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May 28, 2010

Jeanine Townsend
Clerk to the Board
State Water Resources Control Board
California Environmental Protection Agency
1001 I Street, 24th Floor
Sacramento, CA 95814

Subject: Santa Ana Water Board Organochlorine Compounds Total Maximum Daily Load

Dear Ms. Townsend:

The County of Orange, OC Public Works Department (OC Public Works), has reviewed the proposed amendment to the Water Quality Control Plan for the Santa Ana River Basin, adopted on September 7, 2007 by the Regional Water Quality Control Board – Santa Ana Region (Regional Board), to incorporate organochlorine compounds Total Maximum Daily Load (TMDLs) allocations for San Diego Creek, and Upper and Lower Newport Bay.

Protection and restoration of Newport Bay and all of our coastal resources is an important objective which we share with the State Water Resources Control Board (State Water Board). Our coastal resources are precious to the residents of Orange County, and efforts to protect and enhance them are appropriate and appreciated.

This letter makes two major recommendations with respect to the proposed adoption of these TMDLs. The balance of the letter provides supporting information for the recommendations.

1. The attached report, *Final Report of the April 7-8, 2009 Meeting of the Independent Advisory Panel for the Assessment of Organochlorine Compounds for the Newport Bay,* (NWRI 2009[1]) (IAP Report) should be included in the administrative record for these TMDLs. This report, as discussed later, raises significant issues regarding the validity of the numeric targets in the TMDLs.
2. The final compliance deadline for the TMDLs should be extended from December 31, 2015 until December 31, 2019. This extension will:
   a. Provide the time necessary to complete the Implementation Plan. Due to the multi-year delay (currently over 2 1/2 years) between Regional Board adoption of the TMDLs and final approval by the State Water Board, Office of Administrative Law (OAL), and US

[1] NWRI. 2009. Final report of the April 7-8, 2009 meeting of the independent advisory panel for the assessment of TMDL targets for organochlorine compounds for the Newport Bay. National Water Research Institute, Fountain Valley, CA. 29 pp.

EPA, the current timeframes in the Implementation Plan will extend beyond the final compliance date.

b. Allow for the coordination of Implementation Plan efforts with the anticipated Phase II Sediment Quality Objectives (SQO) Policy.
c. Provide the necessary multi-year timeframe for the tissue, sediment and water quality data collection effort to support development of new TMDL numeric targets as called for in the IAP Report.

We believe that under California Water Code section 13170 The State Water Resources Control Board may amend or supplement the Water Quality Control Plan adopted by the Regional Board, including provisions in a TMDL that is part of that plan. To the extent that any such amendment to the TMDL creates a conflict between the Regional Board adopted TMDL and the State Board amended TMDL, the State Board TMDL supersedes and controls. We recommend that the State Board exercise its authority under section 13170 and amend the final compliance deadline in this TMDL.

Background

In, 2002, USEPA promulgated technical TMDLs for organochlorines compounds for the San Diego Creek/Newport Bay watershed. The technical TMDLs did not include an implementation plan or compliance schedule and acknowledged the fact that the TMDLs were based on limited data.

Regional Board staff subsequently revised USEPA's impairment assessment and TMDLs and developed an implementation plan. The draft Regional Board staff report, entitled *Total Maximum Daily Loads for Organochlorine Compounds in San Diego Creek and Upper and Lower Newport Bay*, was issued on November 17, 2006 (Rose 2006[2]) and a supplemental staff report was prepared for the adoption hearing in September 7, 2007. Since the initial staff report, OC Public Works and other watershed stakeholders have had significant technical concerns about the TMDL numeric targets and the underlying science which resulted in them. Among many issues, we were concerned that an apparent declining trend in organochlorine concentrations in the Newport Bay watershed was not given sufficient consideration by Regional Board staff, that the databases used to develop some of the targets contained erroneous or misleading data, and that some of the TMDL numeric targets were outdated and not based on the best available science. In addition, some numeric targets were below current analytical detection limits, which would not allow stakeholders to show compliance until such time as analytical methods improve to detect such low concentrations. These concerns, among others, were detailed in two comment letters to the Regional Board dated January 12, 2007 and August 23, 2007 which are part of the administrative record that has been submitted to State Board as part of the TMDL Basin Plan Amendment (BPA) package. Stakeholders proposed alternate numeric targets based on methodologies that were thought to be the state of the science. Throughout the TMDL development process, stakeholders and the Regional Board collaborated diligently to resolve these technical issues.

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[2] Rose, K.L. 2006. Total maximum daily loads for organochlorine compounds. San Diego Creek: total DDT and toxaphene. Upper and Lower Newport Bay: total DDT, chlordane, total PCBs. Orange County, California. Santa Ana Regional Quality Control Board Staff Report, Riverside, CA. 135 pp.

In recognition of the uncertainty surrounding certain aspects of the TMDLs, the Regional Board revised the Implementation Plan for the TMDLs to allow the collaborative process to continue. On September 7, 2007 the Regional Board approved the TMDLs with the revised implementation plan. Among other requirements, the Implementation Plan allows for the formation of a Working Group and development of a comprehensive Work Plan to meet the TMDL requirements, consistent with an adaptive management approach (Working Group Option). The Working Group Option anticipated convening an Independent Advisory Panel (IAP) to evaluate the TMDL numeric targets, and a subsequent effort, based upon the IAP results, to re-evaluate TMDL numeric targets and loads. Although these tasks were required to be performed after the OAL approval of the BPA for the TMDLs, in 2007 stakeholders and Regional Board staff proactively formed the Toxicity Reduction and Investigation Program Working Group. In April 2009, the Working Group convened the IAP and initiated development of a Work Plan to address these special studies requirements. The IAP issued its final report on August 4, 2009.

Separately, the State Water Board has adopted Phase I Sediment Quality Objectives (SQOs) and is in the process of developing Phase II SQOs. These SQOs regulate sediment concentrations of a range of pollutants, including organochlorine compounds that are the subject of these TMDLs. It is the intent of the stakeholders and the Regional Board that the Work Plan developed pursuant to the organochlorine compounds TMDLs also fulfills the requirements of the SQO policies.

The IAP process and the SQO polices are discussed in turn below.

Independent Advisory Panel and Conclusions

The IAP was composed of independent, well-respected scientific experts who could authoritatively review the TMDLs and all relevant technical materials and was managed by a neutral third party, the National Water Research Institute (NWRI). Regional Board staff with other Working Group stakeholders, participated in the selection of members for the IAP. These experts included independent consultants Drs. Brock Bernstein, Charles Menzie, and Lynn McCarty, Dr. Michael Fry of the American Bird Conservancy, Dr. James Meador of the National Marine Fisheries Service, and Dr. Daniel Schlenk of the University of California at Riverside. The IAP convened for a two day workshop on April 7-8, 2009, where members viewed presentations from stakeholders and Regional Board staff, and had an opportunity to question presenters. The IAP was charged with answering five questions regarding the TMDLs, which appear below, followed by a summary of the IAP's conclusions.

1. Are the methods and underlying data used to develop the targets for the organochlorine TMDLs in the Newport Bay Watershed, as well as the targets proposed by stakeholders, based on the best available science?

2. Are the numeric targets in the organochlorine TMDLs, as well as the targets proposed by stakeholders, protective of beneficial uses?

3. Are there alternate targets, or methods to develop targets that have not yet been considered, that are both scientifically defensible and protective of beneficial uses?

4. Is the analysis indicating a declining trend in organochlorines concentrations robust? If the analysis is robust and there is strong evidence of a declining trend, should this trend be reflected in defining targets and, if so, how?

5. What are the recommended next steps to resolve any deficiencies, conflicts, or data gaps from questions 1 through 4?

IAP Response to Question 1

The IAP found that neither the TMDL numeric targets nor those proposed by stakeholders were based on the best available science. The TMDL numeric targets were derived from a variety of sources, including sediment Threshold Effect Levels (TELs) for the protection of benthic communities and the aquatic food webs they support, screening values for fish tissue from the California Environmental Protection Agency Office of Environmental Health Hazard Assessment (OEHHA) for the protection of human health, and guidelines from a 1972 publication[3] of the National Academy of Sciences (NAS) for the protection of wildlife. The sediment TELs and OEHHA fish tissue screening values were also used by USEPA as numeric targets for their organochlorine compounds TMDLs.

TELs and other similar values are based on a statistical association between chemical concentrations found in sediments and degraded benthic communities, based on numerous independent peer-reviewed studies. Chemical concentrations below the TEL are not expected to be associated with adverse effects. However, there is no cause and effect relationship between TELs and degraded benthic communities. Further, the databases in which the results of these studies were compiled have not been subject to careful peer review. Stakeholders identified several inconsistencies and flaws in these databases. The IAP's review of these databases resulted in the following conclusion:

"Though individual studies from which the TEL database extracted data have been peer reviewed, the data screening and aggregation process and related quality assurance procedures on which the database itself was built have not been thoroughly reviewed and vetted. The Panel believes that this lack of transparency and documented quality control seriously undermines confidence in the applicability of the derived TELs even for purposes related to direct sediment toxicity."

While use of OEHHA screening values as regulatory targets for the protection of human health does occur (for example the state's Functional Equivalent Document (SWRCB, 2004) prepared to support the development of the 303(d) listing policy), the IAP concurred with stakeholders that such use was not scientifically supported and inappropriate as these screening values were not developed for this purpose. In 2008 OEHHA developed new screening level values:

- Advisory Tissue Levels (ATLs): ATLs are based on the relatively high 10^{-4} cancer risk level to allow for the health benefits of consuming fish and were developed by OEHHA for its own purposes and not for use as broader regulatory guidelines.

[3] NAS. 1972. Water quality criteria 1972. A report of the Committee on Water Quality Criteria. EPA Report EPA-R3-73-033. Environmental Studies Board, National Academy of Sciences, National Academy of Engineering. Washington, DC. 594 pp.

- Fish Consumption Guidelines (FCGs): In recognition that agencies such as USEPA and Regional Boards typically set TMDL targets and other criteria on the basis of risk alone, and do not balance benefits as OEHHA attempts to do, OEHHA developed the FCGs, which are based strictly on risk and use a more conservative cancer risk factor of 10^{-6}.

The IAP recommended that the Regional Board review OEHHA's fish tissue targets related to human health and decide which approach (ATLs or FCGs) is most appropriate for use in the organochlorine compounds TMDLs. State Board staff are now recommending the use of FCGs instead of OEHHA's 1999 screening values in assessing impairment due to contaminants in fish tissue.

