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Kevin Buchan
Manager, Bay Area Region

December 14, 2017

Ms. Jeanine Townsend
Clerk to the Board
State Water Resources Control Board
P.O. Box 100
Sacramento, CA 95812-2000

via email (commentletters@waterboards.ca.gov)

RE: WSPA Comments on California Sediment Quality Objectives

Dear Ms. Townsend:

The Western States Petroleum Association (WSPA) is a non-profit trade association representing twenty-six companies that explore for, produce, refine, transport and market petroleum, petroleum products, natural gas, and other energy supplies in California, Arizona, Nevada, Oregon, and Washington.

WSPA appreciates the opportunity to provide the following comments related to the State Water Resources Control Board's ("SWRCB" or "Board") Proposed Amendments to the Water Quality Control Plan for Enclosed Bays and Estuaries: Sediment Quality Objectives ("SQO") released for public review and comment on October 24, 2017. These proposed amendments, upon adoption, would be incorporated into the Inland Surface Waters, Enclosed Bays, and Estuaries (ISWEBE) Plan.

As briefly highlighted here and discussed in detail in the attached memo prepared for WSPA by Susan Paulsen and Susan Kane Driscoll of Exponent, WSPA has concerns regarding the proposed SQOs. In addition to discussing the concerns, we are pleased to offer suggested revisions to address each of the issues.

Applicability

WSPA is concerned that the SQOs are not applicable to all waters, particularly in areas where a total maximum daily load (TMDL) has previously been developed. As currently constructed, the SQOs would not apply to entities who discharge to receiving waters that have an established TMDL for organochlorine pesticides or polychlorinated biphenyls from sediment in sportfish unless a regional board approves such an application. Our concern, however, is that many TMDLs are based on outdated and faulty science that is inconsistent with the proposed SQO provisions.

WSPA recommends the Board revise the draft to apply SQOs to all waters, including those for which a TMDL has previously been developed. Additionally, WSPA recommends the state and regional water boards be required to develop TMDL allocations using the methodology of the proposed SQOs.

Consistency

The Board should revise the State Listing Policy to be consistent with the sediment quality provisions. The original Policy adoption occurred in 2004 prior to the adoption of the SQOs Part 1 and the Policy has not been modified in line with the SQO provisions that provide that sediment quality provisions that added an additional listing criterion should apply only to listing for exceedances of the narrative SQO for aquatic life protection. Instead, the Policy continues to allow sediment quality guidelines to be used in listing decisions and the use of them in this way as a basis for management actions is inappropriate as no single one can account for all of the factors that influence contaminant effects.

WSPA recommends the Board modify the Provisions such that listing decisions and receiving water limitation exceedances do not use the “Possibly Impacted” category. This particular category connotes significant uncertainty about the sediment condition and the cause of any impacts. Given such uncertainty, it should not be used as a basis for listing.

Additionally, in situations where Stressor Identification Evaluations (SIE) are inconclusive, it is unclear whether or not an “off-ramp” exists. The flow chart and overall framework is in need of such clarification and off-ramp options when SIEs are inconclusive or at a minimum more explicit parameters being established to limit the scope of additional study required pending future, routine SQO monitoring.

Tier 2 and Tier 3 Assessments

WSPA recommends the bioavailability of sediment contaminants should be included as an option in Tier 2 and Tier 3 human health risk assessments. This is important as site-specific bioavailability of chemicals is core to understanding exposure and risks. Differences among sites in this regard are widely accepted.

Background

The use of “regional background” in establishing management guidelines for sites is appropriate and protective. It may not be realistic to eliminate certain pollutants from the state’s waters as they may be tied to a host of sources including atmospheric deposition and legacy issues. In this regard, WSPA is pleased to support consideration of regional background contamination being included in the SQO Provisions.

WSPA appreciates the opportunity to provide comment on the proposed Sediment Quality Objectives. We look forward to working with you to move forward a workable, science-based framework for sediment quality. Thank you.

