

Thematic Development Plan Environment and Health 2020

**This document has been
automatically translated
from Norwegian**

Norwegian Institute of Public health

1. Introduction and reservations
2. Introduction environmental health
 - 2.1 Coherence between the development plan and NIPH's strategy
3. Today's starting point
 - 3.1 Background
 - 3.2 Structure
 - 3.3 Our users and their needs
 - 3.4 Preparedness
 - 3.5 Our partners and competitors
4. Topics in environmental health
 - 4.1 Themes and process
 - 4.2 Existing themes and possible focus areas
5. Future development of existing themes
 - a. Substances hazardous to health
 - i. Industrial Chemicals and Consumer Products
 - ii. Chemicals in food and water
 - b. Radiation
 - c. Kosthold
 - d. Microbiome
 - e. Air pollution, Indoor climate and noise
 - f. Tobacco
 - g. Drinking water
 - h. Chemicals and infectious diseases
6. Possible new focus areas
 - a. Climate change
 - b. Built environment

1. Introduction and reservations

A new organizational structure for the Area of Infection Control, Environment and Health was negotiated in the IDF on 12 June 2019. As an interim solution, environment and health is organised as a large department with the four sections Air and noise, Toxicology and risk, Environmental exposure and epidemiology and Molecular toxicology. The purpose of this project is to arrive at a clear development plan for the field of environmental health, which in addition to providing direction will form the basis for the organization of the field at the department. The Department of Environment and Health is the department with the most environmental health-related topics overall. In addition, there are several other departments at the department that work with various topics under environmental health. It is therefore important that the department facilitates close cooperation on the topics that cut across areas and departments in this field. Which changes in organisation are necessary and appropriate must be clarified after the development plan has been finalised. Action plans for implementation of the goals in the development plan will also be drawn up after the development plan has been adopted.

A working group with representatives from the academic community, all areas, and employee representatives was established to carry out the process. In this group, the topics were discussed so that input from the various areas in the department was taken care of. In order to describe the need for further development of existing tasks and future topics, a smaller project group was appointed, consisting of the Director General and Heads of Section from the Department of Environment and Health, as well as the project manager.

This paper describes the development of some existing and new thematic opportunities in environmental health, and therefore does not include all ongoing activities. Developments within each topic depend on good infrastructure in the form of, among other things, methodological expertise and analytical instruments. This is not described to any great extent in this document. The fact that an ongoing activity is not mentioned does not mean that it should not be continued. The relevant academic communities will subsequently prepare detailed plans to further develop the topics in the development plan. We envisage this will take place in consultation with associated managers so that staffing and operating funds are secured for the activities. The development plan will be a living document that will need to be revised regularly.

2. Introduction environmental health

Environmental health can be defined as research and consulting to prevent injury and disease in humans, as well as promote well-being, by:

- identify and characterise substances hazardous to health
- identify and evaluate exposure sources
- limit exposures to harmful physical, chemical and biological agents in air, water, soil, food and other environmental media and environments that may adversely affect human health.¹

The presence of foreign and natural hazardous substances in the environment is one of the major public health threats now and for future generations. In 2017, the Lancet Commission on Pollution and Health reported that pollution causes about 9 million deaths annually worldwide. Three times more than all deaths caused by AIDS, malaria and tuberculosis combined, and 15 times more than the number who die in wars and other forms of violence.² Air pollution is possible to measure and can be linked to residential address and working conditions. Exposure to chemicals from food and drink is difficult to measure due to very different dietary patterns in the population. Air pollution therefore makes the largest measurable contribution to the global burden of disease from pollution. Knowledge about health effects and exposure to most environmental pollutants and chemicals is too inadequate to be included in disease burden estimates, and this represents a considerable knowledge gap. The estimated health effects of pollution are therefore thought to be the tip of a much larger iceberg.

Emissions from the transport sector and industry, as well as the production of chemicals and the presence of contaminants in products, food and water, affect our health. Many pollutants are very stable, and can remain in nature for many decades after the chemicals are phased out of the market. Some compounds are concentrated in the food chain and can therefore occur at high levels in species that form an important part of the human diet, such as oily fish. The list of new chemicals is growing rapidly, and their use is expected to triple by 2050. This contrasts with the UN Sustainable Development Goals (target 3.9): "By 2030, significantly reduce the number of deaths and illnesses caused

¹ <https://www.neha.org/about-neha/definitions-environmental-health>

² PJ Landrigan, R Fuller, NJR Acosta et al, The Lancet Commission on pollution and health, The Lancet 2017

of hazardous chemicals and polluted air, water and soil".³ The New Green Deal in the EU also has significant ambitions to protect citizens from hazardous chemicals and create a non-toxic environment. In addition, the EU wants to strengthen the rules, processes and methods for risk assessment of new substances.⁴

At the same time, greenhouse gas emissions pose a threat to health and well-being in the future. Climate change is one of the global community's greatest challenges and must be addressed across sectors. Changing the use of chemicals to address climate change, such as pesticides and biocides, could affect public health. Increased precipitation and flooding may result in more moisture and mould damage and altered use of pesticides and biocides in, for example, the indoor environment and agriculture. In addition, flooding could lead to the release of old pollutants from landfills, which could pose health threats to the population. Climate change will also affect the occurrence and spread of pollen and other allergens, natural toxins, pests and infections. It is therefore important to monitor and predict possible health effects caused by these changes.

