



Sanitaire SBR ICEAS^R Process Cleans Complex Waste Stream

The DuPont Corporation operates a world-class chemicals and fibers manufacturing complex on the north coast of Spain. ICEAS^R Sequencing Batch Reactor (SBR) technology from ITT Industries' Sanitaire unit was selected to meet the challenging waste treatment needs for this growing site which has had environmental protection as a core objective and operating principle from its inception in 1991.

The Workings of the ICEAS Process

The ICEAS (Intermittent Cycle Extension Aeration System) process is a variant of a sequential batch reactor (SBR) system where the processes of biological oxidation, nitrification, denitrification, phosphorus removal and liquids/solids separation are achieved continuously in a single basin. What makes the ICEAS process different is a continuous inflow, as opposed to conventional SBR processes, even during the settle and decant phases of the operating cycle.

The Sanitaire ICEAS SBR process can be used at both municipal and industrial wastewater treatment plants including biological nutrient removal. The process is a fully automatic, simple to operate, time-based system that responds to flow and load variations and is easily expanded.

Asturias Home to Expanding Chemical Facility

Along the Northwest coast of Spain is the principality of Asturias. To the north of this region of over one million inhabitants lies the Bay of Biscay, where the seacoast joins it to the European Atlantic arc. When viewing the green and blue of the mountains and the sea and the wilderness forests, it is easy to see why Asturias is known locally as the "Natural Paradise".

In this natural paradise is a huge - and expanding - chemicals and fibers manufacturing complex operated by DuPont that has the protection of the environment at the top of its priorities. In 1991, DuPont began developing this manufacturing complex on a green-field site in a largely agricultural valley in Asturias. The nearly 350 hectare (850 acre) site is



Sanitaire's SBR wastewater treatment system is used to clean a very complex waste stream at a Dupont Corporation chemical facility in Northern Spain.

located was initially commissioned to produce Nomex^R fiber, with plans calling for multiple production units to be constructed over a period of years for other products.

Environmental Protection is Key to Plant Expansion

From the project's inception, environmental protection of the site, the surrounding rural community, and the receiving waters from the plant was of crucial importance for DuPont. In light of the diversity of the products planned for the site and the complexity of the waste stream, the wastewater treatment for this industrial complex was foreseen as being a significant challenge.

This was all the more so because of the stringent discharge requirements for protection of the downstream estuary.

The products manufactured currently at the DuPont site include Nomex^R fiber, tetrahydrafuran (THF an intermediate chemical used for the manufacture of products such as DuPont Lycra^R elastane), Sontara^R spunlaced products, a new range of agricultural chemical products, and lastly, Corian^R. All of these products have come on stream with plant expansions over the past decade.

After evaluating various biological treatment options, ITT Industries' Sanitaire division was chosen to provide the wastewater solution. Sanitaire's ICEAS^R variant of the sequencing batch reactor technology was determined to be the best suited for this developing, multi-project manufacturing complex. The SBR system was selected primarily due to its capabilities to be expanded in a modular fashion, its automated operation, as well as its process flexibility to handle relatively low but variable flows.

Wastewater Needs Expanded with Plant

The initial waste treatment project with a single SBR unit was completed and put into operation in 1993 when the first production unit came online. According to Roger Byrne, sales manager of ABJ (part of Sanitaire), "DuPont is very committed to being a good neighbor and went to great extremes to treat their waste at this facility".

Byrne continued, noting that, "This waste stream is very unusual in its complexity." With each expansion of the facility to produce new products, a series of bench and pilot-scale studies were conducted at DuPont and outside laboratories to determine the biodegradability of the various process waste streams to be treated in the SBR system as well to collect design data for sizing and equipment specifications. Byrne said that, "We worked with DuPont from a process standpoint. Their process people do a lot of testing and ask us for the solutions based on their models."

In describing the waste treatment facility, Byrne said, "It is an ICEAS process which has the capability of having a continuous flow SBR. The facility has the ABJ decanters and SANITAIRE diffusers. Some of these are installed in special circular tanks, so some of the particulars of the installation are somewhat different than a typical municipal waste treatment plant."

The SBR system has since been expanded twice. The first expansion in the mid-1990's involved the addition of a second, larger SBR to accommodate a significantly greater waste load from the next production unit, which manufactured THF.

The second expansion of the SBR system was completed in December 1999. This most recent expansion increased the treatment capacity of the plant by almost three-fold with the construction of two more SBR's. The current treatment capacity is now approximately 15,000 kg/day, which is 14 times that of the original system.

The expanded facility now has the capability to operate as a two-stage process with dual SBRs comprising each stage of treatment. Higher-strength wastes are "pre-treated" in the first stage at a relatively high food-to-mass ratio. Lower-strength wastes are combined with the first-stage effluent for final treatment in the second-stage SBR to comply with stringent effluent requirements.



With the expanded system, the concentrated process wastewater from the THF and Fungicides plants will flow to the 1st stage SBR's and then to the 2nd stage. The Nomex, Sontara and Corian wastewater will flow directly to the 2nd stage and be treated along with the 1st stage effluent. Byrnes notes that, "This site proves the flexibility of the ICEAS process and how it can adapt to various waste streams."

The first-stage SBR's have SANITAIRE fine-bubble diffusers (membrane type) while the second-stage SBR's have SANITAIRE coarse-bubble diffused aeration. Each SBR is equipped with an influent baffle, which forms a "pre-react" zone and allows continuous feeding throughout the cycle.

The treated effluent flows by gravity through a final monitoring flume where a 24-hour composite sample is taken for lab analysis. The SBR effluent then combines with the inorganic sewer flow in a final discharge basin from which the total cleaned and treated flow is pumped to the Ria Aviles.

How is the environment faring in Asturias? DuPont Senior Vice President Stacey Mobley recently said in a speech that, "At our plant site in northern Spain, the bird count before we constructed our plant was 27 species. When our plant was built, we reintroduced 52 native trees in the area surrounding our facility. Bird populations soared and the count (now) is 103 species."

That performance would lead the residents of Asturias, who treasure both their region's natural beauty and the jobs the plant brings to have something to chirp about.