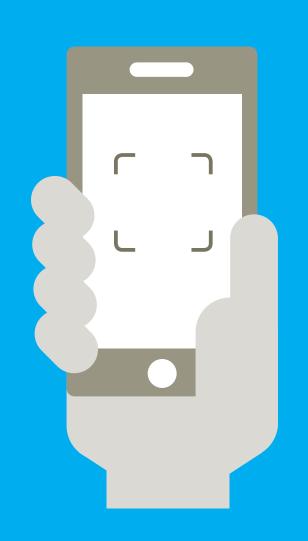
Benzethonium chloride is predicted to pose no ecological risk in surface Water or soil. Sediment risks are uncertain.



Want to know more? Scan here for further information.



Environmental Risk Assessments for Topical Antiseptic Ingredients: Benzethonium Chloride

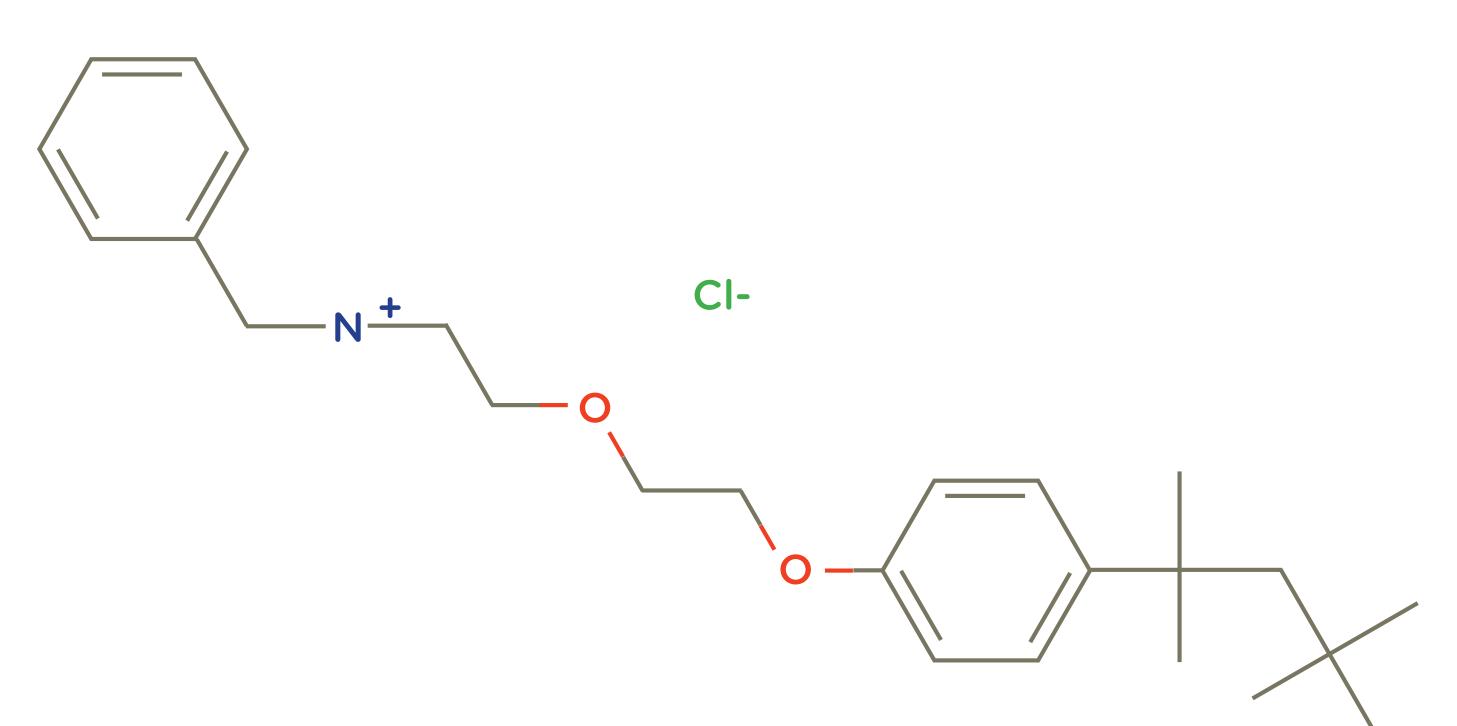
Phyllis Fuchsman,¹ Kyle Fetters,¹ Michael Bock,¹ Alison O'Connor,¹ Lauren Brown,¹ Igor Mrdjen,¹ Miranda Henning,¹ Monica Lam,² Nathan Pechacek,³ Kathleen Stanton⁴

