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ENVIROSWIM COMPARATIVE RISK ASSESSMENT

Multi-Barrier Treatment vs Conventional Chlorine-Dependent Benchmark

Strengthened assessment incorporating regulatory developments through 21 August 2026

Prepared for	Watertech Services International Pty Ltd / Enviroswim
Assessment date	21 August 2026
Assessment status	Comparative technology and control assessment; not a substitute for a site-specific WHS risk assessment
Evidence period	May 2026 assessment updated for regulatory developments through 21 August 2026
Next review	After a regulatory, operational or scientific change; after any significant incident; or within 12 months

EXECUTIVE DETERMINATION The 2026 regulatory developments make the Enviroswim proposition stronger where chlorine-related hazards are material: Enviroswim is capable of functioning as a substitution and source-reduction control higher in the hierarchy than ventilation, procedures or RPE. Its comparative advantage must still be verified for the site and does not remove residual public-health, chemical or operational duties.

1. Purpose, scope and strengthened position

This assessment compares foreseeable operational, occupational-health, public-health, environmental and infrastructure risks associated with conventional chlorine-dependent sanitation and the Enviroswim multi-barrier system. It updates the May 2026 assessment in light of new national airborne-contaminant material and recent South Australian and Queensland guidance relevant to hazardous pool chemicals.

The comparative assessment distinguishes between:

- **consequence controls** - ventilation, procedures, emergency response and PPE applied after a chlorine-related hazard exists; and
- **source controls** - elimination, substitution and minimisation that reduce the amount of hazardous chemical purchased, carried, stored, decanted or generated.

Enviroswim's strongest WHS relevance is in the second category. It can reduce the source term while retaining microbiological control through copper/silver ionisation, electronic oxidation and ultrasonics. The assessment does not describe the system as risk-free or universally chlorine-free; it identifies the risk pathways it materially reduces and the controls that remain.

Assessment boundaries

- Conventional chlorine-dependent systems include manually dosed chlorine, automated hypochlorite dosing and salt chlorination where chlorine remains the principal sanitising residual.
- Enviroswim refers to an installed and maintained ES3 multi-barrier configuration operating within the manufacturer's validated water-chemistry and hydraulic envelope.
- The comparison covers normal work, abnormal conditions and reasonably foreseeable incidents across residential service work, pool retail and storage, hospitality pools and commercial aquatic facilities.
- Jurisdiction-specific public-health requirements override any general conclusion in this document.

2. Regulatory developments incorporated

The assessment has been updated to reflect the following confirmed developments. They do not create an Enviroswim mandate. They do strengthen the need for a PCBU or equivalent Victorian duty holder to compare higher-order source controls with continued reliance on chemical handling, ventilation, procedures and PPE.

1. WES to WEL transition - 1 December 2026

Australia will adopt the Workplace Exposure Limits list following implementation in the relevant WHS laws. Safe Work Australia explains that the terminology communicates that the values are limits not to be exceeded. The WEL is not a dividing line between a healthy and unhealthy workplace, and the duty to eliminate or minimise remains. [E1]

2. Chlorine and copper numerical limits unchanged

The 24 June 2026 decision means the numerical exposure levels for chlorine and copper will remain at their existing WES values on transition. No reduction in the chlorine numerical limit takes effect on 1 December 2026. [E2]

3. Air monitoring and competent advice

Safe Work Australia states that air monitoring is required where the PCBU is not certain on reasonable grounds whether airborne concentrations exceed the applicable limit, or where monitoring is necessary to determine health risk. Personal monitoring is directed to the worker breathing zone. [E3, E4]

4. Hierarchy of control

PPE, including RPE, is one of the least effective controls because it does not control the risk at source. Substitution, isolation and engineering controls must be considered first. [E4]

5. Health monitoring and uncertainty

SafeWork SA guidance states that significant or uncertain hazardous-chemical exposure can require health monitoring and review of controls. Its decision framework treats exposure above 50% of the WES as potentially high and gives particular attention to foreseeable leaks, spills and regular reliance on administrative controls or PPE. [E5, E6]

6. Pool-industry supply chain

Workplace Health and Safety Queensland expressly identifies pool-chemical retailers as workplaces storing and handling hazardous chemicals, including hypochlorites, hydrochloric acid and other pool chemicals. The control question therefore extends beyond aquatic centres to retail, warehousing, distribution and servicing. [E7]

What this means for the comparative control decision

A conventional chlorine-dependent operating model often controls risk after the hazardous chemical has been purchased, delivered, stored, decanted or generated: segregation, bunding, ventilation, procedures, emergency arrangements and PPE. Those controls remain necessary, but many sit below elimination and substitution in the hierarchy.

