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COUNCIL



RMP

REGIONAL MONITORING
PROGRAM FOR WATER QUALITY
IN SAN FRANCISCO BAY

sfei.org/rmp

Joint Meeting of the RMP Microplastic Workgroup and OPC Microplastics Stakeholders

April 21st, 2021 (remotely held meeting)

Meeting Summary

Advisor

Name	Affiliation/Roles	Present
Chelsea Rochman	University of Toronto	Yes

Attendees:

Adam Wong (SFEI)	Emma Sharpe (Western Washington University)
Alicia Gilbreath (SFEI)	Eric Dunlavey (City of San Jose)
Alvina Mehinto (SCCWRP)	Ezra Miller (SFEI)
Amanda Roa (Delta Diablo)	Farid Ramezanzadeh (Hayward)
Amelia Labbe (Cabrillo Community College)	Heather Goss (EPA)
Andy Gray (UC Riverside)	Heather Podoll (Fibershed)
Anne Balis (City of San Jose)	Holly Wyer (OPC)
Anne-Cooper Doherty (DTSC)	Jackie Doremus (Cal Poly)
Artem Dyachenko (EBMUD)	Jackie Lang (UC Davis)
Ashley LaBass (Bay Planning Coalition)	Jared Voskuhl (CASA)
Autumn Cleave (SFPUC)	Jasquelin Pena (UC Davis)
Barbara Baginska (SFB RWQCB)	Jay Davis (SFEI)
Brian Laurenson (Larry Walker Associates)	Jaylyn Babitch (City of San Jose)
Bryan Frueh (City of San Jose)	Jeremy Conkle (TX A&M Corpus Christi)
Carlie Herring (NOAA)	Jerry Kickenson (Sierra Club Grassroots Network)
Carolynn Box (independent ocean conservation consultant)	Karin North (City of Palo Alto)
Charles Wong (SCCWRP)	Kay Ho (EPA)
Chris Sommers (BASMAA)	Kelly Moran (SFEI)
Conrad MacKerron (As You Sow)	Kiya Bibby (California Ocean Science Trust)
Corey Clatterbuck (SFB RWQCB)	KM Michels (Safe Healthy Playing Fields)
Dawit Tadesse (SWRCB)	Krystle Moody Wood (Materevolve)
Deepak Mallya (The Tyre Collective)	Leah Thornton Hampton (SCCWRP)
Diana Lin (SFEI)	Lisa Erdle (University of Toronto)
Don Yee (SFEI)	Lisa Mondy (Sandia National Laboratories)

Luisa Valiela (EPA)	Shelly Walther (LA County Sanitary District)
Maggie Stack (San Diego State University)	Sherry Lippiatt (NOAA)
Margaret McCauley (EPA)	Simona Balan (DTSC)
Mary Lou Esparza (CCCSD)	Simret Yigzaw (City of San Jose)
Melissa Foley (SFEI)	Siobhan Anderson (The Tyre Collective)
Miguel Mendez (SFEI)	Sriram Gopal (Association of Home Appliance Manufacturers)
Miriam Diamond (University of Toronto)	Stephanie Karba (Patagonia)
Molly Martin (EPA)	Steve Weisberg (SCCWRP)
Monica Arienzo (Desert Research Institute)	Susanne Brander (Oregon State University)
MSmith	Sutapa Ghosal (CDPH)
Olivia Angus (Surfrider Foundation)	Tan Zi (SFEI)
Rebecca Sutton (SFEI)	Tanya Torres (NOAA)
Richard Looker (SFB RWQCB)	Thomas Mumley (SFB RWQCB)
Richard Thompson (University of Plymouth)	Thomas Novotny (San Diego State University)
Roman Berenshteyn (Bay Planning Coalition)	Tim Merkel (Clean Brake Performance)
Roxana Suehring (Ryerson University)	Florian Pohl (University of Plymouth)
Samantha Harper (SFB RWQCB)	Violet Renick (Orange County Sanitation)
Sarah Hutmacher (San Diego River Park Foundation)	Wayne Landis (Western Washington University)
Scott Coffin (SWRCB)	Win Cowger (UC Riverside)
Shelly Moore (SFEI)	

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’s advisor, Chelsea Rochman, and new member of the SFEI team, Kelly Moran. After a brief roll call, Melissa reviewed the day’s agenda and communicated the goals for the day, emphasizing the roles of advisors, experts, and stakeholders in providing input on the OPC project as well as the Regional Monitoring Program for Water Quality in San Francisco Bay (RMP) Microplastic Workgroup (MPWG) multi-year planning and special studies.