Guidelines from a 1972 NAS publication (NAS 1972) were used as TMDL targets for the protection of terrestrial wildlife, especially birds. The IAP found that these guidelines, which are nearly four decades old did not represent the current best available science and that the use of standard numbers, such as the NAS guidelines, does not allow for the use of local information that reflects site-specific processes that may affect bioaccumulation processes and contaminant effects. The IAP recognized that a TMDL target developed to protect wildlife should fully consider Newport Bay's threatened and endangered species. As there are no scientifically supported targets that are directly applicable to all wildlife species of concern in Newport Bay, the IAP recommended that Regional Board staff build on the efforts currently underway by the Biological Technical Assistance Group (BTAG). This workgroup was initiated by USEPA Region IX and is staffed by scientific representatives of state and federal agencies with the goal of establishing a formal process for developing and refining toxicity reference values (TRVs) based on the best available current science. This would require a thorough review of toxicological and contaminant data on the bird species and food webs found in Newport Bay.

The TMDL toxaphene numeric target for sediment is set below the current analytical detection limit. While the IAP concluded, and stakeholders concur, that toxaphene is a toxic chemical of concern, the IAP does not believe that the state of the science allows development of a reliable TMDL sediment target for toxaphene. Technical toxaphene is a complex mixture of over 600 different chemicals with different chemical properties. Once released in the environment, these chemicals also weather at different rates into even more complex mixtures of chemical degradates, that have different partitioning coefficients, bioavailabilities, toxicities, and environmental fates. The IAP concluded that instead of developing specific guidance or numeric targets for toxaphene in sediment, the sediment control measures proposed in the TMDLs to address DDT issues would also be effective for toxaphene and that the continuation of a modest sediment and fish tissue monitoring effort to track toxaphene trends should be sufficient.

The IAP concluded that sediment, water, and tissue targets should be derived as part of an integrated modeling approach that incorporates specific endpoints and information about the entire foodweb. This approach should consider a "wide range of endpoints, surrogate species, toxicity reference values, and past studies". The IAPs findings and recommendations were based on their determination that the challenge of setting management thresholds for bioaccumulative compounds such as organochlorines should be approached through a structured risk assessment process.

IAP Response to Question 2

Since the TMDL numeric targets were not based on a scientifically rigorous risk assessment methodology, the IAP concluded that they could not determine whether the proposed targets were appropriately protective of beneficial uses or would meet the management goals of the TMDLs. For the protection of wildlife, the IAP recommended that Regional Board staff select or calculate protective prey tissue levels (targets) for three species of birds: the light-footed clapper rail, California least tern, and osprey. Each of these species feeds on different components of the foodwebs within the Newport Bay ecosystem. The IAP recognized that obtaining direct data on conditions (e.g., contaminant levels in tissues, sublethal reproductive effects) in threatened and endangered species is subject to severe constraints and proposed the use of surrogate species, as long as surrogates were ecologically similar to the recommended species listed above.

The IAP also recommended consideration of the following:

- Appropriate endpoints, by which the IAP means any measurable effect of exposure to toxic chemicals, including mortality, reproductive effects, endocrine disruption, and reduced growth rates. Endpoints should be relevant to sustainability of any species to be protected in the watershed. Further, all studies or values should be based on sound science that was peer-reviewed or was fully documented so that methods, data and conclusions can be reviewed.
- When developing appropriate number targets Regional Board staff should carefully consider the use of No-Observed-Effect Levels (NOELs) verses Lowest-Observed-Effect Levels (LOELs) because the low statistical power associated with most toxicity tests means that many NOELs are statistical artifacts. The IAP recommended that Regional Board staff should only use NOELs in conjunction with LOELs or, alternatively, LOELs could be used with appropriate safety factors, which would result in an approach with fewer statistical shortcomings (use of LOELs for federally listed bird species would have to be approved by USFWS).
- Appropriate safety factors should be "explicitly considered for different wildlife species and life stages" and that safety factors could be used in policy decisions related to the level of uncertainty in the analysis, the extent to which that uncertainty may compromise the degree of protection, and the potential for interactions among mixtures of toxicants.

IAP Response to Question 3

The IAP concluded that viable alternative targets are available, including published values from Environment Canada and the US Fish and Wildlife Service. Methodologies for risk assessment that could be applied to the Newport Bay watershed include risk based approaches recommended by USEPA. Future studies planned for the Newport Bay Toxicity Reduction and Investigation Program should provide data needed to help effectively apply such site-specific risk-based approaches to the watershed.

The IAP recommended that the TMDL numeric targets be based on a site-specific, risk-based approach that explicitly considers local species and their food webs, uncertainties or data gaps.

Full consideration should be given to all toxicant uptake pathways and their final distribution to wildlife species of concern. This approach will involve four steps.

1. Identify a Toxicity Reference Value (TRV) for local species for relevant compounds, based on concentrations considered to be protective. These can be found in the scientific literature or can be calculated from local and published data.

2. Back calculate from the TRV to an appropriate tissue target in prey items for protected birds in the watershed using "biomagnifications factors, assimilation efficiencies, rates on ingestion, and body weight".

3. Estimate bioaccumulation factors from toxicant concentrations in prey items and in sediment and water.

4. Use bioaccumulation factors to back calculate sediment and water targets from fish tissue targets.

A final step should consider an appropriate safety factor to account for risk, uncertainties, and known data gaps. The IAP report noted that "thorough site-specific conceptual models can help address impairment that might be overlooked due to unique modes of action (e.g. endocrine disruption)". A flow chart graphically showing this integrated approach was included in the IAP report.

IAP Response to Question 4

With regards to the apparent declining trend in organochlorine compound concentrations, the IAP found that the declining trend in organochlorine concentrations in red shiner tissue was statistically robust from 1980-1996, but concentrations after 1996 showed no apparent trend. Organochlorine concentrations in mussels and striped mullet also showed a declining trend until 1990, which support the conclusion that organochlorine concentrations in the watershed declined at least until the early 1990s.

There are no recent trend data on DDT concentrations in resident fishes of Newport Bay, but tissue concentrations in 2002 and 2005-06 were not significantly different from the post-1996 data. The IAP did not believe that past trends could be extrapolated to the future to assert that concentrations would continue to decline to non-detectable levels. There are numerous uncertainties with respect to continued inputs of organochlorines from the watershed that would confound trend analysis without more recent data.

If future trends are to be considered in TMDL targets, the IAP recommended that Regional Board staff examine trend data relative to rainfall or sediment loading data that may provide context for observed trends. A study conducted by the County of Orange on legacy organochlorine concentrations and loads in Newport Bay watershed stormwater from 2006-

2008 (Goong 2008[4]) may also provide useful insights to help explain concentrations in fish tissues over time.

The IAP also recommended development of mass-balance models for organochlorine contaminants to help evaluate the potential for pollutant cycling in the watershed. This could also help illuminate currently unidentified sources, which may become more important as concentrations decline.

The IAP recommended that trend monitoring should incorporate representative resident fish species, including prey species for birds. This information can be used to help understand how changes in organochlorine loads and pollutant cycling in the system are reflected in fish tissues.

IAP Response to Question 5

In summary, the IAP found that the TMDL targets were not based on the current best available science, but could not determine whether the targets were over- or under-protective. The IAP concluded that other viable targets (e.g. Environment Canada guidelines) and methodologies were available to help determine appropriate targets for the watershed, but that extrapolation of declining trend data for organochlorine compounds into the future is unreliable.

The IAP recommended development of a site-specific risk assessment model that explicitly considers uncertainty and which links sediment and water exposures to fish or invertebrate tissue concentrations, which in turn can be linked to exposures in predatory wildlife in the watershed. These linkages should be made with peer-reviewed bioaccumulation models.

The IAP recommended specific data gathering efforts to help develop these models, including additional monitoring efforts in the watershed to help improve food web models and the understanding of factors influencing trends in contaminant concentrations.

Sediment Quality Objectives

Since the adoption of the organochlorine compounds TMDLs by the Regional Board in September 2007, the State Water Board has adopted Phase I Sediment Quality Objectives (SQOs), which use three lines of evidence (sediment chemistry, toxicity, and benthic community composition) to assess direct effects of pollutants to benthic organisms. If Phase I SQOs are exceeded, the SQO Policy requires that a stressor identification process be performed to determine which pollutant(s) are responsible for the SQO exceedance. This requirement overlaps with the TMDLs' requirement that a special study be conducted to determine the cause of toxicity in the sediments of Newport Bay.

In addition, the State Water Board is in the process of developing Phase II SQOs, which will examine the potential for organochlorine compounds in sediments to bioaccumulate into seafood and to subsequently affect human health via indirect effects. Although the determination of ecological risk is not part of Phase II SQO development, it was previously

[4] Goong, S.A. 2008. Legacy organochlorine pesticides in the Newport Bay watershed, Orange County, California. Technical Report. County of Orange, OC Watersheds Section, Orange, CA.

under consideration by the Science Team working on the SQO; in fact, the IAP pointed to an approach developed by the San Francisco Estuary Institute (Greenfield *et al.* 2007[5]) as part of the Phase II SQO development process as one method that could be used to re-assess TMDL targets for the Newport Bay watershed. Although this work product was not carried forward as part of the Phase II SQO development process, it is anticipated that the human health risk evaluations and other components of the Phase II SQO will dovetail with the requirements of the organochlorine compounds TMDLs. The Phase II SQOs are currently required by a Court Order to be adopted in December of this year.

Because the SQO policy regulates the same pollutants as the organochlorine compounds TMDLs, and because many of the issues raised in the context of the organochlorine compounds TMDLs are consistent with those governed by the SQO, the Toxicity Reduction and Investigation Program Working Group Work Plan, currently in development, will need to consider the issues raised by the IAP's review of the TMDLs and the SQO Policy.

Conclusion

The combination of the delay between Regional Board adoption and final approval of the organochlorine compounds TMDLs, and the confirmation by the IAP that TMDL targets need to be revised, necessitate a revision of the final TMDL compliance deadline. Stakeholders have acted proactively to "front-load" TMDL implementation activities prior to adoption of the TMDLs by the State Water Board and OAL to help resolve significant technical uncertainties in these TMDLs. The IAP has recommended a path forward to develop sound TMDL numeric targets based on the current best available science. A revised compliance deadline will also allow the Working Group's Work Plan to incorporate the recently adopted Phase I SQO and forthcoming Phase II SQO policy requirements.

The County of Orange looks forward to working together with the Regional Board and other watershed stakeholders in implementing appropriate Organochlorine Compounds TMDLs in the Newport Bay watershed. If you have any further questions regarding these comments, please contact Amanda Carr at (714) 955-0650.

Very truly yours,

Chris Crompton, Manager
Environmental Resources

Attachments: IAP 2009 Final Report

[5] Greenfield, B.K., A.R. Melwani, J.J. Oram, and S.M. Bay. 2007. Indicator development and framework for assessing indirect effects of sediment contaminants. Contribution #524. San Francisco Estuary Institute, Oakland, CA.

