Scottish Environment Protection Agency
Buidheann Dìon Àrainneachd na h-Alba

For the future of our environment

Marine finfish farm developments and other users of the water environment

Version 1.0

July 2025

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1. Purpose

When determining applications for a licence to develop a new marine fish farm or to modify an existing fish farm, SEPA is required to assess the impact of proposed discharges of farm effluents (e.g. fish faeces and used medicines) on the interests of other users of the water environment.

Nearly all the concerns raised with SEPA about proposed fish farm discharges are about their potential interactions with the interests of swimmers, shellfish farmers or commercial capture fisheries.

Sometimes we also receive representations raising concerns about the impact of the operation of farm infrastructure (pens, barges, etc) on landscape and visual amenity; access to parts of the sea, for example, for fishing vessels; or local noise levels. Such concerns do not fall within SEPA's regulatory scope but will be considered by the relevant local authority when it is determining applications for planning permission.

Our assessments include a generic screening assessment and, if necessary, site-specific assessments. This document summarises:

- Our assessment process.
- Where we have concluded, based on generic screening assessments, that a type of discharge does not have the potential to adversely affect a type of use and, hence, site-specific assessments are not required for that discharge/water use combination.

2. Assessment process

The process we use to assess whether a proposed fish farm discharge is likely to impact on the interests of other users of the water environment involves a stepwise risk assessment.

Generic screening assessment

The first step is a generic screening assessment. This is an assessment of whether, in principle, the type of discharge concerned has potential to impact on the interests of the other users of the water environment concerned; and, if it does, the circumstances necessary for there to be an impact.

For example, such an “in principle” assessment might involve comparing:

- The maximum concentrations of substances that discharges from a farm could produce in the water environment under different scenarios.
- Information on the maximum concentrations of the substances in the water environment that would **not** impact on the other users of the water environment’s interests.

If the assessment concludes that there is no reasonable likelihood under any plausible scenarios that discharges of the type concerned would impact the other users of the water environment’s interests, we will apply this conclusion generally and not require site-specific assessments.

Initial site-specific assessment

If impact is not ruled out at the generic screening assessment step, an initial site-specific assessment will be undertaken. This involves two steps:

- Identifying if, and where, in the vicinity of the proposed farm development the other use of the water environment is occurring.
- Using screening models to assess whether substances from the proposed discharge could reach those locations in concentrations that could impact the other users of the water environment’s interests.

Some information is held publicly about relevant other uses of the sea. For example, information on the location of active shellfish sites is available on Scotland’s Aquaculture Website. However, we have also designed our pre-application and application processes for marine fish farm developments to find out about other water uses occurring in the vicinity of proposed developments.

At pre-application, we ask developers to organise engagement with local communities, including to gather local knowledge about other water uses in the area. We publish our initial screening modelling and risk identification reports, so they are available to help inform this engagement.

If other uses of the sea are identified in the vicinity of a proposed fish farm development, we will update our screening report for the proposed development to include information on if, and how, substances discharged from the farm could interact with locations at which the other uses take place. We will use the outputs of our screening models to generate this information.

It is important that our assessments are based on good evidence. For this reason, we expect anyone who wishes us to consider potential risks to the interests of other users of the water environment provides:

- A description of the type of use.
- Appropriate evidence that the use is a current and on-going use.
- Suitable details to pinpoint the locations where the other use takes place.
- Information on the pattern of use during a year.
- Information on the scale of the use (e.g. estimated number of users, etc).

Detailed site-specific assessment

If initial screening concludes that the discharged substances could reach the locations where the other uses of the water environment take place in concentrations that could impact the interests of the users, the final step in assessing impact is a detailed site-specific assessment.

A detailed site-specific assessment will involve:

- Refined modelling of the dispersion of discharged substances to provide robust, and appropriate resolution, predictions of the concentrations of substances likely at the locations at which the other uses of the sea take place.
- Consideration of any relevant detailed information about the use, such as its timings, and any specific aspects of the proposed operation of the fish farm that would mitigate or otherwise affect interaction with the use.

