



REFERENCE CHART • PROCESS CONTROL

ORP for Different Water & Wastewater Processes

A process map of oxidation-reduction potential (ORP, in mV) across aerobic, facultative, and anaerobic conditions — from ammonia oxidation to methane formation.

Oxidation-reduction potential is one of the most useful real-time indicators in water and wastewater treatment. This chart maps the ORP ranges associated with key biological and chemical processes — nitrification, denitrification, biological phosphorus removal, iron and manganese oxidation, biofilm control, and disinfection-by-product breakdown — helping operators target the right redox window for each objective.

ORP in mV	+700	+650	+600	+550	+500	+450	+400	+350	+300	+250	+200	+150	+100	+50	-50	-100	-150	-200	-250	-300	-350	-400	-450	ORP in mV
	Aerobic microbial metabolism (O ₂ electron acceptor)							Facultative microbial metabolism (NO ₃ ⁻ , Mn ⁴⁺ , Fe ³⁺ , SO ₄ ²⁻ electron acceptors)							Anaerobic microbial metabolism (SO ₄ ²⁻ , CO ₂ electron acceptors)									
					Oxidation of EPS, microaerophilic and aerobic biofilm elimination (>+300 mV)			Organic Carbon Oxidation COD/cBOD degradation with molecular oxygen (+50 mV to +300 mV)			Elimination of anaerobic biofilm (-50 mV to +50 mV)													
			Oxidation of Mn to Mn > +500 mV		Manganese Reduction (+220 mV to +500 mV)			Oxidation of Iron & Manganese. Maximum iron removal 3 mg/L						Acid formation, fermentation (-100 mV to -225 mV)										
			Reduction of nitrate (+300 mV to +600 mV)						Biological phosphorus removal/ Polyphosphate development (25 mV to +250 mV)			Polyphosphate breakdown / Biological phosphorus release (-25 mV to -250 mV)												
					Complete oxidation of ammonia at +500 mV		Nitrification (+100 mV to +350 mV)				Denitrification (-50 mV to +50 mV)					Methane formation (-200 mV to -400 mV)								
	Degradation of recalcitrant, emerging compounds (+500 mV to +800 mV)					Reduction of iron (+180 mV to +400 mV)																		
	Oxidation of pesticides, pharmaceuticals, antibiotics, petrochemicals (+400 mV to +700 mV)					Elimination of T&O from NOM			Aerobic biological nutrient removal (+50 mV to +200 mV)		Anoxic biological nutrient removal — just nitrates, little or no oxygen (+50 mV to -200 mV)				Anaerobic biological nutrient removal — no nitrate and no oxygen (< -300 mV)									
				Breakdown of Chlorinated Disinfection Byproducts (> +350 mV)						Reduction of sulfate (+100 mV to 200 mV)					Sulfide (H ₂ S) formation (-50 mV to -250 mV)									
	Aerobic microbial metabolism (O ₂ electron acceptor)							Facultative microbial metabolism (NO ₃ ⁻ , Mn ⁴⁺ , Fe ³⁺ , SO ₄ ²⁻ electron acceptors)							Anaerobic microbial metabolism (SO ₄ ²⁻ , CO ₂ electron acceptors)									
ORP in mV	+700	+650	+600	+550	+500	+450	+400	+350	+300	+250	+200	+150	+100	+50	-50	-100	-150	-200	-250	-300	-350	-400	-450	ORP in mV

Aerobic metabolism (O₂ acceptor) at high ORP → facultative (NO₃⁻, Mn⁴⁺, Fe³⁺, SO₄²⁻ acceptors) → anaerobic (SO₄²⁻, CO₂ acceptors) at low ORP.