Changing paths in Latin America

Ana Cervantes, Polyguard, USA, describes how some companies in Latin America are changing the way they approach rehabilitation and field joint coatings.

The initial reaction of most of the oil and gas industry in Latin America to the lower price market conditions was to delay the construction of important new pipeline projects. In the meantime, integrity management programmes (IMP) for existing pipeline infrastructure must be continued.

Corrosion control, typical failures

The basis of the corrosion control strategy for buried steel pipes is to prevent electrolytes from reaching the steel surface by installing a coating that acts not just as a physical barrier between the electrolyte and the steel surface, but is also capable of remaining bonded to the metal with high adhesion. Over time, a pipeline might experience the consequences of substandard conditions, so a cathodic protection (CP) system must be installed

to the pipeline to prevent a corrosion reaction from occurring. If the coating fails and the CP does not prevent a corrosion reaction, the pipeline will be in danger of experiencing stress corrosion cracking (SCC), consequently leading to loss of wall thickness.

At the time that the first pipelines in Latin America were buried, their protective coatings were expected to work in conjunction with the complementary CP system. In keeping with what has happening in other latitudes, the first pipelines for the oil and gas market in Latin America were coated with coal tar enamel, then polyethylene (PE) tapes became popular along with liquid epoxies, then heat shrinkable sleeves, fusion bonded epoxies (FBE) and three layer polypropylene/PE (3LPP/PE) were adopted. Those coatings remained in project specifications for many years, creating a sense of complacency within corrosion engineering teams, who perhaps failed to notice the possibilities of subsequent new coating developments. This created a closed loop that perpetuated the particular coatings' failure modes, so that the pipeline owners and/or the subcontracted pipeline managers got used to using the original coating over their joints and for rehabilitation. This happened for many years and the practice still remains in most areas of this region; in this manner the repetitive failure modes are deemed normal.

Figure 1. Installing RD-6 on a pipeline.

Figure 2. RD-6 applied in Peru.

Over time, the typical coating failures observed are:

- Mechanical failures at the overlap area caused from soil stress exerted on coatings combining soft bitumen or rubber adhesive and solid elongating PE/polyolefin backing. The transitions onto the plant coating in the case of shrinkable sleeves on the joints and the overlap between the wraps of the same cold applied tape at the 4 - 8 o'clock positions are usually the weakest areas.
- Blistering created from water-permeant epoxies.
- Cathodic disbonding: coating holidays caused by the loss of adhesion between the coated surface and the coating as a result of a cathodic reaction.
- Pitting corrosion caused by shielding coatings that prevent the CP current from reaching the steel surface from the electrolyte.

Introduction of a non-shielding coating

The introduction of the Polyguard RD-6 non-shielding coating system to oil and gas projects in Latin America more than a decade ago has provided the market with an option to prevent typical coating failures, just as has been done in similar cases documented in the US since 1988.

The unique combination of the RD-6 system properties such as non-shielding of the CP currents, high adhesion (higher than similar field coatings), resistance to disbonding, resistance to soil stress, easy installation and being an environmental friendly coating has secured the attention of customers in Latin America – in countries all the way from Mexico down to Chile – who are willing to upgrade their current specifications and take advantage of this proven technology. Those customers have successfully specified Polyguard for new pipelines, field joints coating and/or rehabilitation work, most of them moving from the obsolete heat shrinkable sleeves, PE tapes and liquid epoxies to the mesh backed, non-shielding RD-6 coating. Colombia has installed over 100 km of the product, followed by Peru with 75 km and Chile with 25 km, among others.

Acknowledging the CP shielding effect

It is important to note that the way protective coatings degrade over time is critical to maintaining the integrity of a pipeline and can determine if the coating contributes to the CP shielding effect. Unfortunately there is currently no survey or measurement device capable of detecting CP shielding, but shielding is a well documented concept and has been discussed in many technical forums, resulting in the following federal US regulations:

- 49 CFR 192.461 & 195.551: "Coating materials must have properties which are compatible with any supplemental cathodic protection."
- 49 CFR 192.112 (2008): "Any gas line increase MAOP from 72 - 80% must have a non-shielding coating."

The first regulations in Latin America referencing the problem of shielding coatings are the 'Decreto Supremo 081- 2007- EM' (Reglamento de Transporte de Hidrocaburos por Ductos derogado) in Peru and the 'Proyecto de Norma Oficial Mexicana: NOM-007-SECRE-2015' developed in Mexico, currently under evaluation.

- Supreme decree 081-2007-EM, Article 54th: "The coatings used for anti-corrosion protection of pipelines must be compatible with the cathodic protection system; they must have a high resistance to cathodic disbonding and must not create shields (shielding)."
- NOM-007-SCRE-2015.
  - 2.4 Shielding: "An electric armor phenomenon resulting from the effect of a material with electrical insulation characteristics; it prevents or deviates cathodic protection energy from reaching the structure to be protected."
  - 7.57.2 Corrosion control of pipelines: "Field applied anticorrosion coating ... when it is necessary to carry out the application of the coating in the field, including repairs, it must be carried out according to the corresponding procedure, using a material of the same characteristics or compatible with the coating of the system, as well as with the existing cathodic protection system, in order to minimise the presence of shielding."
  - Appendix III, 2.4.1: "The pipeline shall be protected against external corrosion by means of a coating which prevents shielding."

The American CFR references to shielding and guidance on avoiding shielding have also been adapted outside Latin America, for example by the Taiwanese regulatory authorities. Additionally, NACE currently has a Task Group (NACE TG 523) that is creating a document to better define the problem of cathodic shielding.

Effectiveness of the pipeline coating

Large oil and gas transportation companies in Latin America perform periodic approval processes; they are typically carried out every 5 - 8 years and they form an important part of integrity management programmes.

Coating manufacturers participate in customer-specific evaluation, not just to assess the essential coating properties such as adhesion to substrate, cathodic disbonding etc., but also to evaluate the overall effectiveness of the coatings applied. The evaluation includes coating productivity, environmental impact (pollution) and recertification of coated samples at an external designated lab. As a result of this exercise, companies are able to identify the best coating options for each different application and their coating supplier list is updated accordingly.

For instance, the coating approval process for buried pipes and for submerged pipes in certain countries in Latin America – where the weather conditions can change within a couple of hours – might be a real challenge to those coatings that require narrow application windows, deep surface profile preparation, special surface conditioning, specific long curing times or a wait of several hours for adhesion field testing. These factors may result in delays of the backfilling process in a real world application.

Polyguard RD-6 coating system is one of the best options for buried pipelines and submerged pipelines, as well for field joints and rehabilitation. The RD-6 coating system is listed as such on the qualified approved coating list of the largest gas companies in Latin America.