EFFICIENT TREATMENT OF PHARMACEUTICAL RESIDUE AT SOURCE - EPIC

FINAL REPORT – Policy recommendations for sustainable management for pharmaceuticals (WP4)

Finnish Environment Institute (SYKE)
University of Helsinki (UH) &
Subcontractor Law and Water

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Further information of WP4:

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Policy recommendations for sustainable management for pharmaceuticals (WP4)

- 4.1 - Market Based Instruments (UH, SYKE & Law and Water)
  - 4.1.1 - Enhanced Environmental Permitting of Pharmaceutical Plants
  - 4.1.2 – Decrease Environmental Impacts of Medicines via Improved Legislation
- 4.2 - Improved Waste Management (SYKE)
- 4.3 - Raising Awareness (SYKE & UH)
- 4.4 - Promoting Environmental Classification (SYKE & UH)

Partners - Policy recommendations for sustainable management for pharmaceuticals (WP4)

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- Subcontractor: Law and Water
  - Niina Vieno

Needs generally – Policy recommendations for sustainable management for pharmaceuticals

- Knowledge on emissions & effects of residues of active pharmaceutical Ingredients (APIs) on the environment
- Raise awareness on environmental impacts of pharmaceuticals e.g. via capacity building and websites targeted to professionals and citizens
- Minimise pharmaceutical waste and enhance the collection of waste containing pharmaceutical residue at source
  - More information on relevant and potential policy instruments for sustainable management for APIs at different scale (local, national & EU level)

Needs – 4.1.1, Enhanced environmental permitting of pharmaceutical plants

- API emissions from pharmaceutical industry commonly assumed to be negligible in the western countries, but information on emissions has not been published
- More information on policy instruments & measures to promote sustainable manufacture of APIs at different scale →
  - National level: enhancing environment permitting of pharmaceutical plants
  - EU & global level: emissions occurring during the production chain should be incorporated in regulations or guidances. At present, they are out of the scope of both marketing authorization for medicinal products & Good Manufacturing Practices (GMP) on pharmaceutical plants
- Minimise waste and wastewater containing pharmaceutical residue & enhance its collection and treatment in the pharmaceutical plant before mixed and diluted with other waste water at the municipal waste water treatment plant (MWWTP)

Needs – 4.2, Improved Waste Management

- Enhance separate collection of medicine waste in health care facilities and ensure its treatment in an environmentally sound manner
- Increase awareness at the health care facilities on the legal requirements related to collection, transport and treatment of medicine waste
- Disseminate information to the health care facilities on the safe handling of medicine waste

Needs – 4.3, Raising Awareness

- Need from professionals (e.g. in pharmacy, medicine, and related health-care personnel, including students) and citizens for information on environmental impacts of pharmaceuticals and possibilities to reduce them

Needs – 4.4, Promoting Environmental classification

- Increasing amount of pharmaceuticals end up in the environment (population growth, ageing population) and urbanization further increases their local accumulation
- Most of the load originates from therapeutic use via human excretions (APIs and their biological metabolites) to wastewater
- Pharmaceuticals can have adverse environmental effects (e.g. antimicrobial resistance, endocrine disruption, secondary poisoning)
- Growing demand for in-depth knowledge and for open data on the environmental characteristics (PBT) and risks that pharmaceuticals pose to the environment (the EU strategic approach to pharmaceuticals in the environment)

Needs – 4.4, Promoting Environmental classification

- Classification needed to facilitate decision making on API use based on environmental aspects **when possible**: doctors (prescription), pharmacists (OTC), consumers (OTC), public procurements
- Currently we are lacking tools that could support sustainable decision making regarding pharmaceuticals consumption
- New in-depth knowledge and open data on the environmental effects of manufacturing (global challenge), use and end-of-life is needed during all stages of a drug's life-cycle to be able to assess the total environmental impact of pharmaceutical products
- Education in sustainable pharmacy for health care professionals has been supported since 2015 (Generation Green Initiative of the Faculty of Pharmacy, University of Helsinki)

