

LANDFILL ACCEPTANCE CRITERIA FOR PFAS

IMPLICATIONS FOR REMEDIATION OF PFAS CONTAMINATED SITES

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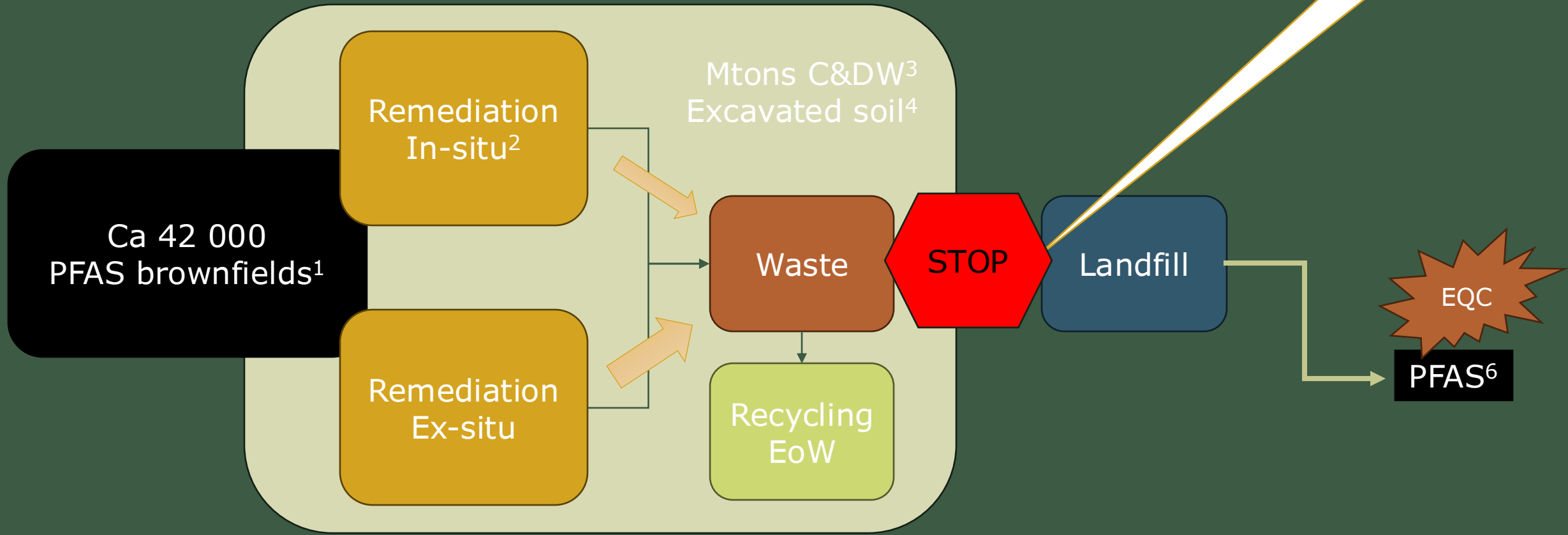
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In short I will

- **Debunk** two common misconceptions/misconstructions
- Quickly **glance** at role of landfills in management of PFAS-containing waste (soil)
- **Check out** Landfill acceptance criteria - PFAS