NATIONAL WATER RESEARCH INSTITUTE

Final Report

of the April 7-8, 2009, Meeting of the

Independent Advisory Panel

for the

Assessment of TMDL Targets for Organochlorine Compounds for the Newport Bay

August 4, 2009
Fountain Valley, California

Disclaimer

This report was prepared by an NWRI Independent Advisory Panel, which is administered by the National Water Research Institute (NWRI). Any opinions, findings, conclusions, or recommendations expressed in this report were prepared by the Panel. This report was published for informational purposes.

Assessment of TMDL Targets for
Organochlorine Compounds for the Newport Bay

Purpose and History of the Panel

In 2009, the County of Orange (County) requested that the National Water Research Institute (NWRI) of Fountain Valley, California, form an Independent Advisory Panel (Panel) to review the methods and underlying data used to develop total maximum daily loads (TMDLs) for organochlorine compounds for the Newport Bay Watershed, located in central Orange County, California. TMDLs are the maximum amount of a pollutant that a water body can receive and still attain water quality standards.

The Newport Bay Watershed constitutes 154 square miles (98,500 acres) in central Orange County, California. The major features of the watershed include Newport Bay (Upper and Lower), San Diego Creek, Santa Ana Delhi Channel, and other small tributary drainages. Lower Newport Bay is considered to be that portion of the Bay south of the Pacific Coast Highway Bridge (Highway 1). The Lower Bay harbor is important for recreational use and supports nearly 10,000 pleasure boats, as well as many residential and commercial facilities. Upper Newport Bay (north of the Pacific Coast Highway Bridge) includes a 752-acre estuary and ecological reserve and is home to 78 species of fish and six imperiled species of birds, such as the light-footed clapper rail. The threatened and endangered bird species are a primary concern. Organochlorine pollutants are toxicants that can bioaccumulate in plants and the fatty tissues of fish, birds, and mammals, and biomagnify in the food chain. Examples of organochlorines include chlordane, dichlorodiphenyltrichloroethane (DDT), dieldrin, toxaphene, and polychlorinated biphenyls (PCBs).

The charge to the Panel was to consider the following:

1. Are the methods and underlying data used to develop the targets for the organochlorine TMDLs in the Newport Bay Watershed, as well as the targets proposed by the stakeholders, based on the best available science?

2. Are the numeric targets in the organochlorine TMDLs, as well as the targets proposed by the stakeholders, protective of beneficial uses?

3. Are there alternative targets, or methods to develop targets that have not yet been considered, that are both scientifically defensible and protective of beneficial uses?

4. Is the analysis indicating a declining trend in organochlorines concentrations robust? If the analysis is robust and there is strong evidence of a declining trend, should this trend be reflected in defining targets and, if so, how?

5. What are the recommended next steps to resolve any deficiencies, conflicts, or data gaps from questions 1 through 4?

The Panel members include:

- *Panel Chair:* Brock B. Bernstein, Ph.D., Independent Consultant (Ojai, CA)
- Michael Fry, Ph.D., American Bird Conservancy (Washington, D.C.)

- Lynn S. McCarty, Ph.D., L.S. McCarty Scientific Research & Consulting (Ontario, Canada)
- James Meador, Ph.D., NOAA National Marine Fisheries Service (Seattle, WA)
- Charles A. Menzie, Ph.D., Exponent (Alexandria, VA)
- Daniel Schlenk, Ph.D., University of California, Riverside (Riverside, CA)

A short biography on each Panel member is included in Appendix A.

Introduction

A 2-day meeting of the Panel for the Assessment of TMDL Targets for Organochlorine Compounds in Newport Bay was held April 7-8, 2009, at the Holiday Inn Costa Mesa in Costa Mesa, California.

Representatives from the County, Santa Ana Regional Water Quality Control Board, and stakeholders Dr. Jim Byard and Dr. Susan Paulsen gave presentations during this meeting on the following topics:

- Panel charge.
- Overview of the Newport Bay Watershed.
- Organochlorine compounds TMDLs for the Newport Bay Watershed.
- A critical review of the TMDL targets and impacts of organochlorines in the Newport Bay Watershed.
- Risk assessment case study of DDT in Newport Bay.
- Existing DDT levels in forage fish in Upper Newport Bay.
- Sediment chemistry and toxicity – Sediment quality objectives.

A tour of the watershed, specifically of Newport Bay, was also included as part of the Panel meeting.

The meeting agenda is included in Appendix B. A complete list of Panel meeting attendees is included in Appendix C.

Findings and Recommendations

The findings and recommendations that resulted from the April 2009 Panel meeting are presented below. However, before addressing the individual questions in its charge, the Panel has highlighted a number of more general issues.

1. General Comments

The Panel was impressed by the willingness of all parties to engage in the rigorous and open-ended discussion held at the April meeting. The presentations were thorough, each presenter offered their comments in a clear and concise manner, and all responded directly to the Panel's numerous comments and questions. In combination with the multiyear workplan the parties are developing, the Panel believes this overall effort is an excellent model of how such complex issues should be approached in a regulatory setting.

The Panel also appreciated clarification on the details of its charge since this helped provide the basis for more direct answers to the key concerns that prompted the Panel's involvement.

Based on material presented at the meeting and in follow-up discussions with participants, the Panel understands the Regional Water Quality Control Board's (Regional Board) first priority to be the protection of beneficial uses related to wildlife, particularly the threatened and endangered bird species in the watershed, with a second priority being the protection of human health related to consumption of sportfish caught in Newport Bay. The Regional Board's primary management tool for addressing organochlorine contamination is the TMDL process, with its focus on reducing organochlorine loads to the Newport Bay from the watershed. The Panel thus understands that the Regional Board is focusing primarily on sportfish that acquire the bulk of their organochlorine tissue contamination from in-Bay sources, because the TMDL would not address sources of contamination outside Newport Bay and its watershed. Finally, the Panel understands that the Regional Board recognizes that toxicity to benthic invertebrates, stemming from direct exposure to contaminated sediments (in laboratory tests), is unlikely to be related to the organochlorines for which TMDLs have been developed. The focus of the organochlorine TMDLs is, therefore, the bioaccumulation of these chemicals from water and/or sediment, with subsequent transfer through the foodchain to humans (via consumption of sportfish) and wildlife species (through consumption of fish and invertebrates).

While the Panel recommends additional data gathering, data analysis, and modeling, it also understands that there are limitations on the applicability of historical data, as well as constraints on the ability to gather additional data that would be ideally suited to the questions it poses. For example, obtaining direct data on conditions (e.g., contaminant levels in tissues, sublethal reproductive effects) in threatened and endangered species is subject to severe constraints. In addition, the Panel recognizes that descriptions of many processes in a complex and highly variable system, such as Newport Bay, will always be somewhat uncertain.

The Panel's findings and, particularly, recommendations are based on a core judgment that the challenge of setting management thresholds for bioaccumulative compounds such as organochlorines should be approached through a structured risk assessment process (see Recommendations for Questions 2 and 3). Thus, the Panel strongly supports the Regional Board's phased approach to the organochlorine TMDLs, the extended implementation schedule that allows for additional studies to be performed, and the Regional Board's stated willingness to modify the TMDLs as new information becomes available.

2. Question 1

Are the methods and underlying data used to develop the targets for the organochlorine TMDLs in the Newport Bay Watershed, as well as the targets proposed by the stakeholders, based on the best available science?

Findings

The Panel finds that neither the targets used in the TMDLs nor the targets proposed by the stakeholders are based on the best available science. Each target is discussed in turn.

The Regional Board's sediment target is based on Threshold Effects Levels (TELs) for DDT and Effects Range Median (ERM) levels for chlordane. The Panel noted two limitations regarding the use of these values. The first is that TELs and ERMs do not relate to the impairments for which the TMDLs are being derived; instead, they are screening values for direct toxicant effects on exposed benthic invertebrates. The Panel notes that TELs and ERMs are used in the

organochlorine TMDLs as a practical estimate of contaminant levels that might lead to the bioaccumulation of sediment-borne contaminants in higher trophic levels. However, no functional relationship exists between contaminant levels associated with toxicity to benthic organisms due to direct exposure to contaminated sediments and those associated with bioaccumulation. Guidance, such as that developed at the 2002 Pellston workshop on sediment quality guidelines (Moore et al., 2005), specifically refers to the inappropriateness of using such sediment quality guidelines for interpreting the risk of bioaccumulated toxicants. Secondly, the Panel concludes that the derivation of these screening values is subject to considerable scientific uncertainty. Both TELs and ERMs are derived from statistical estimates of the level of contaminants in sediment at which effects to sediment organisms are observed in toxicity tests, using data aggregated from numerous separate studies. Dr. Byard pointed out at the April 2009 Panel meeting that the TEL database has numerous undocumented inconsistencies and apparent flaws. Though individual studies from which the TEL database extracted data have been peer reviewed, the data screening and aggregation process and related quality assurance procedures on which the database itself was built have not been thoroughly reviewed and vetted. The Panel believes that this lack of transparency and documented quality control seriously undermines confidence in the applicability of the derived TELs even for purposes related to direct sediment toxicity.

The Regional Board's use of Screening Values from CalEPA's Office of Environmental Health and Hazard Assessment (OEHHA) to set fish tissue targets for human consumption is an inappropriate use of these values. OEHHA makes it clear in its publications that Screening Values were developed for OEHHA's internal use as a practical threshold for identifying situations that deserve additional attention and where detailed risk assessment might be called for. Only in cases where such risk assessment suggests a human health risk would consumption advisories then be implemented. The Panel recognizes that the Regional Board's use of OEHHA's Screening Values is not uncommon and that these Screening Values were included as a potential set of guidelines in the Functional Equivalent Document (FED) (SWRCB, 2004) prepared to support the development of the State's 303(d) listing policy. However, this application of the Screening Values is not scientifically justified since they were not developed for this purpose. OEHHA has developed new thresholds that are more suited to the Regional Board's current purpose (see paragraph below on OEHHA's newer results, and Question 3).

The Regional Board used the National Academy of Sciences' (NAS) 1972 guidelines[1] for setting wildlife tissue thresholds for total DDT. The Panel does not believe this is the best currently available science. Much additional data has been gathered and the understanding of contaminant effects has improved greatly since the early 1970s. In addition, the use of standard numbers, such as the NAS guidelines, does not allow for the use of local information that reflects site-specific processes that may affect bioaccumulation processes and contaminant effects. The Panel also noted that the NAS report includes significantly different thresholds for DDT in marine and freshwater systems, a reflection of the fact that different expert panels derived the marine and freshwater thresholds. The fact that two expert panels arrived at such significantly different results using essentially the same datasets further undermined the Panel's confidence in the applicability of the NAS guidance to Newport Bay.

The stakeholders proposed a fish tissue target for DDTs for human consumption of 520 parts per billion (ppb), based on the value in Table 2 of Klasing and Brodberg (2008). This Advisory Tissue Level (ATL) of 520 ppb allows for the consumption of three servings of fish per week.

