TOC Analysis at Airports

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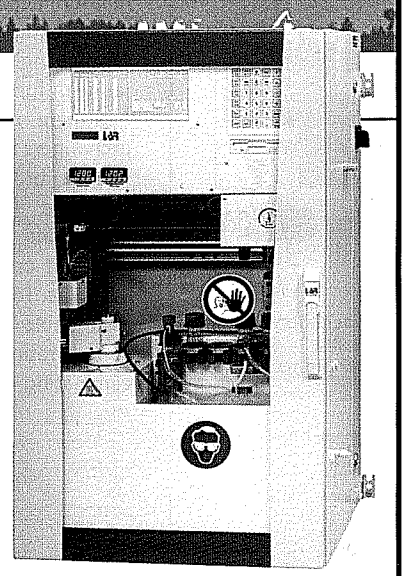


As other industrial devices airports have to control their run-off water for TOC and/or COD. The amount of waste water produced at airports is not negligible: The Frankfurt airport (one of the biggest airports in Europe) has produced 1.63 million cubic meters in 2006, the same amount as a medium-sized city. The sewer system of this airport consists of a 200km tubing system with a low quantity of monitoring and controlling stations. It goes without saying that TOC (or CSB) is an important parameter for controlling the water quality. The demands at airports on TOC measurements however are quite different to others like municipal waste water treatment plants. Main sources for the contamination of the sewage water are cleaning processes of the airplanes (1 airplane requires about. 5000L water) and deicing measurements. The latter one can be considered the main source for TOC in wintertime. In more than 80% of the time the run-off water of airports is rather low in TOC. Things are different however in wintertime. Airplanes need an excessive de-icing for safety reasons and most of the deicing agents will be discharged by the draining system of the airport. After a deicing procedure the TOC increases within minutes from the normal background (<100ppm) to more than 10,000mg/l. Water with high TOC concentrations airports usually store in separate basins for pretreatment measures before it is discharged into wastewater treatment plants. The fast change in the TOC load puts certain demands on the analytical technique. It goes without saying that lab analysis is far too slow to meet the demands of an airport concerning reaction time. But even online analysers may fail on this application. A common technique in online analysis is the continuous sample injection. This method levels the peaks which are produced by the deicing procedure. Furthermore continuous systems are much slower than discontinuous systems. On the first glance this seems a bit surprising, but it can be explained by the sampling system of continuous instruments. These instruments are dropping the sample continuously into the furnace. The furnace itself can take just a few drops per minute, otherwise the pressure built up by the water evaporation would do serious damage on valves, detector, etc. It is easy to understand that it takes some time to replace the sample in the feeding tube this way. In most of the analysers available at the market this takes about. 10-20 minutes, depending on the tube length and inner diameter. The effect on the treatment of the run-off water is twofold:

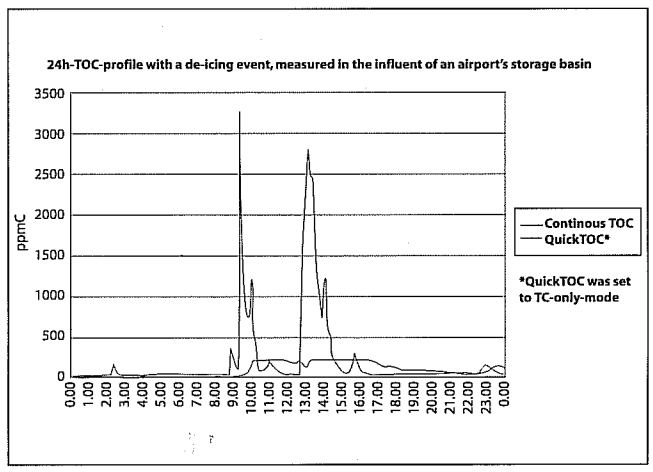
1. Water with a high TOC load is discharged into the sewage system, thus overloading and even inhibiting the local waste water treatment plant.
2. Water with low TOC concentration is stored in a separate basin for pretreatment. This requires a higher and therefore more expensive pretreatment capacity. Another difficulty in the application is the substances used for de-icing. Usually the deicing agents contain glycol and other sticky substances. When those samples are analysed in a system which involves tubes and valves the results will always be influenced by a huge memory effect because Glycol will stick in tubing's and valves, thus contaminating the following samples. The feeding system should therefore contain a direct injection method where the samples just get in contact with the injection needle.

Another requirement is the ability of the analyser to cover a broad concentration range. If no de-icing agents are used, the TOC concentration in the drain-off water is usually <100ppm. During the deicing period the TOC can increase within a couple of minutes to >50000ppm. The analytical device of course should be able to cover both concentration ranges. It was already mentioned that just a fast discontinuous system can meet the demands concerning analysis frequency. The QuickTOC by **LAR** (Germany) is working by direct injection of the sample into the combustion system. Since the sample does not get in contact with tubes or valves, the carryover is very close to 0. The combustion system itself does not need catalysts because of the high combustion temperature of 1200°C, therefore one of the main maintenance sources is eliminated. The type of the deicing agent does not influence the TOC result because of the high temperature combustion method. When a TOC sensor is used it needs to be calibrated when the composition of the deicing mixture is changing. This may happen quite frequently because for the deicing of the planes and deicing of the runways different chemicals are needed. As mentioned before, glycol, glycerin or acetates are used for plane deicing whereas the deicing of the rollways is done by urea.

The absorption coefficient of those substances is quite different; therefore the TOC determination by UV absorption measurement is questionable.

The big measuring range is covered by using different IR channels and different injection volumes. If a certain TOC concentration is exceeded the instrument switches automatically to a less sensitive IR channel and injects a smaller volume into the furnace. When the concentration is back at lower levels the settings will automatically be readjusted to their initial values.

High temperature combustion for TOC determination is preferable to UV oxidation techniques because especially in wintertime the salt concentration in discharge water may increase because of the use of salt for preventing the icing of pavements. It is a well-known fact that higher salt concentrations will give lower readings on TOC analysers which are based on UV oxidation.



A typical daily curve is shown in diagram. 1. A daily curve of a continuous system is also displayed. It is quite obvious that the continuous system has a delay of about. 15 minutes in recognizing peaks in the TOC concentration. The carryover of the discontinuous system is much less because the injection needle is rinsed carefully after each injection. The continuous system results are shown in diagram. 1, does not have an automatic channel switch, therefore the TOC peak is cut at 2000mg/l which is the maximum measuring range of the instrument. The discontinuous system on the other hand is able to cover this wide range by means of the automatic switch which was already mentioned. The system described above has shown its ability to fulfill the requirements of TOC monitoring at airports at various occasions, for instance at the airports of Nürnberg/Germany, Atlanta/USA and many more.