Pharmaceuticals in Wastewater

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BACWA Meeting

Goal

Develop recommendations for monitoring pharmaceuticals

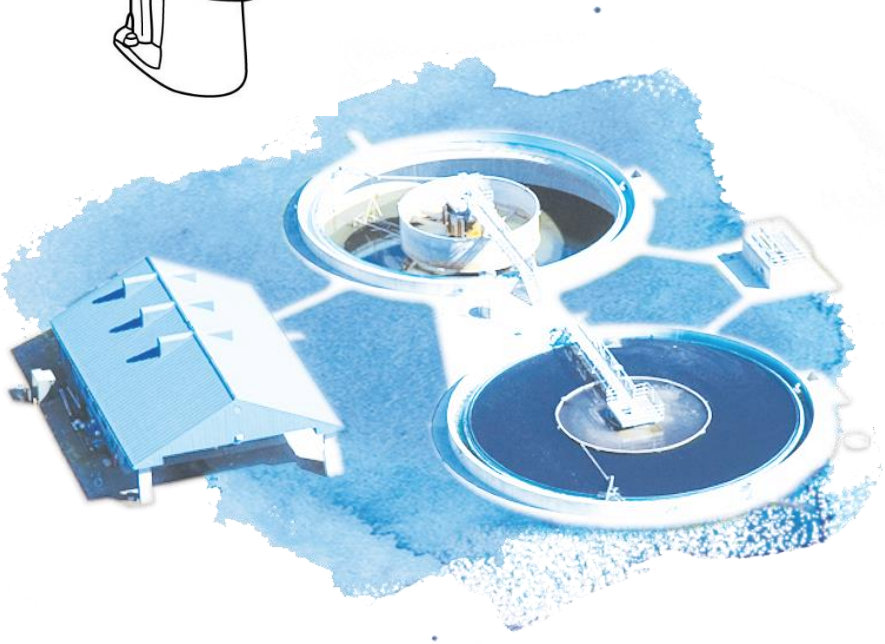
High Concern moderate or high impact	Bay Levels greater than Observed Effects
Moderate Concern low impact	Bay Levels greater than Predicted No-Effect Concentration Less than Observed Effects
Low Concern limited impact	Bay Levels less than Predicted No-Effect Concentration
Possible Concern uncertainty as to impact	Uncertainty Insufficient data

RMP

High Concern moderate or high impact	None currently
Moderate Concern low impact	PFOS PFOA, Long-Chain Carboxylates Fipronil Nonylphenol
Low Concern limited impact	PBDEs and HBCD Pyrethroids* Personal Care & Cleaning PBDDs / PBDFs **Pharmaceuticals**
Possible Concern uncertainty as to impact	Alternative Flame Retardants ← Bisphenols ← Other PFASs (Fluorinated Chemicals) Pesticides, Plasticizers, Microplastic Siloxanes, SDPAs, UV-BZTs, and others

RMP

Wastewater Pathway



- Sources
  - Excretion
  - Improper disposal
- Transported via wastewater
- Biologically potent

