

A technical paper for cruise operators

Onsite Hypochlorous Acid Generation in Cruise Operations

Logistics, cost, the evidence, and the 2025 VSP Standards

What this paper does and does not claim

An EcoloxTech system is a **device that produces a hypochlorous acid solution on site**. It is regulated by the EPA as a device, it is not a registered disinfectant, and we make no efficacy claims for it or for the solution it produces.

Where this paper reports laboratory or published findings, they are findings about hypochlorous acid under the conditions stated, attributed to the laboratory that produced them. They are not claims for any product.

Where a documented disinfection claim against a named organism is required, it comes from a registered product used according to its label — for us, HOCl-AS200, EPA Reg. No. 101112-1.

Cost figures are EcoloxTech's own data and are labelled as such. They are not an independent audit.

We do not claim that our equipment prevents outbreaks. An outbreak has many causes and a sanitation programme has many parts. What we can evidence is what a system is, what it replaces, what it costs, and what published testing on hypochlorous acid has found.

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This revision supersedes the April 2026 edition.

1. The operational problem is logistics

Every argument for making disinfectant on site is sharper at sea, because a vessel is a closed system in a way that a building ashore never is. The chemistry matters, but it is not what makes the cruise case distinctive. The supply chain is.

- **You cannot take a delivery.** A shore-based site that runs low makes a phone call. A ship three days out does not. Everything consumed between ports has to be aboard on departure, so the programme is sized by what *might* be used, plus a margin.
- **Weight and volume are budgeted.** Space given to a chemical store earns nothing, and drummed chemistry is mostly water being carried around an itinerary at considerable expense.
- **Hazardous goods carry rules.** Concentrated chemistry aboard a passenger vessel brings stowage and segregation requirements, handling procedures, PPE, spill response and disposal — all real cost before anything has been cleaned.
- **The environment is corrosive and continuously occupied.** Salt air is already attacking every surface. Unlike a food plant at two in the morning, a cruise ship has no empty shift.
- **Demand is lumpy.** Turnaround day, an illness response, an itinerary change. A stored inventory must cover the peak; generation capacity must cover the peak too, but capacity is a machine you already own rather than volume you already bought.

2. What an onsite generator is

An EcoloxTech generator is an electrochemical device. It takes softened water, salt and electricity and produces a hypochlorous acid solution at a set concentration and pH, at the point of use. There is nothing to ship, store, dilute or dispose of, and the recurring inputs are a salt bag, water and power.

Its regulatory status is worth being precise about, because it is routinely misdescribed in this industry. Equipment that generates a pesticidal substance on site is regulated by the EPA as a **device**. A device is not a registered product: it is not required to demonstrate efficacy in the way a registered product is, and it may not carry pesticidal efficacy claims. We therefore make none, and you should treat any supplier who does with caution — a device bearing efficacy claims is an unregistered pesticide.

What the device does remove are two failure modes

- **You cannot run out of something you manufacture.** With power, water and salt aboard, the stock-out scenario — the one that ends with someone improvising, or a task quietly not being done — stops being a scenario.
- **You cannot mis-dilute what a machine produces at a set point.** Hand dilution is the commonest failure point in any sanitation programme, and it fails both ways. The crew's job becomes verifying the set point rather than achieving it.

Neither of those is a claim about what hypochlorous acid does. They are statements about a supply chain, and they are the part of the argument that survives contact with an operations team that has heard a great many chemistry pitches.

3. What the research on hypochlorous acid shows

This section is about hypochlorous acid, not about our equipment. The distinction is the one this category blurs most often, and keeping it is what makes the evidence usable.

In virucidal hard-surface efficacy testing by **Microbac Laboratories Inc.** (Sterling, Virginia, August 2018), a hypochlorous acid solution at **50 ppm free available chlorine** was tested against **murine norovirus strain MNV-G** — the accepted surrogate for human norovirus, which cannot be routinely cultured — on a ceramic tile carrier, with a 5% serum soil load, at 21°C. The contact time was **one minute**.

Solution	Replicate 1	Replicate 2
50 ppm, pH 5	4.57 log ₁₀ reduction	5.07 log ₁₀ reduction
50 ppm, pH 8	4.07 log ₁₀ reduction	3.82 log ₁₀ reduction

Microbac Laboratories Inc., virucidal hard-surface efficacy test, murine norovirus MNV-G, one minute at 21°C with a 5% serum soil load. Sponsor: IET, Inc. dba EcoloxTech. Both solutions passed the test.

Two things are worth drawing out. First, 50 ppm is a low figure beside the concentrations conventional chlorine protocols work at. Second, and more useful, the two rows differ only in pH — same chlorine concentration, same organism, same soil load, same contact time. At pH 5 almost all of the available chlorine is present as undissociated hypochlorous acid; by pH 8 much of it has shifted to the hypochlorite ion. That is the argument for specifying a set point rather than only a ppm figure, and it is why two products quoting the same number on the label are not necessarily the same solution.

