CHAPTER 2

1997 Review Implementation

Five-Year Program Review Summary

In early 1997, seven independent scientists and specialists skilled in matters pertaining to monitoring design, data analysis, quality assurance, and science administration and management evaluated the Regional Monitoring Program (RMP). This external program review was part of the initial program design. The purpose of the review was to examine the technical underpinnings, structure, function, and performance of the RMP and its staff, contractors, and administrative structure. The following is the Executive Summary and the Conclusions and Recommendations for Implementation from the panel's Final Report[1].

The Regional Monitoring Program for Trace Substances (RMP) in the San Francisco Estuary has successfully produced high-quality data on chemical contaminants and their toxicity throughout San Francisco Bay. Since its inception in 1993, it has combined shared support, direction, and participation by regulatory agencies and regulated organizations/industries in a model of collective responsibility. As a result, it is developing an expanding database of information that has helped to address important decision-making needs of regulatory agencies and other Program Participants.

This report presents the findings and recommendations of an in-depth review of the RMP carried out during its fifth year of operation. This review was an integral part of the Program's initial five-year plan and was carried out by a panel of nationally recognized experts in a range of fields. Its objectives were to:

- determine the successes and shortcomings of the RMP,
- identify parts of the Program that should be retained or amplified to maintain performance at a high level, and
- suggest changes or additions to meet present and future needs.

The RMP has faithfully addressed its guiding objectives and has achieved notable successes during its first five years of operation. These include:

- Establishing and carrying out a large, complex technical program with few, if any, problems.
- Gathering extremely high-quality data that describe the present state of the Bay.
- Producing data that have been used in a variety of environmental management decisions by regulatory agencies, dischargers, and industry.
- Establishing a climate of cooperation and a commitment to participation among an extremely wide range of regulators, dischargers, industry representatives, and scientists.
- Fostering the involvement of other government and academic scientists with valuable knowledge and expertise.
- Preparing and widely disseminating thorough and accurate yearly reports on the Program's data and accomplishments.
- Implementing a thorough quality control system for laboratory analysis and data management.
- Setting up a World-Wide-Web site to make the Program's data more widely available to potential users.

As a result of these successes, the Review Panel found widespread support for the RMP, many instances of its usefulness, and a firm commitment that it should be continued for at least another five years.

The Review Panel also found, however, that these very successes, along with five years' experience and the benefit of hindsight, have raised serious issues that must be addressed if the RMP is to fulfill its potential. The Review Panel believes

[1] The full final report is available through SFEI.

that complex programs, such as the RMP, must continue to evolve in response to their users' needs if they are to avoid the "monitoring trap" of simply collecting data for its own sake. In the RMP's case, two core themes consistently arose in the evaluations the Review Panel carried out from a variety of perspectives (basic objectives, study design, data analysis, information management, organizational dynamics, and management).

The first theme is the need for more detailed definitions of all aspects of the RMP, in particular

- core program objectives,
- specific management and scientific questions needed to focus study design and data analysis,
- the roles, responsibilities, and authorities of all parties to the RMP,
- decision-making processes, and
- methods of identifying and resolving healthy conflict.

The RMP's original objectives provided effective guidance during the Program's early years. However, at present they are not sufficiently detailed or specific enough to effectively focus the Program's efforts on management's key information needs. As a result, much of the current data analysis, interpretation, and reporting is diffuse and not particularly relevant. Similarly, the Program's commitment to consensus-based management has helped build an important degree of involvement and commitment on the part of all parties to the RMP. On the other hand, it has also resulted in an inability to directly address important issues, such as developing more detailed objectives, where there is disagreement among some of the parties. The Panel recommended that the RMP make it a high priority to address the issues listed above as part of developing a new five-year plan.

The second theme is the need for the RMP to broaden its scientific horizons in order to increase the usefulness of its results in decision-making. The Panel strongly recommended that the RMP undertake modeling and analysis to place the RMP data in the context of other data from San Francisco Bay. In particular, historical data can provide a larger perspective within which to interpret the relatively short time series of data developed to date by the RMP. These other datasets represent a valuable resource that is currently being under-utilized.