ENVIROSWIM CONTROL PROPOSITION Where technically suitable and permitted, Enviroswim can materially reduce the quantity and frequency of conventional chlorine products required and reduce chlorine-derived contaminant formation at source. That makes it relevant to the mandatory higher-order-control inquiry, not merely to water-treatment preference.

Victoria does not generally use the PCBU terminology because it operates under its own Occupational Health and Safety legislation. Equivalent employer and duty-holder obligations must be assessed under Victorian law. Jurisdiction-specific public-health and aquatic-facility requirements also remain controlling.

3. Enviroswim as a higher-order control

The comparative assessment is based on the treatment train, the exposure pathways it reduces and the controls that remain. Enviroswim is not described as 'chemical free'.

PRINCIPAL DETERMINATION On the evidence reviewed, Enviroswim has a materially lower whole-of-system risk profile for hazards driven by chlorine inventory, handling frequency, chlorine-derived by-products, high salinity and single-barrier dependence. Its advantage is conditional on correct commissioning, water balance, filtration, monitoring and legal acceptance for the particular pool.

1. Substitution and source minimisation

Control finding: The system shifts routine sanitation away from primary dependence on stored or generated chlorine and toward copper/silver ionisation, electronic oxidation and ultrasonics.

Evidence basis: Reduced conventional chemical inventory and handling frequency directly reduce the number of opportunities for incompatible mixing, spill, vapour and manual-handling events. The 2026 guidance gives this higher-order control logic more regulatory weight.

Boundary: Acids, cleaning chemicals or supplementary oxidants may remain. Their SDS, storage, segregation, transport and PPE requirements continue.

2. Persistent outdoor residual without cyanuric acid

Control finding: Copper/silver ions are not photodegraded or volatilised in the same manner as free chlorine, so the residual does not require cyanuric acid for sunlight protection.

Evidence basis: The Dr Simon Toze review and Enviroswim operating evidence support the persistence mechanism. Removing routine CYA dependence avoids the recognised reduction in active chlorine performance at elevated stabiliser concentrations.

Boundary: Ion availability and staining risk still depend on pH, alkalinity, water balance and correct output. Enviroswim operating parameters must be maintained.

3. Multi-barrier microbiological control

Control finding: Enviroswim uses independent treatment mechanisms rather than one chemical residual alone, reducing vulnerability to a single failure mode.

Evidence basis: Tweed Laboratory reports supplied for this assessment state that the tested Enviroswim configuration achieved the NSW Health 4-log *Pseudomonas aeruginosa* benchmark within 30 seconds under the specified test conditions. NSF/ANSI 50 certification documentation and long-term field monitoring add separate evidence layers.

Boundary: The laboratory result must not be generalised beyond its test conditions. Filtration, turnover, operational monitoring and incident response remain essential.

4. Lower chlorine-derived DBP and airborne-contaminant potential

Control finding: Reducing chlorine demand and combined chlorine formation reduces the source term for chlorine-derived chloramines and DBPs.

Evidence basis: The conclusion follows from the chemical pathway and the reviewed literature. The assessment does not assume that by-products can never form.

Boundary: Indoor-air benefit should be verified by before-and-after combined chlorine, water DBP and breathing-zone or representative air measurements where exposure is material. Required ventilation remains.

5. Lower salinity and corrosion pressure

Control finding: Enviroswim normally operates at substantially lower TDS than conventional salt chlorination and can reduce chloramine burden.

Evidence basis: Sleeman Centre chemistry records and the operating specification support lower salinity. The mechanism supports reduced corrosive pressure on metals, electrical systems and building fabric.