[1] National Academy of Sciences. 1972. Water Quality Criteria 1972. A Report of the Committee on Water Quality Criteria, Environmental Studies Board. Washington, D.C. EPA-R3-73-033.

However, the ATL is not necessarily directly applicable to use in setting targets in the context of the Organochlorine TMDLs. As Klasing and Brodberg (2008) say (p. 60):

> The ATLs described in this report should not be misinterpreted as static "bright lines" that others can use to duplicate state fish consumption advisories. As noted, ATLs are but one component of a complex process of data evaluation and interpretation used by OEHHA in the assessment and communication of fish consumption risks.

Dr. Brodberg of OEHHA has clarified that ATLs are developed by OEHHA for its own purposes and not for use as broader regulatory guidelines. ATLs are based on the relatively high 10^{-4} cancer risk level to allow for the health benefits of consuming fish; at this risk level, given current contaminant levels in fish tissue, non-cancer risks are larger than cancer risks for most consumption categories. Thus, the tissue level of 520 ppb of DDT cited by Dr. Byard is based on non-cancer risk factors. OEHHA is aware that agencies such as U.S. Environmental Protection Agency (U.S. EPA) and the Regional Board typically set TMDL targets and other criteria on the basis of risk alone, and do not balance benefits as OEHHA attempts to do. To accommodate the needs of other such agencies, OEHHA has also produced Fish Contaminant Guidelines (FCGs), which are based strictly on risk and use a more conservative cancer risk factor of 10^{-6}. These values, presented in Table 1 of Klasing and Brodberg (2008), are quite different from the ATLs. For example, the FCG for DDT, for one serving per week, is 21 ppb, markedly lower than the ATL even for three servings per week (520 ppb). The Panel concludes that the stakeholders' proposed DDT fish tissue target of 520 ppb is based on a different risk/benefit framework than the older Screening Value of 100 ppb used by the Regional Board, as well as on more current science, but that it is not necessarily the most applicable target in this instance. The same is true of PCBs, with an ATL of 21 ppb (for three servings per week) and a FCG of 3.6 ppb (for one serving per week), and toxaphene with an ATL of 200 ppb (for three servings per week) and a FCG of 6.1 ppb (for one serving per week).

In their critique of the Regional Board's DDT fish tissue target for human consumption, the stakeholders also noted that, "There is no fish consumption advisory for Newport Bay because fish concentrations are too low" and that there is "no health advisory for PCB in sportfish from Newport Bay." The Panel believes, based on discussions with OEHHA staff, that this is a misinterpretation of the absence of consumption advisories for sportfish in Newport Bay. OEHHA notes that data requirements for developing consumption advisories are demanding and that sufficient data do not exist for Newport Bay. In addition, OEHHA's main priority in its recent reevaluation of consumption advisories in Southern California was open coastal locations for which adequate, consistently collected, and analyzed data were available. They noted that the absence of consumptions advisories for Newport Bay should not be interpreted in any way as a reflection of OEHHA's judgment about the relative safety of consuming fish from the Bay.

The stakeholders suggested a DDT fish tissue target of 150 ppb for the protection of bird species, based on extrapolations of data in a study by Anderson et al. (1975) of reproductive effects in brown pelicans. The Panel believes this tissue level is not directly applicable as a fish tissue target in Newport Bay for several reasons. While brown pelicans are the most sensitive bird for eggshell thinning effects, these may not necessarily be the endpoint of concern for all targeted bird species in Newport Bay. Other endpoints related to survival, growth, or reproduction may well have different thresholds. Nor does the Panel believe that the estimation of brown pelican egg tissue residues, based on a presumed one-to-one relationship between declines in fish tissue and declines in pelican egg tissue, is supported by other data on the behavior of such relationships, particularly when the relationship is based primarily on data from one point in time

when DDT concentrations in the Southern California Bight were changing dramatically. As the Regional Board pointed out in its response #8 to the Flow Science report on DDT, another equally arbitrary comparison (DDT levels in pelican eggs to levels in pelican diet in 1969) results in a biomagnification factor of 18, which results in higher estimates of egg tissue levels using the 1974 fish tissue level of 150 ppb. The Panel believes that selecting individual comparisons from single points in time is not an appropriate approach for setting TMDL targets, which should be based on a review of all available evidence. The stakeholders use a different approach with data from ospreys to arrive at the same fish tissue target of 150 ppb. The Panel believes that the biomagnification factor used in this calculation (10) is unrealistically low. Finally, the stakeholders' suggested tissue target of 150 ppb does not include a safety factor, which is often used to compensate for data gaps, uncertainties, and differences between species and sensitive life stages.

Recommendations

Sediment, water, and tissue targets should be derived as part of an integrated modeling approach that incorporates specific endpoints and information about the entire foodweb. The modeling approach discussed by Ben Greenfield at the Panel meeting and described in more detail in the Newport Bay case study in Greenfield et al. (2007) is the type of approach the Panel believes is appropriate for developing targets that can be used to protect endpoints of interest (or species of concern) (see Recommendations for Question 3). This approach may require gathering additional data about contaminant levels in specific categories of prey items in portions of the foodwebs in the Newport Bay (building on, for example, Allen et al., 2008). The results of this effort should be compared to the sediment targets proposed in the comment letter from the Fish and Wildlife Service and based on a similar back calculation approach.

The Regional Board should review OEHHA's fish tissue targets related to human health and decide which of these is most appropriate for use in the organochlorine TMDLs. Given that one of OEHHA's main responsibilities is to develop such information for other state agencies, the Regional Board should carefully evaluate OEHHA's targets before considering any others. The primary issue for the Regional Board is to determine whether to base its human health related targets on the approach that balances health risks and benefits (i.e., ATLs) or the approach that focuses only on risk (i.e., FCGs). The Panel believes that both approaches are legitimate, have a strong conceptual and analytical foundation, and are based on current scientific knowledge. In addition, both fall within the range of risk levels recommended by the U.S. EPA (10^{-4} to 10^{-6}). However, conceptually, the ATLs represent a different approach, since they attempt to incorporate information about the benefits of seafood consumption that was not available when the risk-based approach was developed.

Setting targets to protect wildlife health is more complex than setting sediment, water, or human health related targets. Human health related targets have been established by OEHHA. Sediment and water targets can be derived by back calculation once appropriate targets for sportfish and prey tissue are set. However, there are no similarly well-developed targets that are directly applicable to all wildlife species of concern in Newport Bay. The Panel, therefore, recommends that the Regional Board build on the efforts underway by the Biological Technical Assistance Group (BTAG). This is a workgroup initiated by U.S. EPA Region IX and staffed by scientific representatives of state and federal agencies with the goal of establishing a formal process for developing and refining toxicity reference values (TRVs) based on the best available current science. Board staff should undertake a thorough review of the literature on contaminant effects, thresholds, and screening values relevant to bird species of concern in Newport Bay.

This information should be organized and applied as described in the Recommendations for Question 3.

Toxaphene was identified as a chemical of concern in the Newport Bay Watershed. Toxaphene is toxic to fish in laboratory assays, with concentrations around 500 nanograms per gram (ng/g) affecting reproduction and growth, while concentrations in the low parts per million (ppm) range are lethal. In addition, OEHHA has identified toxaphene as a chemical of concern for human consumption of sportfish. However, the Panel believes current science does not yet permit setting reliable targets for toxaphene to the extent possible for other contaminants. Toxaphene is a complex mixture of an unknown number of congeners (250 to >670) (ATSDR, 1996), and the octanol-water partition coefficients will differ for each chlorinated compound, with estimated partitioning coefficients varying from 3.3 to 6.44. In addition, the toxaphene source, degree of weathering, and extent of biological dechlorination may all affect the partitioning coefficient. Since all 600+ chemicals will have different partitioning coefficients and different toxicities, it is not possible to determine a "correct" partitioning coefficient, and a conservative approach is appropriate, since it is not possible to identify which component is responsible for toxicity. It is likely that bioaccumulation is a greater concern than direct toxicity, and there are no data to suggest that water toxicity results from the same components that bioconcentrate. The more lipophylic components are the most likely to bioconcentrate, while more water-soluble components are more likely to be responsible for aquatic toxicity. The Panel suggests that toxaphene, while a chemical of concern, is generally less problematic than DDT. However, it is more challenging with regard to the development of site-specific media and organism target levels for regulatory monitoring programs. In the case of Newport Bay, rather than developing specific guidance for toxaphene, it is likely that any sediment control measures used to address DDT issues would also be effective for toxaphene. The continuation of a modest sediment and fish tissue monitoring effort to track toxaphene trends should be sufficient.

3. Question 2

Are the numeric targets in the organochlorine TMDLs, as well as the targets proposed by the stakeholders, protective of beneficial uses?

Findings

The Panel finds that this question is not amenable to a strict yes/no answer. The real issue is whether targets are appropriately protective, or protective enough to achieve management goals.

Determining whether the proposed targets are protective enough to meet management goals is to some extent a matter of both professional judgment and policy decisions. However, such judgment must be based on the best available current science applied in a consistent risk assessment framework. Based on its findings for Question 1, the Panel concludes that, without the type of assessment described in the following recommendations, it is not possible to rigorously evaluate whether the targets are appropriately protective of beneficial uses.

Recommendations

The Regional Board should develop numeric targets using a structured risk assessment modeling approach as described in the Recommendations for Question 3. This process should consider a wide range of endpoints, surrogate species, toxicity reference values, and past studies to identify suitable inputs to a modeling approach such as described in Greenfield et al. (2007).

More specifically, the Panel recommends that protective prey tissue levels (targets) be selected and/or calculated for three species of wildlife bird species: the clapper rail, least tern, and osprey. Each feeds on different components of the foodweb within the Newport Bay ecosystem. Clapper rails feed on invertebrates and small fish in exposed or shallow intertidal areas, and tissue values will thus need to be derived for the invertebrate and small fish prey base supporting this species. Least terns and ospreys feed primarily on fish, but their primary prey species differ somewhat in size and bioaccumulative potential and may be associated with different parts of the prey base within the Newport Bay ecosystem.