In addition, the Panel recommended that the RMP address a wider range of fundamental scientific issues that are key to any attempts to interpret the implications of the RMP's monitoring data. These issues include such questions as the annual input of key pollutants to the Bay, the response of the Bay system to past reductions in pollutant input, and the relationship between observed patterns and trends of key pollutants and various kinds of sources, both human and natural.

The Review Panel believes that such issues are not unique to the RMP, but are challenges that typically face complex environmental monitoring and management programs. The Review Panel further believes that the parties to the RMP have the commitment, understanding, and ability to successfully meet these challenges and to continue to make the RMP a model of cooperative environmental problem solving.

The Review Panel outlined a large number of recommendations to improve both the short- and long-term performance of the RMP. Some of these recommendations require little, if any, additional funding and can be implemented relatively quickly. Others are larger in scope or more fundamental in nature and require more time and effort to implement. These include, for example, special studies to integrate data from other studies into the RMP and to begin developing mass-balance models to provide a context for interpreting RMP results. They also include efforts to clarify the roles and responsibilities of the parties to the RMP and to develop a revised set of program objectives. The Review Panel believes that this last set of recommendations is of the utmost importance and should be given the highest priority.

One of the RMP's major strengths is that the technical and administrative personnel involved in the project believe very strongly in it. For example, SFEI has already begun to implement many of the more straightforward recommendations in the draft report of this review issued on 20 May 1997. Other recommendations, however, are more difficult to implement. They may address

more fundamental and potentially contentious issues (e.g., the development of new study objectives) or ones that require the full involvement of all parties to the RMP (e.g., clearer definition of roles, responsibilities, and authorities). In the final analysis, each recommendation will be evaluated and considered for its overall value to the Program and only those considered necessary to the Program will be implemented as interest, time, and money allow.

This chapter provides some guidance for this evaluation and for planning the implementation of high-priority recommendations. It documents the overall conclusions the Review Panel derived from interviews, analysis, and discussions with technical and administrative personnel associated with the RMP. These in turn led to a preliminary prioritization of the recommendations made in the body of the report and a suggested plan for implementing the most critical ones. The Review Panel understands, nevertheless, that it is the responsibility of the Regional Board, the Steering Committee, and SFEI to evaluate each recommendation and determine whether or not it should or can be implemented.

Overall Conclusions of the Review

- The Regional Monitoring Program for Trace Substances in the San Francisco Estuary is a valuable environmental monitoring program based on a unique partnership between regulatory agencies and dischargers that can serve as a model for others.
- The data from the RMP are of very high-quality and reflect, in many cases, state-of-the-art analysis for environmental parameters that is unequaled in a monitoring program of this size.
- Participants in the RMP believe that the Program is important and valuable to them and will, in the long run, be of benefit to regulators, dischargers, and the population of the Bay Area.
- The RMP has operated on a consensus management model to date. The quality of the program can best be preserved in the future by a more specific description of the roles, responsibilities, and authorities of the parties involved, as well, as of key decision-making processes.
- Participants in the RMP agree that the Program should be continued for at least another five years; a strategic plan is needed to guide the development of the Program through those years.
- The original objectives of the RMP served it well during its early years; however, they are diffuse and non-specific. Study design, field execution, data analysis, and reporting would benefit from development of more specific objectives based upon the needs of the Regional Board and the Participants.
- The overall value of the RMP can be improved by applying a greater degree of interpretation to the data being collected, as well as, a more thorough integration into the RMP of the results from other monitoring and research programs in the Bay Area, both past and present.

Prioritizing Recommendations

The Five-Year Review compiled many recommendations to be considered for implementation. Whereas some of these can be implemented immediately and with little effort, many that focus on the objectives and design of the Program are closely interrelated and should be implemented only following a careful consideration of their relationships.

Recommendations for Immediate Implementation

Table 2.1 summarizes those recommendations that the Review Panel believes can be incorporated rather easily into the RMP's operations.

With two exceptions (recommendations 5a and 5b), implementation for all the recommendations in Table 2.1 fall to SFEI. Recommendation 5a calls for the Regional Board to clarify and define precisely what their responsibilities are in the RMP.

