# POP-IDENT – Identification of new POP candidates

## - Arctic results in the context of the Stockholm Convention

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## POP-IDENT project: Identification of new POP candidates

**Aim:**

Find new potential POP candidates for the consideration by the Stockholm Convention Review Committee (POPRC).

**Starting point:**

List of 12 potential POP candidates prioritised mainly based on modelling data (original list by Blepp et al. (2012))

**Tasks:**

T 1 Prove the POP properties of the 12 compounds by compiling monitoring and other relevant data.

T 2 Identify other potential POP candidates.

T 3 Prepare *provisional* risk profiles for potential POP candidates according to Annex E, Stockholm Convention.

T 4 Draw up proposals for future monitoring studies.

## POP assessment according to Annex D, Stockholm Convention

| Property | Screening criteria |
|---|---|
| Persistence (P) | t½ in water: 2 months<br>t½ in sediments: 6 months<br>t½ in soil: 6 months |
| Bioaccumulation (B) | BCF/BAF > 5000<br>log $K_{OW}$ > 5 |
| Long-range transport potential (LRTP) | t½ in air: > 2 days |
| (Eco)toxicity (T) | no quantitative thresholds provided |

## Use of monitoring data to prove hazardous properties of substances

**In general, environmental risk assessments of substances are based on**

**laboratory data and**

**modelling data.**

**Monitoring data** can be used as an **additional information source** to prove or possibly disprove the results of laboratory and modelling studies on

**- persistence (P)**

**- bioaccumulation (B)**

**- and long-range transport potential (LRTP).**

## POP assessment according to Annex D, Stockholm Convention

| Property | Screening criteria |
|---|---|
| Persistence (P) | t½ in water: 2 months<br>t½ in sediments: 6 months<br>t½ in soil: 6 months<br>**Other evidence** |
| Bioaccumulation (B) | BCF/BAF > 5000<br>log $K_{OW}$ > 5<br>Other evidence<br>**Evidence by monitoring data** |
| Long-range transport potential (LRTP) | t½ in air: > 2 days<br>**Evidence by monitoring data** |
| (Eco)toxicity (T) | no qualitative thresholds provided |

## Monitoring data as evidence of persistence (P)

**Persistence of a compound can be indicated by detection**

- in remote and pristine regions (e.g. Arctic seas, Alpine lakes)*
- in higher concentrations in predators (higher levels of food webs) esp. in unpolluted regions*
- in residues from historic emissions immobilised in deeper layers of sediments (lakes, bays)

* ECHA (2014)

Source: AMAP 2009

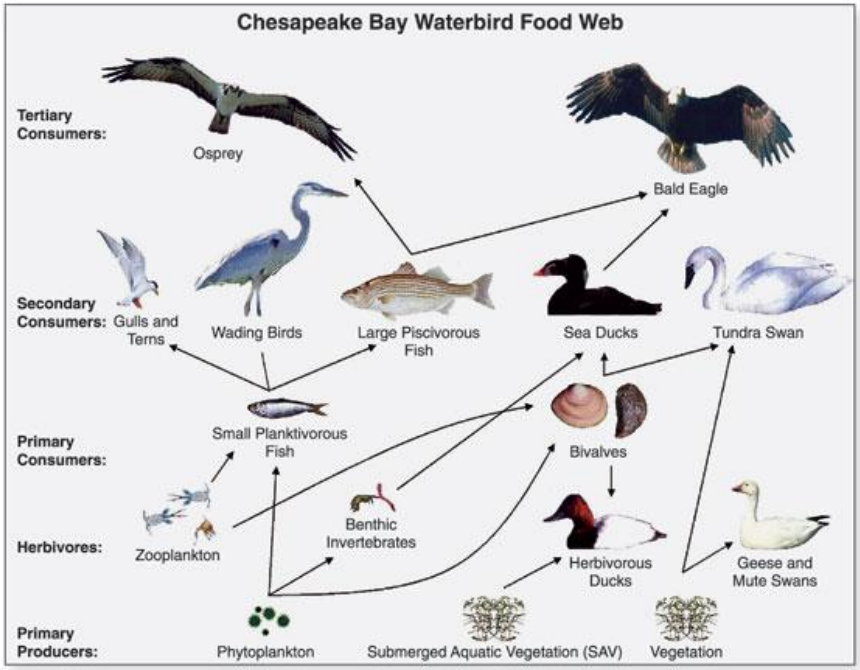
**Relevant monitoring data can include**

- **time series** of concentrations in abiotic compartments and in organisms
- concentrations in **depth profiles** of sediments
- results of **retrospective measurements** (e.g., use of samples from environment specimen banks)

## Monitoring data as evidence of bioaccumulation (B)

**Relevant monitoring data can include**

- time series of concentrations in organisms
- bioaccumulation factors (BAF) (biota/water, sediment or soil)
- biomagnification factors (BMF) (predator/prey)
- trophic magnification factor (TMF) (comprising at least three trophic levels of a food web)




Source: USGS 2008

## Monitoring data as evidence of LRTP

**Stockholm Convention, Annex D:**

**Evidence of LRTP of a chemical is given by findings in remote regions and/or by modelling results**.

**Findings from remote regions can include**

- detection in Arctic and Antarctic regions, high mountain regions and remote marine areas

**Vice versa:** Non-target-screening in remote regions may be an option to identify previously unknown compounds with LRTP.

