CORRESPONDENCE / MEMORANDUM **State of Wisconsin**

DATE: **January 22nd, 2014** FILE REF: 265008790

TO: Timothy Thompson – District South – East

FROM: Jackie Fratrick – District South - East

SUBJECT: Water Quality-Based Effluent Limitations for Norway S.D. #1 (WI-0031470-7)

This is in response to your request for an evaluation of water quality-based effluent limitations for toxic substances using chs. NR 102, 105, 106, and 207 of the Wisconsin Administrative Code (where applicable), for the Town of Norway S.D. discharge to Waubeesee Lake Drainage Canal in Racine County (Illinois Fox River basin). The evaluation of the permit recommendations is discussed in more detail in the attached report.

Proposed Effluent Limitations for Norway S.D. #1	
Parameter	**Limitation**
BOD	10 mg/l, weekly and monthly averages
Total Suspended Solids	10 mg/l, weekly and monthly averages
Ammonia	See table below
Dissolved Oxygen	7.0 mg/l, daily minimum
pH	6.0-9.0 s.u.; daily range
Fecal Coliform	400/100 ml, monthly geometric mean
Total Phosphorus	0.075 mg/l, six month average; 0.225 mg/l, monthly average; an interim limit of 1.0 mg/l, monthly average, is also recommended.
Chlorides	Interim weekly average limit of 680 mg/l; 4X/monthly monitoring; see body of the report for more information
Mercury, Total Recoverable	Monitoring only; laboratory qualifications, analytical methods, and quality assurance requirements shall be in conformance with the requirements of NR 106.145.

Ammonia Effluent Limits (mg/l)	
Month(s)	**Limits**
May-September	3.6 mg/l, weekly average; 1.4 mg/l, monthly average
October	7.4 mg/l, weekly average; 3.0 mg/l, monthly average
November-March	24 mg/l, daily maximum; 11.4 mg/l, weekly average; 4.5 mg/l, monthly average
April	24 mg/l, daily maximum; 5.3 mg/l, weekly average; 2.1 mg/l, monthly average

Along with the chemical-specific recommendations mentioned above, acute whole effluent toxicity testing is recommended at Norway S.D. Accordingly, following the guidance provided in the Department's July, 2008 Whole Effluent Toxicity Program Guidance Document - Revision #8, one acute whole effluent toxicity test

battery per year (or five for the term of a five year permit) is recommended, in rotating quarters. Please consult the attached report regarding relevant monitoring conditions that relate to this discharge.

Thermal limits are addressed in a separate document.

Attachment

PREPARED BY:

Jackie Fratrick,
Effluent Limits Calculator

Cc: Diane Figiel – WY/3

Water Quality-Based Effluent Limitations for
Norway S.D. #1 (WI-0031470-07)
Prepared by:
Jackie Fratrick, SE Region
January, 2014

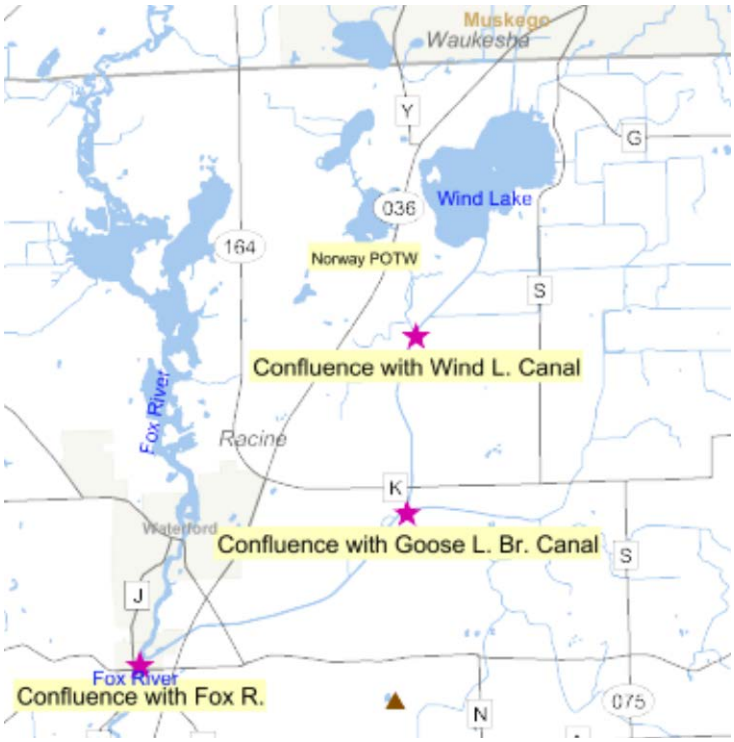
Existing Permit Limitations (WPDES Permit # WI-0031470-6, effective January 1st, 2002, and expired December 31st, 2006):

