



Turnkey Tube Cleaning and Liner Installation in Six Days!

A Gulf Coast refinery called Curran to support restoration of in-service air coolers, during a short maintenance pit stop.

When the timing of the replacement air coolers slipped, the refinery implemented its contingency plan. This plan called for the installation of C276 full-length tube liners to extend reliable operation of existing equipment.

A Scheduled Eight-day Mechanical Outage... more than 1,000 full length tube liners to install

The work scope was to synchronize the effort among the refinery, Curran International, and the NDE contractor. The group needed to meet an eight-day mechanical outage schedule. In those eight days, under the reliability engineers' direction, four exchanger bundles needed to be cleaned; NDE facilitated; and more than 1,000 full-length tube liners installed.

Curran Mobilizes

Curran mobilized the technicians and equipment required to support multiple crews around the clock. First, grit blast cleaning all existing carbon steel tubes for NDE. Following NDE, using the same manpower, C276 full length alloy liners were installed.

Based on the on the NDE exchanger-reports, the refinery planned to have Curran install the C276 full length liners on a where-needed basis.

C276 is a superior alloy that provides a corrosion-resistant barrier over carbon steel tubes. The "alloy upgrade" restores tube for continued service and barrier eliminates tube mechanical-plugging and sustains exchanger-duty.

Curran-cleaned tubes readily accept the nominally smaller C276 liners. These liners are installed through the header and down the length of the tube. Hydraulic pressure expands full-length tube to the ID of the repaired tube. There's an animation of installation at the Curran website, www.curranintl.com.

Curran Grit-Blasted Clean 100% of the Tubes

The refinery scope was to have Curran to grit-blast clean all the carbon steel tubes in four banks. Curran coordinated with the NDE

contractor to synchronize their work so the NDE could be completed shortly after Curran's tube cleaning. Curran's proprietary pitch and catch containment kept catwalks clean and unobstructed. This cleanliness gave the NDE contractor complete access to header and tubes immediately following Curran crews.

The Curran-cleaned tubes optimized timely NDE data collection.

The work of the two separate contractor teams flanged-up well to support the aggressive mechanical schedule.

The Work Proceeded Smoothly

The work was across four banks (A/B/C/D) located on the same deck, Curran completed tube cleaning. The NDE crew followed with tube RFT inspection. Timely assessment of NDE data for the "A" bank enabled Curran to seamlessly transition its scope to tube liner installation. Curran crews started installing C276 liners in "A" bank at the same time RFT crews continued data collection at C/D banks.

Using multiple sets of hydraulic expansion tools, the entire Curran crew expanded the C276 full length liners. The crew also cut tube and trimmed the internal liners to match the projection of the existing tubes- at tubesheets within the plug type header.

The grit blast cleaned tubes resulted in high integrity NDE assessments, giving refinery reliability specialists the confidence to reduce the tube liner installation repair scope to about half as many as had been originally scoped-out.

Turnkey Scope with a Single Point-of-Contact - Curran

The Curran turnkey scope, and NDE inspection, was completed in 6 days total.

By executing tube cleaning and liner installation as a turnkey scope, Curran is the single point of contact. This optimizes on-site resources.

To learn more, contact Ed Deely, edeely@curranintl.com, 281.339.9993.

New Coatings Reduce Fouling in Crude and Hydrocarbon Manufacturing.

Curran Advanced Antifouling & Anticorrosion Coatings and Applications

Now, thin film application of engineered hybrids and inorganic coatings can provide “release” at substrate to improve flow in hot, viscous services. These thin coatings, or surface treatments, reduce the surface tension of ferrous and alloy tubes.

These Thin Coatings Promote Antifouling:

- FCC slurry
- Vacuum bottoms
- Heavy gas and oil
- Feed effluent services



Curran’s portfolio of advanced materials includes, hybrid ceramic and Sol Gel hybrids, and water-based polymers that are functional at 5 to 45-microns coating thickness. This enables a value-added solution to solve fouling and reduce routine maintenance of critical heat exchangers.

Proven Anti-Fouling Results

Applications to exchanger tube IDs, ODs and plate and frame designs have been proven in client field trails.

- ✓ **Crude Antifouling** – promotes crude repellency to 400c; ambient or low temperature cure formulations.
- ✓ **Process Water Antifouling** – promotes process water repellency to 200C; can be used in high percent water services.
- ✓ **Furnace Tube Coatings** – provides a corrosion barrier to 1000C; crystallizes at substrate in service; ablative and ceramic formulations.

Using this portfolio of exchanger coatings and Curran’s application expertise combine to provide anti-fouling solutions for many services.

Contact Ed Curran ecurran@curranintl.com or 281.339.9993.

Catch Curran

Special Summertime Schedule

No tradeshow and conferences for a while

Instead!