Background: PFAS brownfield management





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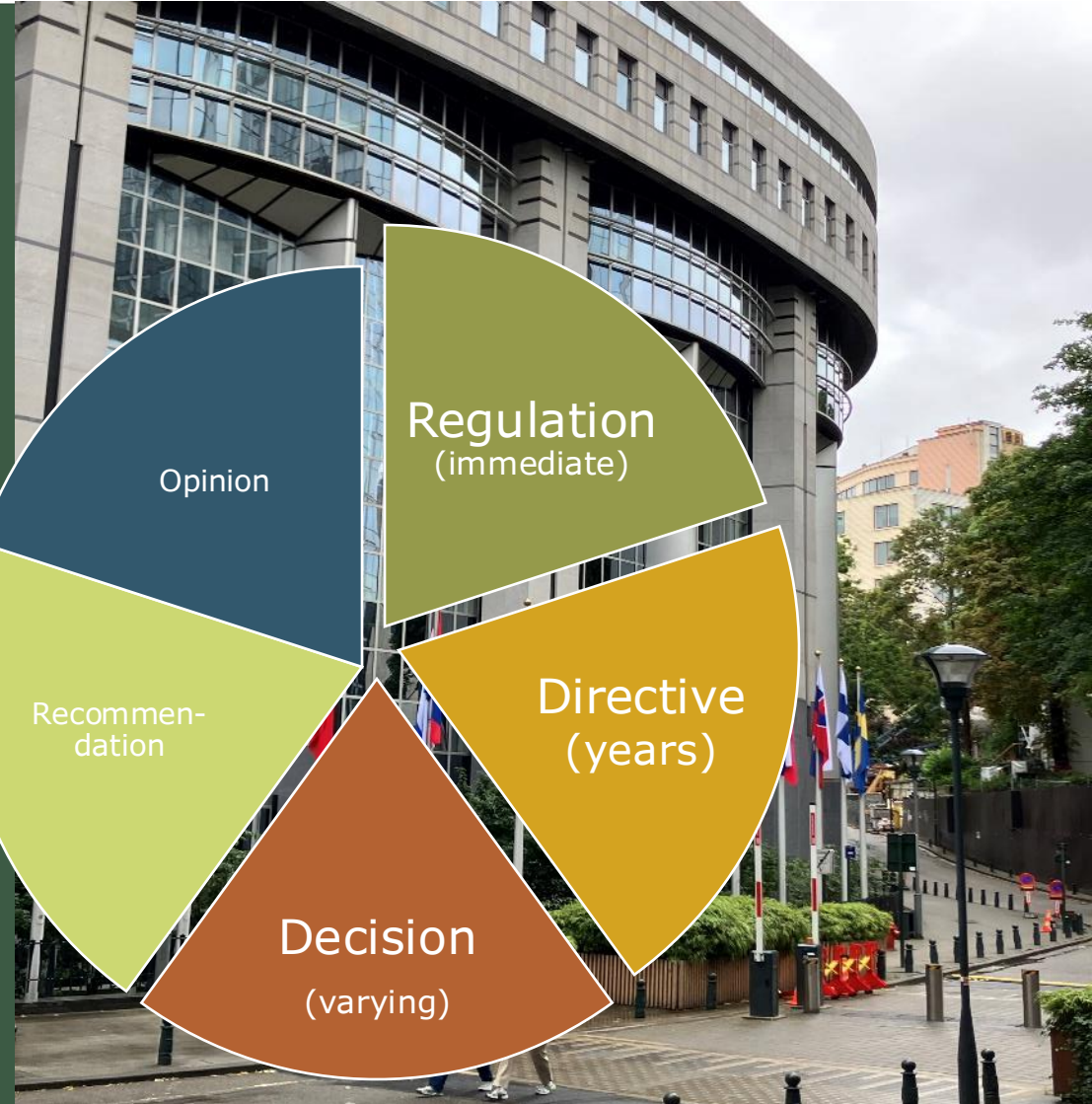
EU SECONDARY LAW



Pre-PFAS

Landfill directive (EU)
2018/850

Council decision
2003/33/EC (waste
acceptance criteria)





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Waste acceptance criteria to landfill

Council decision 2003/33/EC

- Waste characterization
(incl. leaching, mandatory)
- Limit on total contents
(TOC, "old school" hazardous substances/landfill class)
- Limit on leaching
(/landfill class for metals, DOC, ...)

What and what not to landfill



When it leaves/leaks (Environmental quality standards)

In

(waste acceptance criteria - WAC)

Landfill directive and council decision



Out

(leachate/landfill gas)

"Water Framework directive" (soon)

BREF



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Waste properties

Common
Misconstruction



Lower limit: 3000 ppm for some PFAS (CLP)

Waste
classification



All waste!

