

IGCC Wastewater (ZLD) System

Power Industry | Case Study

ELCOGAS, S.A.

Puertollano, Spain - ELCOGAS, S.A. was founded in 1992 for the sole purpose to build a 335 MW IGCC power plant using the best available technology.

Comprised of several major European electric providers, the company goals include the economic production of power through technical innovation and continuous research & development.



The Client's Needs

ELCOGAS, established in 1992 with the aim of building and operating a 335 MW Integrated Gasification Combined Cycle (IGCC) power plant as well as the commercialization of its technology.



Based on the PRENFLO™ gasification process, the plant uses a mixture of local coal (from ENCASUR) with a high-ash content and petroleum coke produced at a nearby REPSOL refinery as feedstock.

The goal of the plant is to use technical innovation to create a highly efficient, environmentally sustainable plant when compared to other thermal power generation. This is also true of the water treatment system, which would need updating to meet required compliance to increasingly strict local and state regulations.

The Solution

Veolia Water Technologies worked with ELCOGAS to implement a new, more effective water treatment system for the plant. Veolia developed a new thermal process based on similar applications which is ideal for treating gray water from the gasifier. It offers a reliable, robust solution to achieve the objectives of the plant for maximum water reuse, Zero Liquid Discharge (ZLD), and use of the best available technology.

The proprietary CoLD® Process, utilizing HPD® evaporation and crystallization technology, was developed to overcome challenging wastewaters such as IGCC gray water that may contain chloride, ammonia, organic acids, cyanides, sulfides, silica, and heavy metals including mercury and selenium. It provides a solution without the complications and costs of pretreatment and drying equipment to attain a ZLD facility.

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Process Description

The CoLD® Process requires no chemical or filtration pretreatment of the gray water prior to evaporation that adds cost and complexity to the process. The gray water is fed directly to an HPD® MVR evaporator in which the bulk of the concentration takes place. The vapors generated are sent to a vapor washing system in order to protect the vapor compressor from foaming events and carryover that are common with certain wastewater streams.

Concentrate from the evaporator is sent to the CoLD crystallizer where chlorides and other solids are removed from solution. What makes this process unique is that at the lower temperature in the CoLD crystallizer, the highly soluble solids will crystallize at relatively low temperatures. These solids are then sent to a filter press for disposal and the filtrate is recycled back to the crystallizer.

Volatile compounds (formic acid, ammonia, cyanide and hydrogen sulfide) which condense into the distillate produced from the evaporator and CoLD crystallizer are removed by an integrated stripping system. This allows the distillate quality to meet the recycled water specifications.

System Benefits

Use of the CoLD process at ELCOGAS provides a relatively simple and robust solution to treatment of a very difficult effluent stream. The basis of the process has been proven in many previous installations in the chemical processing industries.

When compared to conventional thermal processes, the CoLD Process offers lower capital costs and beneficial environmental performance:

- The elimination of pretreatment and drying equipment reduces CAPEX by 25%
- Lower energy consumption and chemical usage lowers carbon footprint impact by 13%
- Up to 10 times better downstream water footprint based on Water Impact Index analysis



The Results

The wastewater treatment system was delivered by Veolia on a turnkey basis to ELCOGAS that included civil works and erection. This includes all major process equipment, ancillary equipment, buildings, and general construction management.

The system has performed as designed and effectively treats the gasifier gray water to achieve a ZLD solution.

The key condensate quality data is shown below:

| Parameter | Specification (mg/l) | Actual (mg/l) |
|-----------|----------------------|---------------|
| Ammonia | <10.0 | <10.0 |
| Sulfide | 0.2 | <0.1 |
| Arsenic | 0.05 | <0.01 |
| Selenium | 0.001 | <0.0005 |
| Cyanide | 0.04 | 0.015 |
| Mercury | 0.02 | <0.01 |

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