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CONTRIBUTION

From:	General Secretariat of the Council
To:	Working Party on the Environment
Subject:	Urban Wastewater Treatment Directive: Non-paper proposal

Delegations will find in the Annex a non paper from the DK delegation.

Dimensioning of Danish wastewater treatment plants

Danish practice - Nitrogen removal requirements at low temperature

The directive concerning urban wastewater treatment (91/271/EEC) sets requirements for tertiary treatment of discharge from urban wastewater treatment plants (UWWTP). The requirements for discharge of total nitrogen is measured as *annual means* as referred to in Annex I, paragraph D 4(c) of the directive. As stated in Annex I, paragraph D, table 2, footnote 3: “the requirements for nitrogen may be checked using *daily average*... In this case, the *daily average* must not exceed 20 mg/l of total nitrogen for all the samples when the temperature from the effluent in the biological reactor is superior or equal to 12 °C.”

In Denmark, concentration of total nitrogen in effluent from the UWWTP is measured using *annual means*. Consequently, the temperature limitation to the total nitrogen requirement, applicable only when using *daily average* measurements, is not applied in Denmark.

The Danish implementation of the directive or other Danish legislation does not contain any specific formulation regarding nitrogen removal during low temperature conditions. The total nitrogen requirement, established in Danish wastewater legislation, of <8 mg/l is applicable at all times and at all temperatures.

However, there are Danish cases, where the total nitrogen requirement can be waived during certain weather conditions in the winter. Dispensations like this must be included in the specific authorisation to discharge of treated wastewater granted to the individual UWWTP.

An example of a paragraph from the specific authorisation of a Danish WWTP:

“If the temperature in the reaction tank falls below 6 °C for a continuous period of 6 days or more, the requirement for total nitrogen is waived for a temporary period, which is agreed with the County”.

The temperature in the authorisation is coupled to the dimensioning of the WWTP as explained below.

Dimensioning of the WWTP

During the cold winter months, the nitrogen removal may be reduced due to reduced biological activity as a result of low temperature in the reaction tanks. The dimensioning of the WWTP is based on the load and temperature conditions during the coldest winter period. Danish scientific publications^{1, 2, 3, 4} suggest a dimensional practise with a temperature interval of 5-20 °C in the reactor tank based on studies of annual temperature fluctuations in the reactor tanks and the relationship between nitrogen removal rates, temperature and sludge age. It is common professional practice in Denmark to dimension and operate the WWTPs within this temperature interval, so the total nitrogen requirements are met throughout year.

¹ Spildevandsforskning fra Miljøstyrelsen, Nr. 3, 1990: Datagrundlag for dimensionering af renseanlæg, Arbejdsprincipper under Komiteen for Vandmiljøteknologi. Miljøministeriet, Miljøstyrelsen

² Jes la Cour Jansen, (1992). Spildevandsforskning fra Miljøstyrelsen, Nr. 44, 1992: Vinterdrift af renseanlæg med kvælstoffjernelse, Miljøministeriet, Miljøstyrelsen.

³ Vandkvalitetsinstituttet ATV, (1988). Temperaturforhold i danske renseanlæg, indledende undersøgelse.

⁴ Leif Winther, Mogens Henze, Jens Jørgensen Linde, Thorkild Jensen, (2009). Spildevandsteknik (4. ed.). Polyteknisk Forlag.

A new WWTP is often dimensioned based on the temperature of the coldest weeks measured during the previous 3-5 years. If data is not available, typical winter temperatures in Danish WWTPs can be found in the literature. Smaller WWTPs typical have a lower minimum temperature, e.g. 7 °C, while a larger plant have a minimum temperature of e.g. 9 °C. This temperature value is essential for the dimensioning of a new WWTP.