Sincerely,



Enclosure: Memorandum, “Comments on California Sediment Quality Provisions” (Exponent)



E X T E R N A L M E M O R A N D U M

TO: Kevin Buchan, WSPA
FROM: Susan Paulsen and Susan Kane Driscoll, Exponent Inc.
DATE: December 14, 2017
PROJECT: 1405218.000
SUBJECT: Comments on California Sediment Quality Provisions

Exponent was retained by the Western States Petroleum Association (WSPA) to review the Sediment Quality Provisions (SQO Provisions) that were issued by the State Water Resources Control Board (SWRCB) for public comment on October 24, 2017. The draft SQO Provisions would, after adoption, be incorporated into the Inland Surface Waters, Enclosed Bays, and Estuaries (ISWEBE) Plan. The draft SQO Provisions make minor changes to the Part 1 SQOs (the “direct effects” SQOs that apply to benthic organisms), mainly to the implementation procedures that apply for Part 1 SQOs, and include the new Part 2 SQOs (the “indirect effects” SQOs that protect human health from exposure to sediment-derived toxic pollutants in sportfish). This memorandum focuses on both the new Part 2 SQOs and the implementation provisions for both Part 1 and Part 2 SQOs. Prior comments submitted by WSPA on the SQOs are incorporated by reference.

1. The Sediment Quality Provisions (SQO Provisions) should be applied to all waters, including those for which a TMDL has previously been developed.

Section III.A.1.b.4 (at p. 3) currently states that the SQO “*implementation provisions ... do not apply to dischargers that discharge to receiving waters for which a total maximum daily load (TMDL) has been established to address for [sic] the bioaccumulation of organochlorine pesticides or polychlorinated biphenyls from sediment into sportfish tissue within enclosed bays and estuaries unless the applicable Regional Board approves the application of such provisions.*”

However, many of the state’s previously adopted TMDLs are based on outdated and faulty science and are inconsistent with the proposed SQO Provisions. For example, many TMDLs are based upon sediment quality guidelines such as ERLs and TELs, which are inappropriate for use as indicators of bioaccumulation or targets for protection of human health, and which should not be used in development of TMDLs. The State

has invested significant time and effort in the process of developing the proposed SQOs, and the proposed SQOs represent a significant advance in terms of applying appropriate scientific methods to evaluate both the human health risk posed by toxic pollutants in sediments and impacts to benthic organisms. The SWRCB should modify the proposed SQOs to require their use in evaluating existing TMDLs and in developing future TMDLs. Suggested language changes are provided below.

The SQO Provisions similarly include language regarding the implementation of SQOs as receiving water and effluent limitations (see Section IV.A.4.c.1. at p. 32). Section IV.A.4.c.1.d requires effluent limits to be established to protect or restore sediment quality

“only after:

- i. A clear relationship has been established linking the discharge to the degradation,
- ii. The pollutants causing or contributing to the degradation have been identified, and
- iii. Appropriate loading studies have been completed to estimate the reductions in pollutant loading that will restore sediment quality.”

However, receiving water and effluent limitations have been developed across the state to implement TMDLs that are not consistent with the SQO Provisions. In many cases, the adopting agencies have not made these key findings. Permit limits have been applied in cases where no clear linkage between the discharge and the degradation has been established, and for pollutants that are unlikely to cause or contribute to degradation, because of TMDL targets and wasteload allocations that have been established without consideration of the requirements of the SQO Provisions. Only by revisiting TMDLs to ensure that they are consistent with the SQO Provisions will it be possible to develop receiving water and effluent limits that are consistent with the SQO Provisions and that are scientifically and technically appropriate.