## Careful application of monitoring data to prove P, B and LRTP properties

- Sufficient meta-data and a comprehensive documentation of the measurements are needed.
- Can the vicinity to emission sources be excluded when assessing monitoring data from remote regions?
- The mere detection of a chemical in an organism / in remote regions is not a reliable indicator for B or LRTP, resp. (ECHA 2014, Klecka and Muir 2008).
- In addition, data on emission sources and volumes, usage patterns, time-periods of production and usage are required.
- Assessment of TMF studies also requires comprehensive knowledge of the investigated ecosystem.
- TMF studies can be validated by parallel analysis of reference compounds with known TMF (e.g. ubiquitous organohalogens)
- It is recommended to report of the BMF value for each predator-prey pair in the food web in addition to the TMF value (Weisbrod et al. 2009, Ehrlich et al. 2011).

## T 1: Prove P, B, LRTP and T properties of the 12 listed pot. POP cand.

**List of 12 potential POP candidates (prioritisation by modelling data, Blepp et al. 2012)**

↓

**Evaluation based on supplemented data**

↓

**Pentachlorothiophenol**

**1,2,4,5-Tetrachlorobenzene**

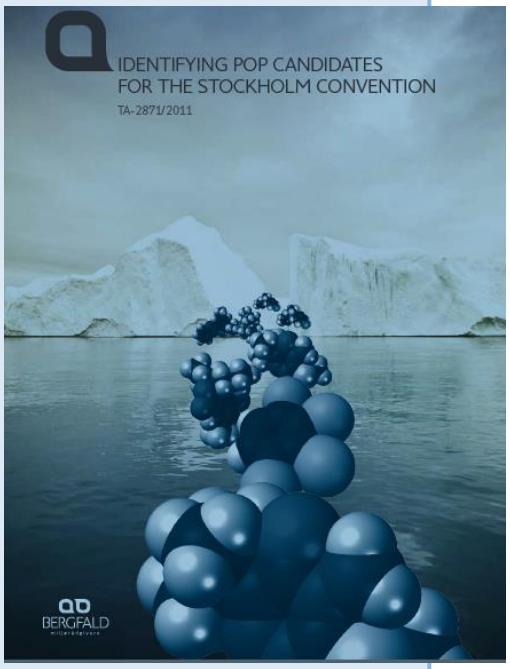
Sources of supplemented data:

- Reports of authorities (e.g. ECHA, EFSA, US EPA)
- Substance databases (e.g. HSDB)
- Scientific literature
- additional Modelling applying EPISUITE 2012
- Request addressed to the representatives of Scandinavian environments specimen banks (ESB), of the Antarctic ESB, to other monitoring experts in Northern Europe und Canada

## T 2: Identify other potential POP candidates

**Identification of potential POP candidates based on monitoring data**

based on the
**Report „Identifying POP candidates for the Stockholm Convention" by Lambert et al. (2011)**




**First criterion of selection:**

**presence of a substance in the Arctic or Antarctic environment**

**Outcome: List of 17 potential POP candidates**

**POP-IDENT project:**

**Supplementation of this data basis by further research**

## T 2: Prove P, B, LRTP and T properties of the 17 listed pot. POP cand.

**List of 17 potential POP candidates (prioritisation by monitoring data, Lambert et al. 2011)**

↓

**Evaluation based on supplemented data**

↓

**Pentabromotoluene**
**1,2,3,4-tetrachlorobenzene**
**Perfluorononanoate**
**Trifluralin**
**Methoxychlor**
**Octachlorostyrene**

**No agreement with the prioritisation list of 12 compounds based on modelling data prepared by Blepp et al. (2012).**

## T 3: Prepare *provisional* risk profiles for selected potential POP candidates

| Substance | CAS | Prioritisation |
|---|---|---|
| Pentachlorothiophenol (PCTP)<br>(e.g., agent in rubber production) | 133-49-3 | based on modelling data |
| 1,2,4,5-tetrachlorobenzene<br>(1,2,4,5-TeCB) including the isomers<br>1,2,3,4-TeCB<br>and 1,2,3,5-TeCB<br>(e.g., dieelectric fluids) | 95-94-3<br><br>634-66-2<br>634-90-2 | based on modelling data |
| Trifluralin (herbicide) | 1582-09-8 | based on monitoring data |
| Chlorpyrifos (insecticide) | 2921-88-2 | Suggested by UBA due to current discussion on risks to human health and the environment |

## Arctic results as evidence for P, B and / or LRTP properties

| Substance | Findings in the Arctic | Regions | Reference |
|---|---|---|---|
| Pentachloro-thiophenol (PCTP) | No data available | - | - |
| 1,2,4,5-tetrachloro-benzene | Polar bears: adipose tissue (1991-2007)<br>Biomagnification in food chains: plants-caribou-wolf | Hudson Bay/Canada<br>Central and Western Canadian Arctic | McKinney et al. (2010)<br>Kelly & Gobas (2001) |
| 1,2,3,4-tetrachloro-benzene | terrestrial, freshwater and marine biota | Greenland | Riget et al. (2003) |
| Sum CBz | Lake sediments | Canadian Arctic<br>Yukon Lakes | Muir et al. (1995), Rawn et al. (2001) |