Approach -Description of activities (WP4) Policy recommendations for sustainable management for pharmaceuticals

- 4.1.1 - Enhanced environmental permitting of pharmaceutical plants
  - Screening the extent of pharmaceutical industry, selection of relevant pharmaceutical plants & search of environment permits
  - Environment permits were analyzed; all relevant information (incl. permit conditions) on e.g. emission & environment impact monitoring, wastewater, solid waste etc. was gathered
  - Focus: APIs in wastewater & solid waste
- 4.1.2 - Decrease Environmental Impacts of Medicines via Improved Legislation
  - Wide perspective on possibilities to include more environmental criteria into legislative framework on medicines
  - Evaluation of existing legislative framework of medicines from the environmental viewpoint
  - Identification of the critical gaps with proposals to bridge these gaps

Approach – Description of activities (WP4)

- 4.2 - Improved waste management
  - Evaluation of aspects to be taken into consideration when preparing the (hazardous) medicine waste management guideline or plan at health care facilities
  - Based on the evaluation, preparation of a short guidance document for health care facilities

- 4.3 - Raising awareness
  - Arranging workshops /seminars on on Pharmaceuticals in Environment
  - Communication of project results at national and international level

Approach – Description of activities (WP4)

- 4.4 - Promoting Environmental classification
  - Familiarization with the existing environmental classification criteria for active pharmaceutical ingredients (APIs); e.g. Swedish FASS database (fass.se) and Janusinfo website of Stockholm County Council (janusinfo.se)
  - Based on Swedish experiences evaluate the prospects for implementation of environmental classification of APIs in Finland

Approach – 4.4, Promoting Environmental classification

Swedish Environmental Classification of Pharmaceuticals (APIs)

fass.se

- Voluntarily published environmental data of APIs from industry
- Published on fass.se website administered by Lif (Läkemedelsindustriföreningen)
- Classification based on risk assessment (PEC/PNEC)
- Also phrases on assessment of hazard: P (persistence), and B (bioaccumulation)
- Data utilized for national purposes in Norway
- Guidance by Lif for companies: https://www.fass.se/pdf/Environmental_classification_of_pharmaceuticals-120816.pdf

janusinfo.se

- Environmental data of APIs from research and industry
- Published on janusinfo.se website targeted for health care professionals
- Classification based on index number (0-9) derived from PBT assessments
- Risk assessment from fass also presented

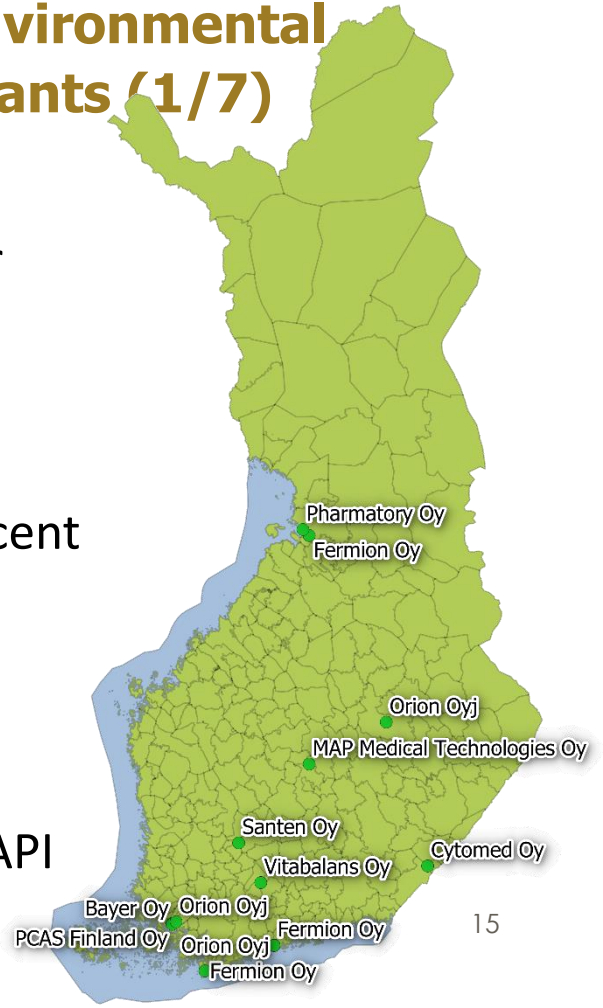
Main outputs – 4.1.1 Enhanced environmental permitting of pharmaceutical plants (1/7)