2. Discussion: Tire Wear Stormwater Conceptual Model Update (RMP & OPC)

Diana Lin introduced the item by reviewing the past efforts of the Workgroup, focusing on the findings from the San Francisco Bay Microplastic Study. She highlighted the important discovery of stormwater as a significant pathway for microplastics, which were evenly composed of fibers and fragments. She continued by detailing next steps aimed at informing management actions, particularly the development of four stormwater conceptual models synthesizing the current understanding of terrestrial microplastic sources and pathways to urban stormwater. She noted that draft conceptual models, funded by the OPC, for cigarette butts and cellulose acetate fibers, fibers (other than cellulose acetate), and single-use plastic foodware (SUPF) would be

presented later in the meeting. Diana gave an overview of the project timeline and important terminology related to the models, including primary and secondary microplastics, degradation, and deterioration. She then 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 are potential near-term priorities for the RMP.

Kelly posed a few questions to the meeting participants asking for input on the conceptual models and data gap priorities. The group discussed the nuances of the separation of tire particles from environmental samples, with Chelsea Rochman noting the importance of understanding that road material is likely attached to many tire particles, thus increasing their density. Kelly remarked that there is variability in processes for formation of tire particles across the tire particle size distribution, which makes particle surface area difficult to estimate. Meeting participants provided comments on the conceptual model, recommending it show the gradient of surfaces from pervious to impervious surfaces rather than two distinct categories and suggesting clarification of whether stormwater treatment types other than bioretention may be effective for removing tire particles before stormwater enters the Bay.

3. Information: Tire Wear Debris Collection to Mitigate Pollution (RMP)

Siobhan Anderson presented on the novel work developed by The Tyre Collective (TTC), a clean technology start-up dedicated to collection of tire wear debris, where she is the Chief Science Officer and lead of research and testing. She discussed the innovative technology created to collect tire wear at the source, highlighting its capture of roughly 60% of airborne particles, and recycling of captured particles. In the short term, these devices can be retrofitted to cars, though over time they could be integrated into all vehicles. Siobhan highlighted TTC's current efforts to understand how particles are created as well as future TTC partnerships to support work to characterize particles in air (with Imperial College London) and proposed partnerships with SFEI, UC Davis, and University of Washington to characterize tire-wear particles generated in the TTC product development process.

After outlining the timeline of the product launch, Siobhan asked the group for questions. Win Cowger remarked about the density distribution of produced tire wear particles, which Siobhan says is an area of interest TTC is working on studying. Win also mentioned the potential to obtain samples from TTC would be of great help for current studies with SFEI and others (especially in creating standards). Siobhan and Deepak Mallya (Chief Product Officer at TTC) indicated interest in sharing samples and developing a library of living data with chemical and overall particle data. Richard Looker asked if the current fluid dynamics testing would improve understanding of tire wear behavior in varying conditions (i.e., dry, wet, wind conditions, and overall climate). Siobhan noted further testing in wind tunnels to understand particles dynamics, and wet surfaces, though there is not yet full understanding of the impacts of different climate conditions on their tire particle collection system.

4. Discussion: California Urban Stormwater Conceptual Models, Part 1 (OPC)

Ezra Miller presented the cigarette filters and cellulose acetate conceptual model, the first of three OPC funded California urban stormwater conceptual models that were discussed at this meeting. Ze went through the conceptual model diagram, first highlighting the relatively quick deterioration of cigarette butts and release of cellulose acetate fibers and other associated contaminants. Ezra also noted important pathways, including improper disposal via littering, further release into aquatic environments through stormwater runoff, and proper disposal through waste management. Ze also presented a draft management options model, specifying important actions, from remediation to prevention, of tobacco manufacturers, government, and the general population.

