

Report Generation and Issue

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Presentation Outline

◆ Reporting Requirements

- ◆ General
- ◆ Sampling
- ◆ Laboratory Analysis

◆ Units of Measurement

- ◆ General Issues
- ◆ Total Nitrogen / TON / Nitrate / Nitrite / Ammonia
- ◆ O-Phosphate / Total Phosphorus

Reporting Requirements - General

- **Report Title (e.g. Test Report)**
- **Unique Identification Number (e.g. Serial Number)**
- **Issue Number**
- **Name, function & signature of person who authorises the Test Report**

Reporting Requirements - Sampling

- **Date & Time of Sampling**
- **Name / Address of Sampling Location (Licensee)**
- **Identification of Sampling Point (e.g. SW1, SE1 etc.)**
- **Type of Sample (i.e. Composite / Grab)**
 - ◆ **Composite Period (times)**
 - ◆ **Total Flow (m^3) over the time period (normally 24 hours)**
 - ◆ **Calculated Flow (m^3/hour)**
 - ◆ **Some licences also have limit m^3/day**

Reporting Requirements - Sampling

● Field Measurements

- ◆ Indication of tests carried out in the field
- ◆ Temperature, DO, Residual Chlorine etc.

● Process Conditions at time of Sampling

- ◆ Production equipment broken down
- ◆ Maintenance being carried out
- ◆ Anything abnormal that may impact on discharge

● Weather Conditions

Reporting Requirements – Lab Analysis

- **Date of Sample Receipt in Laboratory**
- **Sample Storage / Preservation**
 - ◆ How long are samples held before analysis
 - ◆ What Preservation techniques are used
 - ◆ Refrigeration
 - ◆ Freezing
 - ◆ Preservation with Acid / Base
- **Analysis Methods used**
 - ◆ Reference to the Standard Method on which it is based
 - ◆ APHA / US EPA / ISO / Blue Book etc.
 - ◆ Laboratory developed method



Reporting Requirements – Lab Analysis

- **Accreditation status of each Test**
- **Parameter Name**
 - ◆ **Should be unambiguous**
 - ▶ Ammonia as N or NH_3
 - ▶ Total Oxidised Nitrogen or Nitrate
 - ▶ Total or Dissolved
 - ▶ Conductivity @ 20°C or 25°C
 - ◆ **Should be as per licence**
- **Test Results & Units of Measurement**

Reporting Requirements – Lab Analysis

- **Measurement Uncertainty & Limit of Quantitation**
- **Deviations from quality criteria / method**
 - ◆ Full QC criteria not met
 - ◆ Calibration criteria not met
 - ◆ Normal procedure not followed for whatever reason
- **Subcontracted Tests**

Reporting Requirements



Environmental Protection Agency
Regional Inspectorate
John Moore Road, Castlebar



Report of: IPPC Sample Analysis
Report to: Office of Environmental Enforcement, EPA.
Report date: 08/04/10

Source of discharge: Jones Diagnostics Limited
Reg No: Antytown, Co Mayo
Z1104-01

Class of activity: 5.1 Meat Processing
Duplicate: Yes
Composite: No
Grab: Yes
Date collected: 23/03/2010 Date received: 23/03/2010

Comments: ** Denotes non-accredited test
F Denotes Field Measurement

Laboratory Ref: 2100056		Type of Sample: Effluent	
Sampling point: SE1		Sampled by: Joe Bloggs	
Time Sampled: 10.45		Start/End - Dates of Analysis: 23-03-10 / 04-04-10	
Status of results: Final			
Parameter	Units	Limits	
F Flow	mg/m ³	15	4.5
F Temperature	°C	25	16.5
A1 pH	pH Units	6.5 - 9.0	7.8
A2 BOD	mg/l O ₂	150	43
A3 COD	mg/l O ₂	400	181
A4 Ammonia (as N)	mg/l N	5	1.6