- Nearly all plants (12 / 13 plants) discharge waste waters into MWWTPs after pretreatment or after separating the most harmful fractions

Permit conditions

- Solvents commonly considered
- APIs & their emissions considered in the most recent permits (3/13 permits); permits issued 2013–16
- Not common to have obligation to measure API concentrations in wastewater (2/13 permits) or ecotoxicity of wastewater (1/13)

→ seldom set permit conditions on monitoring of API emissions



Main outputs – 4.1.1 Enhanced environmental permitting (2/7)

Recommendation 1. Pharmaceutical plants must be aware of API emissions and impacts on MWWTPs & surface waters

- Emissions to sewer network should be estimated in a calculative way or via measuring or with their combination on the APIs handled in each plant.
  - **Calculatory estimation is recommended as the primary method**, due to uncertainties and costs related to sampling and chemical analyses. Calculations must be based on plant-specific information on e.g. production amounts and losses during manufacture.
- Permit holder must estimate the significance of API emissions when performing **risk assessment at plant level** in cooperation with supervisory authorities
  - Risk assessment should cover the MWWTP but also the recipient waters. If risk found, necessary measures to decrease risks must be presented
- **Industrial wastewaters discharged to MWWTP are recommended to be tested with bioassays** in order to secure efficiency of biological processes in MWWTPs
  - Active sludge nitrification & bacterial growth inhibition tests; especially during unnormal conditions

Main outputs – 4.1.1 Enhanced environmental permitting (3/7)

Recommendation 2. Recommendation on limit values for APIs & bioassays

- **Recommended to apply Svenskt Vatten´s (2012) or other justified limit values for active sludge nitrification inhibition tests**. If limit values are exceeded, the reason for inhibition should be found out.
- **The limit values for certain specific APIs are to be assessed and formulated**
  - Efficient MWWTP processes, high protection level of recipient waters and safe reuse of MWWTP sludge should be taken into account
  - Require smooth cooperation between permitting authority, operator (pharmaceutical plant) & MWWTP

Main outputs – 4.1.1 Enhanced environmental permitting (4/7)

Recommendation 3. Good practices for management of wastewater and waste from pharmaceutical industry

- Operator (pharmaceutical plant) is to be obliged to conclude an industrial wastewater agreement with MWWTP
- Wastewater and waste fractions containing significant amounts of APIs are to be collected separately and to be delivered to special hazardous waste treatment. Wastewater discharged into (municipal) sewer are to be pretreated efficiently enough.
- The failed medicine batches are waste, which is not to be discharged into (municipal) sewer
- There should be no floor drains in process chemical and raw material storages with direct connection into (municipal) sewer
- The use of hazardous chemicals (environment or human health) should be minimized in processes of pharmaceutical plants

Main outputs – 4.1.1 Enhanced environmental permitting (5/7)

- Legislative base:
  - Finnish Environmental Protection Act (527/2014): 6 §, 19 §, 52 §, 53 §, 62 §, 67 §
  - Finnish Environmental Protection Degree (713/2014): 41 § & 42 §
  - Finnish Waste Act (646/2011): 15 §

- **The case-specific consideration and local conditions are to be taken into account when considering or applying these recommendations in the environment permitting of pharmaceutical plants in Finland**

Main outputs – 4.1.1 Enhanced environmental permitting (6/7)