How to read this evidence

- **It is a surrogate.** Human norovirus cannot be routinely cultured, so murine norovirus is used in its place. That is standard practice and accepted for the purpose; it remains a surrogate rather than the human virus.
- **These are sponsor-commissioned laboratory reports**, not peer-reviewed papers. The laboratory is independent and named, the method is a recognised virucidal hard-surface test, and both reports are published in full in our research library so you can read them rather than take our summary of them.
- **One contact time, one temperature, one carrier, one soil load.** The result describes those conditions. A different surface, a heavier organic load or a lower temperature is a different question.

Our research library holds more than 300 indexed studies on hypochlorous acid and electrolysed water across food, water, surface and clinical applications. It is a literature collection, not a body of evidence about any EcoloxTech product, and we present it that way: ecoloxtech.com/research/.

4. Where documented claims come from

If your programme needs a documented disinfection claim against a named organism — for an audit, a procedure, or a customer — that claim comes from a registered product used according to its label. Ours is **HOCl-AS200, EPA Reg. No. 101112-1**, label accepted by the EPA on 10 December 2025.

Label element	As accepted
EPA Registration No.	101112-1
EPA Establishment No.	101112-FL1
Active ingredient	Hypochlorous acid, 0.0174%
Minimum strength in use	Do not use if it contains less than 149 ppm available chlorine
Surfaces	Hard, non-porous surfaces
Pre-cleaning	Surfaces must be precleaned before treatment
Application	Spray 6–8 inches from the surface
Contact time	Surface must remain visibly wet for 5 minutes

The organisms on the accepted label, each at a five-minute contact time on precleaned hard, non-porous surfaces:

Pseudomonas aeruginosa	Staphylococcus aureus	Methicillin-resistant S. aureus (MRSA)
Salmonella enterica	Enterococcus faecium	Escherichia coli
Listeria monocytogenes	Streptococcus pyogenes	SARS-CoV-2
Norovirus (as feline calicivirus)	Murine norovirus	Adenovirus type 5
Herpes simplex virus type 1	Herpes simplex virus type 2	Avian influenza A H3N2
Influenza A H1N1	Respiratory syncytial virus	Rhinovirus type 14
Bovine viral diarrhea virus	Duck hepatitis B virus (HBV surrogate)	Human immunodeficiency virus type 1

Source: the EPA-stamped label for HOCl-AS200, accepted 10 December 2025. Where this paper and the label differ, the label governs.

Two boundaries, stated plainly

HOCl-AS200 is not a terminal sterilant or a high-level disinfectant, and must not be presented as one. Instruments requiring sterilisation or high-level disinfection are outside what this label covers.

The label's contact time is five minutes. The one-minute laboratory figure in section 3 describes a different solution (50 ppm at pH 5) tested for a different purpose. The two are not in conflict, but they must never be presented as if they described the same product.

5. Food contact: what FCN 1811 actually covers

Hypochlorous acid produced by electrolysis is the subject of **FDA Food Contact Notification 1811**. A Food Contact Notification is not an “FDA clearance” and not a device approval — those are different mechanisms, and the distinction matters if an auditor asks you to produce the authority you are relying on.

Two separate authorities apply in a galley, with two different limits, and swapping them is the commonest finding we see:

Authority	Covers	Limit
FCN 1811	Hypochlorous acid in process water or ice in contact with food	Free available chlorine not exceeding 60 ppm , with a drain step or potable rinse for product consumed raw
21 CFR 178.1010	Sanitising solutions on food-contact surfaces	Up to 200 ppm available chlorine, followed by adequate draining

One site-wide ppm figure is therefore wrong somewhere by definition. Write the applicable limit into each procedure and name which authority it comes from.

6. The 2025 VSP Standards

Vessels calling at US ports operate under the CDC's Vessel Sanitation Program. The **2025 VSP Environmental Public Health Standards superseded the 2018 Operations Manual**, and a great deal of supplier and competitor material still in circulation continues to cite the older document. If a supplier quotes the 2018 manual at you, that tells you something about how current the rest of their advice is.

Surveillance thresholds worth having correct

- Report to VSP **36 to 24 hours before** arrival at a US port, with a further update if numbers change.
- A **4-hour update** is required where cases have risen but remain below 2%.
- **2%** cumulative acute gastroenteritis among passengers or crew triggers VSP support and technical assistance.
- **3%** is outbreak classification.
- Case definition: three or more loose stools in 24 hours, or vomiting plus another symptom.

Changes in the 2025 Standards that catch operators out

- Electronic data loggers recording halogen for **at least 16 hours in each 24-hour period**.
- **Legionella** sampling quarterly for spa pools, whirlpools and heated jetted tubs, moving to six-monthly after 24 months of negative results.
- Jetted tubs **drained daily**.

We will not paraphrase the disinfectant requirement for you

Paraphrasing a regulator is how inaccuracies enter this industry, and we would rather lose an argument than start one. Read the disinfectant provisions of the current Standards directly and check your written outbreak prevention and response procedures against that text — not against any supplier's summary of it, including ours.