Waste
characterization

I

II

III

Waste to
landfill class

Lower limit: 3000 ppm for some PFAS (CLP)



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Waste characterization vs. Waste acceptance criteria

Common
Misconception



~~Limit values for
leachate non-
hazardous waste~~

~~No limit values →
free of any
non-hazardous
was~~

Pitfalls with landfilling

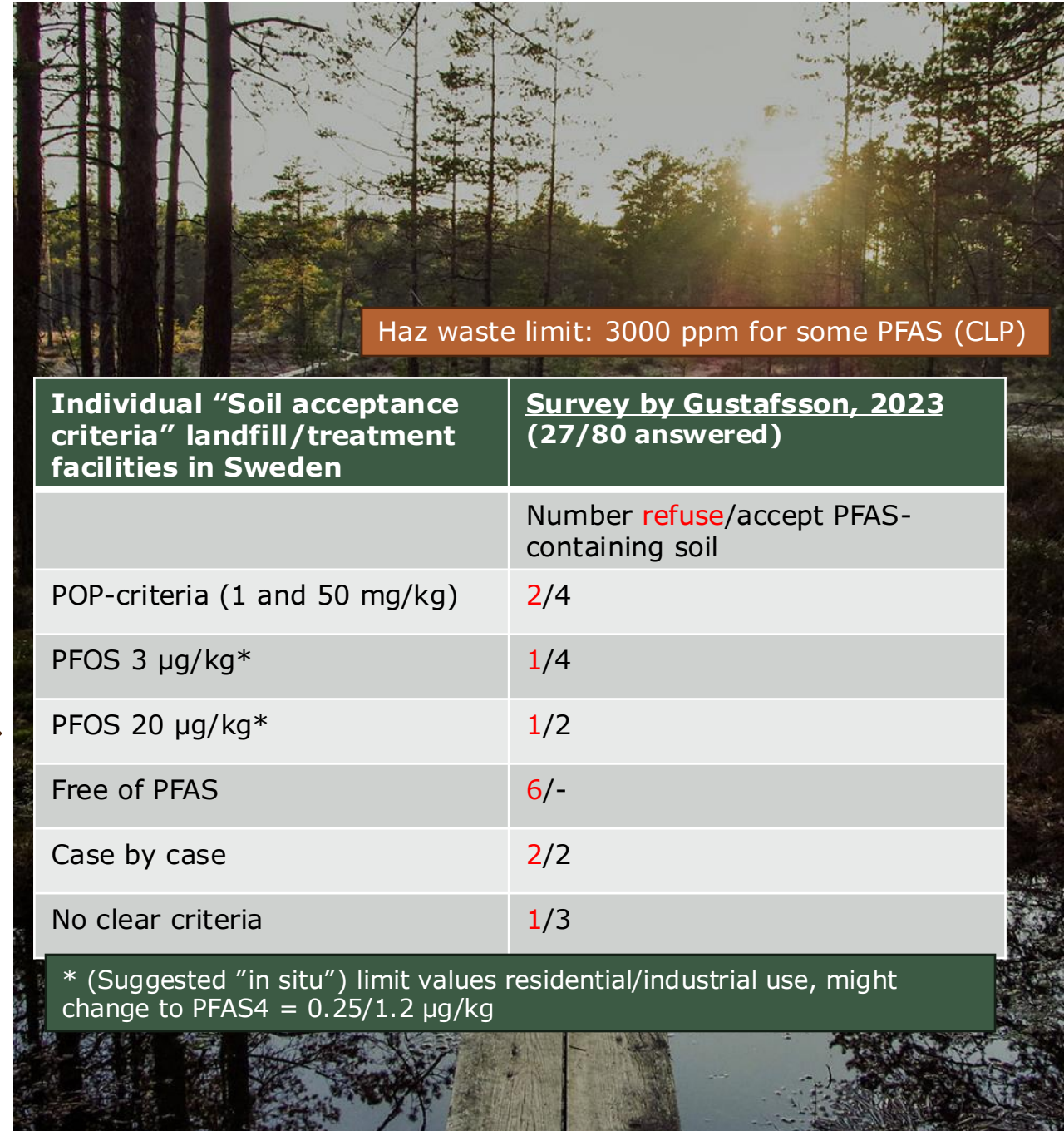
Lack of knowledge (PFAS_{xx}, mobility/leaching, hazards)

Lack of awareness ("nanogram in a megaton business")