In order to protect the population from environmental risk factors, it is essential that Norway have the capacity to assess the hazards posed by different sources of exposure and can contribute to international knowledge and the development of sustainable standards and measures to limit exposure to hazardous substances.

The Norwegian Institute of Public Health's (FHI) ambition is therefore to develop the field of environmental health so that we can anticipate and prevent health threats related to risk factors in the environment.

In this work, we believe it is important that NIPH works to:

- be a leading national centre of excellence for human toxicology, exposure research, environmental epidemiology and health risk assessment, and assist the public and health authorities at all levels within these areas
- monitor exposure to harmful substances in the population in order to predict and prevent possible health effects
- obtain better knowledge about causal relationships between compound exposure to hazardous substances and health outcomes by using advanced

³ <https://www.fn.no/Om-FN/FNs-baerekraftsmaal>

⁴ https://ec.europa.eu/info/strategy/priorities-2019-2024/european-green-deal_en

methods and technology to characterize the toxic effects of hazardous substances integrated with biomonitoring, modelling, biobanks, and health registries

-
- further develop disease calculations and methodology for a systematic valuation of health loss from environmental factors
 - establish a visible role in research and advisory activities in thematic areas that could pose future health threats, especially climate change
 - further develop Advisory deliveries until Environmental helsevern in the municipalities
 - implement a comprehensive communication strategy to provide clients, decision-makers and the general public with access to information they need and call for in environmental health

Our main task is consulting, and our research supports the advisory function. In order to provide clients with a professional basis for making decisions and advising the population, there are some aspects of environmental health that we must focus on in the future:

- **Causal mechanisms:** To understand mechanisms of action for environmental factors enable both prediction of effects and establishment of causal relationships for associations observed in epidemiological studies. A particularly important challenge is understanding how early exposure can cause effects later in life, as well as the effects of chronic low-dose exposure.
- **Individual susceptibility:** Environmental factors do not affect everyone in a population equally. Some individuals, or groups of individuals, have increased susceptibility. This may be due to genetic predisposition, different phases of life, socioeconomic causes, or other underlying diseases. Understanding who is at greatest risk of developing disease or health problems, and why, is central to preventing undesirable health effects from environmental factors.
- **Interactions between different environmental factors:** The exposome is the total exposure an individual is exposed to via the environment over a lifetime. Exposure will depend on eating habits, consumption patterns, lifestyle and disease. People are exposed to many factors from their surroundings at the same time, and it is important that the research addresses how the various environmental factors affect the effect of each other and can lead to health outcomes. Both the exposome and mixed effects

will be important for the understanding of health outcomes caused by environmental factors.

- Next-generation risk assessment: In order to assess all chemicals without (complete) toxicological data combined with requirements for reductions in the use of laboratory animals, there is a need for faster and more efficient testing of new chemicals. This paradigm shift in toxicology and chemical risk assessment focuses on the use of New Approach Methodologies (NAMs) and represents a multidisciplinary approach to chemical toxicity testing. Knowledge of the use of advanced in vitro model systems and organ-on-a-chip systems that better mimic human tissues and organs, in combination with in silico modelling, big data analyses, as well as read-across strategies, use of epidemiological data and the adverse-outcome-pathways concept (AOP), will be a prerequisite for future risk assessment of chemicals and a number of other environmental factors.



2.1 Coherence between the development plan and NIPH's strategy

In 2019, NIPH presented a revised institute strategy.⁵ The strategy will strengthen ten focus areas across the entire department (see picture 1).

Picture 1. 10 initiatives from NIPH's institute strategy

The development plan for environment and health contributes to the implementation of several of the NIPH strategy's initiatives. This is especially true for the following:

Measures to improve public health: The development plan outlines how research and knowledge production in the field of environment and health can support municipalities, e.g. with regard to sustainable and health-promoting urban development, reduction of hazardous substances and air pollution.

Big data and advanced analysis: By adopting new advanced analysis platforms such as CyTof (systems immunology) and sequencing, there is a need for advanced biostatistical and bioinformatic competence in the environmental health field. This will enable NIPH to carry out complex and sought-after analyses that support knowledge production and advice.