Boundary: Corrosion is multifactorial. Materials, humidity, ventilation, stray current, water balance and maintenance must still be assessed.

6. Evidence pathway and due diligence

Control finding: Enviroswim can be evaluated through laboratory efficacy reports, historic NSF/ANSI 50 certification documentation, public-pool field data, independent monitoring and operating records.

Evidence basis: This evidence stack is stronger than relying on residual chemistry or manufacturer assertion alone and allows procurement reviewers to test claimed outcomes.

Boundary: The 2009 NSF/ANSI 50 certification documentation is treated as historical evidence, and this assessment does not claim current listing status. The APVMA FOI response establishes only what was held or produced within the scope of that request; it does not establish that no scientific evidence exists elsewhere.

4. Risk method and scoring

Risk is expressed as likelihood multiplied by consequence. The scores are comparative indicators only. They must be recalibrated for the pool class, jurisdiction, bather load, indoor/outdoor setting, chemical inventory, worker exposure, operator competence and existing controls.

IMPORTANT SCORING PRINCIPLE Where microbiological control fails, the possible consequence to bathers remains serious whichever technology is used. Enviroswim can reduce likelihood through independent and diverse treatment barriers; it does not make the consequence insignificant.

Likelihood / Consequence	Insignificant (1)	Minor (2)	Moderate (3)	Major (4)	Severe (5)
Almost certain (5)	5 Medium	10 High	15 High	20 Extreme	25 Extreme
Likely (4)	4 Low	8 Medium	12 High	16 High	20 Extreme
Possible (3)	3 Low	6 Medium	9 Medium	12 High	15 High
Unlikely (2)	2 Low	4 Low	6 Medium	8 Medium	10 High
Rare (1)	1 Low	2 Low	3 Low	4 Low	5 Medium

Ratings: Low 1-4; Medium 5-9; High 10-16; Extreme 20-25. Scores are not a legal conclusion and do not replace exposure measurement or a competent site assessment.

5. Comparative risk register

The register evaluates Enviroswim explicitly as a control pathway. The score reflects the residual risk after normal system-specific controls, not a claim that risk has been eliminated. Each site must replace these indicative scores with its own evidence.

No.	Risk pathway	Chlorine-dependent pathway	Enviroswim control / residual limitation	Chlorine	Enviroswim	Evidence
1	Hazardous-chemical storage and incompatibility	Chlorine products, acids and oxidisers can react dangerously; packaged or bulk inventory creates spill, fire, gas-release and emergency-response exposure.	Materially reduce routine chlorine inventory and delivery frequency; preserve segregation and SDS controls for remaining chemicals.	16 High	8 Medium	E4, E7
2	Transport and mobile service-vehicle exposure	Repeated carriage of incompatible chemicals creates leak, vapour, collision, load-restraint and emergency-response pathways.	Fewer and smaller routine chemical loads reduce exposure opportunities; transport law and segregation still apply to remaining loads.	16 High	8 Medium	E7
3	Manual dosing, decanting and transfer	Splash, corrosive contact, inhalation and incompatible-container errors can occur during repeated handling.	Lower routine dosing and decanting frequency; automate remaining pH or supplementary dosing where reasonably practicable.	16 High	6 Medium	E4, E7
4	Airborne chlorine, acid vapour, mist or gas	Plant rooms, storage rooms, dosing failures and mixing incidents can expose workers and others.	Reduce source inventory and chlorine demand; retain ventilation, alarms and emergency procedures where chemicals remain.	16 High	6 Medium	E1, E3, E4
5	Chloramines and chlorine-derived DBPs	Reaction with bather waste creates volatile and non-volatile by-products; indoor workers and frequent users may receive repeated exposure.	Lower chlorine dependency and combined-chlorine formation at source; verify with site water and air data.	16 High	6 Medium	S1; E4
6	Over-reliance on ventilation, procedures or RPE	Lower-order controls may be assumed effective without exposure data, correct RPE selection, fit testing, maintenance or records.	Use Enviroswim source reduction first; retain correctly designed supplementary controls for residual hazards.	12 High	4 Low	E4, E6
7	Inability to demonstrate exposure control	Odour, installed ventilation, an SDS or PPE issue do not by themselves establish breathing-zone exposure.	Reduced source term may reduce monitoring burden, but initial and periodic verification may still be required where uncertainty remains.	12 High	6 Medium	E1, E3, E4, E5
8	Sunlight loss and cyanuric-acid dependence	Free chlorine is photodegraded outdoors; CYA protects it but can slow disinfection as concentration rises.	Use persistent ion residual without routine CYA; maintain pH and ion level within validated operating parameters.	16 High	4 Low	S1