Other conclusions

- The authorities should ensure that
  - relevant APIs are to be added into parameter selection of environmental administration data systems (e.g. YLVA). This is prerequisite for that operators can report results related to API emissions (incl. concentrations) in a electronic format to data systems.
  - more detailed information on Good Practices for treatment methods on API containing wastewater will be added into relevant EU BREFs (e.g. Organic Fine Chemicals) under IED (Industrial Emission Directive)
- The environmental aspects of pharmaceutical industry (e.g. API emissions) should be included into some international system (e.g. Good Manufacturing Practices, GMP) in order to gain maximal environmental benefit and not to set pharmaceutical companies in different parts of world to unequal position.
  - this global measure is to be promoted by EU

Main outputs – 4.1.1 Enhanced environmental permitting (7/7)

Final report: SYKE rap 20 /2019:
https://helda.helsinki.fi/handle/10138/302215

Main outputs – 4.1.2 Decrease Environmental Impacts of Medicines via Improved Legislation (1/2)

- The legislative and regulatory framework concerning pharmaceuticals in the environment compiled within 2016-18 (see next slide)
- Half-day national seminar on 'Environmental impacts of medicines – Development of regulation' on 12.12.2018
  - Dr Helen Clayton from the EU, DG-ENVI as the keynote speaker
  - Video recording permanently available at: https://www.helsinki.fi/fi/unitube/video/cc612f69-59a9-4d98-a443-42c7e08850da
- An expert article with the same title has been prepared and will be distributed to healthcare professionals as the primary target group (e.g., via Pharmaceutical periodical Dosis Journal published by the Finnish Pharmacists' Association (https://dosis.fi/julkaisun-tiedot/)

Main outputs – 4.1.2 Decrease Environmental Impacts of Medicines via Improved Legislation (2/2)

Lääkkeen elinkaaren vaihe	Kansainvälinen/EU-taso	Kansallinen taso
Raaka-aineiden valmistus (API-tuotanto)	WTO:n päätöksiä (DOHA-declaration 2001) EUn kemikaaliasetus (1907/2006 REACH); koskee vain valmistuksessa käytettäviä apuaineita SEVESO-III EU teollisuuspäästödirektiivi (2010/75/EU) EU vesipuitedirektiivi (2000/60/EC) & prioriteettiainedirektiivi (2008/105/EY; 2013/39/EU) EU strategia lääkeaineisiin ympäristössä (komission tiedonanto COM(2019) 128) GMP (2003/94/EY) sekä komission ohjeet	Lääketeollisuuden ympäristöluvat: Ympäristönsuojelulaki (527/2014), Ympäristönsuojeluasetus (713/2014), Jätelaki (646/2011) Laki vaarallisten kemikaalien ja räjähteiden turvallisesta käsittelystä (390/2005) VN asetus Kemikaalien käsittelyn ja varastoinnin valvonnasta (685/2015) VN asetus Vaarallisten kemikaalien teollisen käsittelyn ja varastoinnin turvallisuusvaatimuksista (856/2012) Lääkelaki (395/1987) – 2 luku GMP-Fimean määräys 5/2015
Lääkevalmisteet ja myyntilupa	Official Medicines Control Laboratory OMCL 1994 Euroopan farmakopea / laatustandardit lääkkeille Laatustandardi ISO/IEC 17025 EUn ihmislääkedirektiivi (2001/83/EC) EU EMA-CHMP 1.6.2006 ohjeistus ympäristöriskien arvioinnista	Hintamekanismi (HILA): STMn asetus 201/2019 (hintaa koskevat ilmoitukset ja hakemukset)
Tukkukauppa	Komission GDP-ohjeet	Fimean määräys 5/2013
Avohuollon lääkehoito	Kansallisen säätelyn piirissä	Lääkelaki (395/1987) Hintamekanismi – STMn asetus 201/2019
Sairaaloiden lääkehuolto	Julkiset hankinnat, EUn hankintadirektiivi (2014/24/EU) – elinkaarikustannukset (95§)	Laki julkisista hankinnoista 2016/1397
Eläinlääkkeet	EUn direktiivi (2001/82/EY) korvattu eläinlääkeasetuksella (EU) 2019/6 ja asetus (EU) 762/2004 korvattu EMAn lupamenettelyasetuksella (EU) 2019/5. Soveltaminen vasta 2022. EU EMA-CVMP	Laki eläinten lääkitsemisestä (387/2014) Maa- ja metsätalousministeriön asetukset MMMa 17/2014 ja MMMa 22/2014) Eviran ja Fimean ohjeet
Lääkejätteet	EUn jätedirektiivi (2008/98/EY) artikla 17 lääkejätteen keräysjärjestelmät	Jätelaki(646/2011): vaarallinen jäte, kunnan tehtävät Huumausainelaki (373/2008) Fimean määräys 2/2016 Eläinlääkejätteiden osalta MMMa 17/2014, 22/2014