Recommendation: The SWRCB should modify Section III.A.1.b.4 (at p. 3) to read as follows: “Implementation provisions ... ~~do not apply to~~ shall be used to develop requirements for dischargers that discharge to receiving waters for which a total maximum daily load (TMDL) has been established to address for the bioaccumulation of organochlorine pesticides or polychlorinated biphenyls from sediment into sportfish tissue within enclosed bays and estuaries unless the applicable Regional Board approves the application of such provisions. Implementation provisions shall also be used to develop future TMDLs for the bioaccumulation of organochlorine pesticides or polychlorinated biphenyls from sediment into sportfish tissue within enclosed bays and estuaries.” In the SQO Provisions Staff Report at pp. 106-107, Alternative 1 (“Do not include a clause that would grandfather those waterbodies with adopted TMDL”) should be selected.

2. The Water Boards should be required to develop TMDL allocations using the methodology of the proposed SQOs.

Consistent with Comment 1, the Water Boards should be required to follow the proposed SQOs, once adopted, in all TMDLs adopted after the effective date of the Sediment Quality Provisions.

Recommendation: The SWRCB should modify language in Section IV.A.4. at p. 32 as follows: “These actions are further described in Chapters IV.A.4.f and IV.A.4.g. Nothing in this chapter shall limit a Water Board’s authority to develop and implement waste load allocations for Total Maximum Daily Loads. ~~However, it~~ is ~~recommended~~ required that the Water Boards develop TMDL allocations using the methodology described herein, ~~wherever possible.~~”

3. The SWRCB should revise the State Listing Policy to be consistent with the Sediment Quality Provisions.

The State Listing Policy was initially adopted in 2004, prior to the adoption of the Sediment Quality Objectives Part 1. The SQO Provisions specify that “the Sediment Quality Provisions adds [*sic*] an additional listing criterion that applies only to listing for exceedances of the narrative sediment quality objective for aquatic life protection in Chapter III.A.2.a” (Section IV.A.4.e.1 , p. 37). However, the State Listing Policy has not been modified accordingly, and continues to allow Sediment Quality Guidelines, including SQGs, such as ERLs and PELs, to be used in listing decisions (see Listing Policy Section 6.3.1 at pp. 19-20). However, the use of SQGs or chemical-specific concentration-based thresholds as a basis for management actions is inappropriate as “no single SQG approach is able to account for all of the factors that influence contaminant effects” (SQO Part 1 Staff Report at p. 92-93).¹ SQGs are an inappropriate basis for listing, and listing decisions should be made for toxic pollutants in sediment using only the SQO Provisions.

The SQO Provisions continue to allow a water segment to be placed on the 303(d) list if that segment exhibits sediment toxicity but is not listed for an exceedance of the narrative objective for aquatic life protection (see Section IV.A.4.e.1 on p. 37, which allows such a listing in accordance with Section 3.6 of the Listing Policy). The SQO provisions also require that, if the water quality standard exceedance “consists of the sediment quality objective,” the Regional Water Board is to re-evaluate the listing and delist if the water segment does not meet the criteria in the SQO Provisions. In practice, these provisions of the SQO Provisions and Listing Policy appear to conflict with each

¹ https://www.waterboards.ca.gov/water_issues/programs/bptcp/docs/sediment/071808_draftstaffreport.pdf. Note that the SQO Part 1 Staff Report also stated that “the State Water Board may reconsider the Section 303(d) Listing Policy, if appropriate, in the future to further address listings for sediment toxicity.”

other, such that listing decisions have been made and TMDLs have been developed for toxic pollutants that do not appear to be responsible for the observed effects.

Recommendation: The SWRCB should review and revise the State Listing Policy to be consistent with the SQO Provisions. While that would require a separate regulatory action, the SWRCB should insert a finding into its resolution for the adoption of the SQO Provisions that requires appropriate revisions to be made to the Listing Policy.

4. The SWRCB should modify the Provisions so that listing decisions and receiving water limitation exceedances do not use the “Possibly Impacted” category.

a.) Part 1 direct effects SQOs. Section IV.A.4.c.2.a (p. 32-33) includes new language stating that an exceedance of a receiving water limit is demonstrated when “Any station within the site is assessed as Clearly Impacted as defined in Chapter IV.A.1.i and IV.A.1.j or the total percent area categorized as Possibly Impacted and/or Likely Impacted equals or exceeds 15 percent of the site area over the duration of a permit cycle. Calculation of percent area shall be based on data from spatially representative samples selected using a randomized study design or equivalent spatial analysis.”

