

DEEPWATER

CATHODIC PROTECTION RETROFITS

Deepwater Corrosion Services has been designing and manufacturing innovative cathodic protection systems for offshore assets for 30 years; here are some brief descriptions of a number of projects we've undertaken. For more information and images for many of the following, please visit the experience overview at our website. At the very top of the webpage, click on: about / experience overview and choose a region.

OLYMPUS FIELD

Deepwater provided a cathodic protection (CP) system for the Olympus TLP's wellheads and permanent guide bases (PGBs) installed in approximately 3,000 feet of water in the Gulf of Mexico (24 total PGBs). Four large anode sleds (Retropod XL) were deployed around the perimeter of the well bay. To reduce the number of subsea lifts, each unit was designed to protect 6 subsea wells. Retroclamp was used to connect each sled to the proper 6 PGBs on the wells. This cathodic protection system, in conjunction with the existing PGB anodes, is designed to provide protection for 45 years. Each anode sled carries 12,000 lbs. of aluminum anodes, arrayed to provide 32 Amperes of CP current for the 45-year service life.



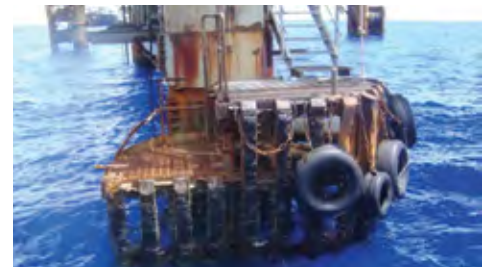
BLACK BAY

Deepwater retrofitted 69 shallow water wellhead platforms, gas lift manifolds and production platforms in Helix' Black Bay field. Due to the shallow average water depth (approximately 10 feet) and shoaling, a special retrofit system was needed. Deepwater's RetroLink suspended anode system was perfect for the job; the field's life was extended for 5 years without the need for underwater intervention. The installation for this field included a total of 115 RetroLinks and 89 continuity jumpers. To protect pipelines and risers, custom continuity jumpers were installed to create a blanket of CP coverage for the entire field.



BAHAMAS LOADING DOCK

Deepwater was commissioned by the Bahamas Oil Refining Company to replace an impressed current cathodic protection system which had been totally destroyed by a hurricane; the system had been protecting a loading dock, which was actually a crude-oil loading terminal comprising multiple isolated jacket and dolphin structures. The designers decided not to use another impressed current system, but to use sacrificial anode strings instead. The retrofit cathodic protection (CP) system consisted of RetroLink anode strings, each of which was 90 feet long. 154 RetroLink (Deep) sacrificial anode systems – each string rated 17 amperes – were used.



KITCHEN LIGHTS

As part of a lead-in project, Deepwater designed an Impressed Current Cathodic Protection (ICCP) system for the Kitchen Lights 3 platform. Due to the hydrographic conditions in Cook Inlet, previous methods for placement of the Mixed Metal Oxide (MMO) anodes could not be used. Deepwater developed a "cage" frame that wrapped around the undersea structural members of the platform. This RapAround held the MMO anode in close proximity to the platform as well as protecting it from the environment. The MMO anodes were energized by three transformer rectifiers located topside. Cable routing was through the center pile.



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DUNCAN WHARF

Deepwater Corrosion Services performed a cathodic protection retrofit for the Duncan Wharf, an aluminum loading berth in Port Alfred, Quebec, Canada. Assets to be protected included an H-pile pier (in semi-arctic conditions) and one sheet-pile bulkhead section. The retrofit cathodic protection (CP) system consisted of 40 x Raparound pile anodes (rated 50 Amperes each), 8 x RetroBuoys (ICCP buoys rated 200 Amperes each) and 2 x VSE anodes (self-burying ICCP anodes rated 50 Amperes each). The cathodic-protection design uses RetroBuoy systems to provide the bulk of the required current from a remote location (many meters away from the dock). The Raparound anodes protect the piles that are partially shielded from the throw of the buoys, and the VSE anodes protect the remaining section of the bulkhead.



NEPTUNE SPAR

Installed in 1997, Neptune is a classic spar located in the Gulf of Mexico (Viosca Knoll block 826), in approximately 1,930 feet of seawater. In August / September 2009, Deepwater Corrosion Services retrofitted the cathodic protection system on the Neptune Spar. The original cathodic protection system on the hull was approximately 300 sacrificial aluminum anodes. At the request of the operator, Deepwater designed, supplied and commissioned a 15-year life-extension impressed-current CP system (ICCP). The retrofit cathodic protection (CP) system consisted of 2 x custom 500 Amp RetroBuoys with shear keys, 2 x transformer rectifiers, 6,660 plus feet of dynamic 7-conductor 3/0 AWG subsea power cable and 2 x Polatrak DR 3 reference electrodes. The entire subsea system was installed in less than 72 hours.



