A Plane Solution

The recovery, re-use and sustainable treatment of glycol pollutants at airports

Every year millions of litres of de-icing chemicals are used at airports to anti-ice taxiways and runways and de-ice aircraft to ensure flight safety and to prevent disruption. Although the application of de-icers is critical for winter operations they are a major source of organic pollution in surface water runoff which can lead to adverse environmental impacts if it's released into a watercourse untreated.

Surface water run off from airports requires careful and responsible management to prevent catastrophic environmental pollution in our streams, rivers and lakes. With this in mind airport authorities must collect and prevent untreated runoff from entering a watercourse in order to remain compliant with key legislation including the European Water Framework Directive and the Environmental Permitting Regulations.

Manchester Airport is owned by the UKs largest airport operator Manchester Airport Group (MAG) and is situated on the southern edge of Manchester in the United Kingdom (UK). In 2013 some 20,000,000 passengers passed through the airport with approximately 159,000 aircraft departures taking place.

"During the 2012/13 de-icing season a staggering 1,349,719 litres of glycol based aircraft de-icing fluid (ADF) was used to de-ice a total of 4925 aircraft."

During this period the average daily application volumes amounted to 9575 litres per day which in waste water treatment terms is equivalent to the strength of wastewater generated by 56,492 people in a single day [3].

Mark Stewart of the MAG environment department commented that "at Manchester Airport we have invested significantly over recent years in in our pollution prevention strategy which included the purchase of several

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online water quality analysers. These allow us to closely monitor the water quality and adjust the drainage system accordingly to prevent detrimental environmental impacts resulting from the release of de-icing chemicals".

At MAG airports aircraft are currently de-iced on aircraft stands prior to taxing to the runway for take-off. On stand de-icing is typical of UK airports but as a consequence de-icers are dispersed over large areas. This results in contamination of huge volumes of surface water runoff which requires treatment prior to release back into the environment. At Manchester Airport contaminated water is discharged as trade effluent to the public sewer for off site treatment at an average cost of 0.052p/litre.

"This adds up to significant sums of money given that during the 2012/13 de-icing season an astounding 818,500,000 litres of de-icer contaminated water was discharged; enough to fill 327 Olympic sized swimming pools."

Graduate researcher Andy Freeman has been working as part of a research collaboration between Lancaster University, Peak Associates Environmental Consultants and Manchester Airport, where they have been exploring alternative sustainable and economic solutions to this age old problem.

In 2013 a field trial was built on site at Manchester Airport to test the treatment potential of de-icer contaminated surface water runoff in a real life application. Surface water from Manchester Airport was mixed with de-icing products used on site and dosed into the trial system. Samples were collected at different stages of the treatment process and analysed for a range of parameters in the airports on-site laboratory to identify the systems efficiency. Preliminary results proved very promising. For example >97.75% removal efficiency was observed when the system was dosed with a moderate pollution concentration. In addition different design characteristics were tested which could lead to further benefits in terms of reduced energy consumption and running costs when compared with alternative technologies.

Source reduction has been used successfully at a number of international airports to reduce the scale of surface water runoff contamination and subsequent disposal costs. This involves recovering highly concentrated spent ADF before it mixes with runoff and is washed into the drains. The glycol proportion can be recycled into a commercial product providing a revenue stream for the airport authority which can be initially used to offset the typically high capital costs associated with infrastructure and specialist recycling equipment.

Despite the apparent benefits which recovery and recycling offer, it has yet to be practiced in the UK. Airport infrastructure, operations and inconsistent de-icer applications resulting from the UKs unsettled climate are all major barriers for implementation.

Future Perspectives

There is a predicted surge in demand for air travel up to 2050 and airport authorities will be required to adapt and mitigate environmental impacts resulting from expansion. Following on from this research there is scope to develop an assessment protocol for monitoring the transport of pollutants across the airport landscape. The aim of this would be to assist airport operators, engineers, designers and consultants to identify and design robust and sustainable solutions, which have been scientifically future-proofed against climate change and airport development plans.

Specifically at MAG there is scope to assess the feasibility of recovery and recycling and whether this could be incorporated into a system which treats de-icer contaminated runoff onsite as part of a holistic de-icer management approach.

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