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Site-specific emission criteria for three Dutch landfills

H. Scharff (**NV Afvalzorg Holding**)
J.J. Dijkstra (**ECN**)
A. van Zomeren (**ECN**)
R.N.J. Comans (**Wageningen
University**)
E. Brand (**National Institute for Public
Health and the Environment**)

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Heijo Scharff, NV Afvalzorg Holding, h.scharff@afvalzorg.nl

Joris Dijkstra, Energy Research Centre of the Netherlands

André van Zomeren, Energy Research Centre of the Netherlands

Rob Comans, Wageningen University

Ellen Brand, National Institute for Public Health and the Environment



Introduction

Landfill regulations with respect to ending aftercare often mention that no threat to human health and the environment should remain. This statement needs to be translated into emission criteria for which compliance can be demonstrated before competent authorities can decide on ending aftercare. Various approaches are proposed or under development (Laner et al, 2012). A generic method for establishing site-specific criteria for emission to groundwater and surface water has been developed in the framework of the Dutch project 'introduction of sustainable landfill management'.

Method

End of aftercare implies that at some point in time liners will fail and natural water infiltration will occur. The water balance of the landfill has to be considered under that assumption. Figure 1 gives an example for the Netherlands.

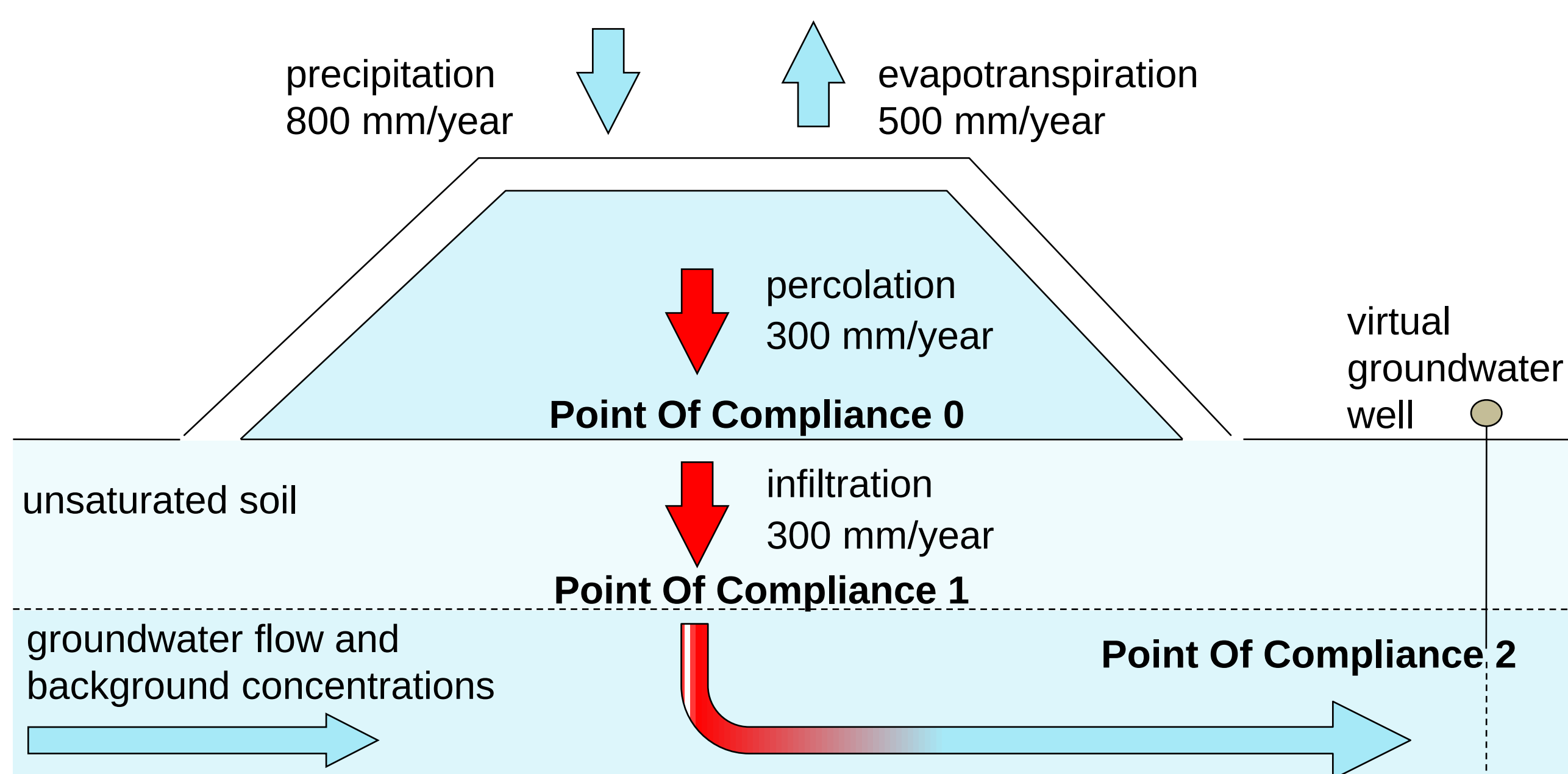


Figure 1: water balance (Dutch climatic conditions)