Anticipating health threats: By focusing on continuing the human environmental biobank, NIPH will be able to measure and monitor which levels of chemicals the Norwegian population is exposed to over time. It is crucial for predicting and preventing future health effects related to chemicals in the environment.

Across sectors: With an ambition to link NIPH's work in environmental health more closely to the municipalities, the development plan designates new opportunities for cooperation with important actors who until now have not been the main audience for the institute's recommendations and advice.

The Development Plan for Environment and Health is also based on the development plan for the Area for Infection Control, Environment and Health, which defines goals for infrastructure development for the environmental health field. Among other things, the area's development plan aims to develop technological and experimental platforms, integrated with models/modelling,

⁵ <http://samarbeid.fhi.no/sites/dsv/Plandokumenter/Strategi/FHI%20Strategi%202019-2024.pptx>

biomonitoring, health registries and health surveys to strengthen causal relationships. The Development Plan for Environment and Health further concretizes these objectives and defines concrete measures to implement the area's strategy.

3. Today's starting point

3.1 Background

NIPH is a national competence centre for health risk assessment of environmental factors, based on the four main pillars of environmental health: toxicology, exposure, epidemiology and risk assessment. While toxicology, exposure and risk assessment are mainly handled by the Department of Environment and Health, epidemiological research and advice in the environmental field have been established across several areas in the department.

The Institute's interdisciplinary coverage of the environmental health field, with experimental toxicology, access to health registries and biobanks, exposure research, epidemiology and systematic knowledge summaries, together provide a unique opportunity to strengthen knowledge about causal relationships between various environmental factors and health outcomes. In addition, the department has extensive national and international research cooperation and participates in several EU projects.

3.2 Structure

In order to deliver on many of the environmental health assignments, it is essential to have good cooperation between the various areas at the institute. Several topics of great importance to environmental health are handled outside the area of infection control, environment and health. For example, the Area of Mental and Physical Health handles many of the tasks in diet, disease burden, non-communicable diseases and tobacco. Tobacco is also one field in which the Health Services Area plays a key role in generating knowledge summaries. In addition, the latter area is responsible for global health and climate change (see section 6), two topics in which the Department of Environment and Health has key expertise. Health data and digitalisation is also an area of relevance for environmental health, particularly in relation to biobanks, and MoBa in particular.

The Department of Environment and Health is the department at the department that has the most deliveries within environmental health. The department currently consists of four sections: Section for toxicology and risk, Section for molecular toxicology, Section for environmental exposure and epidemiology and Section for air and noise. In January 2019, there were a total of 69.9 full-time equivalents in total, of which 11.4 full-time equivalents were externally financed and 4 full-time equivalents were on debit authorization.

3.3 Our users and their needs

According to Section 25 of the Public Health Act and the Regulations relating to environmental health protection in connection with exposure to hazardous environmental factors, NIPH shall assist municipalities, county authorities, county governors and other state institutions, health personnel and the population in general, to protect the population.

NIPH's social mission is to produce, summarise and communicate knowledge to contribute to good public health work and good health and care services. NIPH is responsible for research and summaries of research through knowledge summaries within the institute's social mission and shall support the Ministry of Health and Care Services (HOD), the Norwegian Directorate of Health (HDir), the Norwegian Environment Agency (MDir) and the Norwegian Food Safety Authority, as well as other local and national authorities, the population and other actors, with knowledge-based advice.

The knowledge base that NIPH prepares is used for everything from simple advice over the telephone to complex risk assessments that in time can extend over years. National and international authorities in the field of chemicals and food regulation mainly need extensive professional knowledge in human toxicology and complex risk assessments. For example, NIPH participates on behalf of MDir in the chemical work of the European Chemicals Agency (ECHA) and on behalf of MDir and HOD in work on air pollution and tobacco in WHO, for work with food in the European Food Safety Authority (EFSA) and cosmetics in the Scientific Committee for Consumer Safety (SCCS), where our professionals are appointed as experts based on their expertise. The assignments include various forms of assessments that lead to regulation in the EU and Norway.

This work gives Norway a unique opportunity to influence what the population is exposed to, at the same time as cooperation is important for competence development. Nationally, the work includes many assignments from HOD, HDir, MDir, the Public Roads Directorate, the Norwegian Food Safety Authority, the Scientific Committee for Food and Environment, municipalities and organizations. The scientific knowledge base that is developed is used by the authorities in their risk management, i.e. to implement local measures, national recommendations and establish limit values to prevent undesirable health effects in the population.

