



Notice 2020

Call for applications

from

the Danish Environmental Protection Agency

**Pesticide and Biocide Research Programme
for the period**

2020 - 2023

Deadline for applications: 2 December 2019

**Application form and guidelines for completing the application can be found
here: [http://eng.mst.dk/chemicals/pesticides/grant-programmes/the-
pesticide-research-programme/](http://eng.mst.dk/chemicals/pesticides/grant-programmes/the-pesticide-research-programme/)**



Focus areas in call 2020

The specific research areas that the Danish EPA request applications within are described in this notice. The Danish EPA Advisory Committee for Pesticide Research has recommended the proposed areas on the basis of the expectation that new research-knowledge within these areas will be required over the next 3-5 years. The selection has also focused on areas where it is considered appropriate to retain research continuity. The areas identified in the Danish Pesticide Strategy 2017-2021 (<https://mst.dk/media/141516/pesticidstrategi2017-2021.pdf>) and in the overall research areas described in the Danish EPA strategy for pesticide research 2015-2020 have also been taken into account (<https://mst.dk/media/91941/strategi-bekaempelsesmiddelforskning2015-2020.pdf>).

Research areas - general needs and issues

Pesticide regulation is based on the goal to achieve optimum efficiency for the products while at the same time complying with the many different protection objectives included in the risk assessment of applying the products. The knowledge base required for this risk assessment and regulation is very complex.

Research should support the Danish EPAs work on pesticide regulation. It is therefore important that an applicant review the *state-of-the-art* in relation to current pesticide or biocide regulation by consulting the Danish EPAs website (<http://mst.dk/kemi/>) including underlying documentation concerning the guidelines and basis for authorization and use of pesticides. Furthermore, EFSA and ECHA guidelines regarding risk assessments should be included in the application. This will ensure that new research-knowledge can be incorporated into the Danish EPAs work in relation to national and EU-regulation. Applications on development of new methods should link to guide lines from OECD and other international organisations. Connections to current regulation, knowledge and international research within this area should be described in the application to demonstrate that the projects will contribute new and relevant knowledge.

To support the ongoing intent of limiting the use of synthetic pesticides or biocides, new and further developed methods and strategies which can reduce or replace the use of pesticides or biocides are requested. At the same time, there is a need for a greater understanding of what socio-economic barriers affect the commercial use of new alternative protection methods and strategies.

For research projects that study the effect of pesticides or biocides, the effects (both in relation to human health and the environment) should be seen in relation to estimated or actual exposures. Assessments of the socio-economic consequences and assessments of tools used within the use of pesticide or biocide regulation are also important with regard to future regulation in the areas. This applies at both national and international levels, particularly with regard to EU regulation. Therefore, as far as possible, all project applications should include aspects that ultimately can relate the research results to the possible need for future research and the administrative regulation in relation to the tools and the objectives they help achieve.

The entire area requires greater insight into the impact of pesticides or biocides on human health, nature, and the environment, and on how to distinguish pesticide and biocide impacts from other impacts.

Prioritised focus areas in Notice 2020

A number of research areas of particular interest have been chosen for this call for applications. Note that the research areas on pesticides cover both plant protection products and biocides (*e.g. rat and mouse poison, wood protection products, disinfection products, and non-crop products to control insects and mites*).



The funding for this call is DKK 16.8 mill.

Research area 1: Communication on risks in connection with new knowledge on pesticides or biocides.

An important problem in connection with the regulation and use of pesticides and biocides is the dissemination of new knowledge. Between laymen, including professional users of pesticides, and experts may exist very different perceptions of how new knowledge on risk in connection with use of pesticides or biocides should be converted to actions. This difference may originate from different underlying perceptions of the concept of risk, and how the risks involved in using pesticides is related to other risks, e.g., economical. This may greatly influence the degree to which warnings or recommendations are followed, and thereby, it may be a problem to achieve the wanted effects of the information. Such problems may be intensified when new knowledge on risk that may lead to consideration on revision of the authoritative warnings or recommendations is regularly published. There is a need for a better understanding of what influence the way from information on risk to change in behaviour by users of pesticides. There are initiated initiatives in relation to the private segment, but there is a need for research that generate knowledge on how especially the professional sector, e.g., farmers, growers, and pesticide suppliers, are aware of, understand, and interpret information on risk and danger in relation to the use of pesticides. There is a need for research that can generate information on how these notions are formed by the professional users' understanding of risk involved with the use of pesticides in relation to other risks such as yield loss or reduced economic outcome, and how information may influence their behaviour. The research shall contribute to a more targeted dissemination of research results and regulation initiatives so that the effect on human health as well as the environment and nature can be increased.

Research area 2: The impact of pesticides on humans

This research area includes unintended effects of pesticides on human health in general, including working environment exposure.

