



VESIVIISAS
RUOKAJÄRJESTELMÄ

**ELINTARVIKE-
TEOLLISUUDEN BAT-
PÄÄTELMÄT**

**PROJEKTI: VESIVIISAAMMAN RUOKAJÄRJESTELMÄN
RATKAISUMALLI
DNRO: ESAELY/355/2023**

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INVENIRE

**Euroopan unionin
rahoittama**
NextGenerationEU

PROJEKTIN PERUSTIEDOT

Projektissa on tarkoitus luoda ja pilotoida siirrettävä ja monistettava toimintamalli, jonka avulla ruokajärjestelmän toimijoiden veden kiertotaloutta voidaan tehostaa alueellisesti sekä Suomessa että vientimarkkinoilla. Toimintamalli yhdistää suomalaisen vesialan osaamista ruokajärjestelmien ja regeneratiivisen maatalouden tuntemukseen. Toimintamallia testataan projektin aikana Ahvenanmaalla.

Ahvenanmaalaisille elintarvikeyrityksille ja alkutuotannolle projekti tarjoaa apua vesiasioiden kiertotaloudellisuuden kehittämiseen. Suomalaisille vesialan yrityksille projekti tarjoaa kehittyvän alustan vientimahdollisuuksien aukaisemiseen ruokajärjestelmien vesiasioiden kiertotaloudellisuuden parissa.

- Projektin toteuttajat: Invenire Market Intelligence Oy ja Suomen vesifoorumi ry
- Projektin toteutusaika: 1.8.2023 – 31.3.2025
- Projektin rahoitus: Vesiosaamisen kasvu- ja kansainvälistymisohjelma (MMM/NextGenerationEU)

INVENIRE

- **Yleinen tavoite:** Edistää ruokajärjestelmien muutosta fossiilivapaaseen, ravinne-neutraaliin, biodiversiteettiä tukevaan ja vesiviisaaseen suuntaan.
- **Tämän hetken tarve:** Kehittää ahvenanmaalaisen ruokajärjestelmän toimijoiden kiertotaloudellista vesiviisautta. Luoda palvelukonsepti ja työkalut saman työn toteuttamiseksi millä tahansa alueella.

FINNISH WATER FORUM

- **Yleinen tavoite:** Edistää suomalaisen vesiosaamisen kansainvälistä kasvua ja toimia alustana vesialan yhteistyölle.
- **Tämän hetken tarve:** Tiivistää ja kehittää suomalaisten vesialan osaajien yhteistyötä konsortiomallisesti ja avata niille uusia mahdollisuuksia vientimarkkinoilla.

**YHTEINEN PROJEKTI:
VESIVIISAAMMAN
RUOKAJÄRJESTELMÄN
RATKAISUMALLI**

YHTEENVETO

Teollisuuspäästödirektiivi ohjaa teollisten laitosten päästöjä BREF-asiakirjojen BAT-päätelmien kautta. Näitä ovat esimerkiksi kalankasvatamot, teurastamot, meijerit ja lihanjalostuksen parissa toimivat teolliset laitokset. Nämä BREF-asiakirjoissa määritetyt (Best Available Techniques) vaatimukset määrittävät vaatimukset teollisten laitosten toimintaan sekä ympäristöluvan vaatimukseen. Tämä BAT-selvitys on laadittu täydentämään lainsäädäntöselvitystä antaen viranomaisten vaatimusten ohella kuvan niistä teknisistä vaatimuksista, joita osoitetaan suoraan teollisille laitoksille ruoantuotantopuolella ruoan tuotannossa.

EU:n teollisuuspäästödirektiivin (IED) BREF-asiakirjoissa ”määritellyt parhaat mahdolliset tekniikat” BAT-määritelmät antavat rajoitukset teollisuuspäästödirektiivin määritelmien parissa oleville teollisuuslaitoksille. Elintarviketeollisuudessa direktiiviä koskevat alat ovat erikseen määritelty toimialojen mukaan.

