

## STPNOC • South Texas Project - Unit II Replacement Feedwater Heat Exchanger Tube Bundles

### Project Description

STPNOC South Texas Project Unit II's existing three feedwater heat exchangers were experiencing tube degradation, causing power losses. Ultrasonic testing (UT) of the shells and nozzles revealed that wall thinning was encroaching design minimum wall thickness requirements. Visual exams also revealed manufacturing defects and subsequent degradation of the existing heater shell weldments. The standard remedy for this degradation would normally consist of replacement of the entire feedwater heaters.

### Project Challenges

- An extremely aggressive schedule of twelve days was planned.
- Safety and logistical concerns due to heavy and numerous equipment moves, tight access constraints, extensive cutting, rigging, fit-up, and welding.
- Cutting large shell components and large bore piping creates fit-up challenges that could jeopardize the schedule.
- The required large number of craft personnel would create congestion and safety concerns.
- There was little craft labor available in the local area due to other large projects at the plant and other local projects that depleted welding, pipefitter, and boilermaker resources.

### BHI Project Resolution

STPNOC decided instead to replace the bundles only. A new tube bundle design would provide an increase in steam flow which, combined with moisture separator reheater chevron vane replacement and turbine upgrades, would result in an increase of approximately 60 megawatts to the plant power output. Replacement of tube bundles only would cost less than replacement of the entire heaters, and could be completed in a shorter schedule.

BHI offered an extremely aggressive replacement approach with a continuous hands-on field management and workforce effort. The mechanical crew consisted of 28 BHI personnel consisting of 1 project manager, 1 superintendent, 2 foremen, 16 welders, 4 pipefitters, and 4 machinists.

### Scope Description

BHI provided the following services and workscope completion including:

- Project planning, including preparation and submittal of qualified weld procedures, review of weld packages and travelers. Welder qualification tests were completed using BHI's welding program. STP qualified BHI to their program to provide temporary rigging for the piping.
- Cutting of the three 58" diameter shipping containers using hydraulic clamshell cutters. Interference removal of multiple 1" through 16" piping.
- Cut-out, prep and weld eight 16", three 12" large bore welds and eighteen 3" small bore welds. Removal and re-installation of a 16" feedwater regulator valve.
- Flame cut heads off of the three feedwater heaters. The rigging company pulled the shells and bundles out on pre-staged rails.



A 60" clamshell cutter was used (vs. grinding) to sever the shipping container from the replacement bundle



Strategic and experienced rigging was required to remove the existing bundles and install the new ones



The heater to piping alignment and fit-ups, and zero-defect welding, improved the schedule by two days.

- Internal repairs of minimum wall shell areas including a random total of 3 square feet per heater of weld-buildup near the nozzles using a manual SMAW (stick) process.
- Grinded preparation of the weld joint, rigging into place, fit-up, and welding was completed utilizing manual GTAW (TIG) and semi-automatic FCAW (flux cored) processes.
- The inspection criteria was ultrasonic testing (UT) on shells and visual and magnetic particle testing (MT) on the piping.

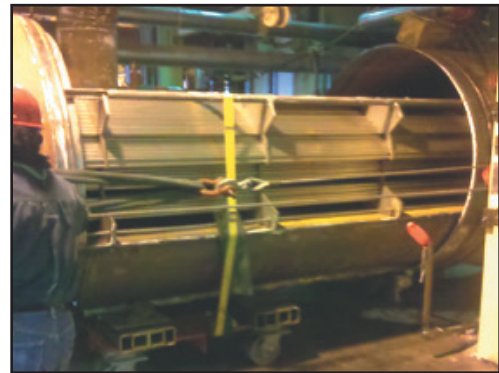
Up-front project planning consisted of three pre-outage visits to STPNOC for planning purposes with the site project management personnel. BHI's Project Manager arrived three weeks prior to project start. Supervisors, machinists and four welders arrived ten days prior to the project in order to cut off the shipping containers. The base crew arrived five days prior to the project start date.

## Project Challenges Resolved

BHI selected welder qualifications of the crew to assure that the appropriate level of experience and production mindset prevailed. BHI site management closely monitored work activities and resource controls, and provided detailed safety and pre-job briefings each and every shift change. All fit-ups went extremely well and no spool pieces for piping were required. No additional mitering of shells or piping was needed, and no welds were rejected during the inspection process, eliminating the need for rework and/or schedule delays.

The project was completed two days ahead of schedule from first system tag out until water tight return to operations, improving the schedule by four shifts. The project schedule worked 7 days per week, 2x12 hour shifts per day. A staggered break for the craft ensured continuous activity and non-stop production on the heaters.

STPNOC employs a stringent lessons-learned program whereby STP personnel and contractors provide lessons-learned feedback on each shift to be incorporated into a project database. By exercising a thorough review of previous outage lessons-learned intelligence, BHI was able to address all concerns.



Welding was completed using GTAW and semi-automatic FCAW (flux core).

## Customer Feedback

Before the project STPNOC management had concerns that such an aggressive schedule might not be feasible.

After the project STPNOC management was extremely satisfied with the safety record (no OSHA recordables injuries or minor first-aid cases). The schedule was reduced by 2 days due to preplanning and near flawless execution. As a result of the project success and the working relationship between BHI and STPNOC, BHI progressed to install six more feedwater heater tube bundles over the next two outages at STP Units I and II.

BHI presented an aggressive approach to the project with industry proven supervision, a highly experienced nuclear field team and an improved schedule. The commercial offer was attractive and in line with the existing customer budget. Schedule, safety and budget requirements were met and the project was considered a success.