Similarly, Section IV.A.4.e (p. 36-37) is entitled “Evaluating Waters for Placement of [*sic*] the Section 303(d) List.” This section includes new requirements for listing decisions based on both Part 1 (direct effects) and the Part 2 (human health) SQOs. Section IV.A.4.e.1 provides new requirements for listings based on the Part 1 SQOs (Aquatic Life – Benthic Community Protection). The new requirements provide that water segments shall be listed if either

“i. Any station within the site is assessed as Clearly Impacted...” or

“ii. The total percent area categorized as Possibly Impacted and/or Likely Impacted equals or exceeds 15 percent of the site area over the duration of a listing cycle. Calculation of percent area shall be based on data from multiple spatially representative samples selected using a randomized study design or equivalent spatial analysis.” [Section IV.A.4.e (p. 37)]

However, the SQO Provisions from Part 1 define “Possibly Impacted” as “Sediment contamination at the site may be causing adverse impacts to aquatic life, but these impacts are either small or uncertain because of disagreement among LOE.” [Section IV.A.1.i.3 at p. 14]. Accordingly, the SQO Provisions require that the “Possibly Impacted” category shall be designated as “meeting the protective conditions if the studies identified in Chapter IV.A.4.f demonstrate that the combination of effects and exposure measures are not responding to toxic pollutants in sediments and that other factors are causing these responses within a specific reach segment or waterbody. In this situation, the Water Board will consider only the Categories

Likely Impacted and **Clearly Impacted** as degraded when making a determination on receiving water limits and impaired water bodies as described in Chapter IV.A.4.” [Section IV.A.1.i.4) at p. 15]. Because the Possibly Impacted category indicates significant uncertainty about the sediment condition and the cause of any impacts, sites in the Possibly Impacted category should not be used as the basis for listing.

We also note that Appendix A-2 requires a Stressor Identification Evaluation (SIE) to be conducted only when a station is classified as Likely Impacted or Clearly Impacted, and not when the station is classified as Possibly Impacted. A classification of Possibly Impacted results when impacts are small or when the LOE are inconsistent. In our experience, it is difficult if not impossible to identify the stressor responsible for impacts that are small or when LOE are inconsistent (see SQO Part 1 Staff Report at p. 119). Thus, the requirement to conduct an SIE only when a station is classified as Likely Impacted or Clearly Impacted is appropriate. Consistent with this observation, it would be inappropriate to base a decision to place a waterbody on the Section 303(d) list or to determine that receiving water limitations have been exceeded, for the same reason it is inappropriate to perform an SIE for a station classified as Possibly Impacted.

Based on these considerations, recommendations are as follows:

1. *The SWRCB should modify the language of Section IV.A.4.c.2.a.ii (p. 32-33) to read as follows: “ii. The total percent area categorized as ~~Possibly Impacted and/or~~ Likely Impacted equals or exceeds 15 percent of the site area over the duration of a listing cycle. Calculation of percent area shall be based on data from multiple spatially representative samples selected using a randomized study design or equivalent spatial analysis.”*
 2. *The SWRCB should also modify the language of Section IV.A.4.e.1.a.ii (p. 37) to read as follows: “ii. The total percent area categorized as ~~Possibly Impacted and/or~~ Likely Impacted equals or exceeds 15 percent of the site area over the duration of a listing cycle. Calculation of percent area shall be based on data from multiple spatially representative samples selected using a randomized study design or equivalent spatial analysis.”*
- b.) As with the Part 1 SQOs, the SQO Provisions for Part 2 are drafted to require that waters be placed on the Section 303(d) list for exceedance of the narrative sediment quality objective for human health if sediments are categorized as Possibly Impacted, Likely Impacted, or Clearly Impacted over the duration of the listing cycle (6 years) [Section IV.A.e.2 on p. 38]. However, the “Possibly Impacted” category is indicative of high chemical exposure but a low site sediment linkage (see Table 22 on p. 29). The Possibly Impacted category indicates significant uncertainty that the site is

contributing to the exposure, and thus the “Possibly Impacted” category should not be used for listing decisions.

