November 2025

Criteria Antibiotic Smart Sweden – Water and wastewater sector

The water and wastewater sector is essential for building an antibiotic-smart society. By adopting Antibiotic Smart Sweden's criteria, participating organisations contribute to reducing the spread of antibiotic substances and antibiotic-resistant bacteria in both society and the environment.

These criteria have been developed in close collaboration with stakeholders and experts within Sweden's water and wastewater sector and have been tested by organisations across different regions.

- Criteria 1–5 apply to organisations operating wastewater treatment plants.
- Criteria 1, 3, 4, and 5 apply to organisations managing wastewater distribution networks.
- Criteria 1 and 5 apply to organisations responsible for drinking water plants.

Note: All details are not included in this translation. Full information is available in Swedish at:

Antibiotikasmart Sveriges kriterier för vatten- och avloppssektorn (antibiotikasmart.se)

Organisation and collaboration

1. One representative for the organisation participates actively in the municipal working group on antibiotic resistance together with representatives from other antibiotic-smart sectors within the municipality.

Background: To work towards the vision of an antibiotic-smart Sweden, collaboration needs to take place between different sites, organisations and sectors at the municipal level. The purpose is to create mutual understanding of the work and challenges faced.

Applicability: This criterion applies only if the municipality is already an antibiotic-smart municipality or is actively working towards becoming one. Collaboration with other sites or organisations, in any form, is strongly encouraged.

Fulfilment: The organisation takes part in the municipal working group for antibiotic-smart sectors within the municipality. Active participation in meetings is encouraged to ensure effective collaboration, although attendance at every meeting is not mandatory. The organisation should, however, be able to demonstrate meaningful engagement—such as contributing ideas, sharing expertise, and maintaining dialogue to support joint efforts.

Reporting: Have you participated in dialogue with other antibiotic-smart sectors within the municipality by actively taking part in the municipal working group on antibiotic resistance? Enter yes/no.

Describe the activities, for example which meetings you have participated in or how other collaborations and interactions have taken place.

Measurements

2. The organisation measures levels of selected antibiotics as well as Escherichia coli (E. coli) and intestinal enterococci in the effluent water from wastewater treatment plants with:

- a minimum of one measurement per year for at least one wastewater treatment plant serving less than 20,000 people, and
- a minimum of two measurements per year for all wastewater treatment plants serving more than 20,000 people.

Background: To address the spread of antibiotic resistance in the environment, reliable data on antibiotic levels and resistance are needed. Today, such data are limited, making it difficult to fully understand the problem and implement effective measures. Antibiotic-smart water and wastewater organisations are therefore encouraged to measure and report concentrations of selected antibiotics in effluent from treatment plants.

Measuring resistance in wastewater is complex and costly. Since antibiotics exert selective pressure, some bacteria leaving treatment plants will always carry resistance. Measuring bacterial levels is simpler and less expensive, so organisations should also monitor the indicator organisms E. coli and intestinal enterococci in the effluent. While single samples provide limited insight, combined data help build knowledge.

There is no consensus on which antibiotics are most relevant to track in Sweden. To ensure comparable data, Antibiotic Smart Sweden has developed a list of substances based on EU watch lists, Swedish regulations, and expert input. The selected antibiotics are shown in Table 1, along with PNEC values for resistance and ecotoxicity.

For bacteria, E. coli and intestinal enterococci were chosen as indicators, aligning with Swedish bathing water regulations. Using the same parameters enables comparisons with downstream bathing sites.

Applicability: This criterion applies only to organisations operating wastewater treatment plants.

Fulfilment:

- Plants serving <20,000 people: one measurement in September.
- Plants serving >20,000 people: measurements in April and September.
- Sampling should be 24-hour composite during normal flow. Deviations must be justified.
- At least 7 of 8 listed antibiotics must be measured using LC-MS/MS after SPE preparation.
- Both indicator bacteria must be analysed using approved ISO methods (see Table 2).

Table 1: The antibiotic substances to be analyzed along with PNEC values for resistance and ecotoxicity, which can be used as reference points to assess one's own contribution to environmental risk.

Antibiotic Substance	PNEC for Resistance (µg/L)	PNEC for Ecotoxicity (µg/L)
Ciprofloxacin	0.064	0.57
Sulfamethoxazole	16	0.6
Trimethoprim	0.5	100
Erythromycin	1.0	0.5
Clarithromycin	0.25	0.08
Azithromycin	0.25	0.02

Antibiotic Substance	PNEC for Resistance (µg/L)	PNEC for Ecotoxicity (µg/L)
Fluconazole	0.25	-
Ketoconazole	-	-

Table 2: Selected Indicator Bacteria and Their Analysis Methods

Indicator Bacteria	Analysis Methods
E. coli, Intestinal Enterococci	ISO 9308-3, ISO 9308-1, SS 028167:2, ISO 9308-2, ISO 7899-1, ISO 7899-2

Reporting:

- How many treatment plants serving less than 20,000 people do you have? Enter number.
- How many treatment plants serving more than 20,000 people do you have? Enter number
- Enter the measured values for each respective measurement and treatment plant.

