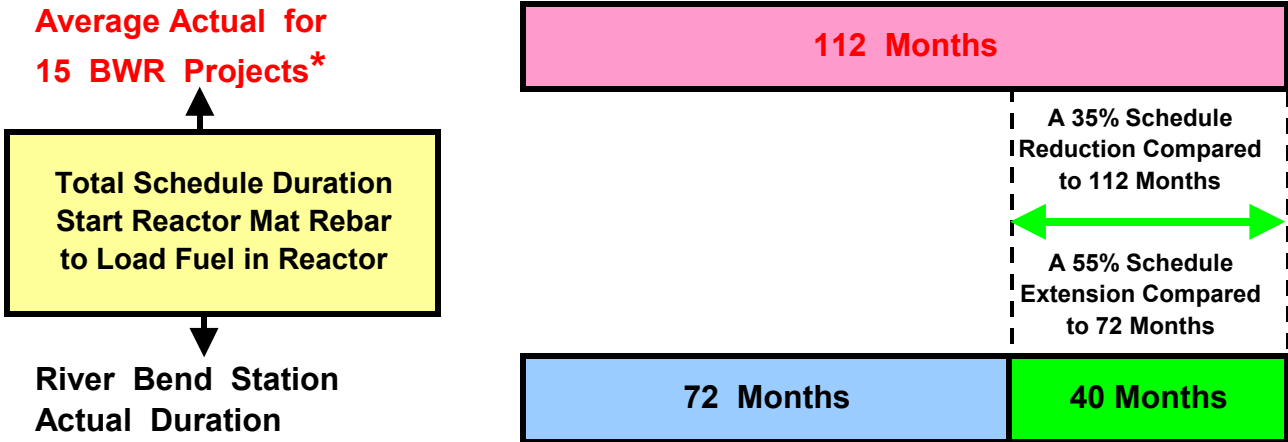
**Improved Shift Change Frequency and Production Continuity  
Alternating 4/10's Approach vs. Typical 5/8's Days/Nights**