Näihin kuuluvat:

- **SA BREF: Slaughterhouses and animal by-products** (Teurastamot ja eläinperäiset sivutuotteet)
- **FDM BREF: Food, Drink and Milk industries** (Elintarvike, juoma ja meijeriteollisuus)

Yleiset huomiot BAT-päätelmien mukaisesta vedenkäsittelystä sektorista riippumatta:

- Veden kierrätys ja uudelleenkäyttö: Kun mahdollista, vesi tulisi käsitellä ja käyttää uudelleen hygienialaadultaan heikommat vaatimukset täyttävissä prosesseissa (esim siivouksessa)
- Erotus: Laadultaan eroavien jätevesien erottaminen kierrätyksen ja jäteveden käsittelyn helpottamiseksi ja kuormittamisen pienentämiseksi
- Paikallinen käsittely: Jäteveden esikäsittely ennen sen päästämistä yhteiskuntajäteveden piiriin haitallisen ravinnekuorman vähentämiseksi.

Käytännössä:

1. veden kierrätys silloin, kun se on kannattavaa/järkevää
2. veden kulutuksen pienentäminen prosesseja tutkimalla/kehittämällä
3. Veden laadun varmistaminen
4. Tarkat kriteerit prosesseissa tapahtuvalle jätevedelle ja vaadittavat teknologiat sen käsittelyyn
5. Edellä mainittuun lisäen: vaaditut parametriarvot päästöille jätevedessä (emission limit values/ELV). Huomionarvoista, että elv:t eivät määrittele pH arvoa, joka on erikseen määritelty.

BAT-päätelmät ja ympäristölupa:

Paikallinen viranomainen käyttää kokonaisharkintaa myöntäessään toiminnalle lupaa. Käytännössä tämä tarkoittaa, että teollisuuspäästödirektiivin ohella määriteltyjen BAT-sääntöjen ohella huomioidaan paikallinen lainsäädäntö sekä mahdollisesti paikalliset erityispiirteet. BAT:in antaessa määritelmän vähimmäisarvoille voi viranomainen määrätä tiukempia rajoituksia paikallista ekosysteemia koskien, mikäli ympäristön arvioidaan olevan tavanomaista herkempi saasteille (esimerkiksi Itämeri).

SLAUGHTERHOUSES AND ANIMAL BY-PRODUCTS (SA BREF)

Water use in slaughterhouses is significant due to the need for hygiene and cleaning. The BREF outlines several techniques to optimize and reduce water use:

- **Efficient cleaning practices:** Adoption of high-pressure, low-volume cleaning systems instead of traditional hoses to reduce the amount of water used for cleaning equipment, floors, and carcasses.
- **Water reuse:** Implementing systems to reuse non-contact cooling water or rainwater where appropriate. Recycled water can be used in non-critical processes like cooling or washing areas that do not require potable water quality.
- **Monitoring water usage:** Continuous monitoring of water consumption to identify areas of excess use, leaks, or inefficiencies, leading to better water management.

For example:

- Using a two-stage washing system where water is reused from the final rinse stage in the initial cleaning stages.
- Installation of flow restrictors on water outlets.

KEY ASPECTS OF DISCHARGE PERMITS FOR SLAUGHTERHOUSES:

1. **Emission Limit Values (ELVs):** The discharge permit will include ELV's for key pollutants in the wastewater, such as:
 - **Biological Oxygen Demand (BOD):** Reflects the amount of oxygen required to break down organic matter in the wastewater. A high BOD indicates high levels of organic pollution.