Main outputs – 4.2 Improved waste management

- Check list / Guidance - Aspects to be taken into consideration in medicine waste management (Hoitolaitosten lääkejätehuollossa huomioitavia asioita), 1.2.2018, Eevaleena Häkkinen / SYKE
- In Finnish language
- EPIC websites: https://www.syke.fi/download/noname/%7BDD9743FD-5F6C-49E9-98D9-AEB43AB6E828%7D/136817

Main outputs – 4.3 Raising awareness (1/2)

- Arranging workshops /seminars on Pharmaceuticals in Environment
  - An international, scientific seminar on 'Pharmaceuticals in the Environment', University of Helsinki, 9.-11.11.2016
  - Enhanced environmental permitting of pharmaceutical plants & Promoting Environmental Classification, 29.11.2017 Helsinki
  - Tekniikat lääkeaineiden poistamiseen vesistä, 6.9.2018 Lappeenranta
  - Environmental impacts of medicines – Development of legislation, University of Helsinki, 12.12.18
  - EPIC Final Conference, 17.5.2019 Helsinki
    - At https://www.syke.fi/hankkeet/epic (Fin) http://www.syke.fi/projects/epic (Engl) http://www.syke.fi/projekt/epic (Swe)
  - Nordiwa Wastewater Conference 23-25.9.2019 in Helsinki
  - Health Care Without Harm workshop 12.11.2019 in Brussels
  - EUSBSR´s Policy Area Hazards Round Table on PiE 10-11.12.2019 in Lund

Main outputs – 4.3 Raising awareness (2/2)

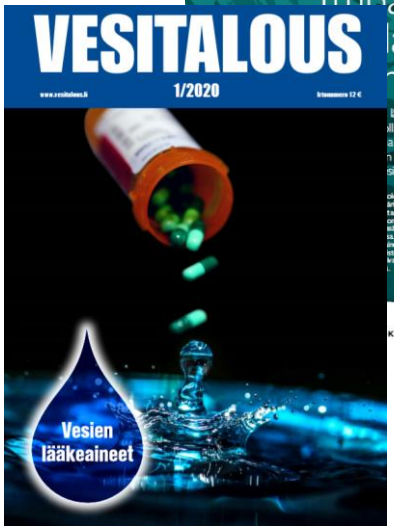
- Communication of project results
  - At national level e.g.:
    - Participation to Cocomms´s Lääkkeetön Itämeri info campaigns in 2018, 2019 & 2020.
    - Lääkealan ympäristöpäivä 2019 13.3.2019 in Helsinki
  - At international level e.g.:
    - Water JPI 2018 Conference, 6.-7.2018, Helsinki
    - SETAC Europe 29th Annual Conference 26-30.5.2019 in Helsinki
    - Nordiwa Wastewater Conference 23-25.9.2019 in Helsinki
    - EU Strategy for the Baltic Sea Region, EUSBSR Macro-regional workshop on Pharmaceuticals in the Environment (PIE)–Monitoring, consumption, technologies and policies 19.9.2019 in Stockholm
    - Co-operative meeting with Swedish National Knowledge Centre on Pharmaceuticals (under Swedish Medical Products Agency) 19.9.2019 in Stockholm
    - Health Care Without Harm workshop 12.11.2019 in Brussels
    - EUSBSR´s Policy Area Hazards Round Table on PiE 10-11.12.2019 in Lund

Main outputs – 4.3 Raising awareness/ Publication, Interviews, Presenatations

- Articles and publications on pharmacauticals in the environment
  - 32 articles / publications
  - Including 7 articles in Vesitalous magazine 1/2020 etc.

