



RMP Emerging Contaminants Workgroup Meeting

April 12-13, 2018
 San Francisco Estuary Institute
 4911 Central Avenue, Richmond, CA

Meeting Summary

Attendees

Science Advisor	Affiliation	Present
Lee Ferguson	Duke University	Yes
Kelly Moran	TDC Environmental	Yes
Derek Muir	Environment and Climate Change Canada	Yes
Heather Stapleton	Duke University	Yes
Bill Arnold	University of Minnesota	Yes
Miriam Diamond	University of Toronto	Yes

Others Present

Michael Fry (USFWS; EEWG Science Advisor)	Simret Yigzaw (City of San Jose)
Dan Schlenk (UC Riverside; EEWG Science Advisor)	Ryan Mayfield (City of San Jose)
Steve Weisberg (SCCWRP; EEWG Science Advisor)	Mike Connor (EBDA)
Ed Kolodziej (University of Washington)	Lorien Fono (BACWA)
Dimitri Panagopoulos (EPA)	Eva Agus (EBMUD)
Bill Mitch (Stanford)	Jen Jackson (City of San Francisco)
Eunha Ho (San Diego State University)	Tessa Fojut (State Water Board, CEC lead for Division of Water Quality)
Tom Mumley (SFB Regional Water Board)	Dawit Tadesse (State Water Board)
Ian Wren (Baykeeper)	Jennifer Teerlink (DPR)
Karin North (City of Palo Alto)	Anne Cooper Doherty (DTSC)
Luisa Valiela (EPA)	Daphne Molin (DTSC)
Daniel Oros (EPA)	June-Soo Park (DTSC)
Robert Wilson (City of Petaluma, BAPPG)	Shoba Iyer (OEHHA)
Doug Dattawalker (Union Sanitary District - chair of BAPPG)	Holly Weir (Ocean Protection Council)
Reid Bogert (C/CAG for San Mateo County)	Rebecca Sutton (SFEI)
Autumn Cleave (SFPUC pollution prevention)	Meg Sedlak (SFEI)
Heather Peterson (SFPUC)	Diana Lin (SFEI)
Eric Dunlavy (City of San Jose)	Jennifer Sun (SFEI)
	Ila Shimabuku (SFEI)
	Phil Trowbridge (SFEI)

Jay Davis (SFEI)
Carolynn Box (5 Gyres)
Bowen Du (SCCWRP)
Lark Starkey (State Water Board Sea Grant Fellow)
Terry Grimm (Cambridge Isotopes)
Helen Yu (San Diego Water Board Region 9 - CEC
lead)

Greg LeFevre (University of Iowa)

The last page of this document has information about the RMP and the purpose of this document.

DAY ONE - April 12

1. Introductions and Review of the Agenda

No changes were made to the agenda.

2. Discussion: CEC Strategy Update

Rebecca Sutton presented an overview of the CEC program and elements of the CEC Strategy that were updated in 2018 via the Draft CEC Strategy Update. Five new compound classes were classified: PFOA and long-chain carboxylates were classified as Moderate Concern compounds, and siloxanes, substituted diphenylamines, UV-benzotriazoles, and rare earth elements such as gadolinium were classified as Possible Concerns due to uncertainty in ecotoxicity risks (lack of available toxicity thresholds). The workgroup discussed needs for refining the tiered risk classification framework, as well as specific recommendations for compounds to add to or move within the risk framework. A summary of this discussion is presented below.

Tiered Risk Classification Framework

- **Low Concern risk tier:** Tom Mumley suggested that the “Low Concern” risk tier be further differentiated between compounds that (1) are expected to remain a low concern, and (2) have data suggesting that risks could potentially be changing.
- **Possible Concern risk tier:** Tom Mumley suggested further differentiation of this risk tier, based on the reason compounds are classified in this category -- lack of toxicity data, uncertainty in available data.
- **Grouping by chemical function:** Miriam Diamond suggested that chemicals could be categorized by function, to identify those that can be addressed using similar management actions. Tom Mumley warned against grouping compounds broadly if there is insufficient evidence to group the whole compound class within a risk tier, but suggested that a separate table could be used to categorize compounds by function.