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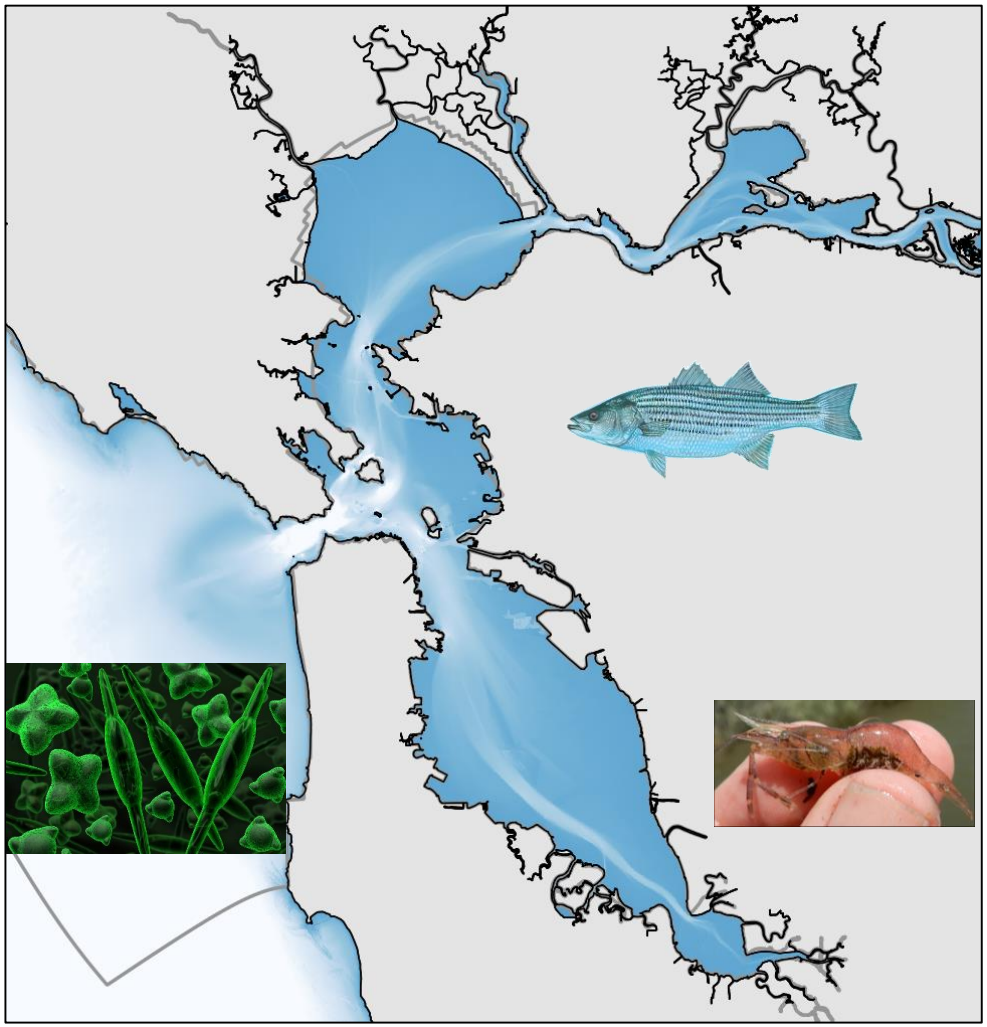
Pharmaceuticals affect aquatic wildlife



- Anti-depressants change fish behavior
- Antibiotics affect algae growth
- Antibiotic resistance

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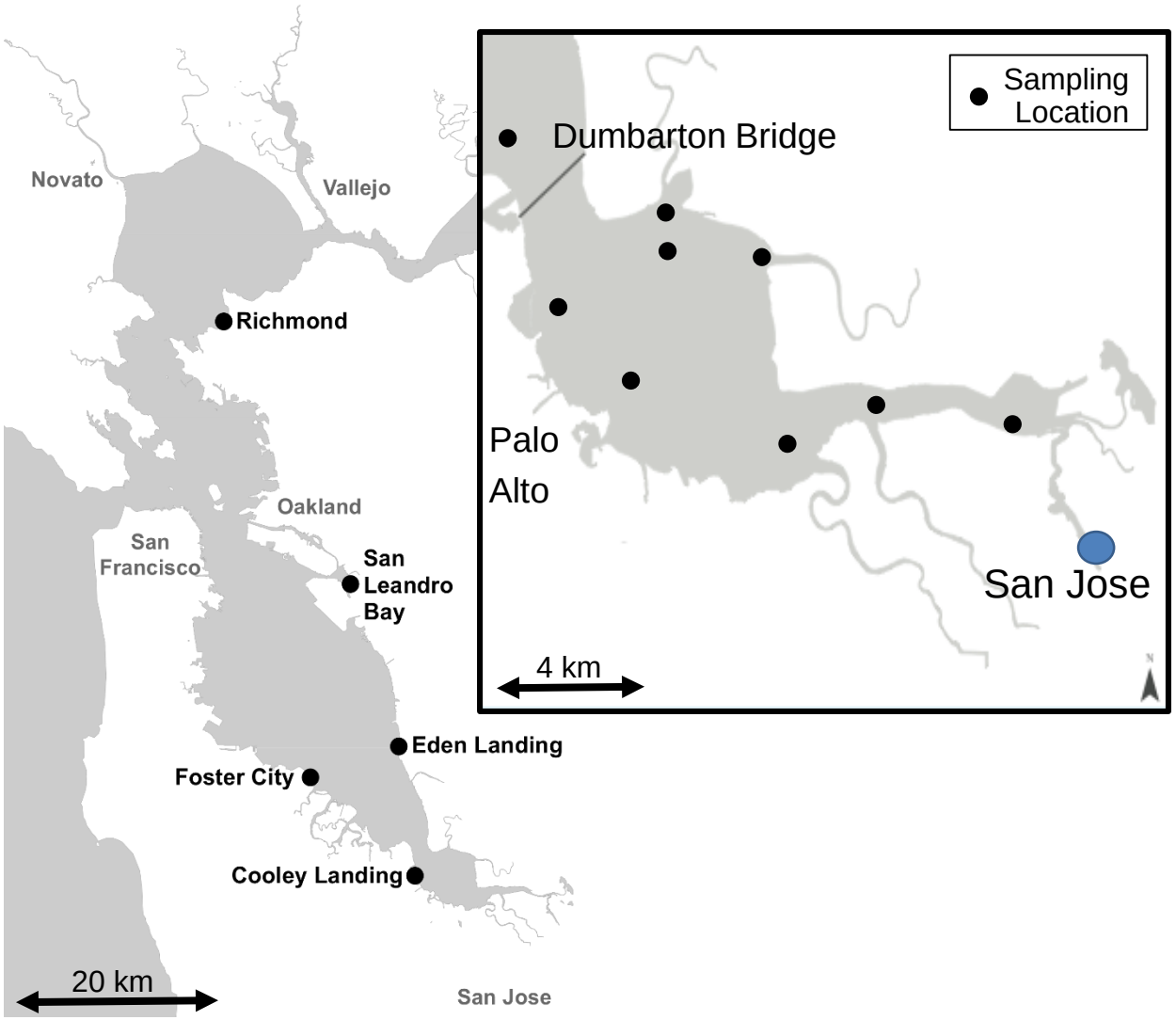
Pharmaceuticals monitored previously