There is a need of valid methods to forecast, measure, and map exposure as well as the long-term impacts on humans in general and particularly on persons working with pesticides.

There is particular interest in project applications within the following areas and issues:

Understanding the role of pesticides in the development of certain diseases

Risk assessment and regulation of pesticides are constantly developing. In order to ensure adequate, continuous and up-to-date risk assessment and regulation of pesticides in the future, there is a need for research and more mechanistic knowledge on the relationship between exposure to pesticides and certain types of diseases as well as development of test methods for these relationships. A special focus area is research into the neurological effects of active substances on children's brains (e.g., development of autism and ADHD), leukaemiae of children, hormone-disrupting effects, especially effects (e.g., diabetes and obesity), where understanding of the mechanisms and test methods are lacking.

Development of azole-resistant human pathogenic fungi in the environment

Some of the fungicides that are used in many pesticide or biocide situations in agriculture, industry and foodstuffs are almost identical with the fungicides that are used against human infections. There are examples that development of fungicide resistance in fungi in the environment spread to human infections, so that the treatment of patients will be increasingly difficult. The report from the inter-ministry working group on azol resistance has pointed out this subject. Cf.

<https://www.ft.dk/samling/20181/almindel/suu/bilag/232/2016372.pdf> (in Danish). Research is needed



that study this subject further and generate knowledge on which conditions lead to fungicide in the environment so that the most important sources can be pinpointed and prevented.

Development of alternative methods for risk assessment of chemicals

There are very few data requirements within general chemical regulation (REACH) for metabolites and co-formulants which can be used in connection with the approval of pesticides. Furthermore, there is a wish that in the future, data for risk assessment of pesticides do not have to be generated on the basis of animal test models. Therefore, there is a need for research that can contribute to the international development of in vitro and in silico methods that may replace the animal models, e.g. development of (Q)SAR methods that can predict acute inhalation toxicity.

Health related exposure to biocides

Development of existing exposure models can provide additional knowledge with regard to risk assessment of pesticides within the health and environmental area of the EU. In some cases there is a need for more knowledge regarding the transport routes of biocides from the site of application to their occurrence in other places in the environment and on their possible effects on human health, nature, and the environment. In addition, there is a need for research that examines if EU standard scenarios for exposure to biocides (BEAT and ConsExpo) reflect the actual application patterns in relation to using products that contain biocides in Denmark for all relevant product types. In this regard, there is a need to analyse the exposure scenarios for private and professional use of biocides. Furthermore, research is needed regarding the current health exposure in connection with various work processes involving biocidal products, e.g. when inhaling aerosols of disinfectants, insecticides, or algicides, with or without protective equipment. There is a need for further knowledge in relation to secondary exposure of especially sensitive groups, such as children, and persons who already are hypersensitive, e.g., allergic persons. Children's eczema and asthma are the most common chronic diseases in Denmark, especially children suffering from atopic dermatitis are more vulnerable, as they in addition to being young also are hypersensitive to allergens and skin irritating substances. If possible exposure should be described taking into account both skin contact, inhalation, and ingestion.

Research area 3: Exposure to pesticides and the effects of these on the aquatic environment, including groundwater

This research area includes the consequences to the aquatic environment (including groundwater) that might arise when using pesticides or biocides, e.g. pesticide use in agriculture, horticulture and fruit growing, and e.g., biocide use in connection with roof cleaning, in paint, wood protectors, disinfectants and antifouling paint for ships etc., which are released either directly or indirectly into surface water via water treatment plants or rainwater.

With regard to the aquatic environment, including the ground water, there is a need for research into presence of pesticides', biocides', and their metabolites' presence and possible effects on individuals, populations, and communities of plants and animals at realistic exposure levels. Especially for biocides there may be a need for more knowledge on the transport routes from the sites of use to other places in the environment, and their possible effects on nature and the environment.

There is particular interest in project applications within the following areas and issues:

Quantification of pesticide routes into the aquatic environment

Sources of pesticides in the aquatic environment are still uncertain. There is a need to determine the various sources and metabolization processes. This also means that the impact of pesticides and biocides should be considered as an aggregate impact as they in some cases contain the same active substances.



The groundwater models include parameters of plant up-take and plant run-off. However, no guidelines exist regarding how these parameters should be determined experimentally, and there is therefore need for more knowledge of these processes and how best to determine them.

Discharges from non-agricultural use.

Research into the use of pesticides on areas not within normal agricultural crop rotation (e.g. plant nurseries, orchards, and nurseries) is needed in order to provide more knowledge on exposure and risks to the aquatic environment.

Environment-relevant exposure to biocides with focus on Danish scenarios.