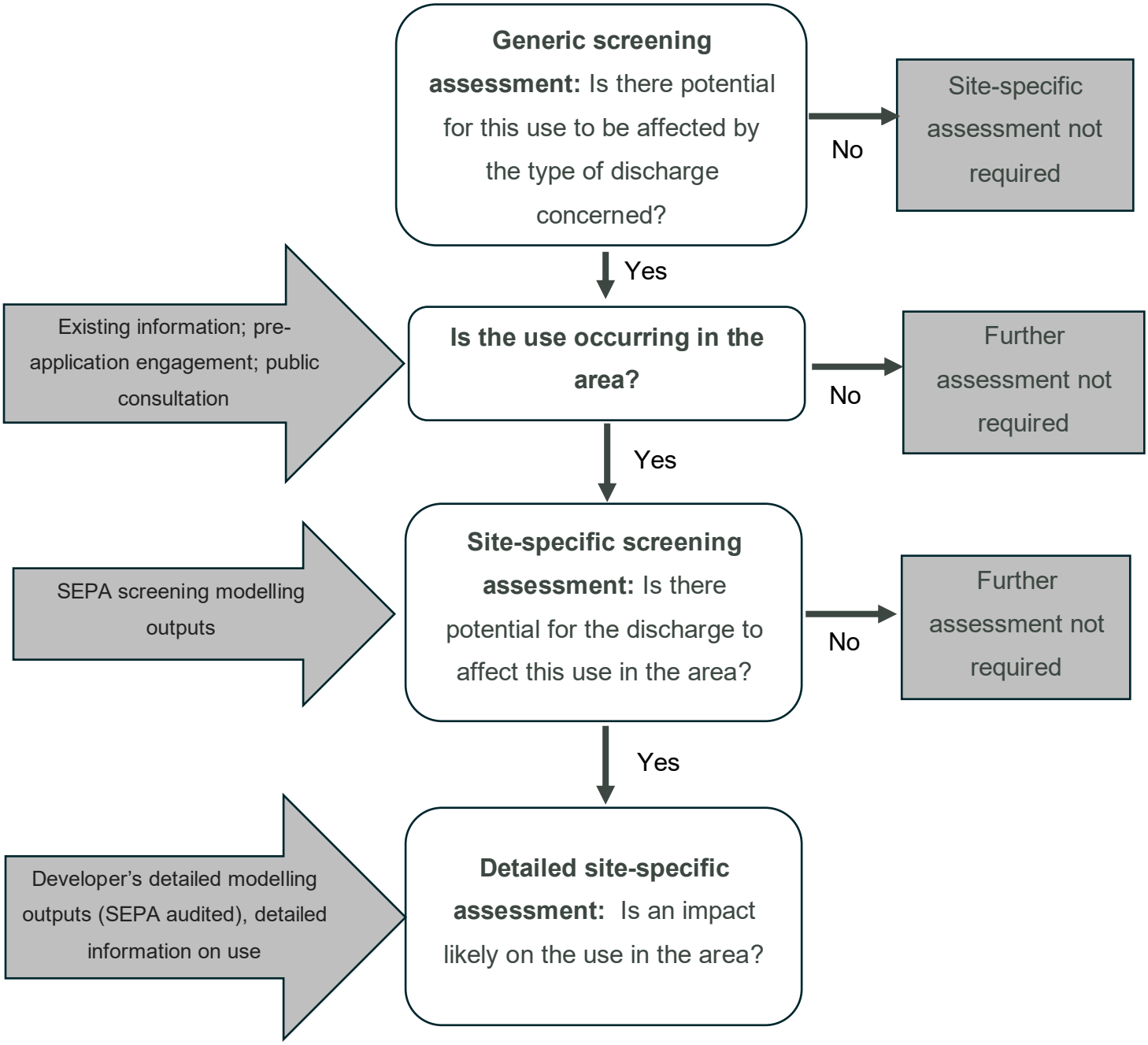
If a detailed site-specific assessment is needed, we will require the developer to undertake the required refined modelling; collect any additional information needed; and submit both when making an application. We will advise developers on modelling methods and will audit the modelling information that they submit.