- Interviews
  - 6 TV and radio presentations / appearances
  - 34 Newspaper and magazine interviews /references

- Presentations
  - 51 in seminars
  - Social media e.g. Lääkkeetön Itämeri info campaigns in 2018, 2019 & 2020.



Main outputs – 4.4 Promoting Environmental Classification (1/4)

- Survey identified 4 possible approaches to implementation
  1. Direct utilization of data on fass.se/felleskatalogen.no combined with a one-off calculation of risks in Finland
  2. Creation of a similar classification as in Norway (based on data from fass but with risk assessment for Finland, published and updated on Finnish website)
  3. Creation of our own National Finnish Environmental Classification System (could be based on wider range of data from various sources, could also include more diverse risk assessments)
  4. Creation of ”Nordic Environmental Classification System”

Main outputs – 4.4 Promoting Environmental Classification (2/4)

Identified important characteristics for the classification system based on stakeholder consultations:

- Open, reliable, comprehensive, research-based data
- Publically available
- Easy to use
- Different levels for different user groups
- Information in Finnish

Main outputs – 4.4 Promoting Environmental Classification (3/4)

- Important to base the classification on reliable and transparent information
- Classification of APIs could be utilized in public procurement of pharmaceuticals, by doctors prescribing pharmaceuticals or by consumers (with OTC-products) to focus on more environmentally friendly pharmaceuticals
- At a local level, environmental impacts can be reduced by steering use toward less harmful pharmaceuticals
- At a global level, environmental impacts can be reduced by steering the use towards more sustainably produced products.
- **Optimally should be wider than country level; could be developed at EU level**

Main outputs –
4.4 Promoting Environmental Classification (4/4)

Final report: SYKE rap 19 /2019:
https://helda.helsinki.fi/handle/10138/302213

Vieno N., Sikanen, T., Äystö, L., Mehtonen, J., Karlsson, S. & Nystén, T. 2020. Lääkeaineiden ympäristöluokituksen hyödyt ja haasteet. The Benefits and challenges of Environmental Classification of Pharmaceuticals. **Vesitalous 1/2020**. (In Finnish with English abstract.)

Benefits and influence – Policy recommendations for sustainable management for pharmaceuticals

- Better knowledge on effective good practices for minimizing pharmaceutical waste that will benefit pharmaceutical industry but also permitting authorities.
- Removing pharmaceutical residue at source improves the quality of water and the reusability of WWTP sludge and allocates treatment costs to the source of origin.
- Spreading guidance on medicine waste management of pharmaceutical substances will benefit the health care operators.
- The raised awareness e.g. on emissions, environmental impacts and ways to reduce emissions of pharmaceuticals will benefit all target groups of project such as permitting & enforcement authorities, MWWTPs, pharmaceutical industry, health care professionals (incl. students) as well as citizens.
- The approaches proposed will serve as basis for the further development work on Environmental Classification that could be utilized in public procurement of pharmaceuticals, by doctors prescribing pharmaceuticals or by consumers (with OTC-products) to focus on more environmentally friendly pharmaceuticals.

Collaboration/ Stakeholders – Policy recommendations for sustainable management for pharmaceuticals

- National collaboration has been successful both quantitatively (high numer of collaborants) and of high quality
- International collaboration could have been more intense and with wider geographical coverage
- Policy Brief was handy to spread in both national and international events and attracted stakeholders (especially with front page & pictures)
- Communication of main results will continue with spreading the publications (incl. Policy Brief) and possibly with presentations with stakeholders after finalizing the project

Collaboration

Partners

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