No.	Risk pathway	Chlorine-dependent pathway	Enviroswim control / residual limitation	Chlorine	Enviroswim	Evidence
9	Organic load and water-condition sensitivity	Bather waste consumes chlorine and forms chloramines/DBPs; performance also depends strongly on pH and temperature.	Ion residual is not consumed by organics in the same way; oxidation and filtration address load. Water balance remains critical.	12 High	6 Medium	S1, F1
10	Microbiological control failure	Single-barrier or dosing failure, stabiliser, organics, sunlight, inadequate turnover or poor operation can reduce protection.	Diverse ionisation, oxidation and ultrasonic barriers reduce single-mode dependence; use independent microbiological verification.	12 High	8 Medium	T1, T2, T3, F1
11	Biofilm and opportunistic pathogens	Biofilm can shelter Pseudomonas, Legionella and other organisms from a residual disinfectant.	Ion residual plus oxidation and ultrasonic action provides multiple controls; physical cleaning and filter/pipe maintenance remain.	12 High	8 Medium	S1, T1, F1
12	Cryptosporidium and Giardia	Protozoa are not reliably controlled by ordinary chlorine residual; filtration and faecal-incident response are decisive.	No comparative reduction is claimed without organism-specific evidence. Maintain filtration, closure and incident protocols.	12 High	12 High	S1
13	Corrosion of plant, electrical systems and building fabric	Chloramine-laden indoor air, aggressive chemistry and high salt can accelerate corrosion and asset failure.	Lower chlorine-derived contaminant potential and lower TDS reduce important drivers; verify through asset-condition and cost records.	16 High	8 Medium	F1; operating specification
14	Energy and runtime dependency	Long pump/chlorinator runtime and ventilation demand increase energy cost and reduce resilience during interruption.	Persistent ion residual may support shorter seasonal runtime; verify against circulation and filtration requirements with metered data.	9 Medium	4 Low	I1
15	Claims validation and procurement due diligence	A familiar benchmark can be accepted without examining whole-system exposure, field microbiology or equipment-specific evidence.	Evaluate the Enviroswim evidence stack and require equivalent independent evidence from every compared technology.	8 Medium	4 Low	T1-T3, F1-F2
16	Competency, abnormal events and emergency response	Chemical-intensive work demands correct training, spill response, RPE selection and decisions about unsafe entry.	Reduced inventory lowers exposure frequency and emergency potential; system-specific training and remaining chemical procedures continue.	12 High	8 Medium	E3-E7
17	Chemical discharge and environmental loading	Backwash and water replacement can discharge salts, chlorine-derived compounds and treatment chemicals.	Reduced chemical dependence and lower salinity reduce the source load; discharge requirements remain site-specific.	9 Medium	4 Low	F1; operating specification
18	Enviroswim-specific water chemistry and control failure	Not applicable as an Enviroswim-specific hazard, although conventional systems have their own system-specific failure modes.	Incorrect pH, ion output, water balance, filtration or maintenance can impair performance or cause copper staining. Commissioning and routine verification are mandatory.	-	8 Medium	Operating manual, S1

Evidence codes are defined in section 7. Score changes should be supported by site data. A lower Enviroswim score is not justified unless the stated source reduction has actually occurred and the residual controls are operating.

6. Conditions required to realise the Enviroswim risk reduction

The comparative advantage is strongest when the installation is treated as a verified control program, not as a once-off equipment purchase.