Classification of reclaimed materials

Lack of available disposal/treatment

Most (all?!) landfills leach PFAS

Haz waste limit: 3000 ppm for some PFAS (CLP)

Individual "Soil acceptance criteria" landfill/treatment facilities in Sweden	Survey by Gustafsson, 2023 (27/80 answered)
	Number refuse /accept PFAS-containing soil
POP-criteria (1 and 50 mg/kg)	2/4
PFOS 3 µg/kg*	1/4
PFOS 20 µg/kg*	1/2
Free of PFAS	6/-
Case by case	2/2
No clear criteria	1/3

* (Suggested "in situ") limit values residential/industrial use, might change to PFAS4 = 0.25/1.2 µg/kg



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Can leaching limit values
for waste to landfill be a
solution?

SEPA commissioned SGI

Study AIM:

(How) could you develop
PFAS WAC?

Leaching
main
issue

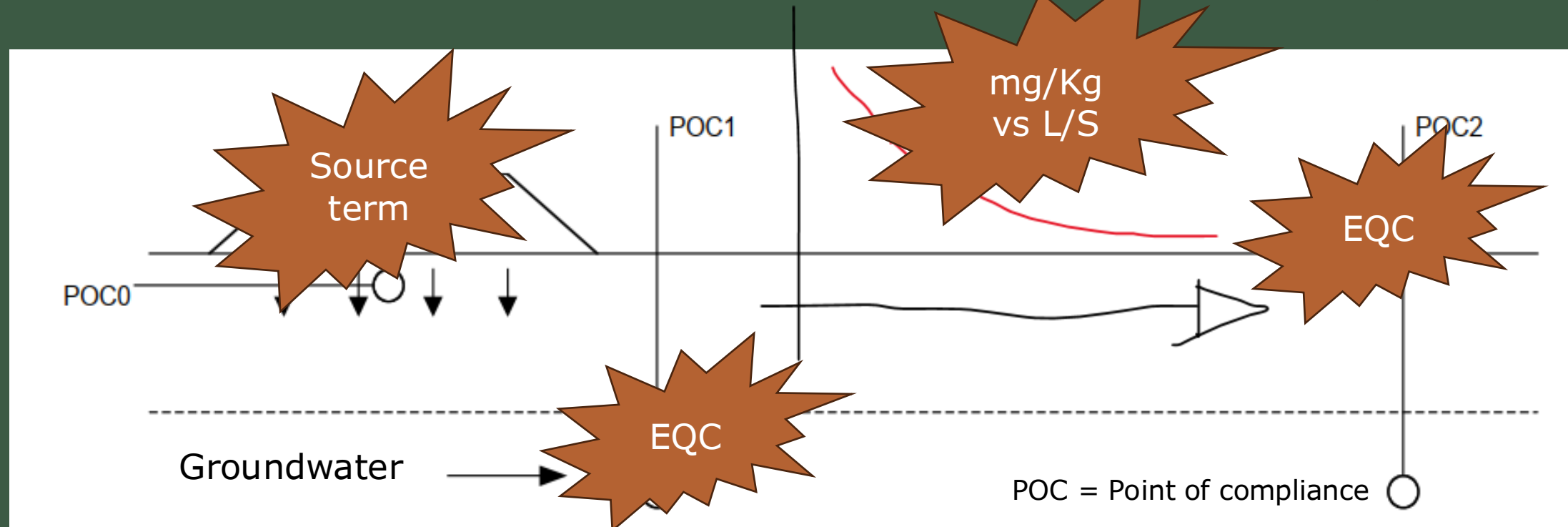
Main environmental risk with PFAS in waste management

- A) "false negative" in waste acceptance control → PFAS-containing waste recycled/circulated
- B) Landfilled waste leaches PFAS / leachate treatment not up to the task



Transport
model

Waste acceptance criteria leaching – "TAC methodology



Single substance approach!