3.4 Our partners and competitors in the field of environmental health

NIPH has a large national and international network of partners in environmental health. Based on the department's profile and expertise, NIPH is involved in many national processes that need assistance in human toxicology. NIPH has established an academic council for human toxicology with participation from Norwegian universities, authorities and institutions. For many environmental health disciplines, we participate or lead networks that are important for obtaining external research funding and for competence exchange. FHI is an attractive partner because we have professional expertise in many disciplines and we have several sought-after method platforms that we can offer. In addition, we participate in Centres of Excellence (CoE) and in several EU consortia. At the same time, the department should constantly assess the competitive situation, both in relation to existing and possible future topics that it wishes to work with. The description of the competitive situation can therefore be divided into two:

1. The competitive situation for existing themes
2. The competitive situation for possible future focus areas

1. NIPH has a unique position in Norway within the field of human toxicology and has both trust and credibility in society as an independent supplier of knowledge. The Department of Environment and Health in the Area for Infection Control, Environment and Health is Norway's largest and most integrated human toxicology research environment. This means that NIPH does not have many direct competitors within human toxicology, which covers both research and consultancy. NIPH

also has a special position in Norway in environmental epidemiology. We have unique cohorts where one can investigate the health effects of environmental exposure in the Norwegian population. This makes us an attractive partner. At the same time, there are many other institutions working with the environment and toxicology, such as the Institute of Marine Research, the Norwegian Veterinary Institute, the Norwegian Institute for Water Research, the Norwegian Institute for Nature Research and the Norwegian Institute for Air Research. Here, however, the main focus is not on human toxicology, but on ecotoxicology. Within research, there is interest in increasing toxicological competence at the Norwegian University of Life Sciences (NMBU), the University of Tromsø (UiT) and the University of Oslo (UiO), but so far the academic community is not able to cover the same breadth of research topics as NIPH. Competition from the private sector exists mainly on the risk assessment side, particularly in relation to air pollution and the assessment of chemicals. In some fields, such as the noise field, we have no national competitors. There are only national and international actors that can offer services that either rely on NIPH's work (especially within air pollution) or that can carry out some of the risk assessment activities. Since the Norwegian authorities want professional competence in chemical assessment to be maintained at the national level, NIPH receives earmarked funds from HOD for risk assessment of chemicals. The same scheme also exists for air and noise. This also means that some of the assignments in the field come directly to the department and not to private actors.

2. However, the main focus of the development plan is not to describe existing tasks, but possible further development of existing and new focus areas within topics where NIPH could take a more active role in the future. For new areas, this applies in particular to the areas of climate change and the built environment (see also section 6):

The competitive picture for climate change encompasses many actors and will be mapped in a separate process at NIPH to establish the priority area (see section 6). Within the built environment, there are already a number of private actors offering advice on health-related issues. This primarily includes consulting firms within the construction industry. Through pilot

projects, NIPH will assess whether there is interest among urban planners, developers and political decision-makers for a more comprehensive description and summary of relevant knowledge. This can be used to prevent harmful consequences of buildings, such as inadequate green areas or poor ventilation.

Finally, NIPH wishes to carry out an assessment of the dietary field, both internally and externally. There are many other actors here, but also opportunities to build a unique research infrastructure that can combine exposure studies with epidemiology, intervention research and surveillance. How the competitive picture is to be described in the field of diet will largely depend on a more systematic mapping of the department's ongoing and planned activities in the field.

3.5 Preparedness

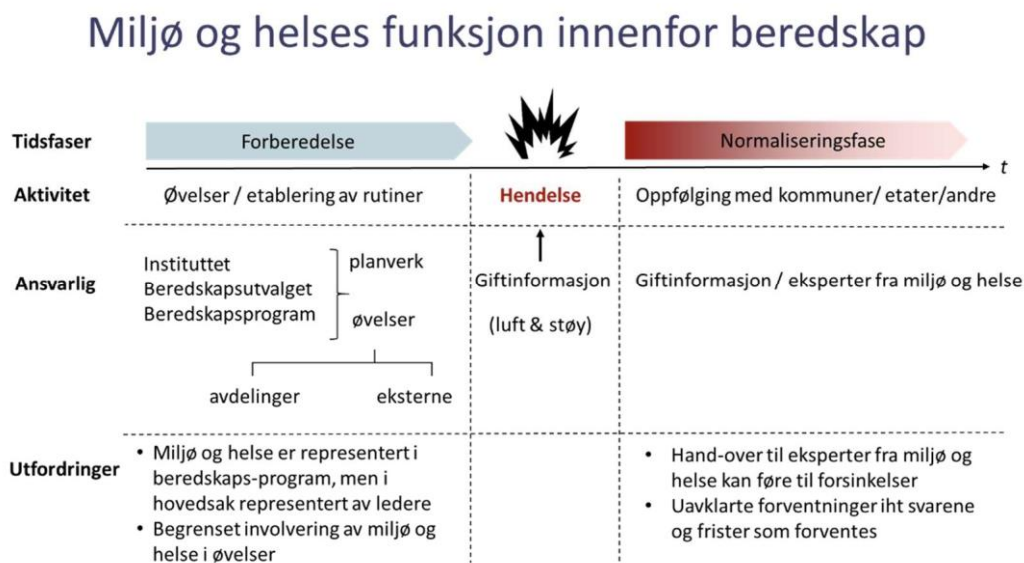
NIPH's emergency preparedness responsibility in the event of major environmental and chemical incidents is rooted in, among other things, the Public Health Act, which gives NIPH responsibility for necessary emergency preparedness preparations, measures in emergency situations, a duty to monitor the health of the population, and a duty to assist in the event of exposure to hazardous environmental factors. Municipalities must notify NIPH of health threats related to hazardous environmental factors that are unusual or unexpected for time and place, may cause significant illness, injury or death, or have rapid and uncontrolled spread of disease.