Classification Recommendations

- **Non-chemical pollutants:** Steve Weisberg suggested that the workgroup consider whether or not it will evaluate non-chemical pollutants, such as pathogens and antibiotic

resistance, as emerging contaminants. SCCWRP is currently considering these groups as emerging contaminants.

- SCCWRP is also currently conducting an antibiotic resistance study, involving monitoring of genes, and could incorporate the RMP if desired. Antibiotic resistance itself is considered a public health issue; there is a public perception that wastewater discharge near beaches is a major source, with little evidence.
- Bill Arnold is currently working on a project to link antibiotic resistance genes with antibiotic levels in the environment, and creating a map of these linkages for Minnesota. This project also seeks to understand whether genes act more like microbes or chemicals in the environment.
- **Rare earth elements and other metals:** Consider high-tech sources for these compounds. Future studies of rare earth elements and other metals should take into account speciation and organic complexing of these compounds. Platinum, palladium, tellurium, and other catalysts have been poorly studied but are likely increasing in use via high-tech manufacturing, and should be considered for further study.
- **Personal care products:** Anne Cooper Doherty noted that the messaging of placing this entire class in the “Low Concern” tier, labeled as having “no impact,” is problematic, given ongoing efforts to manage these compounds. The “no impact” label in particular is an overly strong statement. Jen Jackson suggested revising this to state “minimal impact.” It should also be carefully noted and qualified that the compounds currently listed in this group only include a relatively narrow list of compounds (compared to the universe of personal care product ingredients) that have been monitored in the Bay by the RMP.
- **Precautionary approach for persistent contaminants:** Miriam Diamond suggested that risk be classified using a precautionary approach - compounds that are highly persistent, and for which production is increasing and/or greater than degradation, might be considered significant concerns even if toxicity is not well understood.
- **All PFASs could be assigned Moderate Concern:** Bill Arnold and Miriam Diamond supported classifying PFOS/PFOA precursors (currently Possible Concerns) with PFOS and PFOA as Moderate Concerns. Kelly Moran and Anne Cooper Doherty also noted that DTSC’s classification of PFASs as a class adds motivation for a similar classification for the RMP, which could provide similar messaging for management efforts. Others noted that the short-chain PFASs (currently Possible Concerns) are problematic because they are less degradable, more easily taken up into plants, and harder to treat with conventional methods such as granular activated carbon.

3. Information: Summary of Exposure and Effects Workgroup Meeting

Phil Trowbridge and the EEWG science advisors presented a summary of the previous day’s EEWG meeting. At this meeting, Nancy Denslow presented results from the third phase of the estrogenicity assay development study, which included a screening of water and sediment in Lower South Bay. No quantifiable estrogenic activity was detected, but some questions remain around extraction efficiency, dilution, and very low detections near the method detection limit.

The EEWG and ECWG science advisors cautioned against interpreting the results to indicate a lack of estrogenicity in Lower South Bay. Steve Weisberg suggested further application of the assay in other areas of the Bay in order to make a general assessment of the Bay using this tool; Lee Ferguson suggested using the assay alongside non-target POCIS sampling to make sure the assay is not missing pulses of estrogenic compounds.

Additionally, the EEWG recommended funding for the first year of a three year study that would link responses to a glucocorticoid assay to whole organism (*Menidia*) responses. Dan Schlenk indicated that the glucocorticoid assay has shown more activity in environmental samples than the estrogenic assay in early tests, and that the responses often cannot be fully explained by targeted analyses of known, glucocorticoid-active compounds such as specific pharmaceuticals.

Discussion

Tom Mumley expressed increasing support for including the use of bioanalytical tools in the CEC Strategy. These assays could be used to help spatially focus non-targeted chemical analyses as well as targeted monitoring. Kelly expressed a preference for supporting toxicity studies rather than bioassay development, as the lack of available toxicity data prevents evaluating the risk of many chemical groups, and would more directly affect management decisions relevant to the Bay. The group agreed that further integration of the EEWG and ECWG groups would help develop a strategy for using and addressing these tools and needs.

