What does Sweden do? How do the authorities work together, and what role can the authorities take on for a successful national PFAS strategy?

Markus Klar & Karl Lilja
Swedish EPA, Naturvårdsverket

Environmental monitoring identified PFAS as a problem 20 years ago

- 2001: Screening of PFAS i fish, surface water, leachate from landfills, urban waste water, sediment, suspended particulate matter, air.
  - ➢ Leachate and waste water identifed as a source. Elevated levels in surface waters related to a fire training school.
- 2002-2003: Continued screening aquatic biota incl a retrospective study on guillemot eggs
  - ➢ Elevated levels in urban environments. Increasing trend.
- 2002: Screening of human blood.

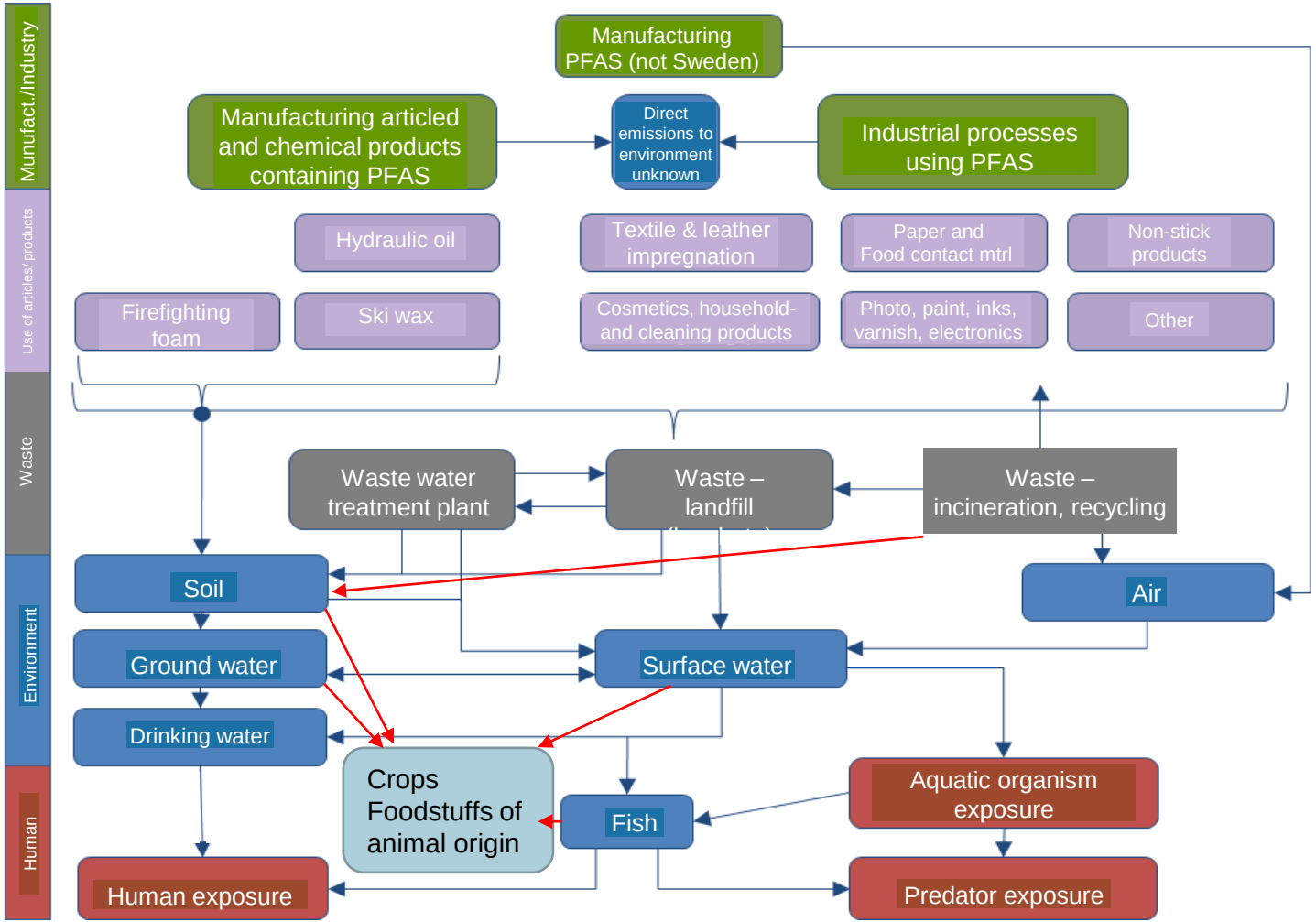
- 2003: Screening PFAS groundwater from background areas.
- 2003-2004: Nordic screening.
- 2005: Continued screening
  - ➢Elevated levels in urban waste water and landfill leachate. Elevated surface water and fish related to an airport.
- 2001-2006 we learned that:
  - PFAS contamination is wide spread, concentrations are elevated in urban areas and there is human exposure.
  - Fire training sites, airports, landfill leachate and urban waste waters identified as (secondary) sources.

Some responses to the results

- Räddningsverket (a former governmental agency, now the Contingencies Agency) responsible for the fire training site identified to contaminate surface water in 2001 decided not to use foam with fluorotensides for training in 2002.
- IVL and Swedavia set up RePATH, a five year research project on PFAS from airports 2009. Swedavia stopped using PFAS-containing foam 2011 (for training in 2008).
- Proposal EQS to be used for specific pollutants by the Water District Authorities published 2008. EQSbiota of 6 µg/kg ww to protect human health.

