Clean Water Standards

Waste Water Quality Standards

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1 Introduction

The **impact on ecosystems** coming from our activities and specifically from discharges of waste water has been identified **as a risk as regulatory, operational or reputational**, and potentially affecting the site or the CBU or the Group.
The management of this risk requires **a standardization of KPI's, measurement protocol and follow-up**. The rules of application must be well defined at Group level but also adapted to the local situation.
The aim is not to be the "best in class" but is to provide a common and international framework for managing the effluent of our installations in accordance to the last regulatory evolution and reach a minimum level of performance for all sites of Danone.

You will find in the following document

- **Standards: KPI's and threshold**
- **Monitoring plan: Frequencies Analytical method reference,**
- **Operational guidelines: sampling guidance, measurement procedures**
- **Peak management : guidance and principles**
- **Reporting guidance and objectives**

2 Definition

- ✓ **Treatment:** We define as "Treatment" any operation that leads to decrease the organic load of wastewater (decrease COD):
  - **We do not consider bar screening, grit removal and flow equalization as "treatment"**, because it has no impact on COD.
  - **Fat and grease removal is considered as a real treatment step**, because it has an impact on COD.
- ✓ **Full on site treatment:** sites carrying out a wastewater treatment on site and discharging directly in the natural environment or in a sewage that flows in the natural environment**.**
- ✓ **On + off site treatment:** sites carrying out a wastewater treatment on site and then discharging in a network or public sewage that leads to an off-site treatment (in a municipal WWTP or to or to a subcontractor installation) before final discharge in the natural environment **.**
- ✓ **Full off site treatment:** sites without treatment on site and discharge in a network or public sewage that leads to an off-site treatment (in a municipal WWTP or to or to a subcontractor installation) before final discharge in the natural environment**.**
- ✓ **No treatment:** sites without treatment on site and discharging directly in the natural environment or in a sewage that flows in the natural environment**.**

NB: sites with WWTP shared between DANONE and other companies and then discharging in natural environment are considered as full on site treatment. (e.g Wexford ELN)

3 Scope of application

The waste water related standards must be applied by all sites discharging directly (with or without waste water treatment plant) in a natural environment (Full on site treatment and no treatment sites).

Nevertheless, the sites connected to the municipal waste water treatment plant or to a subcontractor installation (full off site & on site + off site), might take the opportunity of this standardization in order to reduce the pollutants amount of waste water and then reduce cost (treatment cost), in the frame of the agreement (if any, e.g. ; effluent load) with the partner.

4 DANONE's Ambition and Site's Objectives

A site compliance is defined as :

- **Monitoring plan applied for Performance[1] and Discharge Control[2] KPIs full list**
- **Annual reported data based on Performance KPI are compliant with the standard threshold**

The DANONE Group ambition is:
All sites are compliant by 2020

NB: **Any regulations that are stricter than DANONE standards prevail. If no regulations exist or if DANONE standards are stricter than regulation then these standards prevail.**

5 Indicators:

DANONE defines 3 class of key performance indicator (KPI) :

- **Performances**: KPI to be measured and to be reported against objectives by the sites for the annual reporting through "Clean water reporting". Thus Danone's figures could be used for communication and will be audited by a third party.
- **Discharge control:** KPI to be measured and to be reported by the site apart from the annual reporting on a yearly basis. These KPIs should be followed up as risk assessment indicator and potentially used in case of crisis management.
- **Operations**: Threshold and frequency of measurement to be managed by site with guidelines values in order to maintain capacity and efficiency of facilities.

5.1 KPI (type, class, threshold, monitoring and analysis frequency)

See table 1

[1],[2] : See chapter 5 « Indicators »

Table 1: Waste Water KPI – DANONE *if local regulatory threshold is more stringent, the local regulation must be applied instead of Danone's threshold.

KPI	Class	Threshold*	Frequency for all factories (excluding Water bottling)	Frequency For *Exclusively Water* bottling Factory	Comments
COD : Chemical Oxygen Demand	**Performance**	**< 120 mg/l**	**Daily**	**Monthly**	Reported annually against objectives **Compliance KPIs**
BOD5 : Biochemical Oxygen Demand (5 days - 20°C)	**Performance**	**< 30 mg/l**	**Monthly**	**Monthly**	
TN : Total Nitrogen	**Performance**	**< 10 mg as N/l**	**Monthly**	**Monthly**	
TSS :Total Suspended Solid	**Performance**	**< 50 mg/l**	**Monthly**	**Monthly**	
Oil & Grease	Control of discharge	< 10 mg/l	Yearly	Yearly	Reported annually : **risk assessment KPI** used potentially in crisis management
Cyanides	Control of discharge	< 0.1 mg/l	Yearly	Yearly	
Metals (see below)	Control of discharge	See below	Yearly	Yearly	
Cu (Copper)		< 1mg/l			
Sn (tin)		< 3mg/l			
Mn (Manganese)		< 1mg/l			
Ni (Nickel)		< 1mg/l			
Al (Aluminium)		< 10mg/l			
Fe (Iron)		< 5mg/l			
Zn (Zinc)		< 5mg/l			
As (Arsenic)		< 0.5mg/l			
Sb (Antimony)		< 1mg/l			
pH	Control of discharge	[5.5 – 9]	Daily	Daily	
Temperature	Control of discharge	< 40°C	Daily	Daily	
Total P (Total Phosphorus)	Operations	< 2mg/l	Monthly	Monthly	Control of the effectiveness of process **Operational KPI**
Coliforms bacteria	Operations	< 400 (MPN*/100ml)	Weekly	Weekly	
Residual Chlorine	Operations	< 1 mg/l	Monthly	Monthly	