Ramboll, ² The Procter & Gamble Company, ³ Ecolab Inc, ⁴ American Cleaning Institute

INTRODUCTION

Since withdrawal of triclosan and triclocarban, the surfactant BZC is one of several replacement compounds being used in topical antimicrobial products.

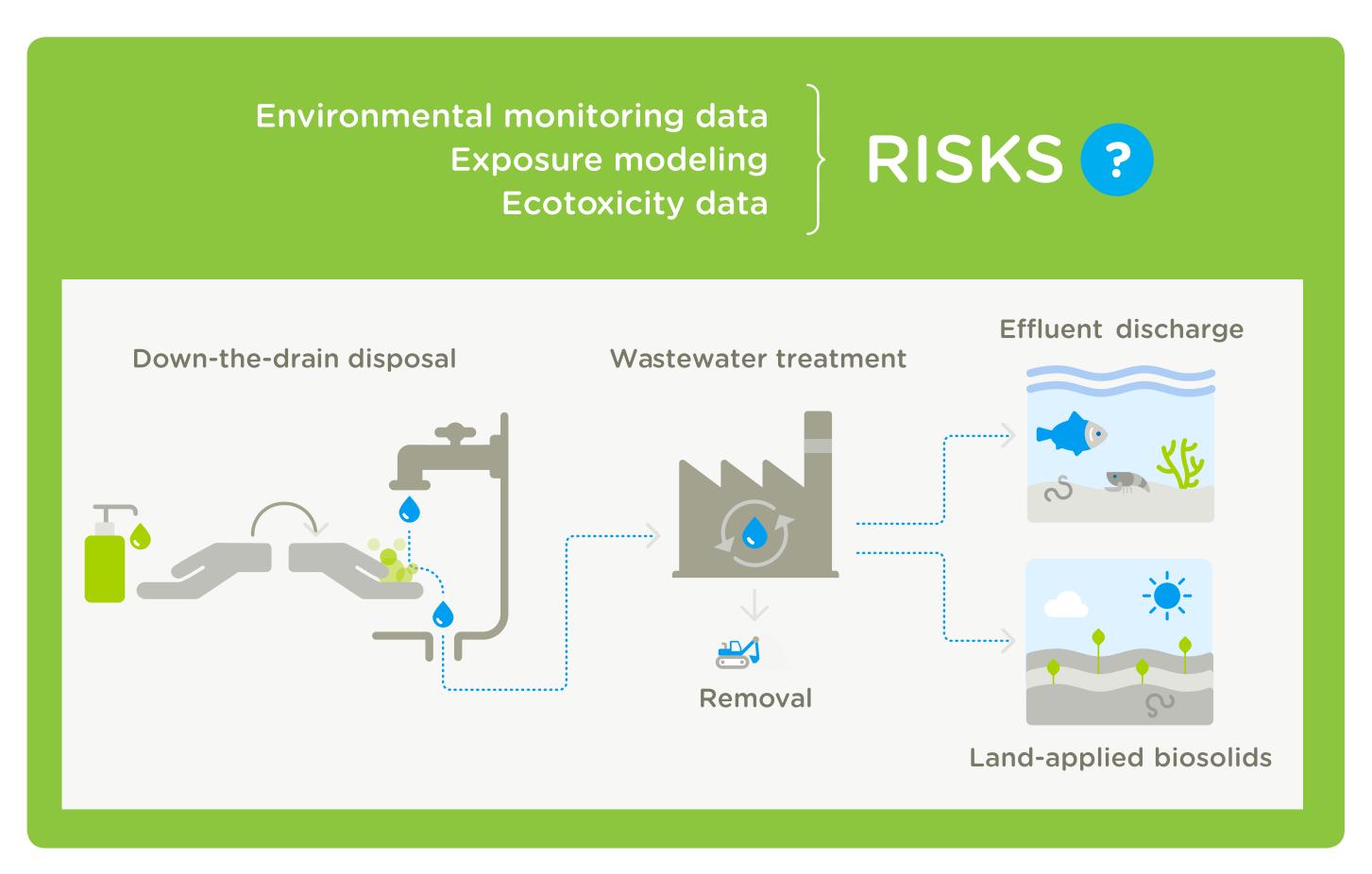
BZC is used less extensively than other ingredients such as benzalkonium chloride or chloroxylenol.