- **Chemical Oxygen Demand (COD):** A measure of the total amount of chemicals (organic and inorganic) in the water that require oxygen for degradation.
 - **Total Suspended Solids (TSS):** Reflects the amount of particulate matter in the wastewater.
 - **Fats, Oils, and Grease (FOG):** High levels of FOG are typical in fish processing effluent and need to be controlled.
 - **Nitrogen (N) and Phosphorus (P):** Nutrient pollutants that, if discharged in excess, can contribute to eutrophication in receiving water bodies.
 - **pH:** The discharge permit will specify acceptable pH ranges for the wastewater to avoid harmful effects on aquatic life.
2. **Wastewater Treatment Requirements:** The BAT conclusions require that fish slaughterhouses implement appropriate treatment technologies before discharging effluent, such as:
- **Primary treatment:** Screening and filtering to remove solids like fish scales, blood, and offal.
 - **Secondary (biological) treatment:** Biological processes such as activated sludge or biofilters to reduce BOD and COD.
 - **Tertiary treatment:** Removal of nutrients (e.g., nitrogen, phosphorus) through processes like nitrification, denitrification, **and** chemical precipitation to prevent water pollution.
 - **Fats and oils removal: Dissolved Air Flotation (DAF)** or other separation methods to remove fats, oils, and greases from the effluent.
3. **Monitoring and Reporting Obligations:** Permits will include strict monitoring and reporting requirements for fish slaughterhouses. This involves:
- **Regular sampling** of effluent for key pollutants (e.g., BOD, COD, nutrients) to ensure compliance with ELVs.
 - **Continuous monitoring** of waste water flow rates and water quality at discharge points.
 - **Annual reporting** to the relevant environmental authority, detailing emissions and any non-compliance issues.
4. **Water Framework Directive (Directive 2000/60/EC) Compliance:** In addition to the IED, the Water Framework Directive (WFD) sets environmental objectives for all European water bodies. Wastewater discharge permits must ensure that waste water

does not compromise the Good Ecological Status (GES) of the receiving water bodies, meaning that:

- Discharges must not cause deterioration in the quality of surface water (rivers, lakes) or coastal waters.
- Discharges must be in line with the local river basin management plan, ensuring the water body can meet its WFD targets.

Example BAT-AELs for fish slaughterhouses

- BOD: 10–40 mg/l (after treatment)
- COD: 30–125 mg/l (after treatment)
- Total Suspended Solids (TSS): 10–50 mg/l
- Total Nitrogen (TN): 10–40 mg/l
- Total Phosphorus (TP): 1–3 mg/l

Environmental Impact Assessments (EIA): For large fish slaughterhouses, an Environmental Impact Assessment (EIA) may be required under the EIA Directive (Directive 2011/92/EU). This assessment evaluates the potential impacts of wastewater discharges on local water bodies, biodiversity, and ecosystems before the permit is issued.

Summary of Discharge Permit Requirements:

- Emission limits for key pollutants (BOD, COD, TSS, FOG, N, P)
- Wastewater treatment: Mandated use of primary, secondary, and tertiary treatments to minimize pollution.
- Monitoring and reporting: continuous monitoring of quality including mandatory reporting to authorities.
- Compliance with EU water regulations: permits must align with both the IED and the Water Framework Directive, ensuring no harm to water bodies.

To maintain compliance, fish slaughterhouses must ensure that their discharge permits are in line with the national transpositions of the EU regulations, which **may also include stricter local requirements** depending on the region and sensitivity of the receiving waters.

FOOD, DRINK, AND MILK INDUSTRIES (FDM BREF) – INCLUDING PROCESSING OF MEAT AND FISH PROCESSING

Water is extensively used in processing meat and fish (for cleaning, cooling, and as a processing medium). BAT measures for water use focus on efficiency, recycling, and reducing wastewater generation.

- **Water recirculation and reuse:** Implementing closed-loop systems to reuse water from processes like cooling, rinsing, and cleaning where safe and feasible, without compromising food safety standards.
- **Segregation of water streams:** Keeping clean and contaminated water streams separate to allow for easier treatment and reuse. This includes using high-quality water only where necessary (e.g., for direct product contact), while lower-grade water can be reused in less critical applications.
- **Optimizing water use in processing:** Minimizing water usage in equipment like conveyors, washers, and scalders in the meat processing industry. Fish processing plants are encouraged to use countercurrent water flow systems for washing fish, which significantly reduces overall water consumption.

KEY ASPECTS FOR DISCHARGE PERMITS FOR SLAUGHTERHOUSES AND MEAT PROCESSING

Slaughterhouses and meat processing facilities generate wastewater high in organic matter (e.g., blood, fat, proteins), suspended solids, nutrients (nitrogen, phosphorus), and pathogens. Discharge permits for these facilities must take into account the treatment and management of these substances.

