Santa Rita Power Plant
Batangas Bay, The Philippines

May 1998

INTRODUCTION

Fossil fuel power plants require vast quantities of cooling water to get maximum efficiency from their steam turbines. For this reason large power plants are usually located close to the large rivers or the sea. In the case of Santa Rita the plant is located on the shores of Batangas Bay enabling the use of seawater for cooling and delivery of the power plant heating fuel by marine tanker.

The power plant size of 1000MW required twin inlet and outlet pipes of 2.5m diam. with GRP being chosen in preference to traditional materials such as concrete or steel which were allowed in the tender documents. GRP pipe is rapidly becoming the industry standard for power plant cooling water applications for the obvious reasons that dictated it's choice for Santa Rita:

1) The first and most obvious was the total corrosion resistance of GRP pipe particularly for handling seawater.

2) Its light weight was a decided advantage at Santa Rita where the pipe runs to the sea were through swampy lagoons and weak sub-soils. Heavier steel or concrete would have required extra provision to support the added weight. In most cases with GRP the net operating weight is less than the original ground weights.

3) Santa Rita is located in a high activity seismic zone and directly over fault lines. It was proven that GRP pipe being inherently flexible and strong in tension, required no further provision for earthquake serviceability.

4) The availability in lightweight lengths up to 12m enabled quick installation allowing the use of lightweight plant. An aspect that became very important in the flooded Santa Rita site.

5) Finally the cost of GRP was competitive.

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THE CHALLENGE

A prime requirement before work could start was Maskell's ISO9001 registration and a full evaluation by the Clients consultants and Seimen's Power Generation, the Project Managers, of the manufacturing facilities anddetailed design analysis. This gave Maskells two and a half months to complete the contract from a standing start. Two weeks to submit full Quality Assurance/Method Statements and detailed design to AWWA C950standards based on site geotechnical information. The remaing time after approval to manufacture, ready to uplift 2200 meters of 2.5m diam. pipe, complete with two 2.5m diam. 90deg. mitred duckfoot bends and numerous special fittings! The challenge was met.

Maskell's order for the pipe came late in the main contract and because it was so late there was not time to establish on site so the pipes were manufactured and shipped from the Auckland plant. This required the chartering of two exclusive vessels to go "door to door," with the first ship arriving to pick up it's cargo four weeks after the date of order and the final ship six weeks after that.

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Quality System

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SITE AND SEISMIC

New ground was broken in the analysis for seismic activity that is of interest to GRP pipe suppliers and users. The initial approach by the specifiers was to treat GRP the same as rigid pipe (concrete) and they originally specified a flexible coupling every 10m of pipe to turn a 'rigid' pipe into a flexible one. Maskells pointed out, as so many GRP pipe manufactures have done before, that GRP pipe is in itself flexible and multiple use of couplings was not necessary. This was not accepted until an incorrect seismic analysis using the above ground code, appeared to show that the pipes would separate at the couplings.

Maskell were asked to comment and with the help of one of the worlds leading seismological engineers, were able to demonstrate that not only was the initial evaluation inappropriate but also develop a completely new analytical tool for subterranean seismic design. Correct analysis demonstrated that the pipe was sufficiently flexible and strong to handle the most rigorous Zone 4 seismic loading whether butt strap jointed or installed with couplings.

As so often happens the installation bought it's own problems. An ingenious approach by the contractor was to incorporate the pipeline in the bed of the causeway to the wharf. This reduced the excavation considerably giving a much more efficient installation. It did however require stone support columns in some areas and this in turn opened up an unexpected aquifer that prevented full dewatering of the pipe trenches. Installation therefore had to take place in a semi-flooded trench which increased the difficulty considerably.

Maskell engineers worked with the contractor on site throughout the contract to help solve these and any other issues that arose to ensure a successful and economic installation. At the time of writing a stage II expansion was about to take place adding a further 500MW of power. This time a further 1000m of GRP pipe was specified.

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