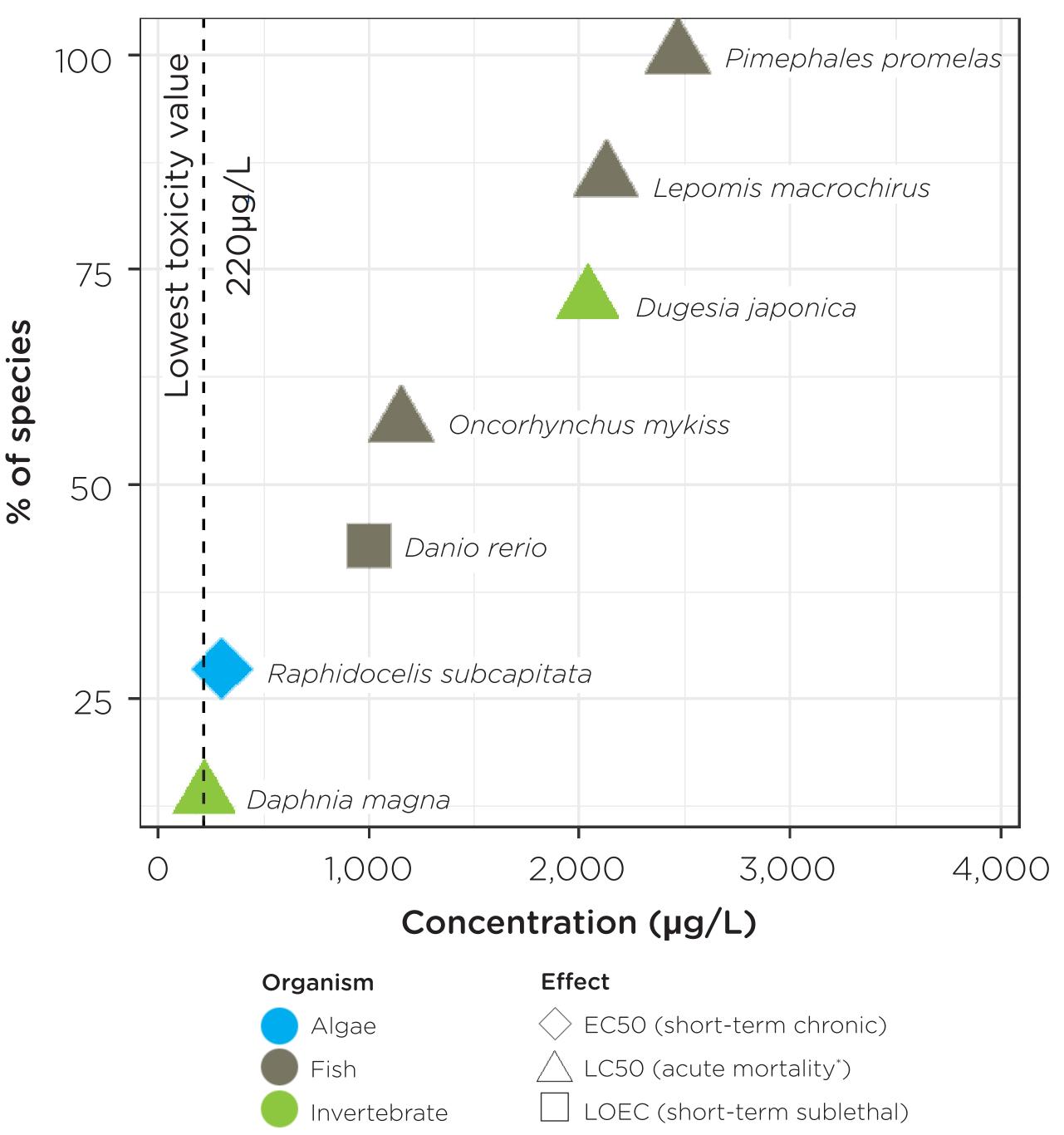
Objectives

- Compile environmental fate, effects and occurrence data for BZC
- Assess environmental risks
- Identify key uncertainties and options to refine the assessment

CONCEPTUAL MODEL



HAZARD PROFILE



- (invertebrates), so target margin of safety is 100

EXPOSURE ASSESSMENT

Monitoring data

(Östman et al 2017)

Media	Detection frequency	Concentration: detection limit or median (range)
Influent (µg/L)	0/12	<0.005
Effluent (µg/L)	0/11	<0.005
Digested sludge ⁺ (mg/kg dry wt)	6/11	0.034 (<0.02-0.101)

[†] Includes primary sludge

Acronym key:

BAC: benzalkonium chloride BZC: benzethonium chloride CMC: critical micelle concentration

EC50: 50% effect concentration EPC: exposure point concentration LC50: 50% lethal concentration