A source - path - receptor model was used. Point of compliance 2 is located in either groundwater or surface water depending on the site-specific hydrology. Criteria at point of compliance 2 are either the 'maximum permissible risk' or 'negligible risk' for not-naturally occurring organic substances. The 'maximum permissible risk' is taken as the concentration at which >95% of the species are protected or in other words: <5% is affected. The 'negligible risk' is that concentration divided by 100. Although under discussion these values can be derived (Figure 2) from abundantly available ecotoxicity data (e.g. Verbruggen et al., 2001).

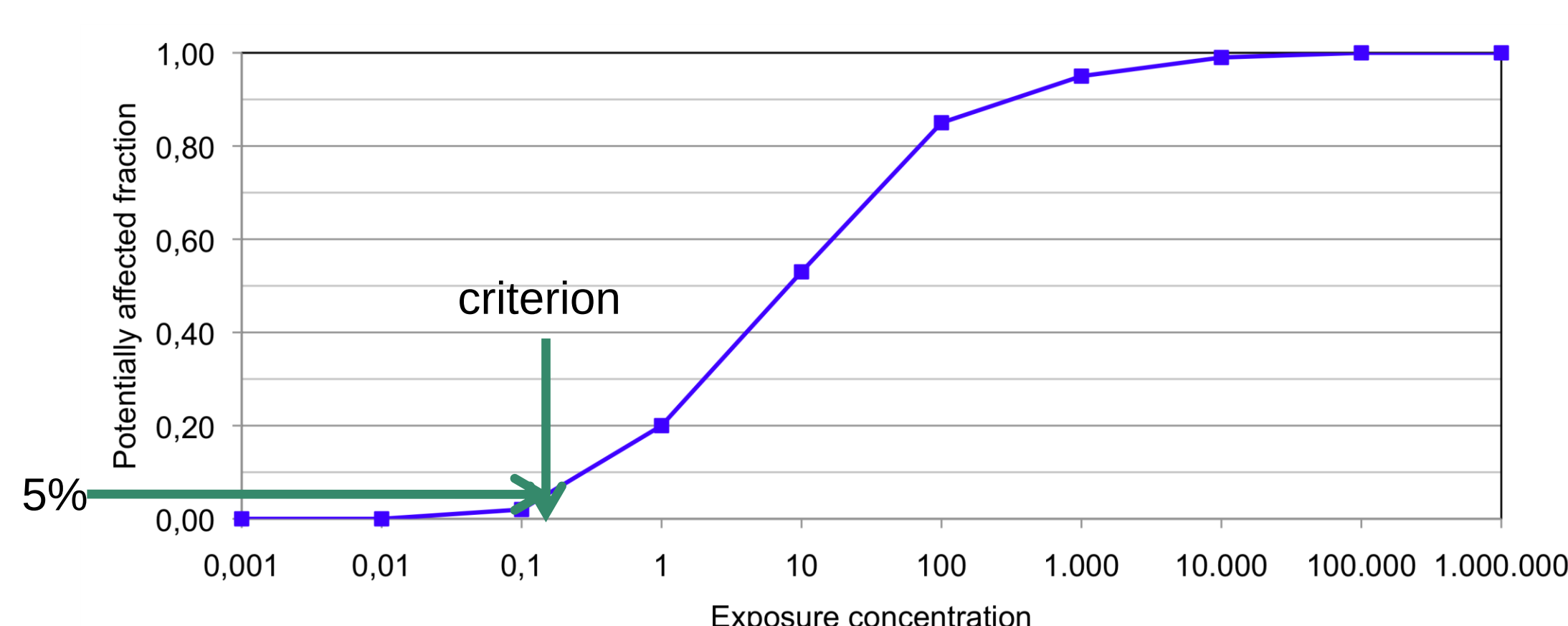


Figure 2: determination of criterion from fictitious 'no observed effect concentration' data of a fictitious compound

Method continued

To derive emission criteria at point of compliance 0 site-specific factors are taken into account for the unsaturated soil including the soil-specific pH and content of mineral and organic reactive surfaces to which released contaminants can bind. Natural background concentrations of contaminants in the groundwater are considered, as well as hydrological dilution of the contaminants on the 'path' towards point of compliance 2. The calculation of the emission criteria is an iterative process (Figure 3). The method involves many assumptions and policy-related choices. E.g. the time-dependency of the source term (constant or declining), the local soil chemistry (e.g. pH and organic matter content) and the time period during which the concentrations in groundwater should remain below the groundwater quality criterion (e.g., 100, 500 or 1000 years).