- 2006: Lower South Bay
- 2008-2009: San Jose
- 2009-2010 Bay-wide

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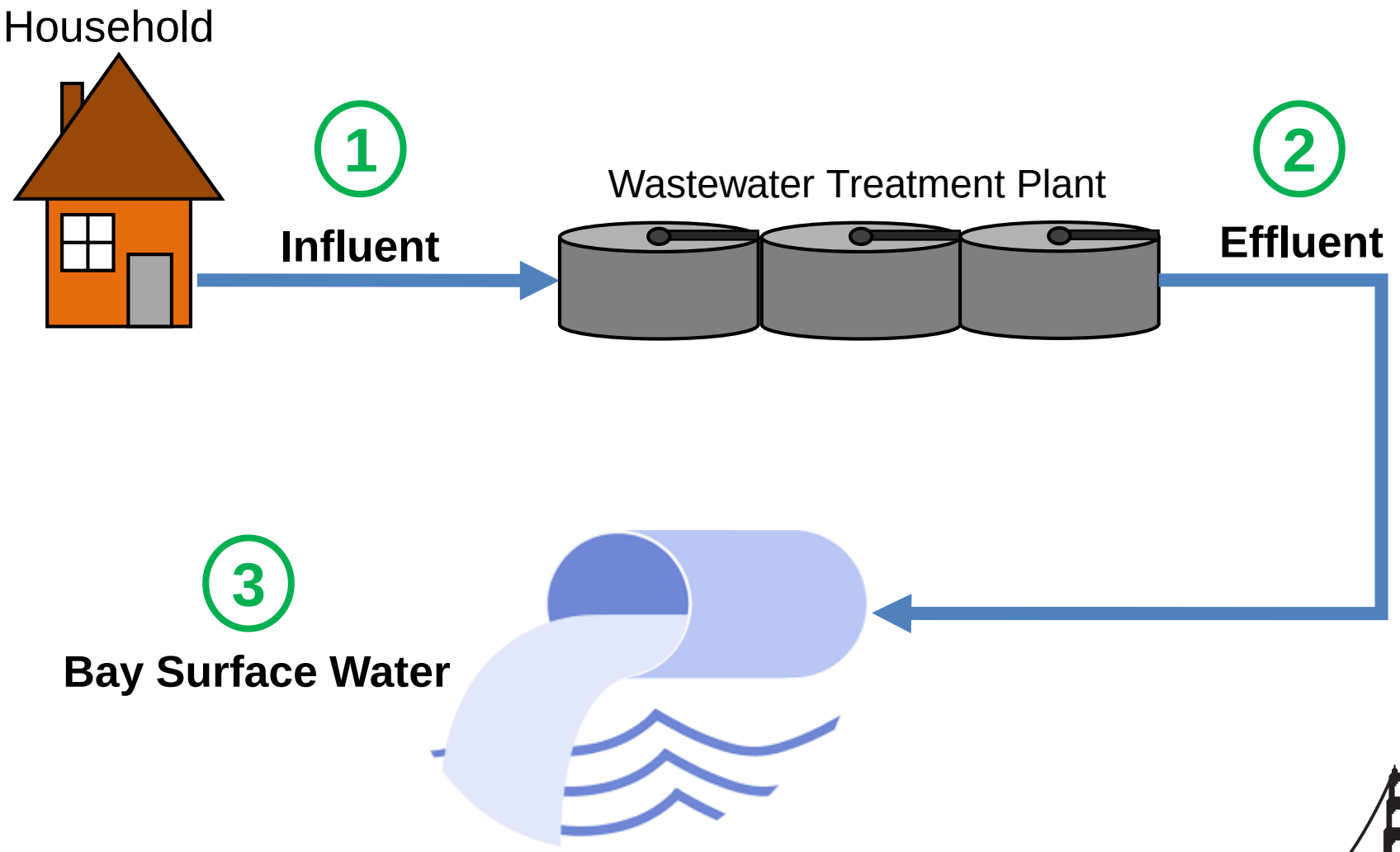
Field samples collected 2016-2017