4. Information: Interaction of Alkylphenols and Alkylphenol Ethoxylates on Endocrine Responses to Pesticides in Fish

Dan Schlenk presented a summary of alkylphenol and alkylphenol ethoxylate (APE) impacts on aquatic biota, including several studies showing synergistic impacts of nonylphenol and pesticide compounds in fish. These studies show that different modes of action can combine to create synergistic *in vivo* impacts, which may not be detectable in *in vitro* studies. APEs can have a number of other impacts beyond estrogenicity, so estrogenicity assays are not sufficient to assess APE toxicity risks.

Dan highlighted that the majority of 4-nonylphenols in industrial mixtures are in the ortho-position, although most research is conducted on the para-position nonylphenol, and emphasized the need to use CAS numbers when addressing specific compounds. Dan recommended monitoring the short-chain ethoxylates if a narrower focus is necessary, given their higher toxicity. Hindered phenols (banned in Canada based on a modeling-only exercise) and halogenated nonylphenols should also be considered for monitoring. 2,4-di-tert butylphenols, tris(nonylphenyl) phosphite, and HDPEs (all plastics) are all major sources of APEs entering the environment.

Jay Davis suggested conducting *in vivo* testing in addition to bioassays, given the potential for indirect synergistic impacts. Lee Ferguson suggested caged fish studies. Dan emphasized the importance of doing the chemistry as well as the bioassays.

5. Discussion & Decision: Potential Monitoring Strategy for Nonylphenols and Nonylphenol Ethoxylates

Rebecca Sutton presented different strategies for monitoring nonylphenols and nonylphenol ethoxylates, the only compound class in the Moderate Concern risk tier that has not been recently monitored (most recent monitoring conducted in 2010). Suggested monitoring included targeted chemistry in ambient water, archived margins sediment, water and sediment in San Leandro Bay, and bioassays in effluent- and stormwater-influenced ambient water and sediment samples. The goal of this monitoring would be to assess whether these compounds should stay in the Moderate Concern category, using some metric such as bioassays or toxicity thresholds.

Anne Cooper Doherty indicated that NPE data in wastewater effluent would be particularly valuable for DTSC, which is assessing PFASs (recently listed in a priority product) and NPEs (currently being assessed primarily in cleaning products) out of the three Moderate Concern compound groups. Evidence of exposure in the aquatic environment is a key consideration for DTSC action, and can include wastewater effluent data and/or ambient Bay samples, even if a toxicity threshold is not available. Wastewater effluent data are sufficient to demonstrate a steady source to the aquatic environment. Data showing linkages between the ambient environment and sources is helpful, but not required for DTSC action.

Tom Mumley recommended that all compounds within the Moderate Concern category have their own strategy, including both a monitoring strategy and assessment of potential management actions that can be taken, the latter informed by further monitoring.

Monitoring recommendations are summarized below:

- Target Analytes
 - Expand monitoring to include long-chained nonylphenol and octylphenol ethoxylates (NPEs and OPEs, or alkylphenol ethoxylates [APEs])
 - Lee suggested expanding the list to include alcohol ethoxylates. These, along with the long-chained NPEs and OPEs, were present at very high quantities in the stormwater-influenced Bay non-target analysis samples, and are also toxic.
- Targeted Analysis methods
 - Both water and sediment sampling are necessary. Short-chain ethoxymers tend to partition to sediment, while more diverse mixtures are found in water.
 - Grab samples are needed -- passive sampling does not provide representative samples due to the chemical properties of these compounds.
- Bioassay methods
 - Bioassay methods have improved over the past 12 years and now may be able to detect effects.
 - *In vitro* assays could miss classes of compounds (i.e., long-chain ethoxylates) that are first metabolically activated before binding to estrogen (or other bioassay) receptors.

- Estrogenicity assays targeting areas like San Leandro Bay would not target only APEs; they would also be affected by the lighter PCBs that are estrogenic.
- Lee recommended targeted analysis of the long-chain ethoxylates first. Bioassays would need to be conducted alongside targeted analyses of other estrogenic compounds as well, such as estrogenic PCBs.
- Locations / Sources
 - The Port of Oakland could be a source of APEs from the shipping industry. While ballast water is not released into the environment, APEs from ship coatings could be a significant.

