



RMP Emerging Contaminants Workgroup Meeting

April 12-13, 2021
San Francisco Estuary Institute

Meeting Summary

Science Advisors	Affiliation	Present
Lee Ferguson	Duke University	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
Dan Villeneuve	U.S. Environmental Protection Agency	Yes

Attendees

Abigail Noble (DTSC)	Coreen Hamilton (SGS AXYS)
Alicia Chakrabarti (EBMUD)	Denise Greig (Cal Academy of Sciences)
Alicia Taylor (DTSC)	Diana Lin (SFEI)
Amanda Roa (Delta Diablo)	Don Gray (EBMUD)
Analise Lindborg (Duke)	Don Yee (SFEI)
Andria Ventura (Clean Water Action)	Doug Dattawalker (USD)
Anne Balis (City of San Jose)	Ed Kolodziej (UW)
Anne-Cooper Doherty (DTSC)	Eric Dunlavey (City of San Jose)
Artem Dyachenko (EBMUD)	Erica Kalve (SWRCB)
Autumn Cleave (SFPUC)	Eunha Hoh (SDSU)
Blake Brown (CCCSD)	Ezra Miller (SFEI)
Bonnie de Berry (EOA/SCVURPPP/BASMAA)	Frances Bothfeld (WA Dept of Ecology)
Bryan Frueh (City of San Jose)	Gaurav Mittal (SFBRWQCB)
Charles Wong (SCCWRP)	Hallie McManus (UC Berkeley)
Chris Sommers (EOA/SCVURPPP/BASMAA)	Heather Lee (DTSC)

Heather Peterson (SFPUC)	Miguel Mendez (SFEI)
Jay Davis (SFEI)	Nina Buzby (SFEI)
Jaylyn Babitch (City of San Jose)	Paul DeLeo (Integral Consulting Inc.)
Jen Jackson (City of SF)	Rachel Scholes (UC Berkeley)
Jennifer Branyan (UC Davis)	Rebecca Sutton (SFEI)
Jennifer Christmann (Vista Analytical)	Reid Bogert (BASMAA/San Mateo CCAG)
John Coleman (Bay Planning Coalition)	Richard Looker (SFBRWQCB)
Jennifer Teerlink (CDPR)	Richard Grace (SGS AXYS)
June-Soo Park (DTSC)	Robert Wilson (City of Santa Rosa)
Karin North (City of Palo Alto)	Sam Good (SFBRWQCB)
Kelly Moran (SFEI)	Scott Coffin (SWRCB)
Kirsten Overdahl (Duke)	Shoba Iyer (OEHHA)
Kristian Fried (Integral Consulting Inc.)	Simona Balan (DTSC)
Lester McKee (SFEI)	Simret Yigzaw (City of San Jose)
Lilly Sabet (SDSU)	Stephanie Jarmul (OEHHA)
Lisa Austin (Geosyntec)	Steve Weisberg (SCCWRP)
Liz Falejczyk (Novato Sanitary District)	Tan Zi (SFEI)
Lorien Fono (BACWA)	Terry Grim (CIL)
Luisa Valiela (EPA)	Thomas Mumley (SFBRWQCB)
Maggie Monahan (SFBRWQCB)	Topher Buck (DTSC)
Mary Cousins (BACWA)	Wendy Linck (SWRCB)
Mary Lou Esparza (CCCSD)	Yun Shang (EBMUD)
Melissa Foley (SFEI)	

DAY ONE - April 12

1. Introductions and Goals for This Meeting

Melissa Foley began the meeting by highlighting remote meeting tips, reviewing the Zoom platform functionalities, and giving a land acknowledgment to the Native peoples of the San Francisco Bay Area. Melissa then introduced the Workgroup advisors and continued with a brief roll call for the various groups present to introduce themselves.

Melissa followed by reviewing the ECWG two-day agenda and giving an overview of the Regional Monitoring Program for Water Quality in San Francisco Bay (RMP), including the program's goals, history, management questions, monitoring structure, and budget. Additionally, Melissa communicated the goals of the meeting, highlighting discussion on the science during updates on finished and ongoing projects, prioritization of special study proposals, and future directions.

2. Discussion: CEC Strategy Update

Rebecca Sutton updated the group on contaminants of emerging concern (CECs) efforts and strategy, including an overview of current activities and revision to the CEC strategy. She began by introducing the SFEI team, particularly noting the addition of Kelly Moran, a now former external advisor to the ECWG. Rebecca's outline of current CEC activities categorized efforts into three strategic elements: (1) targeted monitoring and risk evaluation, (2) learning from others/sharing expertise, and (3) non-targeted analysis (NTA). Related ongoing projects and activities were noted for each element. Rebecca gave a brief aside on Status and Trends monitoring of PFAS in sport fish, noting the larger analyte list, as well as the continued presence of significant levels of PFOS and PFOSA. She also mentioned the limited human health guidance available across the US, with none yet developed for consumption of fish in SF Bay.

Further, Rebecca identified a couple of forthcoming deliverables, including final manuscripts for triclosan in small fish and OPEs and bisphenols in Bay water (submitted in July and August, respectively). She continued with discussion of two projects connected to the State Water Board CEC Initiative. The first study involves synthesizing and analyzing state CECs data from various matrices in CA waters using a tiered risk-based framework similar to that of the Bay RMP to guide recommendations for monitoring and management priorities for the state. The second effort, also connected with the Ocean Protection Council (OPC), is the reconvening of the Ambient Ecosystems CEC Science Advisory Panel ("EcoPanel") to examine the current CEC monitoring and assessment framework.