- **Astros** – 24 home games in July and August, and Minute Maid Park is air conditioned!
- **Galveston beach** – water temp average 85F, 13 ½ hours of day light, daytime temp average 86.
- **Louisiana casinos** – Golden Nugget, L’Auberge, Coshatta... within 3 hours drive!
- **Santana and Doobie Brothers** – Cynthia Woods Mitchell Pavilion July 7
- **IFA Redfish Tour (Texas division) fishing** – August 12
- **Texans Preseason** – home game versus Detroit Lions August 17



Curran Helps Keep Fresh Water Flowing

Desalination/Power Plant Condenser Refurbishment

Client Needs to Keep Producing Power and Fresh Water

A dual-purpose plant on the Arabian Peninsula wanted to restore a corroded dump condenser to operational duty at a minimal cost and little operating schedule impact.

More Than 264,000,000 Gallons of Fresh Water a Day

This large facility, adjacent to the Red Sea, uses seawater cooling to condense spent steam that provides internal energy to desalination and power plant utilities that serve a large local community. It is among the largest dual-purpose plants in the world, producing more than one million cubic meters of fresh water a day. Three turbine units generate 1200 MW of electric power to the local market.

Using titanium tubes, the plant's Operations and Maintenance (O&M) contractor had completed retubing that upgraded two of the three on-site dump condensers.

Restoration of Large Diameter CuNi Tubes

The client also wanted to evaluate the propriety of restoring the third condenser as an option to replacing the CuNi tubes. The condenser bundle had 1900 tubes x 42mm tube diameter x 40' L. The tubes suffered under-deposit corrosion from seawater mineral scaling, pitting, and mechanical plugging.

These issues had already cost the plant about 10% of condenser operating duty.

Curran's Plan

Curran Field Operations presented coating solutions to protect the in-service tubes and mitigate new corrosion. By improving scale and foul release down-tube, the coating would also inhibit mineral deposits.

To restore plugged tubes in the bundle back to operation, Curran recommended full-length alloy liners, which would be hydraulically expanded in the out-of-service tubes.

Solving Situations

During a site visit, the O&M contractor pointed out that a 5' diameter circulating water pipe was flanged at the middle of the inlet and at outlet elliptical heads.

While the 8' diameter head could be removed, the fixed pipe created a possible obstruction to installing 40' long alloy liners. In a later meeting, the O&M contractor said, the client wanted to minimize the ancillary mechanical work and decided not to remove the heads - therefore scrapping the idea of tube liner installation to restore plugged tubes.

Proof of Curran Coating

The client sent several recovered tubes from an earlier bundle re-tube to Curran for a proof of-concept coating demonstration.

Curran prepped and, using a 2-coat system, coated the sample tubes.

- 1) The first coat was Curran 1000T. This proven coating was applied to "repair" tube pitting and mitigate new corrosion.
- 2) As the second coat, a water-based "release" polymer, which optimized hydrophobic performance in a 15 – 20-micron top coat, was added.

The 2-coat system produced an average thickness of about 75 microns total Dry Film Thickness.

The unit shutdown was scheduled early in 2019. The client's requirements allowed Curran time to transport equipment to Arabian Peninsula.

The Works Begins

Before the tubes could be coated, they needed to be dried of residual channel water. While drying the tubes, several tubes were found to have had severe mineral fouling and were plugged. These tubes required hydro-lancing.

Blasting and Prep

Once tubes were cleared and dried, Curran International grit-blasted the tubes' IDs to NACE 1 "white metal cleanliness." Borescope visual inspection verified this condition.

Using an ingenious device Curran crews devised, crews efficiently scavenged spent-grit from the elevated elliptical heads.

In final prep, spent-grit was blown-down from the tubesheets prior to coating.

Coating

One work-shift, a five-man crew was required to apply the 1000T coating to about the 1700 serviceable tubes in the bundle- about 13 miles.

The application method ensured tube pits were encapsulated in a single thin film - about 50 – 60 microns. The following day, a visual inspection of the ID application was performed.

Then, the inlet and outlet tubesheets were coated. Once the Curran 1000T set-up, a thin coat (approximately 15-20 microns) of a proprietary nanocomposite surface treatment was applied in the same manner as the Curran 1000T.

Inspection and Documentation

Utilizing a video probe on various tubes, the finished coating application down-tube was inspected. Images were recorded. Videos were provided for client records. Coating thickness readings were limited to a short length from tube ends, and the average of the all readings was 75.2 microns Dry Film Thickness.

Lastly, the O&M contractor, utilizing a pressure of 3.2 bar, performed a hydro on the shell-side. There, three tubes leaking that had to be permanently plugged, as well as an existing tube plug. The leaking plug was hammered until the leaking stopped.

Another Strong Finish

Months since the application the client has reported that the condenser is operating within specified thermal duty ranges.

The client noted the thin film coating has had little impact on heat transfer performance. The plant's tubes are enhanced, corrosion mitigated, and tube release properties improved.

To discuss this and other condenser restoration projects, **please contact Jason Kolman, jkolman@curranintl.com 281.339.9993.**