**Optimized Sustained Daily Work/Production Momentum  
Alternating 4/10's Advantage vs. Traditional 5/8's Approach**



**Actual Schedule Results for River Bend Nuclear Station  
Utilizing NPCSA and Alternating 4/10's Shift Work Approach**

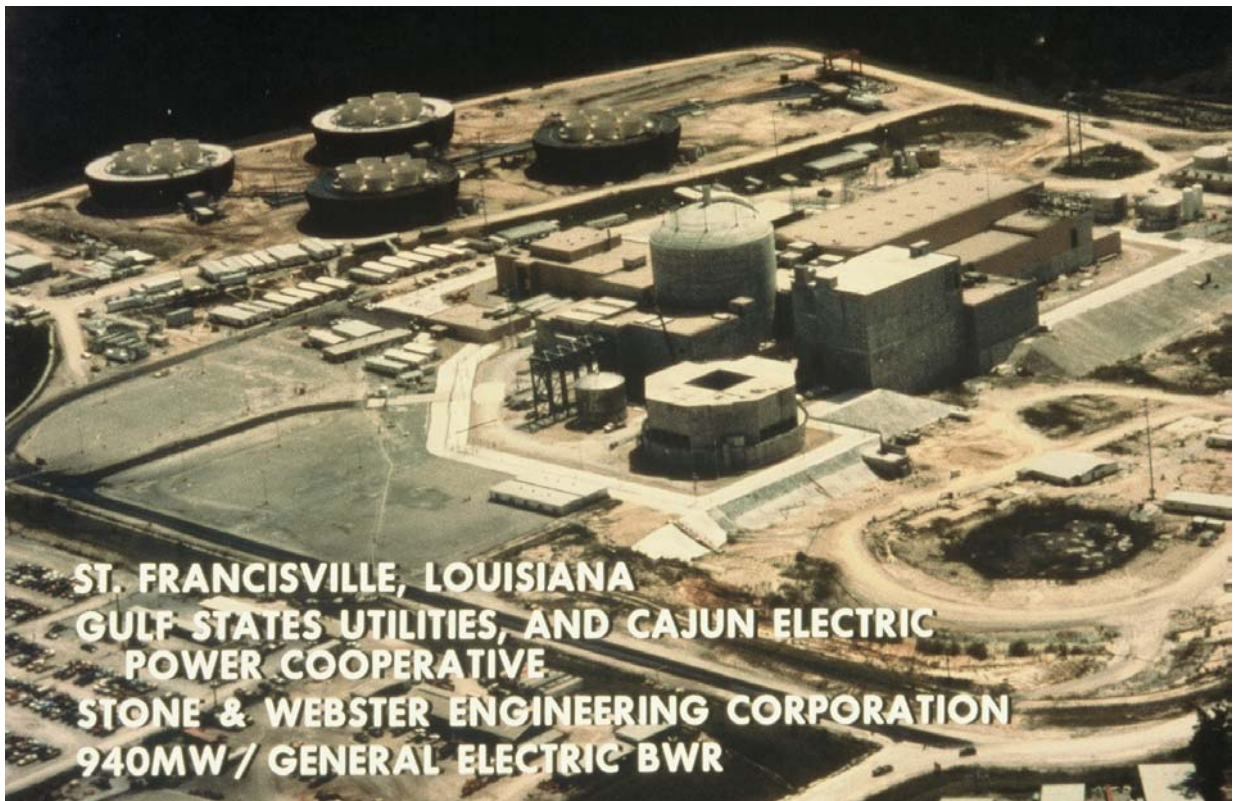
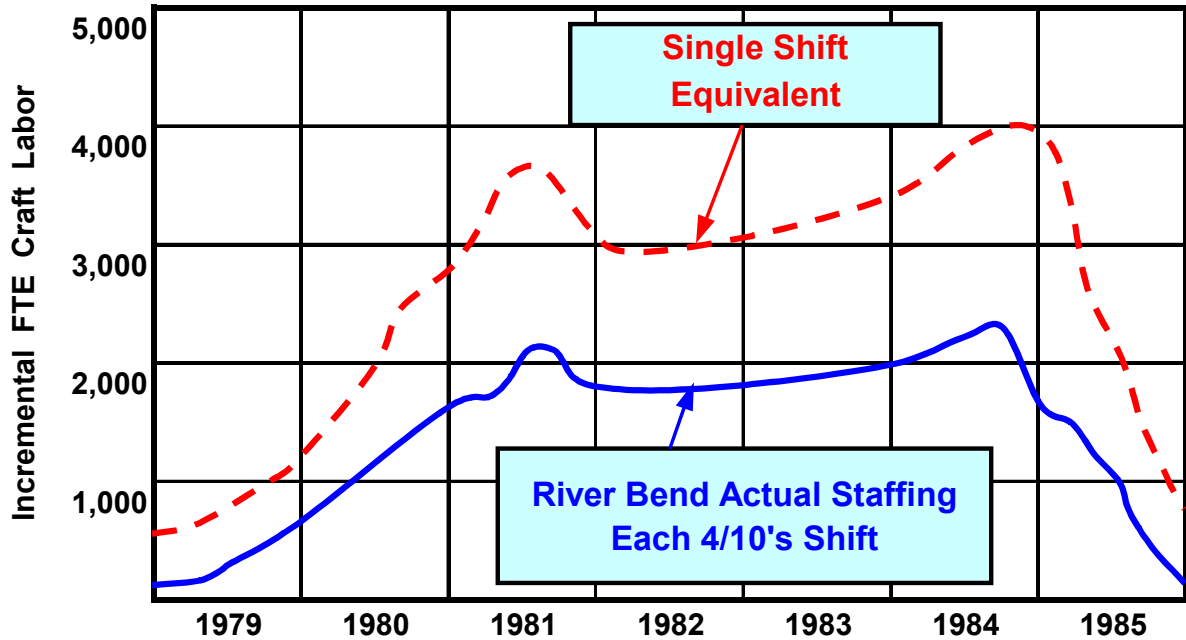