5.2 Analytical Methods

The analytical method must refer to a national or international approved methodology addressing the exact purpose (compounds, metrics, etc…);

If local regulations require local approved methodology, then this methodology shall be adopted. If not, the International approved methodology shall be adopted.

For information, The methodological reference are listed in Table 2 :

KPI	ISO Method	European Method	US standard method
COD (Chemical Oxygen Demand)	ISO 6060:2006	EN ISO 6060:2006	SM 5220 D
BOD5 (Biochemical Oxygen Demand 5 days 20°c)	ISO 5815-1:2003 ISO 5815-2:2003	EN 1899- 1 EN 1899-2	SM 5210
TN (Total Nitrogen)	ISO 11905-1:1998	EN 12260:2004	SM 4500-N
TSS (Total Suspended Solid)	ISO 11923:2007	EN 872 ISO 11923:2007	SM 2540
Oil & Grease	ISO 9377-2:2000	EN ISO 9377-2:2000	SM 5520
Cyanides	ISO 14403-2:2012	EN ISO 14403-2:2012	SM 4500-CN^-
Metals (see below)	ISO 11885:2007 ISO 17294-1:2004 et -2:2003	EN ISO 11885:2007 EN ISO 17294-1:2004 et -2:2003	SM 3000 EPA Method 200.7
Cu (Copper)	See metals	See metals	See metals
Sn (tin)	See metals	See metals	See metals
Mn (Manganese)	See metals	See metals	See metals
Ni (Nickel)	See metals	See metals	See metals
Al (Aluminium)	See metals	See metals	See metals
Fe (Iron)	See metals	See metals	See metals
Zn (Zinc)	See metals	See metals	See metals
As (Arsenic)	See metals	See metals	See metals
Sb (Antimony)	See metals	See metals	See metals
pH	ISO 10523:2008	EN ISO 10523:2008	SM 4500-H^+
Temperature			SM 2550
Total P (Total Phosphorus)	ISO 6878:2004	EN ISO 6878:2004	SM 4500-P
Coliforms bacteria	ISO 9308-3:1998	EN ISO 9308-3:1998	SM 9222
Residual Chlorine	ISO 7393:2000	EN ISO 7393:2000	SM 4500-Cl

Table 2 : Methodological reference for analysis of Waste Water before discharging in Natural environment.

6 Operational Guidelines:

Sampling guidance, measurement guidance and recommendation for equipment are detailed in the clean water operational guidelines. (Appendix I)

7 Peak management: What to do in case of threshold exceeding?

- Ensure you have **the operation parameters (standard) of the waste water treatment plant** :
  - Volume and quality of inflow stream of waste water (untreated effluent)
  - Volume and quality of outflow waste water (treated effluent)

- Parameters of the treatment process

If figures exceed thresholds:

- Verify the quality of the inflow stream of waste water (untreated effluent).
- Verify the good working order of your installation.
- **Urgently, <u>Double-check and confirm by a new analysis the non-compliant KPI</u>.**

➔ If you confirm the non-compliant figures for **performance and control of discharge class KPI**, refer to the standards classification and related action plan (table 4 – Figure 1).

➔ If you confirm the non-compliant figures for **operation class KPI** :

- set up an adapted and enhanced monitoring plan including performance and control of discharge KPI.