Recommendation: The SWRCB should modify the language in Section IV.A.e.2 on p. 38 as follows: “Human Health – Water segments shall be placed on the section 303(d) list for exceedance of the narrative sediment quality objective for human health protection in Chapter II.A.2.b of the Sediment Quality Provisions if sediments from a site are categorized as ~~Possibly Impacted~~, Likely Impacted or Clearly Impacted over the duration of the listing cycle (6 years).”

- c.) Given the large uncertainty and conservative basis (i.e., likely to over-predict effect) of the various lines of evidence, the selection of “15% of the total area categorized as Possibly Impacted and/or Likely Impacted” as the cutoff for designating an area as in exceedance of a Receiving Water Limit, or for deciding to place a waterbody on the 303(d) list, is also overly conservative.

Recommendation: The criteria of total percent area categorized as Possibly Impacted and/or Likely Impacted should be substantially increased (e.g., 30-40%).

5. The use of “regional background” in establishing management guidelines for sites is appropriate and protective.

Because of widespread diffuse sources of organochlorines and PCBs, including atmospheric deposition from global sources and legacy pollutants from continental or regional sources, it is not feasible to eliminate these pollutants completely from the state’s waters. These pollutants were banned decades ago, and their concentrations in the environment are declining slowly over time as they degrade and as diffuse sources show lower concentrations over time. WSPA supports the portions of the Sediment Quality Provisions that reference regional background contamination and require management guidelines for a site to be established in consideration of regional background conditions.

We note that the three lines of evidence used in Part 1 SQOs (i.e., chemistry, sediment toxicity, and benthic infauna) are also subject to variability and regional differences. For this reason, results for individual site sample locations should be compared to indices at a comparable reference location or to regional background conditions rather than to generic values.

Recommendation: Sample results for the three lines of evidence that comprise the Part 1 SQOs should be compared statistically to results at a reference site (or multiple reference sites) in order to characterize whether a particular site location is significantly impacted.

6. The State Water Board should clarify that an “off ramp” exists when Stressor Identification Evaluations (SIE) are inconclusive.

The flow chart shown as Appendix A-2 on p. 49 of the Sediment Quality Provisions describes a point source assessment process. Appendix A-2 describes the actions to be taken when stations are classified as Likely or Clearly Impacted, including preparation and execution of a “Stressor Identification Evaluation” workplan. The flow chart requires a discharger to “review and revise SIE workplan” when the SIE is inconclusive and fails to identify the “chemicals or classes of chemicals” responsible for an SIE exceedance.

Recommendation: Consistent with the SQO Provisions at Section IV.A.4.f (p. 40-41), the SWRCB should clarify the flow chart in Appendix A-2 to note that the Water Board may require a one-time augmentation to that study or, alternatively, may suspend further stressor identification studies pending the results of future routine SQO monitoring.

7. Assessment of the bioavailability of sediment contaminants is fundamental to assessment of sediment quality and should be included as an option in Tier 2 and Tier 3 assessments of human health risk.

Site-specific bioavailability of chemicals is fundamental to understanding potential for exposure and risks. Differences among sites in bioavailability of sediment-associated contaminants have been well documented². Soot and other forms of “black carbon,” which are ubiquitous in coastal sediments, have been shown to sorb hydrophobic contaminants and reduce bioavailability of sediment-associated hydrophobic organic contaminants (HOCs).^{3,4} Abundant data have demonstrated that measured concentrations of HOCs in porewater are better predictors of bioavailability than bulk sediment concentrations.⁵ This is not because porewater is the primary route of exposure, but rather because porewater concentrations reflect the fraction of the total sediment concentration that is available to partition among phases, including porewater

² Hawthorne SB, CB Grabanski, and DJ Miller. 2006. Measured partitioning coefficients for parent and alkyl polycyclic aromatic hydrocarbons in 114 historically contaminated sediments: Part 1. Kow values. *Environ Toxicol Chem.* 25:2901-2911.