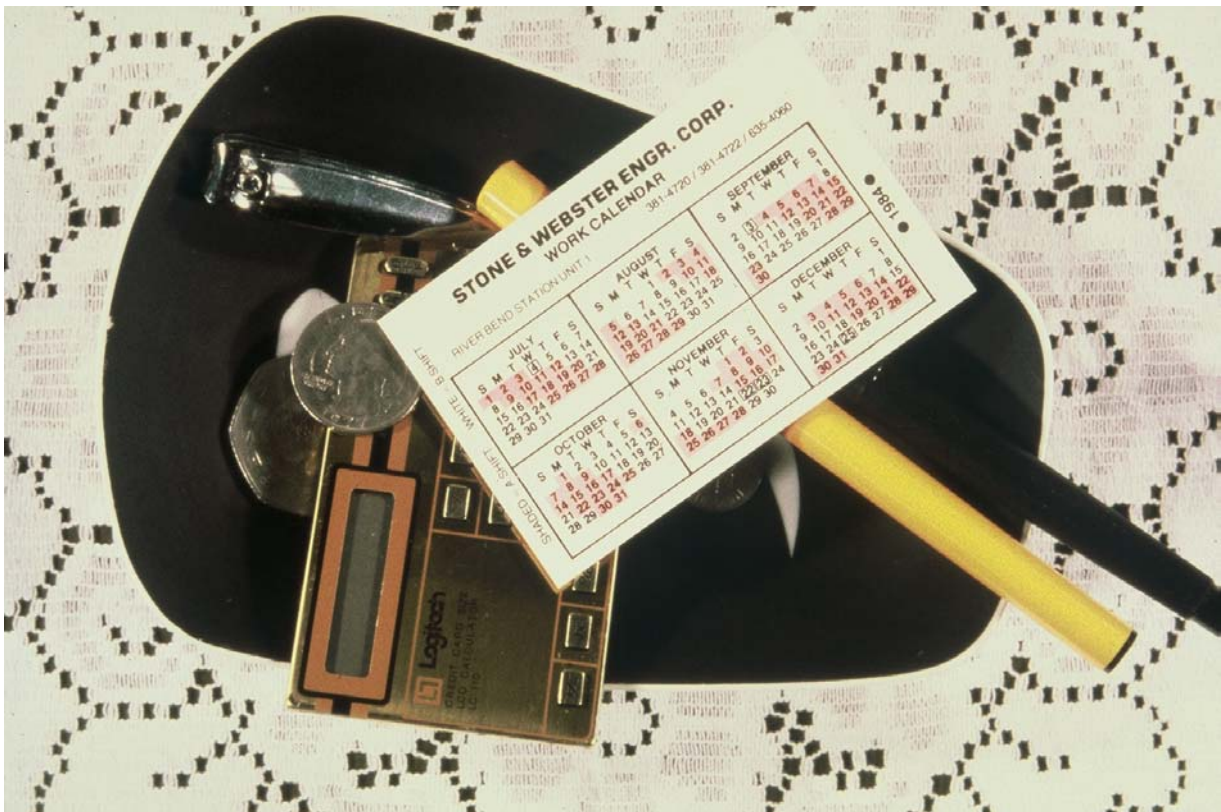
\* US NRC Data for 15 BWR Nuclear Projects Constructed in the Late 1970's/1980's, Utilizing a Combination of 5/8's, 5/10's, 6/8's, Day and Night Shifts, and Overtime.

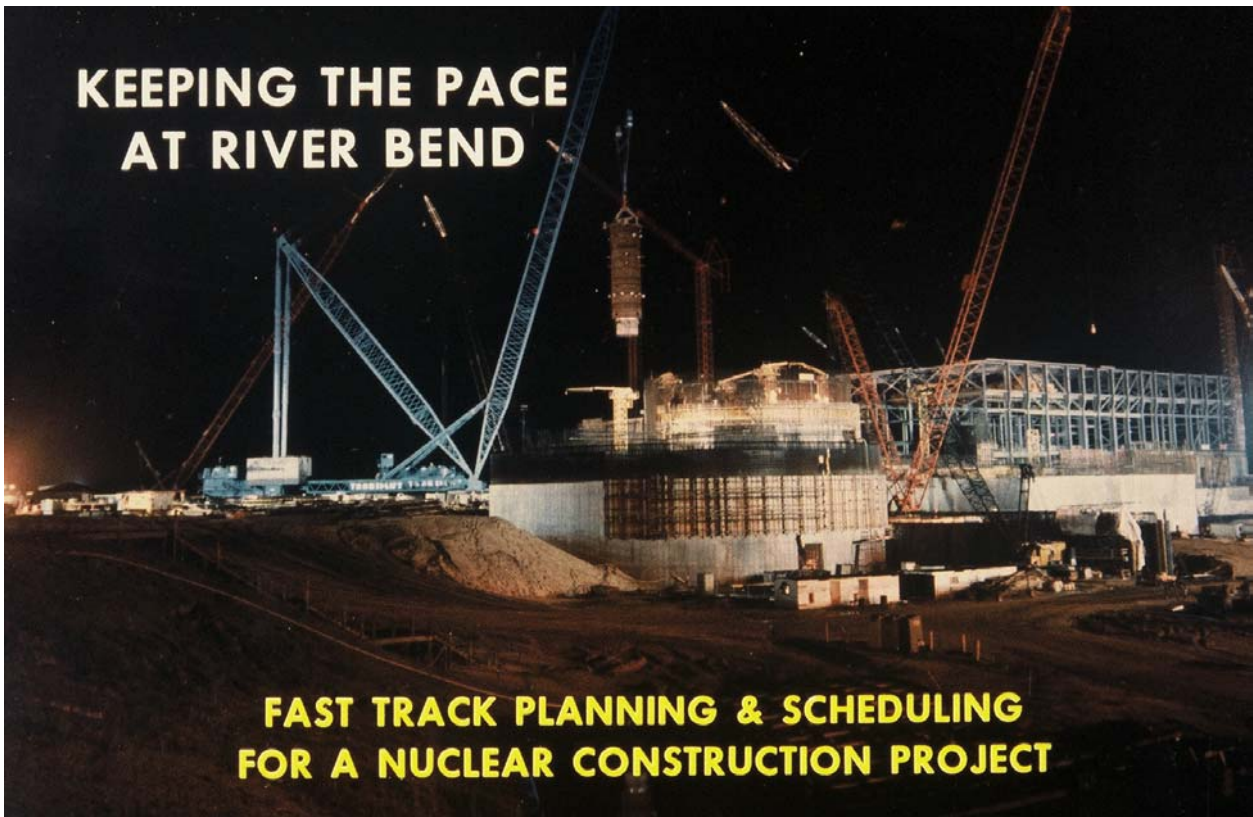
**River Bend Nuclear Station  
Key Installed Commodity Data**