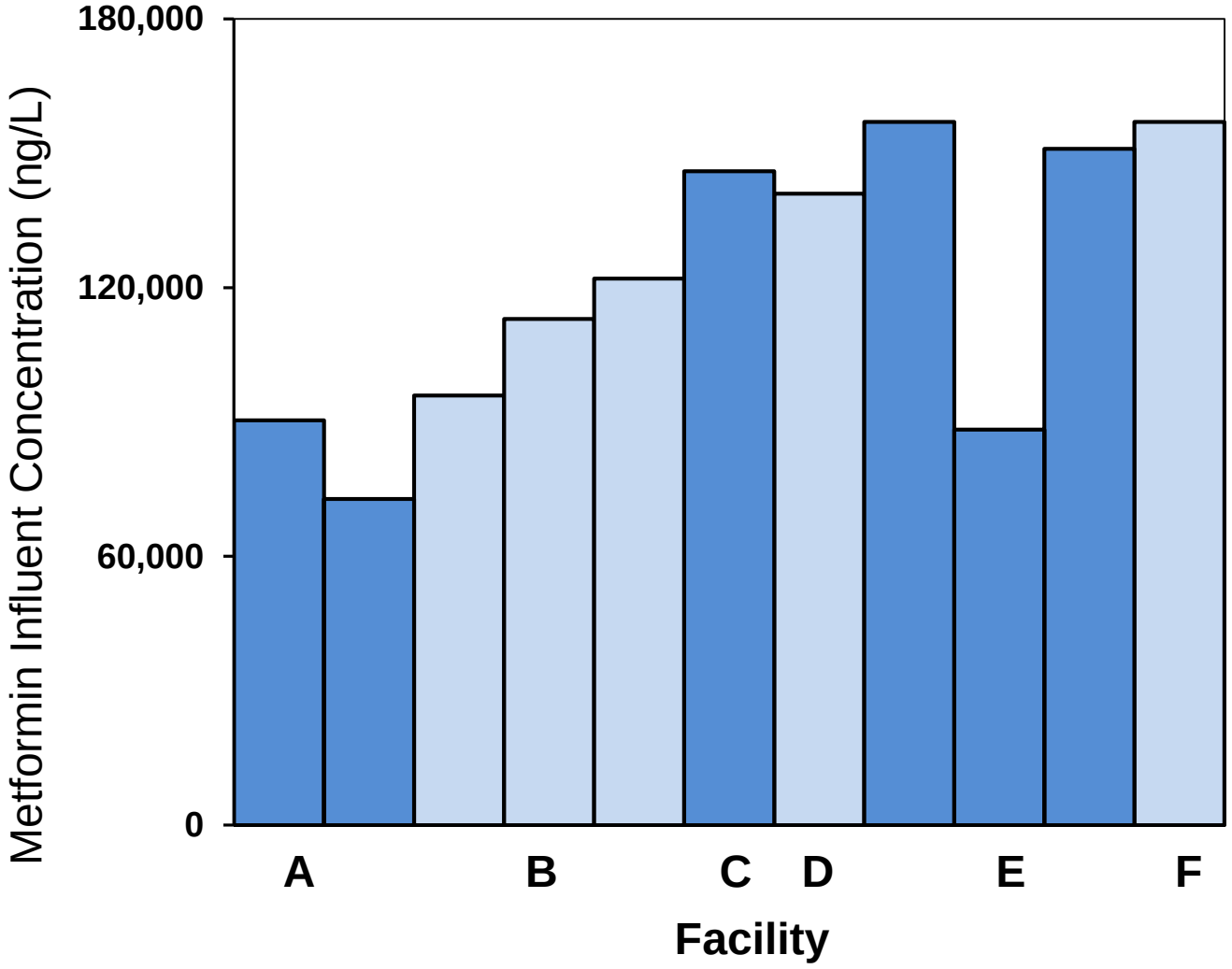
- 7 voluntary participants (anonymous)
- Grab and composite samples
  - Influent
  - Secondary and tertiary final effluent
- Analyzed for 104 compounds
- Standard RMP QA/QC review