Once we have received an application for a discharge of organic waste or medicines at a fish farm, we will publish all the information submitted by the applicant; and ensure that the application is advertised for public consultation. The locations at which other water uses take place should have been identified at the pre-application stage. However, the public consultation exercise (via advertisement of proposed fish farm developments) provides an opportunity for interested parties to check that all relevant locations in the vicinity of the proposed development are being considered.

Once we are satisfied that we have the information needed for the detailed site-specific assessment, we will carry out that assessment to decide if there is a likelihood that the proposed discharge will impact on the interests of the other users of the water environment.

The stepwise assessment process described above is summarised in Figure 1 below.

Figure 1: General assessment process for identifying impacts on the interests of other users of the water environment



3. Assessment of specific water uses

This section of this guidance currently describes our assessment of the implications of certain farm discharges for:

- Swimmers.
- Commercial shellfish farming interests.

Unless otherwise stated, the conclusions of these assessments are not applicable with respect to other uses of the water environment.

3.1 Swimming

This section covers assessment of the implications of fish farm discharges for swimmers.

The conclusion of our generic screening assessment of discharges of the medicines, azamethiphos, deltamethrin and hydrogen peroxide, is that they do not pose a risk to the health of swimmers at the concentrations to which swimmers could be exposed and, hence, site-specific risk assessments are not required.

Swimming involves full immersion in the sea. This means swimmers will have greater exposure to any discharged substances in the water than non-immersive recreational uses of water. Consequently, a conclusion of no risk to the health of swimmers is equally applicable with respect to other recreational users of the sea.

3.1.1 Discharges assessed

Our assessment considers discharges of three medicines:

- Azamethiphos.
- Deltamethrin.
- Hydrogen peroxide.

Fish farm authorisations permit the discharge of hydrogen peroxide under certain conditions. Fish farm developers typically also seek authorisation to discharge azamethiphos and/or deltamethrin.

Discharges of hydrogen peroxide, azamethiphos and deltamethrin are intermittent and made following treatment of fish in situ in a fish pen or treatment of fish in a tank in a vessel at the farm. As a condition of licences, farmers are not permitted to use azamethiphos and deltamethrin simultaneously.

Being large, discharges of azamethiphos and deltamethrin do not mix instantaneously in the receiving seawater. This results in the creation of a plume within which the concentrations of the medicines will be temporarily higher than the environmental standards applied to those medicines by SEPA.

3.1.2 Generic screening assessment

Our generic screening assessment was based on:

- A report prepared by an external consultant, commissioned by Salmon Scotland, deriving potential no effects levels for people for each of the medicines and setting out a model to enable safe exposure concentrations to be derived for different sized swimmers and swim times.
- The results of dispersion modelling undertaken by Salmon Scotland simulating the dispersion of discharges from two different pen sizes and into different receiving waters covering a range of different current speeds (reported as an appendix to the report).

Although sinking and vertical mixing of plumes in the sea will occur, for the above modelling assessment, a worst-case scenario was assumed under which the plumes remain at the sea surface as they disperse from the farm.

Based on the evidence referred to above, the outcome of our generic screening assessment is that:

- Safe exposure concentrations for azamethiphos and deltamethrin are not exceeded at their maximum treatment concentrations.

- Safe concentrations for long exposures would be exceeded for hydrogen peroxide at maximum treatment concentration.
- Mixing in the sea of hydrogen peroxide after discharge is rapid. Evidence from the dispersion modelling is that there is no realistic prospect of someone swimming even near a fish farm to experience an exposure to concentrations of hydrogen peroxide above safe exposure concentration levels.