Ezra provided discussion questions to garner feedback on the content and composition of the urban stormwater and mitigation options conceptual models. Meeting participants commented on research data gaps, particularly on discernment of cellulose from cellulose acetate and toxicity studies for cigarette butt leachate. Several in the group also discussed the impact and effectiveness of collection programs, including street sweeping (with Chris Sommers noting availability of some data that shows street sweeping is more effective for macrotrash, especially because most cigarette butts are littered on sidewalks). Jackie Doremus also noted the expansion of government actions and that it may be better to identify population-wide actions as community-wide, non-governmental actions.

Kelly Moran then presented the fibers conceptual model (excluding cellulose acetate), beginning by identifying the variety of indoor and outdoor fiber sources. She emphasized the unique transmission pathways of fibers from source to stormwater, especially air transport that is possible due to the small size and weight of fibers and their elevated, heated air emission from tumble dryer vents. She continued by noting the remaining data gaps in understanding fiber releases and pathways, including from tumble dryers and construction sites.

Kelly posed some questions regarding the importance of the construction pathway and to provide input on the conceptual model substance and design. The meeting participants noted modeling would be useful to understand air transport of fibers. Several also commented on

remaining data gaps, including understanding emissions from wearing clothes and homeless encampments as a source. Sutapa Ghosal asked about the potential differences of fibers from dryers versus from clothing dried on the line, with Kelly mentioning line-dried clothing is expected to not lose fibers quickly, though with current data gaps, estimating the relative loads from different sources is a challenge.

5. Discussion: California Urban Stormwater Conceptual Models, Part 2 (OPC)

Shelly Moore and Miguel Mendez presented the SUPF stormwater conceptual model. Shelly began by defining SUPF and identifying its urban sources, highlighting the mismanagement of SUPF predominantly through littering. She further noted current actions in California to curb waste from SUPF and trash overall, featuring a Southern California study showing a decrease of plastic bag waste in areas with a plastic bag ban in effect. Miguel continued by identifying important terms in the breakdown of SUPF to secondary microplastics, focusing on the mechanisms of deterioration, including photooxidation, mechanical breakdown, and biodegradation. He discussed the qualitative summary table of the characteristics of deterioration and degradation to focus the conceptual model on land-based sources, where secondary microplastics are most likely to form. Miguel then presented the diagram of the conceptual model, summarizing the sources and pathways discussed throughout the presentation.

Miguel provided discussion questions to ask for input on the content and design of the conceptual model. Meeting participants discussed the need to better understand the types of materials used and connection to sources, especially linking secondary microplastics to large macroplastic items/sources. Roxana Suehring noted a potential collaboration opportunity in a project to map microplastics to macroplastics based on forensic analysis. The group also noted suggested changes to the conceptual model diagram, including broadening of sources beyond urban commercial/residential areas and potential inclusion of highway trash.

6. Summary: OPC Project Discussion Wrap-Up and Next Steps (OPC)

Diana Lin briefly reviewed the California urban stormwater conceptual models and wrapped up any remaining discussion topics. She ended this section of the meeting by reiterating the project timeline, emphasizing important dates for participants to provide feedback on the draft versions of the project. She requested attendees to send any additional comments via email by April 30. No additional comments were received via email.

7. Information: Update on Ecological Health Effects of Microplastics in Water: Characterizing Current Knowledge and Identifying Research Priorities (RMP)

Dr. Susanne Brander from Oregon State University presented on current ongoing efforts related to risk and toxicological assessment of microplastics in California. She discussed the exponentially growing research on plastics, highlighting the importance of size and shape while noting the development of a database of studies, Toxicity of Microplastics Explorer (ToMEx), that

will be available later in 2021. Dr. Brander detailed the current state-level actions, beginning with the Ocean Science Trust Science Advisory Panel that has developed a qualitative risk prioritization framework with a report available at the end of April. She continued by talking about the Microplastics Health Effects Workshop, coordinated by SCCWRP and The State Water Board (SWB) with the RMP providing some support funding, and presented draft tiered microplastic thresholds for ambient waters and associated suggested management actions. Dr. Brander mentioned next steps, including derivation of ambient and human health thresholds, consensus building on the overall management framework, and plans for recommendations for additional research and monitoring.