EWING BANK

This Gulf of Mexico platform is a large 4-leg, 8-skirt pile fixed jacket located in 720 feet of seawater; Deepwater, working in conjunction with Deep Down Inc. and Oceaneering Inc., performed a cathodic-protection (CP) retrofit of the platform in two days. The retrofitted CP system consists of: 2 RetroBuoys (impressed current anode sleds), double-armored power cables (1,200 feet long) and 2 topside marine transformer-rectifiers rated at 450 amps. The RetroBuoys are designed to be deployed on the seabed 150 to 400 feet outboard of the base of the jacket; the double-armored power cables connect each RetroBuoy to a topside marine transformer-rectifier rated at 450 amps. Installation was completed in 19 hours.



GULF OF THAILAND

36 RetroPods were shipped in kit form and assembled dockside by local crews provided by CUEL. Both platforms sit in 200 feet of seawater, making this the deepest RetroPod installation yet. When divers checked CP readings after installation, the results confirmed that both structures are well-protected, including areas farthest from the RetroPods resting on the seabed. The minimum pre-retrofit CP reading at -20 feet was -0.950mV; post-retrofit, it was -0.985mV. The minimum pre-retrofit CP reading at -200 feet was -0.959mV; post-retrofit, it was -1.009mV. V-String zinc reference electrodes were attached, and the leads were run to monitoring devices mounted topside. The entire project was completed in 60 hours.



ARKLOW FIELD

Deepwater supplied and supervised the installation of seven (7) Vaulted Seawater Envelope (VSE) anode arrays on wind turbine monopiles in the Irish Sea. Each monopile was retrofitted with one VSE and one transformer rectifier. The wind farm is located in 8 m - 10 m water depth, so the VSE anode system minimizes the risk of snagging by fishing activities while maintaining a uniform circuit resistance when the system silts over. Assets to be protected included seven offshore wind turbines. The retrofit cathodic protection (CP) system consisted of: 7 x Vaulted Seawater Envelope anode systems (aka VSE) 7 x transformer rectifiers and 7 x DR-2 CD monitors (as part of the monitoring system).



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FORTIES FIELD, NORTH SEA

Deepwater EU (a subsidiary of Deepwater Corrosion Services) successfully designed, deployed and commissioned nine (9) impressed current cathodic protection (ICCP) systems to four (4) fixed platforms located in the Forties Field, North Sea, UK. The 35-year-old platforms are 110 miles (180 km) east-northeast of Aberdeen in about 120 meters of seawater. The owners required a life-extension solution for the CP system that added at least 20 additional years of service for the aging structures. The system included 9 RetroBuoy impressed current anode sleds rated at 450 Amps each, 9 hazardous-area-certified transformer rectifier skids, 9 hazardous-area-certified topside junction boxes and associated topside and subsea cables. Structure-to-seawater potentials were recorded before and after the system was energized.



LUFENG FIELD

Installed in 2005, the Lufeng (LF) 13-2 WHP is a fixed-production platform located in the South China Sea in approximately 430 ft. [132 m] of seawater. Several factors contributed to shortening the CP system's expected lifespan from 10 years to 5 years. Deepwater was contracted to design, supply and supervise the installation of an Impressed Current Cathodic Protection (ICCP) retrofit system. The supplied CP system consists of 2 RetroBuoy impressed current anode sleds, double-armored power cables (1,000 feet long), 2 topside marine transformer-rectifiers rated at 500 Amps, 36 RetroClamp HD cable grippers for subsea cable management, 2 permanently installed dual reference electrodes (DR-III) and a topside CP-monitoring panel.



RAS GHAREB, EGYPT

Deepwater Corrosion Services, in conjunction with Egyptian agent Los Amigos, retrofitted the cathodic-protection system of a fixed platform in the Red Sea in 14 meters of seawater approximately one kilometer off the coast of Egypt. The owner required another 20 years of service from the aging structure. After minor debris removal from the seabed, all 14 RetroPods and RetroClamps were installed and commissioned in 20 hours. Structure potentials were monitored using a diver-held CP probe as well as a topside-deployed DC-II drop cell (all silver/silver chloride). CP potentials prior to the retrofit were at or near the native state of steel, which is [-] 0.670 Volts [Ag/AgCl]; after retrofit, potentials ranged from [-]1.050 to [-]1.080 Volts.



