COMPOSITE REPAIRS

Maintenance accounts for a considerable proportion of OPEX budgets. As fields mature and platforms age, maintenance demands increase, and when work must be carried out subsea, it becomes even more challenging and expensive.

Solutions that can reduce maintenance costs and avoid shutting down production down, are, therefore, particularly attractive.

Particular problems in the offshore environment are corrosion, erosion and impact damage to tubulars, typically pipes carrying a gas or liquid product. Historically, repair has meant either welding or bolting a patch or steel sleeve to the weakened area if the wall thickness will support it or replacing the entire pipe section. In both cases, it is unsafe to continue production while the repair is being made, which dramatically increases repair costs.

Since it was formed in 1987, Houston-based Clockspring|NRI has developed a wide range of composite based systems that can be applied to tubulars experiencing metal loss. Some of these protective coverings, particularly those above surface, can be applied as a carbon fibre cloth and/or a solid epoxy. The cloth is wound around the pipe, with each successive wrap increasing the pressure rating and resulting in a composite system often stronger than the steel. Composites have been formulated for a range of applications, including repairs underwater using a range of products that includes preformed fibreglass split sleeves that can be installed by a diver.

The SnapWrap split sleeve can be placed over the damaged area ofthe pipe and permanently affixed without the need for cutting or welding.

This multi-layered high-strength, corrosion-resistant sleeve is coated internally with a high- performance adhesive and filler material combination designed to bond with the mother pipe. For underwater repairs, a diver can swim to the subsea pipe, place the prepared light-weight sleeve on the pipeline and secure it until it is properly cured for a durable repair.. The diver can return to the surface for the next section and continue the process until the damaged pipe is completely restored.

This was the solution to a challenging repair undertaken by an Alaskan pipe operator that needed to address damage to 20 girth weld joints on a 10in (254mm) gas pipeline in Cook Inlet. The line needed to be repaired without disrupting service, but that was only one of many considerations that had to be taken into account in the operation.

Another was difficulties posed by the subsurface conditions. There was zero underwater visibility at the repair site 100ft (30.5m) below the surface, and in addition, there was very little clearance between the lines. The pipeline had a 2in (5cm) thick concrete coating, which, in some cases, left only 2in of clearance.

The project execution was timed for the summer months- specifically late May to early June- when the water temperature in the inlet would be approximately 43°F (6°C), the minimum application temperature threshold for the composite repair.

The work also had to be conducted during slack tides before the direction of the tidal stream reversed. Tides occur every six hours, so the diver had a bottom-time window of approximately 25 to 40 minutes for each installation period.

Most importantly, the owner needed a solution that would not require the pipeline to be moved, but would be able to deliver long-term performance at the maximum operating pressure of 2,785 psi (192 bar).

Being able to meet these criteria required a reliable product and a capable installation crew. To be sure the project could be performed safely, extensive diver training preceded the project kickoff.

COMPOSITES

Composites can be applied to a range of substrates, such as carbon and stainless steels and alloys as well as PVC and fibreglass. They can not only provide reinforcement and leak containment on straight runs of pipe but are effective on tees and elbows and can be applied in confined spaces and on irregular surfaces.

Although there still is a general lack of understanding about the value of this technology, composites have been used widely for structural repairs (decks), topsides, piping, subsea lines, flare lines, risers and caissons, and they have proven valuable during decommissioning.

When work began at the Cook Inlet installation site, the team discovered that glacial silt deposits entrained within the water meant that the diver had to continually clean the pipeline before each step of the installation process to ensure the adhesive functioned as required and properly secured the Snap Wrap to the damaged area of the pipeline.

To ensure pipe integrity, they found that each sleeve installation had to be completed during a single operation. This meant that the prep team on the barge and the diver had to coordinate their efforts to avoid ending a shift with partially installed sleeves, which would have to be retrieved and discarded.

As the first dives were carried out, it became apparent that placing the sleeves without help would be difficult for the diver. To simplify placement, the on-site team designed a frame specifically for this underwater installation.

Because the frame allowed the sleeve to be opened to the proper extent before the diver entered the water, it improved the diver’s ability to secure the pipe on the damaged pipeline and significantly improved the efficiency of each dive, cutting the application time in half.

The zero-visibility work environment posed another considerable challenge for the lone diver. Placing the composite solution with precision was vital to its effectiveness.

Because of the narrow work window and the zero visibility conditions at depth, some dives were scheduled to take place at night

To make sure each sleeve was in the correct location, the diver loosely preinstalled band clamps either side of the targeted repair area so it was easier to find the correct landing spot by touch to place the composite sleeves.

During the operation, the diver carried the Snap Wrap sleeve with the filler/adhesive from the barge to the pipeline and manoeuvred it into position, wiping the excess filler from the sides of sleeve and placing wrap ties around the finished repair to hold it firmly in place while it cured.

After moving the band clamps to the next repair area, the diver could return to the surface to pick up the next prepared sleeve and repeat the process, finding the right location for the next band by locating the pre-placed clamps

After the composite sleeves were installed, the diver applied a layer of Contour WA, an engineered, bi-axial stitched e-glass tape impregnated with a water-activated polyurethane resin, to the remainder of line for impact protection.

The composite solutions used on this project allowed all the damaged girth welds to be reinforced and restored the line to safe working order. The flexibility of the technology enabled the application process to be modified to expedite the installation, and the products delivered a durable repair.

The scope for application of composite technology is growing as more products are developed, providing alternatives to traditional repairs in a range of challenging environments.