<b>Excavation</b>	<b>10,200,000</b>	<b>C.Y.</b>
<b>Backfill</b>	<b>9,500,000</b>	<b>C.Y.</b>
<b>Concrete</b>	<b>290,000</b>	<b>C.Y.</b>
<b>Embedded Iron</b>	<b>9,300,000</b>	<b>Lb.</b>
<b>Reinforcing Steel</b>	<b>42,000</b>	<b>Tons</b>
<b>Formwork</b>	<b>3,400,000</b>	<b>S.F.</b>
<b>Structural Steel</b>	<b>11,000</b>	<b>Tons</b>
<b>Large Bore Piping</b>	<b>273,000</b>	<b>L.F.</b>

**Incremental FTE Craft Labor Staffing  
River Bend Nuclear Power Station  
Reduced Peak Levels with 4/10's Approach**







**About High Bridge Associates, Inc.....**

***High Bridge Associates, Inc. (HBA) provides consulting and project management services to support the specific needs of medium to large projects of all types. We have an extensive base of experienced professionals that will bring effective management processes to your project or program. Our primary project, construction, operations/maintenance, and decommissioning management services include (1) planning and scope development; (2) independent assessments and feasibility studies; (3) scheduling; (4) cost estimating; (5) cost engineering; (6) configuration management and change control; (7) performance measurement and earned value management; (8) project controls and management information systems; (9) policy and procedure development; (10) training; (11) procurement; and (12) contract administration and claims support.***

***High Bridge Associates is a Woman Owned Small Business enterprise based in Metro Atlanta. HBA principals bring a proven track record of success in providing high value project management consulting and support services to private and government owners, engineer/constructors, and original equipment manufacturers in various industries and business segments. These include the energy, defense, environmental and waste management, information technology, pharmaceutical, and aerospace industries.***

**HBA has Experience with Schedule Intensive Projects and the Alternating 4/10's Approach.....**

***High Bridge principals and senior consultants have extensive experience with planning, evaluating, and managing the delivery of various shift work programs for large commercial nuclear and US government projects. This includes the planning and execution of dozens of commercial nuclear generating station outage and modification program cycles working combinations of shift work to achieve "24/7" application of resources. High Bridge prepared this "White Paper" to update industry and administration decision makers regarding the benefits and challenges associated with applying this approach to large commercial and government projects.***

***HBA management consultant/principal Ken Aupperle has hands-on experience supporting the planning and implementation of the NPCSA and Alternating 4/10's during his previous 25-year career with Stone and Webster Engineering Corporation. This included assignments for the construction of the River Bend Station (RBS) Commercial Nuclear Project in Louisiana and the US DOE Clinch River Breeder Reactor Project (CRBRP) in Tennessee. These involved assisting corporate management with development evaluations and negotiations with national partner organizations (i.e., the US government, labor unions, AE/CM's, and utility owners); a site assignment as the Superintendent of Cost and Scheduling on the River Bend Project; and a site assignment as a Consultant for the CRBRP Project to lead the development of a cost and schedule baseline founded on the Alternating 4/10's approach. . Mr. Aupperle has provided assistance with conducting Alternating 4/10's Cost and Schedule Feasibility Studies for numerous other projects. He has published and presented numerous papers concerning the application of the Alternating 4/10's Approach to achieve schedule reduction and cost savings.***