Current Effluent Limitations for Norway S.D. #1	
Parameter	**Limitation**
BOD	5 mg/l (May-October); 10 mg/l, weekly and monthly averages (November-April). **SEE NOTE BELOW**
Total Suspended Solids	10 mg/l, weekly and monthly averages
Ammonia	0.7 mg/l, weekly average (May-October); 4.1 mg/l, weekly average (November-April). **SEE NOTE BELOW**
Dissolved Oxygen	7.0 mg/l, daily minimum
pH	6.0-9.0 s.u.; daily range
Fecal Coliform	400/100 ml, monthly geometric mean
Total Phosphorus	1.0 mg/l, monthly average.
Chlorides	Interim weekly average limit of 680 mg/l; 4X/monthly monitoring; see body of the report for more information

NOTE: Norway S.D> filed a notice of appeal on certain terms and conditions of Permit WI-0031470-06. Among the objections were the imposition of stringent BOD limitations (specifically limits less than 10 mg/l) and imposition of the noted ammonia limitations. Among other factors, the sanitary district questioned the legal basis for the ammonia limitations. These were the initial imposition of limits after a significant expansion to the wastewater facility.

Information for Permit Reissuance Evaluation:

Receiving Water Information
Name: Waubeesee Lake Drainage Canal, tributary to Wind Lake Drainage Canal, Southeastern Fox River Basin
Classification: Warm Water Sport Fishery, Non-Public Water Supply


Muskego
Waukesha
Y
G
Wind Lake
036
164
Norway POTW
S
Confluence with Wind L. Canal
Fox River
Racine
K
Waterford
Confluence with Goose L. Br. Canal
S
J
Fox River
Confluence with Fox R.
N
075

Flows: 7Q10 = <.01 cfs
7Q2 = <.01 cfs
30Q5 = <.01 cfs
Qave = <.01 cfs
Harmonic Mean = 2.06 cfs

Note: During critical flow conditions, the 7Q10 of the canal is 0 cfs. The flows for 7Q2, 30Q5, Qave, and harmonic mean may be higher, but the most restrictive limits for commonly detected pollutants are typically based on the chronic toxicity criteria (CTC) in NR 105, and CTC-based limits are determined using 7Q10 for stream flow.

Hardness = 321PPM (from geometric average of stream hardness data obtained from Norway WET tests, 1996 - 2001)

% of Flow used to calculate limits = 25%

Background metals results used in limit calculations:

Substance	Result
Cadmium	0.0056 ug/L
Copper	0.827 ug/L
Lead	0.317ug/L
Mercury	1.24 ng/l
Chromium	0.310 ug/L
Zinc	1.18 ug/l

Source: DNR Water Quality Rules Implementation Plan, Chapter 4, January, 1998, for the Sheboygan River at Dotyville (information from nearby basin, but due to the lack of dilution the background values have little impact on the calculated limits)

Effluent Information:
Reported Design Flow:
Annual average = 1.6 MGD
Peak daily = 5.7 MGD
Peak weekly = 3.5 MGD
Peak monthly = 2.4 MGD

Hardness = 426 PPM (geometric mean of data from application)

Acute dilution factor used = Not applicable

BOD: The BOD limitations in the current permit were subject to a notice of appeal by the permittee, and as such were held in abeyance. The proposed limitations are intended as a refinement which may address the concerns of the permittee.

The BOD limits in the current permit were based on the ’26 Pound Formula’ calculation. The allowable BOD to be discharged per day is based on a 2 mg/l drop in dissolved oxygen (D.O.) for every 26 lb of BOD per cubic feet per second (cfs) of stream flow at 7Q10. A typical background D.O. level for Wisconsin waters is 7 mg/l, so a 2 mg/l decrease is allowed while still enabling the stream to meet the 5 mg/l D.O. standard as specified in NR 102.04(4)(a).

Formula:
Allowable BOD = [2.4 x DOchange x (7Q10+Qe)x 0.967(Tstream-24)]/Qe
Where: Qe = 1.6 MGD (2.47 cfs)
7Q10 = 0 cfs
DOchange = 7 mg/l - 5 mg/l = 2 mg/l
And Tstream = 25 (C (summer) and 3(C (winter)

Calculations (using an effluent DO of 7.0 mg/l):

$$\text{BOD (summer)} = \frac{2.4 \times 2 \times (0 + 2.47) \times 0.967(25-24)}{2.47} = 4.6 \text{ mg/l}$$

$$\text{BOD (winter)} = \frac{2.4 \times 2 \times (0 + 2.47) \times 0.967(3-24)}{2.47} = 9.7 \text{ mg/l}$$

A current calculation of BOD limits would use a stream temperature of 21 degrees C, which would result in a slightly higher BOD for May-October (5.3 mg/l).

