AWQC

# NUTRIENT ANALYSIS

## The Australian Water Quality Centre (AWQC) is dedicated to ensuring and responding to the public health requirements relating to the provision of water and wastewater services for communities in Australia and across the world.

Specialist water services

Ensuring public health

**Background**

Nitrogen (N) and phosphorus (P) are nutrients essential for sustaining ecosystem biota (life-forms). However, an excess of N and P can stimulate nuisance growths of aquatic plants in water bodies. Measurement of N and P indicate how eutrophied (nutrient polluted) a water body is and how susceptible it will be to nuisance plant growths occurring.

The most common forms of N available for plant growth in water are the inorganic forms namely nitrate, nitrite, ammonia and organic forms such as urea (the breakdown product of proteins). Nitrate is most commonly available and ammonia the most readily assimilated by plants. Total Kjeldahl Nitrogen (TKN) is another commonly requested analysis and includes ammonia and organic forms of nitrogen but not the oxidized forms. AWQC at present doesn't offer a directly analysed Total N but it can be calculated from the sum of TKN and the oxidised forms, nitrite and nitrate.

Total N = TKN + Oxidised N where TKN = Ammonia N + Organic N; Oxidised N = Nitrite N + Nitrate N.

NATA WORLD RECOGNISED ACCREDITATION

bsi. ISO 9001:2015 Quality Management

Phosphorus exists in water as both dissolved and particulate forms. Particulate P includes P bound up in organic compounds such as proteins and P adsorbed to suspended particulate matter such as clays and detritus (dead and decaying organisms). Dissolved P includes inorganic orthophosphate (H2PO4-, HPO4-2 and PO4-3), poly phosphates, organic colloids and low molecular weight phosphate esters. AWQC most commonly measures Total phosphorus and filterable reactive phosphorus (FRP), which is the best approximation of Available P. Other fractions eg organic P, total dissolved P can also be quantified.

### Quality Control

Apart from the normal quality control samples expected from a NATA accredited laboratory, there are a number of additional quality assurance measures that a best practice laboratory such as AWQC will carry out. AWQC participates in regular Proficiency Testing Programs from a variety of PT program providers. These inter-laboratory proficiency samples are a mix of artificial matrix solutions and real world matrix solutions and cover the whole nutrients testing suite.

### Current limits of reporting

As part of our continuous improvement mindset, AWQC continues to review methodology and instrumentation to ensure the latest technology is used, to achieve faster processing times and lower limits of reporting when compared with older analysis techniques. New instrumentation also allows AWQC to minimise the environmental impact of our methodology.

### Ammonia

Based on aesthetic considerations (rather than health) the concentration of total ammonia (measured as ammonia, NH3) in drinking water should not exceed 0.5 mg/L (this is equivalent to 0.41 mg N/L or 0.41 mg ammonia as N /L).

Ammonia dissolves in water to form an equilibrium mixture of free ammonia (NH3) and the ammonium ion (NH4+). Together these species are classed as ammonia nitrogen

or total ammonia and this is what is measured by the most commonly used colorimetric methods. The importance

of this equilibrium is that it is pH dependant; at higher pH values the toxic free ammonia species will predominate. Thus knowing the total ammonia and pH, one can calculate the relative concentrations of free ammonia and ammonium ion.

A special case exists where ammonia is dosed in conjunction with chlorine to form chloramines, predominantly monochloramine, and a long lasting disinfectant. This is represented by NH3 + Cl2 = NH2Cl + HCl. Typically excess ammonia ie more than the stoichiometric amount, is added and operators need to know this ammonia concentration. Rather than use the normal colorimetric method which would measure both the excess ammonia as well as the nitrogen in the chloramine; an electrode method is used which only measures the excess free ammonia.

With the exception of chloraminated water supplies, typical values at customer taps are less than 0.02 mg/L.

### Nitrite and Nitrate

Based on health considerations, the concentration of nitrite in drinking water should not exceed 3mg/L Nitrite as Nitrite, which is equivalent to 0.93mg/L Nitrite as Nitrogen.

Based on health considerations, the guideline value of 50mg/L Nitrate as Nitrate (equivalent to 11.3 mg/L Nitrate as Nitrogen) as been set up to protect bottle-fed infants under 3 months of age.

Up to 100mg/L Nitrate as Nitrate (equivalent to 22.6 mg/L Nitrate as Nitrogen) can be safely consumed by adults and children over 3 months of age

Nitrite is generally not present in significant concentrations in potable water except where operational difficulties with chloramination leads to nitrite formation due to the presence of nitrifying (or ammonia oxidising) bacteria. Nitrate levels vary significantly and are typically higher in ground water supplies than surface waters.

At AWQC, samples are analysed simultaneously for the two components, nitrite and (nitrite + nitrate), the latter also known as oxidised nitrogen. The nitrate concentration is then calculated from the difference between the two measured components

| Determinand | LOR (mg/L) |
|---|---|
| Nitrogen | |
| Ammonia as N | 0.005 |
| Nitrite as N | 0.003 |
| Nitrate as N | 0.003 |
| Nitrite + Nitrate as N (OxN) | 0.003 |
| Total Kjeldahl Nitogen as N | 0.05 |
| Total Nitrogen (calculated) | 0.05 |
| Phosphorus | |
| Filterable reactive | 0.003 |
| Total | 0.005 |

**Limit of Reporting:**

from 0.003 to 0.05 mg/L

**Sampling Requirements:**

- 250ml sample bottle with no air gap
- OR
- 120ml sample container with 2cm air gap OR
- 120ml filtered sample container with 2cm air gap.
- Transport and store at 4oC
- Ideally, samples to be analysed for soluble nutrients should be field filtered.