Working methods

3. The organisation must have a documented preventive plan and a defined goal to reduce the volume of untreated wastewater discharged during overflow events.

Background: Efforts to prevent wastewater overflow are already underway in many areas, and permitted treatment plants (> 2,000 population equivalents) are already required to report overflow incidents in their environmental reports. The reason overflow is included in Criterion 3 is that it represents one of the most important measures to reduce the spread of antibiotic-resistant bacteria. By aiming to reduce the volume of untreated overflow wastewater, this pathway for the spread of antibiotics and bacteria can be limited.

Overflow of untreated wastewater refers to untreated or insufficiently treated sewage discharged from the sewer network or treatment facility that does not pass through the sampling point used for treated effluent. Since overflow is largely influenced by precipitation, which can vary significantly from year to year, the goal should be formulated as a reduction in the average overflow volume over the past five years.

Applicability: This criterion applies to water and wastewater operations that include sewer networks and/or treatment plants.

Fulfillment: Documented efforts to reduce overflow. This may include a developed plan incorporating one or more of the following actions: reducing the amount of inflow and infiltration water, eliminating overflow points, increasing pump capacity, or other well-justified measures, along with follow-up on these actions.

Reporting: Do you have a documented preventive strategy to reduce the volume of overflow wastewater? Answer yes/no and describe the most important planned action for the coming year in the comment.

Do you have a target to reduce the volume of discharged untreated overflow wastewater? Answer yes/no and describe the target in the comment.

What is the average volume of untreated overflow wastewater over the past five years? Provide a measured or estimated value for all untreated overflow discharges from all treatment plants and sewer networks.

Building knowledge

4. The water and wastewater utility shall carry out upstream work related to antibiotics and the development of resistance among connected operations.

Background: It is important to keep antibiotic levels in wastewater as low as possible, making upstream measures crucial. The aim is not to restrict necessary medical prescriptions but to promote dialogue and knowledge sharing. Actors releasing antibiotic residues into wastewater should understand how water systems work and what measures they can take to prevent the spread of antibiotics and resistance.

Applicability: This criterion applies to water and wastewater utilities operating networks and/or treatment plants.

Fulfilment: Upstream actions are complex and should be adapted to local conditions. Below are some suggested approaches for different sectors:

Public: Information campaigns to ensure unused medicines are collected, not flushed.

Industry: Implement safeguards to prevent active substances or resistant bacteria from entering wastewater. Collaborate with municipal environmental departments to identify relevant actors and open dialogue.

Universities: Discuss handling of antibiotic-containing water, focusing on collection and disposal as hazardous waste.

Healthcare and elderly care: Foster mutual understanding of risks and opportunities. Joint risk assessments and projects can reduce risks, e.g., addressing infiltration or testing treatment of concentrated streams.

General: Explore source-level measures for concentrated flows, such as:

- No floor drains in antibiotic-handling areas.
- Spill response plans and quick reporting.
- Treating antibiotic-rich wastewater as hazardous waste or applying inactivation processes.

Reporting: Are you performing upstream activities about antibiotics and resistance to connected facilities? Enter yes/no and describe your work.

5. The organisation should contribute to knowledge development in the field.

This can be done, for example, by participating in research projects and other forward-looking initiatives, or by exchanging experience to spread good practices in the work against resistance development.

Background: One of the aims of the work within Antibiotic Smart Sweden is to increase awareness of antibiotic resistance across all parts of society. By engaging in knowledge-building activities and sharing experiences, organisations can contribute to improving antibiotic-smart efforts and accelerating progress. The idea is that knowledge-building projects should be published in one central location, making them accessible to everyone and maximizing their potential benefit.

Applicability: This criterion applies to all water and wastewater organisations.

Fulfillment: Knowledge-building projects and sharing experience can take various forms and are not dictated by Antibiotikasmart Sverige. Collaboration may vary and can involve all types of organizations, both nationally and internationally. The work may include knowledge-building and experience exchange with academia, other VA operations, and other sectors of society.

Reporting: Are you participating in knowledge-building projects in this area? Indicate yes/no and provide examples and, if possible, a link to the project in the comment.

Are you participating in experience exchanges in this area? Indicate yes/no and provide examples in the comment.