The selection and/or calculation of target tissue levels for the various prey species should be guided by several considerations, including:

a. ***Species Relevance*** – If surrogate species must be used to compensate for the lack of data on species within the Newport Bay system, they should mimic the species of concern with respect to taxa, size, and food habits.

b. ***Endpoint Relevance*** – Assessing the sustainability of the species in the Newport Bay system with respect to exposures to organochlorines requires considering the toxicological endpoints relevant to sustainability. These include a variety of reproduction, growth, and survival endpoints, and one of these will often emerge as the most important with respect to establishing protective tissue levels. These endpoints should be kept separate from one another (i.e., data sets should not be merged for statistical purposes).

c. ***Reliability*** – The studies or values used should be based on work that has been peer reviewed and/or has a traceable history that allows for transparent review of methods, data, and conclusions.

d. ***Utility of Data*** – Explicit consideration should be given to the value of negative and positive information in the study, and preference should be given to studies with multiple doses that will support probabilistic assessments. The use of no-observed-effect levels (NOELs) and lowest-observed-effect levels (LOELs) should be carefully considered, since the low statistical power associated with most toxicity tests means that many NOELs are statistical artifacts. NOELs should be used only in conjunction with LOELs or, alternatively, LOELs may be used with safety factors, an approach that often has fewer statistical shortcomings.

e. ***Metrics*** – Attention should be given to ensuring that the metrics for exposure match those for effects (e.g., milligrams per kilogram per day [mg/kg/day] or mg/kg tissue etc.).

f. ***Safety Factor*** – The use of an appropriate uncertainty or safety factor should be explicitly considered with regard to different wildlife species and life stages. The U.S. EPA generally uses a 3X, 5X, or 10X safety factor for each of these considerations. Additionally, safety factors may be used as a policy decision related to the level of uncertainty in the analysis and the extent to which that uncertainty may compromise the degree of protection, as well as to the potential for interactions among mixtures of toxicants.

4. Question 3

Are there alternative targets, or methods to develop targets that have not yet been considered, that are both scientifically defensible and protective of beneficial uses?

Findings

The Panel believes there are both alternative targets, as well as risk assessment methods, that are directly applicable to the Newport Bay ecosystem and that have not been considered by either the Regional Board or the stakeholders.

In addition to the NAS (1972) guidelines, there are similar but more recent guidelines published by Environment Canada. In addition, both the Fish and Wildlife Service (FWS) comment letter and the Greenfield et al. (2007) case study of Newport Bay suggest a number of alternative targets that could be considered for application to Newport Bay, and the BTAG mentioned in the Recommendations for Question 1 provides a mechanism for considering targets more appropriate for Newport Bay. Beyond these specific numbers, the U.S. EPA has recently recommended the use of site-specific risk-based approaches (similar to those applied in both the FWS comment letter and Greenfield et al. [2007]) in cases such as this. The Panel believes that the combination of existing data and information with additional studies, such as the work being planned by the Toxicity Reduction Investigation Program (TRIP), would provide an opportunity to effectively apply this approach.

Recommendations

The Panel recommends a site-specific, risk-based approach that would allow for explicit consideration of local species, as well as uncertainty, safety factors, and precaution. Precaution is needed to ensure that unique modes of action are not overlooked and that assumptions of trends do not curtail management actions. Because the Newport Bay system is not at equilibrium (see Question 4 below), it is important to include direct and indirect exposure and uptake pathways from all sources (i.e., water, sediment, prey tissue). This approach should be designed to link this full range of inputs to fish/invertebrate tissues and associated exposures to wildlife species of concern (i.e., the three bird species suggested above). This effort can be accomplished using well-accepted and peer-reviewed bioaccumulation and food chain models, such as the Gobas-based model presented by Ben Greenfield at the Panel meeting. In the simplest terms, this approach would involve the following four steps:

1. Identify a Toxicity Reference Value (TRV) for birds for the compound of concern (e.g., ng DDT/g bird/day), derived from data on concentrations considered protective in the bird (e.g., egg, liver, plasma). TRVs are available in the literature and from programs such as the Department of Defense's Health Effects Research Program (HERP)[2], or can be calculated from a combination of local and published data. TRVs may be validated through monitoring, although it may be difficult, if not impossible, to gather the data directly on threatened and endangered species in the Newport Bay Watershed.

2. Back calculate to a tissue target or threshold for birds' prey items, using biomagnification factors, assimilation efficiency, rates of ingestion, and body weight, and accounting for both sediment and water column pathways for transfer of toxicants.

2 http://chppm-www.apgea.army.mil/tox/HERP.aspx. Health Effects Research Program.

3. Estimate the observed ratio of fish concentrations to sediment and water concentrations in the site of interest (i.e., bioaccumulation factors).

4. Use the estimate (3) to back calculate sediment and water targets from the fish tissue target (2).

In reality, this approach – elements of which were implemented in a streamlined fashion in the FWS comment letter and in more detail in Greenfield et al. (2007) – depends on developing a site conceptual model that identifies the receptor of concern (e.g., endangered bird species), relevant endpoint(s) necessary to focus the assessment (e.g., growth, reproduction), and exposure and effects assessments (see the Recommendations for Question 2 for a more detailed list of issues to be considered in this approach). A final risk characterization step would estimate risk and uncertainty, as well as identify data gaps.

Utilization of a site-specific risk-based process has been recently proposed by a Science Advisory Panel of the U.S. EPA's Office of Water to evaluate potential changes in the Aquatic Life Criteria for Contaminants of Emerging Concern (U.S. EPA, 2008). For example, recent studies have indicated that the impact of some contaminants would be underestimated using the current aquatic life criteria guidelines. In addition, thorough site-specific conceptual models can help address impairment that might be overlooked due to unique modes of action (e.g., endocrine disruption), an element included in U.S. EPA's recent recommendation for a site-specific and tissue-based approach for assessing the ecological risk of hydrophobic pesticides with high LogP values (U.S. EPA, 2009). This approach would parallel guidelines already utilized by U.S. EPA's Office of Water for selenium (U.S. EPA, 2005). Major steps in the overall context of TMDL development and implementation are shown in Figure 1.

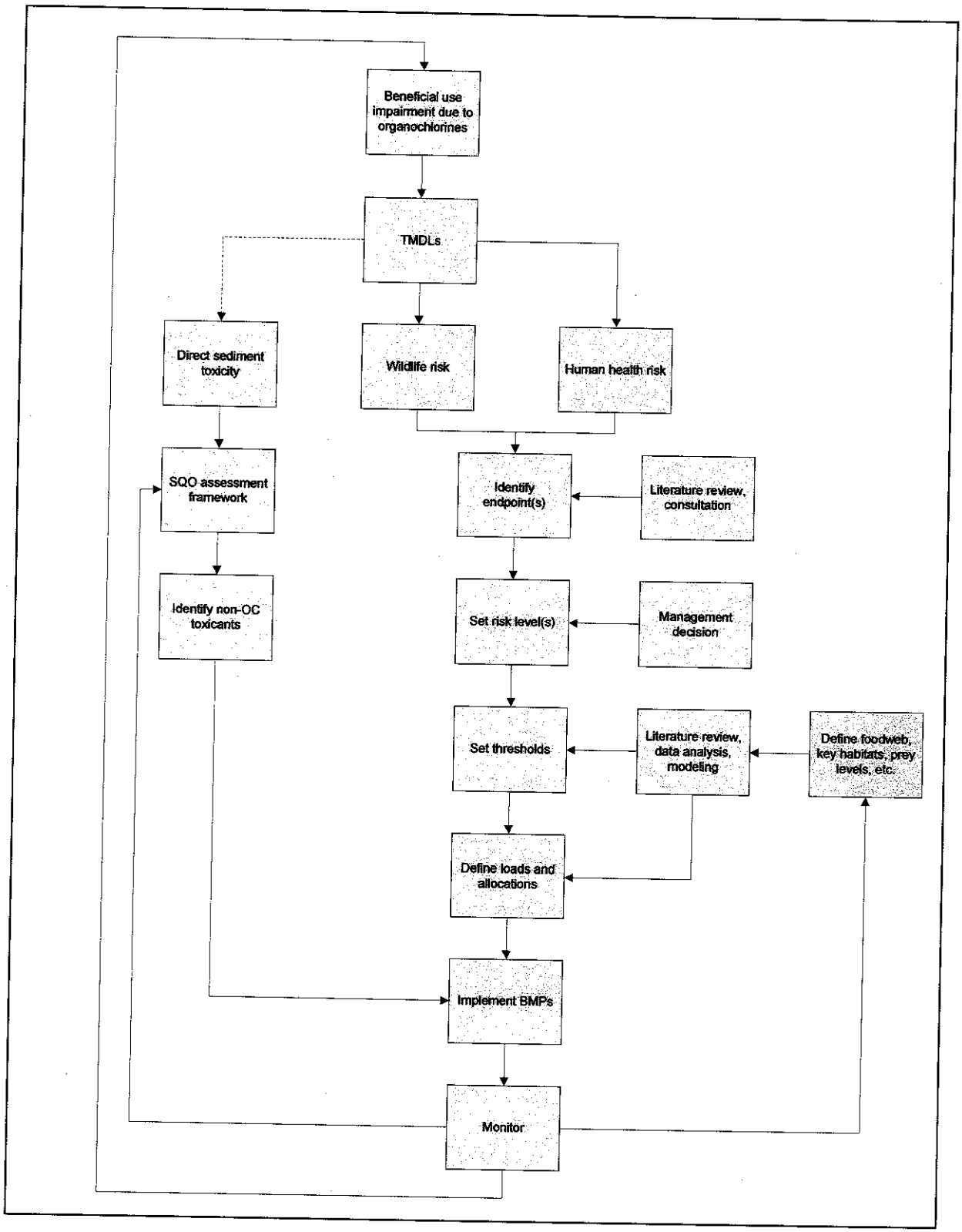

Figure 1. Major steps in the overall context of TMDL development and implementation.

5. Question 4

Is the analysis indicating a declining trend in organochlorines concentrations robust? If the analysis is robust and there is strong evidence of a declining trend, should this trend be reflected in defining targets and, if so, how?

Findings

The Panel finds that the declining trend of organochlorine concentrations in red shiner tissue is statistically robust for the period 1980 to 1996, although the strength of the regression relationship declines when the analysis is performed with all data, including outliers. However, data since 1996 fluctuate with no apparent trend, and the regression relationship for the later period (1993–2002) in the split is substantially weaker than that for the earlier time period, although short-term (<10 years) trends in organochlorines with long half lives may be difficult to identify. Furthermore, the relevance of this specific trend to conditions within the Newport Bay is somewhat uncertain because red shiner is a freshwater species and would not likely occur in estuarine conditions in Newport Bay itself. In general, however, declining trends in the red shiner data to about 1990 are supported by data on mussels and less detailed data on tissue levels in striped mullet, which have declined from more than 5000 ppb in the 1970s (Allen et al., 2004) to about 1000 ppb currently (Allen et al., 2008).