Table 2.1. Recommendations in the Five-Year Review report that can be implemented simply and directly. The recommendations are numbered according to their appearance in each chapter of the report, i.e., number 2e corresponds to recommendation "e" at the end of Chapter 2 of the Final Report. "Responsible Party" is the organization the Review Panel saw as having the best opportunity to implement the recommendation. "Implementation Approach" indicates the steps the Review Panel believes are needed to implement the recommendation. Evaluations of "Financial Impact" are subjective estimates by the Review Panel.

Recommendation	Responsible Party	Implementation Approach	Financial Impact
2e Make RMP information more widely available	SFEI	WWW; publications; presentations	slight
3f Use more sophisticated data presentation	SFEI; Chapter authors	Evaluate presentation methods	slight
4b Document fully the data management system	SFEI; Subs	Descriptive writing	slight
4d Develop computer-assisted quality checks	SFEI	Software development	moderate
4e Conduct recommended lab intercomparisons	SFEI; Subs	Expand intercomparison program	moderate
4g Store data back-ups off site weekly	SFEI	Procure storage site	slight
4h Provide for development of data management staff	SFEI	Courses; workshops	moderate
4j Increase citation of contributions	SFEI	Descriptive writing	slight
4k Analyze citations of RMP data	SFEI	Accounting	slight
4l Analyze WWW site usage statistics	SFEI	Add software to WWW site	slight
4m Develop specific list of PCB congeners	SFEI	Evaluate data	slight
4n Describe laboratory analysis methods in more detail	SFEI; Subs	Descriptive writing	slight
4o Describe accuracy measurements in more detail	SFEI; Subs	Descriptive writing	slight
4p Automatically calculate derived values	SFEI	Software development	slight
4q Add citation information to RMP Annual Report	SFEI	None	slight
4r Word newsletter titles more judiciously	SFEI	None	none
5a Clarify Regional Board responsibilities	Regional Board	Policy statement	none
5b Request from Executive Officer for 5-year plan	Regional Board	Official letter	none
6a Review direct charges internal to SFEI	SFEI	Accounting	slight
6b Define in-kind contributions from staff and contractors	SFEI	Evaluations; interviews; accounting	slight
6c Create technical/logistics manager	SFEI	Talent search	substantial
6d Schedule changes in contractors when possible	SFEI	Planning	slight
6e Implement competitive bidding where possible	SFEI	Planning	slight
6g Prepare Steering Committee agendas early	SFEI	Done	none
7a Accept Five-Year Review report and recommendations	Regional Board; S.C.	Done	none

This item should receive high priority within the Regional Board, since a definition of the Regional Board's responsibilities affects the implementation of other recommendations that directly address the design and execution of the Program.

Recommendation 5b calls for the Executive Officer of the Regional Board to request that parties to the RMP devise a new five-year plan for the Program. This five-year plan would cover the years 1998 through 2002, and would be the primary vehicle for implementing the major recommendations made by the Review Panel (see below).

Most of the recommendations for immediate implementation would have a minor financial impact on the RMP budget. By and large, they represent slight to moderate increases in labor at the technical level. The Review Panel believes that a different division of labor within SFEI would aid implementation and keep financial impact to a minimum. The Review Panel suggests that SFEI emphasize greater use of less highly trained personnel in the more routine data processing, analysis, and report-writing functions, leaving staff at the higher levels to concentrate on more conceptual evaluations.

Perhaps the most expensive of the recommendations in Table 2.1 is the expansion of the laboratory intercomparison program. This would require that SFEI contract with additional laboratories for chemical analysis of split samples taken from the routine sample stream. While additional QA/QC would not necessarily improve the overall quality of RMP data, it would improve its credibility. The relative value of this recommendation should be weighed against other claims on budget resources.

Recommendations for Gradual Implementation

The remaining recommendations fall into two main categories. The first includes specific studies the Review Panel believes are needed to address important scientific and technical issues. These are summarized in Table 2.2 in a sequence that reflects the Review Panel's judgment of their relative importance. It is most essential to integrate data from both current and historical studies into the RMP. This will provide the context needed to assess sources, define impacts, and evaluate design issues, such as the potential value of using TSS to define exceedances[2], defining the seasonality of the data, and estimating the rates of burial of contaminant-laden particles in the Bay ecosystem.