³ Ghosh U. 2007. The role of black carbon in influencing the bioavailability of PAHs in sediments. *Hum Ecol Risk Assess.* 13: 276-285.

⁴ Jonker MTO, AM Hoenderboom and AA Koelmans. 2004. Effects of sedimentary sootlike materials on bioaccumulation and sorption of polychlorinated biphenyls. *Environ Toxicol Chem.* 23: 2563–2570.

⁵ Mayer P, TF Parkerton, RG Adams, JG Cargill, J Gan, T Gouin, PM Gschwend, SB Hawthorne, P Helm ,G Witt, J You, and B Escher. 2014. Passive Sampling Methods for Contaminated Sediments: Scientific Rationale Supporting Use of Freely Dissolved Concentrations. *Integr Environm Assess Manag.* 10: pp. 197–209.

and tissue. If porewater concentrations are lower than predicted based on generic partitioning coefficients, then bioavailability of sediment-associated HOCs are also expected to be lower. Because of the importance of taking into account site-specific bioavailability, EPA's Equilibrium Partitioning Sediment Benchmarks (ESBs) should be included as a sediment chemistry line of evidence.^{6,7,8} Use of these benchmarks is preferred in order to account for site-specific differences in bioavailability.

In addition, the option should be provided in Tier 2 to use passive samplers to measure the freely available concentration of HOCs in sediment, an approach that has been strongly endorsed by the EPA⁹ and the scientific community.¹⁰

The Gobas and Arnot Model (2010) is used to calculate biota-sediment accumulation factors (BSAFs) for Part 2 SQOs to protect human health. Because Gobas and Arnot (2010) states that concentrations of freely dissolved contaminants in surface water and porewater should be used in calculating BSAFs¹¹, the guidance should clearly state that passive samplers can be used to measure concentrations of freely dissolved contaminants in surface water and porewater. In addition, since higher level consumers are expected to receive most of their dose via ingestion of food, the guidance should clearly state that measured concentrations of contaminants in prey can be used in site-specific food chain models.

Recommendations: (1) EPA's Equilibrium Partitioning Sediment Benchmarks (ESBs) should be allowed to be considered in the sediment chemistry line of evidence. (2) Guidance should clearly state that 1) passive samplers can be used to measure site-

⁶ U.S. Environmental Protection Agency. 2005. Procedures for the derivation of equilibrium partitioning sediment benchmarks (ESBs) for the protection of benthic organisms: Metal mixtures. EPA 600/R-02/011. Technical Report. Washington, DC.

⁷ U.S. EPA. 2003. Procedures for the Derivation of Equilibrium Partitioning Sediment Benchmarks (ESBs) for the Protection of Benthic Organisms: PAH Mixtures. EPA-600-R-02-013. Office of Research and Development. Washington, DC 20460.

⁸ U.S. EPA, 2008. EPA/600/R-02/016 PB2008-107282. March 2008. Procedures for the Derivation of Equilibrium Partitioning Sediment Benchmarks (ESBs) for the Protection of Benthic Organisms: Compendium of Tier 2 Values for Nonionic Organics. EPA/600/R-02/016. PB2008-107282. March 2008.

⁹ U.S. EPA/SERDP/ESTCP. 2017. Laboratory, Field, and Analytical Procedures for Using Passive Sampling in the Evaluation of Contaminated Sediments: User's Manual. EPA/600/R- 16/357. Office of Research and Development, Washington, DC 20460

¹⁰ Lydy M, PF Landrum, AMP Oen, M Allinson, F. Smedes, AD Harwood, H Li, KA Maruya, and J Liu. 2014. Passive Sampling Methods for Contaminated Sediments: State of the Science for Organic Contaminants. *Integr Environ Assess Manage*.10: 167–178.