BRENT PIPELINE

Deepwater supplied Retromats and Retroclamps to protect 12 km of pipeline for 15 years. In 2010, a cathodic protection survey showed that two sections at each end of this 148 km pipeline in the North Sea had "low structure potentials". In 2012, Deepwater installed CP retrofits on those sections, which were both at a depth of about 100 meters. The pipeline to be protected was 36" nominal pipe with a 7mm asphalt coating and a 2.25" thick concrete weight coat. To boost the cathodic protection, a total of 16 Retromats and Retroclamps were used in two groups of eight; these were placed within "hot spots" at either end of the pipeline, each 6 kilometers long.



CHEVRON PIPELINE

Deepwater was contracted by Chevron to provide CP retrofit materials for an 8" wet oil pipeline running from their fixed jacked platform to shore. A RetroClamp was installed on the pipeline, RetroLinks were attached and continuity was checked. The RetroLinks were jetted into the mud and the RetroClamp and RetroLinks were sandbagged to protect against trawling. A CP survey at the riser where the 8" pipeline leaves the platform showed the pre-retrofit CP reading on the pipeline was -0.818V vs silver / Silver Chloride (Ag/AgCl) electrode, and the CP readings after the RetroLinks were installed and buried was -0.998V vs silver / silver chloride (Ag/AgCl) electrode. This provided a negative potential shift of 180mV.



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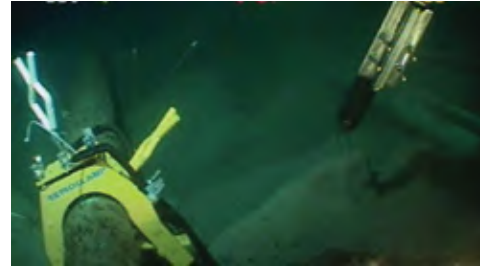
COOK INLET PIER

In 2004, Deepwater Corrosion Services, Inc. was commissioned to develop a pile anode for a pier in Cook Inlet, Alaska. The Raparound pile anode was developed and commissioned to address this uniquely harsh environment where the wharf freezes and thaws each winter, completely encasing the piles in ice. The retrofit cathodic protection (CP) system consisted of 36 Raparound Pile Anodes (rated 50 Amperes each). The photo was taken after the second winter in service (Feb 2006) and not a single failure or low cathodic protection potential reading was found.



ARNOLD / OYSTER FIELDS

Deepwater Corrosion Services performed anode retrofits on Marathon's "Arnold" and "Oyster" fields in the Gulf of Mexico. These two subsea development systems located in water depths ranging from 775 to 1,750 feet were retrofitted in just over 73 hours. Assets to be protected included: 4 flowlines (ranging in length from 3 to 9 miles each), 4 well trees, 2 flowline manifolds and 2 umbilical termination units. The CP system consisted of 19 RetroPods (aluminum sacrificial anode sleds) and various standard and customized RetroClamps for electrical attachment. The installation was accomplished using two ROVs to help set the RetroClamps onto each target member or pipeline. Electrical continuity and CP measurements were then taken.



EUGENE ISLAND

In July 2012, Deepwater was contracted by Phoenix to extend the life of the cathodic protection (CP) system on the Nexen-operated platform EI-295-AD using Deepwater's proprietary subsea RetroLink sacrificial anode system. The platform is located in 220 feet of seawater in the Gulf of Mexico near the Louisiana coast. 24 anode strings using 12 subsea clamps were successfully installed. Post-installation CP readings were taken by a Deepwater technician from the platform using a drop-cell (silver/silver-chloride reference electrode) and the minimum CP potential recorded was -10.904mV . This installation was completed in 60 hours.



SOUTH PASS

Deepwater Corrosion Services, Inc. recently retrofitted an eight-leg, fixed steel jacket in the Gulf of Mexico with two RetroBuoy impressed-current cathodic-protection (ICCP) sleds. Sitting in about 330 feet of seawater, the platform's CP life will be extended by 20 years. Each RetroBuoy system contains one RetroBuoy sled and one Transformer-Rectifier (TR) power unit, which is installed topside. A power cable connects the RetroBuoy and TR. Using saturation divers, the RetroBuoys were installed on the seabed about 175 feet south of the base of the jacket. Both RetroBuoys and cables were installed subsea in less than 30 hours.



CASCADE FIELD

During a July 2012 survey of Gulf of Mexico subsea equipment and pipelines, it was discovered that a crucial component of an umbilical control system was electrically isolated from cathodic protection. Deepwater was asked to design and manufacture a retrofitable electrical jumper system to connect the gateway to an adjacent structure (PLET), which would allow the umbilical component to "borrow" cathodic protection from the PLET's anodes. Within 2 weeks, Deepwater designed, manufactured and shipped a custom RetroClamp and cable system to accomplish this task. The umbilical's CP potential shifted from -631mV (unprotected) to -841mV (protected) versus Ag/AgCl reference electrode.

