

## **Mexican Power Plant Meeting Tough Wastewater Challenges**

### ***Micro Media Filtration, Ion Exchange Upgrade Performing Consistently***

*By Geoff Hong, Regional Sales Manager – Water and George Di Falco, Communications Coordinator, Eco-Tec Inc.*

Recovering water for boiler feed makeup can come with many challenges for power stations; however, the level of complexity involved with treatment is raised considerably when having to deal with municipal wastewater.

Boiler feedwater needs to be of very high – ‘ultrapure’ – quality for power stations, and thus requires a lot of treatment to avoid problems such as corrosion, scale and sludge, caustic embrittlement, and priming and foaming in boilers – all tremendously costly setbacks if allowed to take root.

Wastewater applies to a range of sources from municipal sewage to storm runoff, and may have characteristics of great variability. Typically, wastewater has high levels of dissolved solids, higher metals content than natural water sources, and potentially high levels of organic matter, both natural and manmade.



***Servicios Termoelectrica de Mexicali (STDM), a 600 MW gas-fired combined cycle, combustion turbine (CCCT) generating station in Mexicali, Mexico.***

Rather than engaging in the more common practice of treating water from natural sources to feed boilers, some power plants, such as Servicios Termoelectrica de Mexicali (STDM), must deal with the more precarious conditions of wastewater. Such plants demand purification systems of greater permanence and capacity.

STDM, in operation since 2002, is a 600 MW gas-fired combined cycle, combustion turbine (CCCT) generating station in Mexicali, Mexico. It takes in wastewater from municipal primary treatment lagoons/settling ponds, which it uses for both cooling and boiler feed makeup to produce steam. After its first three years of operation, the plant found that its electrodeionization (EDI) system was not consistently producing water of sufficient quality and quantity. The plant was experiencing operational difficulties as its reverse osmosis units fouled rapidly and required frequent cleanings. STDM needed a stronger, long-term solution and looked to manufacturing and design company Eco-Tec Inc., based in Pickering, Ontario, Canada. Eco-Tec, in business since 1970, has provided more than 1,500 systems in more than 54 countries used for the recovery, purification, and recycling of industrial water, gases, and chemicals. The company supplied STDM with a new system in 2006.



Today, after almost five years of continuous operation, the Eco-Tec water treatment system at STDM continues to exceed the quality and capacity requirements of the plant with minimal operator attention. The compact, low-waste producing equipment has also brought with it various environmental and economical benefits.

The updated system consists of the following main elements:

- Pretreatment using a single high-efficiency Spectrum Micro Media Filter™, which replaced four pre-existing sand filters.
- Upgrade capacity of pre-existing Reverse Osmosis with new membrane elements, valving, and instruments.
- Replacement of EDI system with a compressed short bed Recoflo™ Triflo demineralizer/polisher Ion Exchange unit in a 1 x 100% configuration.

What's of particular note is that the single train (1x100%) configuration reflects a high level of confidence in the system by STDM. Other conventional systems are typically built using two trains (2 x 100%) so that there is a redundant back up which will operate when the main system is regenerating. However, the current system's short regeneration times mean that the system is offline for only a few minutes during which time the level of the de-ionized (DI) water storage tank is drawn down only a small amount. Once the system is back online, it actually operates at a higher capacity to make up for the small amount of water used for regeneration and to refill the DI water storage tank.



***Eco-Tec's compressed short bed Recoflo™ Triflo demineralizer/polisher Ion Exchange unit in a 1 x 100% configuration, at a generating station in Mexicali, Mexico.***

### **Positive Experiences**

During Eco-Tec's latest visit to the plant in August 2011, STDM reported the water treatment system continues to provide very high purity boiler feed water, with final product water conductivity < 0.07 microsiemens/cm and < 5 ppb (parts per billion) of silica, using the tertiary treated city waste water. The single pass RO system provides permeate to feed the demineralizer unit at an average conductivity of 35 microsiemens/cm.