1. Jurisdiction and pool-class screen: Confirm public-health, licensing, facility and residual-disinfectant requirements before selection. Record any continuing chlorine requirement.
2. Chemical baseline: Record the existing chlorine, acid, stabiliser, salt and other chemical inventory; deliveries; decanting tasks; spill history; SDS; ventilation; RPE; and worker exposure concerns.
3. Commissioning and operating envelope: Document pool volume, hydraulics, turnover, filtration, pH 7.2-7.6, copper target 0.2-0.4 mg/L, TDS 1,000-1,500 mg/L, alkalinity, calcium hardness and site-specific controller settings.
4. Independent verification: For public, commercial, indoor or high-use pools, establish baseline and post-conversion microbiology and chemistry. Where airborne exposure is material or uncertain, obtain competent occupational-hygiene advice and representative monitoring.
5. No loss of basic barriers: Maintain filtration, circulation, cleaning, bather hygiene, faecal-incident procedures, closure criteria and emergency response. Enviroswim is an additional control architecture, not a reason to abandon normal aquatic-risk controls.
6. Residual chemical controls: Keep a current register and SDS for every remaining hazardous chemical; segregate incompatibles; maintain bunding, transfer, transport, PPE and emergency arrangements proportionate to the remaining inventory.
7. Competency and records: Train operators in Enviroswim parameters, sampling, electrode and oxidiser maintenance, pH control, abnormal conditions, corrective action and escalation. Retain test, maintenance, incident and training records.
8. Review triggers: Review after a microbiological excursion, chemical incident, air-quality complaint, material process change, new regulatory guidance, certification change, or at least annually.

Verification indicators

Control objective	Measure	Before / after evidence	Owner / frequency
Reduce chemical handling	Litres or kilograms purchased, delivered and decanted; task frequency	12-month conventional baseline versus Enviroswim operation	PCBU / quarterly
Control airborne exposure	Combined chlorine, relevant air contaminants, complaints and ventilation performance	Competent baseline and post-change assessment where material	WHS manager / hygienist
Maintain microbial control	E. coli, Pseudomonas, HPC and jurisdictional parameters	Independent laboratory trend	Facility manager / risk-based schedule
Maintain Enviroswim envelope	pH, copper, TDS, alkalinity, calcium, controller and cell condition	Commissioning record and trend log	Operator / routine
Reduce corrosion	Asset inspection, corrosion events, electrical faults and maintenance cost	Condition and cost trend	Asset manager / annual
Reduce energy and water burden	Pump, treatment and ventilation energy; backwash and replacement water	Metered, weather- and use-normalised comparison	Facility / annual

7. Evidence and source schedule

The schedule separates official regulatory material from Enviroswim-specific technical evidence. The cited item is limited to the stated proposition and does not support a broader conclusion than its scope allows.

Code	Source	What it supports	Scope / limitation
E1	Safe Work Australia - Workplace Exposure Limits: airborne contaminants	WEL transition, limits not to be exceeded, WEL is not a healthy/unhealthy dividing line, eliminate or minimise duty.	Official national policy guidance; jurisdictional implementation remains relevant.
E2	Safe Work Australia - Decision on nine chemicals, 24 June 2026	Chlorine and copper numerical exposure levels remain unchanged on 1 December 2026.	No confirmed reduction in the chlorine numerical limit.
E3	Safe Work Australia - New airborne-contaminant guidance, 30 July 2026	Three guides; air monitoring, competent assessment and preparation for WEL.	Guidance supports duties; not every statement is a new offence.
E4	Safe Work Australia - WHS duties for airborne contaminants	Hierarchy of control, PPE as a lower-order control, breathing-zone air monitoring where uncertainty exists.	Application depends on the actual work and exposure circumstances.
E5	SafeWork SA - Monitoring the health of RPE users	Significant/uncertain exposure, 50% WES guide, leaks/spills and health-monitoring decision logic.	South Australian guidance; other jurisdictions may differ.
E6	SafeWork SA - Respiratory protective equipment	RPE selection, fit, training, health monitoring, inspection, maintenance and records.	RPE remains supplementary to higher-order controls.
E7	Workplace Health and Safety Queensland - Pool chemical retailers	Pool chemicals are hazardous chemicals; storage, bulk delivery, dispensing and incompatibility controls.	Retail guidance; relevant principles extend to similar tasks.