Source
term

$$C_{L/S} = C_0 * e^{-L/S * \kappa}$$

mg/Kg
vs L/S

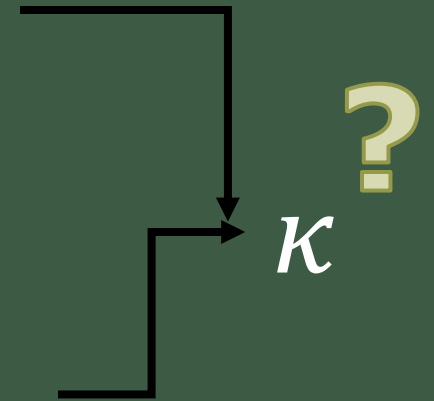
$$E = \left(\frac{C_0}{\kappa} \right) (1 - e^{-(L/S) \kappa})$$

EQC

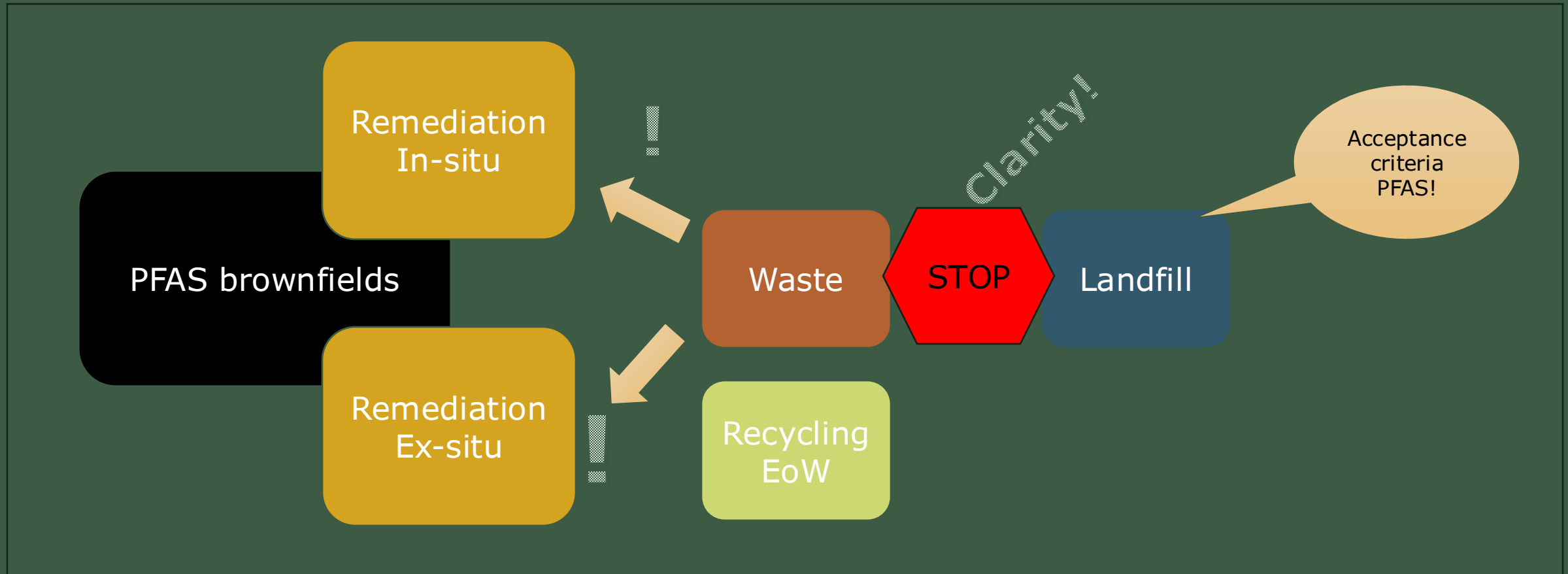
$$EQC = (PFAS\ 25) \quad ?$$

Transport
model

?



Benefits of regulatory WAC-PFAS



Conclusion

Waste management/landfills
important for PFAS brownfield
management

PFAS waste acceptance criteria
can create a unambiguous and
level playing field (ensure end-
of-life management)





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Potential steps towards WAC-PFAS

- Verify/develop standard leaching tests for PFAS (variety of wastes)
- Collect and publish data
- Test/develop transport models for different scenarios for mobile/less mobile PFAS (water-air interface) → and/or worst case?!
- Include (preliminarily at least) precursors

THE END