Groundwater a major gap

- Groundwater is used for drinking water for >50% of SE population, still limited monitoring of groundwater and drinking water.
- 2011: Contamination of drinking water in Tullinge identified. Student attending a summer school in environmental chemistry bring tap water to Stockholm University. Extremely high levels found.
- 2012: Contamination of drinking water in Uppsala identified. Water investigated after analysis of blood samples from a human cohort showed high conc of PFHxS.
- 2013: Contamination in drinking water in Ronneby identified. County administrative board in Blekinge undertake an extended monitoring of groundwater. Very high conc found in GV used for drinking water production.
- All three discoveries depended on elements of luck.
- Scientific publications on contamination of groundwater since end of 1990s!


Munufact./Industry
Use of articles/ products
Waste
Environment
Human
Manufacturing PFAS (not Sweden)
Manufacturing articled and chemical products containing PFAS
Direct emissions to environment unknown
Industrial processes using PFAS
Hydraulic oil
Textile & leather impregnation
Paper and Food contact mtrl
Non-stick products
Firefighting foam
Ski wax
Cosmetics, household- and cleaning products
Photo, paint, inks, varnish, electronics
Other
Waste water treatment plant
Waste – landfill
Waste – incineration, recycling
Soil
Air
Ground water
Surface water
Drinking water
Crops Foodstuffs of animal origin
Fish
Aquatic organism exposure
Human exposure
Predator exposure

PFAS in the environment and food production

PFAS in food
- Levels?
  - Background vs food from contaminated areas?
- Which foodstuffs contribute to exposure?

- Limit values?

Exposure pathways
- Drinking water for production animals
- Feed
- Pasture
- Irrigation water
- Contaminated soil

- What levels are problematic?

Sources
- Fire fighting foam
- Landfill leachate?
- Waste water?
- Fertilizers/soil improvers?
- Local atm deposition industries?
- Fish meal?

- What levels are problematic?

- Complying with food limits: Food producers responsible
- Emmissions to the environment: Operators responsible

- Expertice, guidance, inspections, regulatory implementation etc quite separated

Causes of and needs to cooperation (1)

In 2014 the SCIENTIFIC COMMUNITY URGE GOVERNMENT to APPOINT a COMMISSION to INVESTIGATE

1) What happened?
2) How could the catastrophe be monitored and its negative effects on HH & E be minimised?
3) What can be done to avoid this in the future?
4) **Why did it happen?**

Causes of and needs to cooperation (2)

2016 investigation answers for WHY IT DID HAPPEN!

- Weak Chemicals legislation
  - Operator responsibility – production, placing on the market, use, etc. – a lot in the pipe on PFAS-restriction
- Poor compliance and enforcement of *the environmental code* (Swedish frame law)
  - Lack of resources and knowledge, both on the operator and enforcement side
- Little attention to groundwater contamination
- Incomplete environmental monitoring
- **Poor cooperation within and among authorities**
  - Lack of knowledge
    - Due to poor information sharing and coordination - vertically and horizontally



Causes of and needs to cooperation (3)

SWEDEN – A SPECIAL CASE

Decentralised public administration at thee levels

1. National level - government and about 340 agencies
   - Chief role is guidance for enforcement, ministerial rule prohibited
2. Regional level - 20 regions (county councils)
3. Local level – 290 municipalities (councils)
   - Most of enforcement and welfare services
   - <u>Local autonomy → sovereign enforcement decisions</u>

→ "Soft" inspection – i.e. less requirements, more dialogue

→ Bottom-up effect – data generated at local level

→ High demands on cooperation, trust, transparency, info sharing

Different types of PFAS-cooperation in Sweden

Formalised cooperation →
- Programmes of measures - WFD/MSD
- Government assignments

Networks →
- SamTox (Coop = Sam… in Swedish)
- National PFAS network
- Authority PFAS network

Day-to-day cooperation →
- E.g., development of guidelines
  - Fire fighting activities
  - PFAS-polluted areas
  - Internal coordination, EPA

Examples of Cooperation



Destruction of firefighting foam (AFFF)

FINANCED COLLECTION, TRANSPORT AND DESTRUCTION OF PFAS-CONTAINING AFFF from CIVIL PROTECTION SERVICES

COOPERATION

1) Idea from member in the Toxicological Council – about 4-5 yrs ago
2) Discussed at several occasions at SamTox and PFAS authority network
3) Chemicals Agency drafting a request to the Government in 2021
4) In 2022 appropriation directions for the EPA & Contingencies Agency
   - Strengthened cooperation: EPA ←→ Contingencies Agency
   - € 900 000 for destruction of AFFF and strengthened guidance on use of AFFF in order to **prevent** costs for remedial measures (from EPA-budget)

Destruction of firefighting foam and more…

- Survey: about 1/3 of civil protection services replied in 2021 and 2/3 2022
  - Procurement of 360 000 l AFFF (2021 about 150 tonnes)
- About 190 000 l was destroyed 2022
  - 2 - 11 tonnes PFAS destroyed at a cost of € 600 000
- Will continue in 2023 – new civil protection services are added continuously

- **New guidance** – environmental effects of fire water published (Contingencies Agency)
- **Guidance for enforcement** – to come this year (EPA)
- Building of **Database** on chemical signatures of AFFF:s (Fac. of Engineering Lund Uni.)

Keys to ”Success”

National level

- Formation of networks – SamTox, PFAS-networks

Authority level

- Analyse problem and identify stakeholders

- Form stakeholder focus groups to gain relevant knowledge

- Establish professional AND personal relationship to build trust


NATUR
VÅRDS
VERKET