Enviroswim-specific technical evidence

Code	Source	What it supports	Scope / limitation
T1	Tweed Laboratory Centre - Evaluation against NSW Health New Disinfection Process Criteria (2001)	Specified Enviroswim configuration reportedly achieved 4-log <i>P. aeruginosa</i> reduction within 30 seconds under test conditions.	The full report, method, accreditation scope and conditions govern the result.
T2	Tweed Laboratory Centre - Spa pool efficacy testing of ES3 (2004)	Additional organism/time performance under specified conditions.	The result is limited to the reported scope and test conditions.
T3	NSF/ANSI 50 certificate 4D640-02 and supporting documents (2009)	Independent equipment efficacy/safety certification pathway.	Historical certification evidence only; no claim of current listing status is made.
F1	Sleeman Sports Complex microbiological and chemistry records (2004-2005)	Repeated field monitoring across multiple public-pool vessels; ion residual and lower-TDS operation.	Historical, site-specific and not a randomised head-to-head trial.
F2	Gwinganna independent water-quality monitoring reports (2021-present)	Ongoing operational monitoring in a hospitality/wellness setting.	Provisional evidence; not relied upon for the principal determination unless the complete reporting period and laboratory scope are available.
S1	Dr Simon Toze - literature review and technical assessments (2023)	Mechanisms, chlorine limitations, ionisation evidence, DBP and biofilm discussion.	Expert review; organism- and condition-specific limits remain.
A1	APVMA Freedom of Information response	The documents sought were not held or produced within the scope of the request.	Does not prove no evidence exists elsewhere or invalidate all registered products.
I1	Watertech / Enviroswim energy and operating-cost material	Runtime, energy and cost hypotheses and case data.	Manufacturer evidence requiring site-metered, normalised validation.

Evidence confidence

- **Higher confidence** - official regulatory sources; complete accredited laboratory reports; recognised third-party certification records; repeated independent field monitoring.
- **Moderate confidence** - expert literature review and consistent operating records with transparent methods.
- **Provisional** - manufacturer white papers, case estimates, incomplete source files or claims requiring site validation.

8. Comparative conclusion

BOTTOM LINE The recent regulatory developments strengthen the Enviroswim case most clearly in occupational and whole-of-system risk control. The decisive question is no longer only whether a pool meets a residual disinfectant convention; it is whether the selected treatment architecture eliminates or minimises foreseeable hazardous-chemical and airborne-contaminant exposure so far as reasonably practicable while maintaining verified microbiological control.

On the evidence reviewed, Enviroswim warrants explicit and serious consideration because it can:

- reduce routine dependence on conventional chlorine products and associated storage, transport and manual-handling exposure;
- reduce the source term for chlorine-derived chloramines and DBPs;
- provide a persistent outdoor ion residual without cyanuric-acid dependence;
- apply three treatment barriers rather than relying on one chlorine residual alone;
- operate at substantially lower salinity than conventional salt chlorination; and
- support a due-diligence pathway using laboratory testing, certification documentation, field data and ongoing verification.

These advantages do not justify claims that Enviroswim eliminates every hazard, controls *Cryptosporidium* without normal incident measures, removes the need for filtration or ventilation, or automatically satisfies every public-health jurisdiction. This assessment does not make those claims.

The resulting conclusion is: where Enviroswim is technically suitable and legally accepted, it can be a reasonably practicable substitution and source-reduction control that materially lowers several major risk pathways inherent in chlorine-dependent operation. A decision maker should therefore document why this higher-order option was accepted or rejected, using whole-of-system evidence rather than historic convention alone.

Decision statement for procurement or regulatory review

ASSESSMENT POSITION Enviroswim should be assessed as a lower-chemical, multi-barrier control option within the hierarchy of controls. Any comparison should include microbiological performance, chemical inventory and handling, airborne exposure, DBP formation, corrosion, energy, monitoring requirements and residual legal obligations. Equivalent evidence should be required from every sanitation technology under consideration.

Regulatory status and use limitation

This document distinguishes existing statutory duties, confirmed forthcoming changes and regulator guidance. It is a comparative technical and control assessment, not legal advice and not a completed site risk assessment. Actual duties depend on the jurisdiction, pool class, chemicals, quantities, work activity, exposure, public-health rules and the controls in place.