Rebecca discussed the upcoming CEC strategy revision, noting its purpose to guide future monitoring efforts undertaken by the Bay RMP. SFEI staff recommended moving forward with the scheduled update in 2022, and noted it as a more significant effort than other smaller update efforts. Rebecca presented reasons in support of the revision, including that the last significant update was five years ago, and this provides the opportunity to update the tiered risk-based framework, standardize information on CEC classes, and incorporate strategy developments (i.e., persistence, toxicology). This revision would include an additional cost of \$30K.

Meeting participants were asked for their input on moving forward with the revision in 2022, with most in support of conducting the revision. Dr. Miriam Diamond commented on wanting further information on CECs management summaries with Rebecca Sutton clarifying there are more specific documents available on individual contaminant classes and the revision of the strategy would be to inform managers on potential next steps, especially on what monitoring would help answer important stakeholder questions. Others in the group inquired about the coordination of this revision to planned statewide work. Rebecca remarked that the statewide strategy would be ready by early next year, giving enough time to consider it as a part of the 2022 revision. Steve Weisberg agreed and noted Dr. Derek Muir, ECWG Advisor, is on the statewide panel and can help to ensure there is coordination between the RMP and statewide efforts. Tom Mumley agreed with a revision, though noted issues with the timing and level of effort required. Tom

noted the ongoing Status and Trends (S&T) redesign was focused on CECs, so the revision should correlate with updates to the S&T monitoring design. He also mentioned inclusion of necessary stakeholder participation and up-to-date CECs management strategy and needs within the update, with several participants in agreement. Though time was tight on the first day, Melissa Foley noted further discussion with stakeholders could occur during the prioritization of special studies on day two.

3. Discussion: Tire Contaminants: Update from the Microplastic Workgroup

Melissa Foley began the item by noting the motivation behind the tire contaminant work, where it is important to consider the occurrence and impacts of both particles and chemical contaminants. Melissa also noted the collaboration across workgroups (ECWG, MPWG, and SPLWG) for this project and introduced Kelly Moran to discuss the tire wear stormwater conceptual model funded by the RMP.

Kelly presented the current status of the conceptual model, an RMP special study in its second year. The focus of the conceptual model work has been on tire particles because they were the most common type of microplastic entering San Francisco Bay. Kelly highlighted the importance of viewing tire particles as both microplastics and chemical carriers, as illustrated by evidence implicating a tire-related toxicant in the pre-spawn mortality of coho salmon in the Pacific Northwest. She discussed the size distribution of tire wear particles, their large surface area for leaching contaminants, and their pathways of release into the environment. Kelly then presented the diagram of the conceptual model, walking through the various sources and pathways for tire wear particles to reach stormwater runoff, including the long-range transport via air and short-range transport to land surfaces. She continued by introducing the tire particle mitigation options diagram, emphasizing the variety of available mitigation measures that could be implemented by various key players, including tire and vehicle manufacturers, government entities, and the general population. She reviewed the many data gaps remaining, including management-relevant data gaps in the areas of environmental monitoring, fate and transport, and mitigation, a subset of which could be potential near-term priorities for the RMP.

Kelly asked the meeting participants some questions, particularly on their input for the conceptual models and data gap priorities. Several in the group discussed potential expansions of the study including examination of contaminants that remain (i.e., do not leach) on particles for potential source tracking, direct measurement of various matrices, chemical transformation as it relates to fate, bioavailability, and connection to air quality. Kelly noted existing knowledge gaps in these areas and the further studies that are needed before pursuing these project avenues. Miriam Diamond noted the potential to develop a framework of the most pressing needs to address toxicity of tire particles, including identifying the most mobile fraction, the pathway(s) to the Bay, and wildlife exposure within the Bay. Such a framework would need to incorporate consideration of regional differences between noted studies (i.e., with lower levels of rainfall in the Bay Area relative to the Pacific Northwest, washoff may be more limited and the

time for in-watershed processes longer). Additionally, Dr. Dan Villeneuve mentioned the difficulty in comparison of studies across a range of manufacturers and particle sizes, highlighting consideration of referring to current samples as “uncharacterized complex mixtures.” The chat also included lively discussion with participants digging deeper into topics such as tire wear source control and collection as well as development of standardized tire wear particles for testing. Reid Bogert indicated that stormwater stakeholders generally support science to inform tire particle/chemical source control.

4. Information: Ethoxylated Surfactants in Bay Water, Wastewater, and Stormwater

Analise Lindborg, a Masters student at Duke University, presented preliminary results of the 2019 RMP special study examining ethoxylated surfactants in San Francisco Bay water, wastewater, and stormwater. Ethoxylated surfactants are commonly detected in the aquatic environment, with a previous RMP study published in 2013 finding nonylphenol in Bay water and nonylphenol ethoxylates (NPEOs) in Bay sediment and mussel tissue. As Analise highlighted, this study builds on previous work to confirm the presence and quantify the concentration of ethoxylated surfactants in the Bay by looking at a broad range of analytes of varying ethoxylated chain lengths including NPEOs, octylphenol ethoxylates, and alcohol ethoxylates, as well as examining a variety of matrices to understand the pathways of contamination into the Bay.

For wastewater effluent, Analise noted the highest concentrations were detected for shorter ethoxymer chain lengths, with WWTPs performing secondary treatment showing an order of magnitude greater concentrations than detected in WWTPs with advanced secondary treatment. One site in particular showed significantly higher levels of these contaminants, likely due to industrial influence from a paint manufacturer. Analise continued with stormwater samples, which also featured various analytes at similar levels to wastewater, with higher concentrations at sites known to have greater industrial and transportation land-use influence. Compared to stormwater and wastewater, ambient Bay sites showed lower concentrations, with quantifiable detections at very few sites and different contaminant signatures relative to other matrices and across subembayments.