The general preparatory preparedness responsibility is fulfilled at the departmental level, as described in the institute's emergency preparedness plan (under revision). Much of the responsibility for chemical preparedness rests with the Department of Acute Poisonings, which is the warning point for municipal alerts and can provide advice on acute danger in the event of incidents, in some cases in cooperation with the Department of Environment and Health. Competence from environment and health will often be central in the normalisation phase after incidents. There is a gradual transition from situations with unwanted exposure to harmful environmental factors, where advice from NIPH is provided on demand as described earlier in the document, to emergency preparedness incidents (Picture 2).

The objectives of the emergency preparedness work in the environmental and health field are well integrated into the institute's preparedness

preparation. There are established routines for seamless collaboration between the academic communities at NIPH during the handling of incidents, so that the department provides uniform assistance based on the best available knowledge within given time frames, and contributes to safe follow-up and documentation afterwards. Cooperation between the sections in the Department of Environment and Health and other departments must be further developed to maintain good preparedness. Among other things, it is important to establish robust systems that ensure coordinated responses where relevant.

Fig. 2. Environmental health preparedness



4. Topics in environmental health

4.1 Themes and process

The field of environmental health is extensive and includes many different disciplines, issues and scientific methods.

The working group therefore chose to use an overall description of "environmental health" from the World Health Organization (WHO) as its point of departure (Image 3).

Image 3. WHO's description of environmental health⁶



The purpose was to ensure that the working group not only considered the tasks of the day, but the field as a whole. A further category was therefore added to the WHO overview; Nutrition, diet and sustainability, which is an area where the institute already has some ongoing activities (see Image 3).

⁶ Kilde: <https://www.who.int/phe/PHE-prevention-diseases-infographic-EN-3-1200px.gif?ua=1>

Picture 4. NIPH's description of environmental

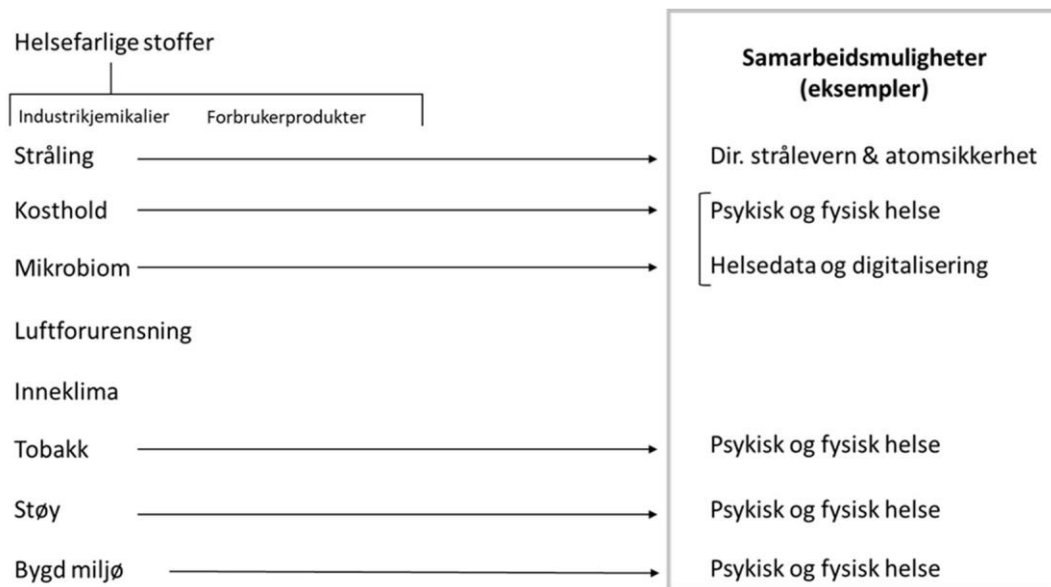


Image 4 represents the various thematic areas within environmental health. Green boxes indicate which existing disciplines NIPH already has significant assignments in. Yellow boxes indicate topics to be considered as possible future priority areas, and red boxes describe topics where other research institutions have an overarching national responsibility.