Key Regulations for Slaughterhouses and Meat Processing:

- **Emission Limit Values (ELVs):** Permits will set ELVs for pollutants in wastewater, such as:
 - **Biochemical Oxygen Demand (BOD):** Indicates the amount of oxygen required to biologically break down organic matter.
 - **Chemical Oxygen Demand (COD):** Measures the total amount of organic and inorganic substances in the wastewater.
 - **Total Suspended Solids (TSS):** Represents particulate matter like blood and tissue.

- **Fats, Oils, and Grease (FOG):** A significant component in wastewater from slaughterhouses and meat processing.
- **Nitrogen (N) and Phosphorus (P):** Important nutrients that must be controlled to prevent eutrophication in receiving waters.
- **pH:** Ensures the wastewater is within acceptable limits to prevent harm to aquatic environments.

Wastewater Treatment Requirements:

Facilities must implement Best Available Techniques (BAT) to treat wastewater before discharge. These techniques include:

- **Screening and filtering** to remove large solids (e.g., meat particles, bones).
- **Dissolved Air Flotation (DAF)** for removing fats, oils, and grease.
- **Biological treatment** (e.g., activated sludge systems) to reduce BOD, COD, and nutrients.
- **Tertiary treatment** (e.g., nitrification, denitrification, phosphorus removal) to further reduce nutrients like nitrogen and phosphorus.
- **Disinfection** to remove pathogens and ensure wastewater is safe for discharge

Example BAT-AELs for meat processing

- **BOD:** 10–50 mg/l
- **COD:** 30–125 mg/l
- **TSS:** 10–50 mg/l
- **Total Nitrogen (TN):** 10–40 mg/l
- **Total Phosphorus (TP):** 1–5 mg/l
- **FOG:** 5–20 mg/l

KEY ASPECTS OF DISCHARGE PERMITS FOR DAIRY PRODUCTION:

1. **Emission Limit Values (ELVs):** The discharge permits for dairy production will include ELV's for several key pollutants commonly found in dairy wastewater:

- **Biochemical Oxygen Demand (BOD):** Represents the organic matter that can be biologically degraded in wastewater. Dairy wastewater has high BOD due to milk residues, whey, and cleaning agents.
 - **Chemical Oxygen Demand (COD):** Measures the amount of organic and inorganic substances in wastewater that consume oxygen during breakdown.
 - **Total Suspended Solids (TSS):** Dairy wastewater contains particles like fats, proteins, and residues from cleaning operations.
 - **Fats, Oils, and Grease (FOG):** Dairy production wastewater typically has high levels of milk fats and oils that must be controlled.
 - **Nitrogen (N) and Phosphorus (P):** Nutrients from dairy processes that can cause eutrophication if released in excess.
 - **pH:** Permits will specify an acceptable pH range to ensure that the effluent does not harm aquatic ecosystems or damage wastewater treatment systems.
2. **Wastewater Treatment Requirements:** Wastewater from dairy facilities must be treated before discharge to meet the emission limits. The BAT conclusions specify various treatment technologies that must be used to meet the ELVs:
- **Primary Treatment:**
 - **Screening and filtration:** Used to remove solids like milk solids, cleaning residues, and packaging material from the wastewater before further treatment.
 - **Dissolved Air Flotation (DAF):** A common method for separating fats, oils, and grease (FOG) from the wastewater, which is particularly important in dairy facilities due to the high fat content in the effluent.
 - **Secondary (Biological) Treatment:**
 - **Activated sludge systems:** Biological treatment processes where microorganisms break down organic materials in the wastewater, reducing BOD and COD levels.
 - **Sequencing batch reactors (SBR) or Membrane bioreactors (MBR):** Alternative biological treatment methods, which are often applied when space is limited or a higher level of treatment is needed.
 - **Anaerobic digestion:** For high-strength effluents, particularly whey, anaerobic digestion is an effective method that also produces biogas as a renewable energy source.
 - **Tertiary Treatment:**

