UV-C Robot Reduces Water and Chemicals

BLUE OCEAN ROBOTICS
- for humans

Approx. 700 L less chemical used per year

Approx. 5,000 L less water for injection per year



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Which SPP thematic track does your case study align with?
Planet

Where does your case study sit within the procurement lifecycle?
Manage: implementing the selected solution and monitoring sustainability performance.

What was the core challenge you were facing, and what was the context?
At a global pharmaceutical company's manufacturing site in the Netherlands, aseptic and non-aseptic areas used manual chemical disinfection, consuming chemicals and water for injection. The challenge was to reduce this use and related waste without weakening environmental-monitoring performance. As personnel are a recognised potential source of microbial and particulate contamination, the site also sought to reduce human presence in these areas. This objective is consistent with EU GMP Annex 1 which identify personnel as a potential contamination source and state that only the minimum number required should be present in cleanrooms. Any alternative had to fit established workflows, operate around fixed equipment and be validated before routine use.

What approach did you take to tackle the challenge? The global pharmaceutical company first assessed market options for reducing chemical disinfection, comparing efficacy, cleanroom suitability, automation and implementation needs. It selected autonomous UV-C and worked with Blue Ocean Robotics on a phased rollout. A site survey defined room classifications, layouts, workflows and target doses. The robot was mapped across selected aseptic and non-aseptic areas, with docking, saved locations, preferred and restricted zones and routes configured around equipment. Navigation and room setups were tested before workflows were finalised. UV-C delivery was verified with indicators and dosimeters, supported by surface-coupon testing and environmental monitoring. Installation qualification and site acceptance testing followed, alongside operator and superuser training. Deployment began in the Grade B filling area.

What was the outcome, and how did you measure the impact?
Following implementation of one autonomous UV-C robot, the company's manufacturing site reported annual reductions of approximately 700 litres of chemical use and 5,000 litres of water for injection. The impact was quantified by comparing consumption under the previous chemical disinfection process with annualised consumption after UV-C was incorporated into routine workflows. The automated process also reduced the need for personnel to enter cleanrooms for disinfection and lowered chemical handling. Additionally, the reduced time needed for disinfection made it possible to increase production from 2 to 3 batches a day.

Who was involved and how did you build buy-in (or not)? The project involved the company's manufacturing science and technology, microbiology, manufacturing engineering, safety, health and environment, facilities and operators, supported by Blue Ocean Robotics' implementation team. Buy-in was built by linking the initiative to the site's digital and sustainability plans while addressing quality and operational risks before rollout. Stakeholders jointly reviewed rooms and workflows, agreed target UV-C doses and validation methods, and assessed dosimeter, surface-coupon and environmental-monitoring results.

This is a community-sourced case study
Entry date: October 2026
Please note: The Guide has benefited from the input of individuals, companies, and organizations.
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What was the cost or investment required, and what have been the expected (or unexpected) business trade-offs or benefits?

The investment comprised the autonomous UV-C robot and internal resources for site assessment, mapping, validation, room preparation, connectivity, procedure updates and training. Ongoing requirements include servicing, lamp replacement and electricity. The main trade-offs were the upfront investment, specialist time from quality, microbiology and engineering, and the need to run UV-C cycles in unoccupied rooms. In return, the site reduced chemical and water-for-injection consumption, chemical handling and operator presence in cleanrooms. Automation also freed staff time from parts of the manual disinfection process and supported a more consistent, repeatable workflow.

What were the key success factors?

The key success factor was selecting and validating a technology that supported compliance with EU GMP Annex 1 while delivering measurable sustainability benefits. Autonomous UV-C reduced the need for people to enter cleanrooms during disinfection, lowered chemical use and reduced water-for-injection consumption without compromising microbiological control.

What was the "ugly truth" you encountered & what would you do differently next time?

The "ugly truth" was that the robot was not a plug-and-play replacement for chemical disinfection. In a regulated cleanroom, routes, doses, equipment and workflows had to be mapped, tested and validated. Fixed equipment, UV-C shadowing, automatic doors, connectivity and missing power at the docking point added complexity. Next time, the global pharmaceutical company would recommend to involve teams as early as possible, verify infrastructure in advance and start with one room and workflow. Others should allow more time for validation and process adjustment than for installation.

How would you recommend those with fewer resources approach this?

Teams with fewer resources should initially use autonomous UV-C as a supplementary disinfection step rather than replacing the validated primary process. Start with one clearly defined, lower-risk area with less demanding validation requirements, such as a non-aseptic support or storage room, subject to a documented risk assessment. Retain the existing cleaning and disinfection procedure, but at fewer weekly/monthly intervals, introduce one standard UV-C workflow and verify delivery with dosimeters and routine environmental monitoring.

For whom would you recommend this initiative?

This initiative is best suited to pharmaceutical and life-science manufacturers with cleanrooms or controlled environments, including EU GMP Annex 1 settings, that want to reduce chemical disinfectants, water for injection and personnel entry while maintaining contamination control. It is particularly relevant for sites with frequent, repeatable disinfection cycles, established quality systems and clear water, waste or digitalization goals. Key functions microbiology, quality assurance, engineering and facilities, safety and environment, sustainability and procurement. Organizations with less validation capacity can begin in lower-risk, non-aseptic areas before expanding.

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