

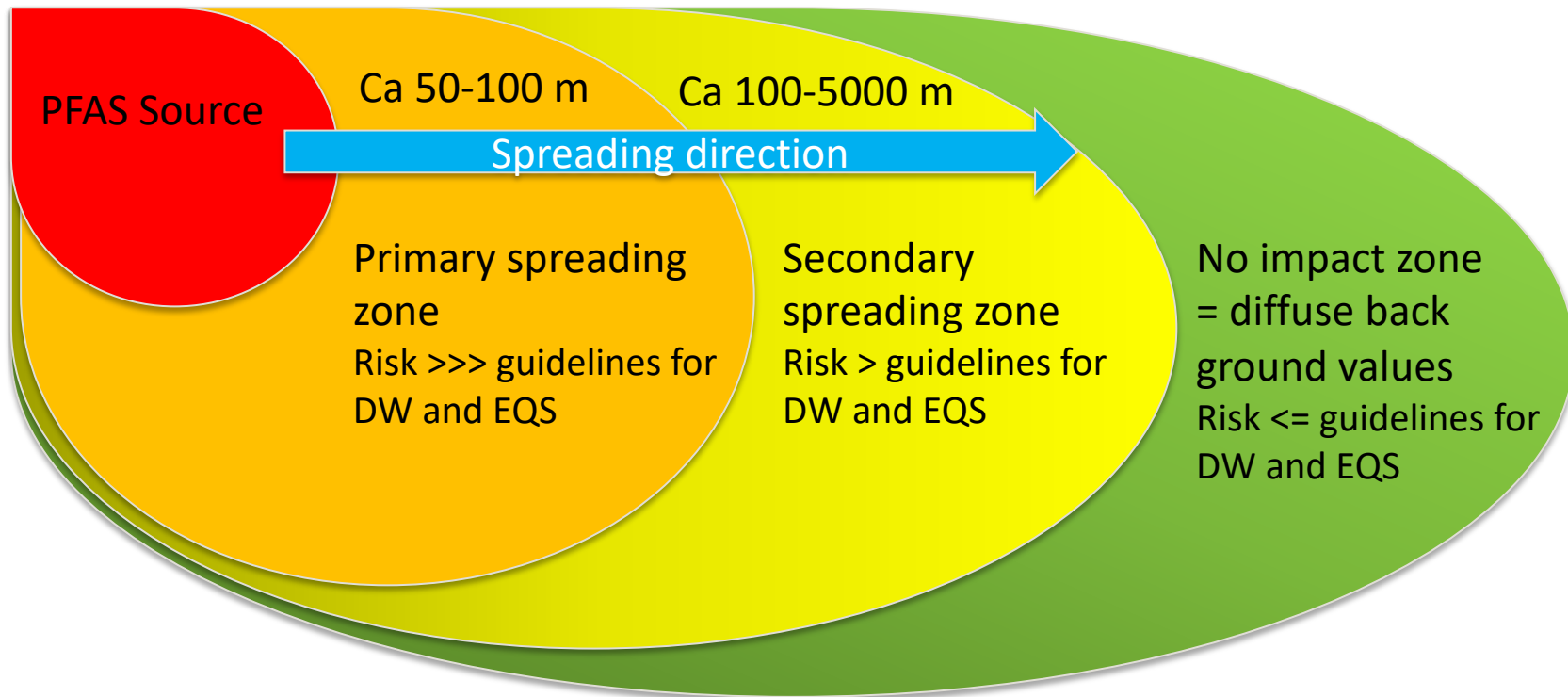
While waiting for remediation

Risk management in PFAS contaminated area

General need to know about PFAS

- ≥ PFAS spreads easily
- ≥ PFAS has no smell or colour at contaminated sites – you may detect it's presence when seeing bubbles on a stream or a beach or in a sewage plant.
- ≥ PFAS's have a range of mobility in soil and water but almost all are considered very mobile
- ≥ Shorter PFAS are more mobile than the longer
- ≥ The complex PFAS such as 6:2 FTS etc tend to break down into other persistent PFAS in nature
- ≥ The longer PFAS are more bioaccumulative and have longer halftime in humans and animal kingdom.
- ≥ The shorter PFAS can be drawn up in to plants leafs and twigs
- ≥ PFAS poses risks for humans and the ecosystem at low concentrations - ng/l

Groundwater from PFAS contaminated site



PFAS moves at different speed in the groundwater – short PFAS move faster than long PFAS
Data from investigated sites show that the actual mobility needs to be monitored in a series of wells since the composition of PFAS, soil composition and other unknown factors play an important role