Analise closed by highlighting the relevance of the wastewater and stormwater pathways, while noting limitations due to blank detection issues and limited data availability. She also provided future directions for the study of ethoxylated surfactants, including analysis of margin sediment collected in South and Lower South Bays. Several meeting participants asked questions, beginning with Tom Mumley inquiring about the importance of vehicles in the stormwater pathway. Analise suggested potential explanations, including detection of compounds in tire leachate and their use in emulsifiers (such as in anti-freeze), though Dr. Lee Ferguson noted it is hard to establish a direct link to vehicles. Miriam Diamond wondered about the variability in results and if transformation between the point of release and actual mobilization could be a potential explanation. Analise noted the difficulty in addressing what is happening in the

intermittent stages, though examining influent concentrations could help address variability in wastewater. Lee reminded the group of the special challenges associated with this class of analytes, including widespread uses leading to field and lab blank contamination for some compounds, and the lack of well-characterized standards (including linear vs. branched molecules). His team created standards specifically for this project.

5. Information: Preliminary Results of Non-targeted Analyses of South and Lower South Bay Sediment

Dr. Eunha Hoh of San Diego State University and Dr. Lee Ferguson of Duke University both presented preliminary results on a 2018 RMP special study to use non-targeted analyses (NTA) to identify unknown CECs in margin sediments in South and Lower South Bays. Dr. Hoh first presented on non-polar contaminants, followed by Dr. Lee Ferguson discussing polar contaminants. Dr. Hoh gave an overview of the strategy for NTA of non-polar compounds, highlighting study goals to determine which compounds are only present, or present at significantly greater levels in margin sites compared to ambient ones, and prioritize these compounds for future environmental monitoring. She continued by discussing the unique analytical method using GCxGC/TOF-MS, the overall approach to non-target screening, and the framework for compound inclusion and identification. Preliminary results showed detection of 476 compounds and identification of 206 at ambient sites, compared to detection of 401 compounds and identification of 173 at margin sites. A total of 130 identified compounds were found in only margin samples or were significantly higher in absorbance there than in ambient sites. Of those 130 compounds, Dr. Hoh remarked that 54% are PAHs and 30% were detected at more than half of sites, though there was notably no relationship between frequency of detection and absorbance (a proxy for concentration). Using the Decision Analysis by Ranking Techniques (DART) software (which ranks chemicals by ubiquity, chemical properties, and toxicity), the 130 compounds were prioritized with 33 contaminants within the top four most concerning ranks including various PAHs, phthalates, and terpenes. Dr. Hoh also noted the interesting signature of legacy pollutant p,p'-DDE, suggesting continued sources, and the overall utility of NTA as a complementary effort to targeted monitoring.

Dr. Lee Ferguson followed by presenting on the polar compound analysis on a subset of the same samples used for non-polar analysis, particularly focusing on preliminary data from margin samples. He discussed the slight differences in prioritization strategy, which is still being developed, and the varying analytical approaches when compared to the non-polar analysis. Roughly, 300-400 compounds have been detected with 59-64 identified, though the identification process is ongoing. Preliminary identifications included antioxidants, quaternary ammonium compounds, and tricresyl phosphate. Also of note was detection of mystery brominated compounds in Lower South Bay, potentially a cyanobacterial toxin based on environmental factors, including proximity to local salt ponds. In addition, previously unreported azo dye compounds were detected in LSB sediments; roadway paint is one hypothetical source. Overall, most of the compounds detected were putative natural products, though these had low

structure annotation confidence scores, with nitrogen heterocycles being prominent contaminants at sites close to roadways.

Several meeting participants discussed the potential for future efforts to identify sources for PAHs and further explore natural products based on existing structural knowledge. Jay Davis commented that examination of the presence of legacy contaminants in South and Lower South Bays suggests the difference between margins and ambient sites may not be particularly significant due to mixing over time, and wondered if assessment is possible without bias towards any site type (ambient vs. margin). Dr. Hoh noted that it is possible though likely to expand the number of compounds examined.

6. Information: Bisphenols in Wastewater and Sediment

Miguel Mendez presented preliminary results on bisphenols in wastewater and archived sediment samples (2017) from a 2020 RMP special study. Bisphenols are high production volume chemicals that are used in a broad array of applications, and they are known endocrine disruptors, with some included on California's Prop 65 List. A previous 2017 RMP study found bisphenols A (BPA) and S (BPS) in ambient Bay waters at levels comparable to protective thresholds, motivating classification as moderate concern under the RMP-risk based tiered framework, and further study in other matrices and pathways. Overall, Miguel noted bisphenols A and F were predominantly detected in both sediment and effluent samples, though effluent samples showed three other bisphenol detections. Compared to other matrices, including data from a complementary study on stormwater and previous ambient water data, Miguel showed the median concentration in effluent for BPA, BPF, and BPS was higher than other bisphenols and close to their predicted no-effect concentrations (PNECs), with additional concern for potential additive or mixture effects. He suggested focusing on the three main bisphenols detected (BPA, BPF, BPS) and continued monitoring of bisphenols in ambient water via S&T efforts.