Norway Sanitary District filed a notice of appeal, objecting to the more stringent BOD limits for the months of May through October. During the course of discussions with DNR staff, Norway agreed to perform a time-of-travel study of the effluent, to determine whether additional downstream dilution could be considered in establishing summer BOD limits greater than 5 mg/l. Since BOD acts as a pollutant in reducing dissolved oxygen from a stream, and since BOD_5 (or the amount of oxygen depletion over the course of five days) is used for regulatory purposes, the premise was that sa significant portion of the five day oxygen might be occurring downstream of the Waubeesee Lake Drainage Canal, where more dilutionary flow is available.

The time of travel study, submitted by Norway in 2007, concluded that the flow from the outfall reached the confluence of the Waubeesee Lake Canal with the Wind Lake Canal in around 6.2 hours. At the time of the study, there was no upstream flow from the outfall, which suggests that this travel time represents a minimum travel time (time of travel would likely be less if an upstream flow had existed at the time). At a time of travel of 6.2 hours, a BOD decay rate (Metcalf & Eddy, 3rd Ed.) would indicate an oxygen demand of slightly less than 1 mg/l.

There is no formal stream flow data for the Wind Lake Canal at the confluence with the Waubeesee Lake Drainage Canal, but department staff estimated the flow to be about 1 to 2 cfs. In addition, there are additional flows entering the canal system at several points before discharging to the Fox (IL) River.

At a 7Q10 of 1 cfs for the Wind Lake Canal, a 26 lb calculation would result in a 'limit' of about 7.45 mg/l using the 26 lb/formula; at a stream flow of 2 cfs, the 'limit' would be about 9.6 mg/l. This does not take into account that the canal system includes other flow inputs.

Therefore, information indicates that the fast time of travel in the immediate receiving water, and potential dilution in downstream waters can be a consideration in establishing effluent BOD limits, and that a year-round limit of 10 mg/l is protective of the resource.

Note that this assessment does not apply to other pollutants, since some (like ammonia) exhibit toxicity, and others (like phosphorus) are relatively conservative pollutants.

Dissolved Oxygen: No change is proposed from the current limit of 7 mg/l, daily minimum. Effluent dissolved oxygen provides a source of oxygen that is used by oxygen demanding substances.

Ammonia-Nitrogen (NH3-N): The State of Wisconsin promulgated revised water quality standards for this substance effective March 1, 2004 which includes criteria based on both acute and chronic toxicity to aquatic life. Promulgated standards are in NR 105; procedures for establishing ammonia limitations are in NR 106. These rule changes were promulgated after Norway Sanitary District filed a notice of appeal that in part objected to the ammonia limitations in the current permit. In accordance with the acceptance of the notice of appeal, the ammonia limits were held in abeyance pending a resolution of the issues. Also, as the proposed limits for ammonia, below, represent an initial imposition of limits that were determined with changed criteria, no antidegradation review is needed.

Daily Maximum Limits based on Acute Toxicity Criteria (ATC): Daily maximum limitations are based on acute toxicity criteria, which are a function of the effluent pH and the receiving water classification. The acute toxicity criterion (ATC) for ammonia is calculated using the following equation.

$$\text{ATC in mg/L} = [A \div (1 + 10^{(7.204 - pH)})] + [B \div (1 + 10^{(pH - 7.204)})]$$

Where:

A = 0.411 and B = 58.4 for a Warmwater Sport fishery, and

pH (su) = that characteristic of the effluent.

The effluent pH data from January of 2009-September of 2013 was examined as part of this evaluation. A total of 11 sample results were reported from May 2007 to July 2008 (1236 results). The maximum reported value was 7.8 su (Standard pH Units). The mean plus 2.3 standard deviations, an estimate of the upper ninety ninth percentile for a normally distributed dataset, is 7.77 su. A value of 7.8 is believed to represent the maximum reasonably expected pH, and therefore most appropriate for determining daily maximum limitations for ammonia nitrogen. Substituting a value of 7.8 into the equation above yields an ATC = 12.14 and a computed daily maximum limit of 24.3 mg/L.

However, the precision and accuracy of the pH monitoring data have not been verified. In addition, it is conceivable that modifications to the treatment process could alter the effluent pH. And finally, the rules allow manipulation of the effluent pH in order to comply with daily maximum limits for ammonia nitrogen. Consequently, presented below is a table of daily maximum limitations corresponding to various effluent pH values. Use of this table is not necessarily recommended in the permit, but it is presented herein for informational purposes.