4.2 Existing tasks and possible focus areas

Using WHO's overview as a starting point, the working group mapped and categorised the day's tasks, initially focusing on the Department of Environment and Health. Image 3 provides an overview of topics that the department is working on and which actors within and outside NIPH must be involved for a final mapping of ongoing and planned activities (Picture 5).

Fig. 5. Topics within the Department of Environment and Health



The overview of existing topics makes it clear that the department works within some thematic areas that are outside the WHO overview. This applies to both diet and nutrition, and the microbiome. In addition, climate change and a more extensive focus on the built environment were identified as possible focus areas. In order to describe future initiatives within each theme, the working group went through two processes:

1. a study of focus areas in which the department has limited, inadequately coordinated, or no activity. Here, the working group assessed five topics (see Image 6), and appointed individual members to describe the task field in a mini-report to the whole group. The assessment of the working group for the individual initiatives is shown in Picture 5.
2. a description of opportunities for future development of existing tasks, which were carried out by a smaller project group (department director and section heads in the Department of Environment and Health and project manager). The result of this process is summarized in section 5 below.

Fig. 6. Assessment of new focus areas and existing topics with limited activity

Mulige satsingsområder	Mini-utrednings vurdering	Avklaringsbehov Intern (områder)	Avklaringsbehov ekstern
 Klimaendring →	✓	Psykisk og fysisk helse Helsetjenester	HOD ; UD ; HDir ; Mdir
 Ernæring og bærekraft →	✓	Psykisk og fysisk helse Hersedata og digitalisering	HOD ; Landbruks / Matdepartement ; Mattilsynet ; Mdir
 Bygd miljø →	✓	Psykisk og fysisk helse Helsetjenester	HOD (Folkehelseavdelingen) ; Statens vegvesen ; kommunesektor
 Landbruk Inkl. pesticid-bruk og avløpsvann →	?	Psykisk og fysisk helse	Mattilsynet ; MDir ; Landbruks / matdepartement
 Stråling →	?		HOD ; Dir strålevern & atomsikkerhet

As Picture 5 shows, the working group agreed that climate change, nutrition and sustainability and the built environment were topics that should be examined further as future priority areas (see sections 5 and 6). The working group was in doubt as to whether agriculture should be a separate initiative and had insufficient information to unambiguously assess the radiation initiative, which must be clarified with external contracting authorities (see also section 5 below).

Diet, climate, air pollution, tobacco, noise, microbiome, and built environment are subject areas in environmental health where there are activities in different areas and departments across the department. In order to coordinate advice and research in these fields, it is important that the department establishes solid forms of cooperation.

5. Future development of existing themes

a. Substances hazardous to health

i. Industrial chemicals and consumer products: The goal is to develop NIPH's position as the leading national competence centre in human toxicological advice and research

In order to assist governments at national and international level, as well as municipalities, in dealing with the increasing amount of chemicals on the market, we must not only keep abreast of current hazard and risk assessment methods, which are largely based on in vivo studies, but also invest in new technologies and methods.

Therefore, we want to:

1. build advanced in vitro platforms with associated endpoint analyses to perform complex hazard and risk assessments at a high international level. In the future, knowledge of advanced in vitro models will be a prerequisite for contributing to international risk assessments. The EU has an extensive focus on applied research in new models for hazard and risk assessment, which provides us with good opportunities for cooperation.
2. build up expertise in models, data analyses and test systems to risk assess large groups of chemicals simultaneously, ensure good exposure data and further develop risk assessment of complex endpoints:
 - a. in silico modelling (assessments of chemicals based on structural similarity)
 - b. Advanced data analysis and modeling
 - c. further develop epidemiological models
 - d. risk assessment test and screening methodology (assess complex endpoints)
3. establish a European coordination mechanism for toxicological advice. This will make it possible to avoid duplication of work and create a forum for sharing experiences on new methods. Possible partners are the Technical University of Denmark, Karolinska Institutet, the French Agency for Food, Environmental and Occupational Health & Safety, The German Federal Institute for Risk Assessment og The Dutch National Institute for Public Health and the Environment.

ii. Chemicals in food and water: The goal is to have a good overview of what the population is exposed to by chemicals from food and water, and to deliver risk assessments and research-based knowledge to ensure food safety in Norway

Food and water are often our main sources of exposure to a wide range of chemicals such as industrial chemicals, pesticides, additives, flavouring agents, natural toxins, process-developed substances and chemicals released from packaging.

