

# Here comes BOD monitoring

*Melanie Brown looks at the use of a BOD monitor to measure run-off at Britain's airports*

Glycol is widely used as an antifreeze agent at airports. It is sprayed on aircraft and accumulates in run-off water resulting in a biochemical oxygen demand (BOD), which must meet discharge consents for the site. If airport storm water run-off can be monitored on-line, the first flush of contaminated water can be collected and isolated for discharge to sewer, while clean run-off water can be passed to receiving waters.

Six years ago, the British Airports Authority (BAA), which owns and runs Heathrow, Gatwick, Stansted, Southampton and three Scottish airports, purchased a UV persulphate TOC analyser to monitor BOD in airport runoff. Trials at Gatwick Airport found that this instrument had a high manpower requirement and that the results obtained did not correlate sufficiently well with the five-day laboratory BOD test. Subsequent trials with Envitech's trailer-mounted BIOX 1010 unit were successful and the instrument was installed at Gatwick in 1996.

The BIOX 1010 is an on-line analyser for continuous BOD measurement suitable for use in industrial and municipal wastewater treatment plants. Wastewater is continuously pumped through a sample bypass. A small stream from the bypass is diluted with oxygen-saturated water and then pumped into the bioreactor.

Microorganisms in the reactor grow inside small plastic cylinders to protect them from the mechanical abrasion caused by mixing. The respiration rate of the microbial population is automatically maintained at a constant level by a feedback loop that varies the dilution ratio. Increasing contamination of the wastewater increases the respiration rate, which in turn increases the dilution rate. If the contamination level decreases, so does the dilution rate.

The mixing ratio of wastewater and dilution water is used to calculate the BOD. BOD data are generated within three to 15 minutes with a detection limit of 5 mg/l. The instrument can be specified with one of three different concentration ranges between 20 and 100,000mg/l BOD. Data is presented in a six-hour graph, and up to 14 days historical data can be recalled and displayed graphically. The BIOX 1010 typically costs around £23,000.

## Minimal operational input

At Gatwick it is used to monitor the quality of run-off water as it leaves the collecting pond and to determine whether it can enter the local river or whether it must be discharged to the local sewage works for treatment. The unit requires minimum operator input and the instrument is maintained and serviced by Envitech. During an eight-month period in 1997, the BOD measured by the BIOX 1010 unit at Gatwick closely matched the five-day BOD laboratory analyses of the same samples.

East Midlands Airport also began monitoring run-off using a TOC analyser and similar problems of high maintenance cost and lack of a sufficiently close relationship to BOD were encountered. The BIOX 1010 was selected as a direct replacement for this instrument and two units were installed in 1998. Three further units were added in autumn 1999 to monitor run-off resulting from new runway and parcel processing facilities.

The instruments are being used in conjunction with flow diversion chambers to determine the appropriate route for the wastewater. A fully automatic and integrated system has been designed to control run-off from the whole site. Three BIOX units measure the incoming BOD. If it is less than 15 mg/l BOD, then it flows through a penstock into a "clean" pond. If it exceeds 15 mg/l, the clean penstock closes and a second one is opened allowing the water to pass into a "dirty" pond.

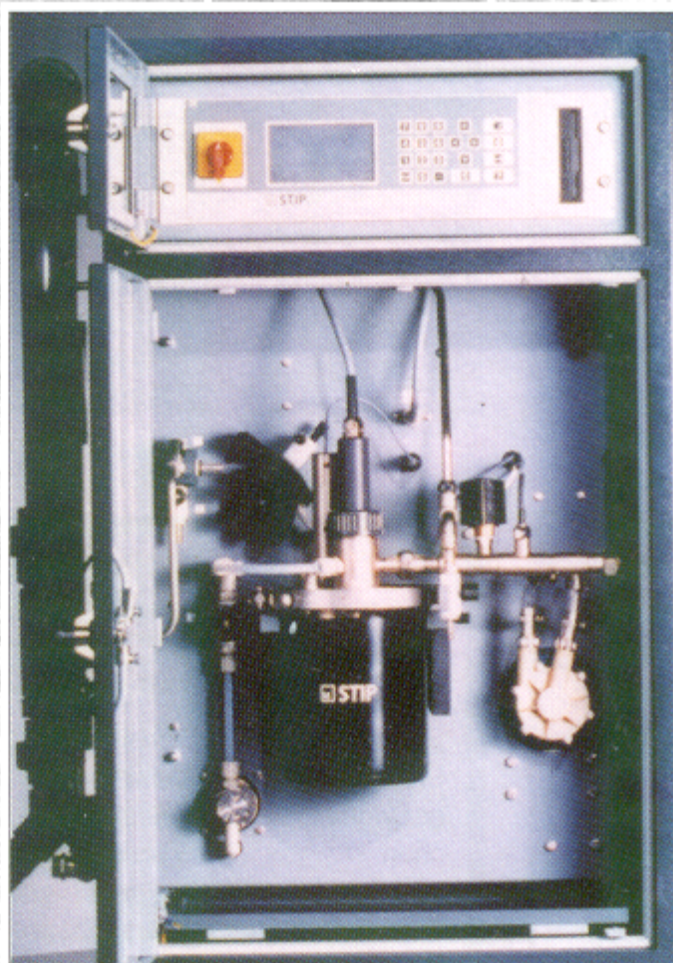
The clean ponds have a local discharge to a nearby watercourse and the contaminated water is passed to a final pond for disposal. This is not suitable for discharge to a local stream, but may be pumped to the River Trent in the winter season under a load-based consent. The licence is limited on an hourly basis and is adjusted depending on the flow in the river. A signal from the Environment Agency is transmitted into the Scada monitoring and control system, informing it of the level in the river and thus its notional permitted capacity to accept the flow.

## Reliability

Since commissioning, the BIOX instruments have been operational at East Midlands Airport for 98% of the time. At the end of 1998, the first BIOX 1010 was installed at Stansted Airport to directly control penstocks, which determine whether the flow goes to a clean or dirty discharge pond. Trials were carried out at Manchester Airport prior to purchase and installation of a BIOX unit in early 1999 to replace an existing TOC instrument, which was not providing adequate control. A second unit was installed at this site early in 2000. Subsequently BIOX units have been introduced at Birmingham International and Aberdeen airports. High maintenance costs of TOC systems combined with successful results from SEPA's (Scottish Environment Protection Agency) trial programme with BIOX secured the order for Aberdeen. In 2000, Heathrow Airport ordered eight BIOX units and discussions are currently underway with several other UK airports.

The advantages of relatively low maintenance and operational costs, good correlation to the five-day laboratory BOD test and the rapid response time of the BIOX 1010 have made it the front runner for monitoring airport run-off.

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Inside the BIOX 1010

**"A fully automatic and integrated system has been designed to control run-off from the whole site"**