6. Information & Discussion: CECs Model Development

Rebecca Sutton and Jing Wu presented recent progress towards the development of a suite of modeling tools for CECs -- including steady-state one-box models, the Bay Area Hydrologic Model for stormwater (Jing Wu), a hydrodynamic model (Rusty Holleman), and a biogeochemical model under development (Zhenlin Zhang).

Miriam Diamond recommended developing a strategy for utilizing the models, or a simple “conceptual model of the models.” She suggested that the models be loosely coupled in order to allow them to be used in sequence, and to provide a framework for utilizing different aspects of the modeling package for various purposes and compounds. Bill Arnold noted that coupling the BAHM would require significant spatial precision. Miriam also strongly advocated for including the atmospheric pathway in models, and noted that biota could be included in sequence after these models (i.e., bioaccumulation and food web monitoring suggested by Derek Muir), but in some cases may need to be included within mass-balance equations as organisms can be a contaminant reservoir.

Kelly Moran and Tom Mumley strongly supported focusing largely on conceptual models and other simple modeling before diving into the more complex options presented, particular in data poor environments. Kelly highlighted the need to simply focus on the relative importance of stormwater vs. wastewater pathways, and develop tools to further link wastewater pathways to sources.

Jennifer Teerlink was supportive of developing a modeling approach for fipronil, to understand the relative contribution of stormwater and wastewater pathways, as well as other potential pathways. Heather Stapleton cautioned that PFAS precursor data needs to be included in any PFAS bioaccumulation model.

7. Information: Identification, Sources, and Risks of Novel and Emerging Contaminants in Urban Stormwater

Ed Kolodziej presented results from a series of studies conducted to understand the potential CEC causes of acute Coho salmon mortality following urban storms in Washington. Pathogens, metals, pesticides, PAHs, ammonia, and basic water quality parameters have been tested and

do not appear to be the sources of mortality, which can occur after 2-3 hours of exposure. Ed Kolodziej's group conducted cluster analyses on a series of non-targeted analyses conducted in stormwater runoff and various impacted fish tissues, utilizing this method of "biologically relevant suspect screening" to identify those compounds that are co-occurring in all these samples. Several key compounds identified included contaminants associated with roadways, including acetanilide (tire rubbers), 1,3-dicyclohexylurea, and diphenylguanidine (tire vulcanization). A GIS/landscape modeling study showed a higher level of mortality in areas with higher impervious surface area.

A follow up study was conducted to identify potential sources, which included conducting non-targeted analyses in leachates and dilutions of various roadway-related products, including vehicle fluids and tire leachate. The top 10 compounds detected in all samples with acute mortality were also found in tire rubber leachate, although little information is available about these compounds in the literature. Notably, contaminants in tire dust were more closely clustered with contaminant stream water than highway runoff. Field samples show no visual evidence of microparticles from tirewear, but Ed is exploring having samples analyzed for particles. Lee Ferguson suggested that benzotriazoles be included in Ed's follow-up LC/MS/MS targeted analyses. TIE follow-up tests are being considered but not currently planned, given the high probability of many negative results.

Of note, chum salmon do not succumb to the same toxicity as Coho salmon; hemoglobin on Coho salmon is more sensitive to oxidation, and juvenile Coho spend more time in freshwater than other species. Ed also noted that acute toxicity to smaller fish could be possible, but small fish carcasses are very rapidly preyed upon and therefore may not be easily observable. Anecdotally, Ed has heard of similar issues in Northern California; Luisa Valiela suggested a similar issue could be causing the leopard shark die-offs in South Bay, and Jen Jackson offered to ask creek groups if any similar evidence of acute toxicity has been observed locally.

8. Information: Pharmaceuticals in Bay Area Wastewater

Diana Lin presented preliminary data from the voluntary BACWA study on pharmaceuticals in wastewater. Because this was a voluntary study, different study designs were used at each location, and the participating facilities may not be representative of the entire Bay Area. Tom Mumley cautioned against making broad statements based on this limited dataset.