KPI	Class I	Class II	Class III
COD (Chemical Oxygen Demand)	< 120 mg/l	[120 - 160]	> 160 mg/l
BOD5 (Biochemical Oxygen Demand 5 days 20°c)	< 30 mg/l	[30 - 50]	> 50 mg/l
TN (Total Nitrogen)	< 10 mg as N/l	[10 - 20]	> 20 mg/l
TSS (Total Suspended Solid)	< 50 mg/l	[50 - 100]	> 100 mg/l
Oil & Grease	< 10 mg/l	[10 - 20]	> 20 mg/l
Cyanides	< 0.1 mg/l	[0.1 - 0.2]	> 0.2 mg/l
Metals (see below)	See below		
Cu (Copper)	< 1mg/l	[1 - 2]	> 2 mg/l
Sn (tin)	< 3mg/l	[3 - 6]	> 6 mg/l
Mn (Manganese)	< 1mg/l	[1 - 2]	> 2 mg/l
Ni (Nickel)	< 1mg/l	[1 - 2]	> 2 mg/l
Al (Aluminium)	< 10mg/l	[10 - 20]	> 20 mg/l
Fe (Iron)	< 5mg/l	[5 - 10]	> 10 mg/l
Zn (Zinc)	< 5mg/l	[5 - 10]	> 10 mg/l
As (Arsenic)	< 0.5mg/l	[0.5 - 1]	> 1 mg/l
Sb (Antimony)	< 1mg/l	[1 - 2]	> 2 mg/l
pH	[5.5 – 9]	[3.5 -5.5[or]9 – 11]	<3.5 or >11
Temperature	< 40°C	[40 - 50]	> 50 mg/l

<u>Table 4 : Standards classification for Action Plan</u>

Figure 1 : Class-related action plan

- **Class I :**
  1. Continue the current monitoring plan

- **Class II :**
  1. Alert the Operations Director and Environmental Responsible of the BU.
  2. Verify the sampling method, Setup an adapted and enhanced monitoring plan (Shorten sampling frequency, and increase sampling location).
  3. Perform a root cause analysis: If issue is related to operations (incorrect use) then an action plan shall be defined and implemented to remedy to this issue.
  4. Continue the enhanced monitoring plan until recovering of standard, confirm the good working order,
  5. Report and record the deviation

  If issue is related to the design of WWTP refer **to Class III**.

- **Class III :**
  1. Alert WWBU operations and WWBU Nature.
  2. Setup an adapted and enhanced monitoring plan (Shorten sampling frequency, and increase sampling location) and put under surveillance discharged water.
  3. Analysis + interpretation: Perform root cause analysis. If issue is related to operations (incorrect use) then refer to **to Class II.**
  4. If issue is related to the design of WWTP, BU is immediately **engaged** to find solution and define an **action plan with the Top Management** in order to solve as soon as possible the non-compliance situation. For Dairy division it is necessary to contact and align with DEW team to support the project.
  5. The action plan will be presented to WWBU operations and Nature to validate investments. Two possible solution
     - If feasible, Discharge the waste water toward an authorized installation (municipal or private WWTP)
     - and/or design installations enabling the treatment .

8 Reporting Guidance and Objective

The data will be reported through “Clean water reporting”.

Only Performance and Control of discharge Class KPI shall be reported. The Operation Class KPI is dedicated to internal control of process.

Performance Class KPIs are yearly targeted according to the standard threshold (see chapter 4) . Control discharge KPIs are not targeted.

The reported data will be the annual average:

$$\text{Reported Data} = \frac{\sum_0^N (analysis\ result)}{Analysis\ amount\ (N)}$$

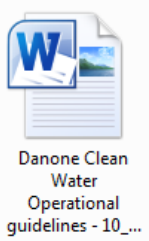
In case of additional analysis due to Peak Management, the average of result during the peak period is calculated. Then the average Peak period result is included in the regular analysis results list and then, the annual average is calculated.

9 APPENDICES

1- APPENDIX I: Clean water operational guidelines
2- COD (Chemical Oxygen Demand) - BOD5 (Biochemical Oxygen Demand 5 days 20°c)
3- TN (Total Nitrogen)
4- TSS (Total Suspended Solid)
5- Oil & Grease
6- Cyanides
7- Metals
8- pH
9- Temperature
10- Total P (Total Phosphorus)
11- Coliforms bacteria
12- Residual Chlorine

1. APPENDIX I

Clean water operational guidelines



2. COD and BOD5

Chemical Oxygen Demand (COD) and Biochemical Oxygen Demand (BOD5) are used as a measurement of pollutants in wastewater and natural waters.

COD is defined as the amount of a specified oxidant (Cr2O72-) that reacts with the sample under controlled conditions. The quantity of oxidant consumed is expressed in terms of its oxygen equivalence. COD is a standardized test.

BOD5 is a measure of oxygen consumed by microorganisms under specific conditions. In other terms BOD5 is a measure of amount of organic matter included in the sample and which are degraded in 5 days at 20°C.