Signed: _____ Date: _____
Ray Smith
Regional Chemist, EPA Castlebar



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Reporting Requirements

● Scope & Accuracy of Analysis

Parameter	Units	Limit of Quantitation (LOQ)	Uncertainty (95%)	Reference Test Method	Maximum Storage Period (before analysis)	Sample Preservation
Biochemical Oxygen Demand	mg/l O ₂	1.0	± 18.7 %	APHA Section 5210 B	35 hours	Refrigeration
Colour	Hazen	5	± 5.2 %	APHA Section 2120	35 hours	Refrigeration
Conductivity	µS/cm	15	± 1.6 %	APHA Section 2510	35 hours	Refrigeration
pH	pH unit	0.1	± 0.1 pH	APHA Section 4500 H ⁺	35 hours	Refrigeration
Turbidity	NTU	0.5	± 8.5 %	APHA Section 2130 B	35 hours	Refrigeration
Suspended Solids	mg/l	8	± 10.8 %	APHA Section 2540 D	7 days	Refrigeration
Total Solids	mg/l	30	± 10.6 %	APHA Section 2540 B	7 days	Refrigeration
Total Dissolved Solids	mg/l	60	± 12.5 %	APHA Section 2540 C	7 days	Refrigeration
Chemical Oxygen Demand (COD) *	mg/l O ₂	25	± 10.7 %	APHA Section 5220 D	35 hours	Refrigeration
Total Hardness	mg/l CaCO ₃	30	± 6.1 %	APHA Section 2340 C	35 hours	Refrigeration
Alkalinity	mg/l CaCO ₃	8	± 5.3 %	APHA Section 2320 B/ Blue Bk HMSO 0117516015	35 hours	Refrigeration
Ammonia *	mg/l N	0.03	± 8.5 %	Blue Bk HMSO 0117516139	35 hours	Refrigeration
Chloride	mg/l Cl	2	± 6.6 %	APHA Section 4500-Cl E	35 hours	Refrigeration
Total Oxidised Nitrogen (TON) *	mg/l N	0.4	± 12.6 %	APHA Section 4500-NO ₃ H	35 hours	Refrigeration
o-Phosphate	mg/l P	0.012	± 10.0 %	APHA Section 4500-P E	35 hours	Refrigeration
Nitrite	mg/l N	0.005	± 12.3 %	APHA Section 4500-NO ₂ B	35 hours	Refrigeration
Silica	mg/l Si	0.1	± 6.6 %	APHA Section 4500-SiO ₂ D	28 days	Refrigeration
Fluoride	mg/l F	0.03	± 8.9 %	APHA Section 4110	28 days	None
Nitrate *	mg/l N	0.05	± 5.2 %	APHA Section 4110	35 hours	Refrigeration
Sulphate	mg/l SO ₄	0.5	± 3.4 %	APHA Section 4110	28 days	Refrigeration
Total Phosphorus	mg/l P	0.01	± 9.3 %	APHA Section 4500-P B & E	28 days	Freezing

Units of Measurement – General

● Common Data Issues

- ◆ Parameter Names
- ◆ Units of Measurements

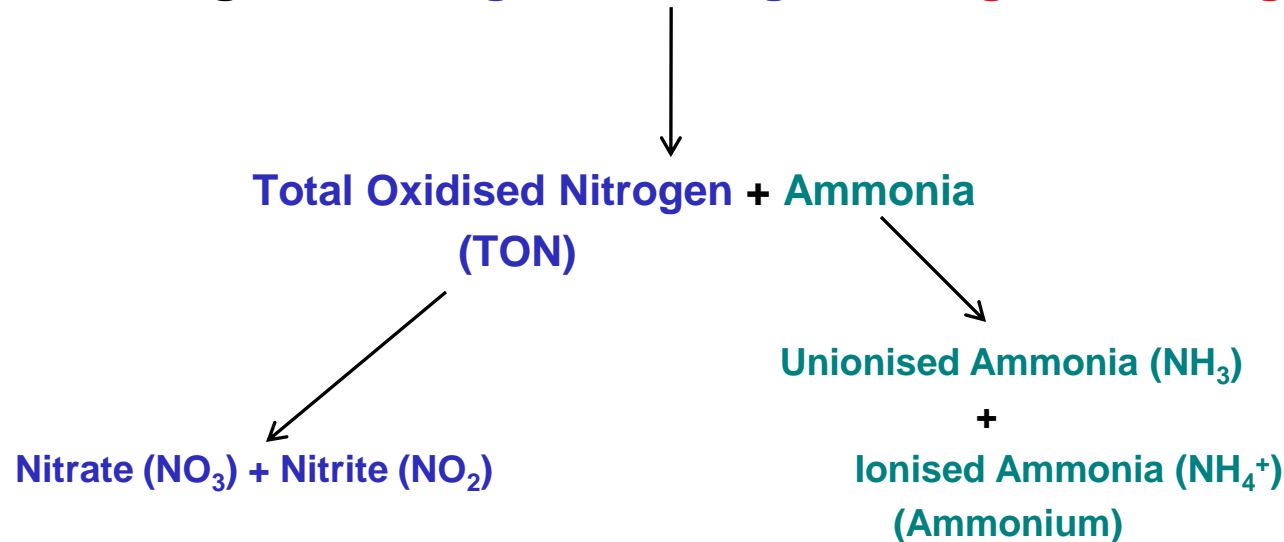
● Units of Measurement Issues

- ◆ mg/l instead of $\mu\text{g/l}$ (easy to identify)
- ◆ Nitrate as NO_3 instead of N (less easy to identify)
- ◆ Ammonia as NH_3 instead of N (very difficult to identify)



Units of Measurement – Nitrogen Forms

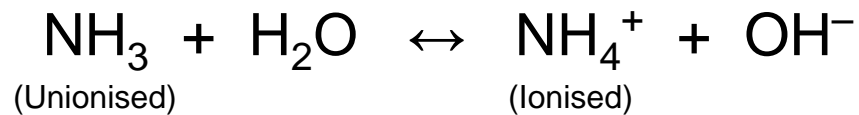
Total Nitrogen = Inorganic Nitrogen + Organic Nitrogen



Also: Total Kjeldahl Nitrogen (TKN) = Organic Nitrogen + Ammonia
= Total Nitrogen – Total Oxidised Nitrogen