Miriam Diamond inquired about the bisphenols relative signatures across stormwater and wastewater, and Miguel responded that stormwater samples showed more BPA, though data is preliminary. A comparison of the two matrices is planned. Tom Mumley asked for further insights on future monitoring and Miguel responded that contamination issues with BPF in the previous ambient water study and potential changes over time warrant another look at three bisphenols in surface water. Derek Muir also wondered about why PNECs were chosen, with Ezra Miller commenting that the chosen PNECs include a broad array of species, are protective, and correlate with the thresholds used by the state's EcoPanel.

7. Information: Building a Statewide Wastewater Pesticide Monitoring Network

Dr. Jennifer Teerlink from the California Department of Pesticide Regulation (DPR) presented on DPR's efforts to establish a permanent wastewater monitoring system through its Surface Water Protection Program (SWPP). Dr. Teerlink began by giving an overview of the SWPP, noting the

various approaches taken to protect surface waters (i.e., prevention, regulation, assessment, modeling). She focused on prevention efforts, highlighting the use of a pesticide registration evaluation model to identify compounds that pose a risk through information from product labels, chemical data, and toxicity data. She continued by highlighting previous work with the RMP finding fipronil in wastewater and its minimal removal via wastewater treatment processes. Recent developments have allowed for funding of a wastewater program including special studies to understand pesticide sources and fate, as well as a statewide monitoring effort to characterize spatial and temporal trends in influent, effluent, and biosolids. Dr. Teerlink discussed preliminary results, which widely detected fipronil and its degradates, as well as imidacloprid and some pyrethroids. She also noted that influent and effluent showed different chemical signatures. A conceptual model was developed to help examine potential sources of pesticides to WWTPs and best target mitigation practices. Dr. Teerlink closed with discussion on next steps for the wastewater monitoring program, including establishment of analytical methods and long-term monitoring studies, while highlighting areas of collaboration with the RMP, such as inclusion of pesticides in the RMP's tiered risk-based framework, the QACs study, and investigations on "inert" ingredients within pesticide formulations that are not pesticide active ingredients (like PFAS) and antimicrobials (as DPR does not currently have access to a laboratory with analytical methods for antimicrobials).

Meeting participants discussed interest in various analytes including DEET, fungicides, carbamates, and legacy pesticides (e.g., lindane). Dr. Teerlink noted DEET and many fungicides were not prioritized for analysis due to high aquatic toxicity thresholds, while also commenting that she would look further into the presence of carbamates. She also remarked that legacy pesticides are not prioritized for DPR, though it may be a good idea to flag detections (e.g., via non-targeted analysis) for partner regulatory agencies. Building materials impregnated with pesticides were flagged by experts as an important indoor source of interest for future studies of wastewater.

8. Information: PFAS in Wastewater Matrices (BACWA Study)

Dr. Lorien Fono of the Bay Area Clean Water Agencies (BACWA) discussed the development of the PFAS study in Region 2 Publicly Owned Treatment Works (POTWs), which emerged as part of a statewide investigation order to analyze PFAS in wastewater in California. She noted the utility of working with the RMP to inform region-wide understanding, design an efficient study to inform management actions, and leverage the other work and resources of the RMP. Lorien also talked about the comparability of the Region 2 study to statewide efforts and highlighted the overall importance of this study to better understand the sources, transport, and fate of PFAS.

Diana Lin continued by giving an overview of the two-phase project: Phase 1 examined a representative subset of facilities in Region 2, while Phase 2 will tailor additional monitoring based on the results of Phase 1. She discussed the design of Phase 1 where influent, effluent, and biosolids were sampled at fifteen representative facilities selected using a diverse set of factors (such as discharge volume, service population, industrial discharges). Grab samples

were collected at most facilities, though, as a comparison of sample methods, a few collected both composite and grab samples. Diana noted that target analysis was done on all samples, while total oxidizable precursor (TOP) analysis, to indirectly quantify potential PFAS precursors, was only done on influent and biosolids. She continued by presenting preliminary results, mentioning minimal contamination of blank samples (possible contamination of 6:2 fluorotelomer sulfonate) and similar concentrations among grab and composite samples from select facilities. Across all matrices, 30 PFAS analytes were detected above the reporting limit, with most significant increases in short-chain carboxylates at municipal POTWs. Further, summed concentrations of PFAS measured using TOP analysis in influent were roughly double those detected using the target method, suggesting significant presence of precursors. Diana asked for input on potential next steps for Phase 2 including suspect screening analysis, total organofluorine analysis (TOF), and reverse osmosis concentrate monitoring of additional facilities.

Workgroup experts generally agreed on next steps, with Dr. Derek Muir particularly noting the benefit of TOF across matrices to understand the full view of potential PFAS contamination. Dr. Lee Ferguson agreed with the addition of TOF, and inquired about the confidence of TOP results, particularly in biosolids. Diana noted confidence in TOP results received so far, though biosolids TOP results have yet to be received due to method difficulties. Several workgroup members also mentioned potential additions to Phase 2 including Dr. Miriam Diamond on study of PFAS breakdown products and Dr. Heather Stapleton on broadening the target analyte list to include diPAPS and fluorotelomer alcohols, as a complement to suspect screening. Richard Grace of SGS AXYS gave a brief overview of the general analytical process and method availability related to extra analyte groups. Miriam Diamond anticipated difficulty in identifying unique PFAS signatures associated with specific sources due to the high production volumes of PFAS, consistent with widespread use in many types of products.