Kelly Moran supported the investment of time to calculate per capita influent loads, even based on grab samples. Bill Arnold noted that the same suite of antibiotics detected in the Bay have been detected in Minnesota, and the negative removal efficiencies observed were not unusual, as these compounds can become conjugated and deconjugated during treatment. Miriam Diamond noted that she has conducted some modeling of pharmaceuticals, and could potentially inform efforts by the RMP to model the dilution of observed effluent concentrations in the ambient Bay. Lorien Fono noted that the State Water Board is just as interested in effluent data as ambient Bay data, highlighting the value of this study even without further modeling.

9. Information: Preliminary Data on CECs in San Francisco Bay

Rebecca Sutton and Jennifer Sun presented preliminary data on wastewater indicator and pesticide compounds in margins sediment and water. No new red flags were raised; galaxolide fell below state monitoring trigger levels, which would allow it to be classified within the personal care products group as a Low Concern. Pyrethroid and fipronil / fipronil degradate data support current classifications as Low Concern and Moderate Concern, respectively. Imidacloprid data could potentially warrant classification as a Moderate Concern. Carbendazim was detected at all sites but only at one site above the available EPA aquatic life benchmark, and is not yet a major concern. Heather Stapleton asked about the strobilurin fungicide pesticide class, which were monitored; only azoxystrobin was detected, in water at several sites.

Kelly Moran noted that urban runoff is low during the time of sample collection, so detections may be more likely tied to wastewater sources, even if sources and product applications that would likely lead to stormwater pathways may be common for the detected compounds. Mike Connor suggested monitoring contaminant classes in harbor seal blubber sample in Lower South Bay to further focus on compounds with a greater likelihood of potential ecological effects.

10. Information: Partitioning and Persistence of Volatile Methylsiloxanes in Aquatic Environments: A Case Study for the Bay

Dimitri Panagopoulos presented a summary of available information on the physical-chemical characteristics and volatile methylsiloxanes (VMS), as well as a proposal to conduct *pro bono* analyses of VMS in the Bay. Published log K_{oc} and enthalpy values are conflicting and may not be highly reliable, and result in substantial differences in estimates of environmental fate and residence times of these compounds. The proposed study would involve measurement of VMS in sediments and near wastewater effluent outfalls to empirically calculate residence times to compare with the modeled estimates. Science advisors cautioned that back-calculating log K_{oc}s from the empirical measurements may not be reliable.

Jennifer Jackson noted that the Air Resources Board has banned perchloroethylene in dry cleaning by 2023, and since siloxanes are a potential alternative, data on the exposures and potential toxicity of these compounds would be useful to have soon. Mike Connor noted that the Water Environment Research Federation is currently working to understand the fate of siloxanes in wastewater treatment plants.

Mike Connor also suggested a more robust evaluation of physical-chemical parameters for CECs considered by the RMP, to inform the categorization of compounds within the tiered risk framework.

Day 2 - April 13

1. Summary of Yesterday and Goals for Today

2. Discussion: CEC Pathways Monitoring Strategy

Rebecca Sutton presented an overview of the pathways monitoring strategy that was added to the draft 2018 CEC Strategy Update. Pathways monitoring provides a stronger link to potential management activities, and presents an opportunity to identify early indicators of trends before significant concentrations are detected in the environment, given the higher concentration of contaminants in pathways. Major topics of discussion are summarized below.

Screening vs. Loading studies

Rebecca clarified that loadings studies will only be developed for chemicals of significant concern. Kelly Moran strongly support additional pathways monitoring, given the higher concentrations of contaminants in pathways and the linkages to sources, and cautioned against moving too quickly into loadings studies, which can be costly and drain resources from valuable screening level studies. Reid Bogart supported the primary focus on screening level studies. Mike Connor argued that the monitoring needs to be quantitative to be useful.

Atmospheric Pathway

Miriam Diamond highlighted that the atmospheric pathway includes not only wet deposition measured in stormwater, but also direct deposition to the Bay, which includes compounds that are not degraded before reaching the Bay. Kelly Moran noted that the atmospheric pathway modeling was included in the Copper and Brake Pad Partnership effort, but that the modeling was mainly relevant to stormwater. Tom Mumley argued that this pathway should be a lower priority: while direct deposition may be an issue, the major sources of direct atmospheric deposition are global, given that the prevailing winds move east. This looser link to potential local management action and the higher cost of addressing this new pathway should make it a lower priority.