Meeting participants commented on the role of different considerations (integration of chemicals in particles, size, morphology, and polymer type) within the risk assessment, which Dr. Brander noted are a part of ongoing discussions, though data availability is fairly limited. Wayne Landis asked about the highest priority topics to reduce the uncertainty of the analysis; Dr. Brander responded that the largest data gaps are fibers, tire wear particles, and targeted studies on these plastic types (i.e., toxicity and presence in the environment). Richard Looker remarked that species sensitivity distributions using lowest observable effect concentrations (LOECs) would be valuable as a part of the analysis. Dr. Brander mentioned that the SWB is currently working on developing LOECs and that no observable effect concentrations (NOECs) were chosen to be conservative and consistent with the SWB.

8. Information: Microplastic Risk Assessment for San Francisco Bay (RMP)

Emma Sharpe, a Masters student at Western Washington University, presented on the microplastic risk assessment for SF Bay, a collaborative effort with SFEI supported with funding from the RMP Microplastic Strategy and a National Science Foundation grant. Emma presented the Bayesian Network relative risk model, describing the overall approach to its development. She noted the current selection of endpoints (including key marine species and human health) and development from conceptual model to Bayesian Network to ultimately calculate and communicate risk. She mentioned sources of uncertainty in the analysis and concluded by noting results are expected in the summer of 2021.

Meeting participants asked technical questions, including Dr. Chelsea Rochman on the value of using the amount ingested versus the amount available for exposure in the environment within this model. Emma responded that both could be included, with Dr. Rochman adding the potential to survey the literature and use data related to its lifetime in the gut of the species in this study. Diana Lin also inquired about the utility of inclusion of invertebrates, or similar species lower on the food chain, as an additional endpoint. Emma noted this is a good idea, with Wayne Landis adding that the current endpoints are based on possible management decisions. Jay Davis suggested it is difficult to tie endpoints to decision making due to remaining questions on priority decision in microplastics. Jay also mentioned other species that may be beneficial as endpoints, especially steelhead trout due to their presence in the Bay and nexus with potential tire particle toxicity (as they are closely related to coho salmon).

9. Discussion: Microplastic Workgroup Multi-Year Plan and Future Work (RMP)

Melissa Foley introduced this item with an overview of the RMP, outlining the program objectives and budget allocations related to special studies across workgroups. Diana Lin continued with discussion of current efforts within the MPWG, including stormwater conceptual model development and an EPA-funded project on green stormwater infrastructure monitoring, as well as collaborations with projects led by other interest/science groups and academia such as the ecological health effects workshop with SWB and SCCWRP. She also spotlighted the MPWG's continued focus on informing management actions, particularly through studying transport, and noting the momentum and motivation at the local and state level to find solutions to mitigate microplastic pollution. Diana further mentioned potential near-term priorities (next five years) within the Multi-Year Plan, including tire wear strategy and particle analysis (2022) as well as air (2023), stormwater (2024), and ambient Bay monitoring (2025).

Meeting participants discussed the prospective priorities and objectives of the MPWG, with an overall consensus to continue discourse in the future after a late summer update via email on current status of projects and deliverables. They recognize the importance of having a strategy that can track other efforts and identify data gaps that need to be filled, even if funding for all work is not provided by the RMP. In particular, Dr. Chelsea Rochman expressed approval for the tire strategy and air monitoring, though questioned the exclusion of agricultural runoff (potential relationship to Bay RMP) and earlier monitoring in the ambient Bay waters. Steve Weisberg and Holly Wyer noted interest in air monitoring, with the latter also noting the soon to be released OPC priorities to further inform monitoring and OPC's intention to perform a microplastics inventory. Wayne Landis suggested performing a multi-stressor risk assessment, including chemical contaminants, to build on previous risk assessment efforts motivating sustained monitoring. Barbara Baginska noted a need for continued examination of current findings and available information, as well as further consideration of how to use this knowledge to manage water quality within the RMP and Regional Water Board. Richard Looker questioned if the focus should be on sources rather than on understanding risk and potential for harm in the Bay first.