Daily Maximum Limits – WWSF

Effluent pH - su	NH_3-N Limit – mg/L	Effluent pH - su	NH_3-N Limit – mg/L
pH ≤ 7.5	No Limit	8.2 < pH ≤ 8.3	9.4
7.5 < pH ≤ 7.6	34*	8.3 < pH ≤ 8.4	7.8
7.6 < pH ≤ 7.7	29*	8.4 < pH ≤ 8.5	6.4
7.7 < pH ≤ 7.8	24*	8.5 < pH ≤ 8.6	5.3
7.8 < pH ≤ 7.9	20*	8.6 < pH ≤ 8.7	4.4
7.9 < pH ≤ 8.0	17	8.7 < pH ≤ 8.8	3.7
8.0 < pH ≤ 8.1	14	8.8 < pH ≤ 8.9	3.1
8.1 < pH ≤ 8.2	11	8.9 < pH ≤ 9.0	2.6

* During the months of May through October if the pH is less than or equal to 7.9 there is no daily maximum limit for NH_3-N for municipal WWTF's treating primarily domestic wastewater. Limits shown in the table above with an asterisk* apply from November through April only.

Weekly Average & Monthly Average Limits based on Chronic Toxicity Criteria (CTC):
Weekly average and monthly average limits for Ammonia Nitrogen are based on chronic toxicity criteria.

The 30-day chronic toxicity criterion (CTC) for ammonia in waters classified as a Warmwater sport fishery is calculated by the following equation.

$$CTC = E \times \{[0.0676 \div (1 + 10^{(7.688 - pH)})] + [2.912 \div (1 + 10^{(pH - 7.688)})]\} \times C$$

Where:

pH = the pH (su) of the <u>receiving water</u>,
E = 0.854,
C = the minimum of 2.85 or $1.45 \times 10^{(0.028 \times (25 - T))}$ – (Early Life Stages Present), or
C = $1.45 \times 10^{(0.028 \times (25 - T))}$ – (Early Life Stages Absent), and
T = the temperature (ºC) of the receiving water – (Early Life Stages Present), or
T = the maximum of the actual temperature (ºC) and 7 - (Early Life Stages Absent)

The 4-Day criterion is simply equal to the 30-Day criterion multiplied by 2.5. The 4-day criteria are used in a mass-balance equation with the 7-Q_{10} (4-Q_3, if available) to derive weekly average limitations. And the 30-day criteria are used with the 30-Q_5 (estimated as 85% of the 7-Q_2 if the 30-Q_5 is not available) to derive monthly average limitations. The stream flow value is further adjusted to temperature. 100% of the flow is used if the Temperature ≥ 16 ºC. Only 25% of the flow is used if the Temperature < 11 ºC. And 50% of the flow is used if the Temperature ≥ 11 ºC but < 16 ºC.

The rules provide a mechanism for less stringent weekly average and monthly average effluent limitations when early life stages (ELS) of critical organisms are absent from the receiving water. This applies only when the water temperature is less than 14.5 ºC, during the winter and spring months. Burbot, an early spawning species, are not believed to be present in the Des Plaines River. So "ELS Absent" criteria apply from October through March, and "ELS Present" criteria will apply from April through September.

Since minimal ambient data is available, the "default" basin assumed values are used for Temperature, pH and background ammonia concentrations. The default temperature data are consistent with the results given in NR 102 for small warm water streams. pH results are consistent with those found in non-impounder hard water streams. Since the stream flows used for the limit calculations are zero, background ammonia l3evels do not factor into the calculations, so zero is used.

		Spring	Summer	Fall	Winter
		April	May – Sept.	October	Nov. - March
Background Information:	7-Q_{10} (cfs)	0	0	0	0
	7-Q_2 (cfs)	0	0	0	0
	Ammonia (mg/L)	0.09	0.07	0.09	0.25
	Temperature (°C)	9	21	10	3
	pH (su)	8.09	8.08	8.06	7.9
	% of Flow used	25	100	25	25
	Reference Weekly Flow (cfs)	0	0	0	0
	Reference Monthly Flow (cfs)	0	0	0	0
Criteria mg/L:	4-Day Chronic				
	Early Life Stages Present	5.32	3.56	5.57	6.99
	Early Life Stages Absent	7.60	3.56	7.45	11.36
	30-Day Chronic				
	Early Life Stages Present	2.13	1.42	2.23	2.80
	Early Life Stages Absent	1.50	1.42	2.98	4.54
Effluent Limitations mg/L:	Weekly Average				
	Early Life Stages Present	5.32	3.56		
	Early Life Stages Absent			7.45	11.36
	Monthly Average				
	Early Life Stages Present	2.13	1.42		
	Early Life Stages Absent			2.98	4.54

Conclusions and Recommendations:
NR 106.33(2) specifies that, whenever ammonia limitations calculated for a sewage treatment works regulated under NR 210 and treating primarily domestic wastewater are greater than or equal to 20 mg/l for May through October, or 40 mg/l for November through April, effluent limitations may not be included for the applicable periods. Since the calculated daily maximum limit is 24 mg/l, these limits will not apply for the months of May through October.

In summary, after rounding, the following effluent limitations for Ammonia Nitrogen are calculated for Norway S.D. No mass limitations are recommended in accordance with s. NR 106.32(5).