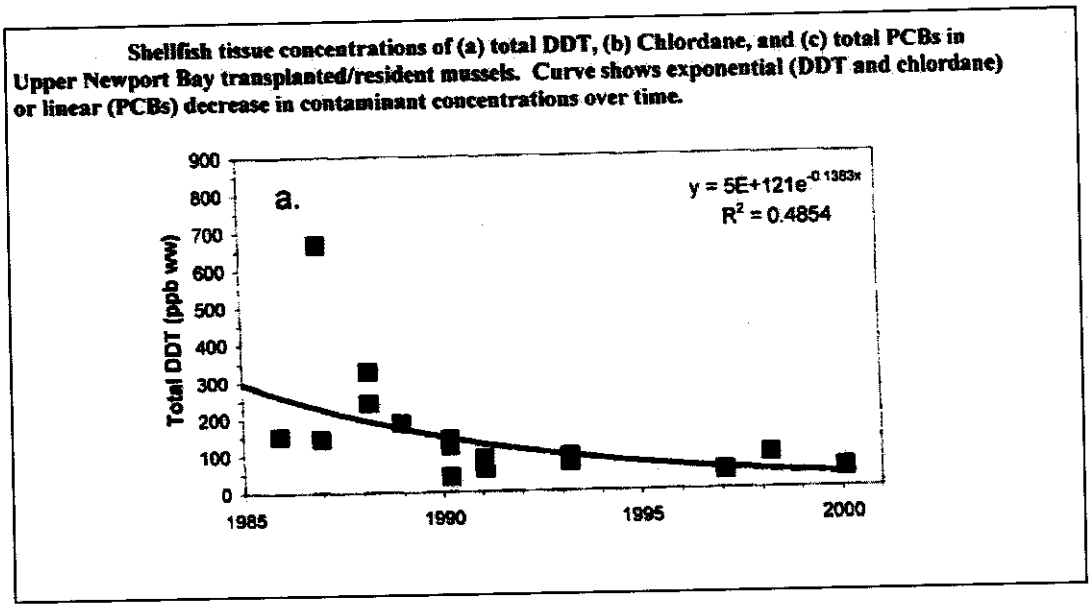

Figure 2. Figure from initial TMDL document (SARWQCB, 2006).

The lack of detailed trend data for marine and estuarine fish inhabiting the Newport Bay makes it impossible to determine if tissue concentrations in these species have declined at the same rate as tissue concentrations in red shiners and mussels. In fact, DDT concentrations in the same resident fish species in 2002 and 2005-2006 were not significantly different (Figures 3 to 5).

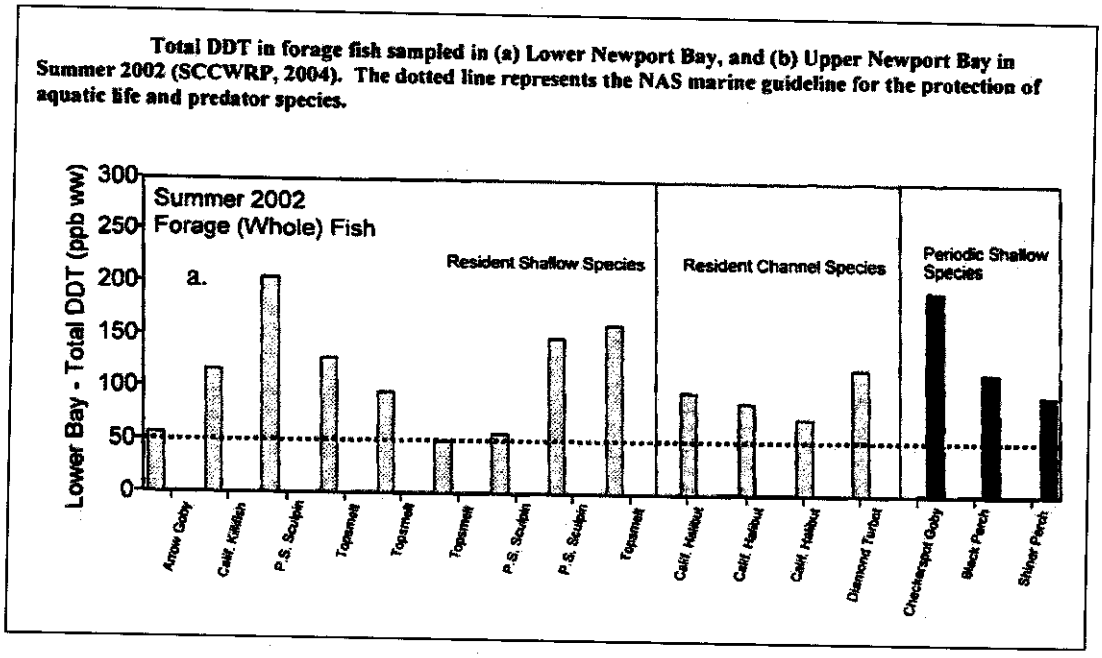

Figure 3. Figure from initial TMDL document (SARWQCB, 2006).

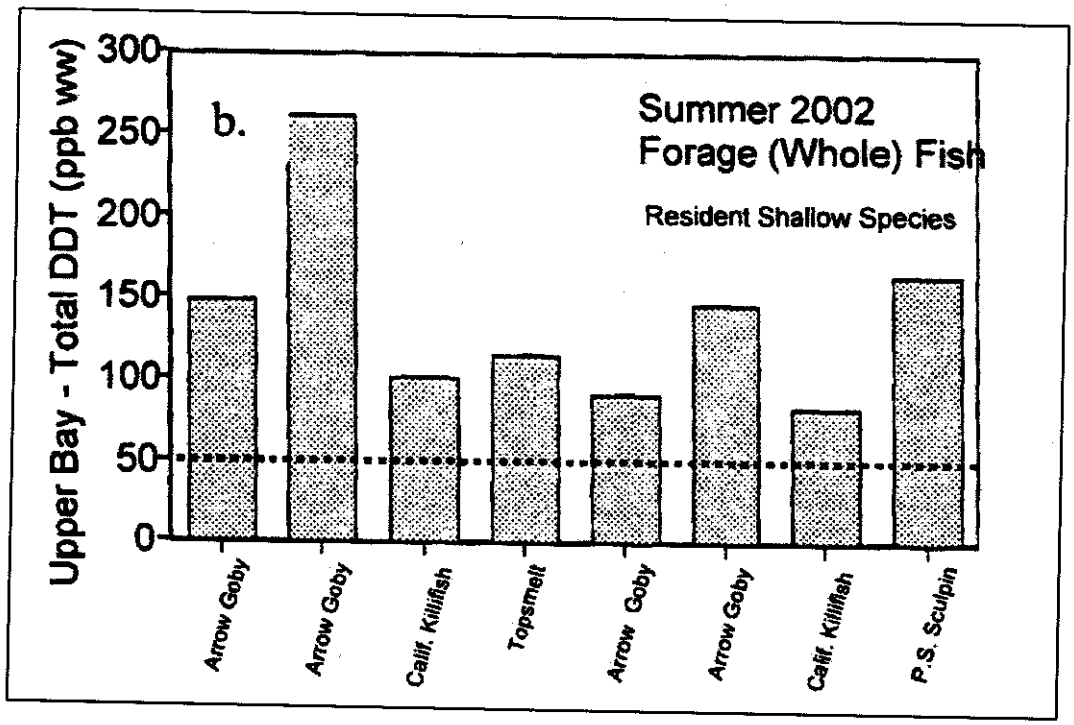

Figure 4. DDT concentrations of fish collected in the summer of 2002 from Upper Newport Bay (Allen et al., 2004).

Sample Description	No. Composites	Total DDT (ug/kg ww) Min	Max	Mean	Wildlife SV = 14 ug/kg ww SD	CV%	Std Length Range (mm)
topsmelt	18	41.2	[illegible]	82.8	34.4	37	18-81
California killifish	11	78.8	[illegible]	[illegible]	45.8	29	21-71
cheekspot goby	1	23.6	23.6	23.6	--	--	18-30
shadow goby	1	36.8	36.8	36.8	--	--	20-33
California halibut	3	18.6	94.4	63.9	39.2	61	73-119

Figure 5. Concentrations of DDT in fish species collected in 2005–2006 from Upper Newport Bay (Allen et al., 2008).

The Panel agrees with the stakeholders' conclusion (Byard et al. [2006], pp. 15-16) that sediment data are not suited to the evaluation of systemwide organochlorine trends. In addition to the factors discussed by the stakeholders, the Panel notes that detection limits have improved dramatically over time, which would produce an apparent declining trend simply as an artifact of changing detection limits.

Despite the robustness of past trends in fish and mussel tissue data, the Panel has concerns about the stakeholders' assertion on Slide #32 of Dr. Paulsen's presentation that, "Trends in time will continue." The Panel believes that the natural attenuation of organochlorine contaminant concentrations in Newport Bay to vanishing levels may not be a viable assumption. In watersheds where key source inputs have been substantially decreased or removed, contaminant declines are expected for several reasons, such as degradation, sediment burial, or sequestration, and export. While declines in such situations often initially appear to be first-order (i.e., can be described by a half-life rate constant), they eventually change in rate, depending on the system character and circumstances. For example, reduction in the rate of decline of PCBs in Lake Ontario biota are thought to be related to a substantial reduction in PCB loadings to the point where the atmospheric contribution dominates the total loading and further declines are expected to be largely dependent on decreases in regional atmospheric PCB levels (Gobas et al., 1995).

Also, many contaminants exhibit half lives on the order of decades or longer when associated with anaerobic soils or sediments and, therefore, are reticent to degradation. This is important because pockets of such contaminants within the watershed or in buried sediments may be released when disturbed by storm events or human activity, adding a spike of "new" contaminant to the system and resetting to some degree the trend of decline. As another example, studies have found in some cases that a large percentage of the total contaminant load within a system exists in the biota and is recycled within the food chain. Because these contaminants may not interact with water, they would not be subject to the usual degradation processes that lead to declines and, thus, would not follow the first-order decay curve described by the stakeholders. Such cycling processes have been observed for PCBs in Puget Sound, Washington (biotic recycling) (O'Neill, 2009, personal communication) and for tributyltin associated with anaerobic sediment (Dowson et al., 1996).

While the Panel agrees with the stakeholders that continued conversion of agricultural lands is likely, the degree to which such conversions will reduce organochlorine input is not clear, and land use conversion may temporarily increase organochlorine inputs, especially during construction events followed by runoff. In addition, land use conversion may not affect all organochlorines equally, complicating the task of predicting future trends in organochlorine loadings. The extent to which agricultural soils will be disturbed in the future, the degree to which best management practices (BMPs) succeed in controlling solids, and the efficacy of sediment control mechanisms in the watershed are all sources of significant uncertainty.

Interannual variation in rainfall and sediment loading add an important episodic aspect to the delivery of organochlorines to the Newport Bay.

Thus, the Panel believes it is not appropriate or scientifically sound to extrapolate trends such as that observed in Newport Bay into the future, especially to an endpoint of complete elimination. At some point in the decline, one or more factors (such as internal system recycling, airborne input from outside the watershed, or input via biological transport of contaminated organisms) will decrease the rate of decline, and may cause a long-term phase of little or no decline. Episodic events may disrupt the trend by increasing inputs to the system, as existing data suggests has happened in the past. Without a detailed mass balance model for each contaminant of concern in Newport Bay, it is not possible to begin to estimate future contaminant levels in the Newport Bay. However, it is highly unlikely that the simple first-order decline present in the earlier part of the time period will continue indefinitely.