Data presentation outline



Influent loads similar between plants

- Concentrations ranges within order of magnitude



Glumetza®
(metformin HCl extended release tablets)

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Top drugs in loads of mg/capita/day

- Metformin (anti-diabetic)

- Caffeine
- Painkillers
  - Acetaminophen
  - Ibuprofen
  - Naproxen

TYLENOL

Advil

ALEVE

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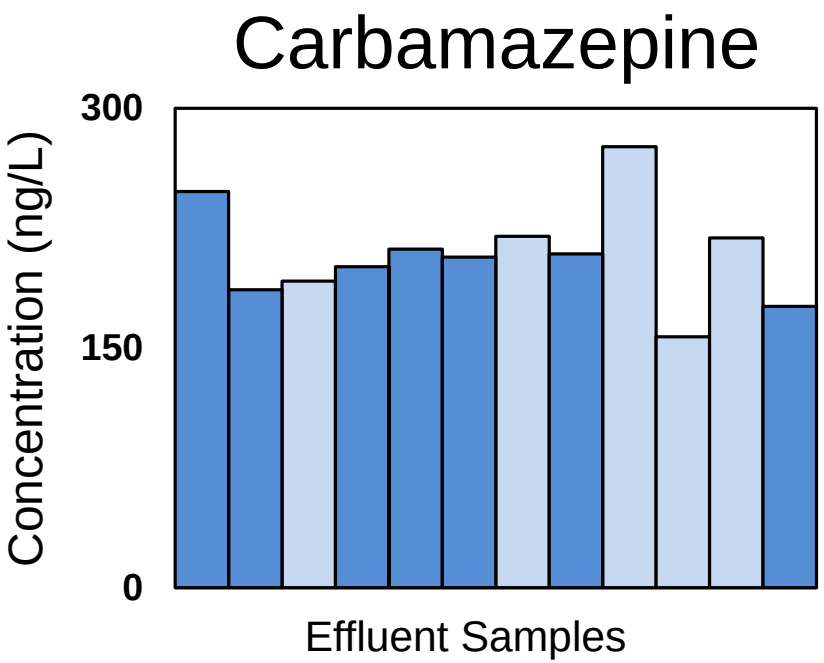
Effluent loads similar between plants