A summary of the evidence is provided in Appendix 1.

3.2 Shellfish farming

3.2.1 Discharges assessed

Our assessment considers discharges of two bath treatment medicines:

- Azamethiphos.
- Deltamethrin.

The conclusion of our generic screening assessment for discharges of azamethiphos and deltamethrin is that they do not pose any significant risk or likelihood of significant risk to the interests of shellfish farmers and, hence, site-specific assessments are not required.

Discharges of azamethiphos and deltamethrin are intermittent and made following treatment of fish in situ in a fish pen or treatment of fish in a tank in a vessel at the farm. As a condition of their licences, we only permit farmers to use one of these medicines at a time.

Being large, discharges of the medicines do not mix instantaneously in the receiving seawater. This results in the creation of a plume within which the concentrations of the medicines will be temporarily higher than environmental standards applied to those medicines by SEPA.

3.2.2 Generic screening assessment

Exposure of shellfish at shellfish farms is likely to be brief due to the intermittent nature of the discharges and rapid dilution and dispersion of discharge plumes. Consequently, our generic screening assessment for the medicines considers short exposures.

The environmental standards for azamethiphos and deltamethrin comprise standards applicable to different, short exposure periods (e.g. 3 hours and 24 hours). Typical treatment concentrations of the medicines and time-bound exposure environmental standards are summarised in Table 1.

Table 1: Typical treatment concentrations and environmental standards for azamethiphos and deltamethrin.

Data	Azamethiphos	Deltamethrin
Treatment (i.e. pre-discharge) concentration (mg/L)	0.12	0.002
Environmental standard 3 hours post release (mg/L)	0.00025	0.000009
Environmental standard 24 hours post release (mg/L)	0.00015	0.000002

According to the 2023 Scottish Shellfish Farm Production Survey, all the commercially farmed shellfish species in Scotland are molluscs. The main farmed species by tonnage are mussel (*Mytilus edulis, Mytilus galloprovincialis and hybrids*) and pacific oyster (*Crassotrea gigas*). Smaller numbers of native oyster (*Ostrea edulis*); queen scallop (*Aequipecten opercularis*); and king scallop (*Pecten maximus*) are also farmed.

Azamethiphos

Our generic screening assessment is that discharges of azamethiphos are unlikely to pose a significant risk to farmed shellfish species. This is because:

- Pre-discharge concentrations are only slightly above 0.1mg/L, the concentration that the available evidence suggests does not pose a risk to molluscs (see Appendix 2).
- Dispersion and dilution following discharge will rapidly reduce the concentration of azamethiphos in discharge plumes to below 0.1mg/L.

Consequently, site-specific impact assessments of risks to commercially farmed shellfish from discharges of azamethiphos are not required.

Deltamethrin

Our generic screening assessment is that discharges of deltamethrin are unlikely to pose a significant risk to farmed shellfish species when discharged at a treatment concentration of 0.002mg/L. The available evidence indicates this concentration is lower than the concentrations that have the potential to harm molluscs (see Appendix 2). **Consequently, site-specific impact assessments of risks to commercially farmed shellfish from discharges of deltamethrin are not required.**

Appendix 1: Swimming and bath medicines

This appendix summarises the principal evidence we used for our generic screening assessment of discharges of bath medicines and their potential to affect people using the sea to swim.

The information in Table 2 is derived from a report, "*Assessment of potential risk to human health following use of azamethiphos, deltamethrin and hydrogen peroxide in fish farms, October 2023*" prepared by a chemical risk assessment and environmental consultancy commissioned by Salmon Scotland.

Table 2: Summary of data derived from an assessment carried out by the chemical risk assessment and environmental consultancy commissioned by Salmon Scotland on no effects levels and safe exposure concentrations for azamethiphos, deltamethrin and hydrogen peroxide.