The other category consists of recommendations that go to the very heart of the Program: the design of the sampling, analysis, and interpretive components of the RMP, and the formulation of new objectives for the RMP. *The Review Panel considers these "developmental" activities the most important part of the Five-Year Review report. Failure to address and reach some reasonable resolution about these issues would likely lead the RMP into the "monitoring trap" (Chapter 2, Chapter 3 of the Final Report) of collecting data for the sole purpose of collecting data. To avoid the regression of the RMP, therefore, the Review Panel believes that all parties should give the highest priority to implementing the following recommendations (see also Table 2.3):*

- To undertake to define carefully the roles of the parties;
- To define the real data needs and the uses to which the RMP data will be put;
- To expand the program objectives in detail (the form of the questions asked) and scope (the conditions evaluated by the RMP and its geographic scope); and
- To evaluate the design of the RMP so that it provides the data needed to answer the questions stated in the revised objective statement.

[2] The RMP has begun to develop regressions between total aqueous concentrations of many trace contaminants and total suspended solids (TSS). This should be expanded to test the validity of using only TSS measurements to monitor exceedances of water quality criteria. It seems that this should be possible because invariably those exceedances are due to high concentrations of particle-bound copper, mercury, nickel, or PCB. These data strongly suggest that present exceedances are due in large part to the historical pool of contaminants in Bay sediments. The Review Panel suggests that this implication be considered in any attempt by the RMP to link water quality patterns to current sources of contamination.

Table 2.2. Recommendations in the Five-Year Review report that suggest specific studies or activities to be undertaken by the RMP. Recommendations that overlap with those in other chapters are cross-referenced.

Recommendation	Cross-Listing	Responsible Parties	Implementation Approach	Financial Impact
2a Integrate other data for holistic appraisal	2b, 3d, 4c, 7b, 7c	SFEI; RB; RMP Subs	Develop study plan/work plan by RMP workgroup; new subcontract or increased effort by SFEI.	substantial
2b Assess sources; develop mass-balance inventory	2a, 3c	SFEI; RB	Develop work plan by RMP workgroup; subcontract or increased effort by SFEI.	substantial
2c Define impacts on resources and beneficial uses		SFEI; Steering Committee; RB	Develop work plan by RMP workgroup; increased effort by SFEI, RB, and SC.	substantial
3g Use TSS measurements to define exceedances		SFEI; Subs	Develop study plan/work plan by RMP workgroup; new subcontract or increased effort by SFEI.	substantial
3i Test seasonality of RMP data		SFEI; Subs	Develop study plan/work plan by RMP workgroup; increased effort by SFEI and subcontractors.	substantial
3j Determine rates of particle burial	2b	SFEI; Subs	Develop work plan by RMP workgroup; subcontract or increased effort by SFEI.	substantial

Implementing the recommendations summarized in Tables 2.2 and 2.3 will require considerable effort from all parties to the RMP. They will involve additional committee and workgroup meetings for planning, discussion, and negotiation. Just as important, the studies listed in Table 2.2 will demand additional financial resources to support new subcontracts, or to enable SFEI to hire additional personnel to maintain their day-to-day scientific, administrative, and management activities, as these additional studies are performed by the senior scientific staff. *The Review Panel believes that such additional funding should be made available to initiate implementation of these suggested studies in order of their prioritization (Table 2.2)*.

The Review Panel also perceives different parties to the RMP as having primary responsibility for implementation of these recommendations. However, each will require collaboration among and between the Regional Board, the Steering Committee, and SFEI. Most will require that work plans be formulated, and that workgroups with representatives of the Technical Review Committee be convened to evaluate the topic and recommend actions to the Steering Committee.

Finally, it is important to note that the full suite of recommendations for gradual implementation (Tables 2.2 and 2.3) are interrelated. The Review Panel suggests that the first step in implementing these recommendations should be a critical path analysis that shows which actions must necessarily precede others. This will assist the parties to the RMP in analyzing the overall implications of each recommendation and in placing them in a logical sequence for implementation and for development of the new five-year plan.

Table 2.3. Recommendations in the Five-Year Review report that suggest more fundamental activities to be undertaken by the RMP. Recommendations that overlap with those in other chapters are cross-referenced.