9. Information: Status and Trends Monitoring Review

Melissa Foley introduced the item by outlining the motivations and objectives of the Status and Trends monitoring program review. Notably, the sampling design will be tailored to efficiently incorporate CECs into S&T monitoring and ensure data are relevant to management needs. Melissa highlighted the variety of expert advisors and stakeholders involved to effectively redesign monitoring efforts towards CECs. Compared to current efforts, the revision would focus on CECs versus legacy contaminants, leading to differences in sample collection location and timing as well as allowing for fluid movement of CECs on and off S&T lists. Further, Melissa talked about the decision pathway used to determine how to best monitor specific CECs, based on particular factors, including the expected pathway, toxicity thresholds, chemical properties, and existing data in the Bay as well as a simple CEC conceptual model. She continued by reviewing the general sampling design aspects, particularly changes in analytes examined per matrix, varying site types with a Lower South Bay focus, and temporal features (i.e., seasonal, annual) to site selection. These features were spotlighted in the sampling design for the pilot S&T effort for CECs in water during the wet and dry seasons. Melissa discussed the timeline for

the effort, including finishing individual matrices (water, sediment, biota) by the end of the summer of 2021, presenting at the Multi-Year Planning Workshop in October, and final design presentation to the TRC in December 2021.

Melissa noted the important role of the ECWG to weigh in on priorities and approve special studies using S&T as a platform for additional work, concluding with a few questions asking for input on the S&T redesign. Several meeting participants discussed the use of non-target analysis and how to best employ the data to inform future monitoring efforts. Lee Ferguson inquired about the geochronology done in the SF Bay, noting it would be ideal to examine a site with high sediment deposition close to a potential source. Don Yee mentioned wetland edges tended to have appropriate geochronology compared to the open bay and also noted consideration of a passive sediment surface trap to collect recently mobilized sediment. A few participants also mentioned the benefits of continuing to monitor via bivalves as well as potential incorporation of spatial variability and effects-based monitoring. Dan Villeneuve suggested considering prey fish monitoring based on experience in the Great Lakes. Miriam Diamond mentioned consideration of how S&T data can inform source reduction as a part of strategy development. Tom Mumley highlighted the importance of the CEC strategy revision to optimize the S&T program design through a more integrated approach.

10. Information: Setting the Stage for Day 2

Rebecca Sutton thanked the group for their focused, productive discussion, and then reviewed the schedule and goals for the following day. She highlighted some potential points of discussion for the MYP and future directions items including: proactive pathways monitoring, biota monitoring priorities, and efforts dedicated to new CECs versus moderate concern contaminants. Rebecca also asked for input on discussion topics, highlighting some points brought up by participants, including future utilization of NTA and tying work to source reduction.

DAY TWO - April 13

11. Information: Summary of Day 1 and Goals for Day 2

Melissa Foley reminded attendees of Zoom features and allowed time for an abbreviated roll call of the day's attendees. Melissa then reviewed the events of Day 1 of the meeting as well as the agenda and goals for Day 2, with a particular focus on prioritization of special study proposals.

12. Information: Discussion: Integrated Watershed Modeling and Monitoring Strategy to Support CECs

Kelly Moran began by highlighting the objectives of the integrated watershed modeling and monitoring strategy, particularly to develop a road map to support monitoring design and model structure for CECs. She continued with discussion of maximizing effectiveness through efficient integration of watershed modeling and monitoring work, which is particularly important for CECs

as they have high analytical costs. Tan Zi then talked about the differences between monitoring and modeling, noting the complicated and iterative process of incorporating both together. He presented the draft diagram of the roadmap for the projects, where management questions are examined to identify data gaps. Then, linked monitoring and modeling are used to inform cost-effective study designs to fill data gaps. This process is iterative, building from simple conceptual models and limited monitoring data to obtain early answers to management questions and, in areas where more detail is needed, using initial data to build dynamic models (again a process integrated with monitoring design) to provide refined answers to management questions.

Kelly closed by reviewing the project timeline, with a draft report expected September 2021, and posing discussion questions, spotlighting input on roadmap development related to the project. Meeting participants discussed the current approach, with Lee Ferguson noting continued work about specific applications to CECs and potential for use of a pilot chemical like ethoxylated surfactants, for which degradation is a factor. Miriam Diamond also noted choosing candidate chemicals known to travel by different pathways, including air, as well as potential addition of a management question addressing control and mitigation. Don Yee mentioned that legacy contaminants could be useful as initial candidates to provide breadth of data along with calibration and validation of the data. Dan Villeneuve inquired about development of models, highlighting opportunities to leverage other efforts within the US. Tan noted a combination of new model development and partner collaborations are planned depending on project needs. Tom Mumley also noted the work will integrate with a variety of other projects under the purview of the RMP and continue to connect with similar projects on a regional and national scale. Chris Sommers noted an open question for CECs modeling regarding the levels of precision and accuracy needed.

13. Information: CEC Toxicology Strategy Update

Ezra Miller introduced the item by outlining the background and motivations for the CEC toxicology strategy update, a study to synthesize and assess the quality of available thresholds for CECs detected in the Bay, as well as calculate thresholds for data-poor CECs and establish a process for identifying thresholds for future CECs. Ze discussed the current project to compile ecotoxicological thresholds, noting the current approach to create a living document of important thresholds derived from an extensive literature review, and detected CEC concentrations from the past ten years of RMP-funded studies. Ezra reviewed the types of thresholds generally used, describing the development of ecosystem level thresholds (e.g., PNECs), while also spotlighting the wide variety of important CECs and sources of ecotoxicological thresholds to consider. Ze noted each threshold is given a quality indicator to identify transparency and uncertainty. These thresholds are then compared to available concentrations to examine risk characterization ratios and associated level of concern, with an additive mixture approach considered for appropriate classes. Ezra concluded by highlighting next steps using predictive toxicology methods to calculate thresholds, with the living document of thresholds

expected to be completed before the next ECWG meeting, along with an additional proposal on predictive toxicology.