- **Nutrient removal:** Techniques like nitrification, denitrification, and chemical precipitation are used to remove nitrogen and phosphorus, which are often present in high concentrations in dairy wastewater.
 - **Polishing:** Further removal of remaining suspended solids, nutrients, and organic matter. This can involve sand filtration, ultrafiltration, or reverse osmosis.
 - **Disinfection:** Using methods like UV treatment, chlorination, or ozone to disinfect the treated wastewater before discharge.
 - **Sludge management:** Sludge generated during the treatment process is dewatered and may be used as fertilizer or for biogas production, provided it meets regulatory standards.
3. **Monitoring and Reporting Obligations:** Dairy producers must regularly monitor and report on their wastewater discharges. Permits typically require:
- **Regular sampling** of the treated effluent to ensure that ELVs for BOD, COD, TSS, FOG, nitrogen, and phosphorus are being met.
 - **Flow monitoring:** Continuous monitoring of wastewater flow rates to detect potential issues and maintain compliance with the permit.
 - **Annual reporting:** The operator must submit reports to the regulatory authorities, detailing wastewater emissions, treatment performance, and compliance with permit conditions
4. **Water Framework Directive (Directive 2000/60/EC) Compliance:** Similar to other sectors, wastewater discharges from dairy production must comply with the Water Framework Directive (WFD). Discharges must:
- Not cause deterioration in the quality of surface or groundwater bodies.
 - Align with the environmental objectives set out in the local River Basin Management Plan (RBMP).
 - Ensure that the receiving water body can meet its Good Ecological Status (GES), as required by the WFD.
5. **BAT-AELs (Associated Emission Levels):** The BAT-AELs provide a range of acceptable pollutant concentrations in the treated wastewater based on what can be achieved using Best Available Techniques. The specific levels for dairy production are determined based on the scale of production and the wastewater treatment technologies in use.

Monitoring and Reporting Obligations:

- Regularly sample and monitor wastewater to ensure compliance with the ELVs.
- Submit emissions reports to authorities, detailing pollutant levels and treatment system performance.

Example BAT-AELs for dairy wastewater discharge:

- **BOD:** 10–50 mg/l (after treatment)
- **COD:** 30–150 mg/l (after treatment)
- **Total Suspended Solids (TSS):** 10–50 mg/l
- **Total Nitrogen (TN):** 5–40 mg/l
- **Total Phosphorus (TP):** 0.2–2 mg/l

Summary of Discharge Permit Requirements:

- Emission limits for key pollutants (BOD, COD, TSS, FOG, N, P)
- Wastewater treatment: Mandated use of primary, secondary, and tertiary treatments to minimize pollution.
- Monitoring and reporting: continuous monitoring of quality including mandatory reporting to authorities.
- Compliance with EU water regulations: permits must align with both the IED and the Water Framework Directive, ensuring no harm to water bodies.

ÅLAND - STATE OF REGULATION

In the Åland Islands, food processing facilities, e.g. fisheries are subject to both local Åland environmental regulations and broader Finnish national laws aligned with EU directives such as the Industrial Emissions Directive (IED) and the Water Framework Directive (WFD).

Key Regulations:

- **Åland's Environmental Protection Act:** Local regulations govern environmental permits for industrial activities, including fish production.

- **Finnish Environmental Protection Act (527/2014):** This national law, applicable in Åland with local modifications, stipulates that activities with significant environmental impacts, such as fish farming or processing, require permits.
- **EU Industrial Emissions Directive (IED):** For larger facilities with potential for significant environmental impact, compliance with the IED is mandatory, and an environmental permit is required.

These form the overall regulation that the facilities must comply with in their production.

DISCHARGE PERMITS FOR WASTEWATER IN FISHERIES IN ÅLAND

Table 4. Discharge permits in Åland

Parameter	Limited concentration [mg/l]	Removal [%]
BOD	15	90
Tot-P	1	90
Tot-N	35	50

Picture taken from: BAT in fish processing industry, Nordic perspective, Renata Tomczak-Wandzel, Eilen Arctander Vik and Tomasz Wandzel

<http://norden.diva-portal.org/smash/get/diva2:851619/FULLTEXT02.pdf>

Other sources:

SA BREF (Slaughterhouses, Animal By-products and/or Edible Co-products Industries)
<https://eippcb.jrc.ec.europa.eu/reference/slaughterhouses-and-animals-products-industries>

FDM BREF (Food, Drink and Milk Industries)

<https://eippcb.jrc.ec.europa.eu/reference/food-drink-and-milk-industries>