NSW Health

Oxidation-reduction potential

Changes to the NSW Public Health Regulation regarding oxidation reduction potential (ORP) in public swimming pools and spa pools

Since the commencement of the NSW Public Health Regulation 2022 (the Regulation) in September 2022, public swimming pools and public spa pools with oxidation-reduction potential (ORP) systems must maintain the minimum disinfectant level as specified in Schedule 1.

Under the changes, ORP systems may still be used to monitor and control disinfection (for chlorine or bromine). However, disinfectant levels, monitoring and record keeping requirements must still comply with Schedule 1 requirements of the Regulation.

What is oxidation-reduction potential?

Oxidation-reduction potential (ORP), also known as redox, is a measure of the tendency for a solution to either gain or lose electrons. Higher (more positive) oxidation reduction potential indicates a more oxidative solution. ORP can be used as a measure of the microbial disinfection activity in water, based on intensity of oxidisers and reducers in relation to their concentration.

ORP indicates the combined effect of all oxidising materials in the water, which is determined by using an ORP probe and meter, and is expressed in millivolts (mV). Systems which monitor ORP and pH are widespread in the aquatic industry, as they provide operators with an ability to automatically control the water chemistry and automatically dose disinfectants.

The World Health Organization recommends that swimming pools in good microbial condition have an ORP level of not less than:

- 720 mV (measured using a silver/silver chloride electrode) with a continuous measurement of pH from 7.2–7.8, or
- 680 mV (using a calomel electrode) with a continuous measurement of pH from 7.2–8.0 at a maintained free chlorine level.

However, the World Health Organization suggests that appropriate values should be determined on a case-by-case basis.

The Centers for Disease Control and Prevention's Model Aquatic Health Code recommends ORP is maintained between 600 mV and 900 mV.

Factors that affect the reading of ORP in swimming pools

ORP is variable due to the quality and variability of the water to be disinfected, availability of disinfectant concentration, pH, cyanuric acid concentration, dissolved oxygen concentration, temperature and organic material contributed by bather load and inadequate filtration. ORP decreases with decreasing free available disinfectant, increasing pH, and increasing cyanuric acid.

The effectiveness of chlorine and other disinfectants is largely influenced by the pH of the water. Both chlorine and bromine lose their disinfection and oxidation capacity at higher pH levels. To ensure disinfectants achieve maximum effectiveness, it is critical that the pH of the water is maintained within a defined range.

Relying on the maintenance of a minimum ORP level alone may not ensure adequate disinfection. Public swimming pool and spa pool operators should set appropriate ORP levels and monitor regularly to ensure that the minimum disinfectant levels set out in Schedule 1 of the Regulation are maintained. Public swimming pool and spa pool operators must measure and control pH and cyanuric acid concentration in accordance with the requirements of Schedule 1 of the Regulation.

Maintenance of ORP systems

All water quality instrumentation, including ORP systems and automated controllers, should be maintained and calibrated in accordance with the manufacturer's specifications, and a certificate or record of calibration should also be maintained.

To detect and prevent failures due to instrument errors, ORP should be regularly checked against manual disinfection measurements.

References

U.S. Centers for Disease Control and Prevention (2024). *Model Aquatic Health Code* (5th ed.). Atlanta, United States of America.

World Health Organization (2006). *Guidelines for safe recreational water environments Volume 2: Swimming pools and similar environments.* Geneva, Switzerland. ISBN 92 4 154680 8.