Recommendation	Cross-Listing	Responsible Parties	Implementation Approach	Financial Impact
3b Document aims of RMP	2c, 3a, 4a, 5c	All	Agreement on roles and responsibilities of parties; definition of data needs/usage by parties.	?
3c Expand core objectives/questions	2b, 2c	All	Agreement on scope and direction of RMP; develop five-year plan.	?
3a Evaluate design issues	3g, 3h, 3i, 3j, 3k, 3l	All	Definition of data needs/usage by parties; integration with other studies; statistical analyses.	?

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[3] Brock Bernstein is no longer with EcoAnalysis.

Review Implementation: Progress and Future Steps

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The Five-Year Review of the RMP generated a lengthy list of recommendations for improvement. Many of these recommendations were technical in nature and are being readily implemented by SFEI staff. Two in particular, however, required more direct and sustained involvement from the Steering and Technical Review committees. The Review Panel recommended that the RMP reconsider its objectives and focus its efforts more carefully on management needs. It suggested that the RMP could accomplish this more effectively if it improved its decision-making processes and clarified the roles, authorities, and responsibilities of the various parties. Beginning in the fall of 1997, the main parties involved in the RMP (Regional Board staff, Program Participants on the Steering Committee, Technical Review Committee, and SFEI staff) participated in a number of facilitated meetings to respond to these two recommendations.

The group found that they shared most of the goals articulated by each of the parties involved in the RMP and clarified each party's role in guiding the direction of the Program. This recognition increased the confidence that the group could resolve any disagreements without risking working relationships and/or the operation of the RMP itself.

As the next step, the parties to the RMP jointly developed more formal procedures for identifying and evaluating new study ideas against environmental management needs, technical criteria, and fiscal implications; designing a long-term planning template; and clarifying data interpretation and synthesis approaches. The Regional Board stressed their desire throughout this and later discussions for the RMP to put greater emphasis on interpretation and synthesis and challenged SFEI to make it happen. Discussion of how to best prioritize and select special and pilot studies resulted in a more informed realization of the complexity of the RMP's planning process and the need for a more tangible structure. The resulting *Pilot and Special Study Selection Policy* describes in some detail how the efforts of all the parties to the RMP should be coordinated throughout the lengthy study selection and approval process. The documents describing the pilot and special study selection procedure and the *Data Interpretation Policy* are available at SFEI's website at http://www.sfei.org.

RMP Objectives

The RMP's overall goal is to provide data and interpretation that helps to address certain information needs of the Regional Board. In general, these efforts fall under five major objectives which provide a framework for efforts to respond to more specific management questions.

1. Describe patterns and trends in contaminant concentration and distribution.
2. Describe general sources and loading of contamination to the Estuary.
3. Measure contaminant effect on selected parts of the Estuary ecosystem.
4. Compare monitoring information to relevant water quality objectives and other guidelines.
5. Synthesize and distribute information from a range of sources to present a more complete picture of the sources, distribution, fates, and effects of contaminants in the Estuary ecosystem.

[4] Brock Bernstein is no longer with EcoAnalysis.

To help guide discussions about what should be monitored and where, and what kinds of questions might be addressed by special studies, the Regional Board prepared a written statement with focusing questions (see boxes). It is important to note that these questions need to be asked within the context of the current knowledge upon which the RMP needs to build to refine answers and to increase the confidence in management actions. As a result, the technical and scientific questions that motivate the RMP now focus directly on providing information needed to address specific issues named by the primary information user (the Regional Board). This also gives Program Participants some reassurance that RMP data can now be transformed into information that will have relevance and purpose, and that the data will be used to continually adjust management priorities at the Regional Board.

The resulting document, and the understanding among the parties it reflects, fulfill the charge from the Review Panel to focus more carefully on management needs. It was achieved only because of the parties' good-faith efforts to improve their communication, clarify their roles, and respect their differences.

Regional Board's Information Needs

This is the set of questions that are asked on a continuing basis at the Regional Board. As a representation of the Regional Board's information needs and its overall perspective, it does include items that are not the purview of the RMP (e.g., to determine pollutants of concern or define what is and is not controllable). RMP activities should be designed to fulfill one or more of these information needs.