10. Discussion: Microplastic Proposals for 2022 (RMP)

Kelly Moran briefly outlined each of the proposed studies (RMP Tires Strategy and Tire Particle/Contaminant Fate and Transport), noting the motivation for each along with the associated budgets and deliverables. After explaining each proposal, meeting participants were given a chance to ask questions and discuss topics with proposal authors prior to the closed session.

After reviewing the RMP Tire Strategy proposal, including early release of some funding (\$10,000), meeting participants discussed the proposed budget including funding of workgroup meetings and updates as projects cross multiple workgroups. Dr. Chelsea Rochman asked about the scope of broader outreach efforts related to workgroup meetings to help build the strategy, with Kelly noting a focus on California (Bay Area) related stakeholders to inform management actions. Presentation of the tire particle/contaminant fate and transport proposal

elicited a few comments, with Dr. Rochman remarking about the potential use of passive air samplers and chemical confirmation of rubber particles. Kelly Moran commented that current passive air samplers do not allow for direct collection of the full size range of tire wear material and chemical confirmation is important, though costly and currently outside of the budget.

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

The results of the discussions are shown in the following prioritization table.

Study Name	Budget	Priority	Comments
Tires Strategy	\$25,500	1	Refocus strategy on chemical impact to Bay rather than fate and transport
Tire Particle/ Contaminant Fate and Transport	\$110,000	SEP list	This is important work, but is maybe too early for the RMP without knowing the level of risk for the Bay from tire contaminants and particles. Add to the SEP list. Could reduce the budget by focusing on one type of particle (Tyre Collective or roadway collections) that is most environmentally relevant.

12. 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. Jay Davis highlighted future updates and further discussion through email and a formal meeting (funds permitting) in late summer/early fall.

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).

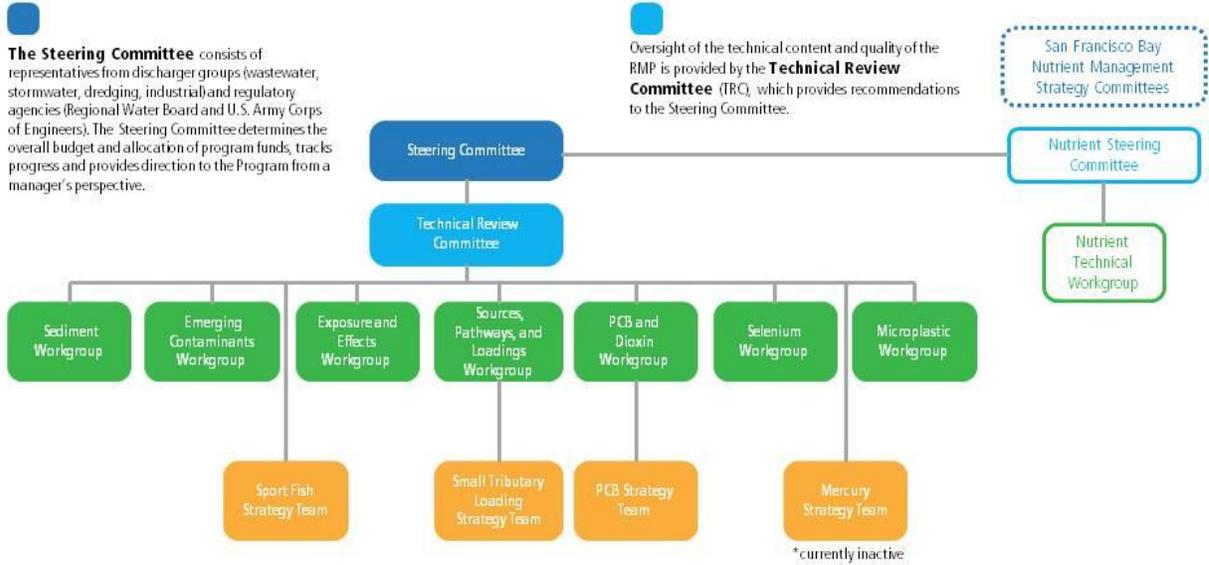
The annual planning cycle begins with a workshop in October in which the Steering Committee articulates general priorities among the information needs on water quality topics of concern. In the second quarter of the following year the workgroups and strategy teams forward recommendations for study plans 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.