Surface water from PFAS contaminated site

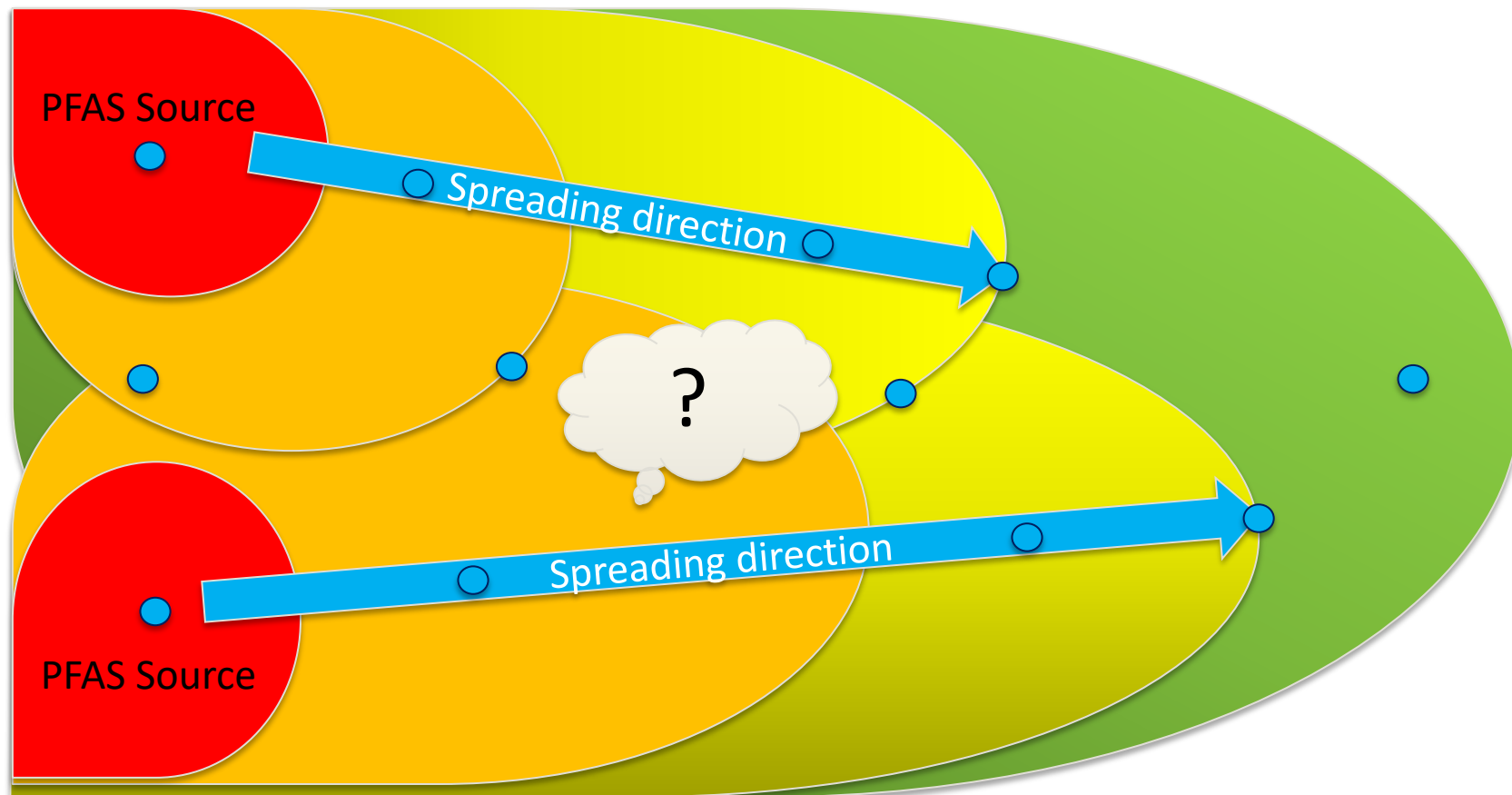


PFAS Source

Primary
Risk >>
guidelines
for DW
and EQS

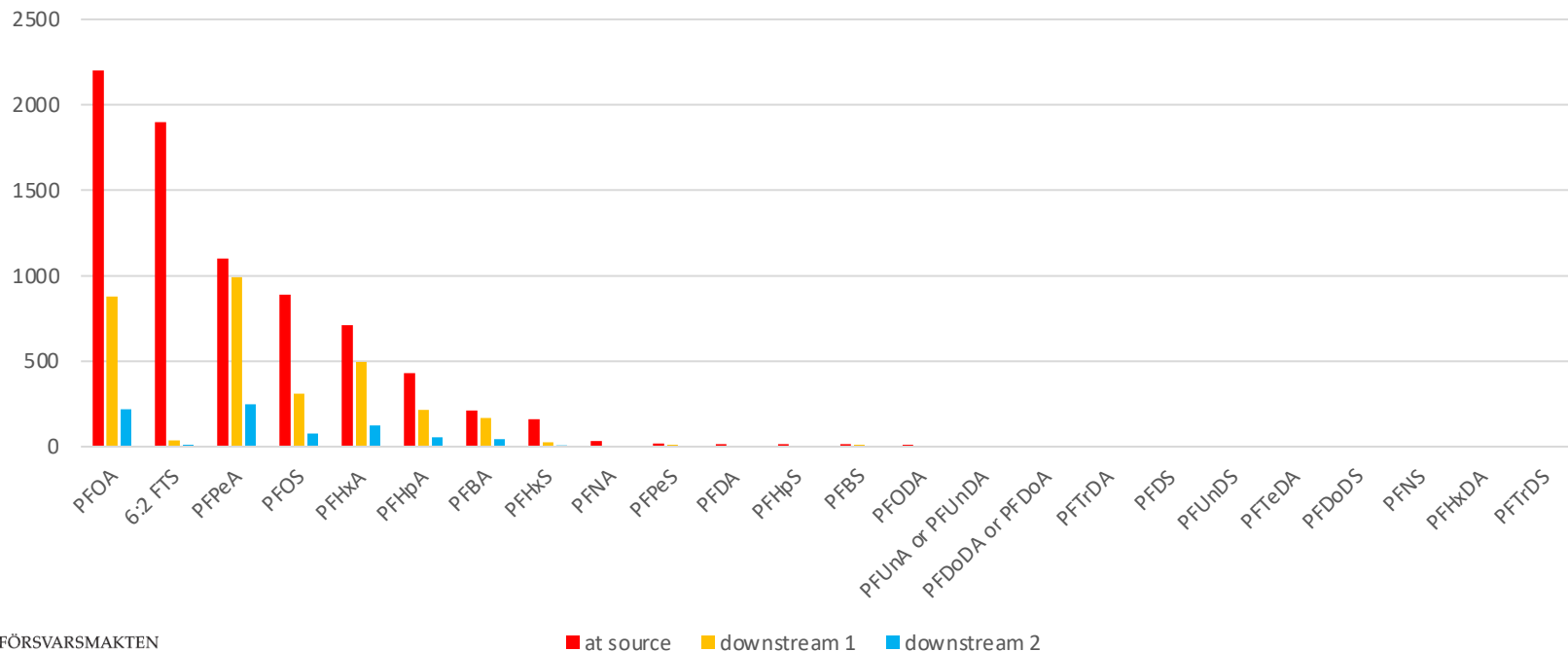
Secondary
spreading zone
Risk > guidelines for
DW and EQS

No impact zone
= diffuse back
ground values
Risk <= guidelines for
DW and EQS



Monitoring what

Generalization attenuation during transport in groundwater



the investigative phase

- ≥ Make a conceptual model including Potential source areas
- ≥ Check likely spreading directions for surface water and groundwater
- ≥ Start taking samples in plume to verify risk at source and in all suspected directions.
- ≥ Analyze all expected PFAS and all PFAS for all existing and proposed guideline values. In Sweden these are all in PFAS-4, PFAS-20 (EU), PFAS-21 and PFAS-24 (EU).

- ≥ Second phase:
- ≥ Create a monitoring programme for all verified sources and plumes
- ≥ Start investigating flow patterns, flow variation, identify what happens during extreme dry and wet weather events
- ≥ Measure all verified PFAS substances and also water quality parameters that may be important when choosing remediation or water treatment
- ≥ Make all possible fixes to cut off infiltration or spreading from the site to buy time to investigate a cost effective remediation method at the source
- ≥ Monitor the site so that no unexpected changes are done such as added water wells, digging, building, ditching etc that may cause additional harm on and off site.

Guideline values – achievable?

On source site

- ≥ NO! Not likely for a long, long time.

What can you do?

You can reduce the concentration in soil and water until:

- ≥ onsite exposure is reduced to acceptable levels
- ≥ Leaching and spreading no longer threatens nearby protected wells and watering systems and EQS can be achieved
- ≥ long term risk management is absolutely necessary
- ≥ Set long term goals for the whole site

Downstream protected sites

- ≥ YES! Or maybe later!
- ≥ If leaching at the source is remediated to acceptable levels
- ≥ If there are no other upstream sources that also need to be remediated
- ≥ If previous leaching and spreading from source shows a downward trend after the source is remediated.
- ≥ When treatment can be used to catch or stop PFAS from entering the site.

Consequences of distance and time

- ≥ Mobility
- ≥ OECD definition short and long
- ≥ Typical change
- ≥ Mixing different sources
- ≥ Calculating impact – flow, concentration, type of PFAS