If a supplier shows you a quotation from the Standards, ask for the section number and the page, and check it yourself before it goes into your procedures.

7. The cost model

EcoloxTech has worked with Norwegian Cruise Line Holdings since 2016, and EcoloxTech E-300 generators have been installed fleetwide since 2020. The figures below are our cruise-line cost data for a 4,266-guest reference ship. Fleet columns are that reference scaled *per berth*, not per ship.

	One ship (4,266 guests)	NCL fleet (21 ships)	NCLH fleet (34 ships)
Sanitation spend before	\$285,000	\$4.23M	\$4.76M
Recurring cost after	\$1,400	\$20,800	\$23,400
Net saving per year	\$283,600	\$4.21M	\$4.74M
Equipment, one time	\$130,000	\$1.93M	\$2.17M
Payback	about 5.5 months	about 5.5 months	about 5.5 months
Net over five years	\$1.29M	\$19.1M	\$21.5M

Source: EcoloxTech cruise-line cost data, scaled per berth. Our own figures, not independently audited.

Three caveats, because a number this large should invite scepticism

- **The saving is a chemical-purchase saving.** It excludes freight, stowage, hazardous-waste disposal and the crew hours spent receiving, moving and mixing — all of which fall as well. The table understates the operational case, and we have left it understated rather than estimate figures we cannot support.
- **The fleet columns are arithmetic, not measurement.** One reference vessel was measured; the fleet figures are that vessel scaled by berth count. Treat them as an order of magnitude rather than an audited total.
- **Payback is identical across the columns by construction,** because saving and equipment cost scale with the same berth count. That is a property of the arithmetic, not a finding.

The number that matters is yours, not ours. Take your last twelve months of sanitation chemical invoices and run the same arithmetic.

8. What onsite generation does not fix

No supplier document is worth reading if it only lists advantages.

- **It is not a substitute for a VSP programme.** It is one input to housekeeping and water management, and it changes nothing about your written procedures, your surveillance obligations or your training.
- **It does not replace cleaning.** Precleaning is a requirement, not a recommendation. Any supplier presenting a one-step clean-and-disinfect use is describing something the label does not support.
- **We do not offer a Legionella answer.** Legionella is a water-system engineering problem — temperature, stagnation, and the design of the system itself. Our research library contains no Legionella studies and we cite none.
- **You swap one supply chain for a narrower one.** A vessel running generators needs membranes, electrodes and control boards delivered to wherever the ship is. Spares are lower volume and weight than drummed

chemistry, which is the point — but they are less substitutable. If a plant runs out of one sanitiser it buys another; if a cell fails, nothing else aboard makes hypochlorous acid. Hold critical spares aboard, keep a documented fallback, and treat the system as shipboard plant with a maintenance schedule and a parts list.

- **Generation needs power and feed water of a known quality.** A vessel with marginal water treatment has a prerequisite to sort out first.
- **Crew competence shifts rather than reduces.** Less chemical handling, more measurement and basic plant maintenance. That is a training change, not a training saving.

9. Questions to ask any supplier, including us

If this paper is useful for one thing, let it be this list. Every question below has an answer we are happy to give, and several of them are questions our competitors will struggle with.

- **Is what you are selling me a device or a registered product?** If the equipment carries efficacy claims, ask which EPA registration number those claims sit under.
- **Show me the accepted label.** Which organisms, what contact time, which surfaces, what pre-cleaning requirement, what minimum strength in use?
- **Is that a study or a claim?** If a percentage or a contact time comes from research, ask for the laboratory, the method, the organism, the soil load and the report itself — not a summary of it.
- **What pH, and how is it verified at the point of use?** Concentration alone does not describe a solution.
- **What is the spares lead time to a vessel at sea,** and what do you recommend we hold aboard?
- **How does the solution behave between generation and use?** Storage time, container and light all matter.
- **Which authority applies to each use** — food-contact surfaces, process water or ice — and what is the limit under each?
- **What does your equipment not solve?** A supplier with no answer to this has not thought about your operation.

Sources and further reading

- EPA-stamped label, HOCl-AS200, EPA Reg. No. 101112-1, accepted 10 December 2025.
- Microbac Laboratories Inc., virucidal hard-surface efficacy reports, murine norovirus MNV-G, August 2018 — published in full at ecoloxtech.com/research/.
- FDA Food Contact Notification 1811; 21 CFR 178.1010.
- CDC Vessel Sanitation Program, 2025 Environmental Public Health Standards, and the VSP surveillance guidance at cdc.gov/vessel-sanitation/.
- EcoloxTech cruise-line cost data; deployment history with Norwegian Cruise Line Holdings. Case study at ecoloxtech.com/case-studies/norwegian-cruise-line/.

About this revision

This edition supersedes the April 2026 white paper. The earlier version attributed efficacy claims to our generators, described FCN 1811 as an FDA clearance, characterised the research library as norovirus evidence, and quoted a section of the VSP Standards we have not been able to verify in the primary text. Those statements have been removed or corrected here.

If you hold a copy of the April 2026 edition, please replace it with this one.