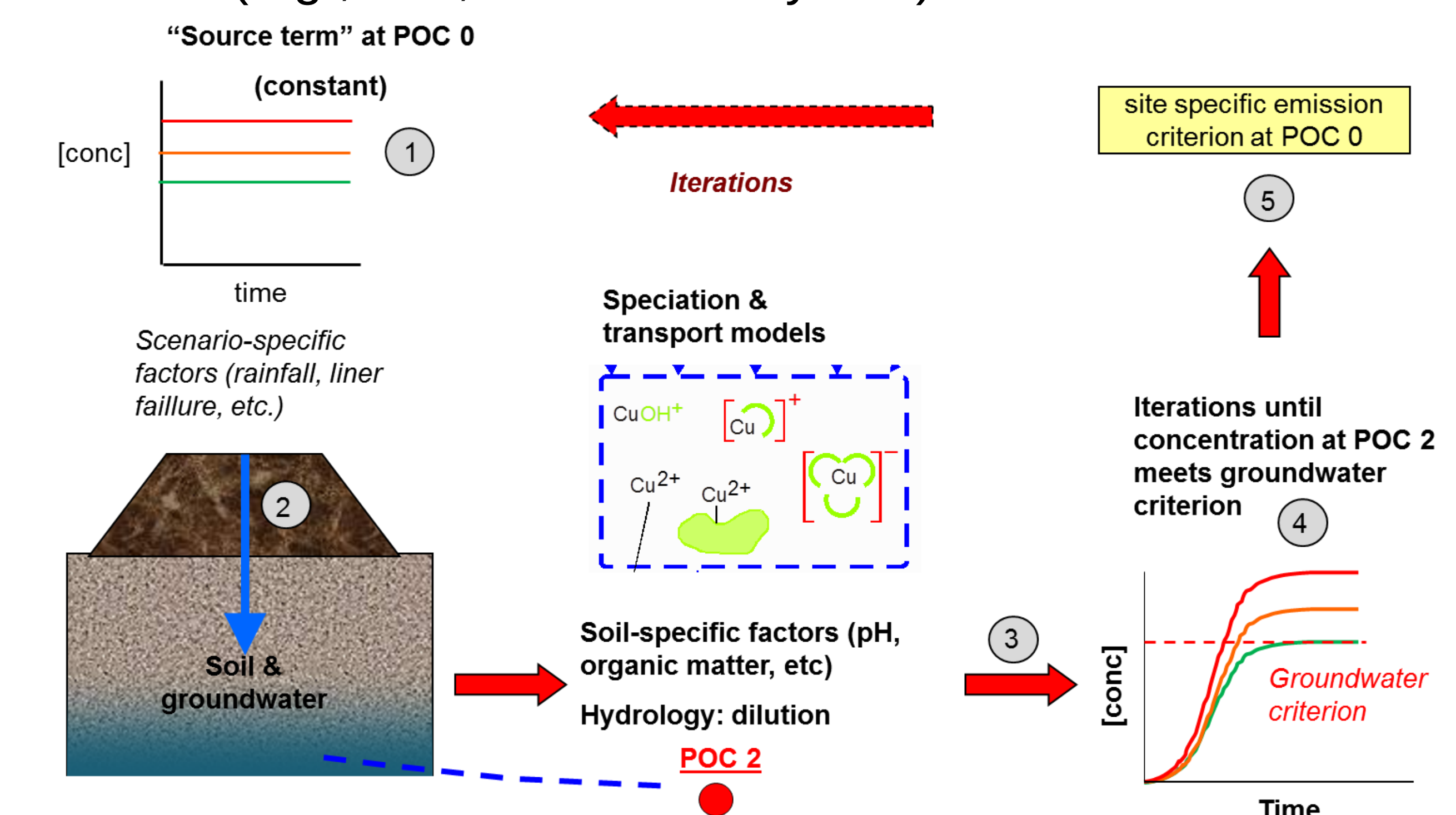


Figure 3: schematic representation of iterative calculation

Results and conclusions

For three 'pilot landfills' site-specific emission criteria have been determined. The values are presented in Brand et al. (2014). The method could also be applied to a situation where the emission takes place in the surface water instead of the groundwater. Through consideration of local conditions the method is applicable in many (not only landfill) situations in many countries in the world. Development in knowledge about ecotoxicity and attenuation processes can and will be included in the method.

Literature cited

- Brand, E., de Nijs, T., Claessens, J., Dijkstra, J.J., Comans, R.N.J., Lieste, R. (2014) Development of emission testing values for pilot landfills for sustainable landfill practices; Phase 2: Proposals for testing values; RIVM Report 607710002/2014.
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- Verbruggen E.M.J., Posthumus R., van Wezel A.P. (2001) Ecotoxicological serious risk concentrations for soil, sediment and water: Updated proposals for first series of compounds. National Institute for Public Health and the Environment (RIVM), Bilthoven, Netherlands. RIVM report no. 711701 020.

ECN

Westerduinweg 3
1755 LE Petten
The Netherlands

P.O. Box 1
1755 LG Petten
The Netherlands

T +31 88 515 4949
F +31 88 515 8338
info@ecn.nl
www.ecn.nl