Additional comments on details in the strategy are summarized below:

- Kelly Moran argued against developing a menu of monitoring options for different types of CEC compounds, which would be too generic to be useful for any one compound group.
- Kelly Moran suggested that the pathway categories include agricultural runoff.
- Tom Mumley noted that while there can be a framework for pathway categories to be addressed for all contaminants, they do not need to be addressed with equal effort (i.e., industrial sources for fipronil are unknown, but likely do not need to be pursued with great effort).
- Karin North suggested monitoring upstream and downstream of low impact development (LID) projects to determine their effectiveness. Miriam Diamond supported this proposal, particularly as LID elements are in the process of being implemented; Kelly Moran expressed skepticism, given the often small size of the watersheds targeted and low overall concentrations detected in such studies.

- Jennifer Teerlink highlighted that the USEPA has now approved a label change for outdoor application products containing fipronil, which DPR believes should begin a downward trend in fipronil concentrations in surface water.
- Bill Arnold suggested that there may be certain industry-specific pathways, such as ports and marinas for APEs (i.e., boat paints and coatings). Lee Ferguson noted that epoxy coatings are also very common in concretes used indoors.

A larger subgroup will be convened to further develop the pathways monitoring strategy over the course of the year, including a specific strategy for wastewater treatment plants (not discussed at the meeting). Participants will include representatives from BASMAA/stormwater agencies (Reid Bogert), the City of San Jose, the City of Palo Alto, BAPPG/BACWA, and DPR. Miriam Diamond and Kelly Moran will provide review of the strategy.

Action Item

- Establish pathways monitoring strategy subgroup and schedule future meetings

3-5. Summary and Discussion of Recommended Studies for 2019

Rebecca Sutton, Meg Sedlak, Diana Lin, and Jennifer Sun presented 2019 Special Study Proposals on the following subjects:

- Emerging Contaminants Strategy
- Stormwater Loading Strategy for CECs
- Roadway Contaminants in Stormwater
- Alternative Organophosphate Flame Retardants Conceptual and Steady-State Model
- Fipronil and Fipronil Degradates in the Bay Food Web
- Sunscreens in Water and Fish
- Non-targeted Analysis of Sport Fish, Cormorant Eggs, Harbor Seals (matching funds for Cal Sea Grant proposal)

Following extensive discussion, studies were prioritized via a closed door session. Studies are listed in order of priority; major topics of discussion for each are summarized below.

Recommended for RMP Special Studies Funding

Priority 1: CEC Strategy

Tom Mumley requested that future proposals include a greater detail on the aspects of the strategy that will be developed each year. Candidates for addition to the current strategy proposal include expanding the strategies for monitoring effects, pathways, and modeling. Karin North reiterated to Becky that, should she need more funding for the emerging contaminants strategy, she should request funds from the Steering Committee.

Priority 2: Non-Targeted Analyses

No clarifying questions were asked. Funding was recommended for this study given the low cost relative to the total project cost leveraged.

Priority 3: Stormwater Screening Study (REVISED)

Multiple science advisors and stakeholders expressed a strong interest in leveraging the proposed Roadway Contaminants study to conduct a screening of other priority compounds, focusing on contaminant screening over loadings studies. Water Board and stormwater agency representatives noted that true monitoring for contaminant loads, as is done for PCBs, requires millions of dollars of investment, and at this stage additional screening-level data for compounds like PFASs can already significantly increase the accuracy of estimated loadings, which can then be used to justify the need for more robust loads monitoring, where appropriate. Tom and Karin both expressed an interest in optimally leveraging the proposed stormwater study to comprehensively evaluate contaminants in runoff. Miriam, Lee, and Kelly expressed support, as did Bill, who suggested including compounds with a range of physical-chemical properties. Mike Connor suggested including a broad array of contaminants, including some non-CEC contaminants such as PCB 153, which could be used within a cluster analysis as a reference to understand which contaminants tend to co-occur.