Several meeting participants discussed potential future directions including a site-specific hazard index in the Bay, incorporating modes-of-action of chemicals (e.g., narcosis, which could be considered cumulative across chemicals/classes), and development of a collection of chemical properties of CECs to inform toxicological considerations. Miriam Diamond and Derek Muir noted further consideration of use trends as well as integration of bioaccumulation and persistence. Ezra noted these various factors are currently considered separately, so work still remains to develop a framework to combine and examine them together. Dan Villeneuve recommended greater transparency with respect to use of these secondary factors in the risk screening process.

14. Discussion: ECWG Multi-year Plan and Future Work

Rebecca Sutton discussed the current ECWG MYP and potential options for future work within the ECWG. She reviewed the MYP, highlighting the wide breadth of pending work from lower to top priority studies for strategy, CECs categorized in the RMP's tiered risk-based framework from possible to moderate concern, new CECs, NTA, and toxicology. Rebecca also noted several future directions for the focus area including: use of NTA results, role of the RMP in identifying CEC sources and pathways, proactive pathways monitoring including air pathway, monitoring to inform source reduction, deprioritizing work on key classes, balance of efforts on new CECs with those established as moderate concern, and determining priorities for biota monitoring.

Rebecca suggested a couple of areas of discussion, including incorporation of topics from yesterday like the use of NTA and source reduction. Several meeting participants discussed the best ways to use NTA and the resulting data, with most noting the need to develop a framework for utilization that includes further mining of available data for information, retrospective analysis, and also considers what is not detected (when conceptual models might suggest it should be present). Dan Villeneuve spotlighted the importance of NTA to develop a view of the contaminant landscape, and thinking about atmospheric deposition to understand the air pathway. Derek Muir and Miriam Diamond supported characterization of the air pathway (dry deposition), and also recommended a focus on high production volume chemicals. Tom Mumley inquired about the value of new NTA studies in marine mammals versus other wildlife and the potential to combine target (e.g., PFAS) and non-target analysis. The group agreed with the combination approach, especially harvesting NTA data for new CECs and leveraging targeted data to get estimates of NTA analytes. Derek Muir noted that seals (mammals) may not be the best species due to the low bioaccumulative value for many CECs, with Tom suggesting prey fish as potential biota to study. Miriam Diamond noted the possible use of passive sampling as a cost-effective alternative to biota, as there is less need to determine exact concentrations.

15. Summary of Proposed ECWG Studies for 2022

Rebecca Sutton gave an overview of all proposed special studies, highlighting the motivation and approach for each study, as well as associated budgets and deliverables. Meeting participants were allowed a few clarifying questions after the presentation of each proposal, though it was noted that more time would be available for discussion in the next agenda item. The focus of discussion was on five high-priority studies, with a more brief review of three lower-priority proposals intended for inclusion on the Supplemental Environmental Projects (SEP) list, and two special study proposals for the Microplastic Workgroup with relevance to ECWG.

The proposal for the fourth, and final, sampling year of the stormwater CECs screening study aims for intensive sample collection with the motivation to fill existing stormwater data gaps. The project would examine over 10 sites with a subset of sites sampled twice, focusing on sites with greater urban land use, unique sources or land uses, and opportunities to leverage monitoring with other RMP efforts. Remaining funds from reduced work in years 2 and 3 will be applied to sampling in year 4.

The stormwater monitoring strategy proposal was then presented, aiming to develop a novel, long-term stormwater monitoring approach to effectively address CECs. The strategy includes developing frameworks for prioritizing CECs for stormwater monitoring and tailoring the sampling design to CECs. Within the sampling design, there is flexibility to respond to stakeholder data needs as well as integrate modeling insights and needs to maximize cost-effectiveness. Chris Sommers highlighted the importance of engaging with stakeholders and continued discussion regarding future directions. Since this is a two-year study, Tom Mumley wondered whether the project could be completed in one year and noted interest in an interim product or at least interim use of the developing strategy to inform monitoring before the strategy is complete. .

Presentation of a followup study of ethoxylated surfactants in wastewater and stormwater followed. The motivation of this study is to fill existing data gaps on ethoxylated surfactants analysis and investigative potential sources in wastewater. This proposal would investigate temporal variation (including comparison of weekday and weekends, short-term, and seasonal variation) in wastewater effluent at three POTWs across four sampling dates with a focus on four specific analytes not included in the original analysis. In addition, biosolids would be sampled at POTWs and stormwater would be screened to leverage existing CECs efforts. Lee Ferguson and Richard Grace talked about analytical methods related to ethoxylated surfactants and options to capture those of concern. Tom Mumley and Chris Sommers discussed biosolids and whether this matrix falls within the scope of the RMP.

A study on tire contaminants in Bay water was introduced, which examines 6PPD-quinone and other tire contaminants observed in Bay Area stormwater to inform their classification within the

tiered risk-based framework. This study leverages the pilot S&T wet season monitoring to understand the impact and presence in the Bay while evaluating the pilot effort.

The final proposal discussed non-target analysis in Bay water, focusing on further characterization of stormwater as a CEC pathway, as well as screening Bay water influenced by stormwater for unexpected or new contaminants for follow-up special studies or monitoring. This project would also leverage the pilot S&T monitoring efforts as well as incorporate stormwater sites upstream from those known to already be stormwater influenced. Partnerships with two different labs will allow for analysis using two different methodologies.