Months Applicable	Daily Maximum	Weekly Average	Monthly Average
April	24	5.3	2.1
May – September	No Limit	3.6	1.4
October	No Limit	7.4	3.0
November – March	24	11.4	4.5

Phosphorus: Revisions to administrative rules regulating phosphorus took effect on December 1, 2010. These rule revisions include additions to ch . NR 102 (s. NR 102.05), which establish phosphorus standards for surface waters. Revisions to ch. NR 217 (s. NR 217, Subchapter III) establish procedures for determining water quality based effluent limits for phosphorus, based on the applicable standards in ch. NR 102.

Section NR 102.06(3)(a) specifically names reaches of rivers for which a phosphorus criterion of 0.1 mg/l applies. For other stream segments that are not specified in s. NR 102.06(3)(a), s. NR 102.06(3)(b) specifies a phosphorus criterion of 0.075 mg/l. The phosphorus criterion of 0.075 mg/l applies for the Des Plaines River.

The limit calculation formula is described in s. NR 217.13 (2)(a) for phosphorus water quality based effluent limitations (WQBELs):

Limitation = [(WQC)(Qs+(1-f)Qe) – (Qs-fQe)(Cs)]/Qe

Where:

WQC = 0.75 mg/l for the Waubeesee Lake Drainage Canal.
Qs = 100% of the 7Q2 of 0 cfs.
Cs = background concentration of phosphorus in the receiving water pursuant to s. NR 217.13(2)(d).
Qe = effluent flow rate of 0.0108 mgd
f = the fraction of effluent withdrawn from the receiving water = 0

Since there is essentially no flow in Waubeesee Lake Drainage Canal, a background phosphorus level is basically of no consequence in the determination of a phosphorus limit for Norway. It is noted, however, that most of the streams in Southeastern Wisconsin exceed the 0.075 mg/l standard. The Fox (IL) River, downstream of the Waubeesee and Wind Lake Drainage Canals, is also known to exceed the applicable phosphorus standard for the reaches up-and downstream of the confluence of the Waubeesee/Wind Lake Canal system.

Based on the fact that the data indicates that the Norway effluent flow constitutes the majority of the combined flow below the outfall, and nearby flowing waters exceeding the criteria, it is recommended that the water-quality based effluent limit be set equal to criterion (s. NR 217.13(7)). The recommended limitation is **0.075 mg/L as a six month average** and, due to s. NR 217.14(2), **0.0225 mg/L as a monthly average** is also applicable. A six month average should be averaged during the months of May – October and November – April.

Interim Limit

When a compliance schedule is needed in the permit to meet a WQBEL an interim limit is required per s. NR 217.17. The average phosphorus concentration from January of 2009 through 2013 is 0.44 mg/l, but this average does not account for variability that may occur within a reporting month. The maximum monthly average for phosphorus during this time was 0.94 mg/l (in September of 2009). Therefore, the recommended monthly average interim limit for phosphorus is 1.0 mg/l, which is the same as the current limit.

Multiple test results above levels of detection are available for mercury and chloride. The results are summarized below. Results for chloride are in the spreadsheet 'Norway Chloride 2014'.

Mercury Summary	
Date	**Hg (ng/l)**
4/16/2009	0.82
5/4/2009	2.06
5/19/2009	1.24
6/1/2009	0.69
6/24/2009	1.04
7/1/2009	1
8/4/2009	0.53
8/18/2009	0.8
9/1/2009	0.99
9/24/2009	0.38
10/1/2009	0.62
10/15/2009	1.02
1day P99	**2.28 ng/l**
4-day P99	**1.52 ng/l**
30-day P99	**1.12 ng/l**

Effluent Limit Summary

The effluent limit summaries will include only those substances which were detected. Concentrations are indicated in units of ug/L except for hardness (mg/l), chloride (mg/L) and mercury (ng/l). Since Norway S.D. uses ultraviolet disinfection, effluent limits for chlorine are not evaluated.

DAILY MAXIMUM LIMITATIONS BASED ON ACUTE TOXICITY CRITERIA (ug/L)							
SUBSTANCE	**REF. HARD. or pH**	**ATC**		**MAX. EFFL. LIMIT**	**1/5 OF EFFL. LIMIT**	**MEAN EFFL. CONC.**	**1-day P99**
Mercury		0.83		1.66			0.00236
Zinc	333	344.68		689.36	137.87	22	
Chloride (mg/l)		757		1514			841

* - The indicated hardness may differ from the effluent hardness because the effluent hardness exceeded the maximum range in ch. NR 105 over which the acute criteria are applicable. In that case, the maximum of the range is used to calculate the criterion.