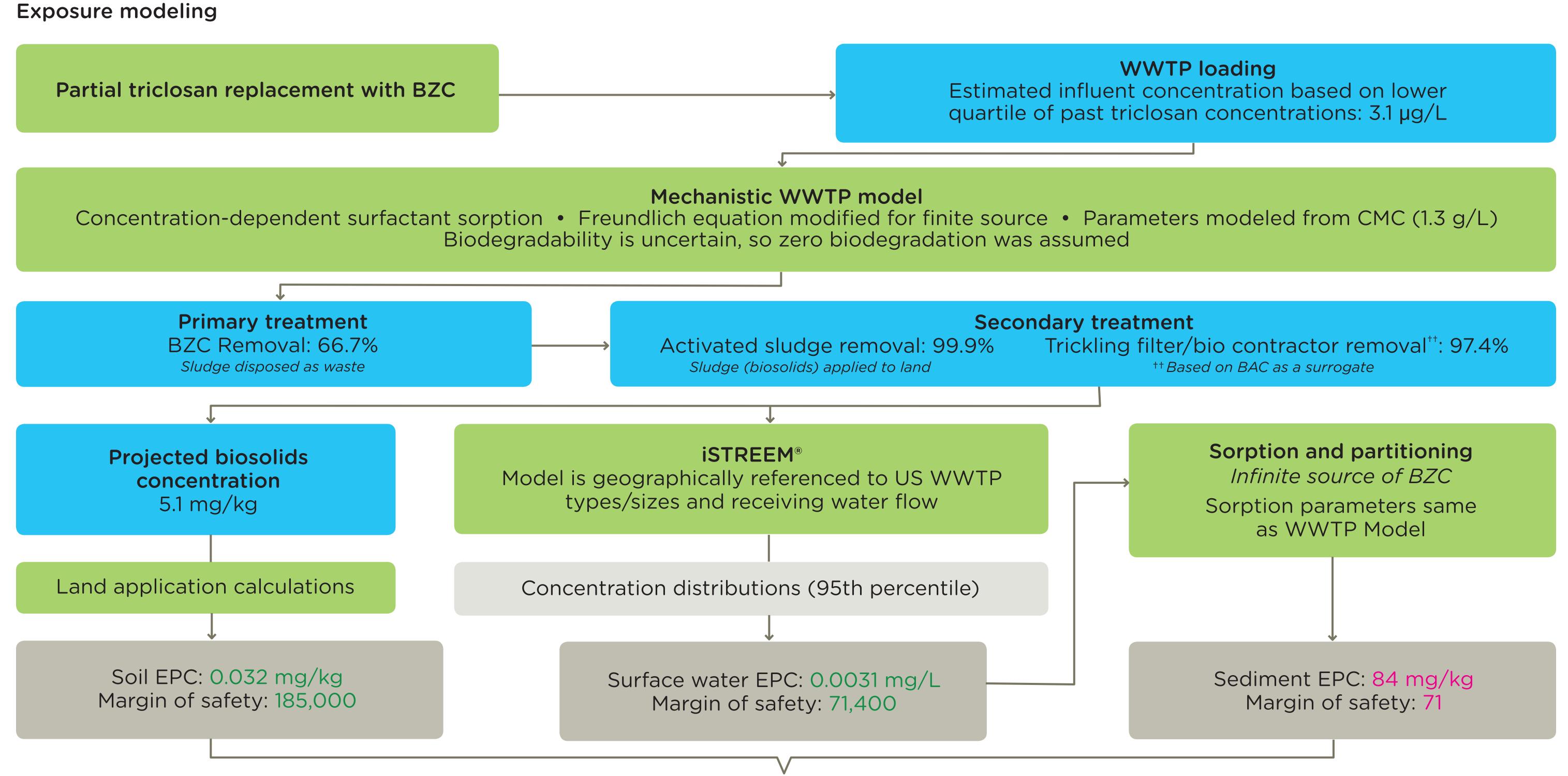
*D. magna result includes mortality and immobilzation

• Lowest aquatic toxicity value extrapolated to soil and sediment (6,000 mg/kg), assuming equilibrium partitioning and using the same surfactant sorption methods as the exposure model

• No chronic toxicity data available for most acutely sensitive taxa

Table 1. Data available from one study of Swedish WWTPs

LOEC: lowest observed effect concentration WWTP: wastewater treatment plant



RESULTS

- Sediment concentrations in effluent-dominated streams not expected to be acutely toxic, but margin of safety is less than preferred when lacking chronic toxicity data
- Both the lowest toxicity value and the exposure point concentration are extrapolated from water to sediment using the same method, yet margins of safety are 1,000X different between surface water and sediment (see Exposure modeling)
- This prediction follows from estimated concentration-dependent sorption parameters, which are uncertain







Target margin of safety for all EPCs: 100

KEY UNCERTAINTIES

Environmental concentrations – US data lacking, international data minimal

Biodegradability - Not readily biodegradable, not tested for inherent biodegradability

Sorption – Determines environmental fate and bioavailability. No chemical-specific data, parameters estimated from two QSARs applicable to sludge and activated carbon

Loading rate - Anecdotal information suggests our assumption may overestimate BZC's share of triclosan replacement

In-river loss from water column – No data, assumed zero. Therefore, surface water and sediment concentrations are most applicable in WWTP mixing zones, will overestimate concentrations downstream

OPTIONS TO REFINE ASSESSMENT

- Sediment analyses to confirm/refute predicted concentrations
- Other media (WWTP influent and effluent, surface water) could be analyzed along with sediment, to refine: modeled loading rate, % removal, partitioning to sediment
- If margins of safety are still insufficient after exposure refinements, then the hazard profile for BZC in sediment could also be refined