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The WRC operates in terms of the Water Research Act (Act 34 of 1971) and its mandate is to support water research and development as well as the building of a sustainable water research capacity in South Africa.

TECHNICAL BRIEF

Water reclamation

Water reclamation: Guidance on monitoring, management and communication of water quality

A newly-completed Water Research Commission (WRC) study developed guiding tool on monitoring, management and communication of water quality on direct reclamation of municipal wastewater for drinking purposes.

Background

Water scarcity is recognised as a major challenge for countries on a world-wide basis in their endeavour towards sustainable life for humankind and the environment. Existing water sources are increasingly coming under stress due to growing water demand on a global scale.

Water resource managers and planners are forced to look at other, unconventional water sources such as desalination (of seawater and brackish groundwater), water reuse and rainwater harvesting. Water reuse has become an attractive option for water augmentation due to improvement in efficiency of treatment processes, reduced costs and the fact that this water source is readily available and in close proximity to the point of application.

Beaufort West water reclamation plant.

In South Africa, there has also been a lot of interest recently in direct water reclamation (direct potable reuse). Water reclamation plants that have been constructed as a result of water shortages include: Beaufort West (direct potable reuse (DPR)), George (indirect potable reuse (IPR)) and Mossel Bay (reuse for industrial purposes).

Direct potable reuse options in Durban (eThekwini Municipality), Port Elizabeth, Cape Town and Hermanus are at an advanced planning stage. In this regard, water reuse for potable purposes involves the reclamation of wastewater for drinking purposes after it has been extensively treated by a number of treatment processes to produce water that is safe for human consumption and human use.

Direct water reuse involves the reuse of treated wastewater or effluent by direct transfer from the site where it was produced, to the site of the new or different beneficial application, whereas indirect water reuse comprises the reuse of treated wastewater from a surface water or groundwater body where it was discharged to with the intention of reuse, before being abstracted for reuse at a new or different site of beneficial application.

In this project, a guide was developed that incorporated the following:

- A description of the status of water reuse for potable purposes for planning and regulatory purposes
- A database of direct and indirect potable reuse potential of towns in South Africa.
- Standardised terminology for water reuse
- Water quality monitoring programmes and guidelines comprising constituents and parameters that will require monitoring.

Outcomes and findings

Water sustains life and it is in public interest that the water supplied by the public utility conforms to required water quality guidelines. These are determined by specialist teams and according to the raw water supply the treatment process is designed.

Regular monitoring of the raw water source, the treatment process steps themselves and the final water quality produced, are the only items of evidence that the utility can produce to ensure the consumers that the water treatment process indeed met all the required targets that have been set.

When dealing with DPR there is a major risk that the utility should keep in mind and that is: one incident, which can be proven to stem from the DPR, where people in the community have been severely compromised will lead to a high probability that the treatment unit may be closed in the extreme or that financial losses will occur due to law suits.

During periods of investigation the treatment unit will most probably not be allowed to operate. With all this said, it is in the interest of the owner and operator of the DPR to ensure that, at all times, good data are produced from a robust monitoring programme.

The higher cost of monitoring can be compared to an insurance policy, once any doubt occurs, it will prove its value to ensure to the public as well as any panel of judges (either in court or the media) that the treatment unit complied with all set guidelines and regulations.

This policy is a proven one practiced in Windhoek since the first DPR came into operation in 1968. With the upgrades and extensions of capacity of the DPR scheme in Windhoek, monitoring was intensified.

With numerous water quality issues mainly caused by natural sources not complying, the public could be convinced that DPR technology (monitoring is an integral part of it) is functioning well and is not causing any threat.

As with an insurance policy, it provides peace of mind to the operational staff component, because it proves their commitment. This is one of the reasons ensuring that both the citizens of Windhoek, as well as the owner and operator of the DPR are proud of their reclamation scheme.