Units of Measurement – Nitrogen Forms

Ammonia



- Temperature & pH dependent

pH	% Unionised Ammonia (NH ₃) @ 20°C
5	0.004
6	0.04
7	0.39
8	3.8
9	11.1
10	79.8

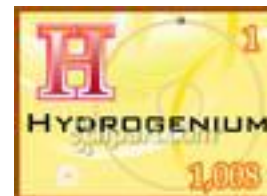
Units of Measurement – Nitrogen Forms

- Ammonia commonly determined using Colorimetric methods
- Measures total ammonia
- Can be reported as mg/l NH_3 , mg/l NH_4 or mg/l N
- Conversion Factors

Convert From	Convert To	Divide By
mg/l NH_3	mg/l N	1.22
mg/l NH_4	mg/l N	1.29

Units of Measurement – Nitrogen Forms

- Conversion from mg/l NH_3 to mg/l N



$$= \frac{(\text{Atomic Weight Nitrogen}) + (3 \times \text{Atomic Weight of Hydrogen})}{\text{Atomic Weight Nitrogen}}$$

$$= \frac{(14.01) + (3 \times 1.008)}{14.01}$$

$$= 1.22$$

Units of Measurement – Nitrogen Forms

- TON & Nitrate can be reported as mg/l NO_3 or mg/l N
- Nitrite can be reported as mg/l NO_2 or mg/l N
- Total Nitrogen generally reported as mg/l N
- Conversion Factors

Convert From	Convert To	Divide By
mg/l NO_3	mg/l N	4.43
mg/l NO_2	mg/l N	3.28

Units of Measurement – Nitrogen Forms

- TON / Nitrate conversion from mg/l NO_3 to mg/l N



$$= \frac{(\text{Atomic Weight Nitrogen}) + (3 \times \text{Atomic Weight of Oxygen})}{\text{Atomic Weight Nitrogen}}$$

$$= \frac{(14.01) + (3 \times 16)}{14.01}$$

$$= 4.43$$

Units of Measurement – Phosphorus Forms

- **Phosphorus in natural waters & wastewaters is usually found in the form of phosphates (PO_4^{3-}).**
 - ◆ Inorganic form (including orthophosphates and condensed phosphates)
 - ◆ Organic form (organically-bound phosphates)
- **Orthophosphate commonly determined colorimetrically (using ammonium molybdate method)**
 - ◆ Molybdate Reactive Phosphorus (MRP)
- **Total Phosphorus – Digestion followed by o-phosphate measurement**

Units of Measurement – Phosphorus Forms

- Commonly reported as mg/l PO_4 or mg/l P (sometimes P_2O_5)
- To Convert from mg/l PO_4 to mg/l P divide by 3.07



$$= \frac{(\text{Atomic Weight Phosphorus}) + (4 \times \text{Atomic Weight of Oxygen})}{\text{Atomic Weight Phosphorus}}$$

$$= \frac{(30.974) + (4 \times 16)}{30.974}$$

$$= 3.07$$

Units of Measurement - Analysis

- **Desirable to measure in same units as per licence**
 - ◆ Nitrogen Forms (mg/l N)
 - ◆ Phosphorus Forms (mg/l P)
 - ◆ Calibration / QC Standards must be prepared in these units
 - ◆ No Conversion factors involved

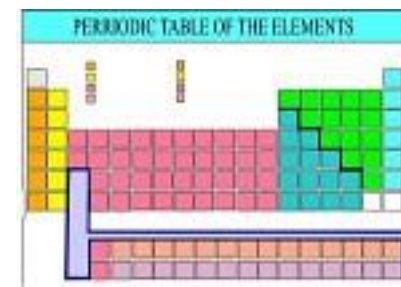
- **Calibration / QC Standards**
 - ◆ Buy in prepared standard or prepare from a salt
 - ◆ Concentration Units are very important

Units of Measurement - Analysis

Task: Prepare 1L of Ammonia Standard 1000 mg/l as N

Salt : Ammonium Chloride (NH_4Cl)

Question: What weight of Ammonium Chloride is required?



A standard periodic table of elements, color-coded by groups. The title 'PERIODIC TABLE OF THE ELEMENTS' is at the top. The table shows elements from Hydrogen (1) to Oganesson (118).

$$= \frac{(\text{Atomic Wt Nitrogen}) + (4 \times \text{Atomic Wt of Hydrogen}) + \text{Atomic Wt of Chlorine}}{\text{Atomic Weight Nitrogen}}$$

$$= \frac{14.01 + (4 \times 1.008) + 35.5}{14.01} = 3.822$$

Dissolve 3.822g of Ammonium Chloride in deionised water and dilute to 1 litre
- 1000 mg/l Ammonia as N

Summary

- **Important that as much information as possible is provided in reports**
 - ◆ Adds greater context to sampling and analysis process
 - ◆ Aids the interpretation of results

- **Greater attention needs to be paid to measurement units**
 - ◆ Ammonia
 - ◆ Total Oxidised Nitrogen
 - ◆ Nitrate
 - ◆ Nitrite
 - ◆ Total Nitrogen
 - ◆ o-Phosphate
 - ◆ Total Phosphorus

.....and finally

Thank You!