- Conc. ranges <u>mostly</u> within order of magnitude

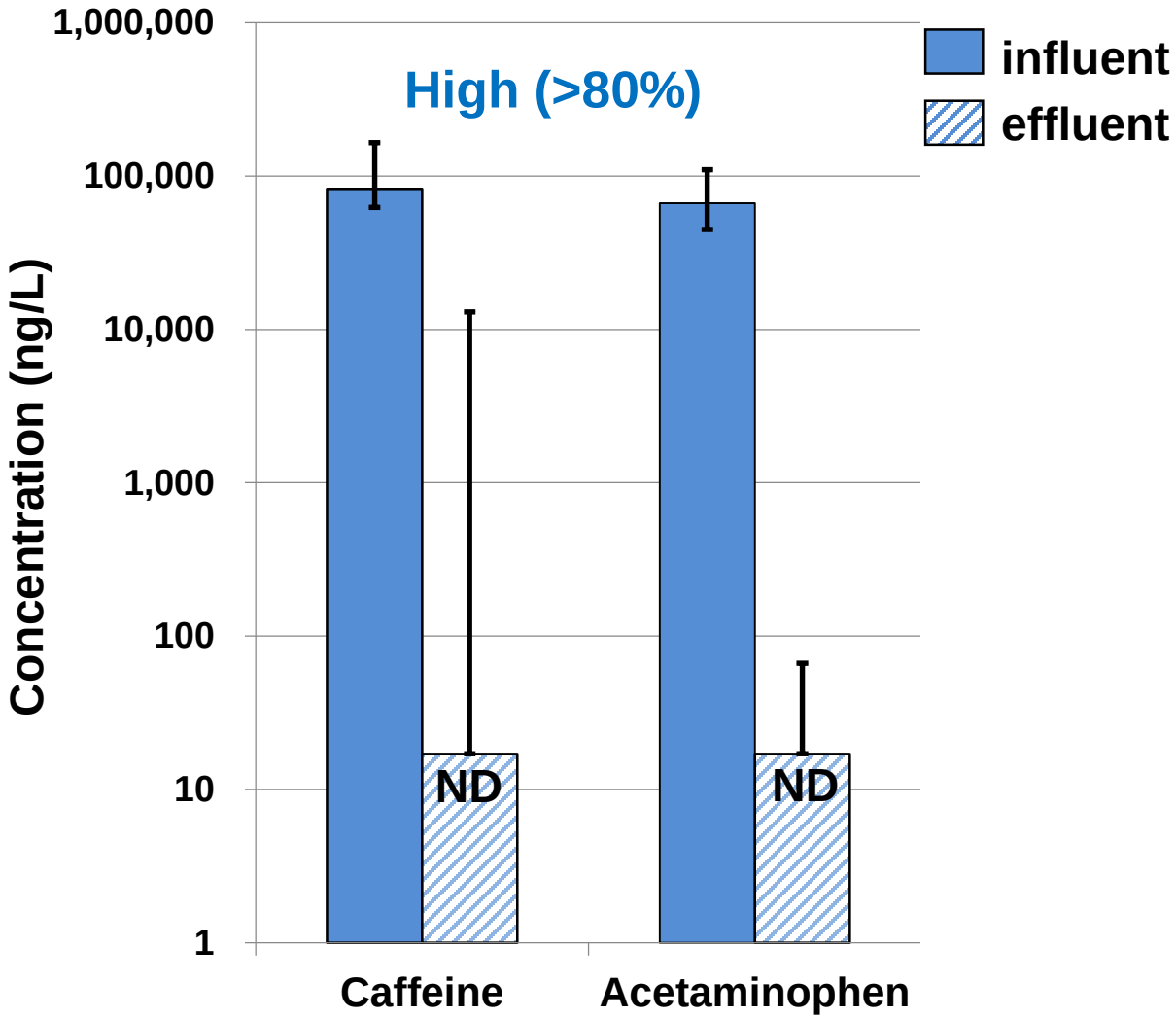


Top compounds in effluent

- Metformin (anti-diabetic)
- Valsartan (high blood pressure)
- Furosemide and hydrochlorothiazide (Diuretics)
- Sulfamethoxazole (Antibiotic)