Guidelines

Monitoring systems are proposed for the three key components of a potable reuse plant, namely raw water monitoring, operational and control monitoring and compliance monitoring. The monitoring makes provision for early detection of deteriorating incoming raw water quality, rapid changes in the raw water quality, maintenance of treatment barriers in the plant through setting of operational alert levels for the various unit treatment processes in the plant, and compliance of the final water quality with adopted local and international norms and standards.

Because the final water at issue in this study is produced from reclaimed wastewater, the focus was on health-related constituents and parameters, which, for the larger part, have not yet been included in local water quality standards.

Conclusions

It is emphasised in the report that the success of a DPR scheme depends on five important elements, namely:

- A reputable specialist team to accompany the project from design to implementation
- A robust treatment training
- A proven treatment technology with a good track record elsewhere. (Pilot plant studies will further prove a technology)
- Water quality monitoring
- Good communication at all levels and between all stakeholders
- Continued training and research

The guidelines have focused on water quality monitoring as an important link in the various potable reuse chains. Important conclusions drawn from the development and public presentation of the guidelines are summarised below:

With good technologies, personnel and communication protocols, barriers and monitoring systems in place, direct and indirect potable reuse is becoming increasingly attractive as a water source.

Although the technological development and analytical and engineering procedures for monitoring are well advanced and potable water quality can be ensured, there are still a few challenges and issues that are receiving attention and which are currently studied further at research centres across the world.

The successful implementation of IPR and DPR schemes

depends strongly on the expertise of design and monitoring teams and the availability thereof in the particular region. A good example is the management of brine streams, and addressing the technological and economic challenges that are evident in this regard.

In the design of DPR monitoring programs, information about the water quality should be clearly communicated to the consumer as well as within the water service provider. Negative communication should be avoided at all cost (without distorting facts), because any negative information and publicity about a water quality event at the consumer point will be blamed on DPR. A good monitoring program will allow the water quality manager to convince all stakeholders about the true reflection of water quality in the system.

The most common and widespread health risk associated with drinking water is microbial contamination and therefore the control of microbial contamination must always be of primary importance. Ensuring the chemical safety of water requires a different approach as not all the chemicals specified in most guidelines and standards for drinking water will occur in all locations, and if they do exist, they may be present below levels of concern.

However, the importance of chemicals in drinking water should not be underestimated, and it is therefore imperative that chemical contaminants be prioritised so that the most important ones are included in monitoring programmes.

For the optimisation of the performance of unit treatment processes, it is important to note that the measurement of control parameters should not aim at concentrations of zero, but rather an indication of the removal percentage or log removal.

This is an important feature of measured parameters since it would be impossible to determine the performance of a treatment process of the measured parameter that indicates the performance of the treatment process is zero at the inlet of the treatment unit. When the operational control of a water reclamation plant is performed correctly, each of the treatment units of the plant will operate at its optimal conditions.

Monitoring a water distribution system requires advanced and expensive monitoring systems if it is to be done automatically, which is the situation that is strived towards. Even then, at some point manual samples will have to be taken to check on the monitoring system and to calibrate the sensors that are used.

Good protocols will ensure that this can be achieved in an efficient manner.
Community size should be taken into account when it comes to monitoring. Currently the tendency is to have a more extensive monitoring system with larger communities since the risk is higher.

However, monitoring should be extensive, irrespective of the number of users. This is a very important point, as it is often considered that smaller communities using IPR or DPR may have a scaled-down version of a monitoring programme. For obvious reasons, this should never be allowed.

Effective communications of data or results is all about building trust relationships. Data without good communication are worthless and will not serve any purpose, should an incident occur where the health of the public is at risk.

Professionalism and care! Trust from the public in drinking water provision is paramount. Internal lines should be open, the public happy and the critics (newspapers or specialists) convinced that they can trust the water service provider to rectify a situation, should something go wrong.

Further reading:
To order the report, *Monitoring management and communication of water quality in the direct reclamation of municipal wastewater for drinking purposes* (**WRC Report No. TT 641/15**), contact Publications at Tel: (012) 330-0340; Fax: (012) 331-2565; Email: orders@wrc.org.za or Visit: www.wrc.org.za to download a free copy.