There is a need for research that analyses whether EU standard scenarios for exposure to biocides (<http://echa.europa.eu/guidance-documents/guidance-on-biocides-legislation/emission-scenario-documents>) also cover the particular national conditions in Denmark. Among other things, this includes special conditions of use in Denmark which differs from the EU scenarios. This could, e.g., be in relation to environmental impacts from active substances that are used for several different purposes and hereby results in a combined larger exposure of the aquatic environment, including infiltration to the ground water. Some examples of these could be active substances, which are used for disinfectants, algacides, or substances that are used for conservation of surface films (PT7) or wood protection (PT8). In addition, knowledge is needed on the present assessment of active substances and their metabolites' fate and behaviour in wastewater treatment plants covers Danish conditions (presently the SimpleTreat 4.0 model is used).

Research area 4: Pesticides and biocides in the terrestrial environment

This research area includes the exposure and impact of pesticides on organisms in the upper soil strata of cultivated areas. It also includes the consequences of the use of pesticides and biocides for plant and animal life in other parts of the terrestrial environment.

The new knowledge will be used to set the objectives for reductions in the use of pesticides, which will be needed in order to achieve the required status for nature and the environment, to continuously monitor this status, and to set quantitative targets for trends for pesticide use in pesticide action plans.

Focus should be on the harmful effects on populations and communities of plants and animals rather than on individuals. Moreover, there should be focus on the dependence of populations and ecosystems on the living conditions of individuals and their spread, including re-colonisation of affected areas.

There is particular interest in project applications within the following areas and issues:

Biodiversity and ecosystem services in the agricultural landscape.

There is a need for research on developing solutions for reduction of the load of pesticides on the terrestrial environment in order to increase biodiversity and ecosystem services in the agricultural landscape. The research should suggest how the impact from pesticides on the environment may be reduced in ways that cost-efficiently will increase the biodiversity in the agricultural area, and to what extent increased biodiversity and ecosystem services could be a benefit to agricultural production (e.g., beneficial arthropods, pollination, or hunting interests) or perhaps be cost neutral.

Relevant exposure routes for birds.

The current risk assessment for birds and mammals includes pesticide exposure via food. Knowledge is required on whether or not the extent of exposure via food is sufficient to perform a comprehensive risk



assessment for birds. Research is required concerning the significance of different pesticide exposure routes, different bird species and different crop types for the total risk assessment for birds.

Risk assessments for bats.

Bats are unconditionally protected in Europe and, thus, must be protected from effects from pesticides and biocides. In a recent published scientific opinion from EFSA, it is assessed that the protection of bats are insufficiently covered by the present risk assessment for birds and mammals. Cf.

<https://efsa.onlinelibrary.wiley.com/doi/epdf/10.2903/j.efsa.2019.5758>. Both with respect to contact and oral exposure are bats significantly different from the test organisms in the guidance documents under the pesticide and biocide regulations. Likewise, are the pesticide application guidelines that recommend sprays in the dark hours and e.g., spray booms mounted with light obvious problems regarding pesticide exposure of bats. Research is needed that can contribute to an improved risk assessment of pesticides in relation to bats.

Environmentally relevant exposure of non-target organisms to biocides.

There is a need for research on which effects use of insecticide containing biocides have to bees and other arthropods that are non-targets. Presently, there are no exposure models or risk assessment models for these non-targets in relation to biocides in the EU. Products with insecticides contain often baits (e.g., sugar, honey, or hormones), which bees find attractive. In addition, a range of these products is used outside around houses and buildings, where bees may come into contact with the products. It is therefore relevant to study if biocides may pose a risk to populations of bees or other arthropods that are non-targets, and further develop models for risk assessment of bees and other arthropods, that are non-targets.

Research area 5: Sustainable use of pesticides and biocides

To promote a more sustainable use of pesticides and biocides, there is a need for social science research, which increases the knowledge on the reactions of users of pesticides or biocides to different means of regulations so that the effects of the regulations on the environment, nature and human health may be strengthened. Relevant means of regulations include e.g., the present authorization procedures of pesticides, demands in connection to realization of the green part of EU's basic payment scheme and the Danish tax on pesticides as well as the subsidy or compensation schemes that exists in connection with the protection of the Danish drinking water reserves. There is also a need for research that may strengthen the implementation of the regulation through better targeting and dissemination or may suggest alternative mechanisms of regulations to the ones presently implemented. The results of the research on existing and alternative regulation mechanisms should be related to the development in the use of pesticides, and how the regulation mechanisms result in incitements for cost-effective changes in agricultural practice that may reduce the environmental load from pesticides.

The EU framework directive on sustainable use of pesticides stipulates that integrated pest management (IPM) must be included in future national action plans, and that users of pesticides are obliged to use the IPM-principles. To promote the use of the principles of integrated control, research is needed on further development of methods on prevention of pest attacks or infestations of crops. Furthermore, research on development of strategies that can prevent build-up of pesticide resistance or reduce the environmental load from pesticides through optimisation of IPM, by replacing pesticides by non-chemical methods and utilising natural regulation mechanisms is needed.