## Arctic results as evidence for P, B and / or LRTP properties

| Substance | Findings in the Arctic | Regions | Reference |
|---|---|---|---|
| Trifluralin | Air/seawater | Greenland<br>North Pacific Ocean | Bossi et al. (2008)<br>Zhong et al. (2012) |
| | Ice cap | West Svalbard/NO | Ruggirello et al. (2010) |
| | Snow core | Nunavut/Canada | Zhang et al. (2013) |
| | Fjord sediments | Svalbard/NO | Ma et al. (2015) |
| | Lake sediments | Bear Island/NO | Evenset et al. (2004) |
| | Zooplankton in remote inland lakes | Ontario/Canada | Kurt-Karakus et al. (2011) |

## Arctic results as evidence for P, B and / or LRTP properties

| Substance | Findings in the Arctic | Regions | Reference |
|---|---|---|---|
| Chlorpyrifos | Marine fog and ice, sea water | Bering and Chukchi Seas | Chernyak et al. (1996) |
| | Snow cores over sea ice | Chukchi and Beaufort Seas | Garbarino et al. (2002) |
| | Lake water | Canadian Arctic | Muir et al. (2004) |
| | Ice core | East Svalbard/NO | Hermanson et al. (2005) |
| | Air | Labrador Sea | Jantunen et al. (2007) |
| | Snow, lake sediments | Alaska, USA | Landers et al. (2008) |
| | Ice cap | West Svalbard/NO | Ruggirello et al. (2010) |
| | Air/seawater | North Pacific Ocean | Zhong et al. (2012) |

## Arctic results as evidence for P, B and / or LRTP properties

| Substance | Findings in the Arctic | Regions | Reference |
|---|---|---|---|
| Chlorpyrifos | Conifer needles, freshwater fish | Alaska, USA | Landers et al. (2008) |
| | Zooplankton in remote inland lakes | Ontario/Canada | Kurt-Karakus et al. (2011) |
| | Seal blubber | Svalbard | Langford et al. (2012) |
| | Food chains plants-caribou-wolf | Nunavut/Canada | Morris et al. (2014) |

## Conclusions of the *provisional* risk profiles

| Substance | Results of the *provisional* risk profile |
|---|---|
| Pentachlorothiophenol (PCTP) | insufficient data base<br>no monitoring data available<br>→ no final conclusion |
| 1,2,4,5-tetrachlorobenzene<br>1,2,3,4-TeCB<br>1,2,3,5-TeCB | potential POP candidate<br>potential POP candidate<br>no potential POP candidate |
| Trifluralin | biomagnification in aquatic and terrestrial food webs not clarified<br>insufficient prove of LRTP<br>→ no final conclusion |
| Chlorpyrifos | persistent only under extreme conditions, borderline bioaccumulative<br>→ probably no potential POP candidate |

## T 4: Recommendations for future monitoring studies

| Substance | Required studies |
|---|---|
| Pentachlorothiophenol (PCTP) | Further laboratory studies<br>First step of monitoring:<br>detection in Arctic compartments |
| 1,2,4,5-tetrachloro-benzene (1,2,4,5-TeCB)<br>including 1,2,3,4-TeCB and 1,2,3,5-TeCB | Isomer-specific studies referring to:<br>- detection in Arctic compartments<br>- analyses of sediment profiles<br>- biomagnification in aquatic food webs in the Arctic |
| Trifluralin | Studies on biomagnification in aquatic and terrestrial food webs in the Arctic |
| Chlorpyrifos | Analyses of sediment profiles<br>Studies on biomagnification in aquatic and terrestrial food webs in the Arctic<br>Besides monitoring:<br>Re-evaluation of studies on bioaccumulation |

## Conclusions

- Prioritisation based on monitoring data can provide information to identify new potential POP candidates.
- Assessment of potential POP candidates is often hampered by an insufficient data basis.
- Monitoring studies often focus on compounds already phased out.
- Monitoring studies or programmes do often not provide data appropriate for P and B assessments.
- In most cases, additional monitoring data are required, esp. data on biomagnification of substances in aquatic and terrestrial food webs.
- Archived (biota) samples from environmental specimen banks may be used for retrospective monitoring studies.
- Standardised analytical methods are an essential prerequisite to detect a substance in environmental compartments.

## Acknowledgement

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Environmental Research Plan 2013, project no 3713 63 418

Source: UBA

## Outlook

**Start of the POP-Implement project in December 2016:**

**Contributions for the implementation of the Stockholm Convention (Elimination and Restriction) for selected POPs**

**Project partners:**

**BfG - German Federal Institute of Hydrology**

**BiPRO - Consultancy for Integrated Solutions**

Initiated and funded by

**German Environment Agency (UBA), Dessau-Roßlau**

Environmental Research Plan 2016, project no 3716 63 4020

Thank you very much
for your attention!