Removal efficiencies

- Vary between compounds and plants



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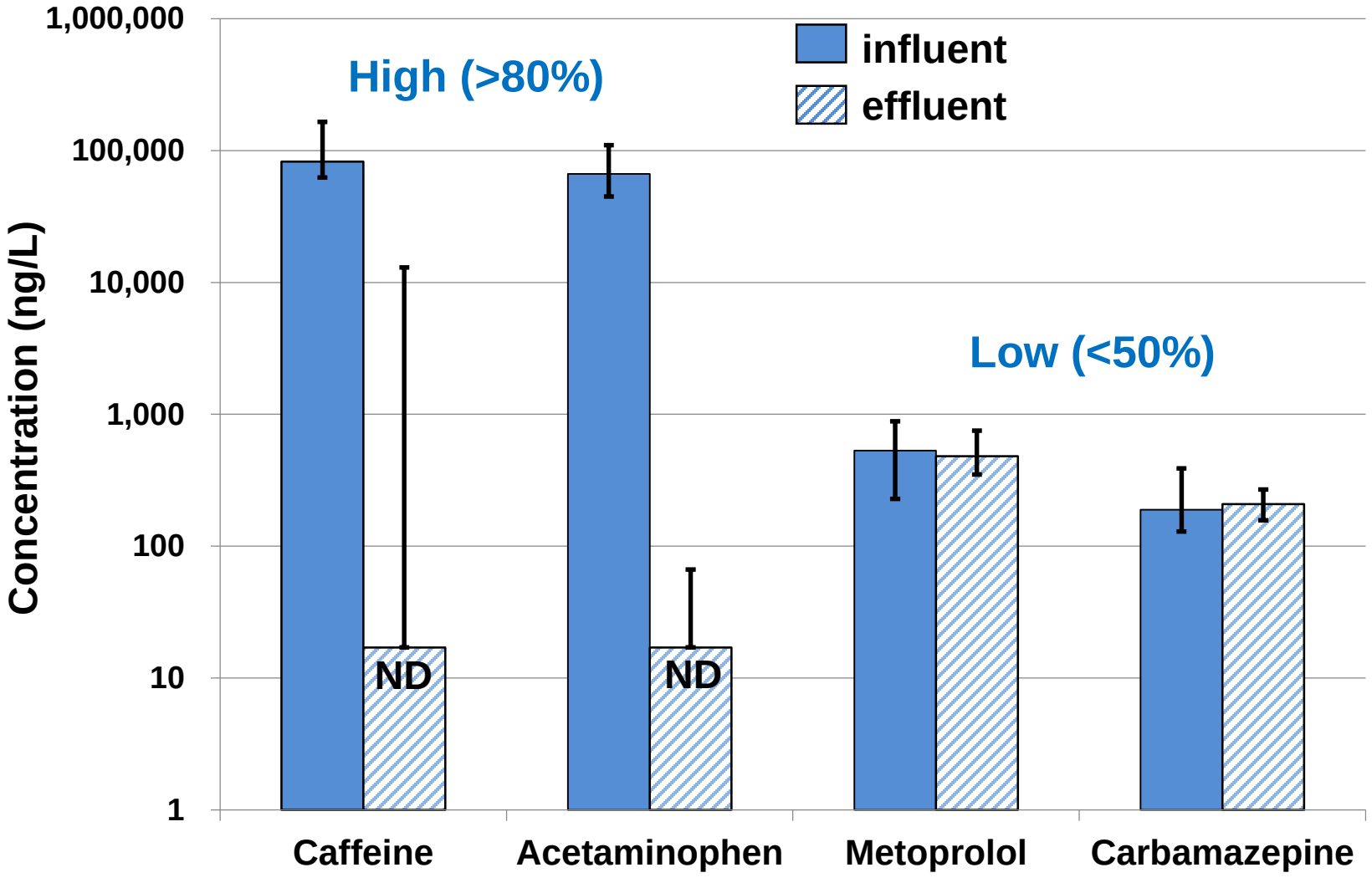

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Bay water concentrations

- Compared to ecotoxicity thresholds to determine risks

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Prioritization criteria

Bay Water Conc. →

1. Previous monitoring studies
2. Predicted based on modeled effluent

Ratio: $\dfrac{\text{Bay Water Conc.}}{\text{Ecotoxicity Threshold}}$ **> 0.1**

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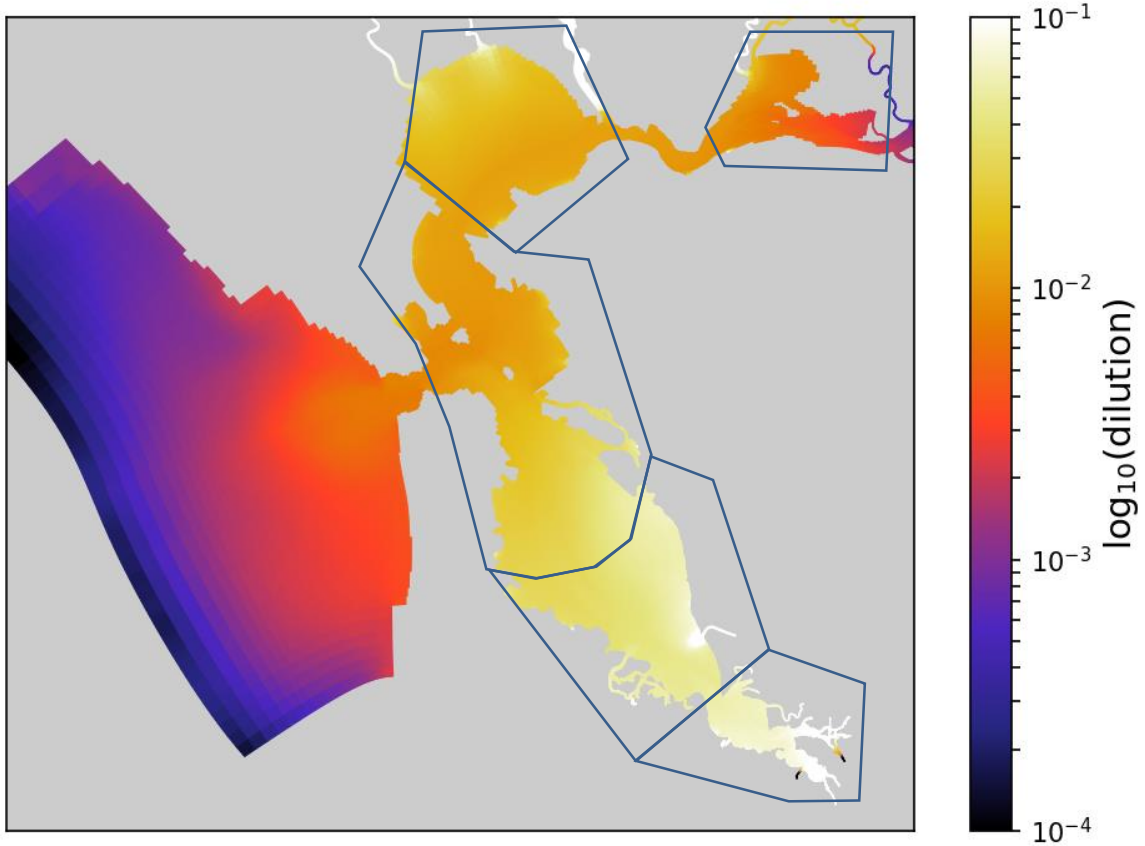
Predicted Bay water concentration