To promote sustainable use of biocidal products, focus should be on the development and use of the principles of integrated control, as well as alternative control methods. There is, amongst other things, a need for research into the causes and consequences of the development of resistance, including side-effects on the environment.



There is particular interest in project applications within the following areas and issues:

Present and future regulations of the use of pesticides.

There is a need for social science research, which can illustrate if present and future means of regulation can be expected to be cost-effective methods to change the agricultural practice. This could be analyses of which methods that have been successful or the opposite in Denmark, and which lessons that can be learned from empirical data, foreign experiences, theories of regulation etc., and if these may be used as inspiration for further development of the Danish pesticide regulation. There is among others a need to investigate if and how combinations of regulation mechanisms may increase the effect of the pesticide regulation, just as research is needed regarding possible synergies and conflicts between the pesticide regulation and other regulations within the agricultural area, e.g., nutrients and climate.

In addition, there is a need for research on geographical factors or production factors that may explain essential barriers and successes of existing means of regulations, including the effects of the pesticide tax, the environmental certification payment scheme, and the demands that are a prerequisite to the basic payment scheme. The research shall elucidate if and to what extent these payment schemes lead to changes in the use of pesticides that are beneficial to the environment and human health. Finally, research is needed on possible new regulation instruments, including financial support schemes, which the revision of the CAP may pave the way for.

Integrated pest management (IPM).

The framework directive for Community action to achieve the sustainable use of pesticides (<http://eur-lex.europa.eu/LexUriServ/LexUriServ.do?uri=OJ:L:2009:309:0071:0086:en:PDF>) states a frame that aim to ensure a sustainable use of pesticides by reducing risks and impact on human health and the environment by promoting the use integrated pest management or techniques such as non-chemical alternatives to pesticides. The directive stipulates among others that the general principles for IPM as stated in annex 3 to the directive are implemented by all professional users of pesticides.

There is a need for research for methods that may be used to ascertain measurements of effect and cost effectiveness of the used IPM methods in Denmark. In addition, there is a need for a larger expansion of the knowledge about IPM and the uptake of the IPM principles, especially in agriculture, but also on golf courses and other recreational areas. Therefore, there is a need for research into the barriers which exist to the dissemination and uptake of knowledge on IPM and the use of the IPM principles – and how this knowledge and uptake can be developed.

In order to be able to develop more precise monitoring, early warning, and decision support systems the need for research into this area is pressing. The research needs include build-up of the biological knowledge base on relevant pests and plant diseases. More precise early warning systems may be able to forecast attacks of specific pests and diseases, so that unnecessary applications of pesticides may be avoided, hereby reducing both the environmental load and the risk for development of pesticide resistance.

Precision technology

To support the IPM implementation in Denmark there is a need for increased use of precision technologies when applying pesticides. Therefore, research on precision technology that can support area specific monitoring and use of data from e.g. sensors and satellite photos is needed to contribute to a more precise application of pesticides leading to a reduction the overall use of pesticides.



Alternative pest management methods and strategies in agriculture, horticulture and fruit cultivation

There is a need for research into the potential of adopting pest management methods and strategies, which are less harmful to health and the environment. Moreover, it is relevant to examine the impact of alternatives to pesticide use on human health, the environment, and nature.

Furthermore, research is needed on the effects of reduced soil management and conservation agriculture in relation to pests and diseases both regarding possible less or increased need for control of these.

Finally, there is a need for research into the prevention and control of pests on crops so that food safety and quality can be improved through a reduction in the amount of pesticide residues in products (both ornamentals and edible produce).

Development of resistance after pesticide use

Use of chemical pesticides implies a risk for development of resistance in the pests to the pesticides. There is a need for research that illustrate which mechanisms promote development of pesticide resistance in pests and in methods that can be used to identify developing pesticide resistance.

Research into the existence, extent and risk for development of pesticide resistance must be related to the current prevention and treatment strategies, incl. IPM, and regulations that may contribute to limit or avoid development of pesticide resistance or address already established resistance in specific pests.

Sustainable use of biocides

The development of biocide resistance is seen in connection with using anticoagulants against rat and mice infestations, and following use of insecticides against cockroaches and bedbugs.

There is a need for research into the development of new control strategies that reduce the development of biocide resistance and reduce the use of biocides, e.g., through the use of biological control or physical alternatives.

Furthermore, research is needed on how initiatives within, e.g., the production industry can reduce the need for biocide treatment or use of preservatives via product design by using alternative materials or techniques which prevent the growth of unwanted organisms.