Recommendations

Given the uncertainty about the nature of any future trends in contaminant concentrations, the Panel does not believe that explicit expectations about future trends should be included in the TMDL targets based on currently available information. The Panel noted the high degree of instability in the system from dredging events and large storm-driven sediment inputs, as well as the potential that nonlinear cycling pathways could become increasingly important as levels decline from their historically highs. To better understand how information on trends over time could be used in the TMDLs, the Panel recommends the following:

1. Board staff should examine available trend data to determine if they can be interpreted equally well from different perspectives. For example, Figure 6 (taken from the stakeholders' presentation) suggests event-related increases in DDT levels in the late 1980s and again in the late 1990s. These could be associated with periodic increased loads from agricultural lands associated with stormwater or other disturbances, such as construction and changes in land use. Comparison with rainfall and sediment loading records would be useful in testing these possibilities. Such information would provide important insights that are missed by making simplifying assumptions about decay rates.

2. The Regional Board should include the development of mass balance models for each contaminant in its TMDL implementation workplan. These models should include major compartments in the system and be used to help evaluate the potential for the types of cycling described above. In addition, the Regional Board should investigate the potential that currently unidentified sources could become important as contaminant levels decline. For example, Blais et al. (2005) document the effects of migratory birds on DDT levels in Arctic lakes. This might be an important source of contaminant input as migratory birds and mammals feeding on the Palos Verdes Shelf (one of the most contaminated sites for DDT on the Pacific coast) could be depositing lipophylic residues into Newport Bay through spawning, defecation, or mortality, as observed in the Arctic.

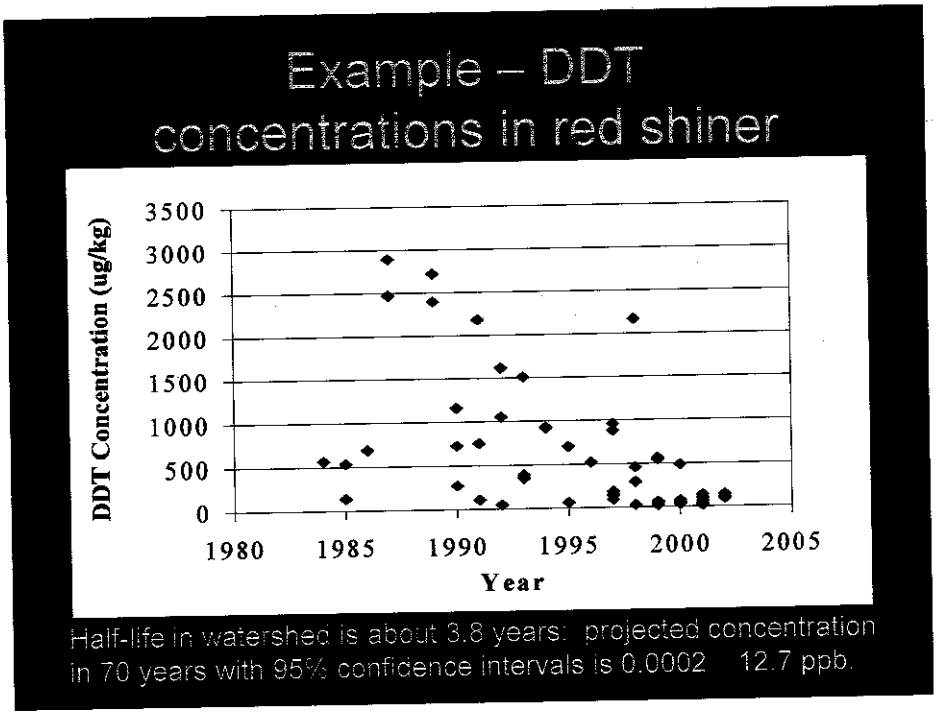

Figure 6. DDT concentrations in red shiner collected from San Diego Creek (Source: Stakeholder presentation at April 7, 2009, Panel meeting).

3. The Regional Board should expand tracking of trends by including one or more representative resident marine or estuarine fish in routine monitoring programs. If birds are the receptor of interest, then forage fish would be an appropriate target species for monitoring. This information should be combined with outputs from the mass balance models to improve understanding of how changes in contaminant inputs to the system, and contaminant cycling within the system, are reflected in tissue levels. As this understanding improves, it should be incorporated into the adaptive aspects of the TMDLs, which should allow targets to be periodically reevaluated as information and understanding improve.

6. Question 5

What are the recommended next steps to resolve any deficiencies, conflicts, or data gaps from questions 1 through 4?

Findings

The Panel's findings in response to questions 1 through 4 are that neither the TMDL targets nor the alternative targets proposed by stakeholders are consistently based on the most current science. While determining the appropriate level of protection of beneficial uses is, in part, a management decision, the Panel found that such decisions must be based on the best available science. Thus, the current targets are most likely not adequately protective, though determining whether they are over- or under-protective depends on applying the most current science to this question.

The Panel also found that there are alternative targets and methods available for use in the Newport Bay Watershed from a variety of federal, state, and academic research sources. Applying these to the Newport Bay Watershed will be challenging because of the non-equilibrium nature of this system, which is subject to a variety of sources of disturbance. As a result, the declining trends in tissue levels highlighted by the stakeholders cannot reliably be projected into the future.

Recommendations

The Panel has made a number of specific recommendations to address specific issues related to each of the four preceding questions. The Panel recommended an overall site-specific, risk-based approach that explicitly considers uncertainty, and safety factors. The Panel also recommended that this approach be designed to link water and sediment exposures to fish/invertebrate tissues and associated exposures to wildlife species of concern, and that it use well-accepted and peer-reviewed bioaccumulation and food chain modeling tools.

The Panel recommended specific data gathering and analysis efforts to develop the necessary inputs to the modeling approach. These efforts include additional monitoring studies within the Newport Bay system, as well as the review and application of data available from other sources. In addition to a better understanding of foodweb structure and bioaccumulation processes, data gathering and analysis should also focus on improving the understanding of historical trends and what factors might influence future levels of contaminants in sediments, water, and tissues.

More specifically, the Panel also recommended that the Regional Board consider its approach to human health risk assessment and make a management decision about whether to incorporate the benefits of fish consumption into its selection of sportfish tissue targets. While there is detailed guidance available from both OEHHA and U.S. EPA, current state policy provides the Regional Water Boards with substantial flexibility in their choice of overall approach to this issue.

References

Allen, M.J., D.W. Diehl, and E.Y. Zeng (2004). *Bioaccumulation of Contaminants in Recreational and Forage Fishes in Newport Bay, California in 2000-2002*. Technical Report 436. Southern California Coastal Water Research Project, Westminster, CA, 68 p.

Allen, M.J., A.Z. Mason, R. Gossett, D.W. Diehl, V. Raco-Rands, and D. Schlenk (2008). *Assessment of Food Web Transfer of Organochlorine Compounds and Trace Metals in Fishes in Newport Bay, California*. Technical Report May 29, 2008. Southern California Coastal Water Research Project, Westminster, CA, 86p.

Anderson, D., Hehl, J., Risebrough, R., Woods, L., Deweesse, L., and W. Edgecomb. (1975) Brown pelicans: improved reproduction off the southern California coast. Science 190(4216):806-808.

ATSDR (1996). *Toxicological Profile for Toxaphene*. U.S. Department of Health and Human Services, Public Health Service, Agency for Toxic Substances and Disease Registry. Atlanta GA, 215 p and Appendices.

Blais, J.M., L.E. Kimpe, D. McMahon, B.E. Keatley, M.L. Mallory, M.S.V. Douglas, and J.P. Smol (2005). "Arctic Seabirds Transport Marine-Derived Contaminants." *Science* 309, 445.

Byard, J.L., R.S. Tjeerdema, and QEA Environmental Consultants, Inc. (2006). *DDT Analysis for the Newport Bay Watershed.* Flow Science Incorporated, Pasadena, CA.

Dowson, P.H., J.M. Bubb and J.N. Lester (1996). Persistence and degradation pathways of tributyltin in freshwater and estuarine sediments. *Estuar Coast Shelf Sci.,* 42: 551-562.

Gobas, F.A.P.C., M.N. Z'Graggen, and X. Zhang (1995). "Time Response of the Lake Ontario Ecosystem to Virtual Elimination of PCBs. Environ." *Sci. Technol.,* 29:2038-2046.

Greenfield, B. K., A. R. Melwani, J. J. Oram, and S. M. Bay (2007). Indicator development and framework for assessing indirect effects of sediment contaminants. SFEI Contribution #524. San Francisco Estuary Institute, Oakland, CA

Klasing, S. and R. Brodberg. (2008) Development of fish contaminant goals and advisory tissue levels for common contaminants in California sport fish: chlordane, DDT, dieldrin, methylmercury, PCBs, selenium and toxaphene. Pesticide and Environmental Toxicology Branch, Office of Environmental Health Hazard Assessment (OEHHA), California Environmental Protection Agency (Cal. EPA), June 2008.

Moore, D.W., R. Baudo, J.M. Conder, P.F. Landrum, V.A. McFarland, J.P. Meador, R.N. Millward, J. Shine, and J.Q. Word (2005). "Bioaccumulation in assessment of sediment quality: uncertainty and potential application." In: *Use of Sediment Quality Guidelines and Related Tools for the Assessment of Contaminated Sediments*. R.J. Wenning, G.E. Batley, C.G. Ingersoll, and D.W. Moore (eds), Society of Environmental Toxicology and Chemistry (SETAC), Chapter 11., pp. 429-495.

O'Neill, S. (2009), Sandie O'Neill, Research Scientist, Washington Department of Fish and Wildlife, Olympia, WA, personal communication.

Santa Ana Regional Water Quality Control Board (2006). Total Maximum Daily Loads for Organochlorine Compounds *San Diego Creek*: Total DDT and Toxaphene *Upper and Lower Newport Bay*: Total DDT, Chlordane, Total PCBs. Orange County, California. Prepared by Kathy Rose November 17, 2006; 135pp.

State Water Resources Control Board (SWRCB) (2004). F*unctional Equivalent Document: Water Quality Control Policy for Developing California's Clean Water Act Section 303(d) List.* Division of Water Quality, State Water Resources Control Board, California Environmental Protection Agency, Sacramento, CA.

U.S. EPA (2005). Minutes of the Science Advisory Board (SAB) Aquatic Life Criteria Guidelines Consultative Panel Meeting; Office of Water; Ecological Processes and Effects Committee; Washington, D.C. (http://yosemite.epa.gov/sab/sabproduct.nsf/a84bfee16cc358ad85256ccd006b0b4b/2cc14eabff12b6dd85256ff200635359!OpenDocument&Date=2005-09-2).