In order to well understand the link between COD and BOD5 : If we continue the biodegradation over 5 days period, around 20 days, we obtain a level which correspond to the BOD ultimate. Hence, if all the organic matter of the sample is biodegradable, we should get :

BOD ultimate = COD (e.g. : this is the case of Glucose molecule : BOD=COD)

But numerous organic molecules in wastewater are not biodegradables or very slowly. Thus, in this case :

COD > BOD ultimate

The use of ratio COD/DBO5 enables to make a good idea of the biodegradability of the effluent and to evaluate the efficiency of the biological treatment. For the industrial effluents, the following rules are retained:

- COD/BOD5 <3 : Effluent easily biodegradable
- 3<COD/BOD5<5 : Effluent moderately biodegradable
- COD/BOD5>5 : Effluent biodegradable with difficulty or not biodegradable.

3. Total Nitrogen

Total Nitrogen (TN) is defined by :

$$TN = N_{organic} + N_{mineral} = N_{organic} + N\text{-}NH_4^+ + N\text{-}NO_2^- + N\text{-}NO_3^-$$

[For your information : Kjeldahl Nitrogen (KN) = $N_{organic} + N\text{-}NH_4^+$]

In waters and wastewaters the forms of nitrogen of greatest interest are, in order of decreasing oxidation state, nitrate, nitrite, ammonia, and organic nitrogen. All these forms of nitrogen, as well as nitrogen gas (N2), are biochemically interconvertible and are components of the nitrogen cycle.

The food industrial facilities generate high amount of nitrogen. Total Nitrogen is an indicator of the pollution of the water, and then its monitoring enables the follow-up of the contamination and potentially of the eutrophication of surface waters.

The usual treatments of wastewaters (flocculation, filtration, etc…) remove in a satisfactory manner the nitrogen compounds.

4. TSS (Total Suspended Solid)

The TSS refers to matter suspended in water/ wastewater.

High values damage consequently the aquatic ecosystem by reducing the penetration of the sun light, decreasing photosynthesis and then the amount of dissolved oxygen, jeopardizing the embryonic development, lowering feed, and then limiting the fish development due to unbalance between species. The asphyxiation of fishes by clogging of branchiate is often the consequences of a high TSS, and the deposits in calm zone can bring out anaerobic developments.

5. Oil & Grease

O&G constituents in wastewater can come from plants and animals (e.g, animal fat, butter, vegetable oils and fats) as well as petroleum sources (e.g., kerosene, lubricating oils). O&G are generally hydrophobic (i.e., “water-hating”) and thus have low solubility in wastewater, resulting in relatively low biodegradability by microorganisms.

The organic solvent associated can disturb the biological process of purification and the digestion of the sludge.

6. Cyanides

‘‘Cyanide’’ refers to all of the CN groups in cyanide compounds that can be determined as the cyanide ion, CN–, by the methods used. The cyanide compounds in which cyanide can be obtained as CN– are classed as simple and complex cyanides. The molecular HCN is well known as the great toxicity to aquatic life. In wastewater, the cyanides come mainly from the galvanoplasty industry, cleaning water of the gas in coking industry and synthesis process in chemical industry. Then, the amount of cyanides in wastewater of food industry is generally very low. The control of this compound is most of the time imposed by law.

7. Metals

The effects of metals in water and wastewater range from beneficial through troublesome to dangerously toxic. Some metals are essential to plant and animal growth while others may adversely affect water consumers, wastewater treatment systems, and receiving waters. The benefits versus toxicity of some metals depend on their concentrations in waters.

8. pH

The acidic and basic status of wastewater is measured through pH. The average value of pH for natural surface water ranges from 7.2 to 7.6, but pH can vary according to geological and chemical context.

9. Temperature

Generally, instead of fixing a discharge temperature, it would be better to take into consideration the discharge thermal flow compared to the cooling capacity of the receptor middle. Hence the upstream survey of the receptor middle would be necessary to estimate the thermal capacity allowing the discharge of effluent.

10. Total Phosphorus

Phosphorus occurs in natural waters and in wastewaters almost solely as phosphates. These are classified as orthophosphates, condensed phosphates (pyro-, meta-, and other polyphosphates), and organically bound phosphates. They occur in solution, in particles or detritus, or in the bodies of aquatic organisms. Phosphorus is essential to the growth of organisms and can be the nutrient that limits the primary productivity of a body of water. In instances where phosphate is a growth-limiting nutrient, the discharge of raw or treated wastewater, agricultural drainage, or certain industrial wastes to that water may stimulate the growth of phytoplancton and algae in such quantities that their decay will consume all the dissolved oxygen (eutrophication).

11. Coliforms bacteria

Coliform bacteria are indicators of residual fecal contamination for monitoring the process and verifying the efficiency of the treatment.

12. Residual Chlorine

Chlorine is used to destroy or deactivate a variety of unwanted chemicals and microorganisms in water and wastewater. An uncontrolled excess of chlorine in water, whether free available or combined (residual chlorine), can adversely affect the subsequent use of the water but also the good operation of biological treatment.