WEEKLY AVERAGE LIMITATIONS BASED ON CHRONIC TOXICITY CRITERIA (ug/L)							
RECEIVING WATER FLOW =		**0**	**cfs**				
SUBSTANCE	**REF. HARD. or pH**	**CTC**	**MEAN BACK-GRD.**	**WEEKLY AVE. LIMIT**	**1/5 OF EFFL. LIMIT**	**MEAN EFFL. CONC.**	**4-day P99**
Mercury		0.44		0.44			0.00154
Zinc	333	344.68		344.68	68.94	22	
Chlorides (mg/l)		395		395			672

* - The indicated hardness may differ from the receiving water hardness because the receiving water hardness exceeded the maximum range in ch. NR 105 over which the chronic criteria are applicable. In that case, the maximum of the range is used to calculate the criterion.

MONTHLY AVERAGE LIMITATIONS BASED ON WILDLIFE CRITERIA							
RECEIVING WATER FLOW =		0	cfs				
SUBSTANCE		WC	MEAN BACK-GRD.	MO'LY AVE. LIMIT	1/5 OF EFFL. LIMIT	MEAN EFFL. CONC.	30-day P99
Mercury (ng/l)		1.3	>1.3*	1.3			1.13

*In instances where the background concentration of a pollutant exceeds the most restrictive criterion, a limit shall be set to that criterion.

MONTHLY AVERAGE LIMITATIONS BASED ON HUMAN THRESHOLD CRITERIA (ug/L)							
RECEIVING WATER FLOW =		0	cfs				
SUBSTANCE		HTC	MEAN BACK-GRD.	MO'LY AVE. LIMIT	1/5 OF EFFL. LIMIT	MEAN EFFL. CONC.	30-day P99
Mercury (ng/l)		1.5	>1.3*	1.3			1.13
Silver		28000		28000	5600	1	

*In instances where the background concentration of a pollutant exceeds the most restrictive criterion, a limit shall be set to that criterion.

MONTHLY AVERAGE LIMITS based on HUMAN CANCER CRITERIA: None of the substances with wildlife criteria were measured above a level of detection in Norway's effluent.

Permit Recommendations:

Chloride: the 1- day P99 value is below a limit for chloride, so no acute (daily maximum) limit is required. The 4-day P99 of data submitted by Norway (668 mg/l) is above the calculated weekly average limit of 395 mg/l, so a chronic (weekly average) limit is needed for the permit.

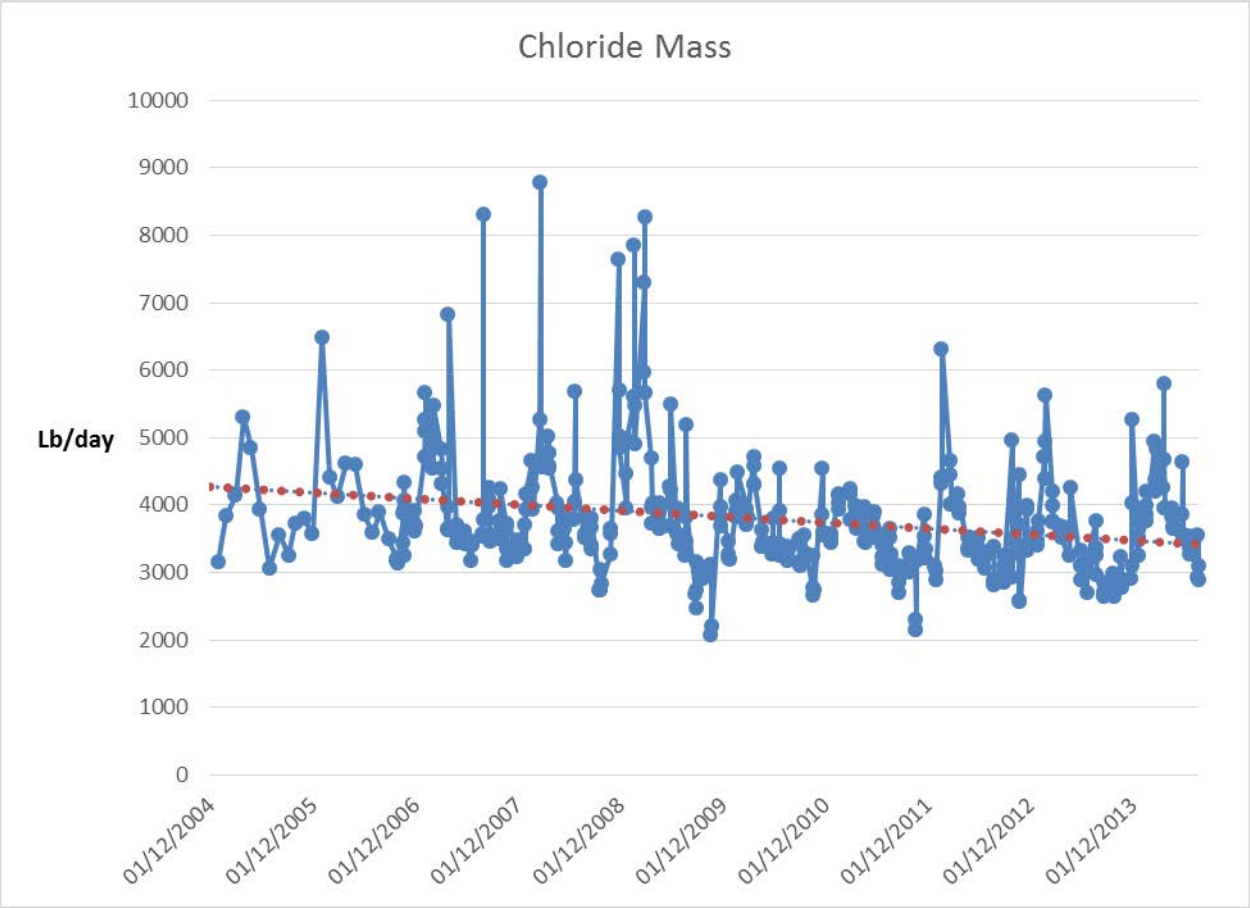
Chloride is regulated somewhat differently than other toxic substances, per the terms and conditions of NR 106, Subchapter IV. The Department recognized that chloride is difficult and expensive to treat at 'end of pipe', and that there is a wide range of potential contributors to a municipal wastewater plant, including individual home softening systems. Therefore, NR 106, Subchapter IV allows for a variance; the imposition of a less restrictive interim limit; a compliance schedule that stresses source reduction and public education; and allowance for a target value or limit to be a goal for reduction. The ultimate objective is that the permittee comply with the water quality-based effluent limit, but allows reduction activities to extend through more than one permit term if needed.