Focusing Questions

1. What are the pollutants and pollutant groups of concern?
   - 1a. of the national priority pollutants, which ones are found in the Estuary system and of those, which ones are at levels that may be causing effects?
   - 1b. of pollutants identified through local (as opposed to national) monitoring, which ones have been identified through TIE analyses or are found at levels above those known to cause effects in estuarine ecosystems?
2. What are the overall loadings and mass-balance budgets for pollutants of concern?
   - 2a. what is the implication of historic discharges for mass budgets and fluxes?
   - 2b. what is the relative contribution of point source outfalls, storm drains, large and small tributaries, harbor activities (including dredging), atmospheric deposition, historic deposits, and natural sources?
3. Of the pollutants of concern with ongoing inputs,
   - 3a. what are the sources to the point of discharge?
   - 3b. are these sources controllable? and if so, under what existing regulatory framework and at what level of government?
4. What is the general pattern of levels, fate, and transport of pollutants of concern within embayments?
   - 4a. do the general patterns suggest different levels of risk/concern within embayments (i.e., are mid-Estuary conditions generally good but shallow areas closer to shore more problematic?)
   - 4b. how are these patterns changing in response to natural processes and progressive management actions?
5. Of the pollutants of concern for which ongoing, controllable inputs still exist, which of the controllable source reductions provide the greatest benefit in terms of preventing further degradation and restoring ecosystem function and human health?
6. How effective are management actions?
   - 6a. how have past management actions affected the overall patterns of levels, fate, and transport of pollutants of concern?
   - 6b. are current management actions achieving effective control of ongoing, controllable sources?

Specific Management Questions

Current issues of concern for the RMP are grouped below in relation to each proposed RMP objective.

1. Compare monitoring data
   - 1a. Which contaminants should be monitored?
   - 1b. How do RMP data compare with relevant water, sediment, and tissue quality guidelines?
   - 1c. How do the various Estuary reaches compare to each other, in time and space, relative to water, sediment and tissue guidelines?
2. Describe patterns and trends
   - 2a. How do contaminant levels change over the long-term?
   - 2b. Can those changes be linked to changes in inputs to the Estuary?
   - 2c. What is the relationship between pollutant trends and patterns seen in the "spine" of the Estuary and those in the shallower margins?
   - 2d. How are spatial patterns and long-term trends in contaminants affected by estuarine processes?
3. Describe general sources and loadings
   - 3a. What proportion of the contaminants in each Estuary reach are contributed by point source outfalls, storm drains, large and small tributaries, harbor activities including dredging, atmospheric deposition, and historic deposits?
   - 3b. How do contaminants move and transform after they enter the Estuary?
   - 3c. At what spatial and temporal resolution should loadings to the Estuary and changes in upstream contaminant inputs due to pollution prevention efforts be monitored?
   - 3d. What are the background concentrations of contaminants in the Estuary from natural sources?
4. Measure contaminant effects
   - 4a. Which contaminants bioaccumulate in estuarine organisms to levels of concern?
   - 4b. What is the spatial and temporal extent of toxicity in the Estuary?
   - 4c. Which contaminants cause effects in the Estuary?
5. Synthesize information
   - 5a. Provide periodic interpretation and synthesis on selected contaminant-related topics.
   - 5b. Describe and distribute key RMP findings to a variety of audiences.
   - 5c. Assess the use of RMP data and information in decision-making.

These facilitated sessions represented the important first steps of the complex task of re-designing the RMP to meet the revised objectives and the first "edition" of management questions. The involved parties recognized that the objectives and management questions will have to be adjusted periodically as the information base grows.

Beginning in spring of 1998, SFEI initiated a detailed assessment of how the RMP's design should and could be modified to better address the management questions. Workgroups including experts from outside the region have been assisting the parties involved in the RMP to summarize the current understanding about chlorinated hydrocarbons, metals, pesticides, sediment as a pollutant reservoir, and characterization of sources and loadings to the Estuary. These deliberations will result in recommendations for collecting needed information and revising the RMP Base Program. The workgroup addressing chlorinated hydrocarbons completed their deliberations in late 1998, while the other workgroups will submit their recommendations in early 1999. These individual recommendations will then be integrated, evaluated from a statistical design perspective, incorporated into the Five-Year Plan, and phased in as financial resources allow. While the re-design is proceeding, the RMP is not remaining entirely static.