The three SEP proposals were briefly outlined, noting that these studies are important to conduct in the Bay but are not currently suggested as top priorities for RMP funding. The first two studies assess PFAS and brominated flame retardants in sediment samples to better understand occurrence, risk, and temporal trends. The third study would examine chlorinated paraffins, a new contaminant class, to assess its occurrence and risk, especially as medium and long-chain paraffins have gained use as a regrettable substitution for short-chain paraffins. Two proposals for the MPWG were also quickly reviewed: the first an overall strategy for tire particles and ingredients to address existing information gaps in the Bay, while the second is an investigation of tire particle characteristics that impact the fate and transport of tire particles and associated contaminants.

16. Discussion of Recommended Studies for 2022 - General Q&A, Prioritization

Melissa Foley introduced the item by reviewing the process for prioritization and recommendation of special studies. She also noted the overall planning budget for the special studies to prioritize for the TRC and overall scope of the budget within the RMP. Meeting attendees asked any remaining questions while proposal PIs were still in attendance. The discussion focused on four of the high priority studies previously presented.

Stormwater CECs Monitoring Strategy

Tom Mumley discussed cutting the current scope of the project, potentially narrowing it to a single year effort. Kelly Moran and Rebecca Sutton noted the considerable value of taking a strategic approach and necessary time and resources to develop the best framework possible. Dan Villeneuve and Chris Sommers echoed these sentiments, highlighting the importance of an effective and flexible strategy. Miriam Diamond talked about potential control actions related to these contaminants and potential of an interim deliverable.

Ethoxylated Surfactants in Wastewater and Stormwater

There was discussion among meeting participants regarding the inclusion of biosolids, with Diana Lin noting the utility to compare to effluent samples, potential for mass balance calculation, and analysing temporal trends. Lee Ferguson highlighted that removal efficiency is affected significantly by treatment, stressing a need to adjust expectations and study questions

to the study design. Anne-Cooper Doherty remarked about the value of including both short-chain and long-chain analytes within the study, with Lee discussing the potential to reanalyze samples from a previous RMP study to have a complete data set. Diana Lin noted the proposal will be reviewed and edited to reflect the noted discussion (i.e., less focus on biosolids and inclusion of both short- and long-chain analytes).

NTA of Bay Water

Several meeting participants discussed the current approach and whether it best identifies potential target compounds, particularly as there are few sampling sites and not much expansion from what has already been done previously. Dan Villeneuve noted the potential to expand the scope of the NTA study to include different sites and scale sampling over a couple of years. Jay Davis noted the objective of this project is to understand what CECs are of concern in the Bay, potentially focusing on collection now and conducting chemical analyses over time. Tom Mumley mentioned greater site selection at stormwater sites as well as the potential to archive water samples. Rebecca Sutton noted doing all stormwater sites for this study is possible and would minimally change the budget; stormwater is a matrix that has not yet been characterized via NTA, unlike wastewater. Derek Muir asked about the comparability of NTA results to previous studies, with Lee Ferguson noting difficulty due to data incompatibility. Lee expressed interest in potential pro-bono work to analyze some of the samples using 2016 methods.

Tire-related Contaminants in Bay Water

Discussion centered around the design of the project, with several meeting participants noting analysis of dry season samples to understand if these contaminants may be airborne and leave a detectable deposition. Examination of dry weather would also help figure out persistence in the Bay as well as better understand temporal variation and peak concentrations. Anne-Cooper Doherty noted the importance of coordinating efforts with DTSC.

17. Closed Session - Decision: Recommendations for 2022 Special Studies Funding

Eric Dunlavey led the closed door discussion. Following extensive discussion, studies were prioritized. A Zoom poll was conducted to help rank proposals. The resulting recommendations are shown in the following prioritization tables:

Study Name	Budget	Modified Budget	Priority	Comments
Stormwater monitoring strategy for CECs	\$50,000	\$50,000	2	\$105,000 (\$50,000 for 2022; \$55,000 for 2023); with stakeholder clarifications in the proposal; reevaluate the scope of the strategy for Year 1 (and Year 2)

CECs in stormwater (Year 4 of 4)	\$100,000	\$100,000	1	
Ethoxylated surfactants in wastewater and stormwater	\$83,415	\$60,000	4	\$12k for biosolids (don't include); reduce number of samples (6-7 per WWTP?; fewer stormwater sites?) or archive; find lab with method for short chain compounds or go back to original samples; add additional field blank(s)
Non-targeted analysis of Bay water (wet season)	\$112,000	\$95,000	5	Number of sites could be adjusted (focus on stormwater?) and/or phased over multiple years (save extraction and archive); also method used could be GC or LC only instead of both
Tire-related contaminants in Bay water (wet season)	\$36,000	\$50,000	3	add dry weather samples in LSB (summer 2021)

SEP Project Ideas			
Study Name	Budget	Yes/No	Comments
PFAS in Sediment	\$55,000 - \$125,000	Yes (2)	TOF should be included
Brominated flame retardants in sediment	\$45,000 - \$110,000	No	levels likely low, so less of a priority
Chlorinated paraffins in sediment	\$50,000 - \$120,000	Yes (1)	No data in the US; but likely present. Highest priority of these SEP proposals

Relevant Studies			
Study Name	Budget	Yes/No	Comments
Tires strategy	\$25,500	Yes	
Tire particle/contaminant fate and transport	\$110,000	Yes	

18. Report out on Recommendations

After the closed door session, proposal authors were invited back to the meeting to hear the final prioritization decisions. Eric Dunlavey summarized the discussed suggestions and recommendations.