In the absence of a variance, Norway would be subject to the water quality-based effluent limit of 395 mg/l, weekly average; the weekly average mass limit of 5270 lb/day; and the alternative wet weather mass limit of 11,530 lb/day.

In the event that Norway has submitted an acceptable request for a chloride variance, the permit will include an interim limit, to be effective on the day of permit issuance; a compliance schedule for source reduction measures; and a target limit or target value. A target limit or value is applicable on the last day of the permit. Norway's current permit includes an interim limit of 680 mg/l, weekly average, and a compliance schedule for source reduction.

NR 106.82(9) defines a weekly average interim limitation as, 'the upper 99th percentile of the permittee's 4-day average of the representative data available to the Department' or 'a value no greater than 105% of the permittee's calculated highest weekly average of the representative effluent data'. The 4-day P99 of the data was 668 mg/l. Norway's current interim limit of 680 mg/l was determined from the 4-day P99 of data collected from 1997 through 2000, so the current P99 is somewhat lower than the current permit limit. 105% of the highest value of the current data base is 724 mg/l, which is greater than the current interim limit.

I recommend that the interim limit remain at 680 mg/l, weekly average. A monthly monitoring frequency is also recommended, effective upon permit issuance. Maintenance of an interim limit of 680 mg/l may suggest that no progress has neen made with previous source reduction measures; however, a review of mass levels for chloride indicate that there is a downward trend of mass in the effluent. See chart below. Also notable is that over the course of the past several years, the sanitary district took aggressive measures to reduce excess infiltration and inflow into the collection system. An incidental effect of these measures is that there is often less ‘clear water’ that would reduce the effluent chloride concentration. As a result, the effluent mass may be a better indicator of progress of source reduction. In addition to the overall trend, the baseline mass of chloride has also decreased.



Chloride Target Value: A target value or limit should represent a reasonable reduction during the term of the permit. A target value of 600 mg/l, weekly average, is recommended for the proposed permit. This level represents 62% of current weeklty average results.

Chloride Monitoring Recommendation: Monitoring of effluent four times per month, on consecutive days, is recommended. This will allow the monthly data to be averaged and directly compared to the interim limit and target value.

Mercury: The 30-day P99 is less than the most restrictive criterion of 1.3 ng/l, so no limit is recommended. Monitoring is recommended during the term of the permit.

Silver and Zinc: The single values are well below the levels of concern for all applicable criteria; therefore, no limits or additional monitoring are proposed.

Permit Recommendations for Whole Effluent Toxicity (WET) Testing/Limits: WET testing is used to measure, predict, and control the discharge of toxic materials that may be harmful to aquatic life. In WET tests, organisms are exposed to a series of effluent concentrations for a given time. Acute tests predict the concentration that causes lethality of aquatic organisms during a 48-96 hour exposure. Chronic tests predict the concentration that interferes with the growth or reproduction of test organisms during a seven day exposure.

Acute WET: In order to assure that the discharge from outfall 001 is not acutely toxic to organisms in the receiving water, WET tests must produce a statistically valid LC_{50} greater than 100% effluent.