Compound classes recommended for studying included:

- PFASs - Eurofins has a new list of ~40 compounds for approximately \$400/sample that North Carolina has used, and may cover the most important compounds for much cheaper than Chris Higgin's method. Total extractable organic fluorine should also be included to capture potential precursors. Erika Houtz's TOP method may provide a similar result to the total extractable organic fluorine method.
- Organophosphate esters, including those primarily used in plasticizers and those newly identified as flame retardants in Heather's recent studies
- Ethoxylated surfactants (see proposed study above)

Tom and Karin expressed strong support for this study, indicating that the Steering Committee could potentially provide additional funds to assist with study design and coordination costs, as well as support leveraging non-RMP staff resources to conduct this study.

Priority 4: Ethoxylated Surfactants Study (NEW)

Motivation

- Lee suggested monitoring APEs and alcohol ethoxylates in 2019. There may be mechanisms for effects other than estrogenicity, including for the long-chain ethoxylates, which have been shown to cause adipogenesis. Heather, and Anne Cooper (DTSC) supported this proposal.
- Anne Cooper indicated that DTSC is finding Bay NPE data old and limited. Additional margins data near pathways would be useful for DTSC to begin understanding sources. Data could be used to inform alternatives analyses as well. No thresholds are available to understand potential adverse impacts from levels currently detected in organisms, but this study may not be able to address this issue.

- Jennifer Teerlink indicated that these are not DPR priorities, but they are common ingredients in pesticide formulations and recent updates in DPR modeling tools (through Pesticide Use Reporting data) could be used to inform the monitoring

Straw-Man Proposal

- Ambient Bay water
- Stormwater - add to proposed stormwater CECs screening study (Roadway Contaminants)
- Margins sediment (archived from 2018)
- Wastewater effluent (small number of samples [~8] would be adequate for DTSC needs)
- Lee Ferguson can conduct analyses
 - Approximately \$500/sample for octylphenols, nonylphenols, and several alcohol ethoxylates
 - Isotope-labeled standards are not available and would be difficult to synthesize. Unlabeled standards could be used, but results could be off by a factor of 2. The group agreed that this level of accuracy would be sufficient for such a screening study.

Priority 5: Sunscreens Study

Given the initial screening level of this study, Bill Mitch suggested revising the design to focus first just on sunscreen compounds in wastewater rather than in the ambient Bay and food web. Karin North and Lorien Fono agreed to provide wastewater effluent for such a study. In addition to butylparaben, methyl- and ethylparaben were recommended for monitoring, as they may be more common in sunscreen products. Fish collected in 2019 could potentially be archived for future monitoring.

Not recommended for RMP Special Studies funding

Priority 6: Alternative Organophosphate Flame Retardants

Tom Mumley indicated that this study could not be used to meet the stormwater municipalities' permit requirement. Tom and Kelly expressed concern that this modeling effort was premature for a Possible Concern compound with limited pathways data.

Heather Stapleton recommended that this compound group be expanded to include a broader range of organophosphate esters, including alkylated aryl phosphates. Many of these compounds are also or mostly used as plasticizers, and those sources should be considered in any related studies; other flame retardant alternatives also seem to be missing.

Miriam Diamond indicated that air concentrations in Toronto, likely from indoor ventilation, were high enough to cause washout into rivers at microgram per liter levels; available management interventions are chemical bans rather than actions that can be taken by the Water Board. For this study, air data is needed separate from stormwater data to inform the modeling, and there is a time limit to leverage graduate student labor costs to complete this work. To reduce costs,

the modeling could be conducted using placeholder air data from Toronto, and filled in with monitoring data collected later from the Bay Area.

Priority 7: Fipronil in the Bay Food Web

Tom Mumley highlighted that this study would be a fate study, without wildlife and human health effects indicators. Derek Muir suggested monitoring these compounds alongside bioaccumulation benchmarks like PCB 153, which is known to bioaccumulate. Stable isotope data would be needed to calculate trophic levels for a true biomagnification study.

Jennifer Teerlink expressed interest in the study but noted that the results would not affect any DPR actions. Kelly Moran noted that these data could generate interesting information to compare against results from the SCCWRP study, which has led manufacturers to try to argue instead that fipronil does not bioaccumulate. However, the group agreed this study was a lower priority; fish should be archived below -20 C, a temperature at which lipids degrade.

Jay Davis recommended that fipronil be analyzed as an add-on to Status and Trends sport fish monitoring. Tom Mumley noted that the fipronil add-on could be a good candidate to receive funds for a small Supplemental Environmental Project (~\$15,000).

