

Project information

Project title

ARCRISK - Time trends and modeling

Year

2013/2014

Project leader

Torkjel Sandanger, UiT/NILU

Participants

- Associate professor Torkjel M Sandanger (NILU/ISM)
- PhD student Therese H Nøst (NILU/ISM)
- Professor Jon Ø Odland (ISM)
- Senior Scientist Knut Breivik (NILU)
- Professor Emeritus Evert Nieboer (McMaster University, Department of Biochemistry and Biomedical Sciences, 1280 Main Street West, HSC 4N59, Hamilton, ON L8S 4K1)

Flagship

Hazardous substances, Theme: The effects of contaminants and climate change on human health, indigenous peoples and Arctic communities

Funding Source

Fram Centre

Summary of Results

This effort has resulted in one published paper and one manuscript about to be submitted. The abstract conclusions of each paper are presented below.

In short, we have shown that

- Time trends of pollutants are decreasing for some and increasing for others, all strongly related to the emission history of each compound.
- We can achieve realistic model PCB concentrations on a population basis.
- Use of a rare longitudinal study design and mechanistic modeling strengthened the understanding of time trends in humans.

Paper 1:

Persistent Organic Pollutants in Norwegian Men from 1979 to 2007: Intraindividual Changes, Age-Period-Cohort Effects, and Model Predictions.

Conclusions: Results suggest substantial intraindividual declines in serum concentrations of legacy POPs from 1979 to 2007 in men from Northern Norway. These changes are consistent with reduced environmental exposure during these 30 years, and highlight the relation between historic emissions and POP concentrations measured in humans. Observed data and interpretations are supported by estimates from the CoZMoMAN emission-based model. A longitudinal decrease in concentrations with age was evident for all birth cohorts. Overall, findings support the relevance of age-period-cohort effects to human biomonitoring of environmental contaminants.

Paper 2:

Repeated Measurements of Per- and Polyfluoroalkyl Substances (PFASs) from 1979 to 2007 in Males from Northern Norway: Assessing time trends, compound correlations and relations to age/birth cohort

Conclusions: The concentration changes of 10 PFASs in the repeated measurements from 1979 to 2007 demonstrate divergent time trends between the different PFASs. The time trends of several PFASs during these 30 years likely reflect the overall trends in historic PFAS emissions. Sampling year was the strongest descriptor of PFOA, PFUnDA and PFOS concentrations and the calendar year trends were observed in all birth year quartiles. Some discrepancy between the trends in this current longitudinal study and cross-sectional studies were observed and likely reflects the different study designs and population characteristics.

We are currently attempting use of the model to predict individual differences in PCB concentrations based on past and current exposure. The concentrations are quite correct on group level but we are struggling to succeed with predicting the individual concentrations.

For the Management

This project provides new insight about how concentrations of POPs change with time and as people age. This will be very valuable for estimating the impacts of diet for example on the concentrations of POPs in humans. It also provides a better understanding of our interpretation of change in concentrations in the years of reduced emissions.

All this could have relevance for dietary advice and estimation of body burdens etc. This can furthermore have relevance for risk estimates for the unborn child.

Published Results/Planned Publications

Paper 1:

[Environ Health Perspect.](#) 2013 Sep 5. [Epub ahead of print]

Persistent Organic Pollutants in Norwegian Men from 1979 to 2007: Intraindividual Changes, Age-Period-Cohort Effects, and Model Predictions.

[Nøst TH](#), [Breivik K](#), [Fuskevåg OM](#), [Nieboer E](#), [Odland JO](#), [Sandanger TM](#).

Department of Community Medicine, University of Tromsø; NILU-Norwegian Institute for Air Research, Fram Centre; and University Hospital of North Norway, Tromsø, Norway.

Paper 2:

Soon to be submitted to Environment International.

Repeated Measurements of Per- and Polyfluoroalkyl Substances (PFASs)

from 1979 to 2007 in Males from Northern Norway: Assessing time trends, compound correlations and relations to age/birth cohort

[Nøst TH](#), [Vestergren R](#), [Berg V](#), [Nieboer E](#), [Odland JO](#), [Sandanger TM](#).

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University Hospital of Northern Norway, Tromsø; Department of Applied Environmental Science (ITM), Stockholm University, Sweden; Department of Biochemistry and Biomedical Sciences, McMaster University, Ontario, Canada

Paper 3:

Manuscript in preparation with preliminary title:

Individual-based mechanistic modelling of Polychlorinated biphenyls in Norwegian Pregnant Women

[Nøst TH](#), [Breivik K](#), [Nieboer E](#), [Odland JO](#), [Sandanger TM](#).

Department of Community Medicine, University of Tromsø; NILU-Norwegian Institute for Air Research, Fram Centre; and University Hospital of North Norway, Tromsø, Norway.

Communicated Results

- Nordnorsk vitensenter- the Science Centre of Northern Norway, Tromsø, Norway, October 23 2013. "Menneskene og miljøgiftene i nord». 20 min oral presentation.
- International collaboration project "Fetotox" meeting, February 28 2013. "Research updates from Tromsø". 20 min oral presentation.
- 4th International Workshop on Per-and Polyfluorinated Alkyl Substances – PFAS, Helsingø, Denmark, October 27-29 2013. "Repeated measurements of PFASs from 1979 to 2007 in Males from Northern Norway". 20 min oral presentation.
- Norsk forening for epidemiologi (NOFE)'s annual conference, Sommarøy, Norway, October 31 2103. "Persistent organic pollutants in males in the Tromsø study 1979-2007". 20 min oral presentation.

Interdisciplinary Cooperation

This project has benefitted greatly from combining theoretical modellers, environmental chemists, epidemiologists and toxicologists. This multidisciplinary approach helps in interpreting the data and to develop this research into new projects.

Budget in accordance to results

The funding has allowed for the combination of detailed dietary data, with individual blood data and the theoretical modeling. The Fram

centre Funding is of uttermost importance in these interdisciplinary projects where funding is always lacking in some parts of the projects preventing us from completing the picture.

Could results from the project be subject for any commercial utilization

No

Conclusions

The link between epidemiology and mechanistic modeling from emissions to human exposure has potential for future projects. The confidence for the modeling assumptions is enhanced and could inspire to new attempts of confronting the model with more empiric data.

The use of empiric and model predicted concentrations together in a study design which is rare is novel and has filled a knowledge gap in the literature with regards to human exposure to pollutants over time.