

## Lemonthyme Power Station Penstock Internal Corrosion Coating Replacement

Lemonthyme Power Station is a 51MW power station located on the Mersey River in the central north west of Tasmania.

Commissioned in 1969, the station is supplied with water from Parangana Dam. The storage is fed from the discharge of Rowallan and Fisher Power Stations and subsequently then flows on to Cethana, Devil's Gate and Palooa Power Stations. Water flow to the station is via a 6.5 km long tunnel and a 1.6 km long surface penstock with a diameter varying between 2.9m and 3.81m.

The station contributes approximately three per cent of Hydro Tasmania's annual revenue. The station is placed within the Mersey Forth chain of stations that then contributes a further eight per cent of revenue to the business (Refer Figure 1). The passage of water through the station, as opposed to by-passing the generator, is a key component of delivering maximum revenue from run of river systems that do not have large storage reservoirs.

An inspection in 2002 identified the beginning of corrosion issues. The coating was failing and warranted replacement at the earliest planning opportunity. A more detailed inspection inside the Lemonthyme Penstock was conducted in February 2005. This was limited to the flatter

areas of the penstock as the interior was very slippery and the steeper sections (45°) were too dangerous to inspect. The inspection of these areas revealed random areas of pitted corrosion with some of the pitting having caused up to 4mm of steel loss.

Analysis of the potential failure mechanisms of the penstock indicated that further loss of thickness of the steel could result in failure of the penstock as a result of negative pressures that might occur during water hammer effects resulting from a station trip and sudden stop to the flow of water. It was therefore determined that removal of the existing internal coating and replacement with a new corrosion protection system was necessary to sustain the asset for the future.

An added benefit of a new coating system was an expected efficiency gain in delivery of water to the station due to reduced friction losses from the coating system.

The existing coating was made up of coal tar enamel and epoxy measuring over 6mm in thickness in some areas. Ultra high pressure water-blasting was specified as the preferred methodology for removal, mainly because of OH&S issues related to removal of these materials using more traditional grit blasting methods. Environmental

and quality considerations contributed to this decision.

An outage of the Lemonthyme Power Station was approved between January and April 2008 with the works estimated to take 12 weeks.

In late 2007 the tender for the works was awarded to Lothway TBS Pty Ltd. Tenders were assessed on the basis of proposed methodology, safety, environment and proposed timeframes. Lothway TBS offered an innovative proposal that met all safety, environmental and quality requirements whilst providing value for money and a timeframe of only eight weeks.

Throughout the project, SICC Services provided technical advice and inspection services as well as 24/7 supervision of the works on behalf of, and in conjunction with, Hydro Tasmania.

Removal of the existing coal tar enamel and epoxy system was carried out with the use of Ultra High Water Pressure (UHWP) robotics. Removal in such a manner resulted in the need to treat both solid and liquid waste. Coarse solids were removed directly from the penstock. Liquids were pumped to a purpose-made settling pond to remove additional solids, then treated in a purpose-built onsite treatment plant, before emptying the treated water in to storage tanks.



Examples of some of the more severe rust nodules created by failure of the corrosion system



On-site treatment plant



Completed section of penstock with butterfly valve in background

The final treated product was tested for "cleanliness" before discharging in to the local river system. The treatment plant was designed to remove Aromatic Hydrocarbons, Chlorobenzene, Polychlorinated Biphenyls and similar contaminants. The treatment plant proved so successful the treated water was "cleaner" than the water in the existing stream.

No treatment facilities existed within Tasmania to deal with the solid waste from this project. Lothway TBS subcontracted Tox Free Solutions Limited to address this issue and the waste was transported to Wedgefield, Port Hedland, Western Australia, for incineration.

As soon as existing coatings were completely removed from discreet sections of the penstock, dehumidification was put in place and a final whip blast carried out.

The new coating system was immediately applied. This consisted of a primer coat and one coat of Interline 975<sup>®</sup> from International<sup>®</sup> Protective Coatings with a total dry film thickness (dft) of 500 microns. Application was predominantly carried out by robotics providing consistent coating thickness and minimal OH&S issues.

The work was completed two days ahead of schedule and over four weeks ahead of Hydro Tasmania's original estimate.

Other challenges faced during this project were:

- Lothway TBS was able to offer a shortened timeframe by running shifts 24/7;
- The site is located approximately one hour from the nearest township, Sheffield. Lothway transported staff to and from the site using a bus in order to minimise the likelihood of accidents resulting from fatigue at the end of shifts;

■ The works included the blasting and painting of the spiral casing at the station. Works in this area had to fit within a two-week window whilst the turbine was removed from the station for refurbishment works. The exact window dates were not known until a week before and were dependent on critical path activities for other contractors in the station;

■ The penstock is in rugged Tasmanian bush and out of site of the public and tourists. This created issues for safety at the site and even issues with curious wildlife wanting to enter the penstock.

Although the prime aim of this work was to reinstate the corrosion protection for the penstock, it has been estimated that reduced head loss effects were achieved by the low friction co-efficient characteristic of Interline 975 corrosion protection system. This has resulted in an estimated benefit of \$0.25M per annum to Hydro Tasmania. Hydro Tasmania was very impressed with all aspects of the Lothway TBS work and International<sup>®</sup> Protective Coatings' support on this project. Nearly two years on there have been no issues identified with the works.



Settling ponds under construction



Upstream "flat" section of the penstock



Painting robot



Figure 1: Schematic showing Lemonthyme in the Mersey-Forth Power Scheme