As a testament to the Spectrum Micro Media Filter's performance – meant to ensure trouble-free downstream operation of ion exchange and reverse osmosis units – the reverse osmosis system only requires cleaning three or four times per year.

The plant maintains a full charge of resins for the demineralizer unit in inventory, along with approximately half of a charge of filter media, but to date they have not had to replace either of the ion exchange resins, or any filter media.

Ing. Martin Juarez, Operacion y Mantenamiento, STDM, reports that they are very pleased with the water treatment system since it is fully automatic and requires very minimal operator attention. In fact, Ing. Juarez was very apologetic about the appearance of the Recoflo™ demineralizer unit, as it is covered in cobwebs and a thick layer of dust. He explained that since there is never a need to service the equipment that it tends to get neglected. "In fact, we sometimes forget that the system is there," Juarez says.



#### ***Installation of the Recoflo Triflo demineralizer***

The Eco-Tec system features a fully automated PLC control incorporating many self-diagnostic features. Operator attention is only required for brief system checks, and the systems are equipped with alarms to detect pump, valve, and other component failures. The short operating cycle of the system also allows for rapid troubleshooting.

As a result, the plant was able to install a communication line from the local control station at the water treatment building to the plant's main control room in order to have full monitoring and control capabilities there. They now have the capability of controlling the water treatment system in three locations; the on-skid control panels, the water treatment building control station, or the plant's central control room. However, the system's programming and operating conditions had to be password protected to prevent

any unauthorized changes. This resulted from an incident several years ago when a filter backwash condition was changed causing the loss of some media.

### **Environmental Limitations in Mind**

Compared to conventional systems, the Eco-Tec system in Mexicali functions with practicality and environmental limitations in mind. Ion exchange units are designed for the lowest consumption of acid and caustic possible. They consume approximately 50% less chemicals than deep-bed co-current ion exchange systems and substantially less than packed bed systems. And resin replacement costs are lower due to the unique design of the compressed resin bed as there is no loss from backwashing or breakage.



***Pretreatment using a single high-efficiency Spectrum Micro Media Filter™, which replaced four pre-existing sand filters.***

The large scale equipment also comes in a surprisingly small, more compact package that's completely skid mounted – requiring a much-appreciated smaller footprint and less maintenance costs for the plant. This smaller footprint is primarily thanks to a self-neutralized waste design which minimizes the need for additional equipment and the uniquely configured Recoflo ion-exchange units.



Recoflo resin beds are only 6 inches (15 cm) in depth, requiring only up to 15% of the resin volume required of conventional ion exchange systems. And the beds are at a state of compression at all times, with no freeboard. Furthermore, Recoflo uses Eco-Tec specified resin beads with a particle diameter that is one-fifth the size of resin used by conventional ion exchange systems. It also uses less than 15% of the total exchange capacity of the resin compared to conventional ion exchange processes that use resin to near exhaustion, resulting in the system's greater efficiency of operation.

The Spectrum Micro Media Filter™ is also an example of how Eco-Tec packed greater performance in a smaller, more eco-responsible package for the plant. The filter makes use of a lower layer of very fine, high-density micro-media with an effective size of less than 0.1 mm; whereas conventional dual media filters typically employ silica sand with an effective size of about 0.35 mm. Thanks to the finer media and higher service flow rates, the Spectrum filter comes with a significantly smaller vessel diameter.

In fact, STDM's previous two-train water-treatment system consisted of four pre-treatment sand filters, 4.6 feet (1.4 m) in diameter each and operating at a service flow rate of 6 gpm/ft<sup>2</sup> (15 m/hr). Eco-Tec's single Spectrum Micro Media Filter™, 5.5 feet (1.7 m) in diameter, replaced all four of the pre-existing filters, and has a design service flow rate of 15 gpm/ft<sup>2</sup> (37 m/hr).