Not Prioritized: Stormwater Loadings

The stormwater loading strategy study was recommended to be deferred to 2020, or following the stormwater screening study. Tom Mumley and other stakeholders expressed interest in the value of this study, but concern that a true loading strategy would be a bigger undertaking than the proposed study. Initial evaluation of the need for loadings study should fit into the larger CEC strategy (i.e., strategies for addressing Moderate Concern compounds, strategies for employing different types of studies and monitoring of different matrices, the pathways monitoring strategy, etc.).

Luisa Valiela noted that the EPA has some atmospheric monitoring equipment that could be utilized if needed. Kelly noted that air monitoring conducted by the Air Board is mostly designed for assessing long-range transport rather than local sources, which would be needed for RMP studies.

Additional Discussion - Effects vs. Chemical Monitoring Strategy

The group discussed several topics related to the integration of effects and chemical monitoring of CECs, including addressing: (1) mixture effects, (2) endpoints and indirect modes of action detected by whole organism vs. *in vitro* testing, and (3) dose levels and detection limits in effects-based testing. Kelly Moran suggested inviting additional experts to advise the group on these issues, such as from EPA's ToxCAST group or NIEHS's National Toxicology Program. Karin and Tom agreed that these issues would be discussed with the RMP Steering Committee and should be addressed in the CEC strategy.

Lee Ferguson relayed information from Nancy Denslow indicating that high throughput screens like ToxCAST and Tox21 are 1 or 2 orders of magnitude less sensitive than more targeted screenings like the estrogenicity assay, which may be detecting low levels that would be missed by these broader screens. Heather Stapleton suggested conducting effects-directed and chemical monitoring in parallel, as mixture effects cannot be predicted by ToxCAST. Derek Muir noted that the EPA has developed a priority compound list based on pure chemical tests, which at a coarse level could be compared to the RMP's monitoring priorities.

Action Items

- Develop new ethoxylated surfactants study
- Revise stormwater screening, CEC strategy, and sunscreens proposals

6-7. Decision: Recommendations for 2019 Special Studies Funding

Study Name	Modified Budget	Priority	Comments
Emerging Contaminants Strategy	\$70,000	1	For next year, provide high level summary of networking and leveraging that have benefited the program and how much effort is associated with strategy improvements.
Non-targeted Analysis of Fish and Wildlife	\$25,000	2	Need \$25k each yr for 3 yrs or \$75k total
Stormwater Screening Study	\$300,000	3	Goal is quantifying presence/rough loads. Add PFASs (n=40, goldilocks level) and TOP fluorine (Colorado School of Mines?). Add organophosphate esters. Add ethoxylated surfactants. Comprehensive cluster analysis. Design needs to be improved (e.g., no Lagunitas). Develop proposal. Need a RMP technical report. Could spread cost over 2 years (planning/sampling in year 1, data mgmt/analysis and reporting in year 2).
Ethoxylated Surfactants Study	\$50,000	4	Effluent, bay water, archived sediment. Develop proposal. DTSC has need for effluent data.
Sunscreens in Water and Fish	\$50,000	5	Revise proposal to effluent testing only. Potentially use RMP archives of fish later.
Alternative Organophosphate Flame Retardant Conceptual and Steady-State Model		6	
Fipronil and Fipronil Degradates in the Bay Food Web		7	Will not affect DPR decisions now. Consider adding as a parameter to a few S&T sport fish samples.
Stormwater Loading Strategy for CECs	\$0		Defer to later years after screening study
Total	\$495,000		

[end of notes]

Other Notes:

NOTES

- We never talked about supporting ecotox tests. This mostly got lost in discussions about supporting assay/effects directed monitoring. Kelly supported ecotox monitoring once or twice, but the conversation always got redirected. Similarly did not discuss classifying pesticides.

THEMES addressed

- Screening vs. Loading
- Effects vs. Chemical

TABLED TOPICS

- Tom - high cost of data services
- Tom - cost of manuscript vs. technical report
- Should moderate concerns be more highly prioritized than others in the study selection? No? No strategy for this?
- Classification of all PFAS together -- is this still up for discussion or not?