Department of Primary Industries
Office of Water

RECYCLED WATER | INFORMATION SHEET NUMBER 6

Types of monitoring

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Why do we monitor?

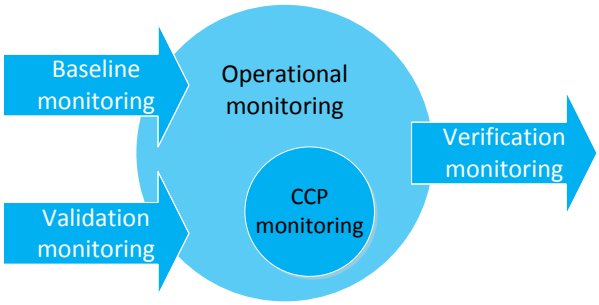
Monitoring is undertaken to ensure that recycled water is consistently provided to a quality that is fit for its intended use.

The main types of monitoring are:

- Baseline monitoring – *'Where are we now?'*
- Validation monitoring – *'Will it work?'* This type of monitoring includes:
    - Pre-commissioning validation
    - Validation of critical control points (CCP)
    - Re-validation
- Operational monitoring – *'Is it working now?'*
- Verification monitoring – *'Did it work?'*
    - Commissioning verification
    - Ongoing verification

The relationship between monitoring types is shown in Figure 1. Baseline and validation monitoring inform what operational monitoring should take place. CCP monitoring is an activity undertaken within operational monitoring. Verification monitoring supports operational monitoring by confirming that risks are being adequately managed.

Figure 1 Relationship between types of monitoring



The extent of monitoring that is required is generally dependent on the risk profile of the recycled water system, the more endpoints potentially to be affected or a higher risk profile (e.g. dual reticulation), the greater the extent of monitoring that will be required.

Baseline Monitoring

Baseline monitoring provides a basis for assessing the potential use of recycled water. Monitoring is undertaken to establish which hazards are present in source water, at what concentrations and how they vary with time and conditions. Alternatively the receiving environment may be monitored to document the condition before recycled water use. Baseline monitoring is best undertaken to provide information for the risk assessment and before establishing the recycled water system.

Validation Monitoring

Validation monitoring is undertaken to predict if recycled water systems *will* be safe for supply to end-users and not have adverse human health and environmental effects. The monitoring is 'indicative' and serves as a basis for making assumptions as to how the plant will operate under a series of conditions. It also informs adequate treatment design to ensure hazards are adequately controlled.

Validation can involve testing a broad range of conditions within the plant operating envelope with focus on high risk conditions (e.g. a scheme undertaking an in-situ validation of UV units would test high flows and/or low UVT conditions). These conditions can be simulated to test the outer bounds within which a particular system, critical control point or process unit operates effectively to produce the required quality for the end-product.

Validation monitoring is performed prior to supply to end-users. It can occur across the design (pre-commission validation) and commissioning stage (validation). After commissioning, validation may be required again (re-validation) for major upgrades or changes to operation or source conditions.

Operational Monitoring

Operational monitoring is the heart of the risk based approach. Operational monitoring involves the routine monitoring of CCPs and other parameters to confirm that processes are under control. It provides advance warning that systems may be deviating from specified targets. Timely operational monitoring allows corrections to be taken before unsafe recycled water is used or before users accidentally misuse recycled water in an unsafe manner.

Schemes should have an operational monitoring schedule that documents:

- The parameters to be monitored
- The sampling location
- The frequency of analysis
- Responsibility for sampling
- Operational/regulatory limits

A typical sampling program for operational monitoring is provided in AGWR Table 5.6.

It is usual for set points to be established for operational monitoring and actions to be undertaken if these set points are exceeded.

Operational monitoring is usually a combination of on-line and operator testing.

Records should be kept of the operational monitoring – ideally in an electronic format that allows for statistical analysis of short and long term trends.

CCP monitoring is a sub-set of operational monitoring. For recycled water systems, when a critical limit is exceeded, supply of the recycled water is usually ceased. When a target or adjustment limit is exceeded, supply is not usually ceased. Refer to Information Sheet 3: *Critical Control Points* for further information.

Verification monitoring

Verification monitoring is undertaken routinely to determine if the recycled water system *was* safe for supply to end-users and confirms compliance with the recycled water quality management system. It is used to confirm product quality, compliance with water quality criteria and identify weaknesses in the existing control measures. Detection of pathogens or indicators is likely to indicate system failure or contamination.

Verification monitoring can include water quality criteria, soils, plants, terrestrial and aquatic biota, ground and surface water, the infrastructure associated with application or receiving environments and assessment of satisfaction of users of recycled water. Therefore it requires monitoring actual conditions in a non-simulated environment. This monitoring confirms the actual capabilities of a particular system, critical control point or process unit to produce the required quality end-product.

Verification is undertaken before operation (pre-commissioning verification) as well as throughout the scheme's operation and its schedule should be informed by a risk assessment or subsequent periodic review recommendations or as a result of complaints, issues or incidents.

Verification monitoring may act as a cross check for operational monitoring. For example, the daily operator testing of ammonia from secondary treatment process is verified on a weekly basis by NATA lab testing sampled from the same location.

Unusual or unexpected verification monitoring results should trigger a review of operational monitoring set-points and CCP limits.

Refer to Information Sheet 7: *Validation and Verification – What's the difference*? This information sheet further explains the distinction between and the need for both validation and verification monitoring.

Statistical validity and minimum data points

A monitoring schedule is devised around the principle of obtaining sufficient data in order to determine significance and identify trends and characteristics. Obtaining numerous samples can be advantageous for developing statistically significant findings however this can be costly and time consuming. Therefore, a trade-off exists between the quality of the data, and the cost and time associated with that monitoring.

To obtain initial estimates of descriptive statistics (e.g. minimum, percentiles, median, mean, maximum and standard deviations), no less than 7 and preferably 15 or more measurements are required (ADWG, 2011).

For ongoing monitoring over a period of time, if data does not reveal significant breaches this may allow frequency of monitoring to be reduced as informed by a risk assessment.

More information

Australian Guidelines for Water Recycling (2006)

Australian Drinking Water Guidelines (2011)

For more information visit www.water.nsw.gov.au or contact: rwapprovals@dpi.nsw.gov.au

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