Chronic WET: In order to assure that the discharge from outfall 001 is not chronically toxic to organisms in the receiving water, WET tests must produce a statistically valid IC_{25} greater than the instream waste concentration (IWC). The IWC is an estimate of the proportion of effluent to total volume of water (receiving water + effluent). The IWC of 100% was calculated according to the following equation:

$$\text{IWC (as \%)} = 100 \times \frac{Qe}{(1-f)\,Qe + Qs}$$

Qe = annual average flow = 1.6 MGD (2.47 cubic feet per second)
f = fraction of the Q_e withdrawn from the receiving water = 0
Q_s = 1/4 of the 7-Q_{10} = 0 cubic feet per second.

Dilution Series: According to the *State of Wisconsin Aquatic Life Toxicity Testing Methods Manual* (s. NR 219.04, Wis. Adm. Code), the default acute dilution series is: 6.25, 12.5, 25, 50, 100%, and the default chronic dilution series is 100, 75, 50, 25, 12.5% . Other dilution series may be chosen by the permittee or Department staff, but alternate dilution series must be specified in the WPDES permit. For guidance on selecting an alternate dilution series, see Chapter 2.11 of the WET Guidance Document.

Receiving water: According to the *State of Wisconsin Aquatic Life Toxicity Testing Methods Manual* (s. NR 219.04, Wis. Adm. Code) receiving water must be used as the dilution water and primary control in WET tests, unless the use of another dilution water is approved by the Department prior to use. The dilution water used in WET tests conducted on outfall 001 shall be a grab sample collected from Sussex Creek. The receiving water location must be specified in the WPDES permit.

Historical WET Data: Below is a tabulation of available acute WET data for Norway during the term of the permit.

Acute WET Test Summary			
Date	**Species**	**Pass/Fail?**	**LC50**
08/11/2001	FHM	Pass	>100
08/11/2001	*C. dubia*	Pass	>100
07/14/2003	FHM	Pass	>100
07/14/2003	*C. dubia*	Pass	>100
11/17/2004	FHM	Pass	>100
11/17/2004	*C. dubia*	Pass	>100
08/31/2005	FHM	Pass	>100
08/31/2005	*C. dubia*	Pass	>100
02/22/2006	FHM	Pass	>100
02/22/2006	*C. dubia*	Pass	>100
02/07/2007	FHM	Pass	>100
02/07/2007	*C. dubia*	Pass	>100
03/12/2008	FHM	Pass	>100
03/12/2008	*C. dubia*	Pass	>100

Chronic WET Test Waiver: In the late 1990's, the permittee performed a series of chronic WET tests that failed. However, subsequent to these failures, the permittee made a demonstration that chloride from domestic softener backwash was the source of toxicity (by organizing several days where customers did not use on-site softening systems, which reduced the effluent chloride to 312 mg/l and during which the chronic WET test passed). Consistent with the conditions of NR 106.89(3), chronic whole effluent testing was held in abeyance. Since additional chloride source reduction measures are necessary to reach a level where chloride toxicity is unlikely, this waiver shall be continued for the proposed permit.

Rationale for Checklist: The following checklist is used to estimate relative risk of whole effluent toxicity from a discharge. The checklist takes into account some risk factors such as toxicants detected in the waste stream, the relative dilution of the waste stream, number of industries contributing to the waste stream, and operation of the treatment system.

	A C U T E
1. IWC	1A. NOT APPLICABLE. **TOTAL POINTS = 0**
2. HISTORICAL DATA	2A. Passed 7 out of 7 acute test batteries. RPF =0. TOTAL POINTS = 0
3. EFFLUENT VARIABILITY	3A. No variable plant loadings, no history of permit violations, no frequent or severe plant upsets, no inconsistent plant operations. **TOTAL POINTS = 0**
4. STREAM CLASSIFICATION	4A. FFAL - Waubeesee Lake Drainage Canal TOTAL POINTS = 5
5. CHEMICAL SPECIFIC DATA	5A. Substances with acute criteria that were detected include ammonia, chloride, mercury, and zinc. (3 pts). Additional compounds of concern that were detected includes silver (2pts). TOTAL POINTS = 5
6. ADDITIVES	6A. One water quality conditioner **TOTAL POINTS** = 1
7. DISCHARGE CATEGORY	7A. Municipality with no industrial contributor **TOTAL POINTS** = 0
8. WASTEWATER TREATMENT	8A. SECONDARY TREATMENT OR BETTER. **TOTAL POINTS = 0**
9. DOWNSTREAM IMPACTS	9A. None directly attributable to this discharge. **TOTAL POINTS = 0**
TOTAL POINTS	**11**

Based on the above checklist, and the fact that the Norway facility is a major facility, the recommended test frequencies are acute test batteries once a year through the term of the permit, in rotating quarters.