Therefore, we want to:

1. establish a systematic monitoring of the population's exposure to hazardous substances through the continuation of the Human

Environmental Biobank Norway. This will provide us with knowledge about what substances hazardous to health the population are exposed to, whether this constitutes a health hazard, and whether measures to limit exposure have had an effect. In addition, dietary data should be linked so that exposure sources can be identified. Exposure levels and sources are necessary knowledge for authorities that perform risk management, i.e. set limit values and, if applicable, introduce measures.

2. establish new competence in advanced methods for exposure calculations, systematic knowledge summaries and risk assessments of mixtures. This will enable us to carry out risk assessments to solve complex issues and improve knowledge support to relevant authorities. Participation in a planned European partnership on risk assessment will provide a good basis for this effort.

b. Radiation: The aim is to generate knowledge to reduce uncertainty in risk assessment of radiation at low radiation doses Therefore, we want to:

1. continue cooperation with SFF CERAD. NIPH has signed a letter of intent regarding the continuation of relevant research with partners from CERAD beyond the project period.

2. clarify the need for knowledge support to the Norwegian Directorate for Nuclear Safety and Radiation Protection. We wish to identify the need for knowledge support from NIPH in relation to the Directorate's needs.

c. Diet: The goal is to produce better knowledge about the importance of desired and undesirable substances in food and water for health as a basis for advice.

Much of the Department of Environment and Health's work on diet is related to food/water as a source of hazardous substances. At the same time, food is also the main source of nutrients and a balanced diet is of great importance for the risk of developing non-communicable diseases. Therefore, we want to:

1. establish a systematic monitoring of the population's diet and nutritional status via regular and predictable surveys, which include

collection of biological material for biomonitoring, for example in collaboration with the NorKostundersøkelsen.

2. assess the effects of diet-related changes in relation to exposure to desired and undesirable substances in food. We will investigate potential health effects of changes in diet caused by, for example, more climate-friendly choices of foods and new foods.

- d. Microbiome: The goal is to create an overview of the need for knowledge and opportunities within the microbiome field for the institute.

The importance of the microbiome for health, both for infectious and non-infectious diseases, is significant, and the field of research is developing rapidly, like also Reflects itself in Number Calls for proposals in the field of research.

Therefore, we want to:

1. investigate the need for a separate commitment to microbiome at the institute. We propose that a working group with microbiological and epidemiological expertise be established to assess opportunities and necessary infrastructure
2. consider how cohort studies at the department can be included in a future microbiome initiative. Research on microbiome samples over time will be an important source of information for describing changes and investigating the effects of microbiome composition
3. assist when necessary in the establishment of a microbiome sample bank in Svalbard. This will give us access to large quantities of sample materials and create opportunities for collaboration with world-leading research groups in microbiome research.

- e. Air pollution, indoor climate and noise: The goal is to be the leading national competence environment for health assessments of noise, air quality and indoor climate conditions. The three disciplines will also contribute to the proposed future focus area, built environment (see section 6).

In particular, we wish to strengthen knowledge about national conditions of particular importance, and to build competence in order to contribute to

targeted measures to reduce health effects from air pollution and noise in indoor and outdoor environments, by:

1. develop in Vitro Lung modeller for Studies of inhalation exposure.
 2. establish the use of disease burden to calculate health loss, with support from the Centre for Disease Burden. This will enable both national and regional disease burden calculations, modelling of intervention effects, and valuation of health loss, also for risk factors that are not included in calculations of the global disease burden. This will also apply to hazardous substances to which we are exposed via other routes of exposure.
 3. establish own and further develop competence and capacity for the use of geographic information systems (GIS) and environmental epidemiological methods for analyses of health consequences of outdoor exposome, in order to link air pollution/noise exposure with health registry data. Such links are necessary in order to conduct research on the relationship between outdoor exposures and health.
- f. Tobacco: The aim is to assist national health authorities with evidence-based, high-quality advice on the effects of nicotine/tobacco products on the population's health.

The use of tobacco products is still among the most important health risk factors in Norway, and increased use of snus and new tobacco and nicotine products, including e-cigarettes, leads to new knowledge needs. NIPH therefore needs a holistic approach across the department, to investigate how we can assist the authorities in the most effective way and exploit the potential of existing resources within toxicology, epidemiology, risk assessment and drug research. We therefore wish to:

1. clarify roles and responsibilities at departmental level. This must entail clarification of contact points, systematisation of advice, and assessment of resource allocation.
 2. clarify the need for future toxicological research activity in this area.
- g. Drinking water: The goal is to build competence in chemical contaminants in water to provide knowledge support to authorities and advice to the population.