U.S. EPA (2008). Minutes from SAB Advisory on Aquatic Life Water Quality Criteria for Contaminants of Emerging Concern, Office of Water; Ecological Processes and Effects Committee. 63pp. Washington, D.C. (http://yosemite.epa.gov/sab/sabproduct.nsf/a84bfee16cc358ad85256ccd006b0b4b/aa1e523621435d88852573db00771f3d!OpenDocument&Date=2008-06-30).

U.S. EPA (2009). Minutes from FIFRA SAP: Selected Issues Associated with the Risk Assessment Process for Pesticides with Persistent, Bioaccumulative, and Toxic Characteristics; Office of Pesticide Programs 111pp. Washington DC. SAP Minutes 2009-01. (http://www.epa.gov/scipoly/sap/meetings/2008/102808_mtg.htm).

APPENDIX A: Panel Biographies

BROCK B. BERNSTEIN, PH.D. (Panel Chair)
Independent Consultant (Ojai, CA)

Brock Bernstein is an environmental scientist and consultant with broad experience in designing and evaluating environmental programs, structuring management and research initiatives, and developing policy. He has field research experience in a range of coastal and oceanic environments, and has also worked on a wide variety of management and policy issues, including the redesign of core compliance monitoring programs for major regional management efforts, the evaluation and/or development of regional assessment programs, and methods to improve fisheries management. In addition, he has served on numerous technical advisory and review committees, including several National Academy of Sciences panels on issues such as improving marine monitoring nationwide and improving the governance and management systems used to manage coastal and ocean resources.

MICHAEL FRY, PH.D.
Director, Conservation Advocacy
American Bird Conservancy (Washington, DC)

Michael Fry is an avian toxicologist whose research interests are in the effects of pollutants and pesticides on ecosystems, with a focus on wild birds. He received his doctorate at the University of California, Davis, where he then went on to become a research physiologist in the Department of Avian/Animal Sciences for 23 years before joining Stratus Consulting in 2003. Michael has been a panel member for the National Academy of Sciences on hormone active chemicals in the environment and has participated in toxicology reviews and international symposia for the Organization for Economic Cooperation and Development (OECD) and for the United Nations University in Japan. He has also served as a committee member for EPA and OECD in revising avian toxicity test methods and was a member of the U.S. EPA Ecological Committee for Federal Insecticide, Fungicide, and Rodenticide Act (FIFRA) Risk Assessment Methods (ECOFRAM).

LYNN S. MCCARTY, PH.D.
Ecotoxicologist
L.S. McCarty Scientific Research & Consulting (Markham, Ontario, Canada)

Lynn McCarty is an ecotoxicologist with extensive experience in the area of risk assessment. An example of projects he has recently worked on include: the review of a risk assessment for a U.S. EPA new pesticide registration application for Valent USA Corporation; preparation of public comments on the EPA's draft "Considerations for Developing Alternative Health Risk Assessment Approaches for Addressing Multiple Chemical, Exposures, and Effects" for the American Chemistry Council; and an external review of Application/Uncertainty/Assessment Factor Proposals for Environment Canada. He has also served as an expert panelist for the

Strategic Projects Triage Selection Panel for Healthy Environments and Ecosystems (held by the Natural Sciences and Engineering Research Council of Canada) and Aquatic Life Criteria Consultative Panel (held by the EPA). In addition, from 1995 to 2003, he served as the Research Manager/Advisor to the Canadian Chlorine Chemistry Council, managing a research program with 38 projects and granting in excess of $2 million. McCarty received his Ph.D. in Biology from the University of Waterloo.

JAMES MEADOR, PH.D.
Fisheries Research Biologist
Ecotoxicology and Environmental Fish Health Program
NOAA National Marine Fisheries Service (Seattle, WA)

Since 1990, Jim Meador has served as a Fisheries Research Biologist of the National Marine Fisheries Service, a branch of the National Oceanic and Atmospheric Administration (NOAA). As an aquatic toxicologist, he studies the relationship between exposure to chemicals in the environment and the biological responses elicited. His interests range from environmental chemistry to the mechanisms of toxicant action. Meador has considerable experience studying aquatic organisms and has held positions at the Scripps Institution of Oceanography, Naval Ocean Systems Center, and Envirosphere Company. Among his honors, he received a NOAA Fisheries Bronze Metal in 2006 for innovative work with an interdisciplinary team on a complex Biological Opinion for ESA-listed salmonids and Paper of the Year for 2006 from the *Journal of Human and Ecological Risk Assessment* for the category of ecological risk assessment. He also serves as a review editor for the journals *Aquatic Biology* and *Marine Ecology Progress Series*. Meador received a B.A. in Zoology from Humboldt State University, M.S. in Biology/ Physiology from San Diego State University, and a Ph.D. in Aquatic Toxicology from the University of Washington.

CHARLES A. MENZIE, PH.D.
Principal Scientist and Director, EcoSciences
Exponent (Alexandria, VA)

Charles Menzie's primary area of expertise is the environmental fate and effects of physical, biological, and chemical stressors on terrestrial and aquatic systems. His expertise in chemical transport and fate includes organochlorine compounds, PAHs, benzene and other light aromatic hydrocarbons, chlorinated volatile compounds, phthalate esters, petroleum hydrocarbons, metals and cyanide compounds. Menzie has worked at more than 100 sites and has been involved in approximately a dozen natural Resource Damage Assessment (NRDA) related cases. He is recognized as one of the leaders in the field of risk assessment and was awarded the Risk Practitioner Award by the Society for Risk Analysis. Menzie has taken the lead in developing guidance documents for industry and government, and helped draft the ASTM Standard for risk-based corrective action (RBCA) for chemical release sites. In addition to his work on chemical risk-related matters, Menzie has developed and applied methods for identifying third parties who have contributed to contamination in aquatic and terrestrial environments.

DANIEL SCHLENK, PH.D.
Professor of Aquatic Ecotoxicology
University of California, Riverside (Riverside, CA)

Daniel Schlenk is Professor of Aquatic Ecotoxicology in the Department of Environmental Sciences at the University of California, Riverside. He has taught courses at both undergraduate and graduate levels, including *Fundamentals of Toxicology* and *Biotransformation of Organic Chemicals*. His research focuses on understanding the biochemical factors that influence susceptibility to environmental and natural chemicals. One example of his current research involves the identification of environmental estrogens and other endocrine disrupting compounds in reclaimed water, wastewater, and sediments, using bioassays. In addition, Schlenk serves as Co-editor in Chief of *Aquatic Toxicology*, which publishes original scientific papers dealing with the mechanisms of toxicity in aquatic environments and the understanding of responses to toxic agents at community, species, tissue, cellular and subcellular levels. Schlenk received his B.S. from Northeast Louisiana University, and his Ph.D. from Oregon State University.

APPENDIX B: Meeting Agenda

NATIONAL WATER RESEARCH INSTITUTE

Independent Advisory Panel Meeting
County of Orange's Implementation of
Organochlorine Compounds TMDLs to Newport Bay

REVISED Final Meeting Agenda
April 7-8, 2009

Meeting Location
Holiday Inn Costa Mesa
3131 Bristol Street
Costa Mesa, CA 92626
Phone: 714-557-3000

On-Site Contact:
Jeff Mosher (NWRI)
Cell: (714) 705-3722

Meeting Objectives:

1. Review the overall charge to the Panel regarding the Organochlorine Compounds TMDLs process.
2. Review the Panel Scope and the specific questions posed to the Panel for review.
3. Present a range of information and comments on the data, assumptions, and methodology for the numeric criteria in the TMDL process.
4. Develop a set of findings and recommendations for the Panel's review of the alternative approaches in setting numeric targets.

Tuesday – April 7, 2009

8:30 am	Welcome and Introductions - Jeff Mosher (NWRI) - Brock Bernstein (Panel Chair)	
8:40 am	Panel Charge	Maryanne Skorpanich (County of Orange)
8:50 am	Overview of Watershed	Stuart Goong (County of Orange)
9:10 am	Organochlorines Compounds TMDLs for the Newport Bay Watershed	Terri Reeder (Santa Ana RWQCB)
10:30 am	**BREAK**	
10:45 am	A Critical Review of the TMDL Targets and Impacts of Organochlorines in the Newport Bay Watershed	Dr. Susan Paulsen (Flow Sciences) and/or Dr. Jim Byard (Consultant)

11:30 am	Risk Assessment Case Study of DDT in Newport Bay	Ben Greenfield (San Francisco Estuary Institute)
12:00 noon	**WORKING LUNCH (Panel members and attendees)**	
12:30 pm	Existing DDT Levels in Forage Fish in Upper Newport Bay	Jack Skinner (Back Bay Environmental Advocate)
1:00 pm	Sediment Chemistry and Toxicity - Sediment Quality Objectives	Steve Bay (SCCWRP)
1:45 pm	Panel Q&A	Brock Bernstein (Panel Chair)
3:00 pm	**BREAK**	
3:15 pm	Panel Deliberations – Closed Session	
5:00 pm	**Adjourn Open Session**	

Wednesday – April 8, 2009

8:30 am	Watershed Tour	
10:30 am	Panel Deliberations – Closed Session	Brock Bernstein (Chair)
12:00 noon	**Panel Working Lunch**	
2:00 pm	**Adjourn**	

APPENDIX C – April 7-8, 2009 Meeting Attendees

Panel:

- *Panel Chair:* Brock B. Bernstein, Ph.D., Independent Consultant (Ojai, CA)
- Michael Fry, Ph.D., American Bird Conservancy (Washington, D.C.)
- Lynn S. McCarty, Ph.D., L.S. McCarty Scientific Research & Consulting (Ontario, Canada)
- James Meador, Ph.D., NOAA National Marine Fisheries Service (Seattle, WA)
- Charles A. Menzie, Ph.D., Exponent (Alexandria, VA)
- Daniel Schlenk, Ph.D., University of California, Riverside (Riverside, CA)

NWRI:

- Jeff Mosher, Executive Director
- Gina Melin Vartanian, Outreach and Communications Manager

County of Orange:

- Amanda Carr
- Chris Crompton
- Stuart Goong
- Jian Peng
- MaryAnne Skorpanich

Irvine Company Consultants:

- James L. Byard, Ph.D., DABT, Consultant
- Susan C. Paulsen, Ph.D., PE, Flow Science

Southern California Coastal Water Research Project:

- Steve Bay

California Regional Water Quality Control Board:

- Wanda Cross
- Terri Reeder

State Water Resources Control Board:

- Chris Beegan

San Francisco Estuary Institute:

- Ben Greenfield

Back Bay Environmental Advocate:

- Jack Skinner, MD

RBF Consulting

- Larry McKenney

PBS&J/OC Great Park:

- Rosanna Lacarra

University of California Cooperative Extension:

- John Kabashima

City of Orange

- Gene Estrada

Newport Bay Naturalists & Friends

- Roger Mallett

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