Data	Azamethiphos	Deltamethrin	Hydrogen peroxide
Oral derived no effects level (mg/kg/day)	0.00125	0.025	0.5
Dermal derived no effects level (mg/kg/day)	0.0025	0.05	0.33
Oral safe 2-hour exposure concentrations for 71.8kg adult (mg/L)	1.795	35.9	718.0
Oral safe 2-hour exposure concentrations for 40kg child (mg/L)	1.0	20.0	400
Dermal safe 2-hour exposure concentrations (mg/L) for 71.8kg adult	4.931	98.63	650.93

Data	Azamethiphos	Deltamethrin	Hydrogen peroxide
Dermal safe 2-hour exposure concentrations for 40kg child (mg/L)	3.76	75.19	496.24
Maximum treatment concentration (i.e. ignoring dilution/dispersion post-discharge) (mg/L)	0.12	0.002	1,500

The information on safe exposure concentrations for dermal and oral exposures in Table 2 was generated using the SWIMODEL summarised below:

Predicted safe exposure concentration for dermal exposure (mg/L) = Derived no effects level (mg/kg/day) x body weight (kg) ÷ [skin surface area (m^2) x skin permeability (L/m^2/hour) x exposure time (hours/day)]

Predicted safe exposure concentration for oral exposure (mg/L) = Derived no effects level (mg/kg/day) x body weight (kg) ÷ [ingestion rate (L/hour) x exposure time (hours/day)]

The information in Table 3 is based on dispersion modelling carried out by Salmon Scotland.

Table 3: Salmon Scotland modelling (using a BathAuto short-term model) outputs for hydrogen peroxide plume concentrations based on a discharge depth of 4 metres; a starting concentration of 1,500mg/L; and 2 different pen sizes and 3 different receiving water mean current speeds.

Mean current speed (m/s)	0.04	0.10	0.16
Average of mean plume concentration over first 2 hours after discharge from 120m circumference pens (mg/L)	215	133	105
Average of mean plume concentration over first 2 hours after discharge from 160m circumference pens (mg/L)	288	184	135
Average of peak plume concentrations over first 2 hours after discharge from 120m circumference pens (mg/L)	358	222	174
Average of peak plume concentrations over first 2 hours after discharge from 160m circumference pens (mg/L)	480	307	225
Distance travelled by plume from 120m pen before peak concentration less than 651mg/L (m)	43	58	68
Distance travelled by plume from 160m pen before peak concentration less than 651mg/L (m)	64	86	100

Appendix 2: Shellfish species sensitivity and bath medicines

This appendix summarises the principal evidence we used for our generic screening assessment of discharges of bath medicines and their potential to affect commercially farmed shellfish species.

Azamethiphos

Toxicity testing shows that mussel and pacific oyster are several orders of magnitude less sensitive to azamethiphos than, for example, crustaceans. A study of the response of *Mytilus edulis* to 24-hour exposure to azamethiphos identified sub-lethal effects (measurable inhibition of acetylcholinesterase and significant impairment of shell closure) at concentrations greater than 0.1mg/L, similar to the treatment (i.e. pre-discharge) concentration. Data presented in Hamoutene et al 2023 suggest that *Mytilus galloprovincialis* and *Crassotera gigas* are less sensitive to azamethiphos than *Mytilus edulis*.

Deltamethrin

The most sensitive toxicity test results for deltamethrin are for crustaceans and other arthropods (Crane et al 2011) rather than molluscs. Most of the sensitivity data on molluscs are for freshwater molluscs. Marine data are available for the eastern oyster, *Crassostrea virginica*. The concentrations that affect molluscs are similar across species. A no observed adverse effect level (NOEL) of 0.0034mg/L has been identified for *Crassostrea virginica* based on 96-hour exposure studies. This NOEL is higher than the treatment (i.e. pre-discharge) concentration of deltamethrin, 0.002mg/L.

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