Adjourn

About the RMP

RMP ORIGIN AND PURPOSE

In 1992 the San Francisco Bay Regional Water Board passed Resolution No. 92-043 directing the Executive Officer to send a letter to regulated dischargers requiring them to implement a regional multi-media pollutant monitoring program for water quality (RMP) in San Francisco Bay. The Water Board's regulatory authority to require such a program comes from California Water Code Sections 13267, 13383, 13268 and 13385. The Water Board offered to suspend some effluent and local receiving water monitoring requirements for individual discharges to provide cost savings to implement baseline portions of the RMP, although they recognized that additional resources would be necessary. The Resolution also included a provision that the requirement for a RMP be included in discharger permits. The RMP began in 1993, and over ensuing years has been a successful and effective partnership of regulatory agencies and the regulated community.

The goal of the RMP is to collect data and communicate information about water quality in San Francisco Bay in support of management decisions.

This goal is achieved through a cooperative effort of a wide range of regulators, dischargers, scientists, and environmental advocates. This collaboration has fostered the development of a multifaceted, sophisticated, and efficient program that has demonstrated the capacity for considerable adaptation in response to changing management priorities and advances in scientific understanding.

RMP PLANNING

This collaboration and adaptation is achieved through the participation of stakeholders and scientists in frequent committee and workgroup meetings (see Organizational Chart, next page).

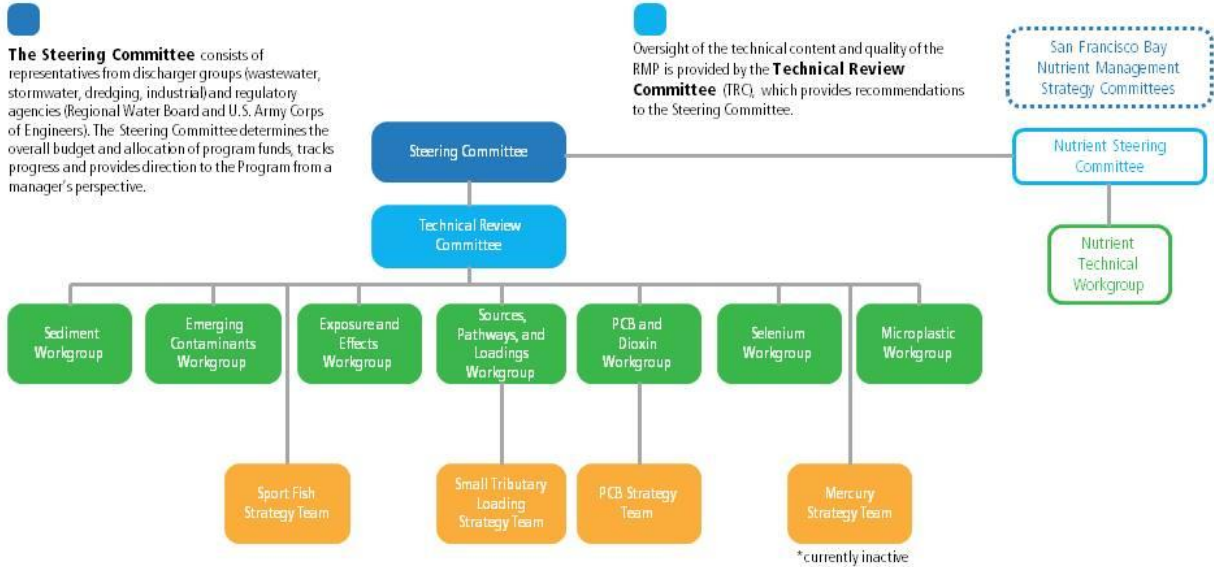
The annual planning cycle begins with a workshop in October in which the Steering Committee articulates general priorities among the information needs on water quality topics of concern. In the second quarter of the following year the workgroups and strategy teams forward recommendations for study plans to the Technical Review Committee (TRC). At their June meeting, the TRC combines all of this input into a study plan for the following year that is submitted to the Steering Committee. The Steering Committee then considers this recommendation and makes the final decision on the annual workplan.

In order to fulfill the overarching goal of the RMP, the Program has to be forward-thinking and anticipate what decisions are on the horizon, so that when their time comes, the scientific knowledge needed to inform the decisions is at hand. Consequently, each of the workgroups and teams develops five-year plans for studies to address the highest priority management questions for their subject area. Collectively, the efforts of all these groups represent a substantial body of deliberation and planning.

PURPOSE OF THIS DOCUMENT

The purpose of this document is to summarize the key discussion points and outcomes of a workgroup meeting.

Governance Structure for the Regional Monitoring Program for Water Quality in San Francisco Bay



The Steering Committee consists of representatives from discharger groups (wastewater, stormwater, dredging, industrial) and regulatory agencies (Regional Water Board and U.S. Army Corps of Engineers). The Steering Committee determines the overall budget and allocation of program funds, tracks progress and provides direction to the Program from a manager's perspective.

Oversight of the technical content and quality of the RMP is provided by the **Technical Review Committee (TRC)**, which provides recommendations to the Steering Committee.

Workgroups report to the TRC and address the main technical subject areas covered by the RMP. The Nutrient Technical Workgroup was established as part of the committee structure of a separate effort – the Nutrient Management Strategy – but makes recommendations to the RMP committees on the use of the RMP funds that support nutrient studies. The workgroups consist of regional scientists and regulators and invited scientists recognized as authorities in the field. The workgroups directly guide planning and implementation of special studies.

RMP strategy teams constitute one more layer of planning activity. These stakeholder groups meet as needed to develop long-term RMP study plans for addressing high priority topics.