FHI has an important emergency preparedness function within the water field, particularly through the Poison Information Centre for the public and the National Water Guard, which provides advice to waterworks in the event of incidents. In addition, we provide knowledge support to the Norwegian Food Safety Authority and HOD. To contribute to safe drinking water, we further want to:

1. increase competence in new chemical drinking water contaminants that may cause health hazards to the population
2. assess how NIPH can assist in ensuring clean water in a global context

In order to achieve the desired development, NIPH needs closer cooperation with internal and external actors to ensure increased research activity and further development in the drinking water field.

- h. Interaction between chemicals from the environment and infectious diseases as well as vaccination: The aim is to investigate how chemicals from the environment affect the incidence and severity of infectious diseases as well as the effects of chemicals on vaccination.

NIPH has a unique opportunity to develop the field that lies at the intersection between infection control and environmental health. There are already a number of activities in the area of infection control, environment and health, but in light of significant knowledge gaps in this field, these issues should receive greater focus in the years to come. NIPH has a high level of professional competence in both infection control and environmental health. In addition, we have good registries, biobanks, modelling, biostatistical and bioinformatic expertise, advanced infrastructure and methodological expertise that will support an increased investment in this field. In order to further develop the field, we wish to:

1. Investigate the need for a focus on chemicals and infectious diseases as well as the effects on vaccination in relation to possible health hazards to the population. It is proposed that NIPH establish a working group of employees with infection control and environmental health expertise to assess knowledge gaps that NIPH can cover and necessary initiatives in the field in relation to infrastructure and competence development.

6. Possible new focus areas

In addition to the further development of existing environmental health topics, the working group proposes future efforts in two areas:

a. Climate change

The department has a lot of expertise that will be fundamental for dealing with climate challenges, especially at the national level. Although the institute is well equipped to handle most of the challenges that can be expected in Norway in the coming years, it is important to also consider how NIPH can assist in addressing the effects of climate change on health in countries that are already more affected by climate change, and whether the challenges are new, or exacerbate existing health challenges (see Table 1). In order to investigate the topic systematically and across the entire department, the senior management group (TL) has established a working group headed by Anne Bergh, which will map the department's ongoing and planned activities in the field. In addition to affecting access to water and global food production, the direct effects of climate change on health are mainly due to changes in patterns of vector-borne disease spread and changes in exposure to environmental factors (including heat waves). The necessary expertise for assessing health risks from climate change is therefore largely located at the Area for Infection Control, Environment and Health.

Table 1: Expected effect of climate change on environmental health (internal assessment)

	Globally	Norway
New health challenges and tasks	<ul style="list-style-type: none"> • Risk assessment of climate measures • Knowledge of regional temperature differences / extreme weather • Identification of new risk factors for health (Norwegian registry data as information source) 	<ul style="list-style-type: none"> • Risk assessments of climate measures • Knowledge of regional temperature differences / extreme weather • Sequelae effects of extreme weather on exposure • Identification of new risk factors over time

Exacerbating factors within existing themes and tasks	<ul style="list-style-type: none"> • Drinking water supply • Emergency preparedness challenges • Spread of infectious diseases • Food safety and security • Migration health 	<ul style="list-style-type: none"> • Increased need for comprehensive knowledge summaries in environment and health • Health effects of changed dietary advice • Extremities and settlements (e.g. molds) • Prevalence and spread of infectious diseases and pollen • Emergency preparedness challenges • Drinking water supply • Vector-borne diseases
---	---	--

b. Built environment

With an increasing densification of residential areas and an increased focus on environmentally and climate-friendly transport, Norwegian cities are going through a rapid process of change. This process means that more people live closer and this creates a need for new types of advice and knowledge about the health effects of buildings and urban development. Many factors in urban development will affect health, either positively or negatively. For example, an increased focus on public transport will reduce air pollution, but may contribute to an increased noise burden. Many building projects, and especially large public urban development processes, already involve a medical assessment. At the same time, the knowledge base on the most effective measures to promote health-promoting urban development remains limited.

NIPH therefore wishes to systematically assess how the department can assist decision-makers with:

1. investigate opportunities and needs for collaboration with the professional communities for the built environment, including authorities, architects and urban planners in order to provide advice on health effects early in the planning process. This also entails the establishment of relevant pilot projects.
2. carry out systematic knowledge summaries that can inform health-promoting buildings and be included in decisions regarding urban development.

3. investigate the effects on health of resilient buildings as a mitigation measure against climate change
4. put together the department's expertise in various fields, such as air pollution, indoor climate, noise, and physical and mental health to offer new knowledge products and services to authorities and decision makers.
5. investigate the possibility of new sources of revenue from sectors with which the department has not previously worked.