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Project Ref:
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From:
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Date:
January 15, 2018

Memo

Subject: Supplement to NOA for Selkirk Wastewater Treatment Plant-Dated October 27, 2017

1. Total Ammonia and Un-ionized Ammonia Concentration in the Effluent

The toxicity of ammonia to aquatic life is mainly related to the un-ionized form of ammonia. The probability of having higher un-ionized ammonia formation increases as the ammonia concentration increases. Various parameters such as water body temperature and pH affects the conversion rate of ammonia to un-ionized ammonia. At higher pH and temperature the ratio of un-ionized ammonia to ionized ammonia increases. According to Manitoba Water Quality Standards, Objectives, and Guidelines (2011), for municipal wastewater effluent discharged to a water body, the total ammonia limits shall not exceed a site-specific limit. The new process at the City of Selkirk is a Modified University of Cape Town (MUCT) process. This process consists of anaerobic, anoxic and aerobic phases. To convert ammonia to nitrogen the microorganisms have to go through anoxic and aerobic phases to be able to function as intended. In this process, ammonia is converted to nitrite and eventually to nitrate by nitrifying bacteria during the aerobic phase. Nitrified mixed liquor is returned to the anoxic zone where the denitrifying bacteria reduce nitrate to nitrogen. The predicted ammonia concentration in the treated effluent using the BioWin simulator is shown in **Table 1**.

According to the data provided by Manitoba Sustainable Development (Contacted via email on January 3, 2018), the data from 2005 to 2017 shows an average temperature value of 5°C in winter and 20°C in summer and an average pH value of 8 in winter and 8.3 in summer. Based on the data provided, the concentration of the un-ionized ammonia in undiluted treated wastewater is calculated and is shown in **Table 1**.

Table 1: Anticipated Ammonia Discharge in Winter and Summer at Average and Maximum Loads

Loads	Flow (MLD)	Ammonia Concentration (mg/L)	Ammonia Nitrogen (as N), kg/any 24 Hour Period	Un-Ionized Ammonia (mg/L)
Summer				
Annual Average Load	4.6	0.1	0.5	0.004
Maximum Month Load	7.5	0.13	1	0.005
Winter				
Annual Average Load	4.6	0.65	3	0.016
Maximum Month Load	7.5	0.8	6	0.02

The un-ionized ammonia concentration in the effluent is regulated by the federal regulations. The Federal Wastewater Systems Effluent Regulations (WSER) limits are shown in **Table 2**.

Table 2: WSER Effluent Limits

Summary of Discharge Requirements	WSER (Average Monthly)
E. Coli	-
Un-ionized Ammonia	1.25 mg/L (Maximum concentration in a quarter)
Total Phosphorus	-
Total Suspended Solids	25 mg /L (Quarterly average)
Carbonaceous Biochemical Oxygen Demand (cBOD)	25 mg/L (Quarterly average)
Total Residual Chlorine	0.02 mg/L (Quarterly average)

According to the BioWin results provided in **Table 1**, the total ammonia concentration in the effluent is well below 1 mg/L and the maximum calculated un-ionized ammonia is approximately 0.020 mg/L which occurs during the maximum month load in winter and it is below the regulated effluent limit by WSER.

2. Plant Start-Up

During the wastewater treatment plant (WWTP) start-up, when the biological process is not fully functional, the secondary effluent from the new WWTP will flow through the existing WWTP to get a secondary treatment to meet the required effluent limits. Since the plant phosphorus removal is mostly carried out by chemical reactions and the effluent is passing through the membranes, the total suspended solids and total phosphorus concentration will be within the required limits. However, the biological oxygen demand (BOD) and ammonia removal is mostly depending on biological processes, the concentration of these two parameters might exceed the limits during the plant start-up. By directing the secondary effluent through the biological treatment in the existing plant the BOD and ammonia in the final effluent are most likely to be within the range.

After the plant start-up when the biological process is fully functional and in a steady condition, the existing plant will be bypassed and the treated effluent from the new WWTP will directly flow to the UV building via the bypass channel in the existing plant.

3. Overflow Routing

Emergency Overflow: The emergency overflow from the new plant headworks will bypass the UV and will flow by gravity to the manhole where the 750 mm pipe from the UV building is discharging. This overflow happens only when the whole plant fails and the equalization ponds are full. Thus, this event is very infrequent.

Mixed Liquor Overflow: Mixed liquor overflow from the membrane splitter chamber (the lowest point of the plant) will flow by gravity to the manhole where the existing plant emergency overflow is discharging. This overflow happens when all the permeate pumps fail. This will be a very rare occurrence and the equalization weir will automatically drop to divert flow to the equalization ponds. Moreover, flow to the treatment trains (secondary treatment units) can be manually closed by the operator using the isolation gates provided in the headworks.