- Hydrodynamic model
- Effluent diluted in Bay water



17 Pharmaceuticals prioritized

- **Antibiotics** – azithromycin, ciprofloxacin, clarithromycin, erythromycin, ofloxacin, and sulfamethoxazole
- **Antidepressants** – amitriptyline, fluoxetine, and sertraline
- **Anti-convulsant** – carbamazepine
- **Painkillers** – codeine, ibuprofen, and oxycodone
- **Antihistamine** – diphenhydramine
- **Anti-diabetic** – metformin
- **High blood pressure** – metoprolol and propranolol

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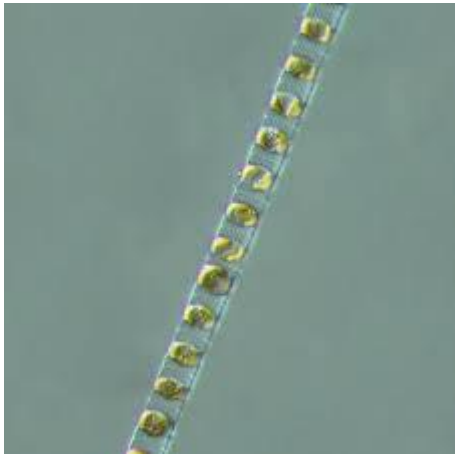
Clarithromycin

- Antibiotic (infections – lungs, ear, sinuses, skin)
- Marine PNEC = 0.015 ng/L
  - Marine diatom
  - Freshwater PNEC = 230 ng/L
- 100% detection frequency
  - Effluent 155 ng/L
- Bay water concentration
  - Predicted (2016): 0.6 - 10 ng/L
  - Previous monitoring (2010) <1.5 - 18 ng/L



Skeletonema marinoi

Pharmaceuticals next steps

- 17 prioritized compounds
- Emerging Contaminants Strategy priority

State-wide drug take-back program

THE BUSINESS > LEGISLATION & REGULATION

California Signs Drug, Needle Take-back Program into Law

Senate Bill No. 212

CHAPTER 1004

d Chapter 2 (commencing with Section 42030) to Part 3 of the Public Resources Code, relating to solid waste.

[Approved by Governor September 30, 2018. Filed with Secretary of State September 30, 2018.]

LEGISLATIVE COUNSEL'S DIGEST

SB 212, Jackson. Solid waste: pharmaceutical and sharps waste stewardship.

Senator Hanna-Beth Jackson
(SB 212 author)

- Signed Sept. 30
- Implementation: 2021

Governor Jerry Brown

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Prevent unnecessary contamination

mountainview.gov

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Draft Report in Review

Contact me:

diana@sfei.org

Final Report

End of October

Thank You

Special thank you to

7 wastewater facilities and BACWA

RMP Emerging Contaminants 2019 studies

- Ethoxylated surfactants
  - Wastewater
  - Sediment
  - Bay water
  - Broad suite: NPEs, OPEs, alcohol ethoxylates C9, C10, C12, C13, C14, C16
- Stormwater study (2-year)
  - Roadway contaminants
  - PFASs
  - Ethoxylated surfactants
  - Phosphate flame retardants

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Emerging Concern Multi-year Plan

- Pharmaceuticals
- Non-targeted analysis
- Moderate Concern CECs
  - PFAS
  - Fipronil
- Possible Concerns
  - Bisphenols
  - Phosphate flame retardants
  - Sunscreen
  - Agriculture pesticides