¹¹ Gobas FAPC and JA Arnot. 2010. Food web bioaccumulation models for polychlorinated biphenyls in San Francisco Bay, California, USA. *Environ Toxicol Chem*, 29: 1385–1395.

specific concentrations of freely dissolved contaminants in porewater and surface water, and 2) measured concentrations of contaminants in prey can be used in site-specific food chain models.

8. Significant uncertainty is introduced by the use of a relatively small number of sediment samples and a generic BSAF to estimate site-specific tissue concentrations and corresponding site linkage factors.

The BSAF values derived by Gobas and Arnot (2010) were based on a dataset of ~1,284 sediment samples from San Francisco Bay. Even with this relatively large data set, the SCCWRP companion document¹² reported that the spatial variability of the measured PCB concentration in sediment was by far the largest contributor (81%) to the uncertainty in predicted tissue concentrations and corresponding BSAF values. Nonetheless, the authors asserted that their model-predicted tissue concentrations were in reasonable agreement with observed tissue concentrations. However, application of BSAFs derived on the basis of >1,000 sediment samples in one water body (San Francisco Bay) to a site-specific data set with far fewer sediment samples in another water body is unlikely to have similar predictive ability. This is because an estimate of the central tendency (and distribution) of tissue concentrations based on > 1,000 sediment samples is likely to be much more accurate than a prediction based on a minimum of 5 site sediment samples (as specified in Table 18 of the Amendments to the Sediment Quality Provisions document). Since predicted fish tissue concentrations will be strongly influenced by how accurately the available site data characterize the actual distribution of sediment concentrations, it seems unlikely that fish tissue concentrations can be accurately predicted from a minimum of 5 sediment samples. Also, because the Site Sediment Linkage categories are based on estimated tissue concentrations, the accuracy of the linkages is also highly uncertain.

Recommendation: The amendments should be adopted only after a more detailed analysis of the accuracy and variability of various input parameters, including but not limited to sediment concentrations, and the resulting accuracy and distribution of estimated tissue concentrations and corresponding Site Sediment Linkage factors. The SQO Provisions should clearly discuss the implications of over- or underestimating sediment concentrations.

9. The Site Sediment Linkage Categories for Tier 2 Evaluations should be clarified.

The degree to which measured concentrations of contaminants in fish tissue are “linked” to a site of interest is calculated via a site linkage factor. The site linkage factor was

¹² Bay S, AN Parks, AR Melwani and BK Greenfield. 2017. Development of a Sediment Quality Framework for Human Health Effects. SCCWRP Technical Report 1000. October 2017.

defined as the ratio of model-estimated tissue concentrations to measured tissue concentrations.

$$\text{Site Linkage Factor} = C_{\text{Est}}/C_{\text{Tis}} \text{ (see SQO Provisions at Section IV.2.d.4., p.27)}$$

Where

C_{Est} = estimated tissue concentration (based on model)

C_{Tis} = observed tissue concentration (based on site-specific data)

The SQO Provisions specify that a Monte Carlo simulation is used to generate a cumulative distribution of site linkage factors for the site. The Monte Carlo simulation uses the variability and uncertainty in the site-specific fish and sediment concentrations, the model BSAF, and the fish home range. The results of the Monte Carlo simulation are compiled into a cumulative distribution. Table 21 (Section IV.2.d.7, p. 29) defines how the cumulative distribution of site linkage factors is used to define overall site linkage.

Table 21. Site Sediment Linkage Categories for Tier 2 Evaluations

Cumulative % of sediment linkage distribution	Linkage threshold	Outcome
75%	<0.5	1. Very Low
50%	<0.5	2. Low
25%	<0.5	3. Moderate
25%	≥0.5	4. High

The categories above appear to be inconsistent. For example, if 75% of the distribution is <0.5, which is defined as Very Low, then the remaining 25% of the distribution would be ≥0.5, which would be defined as High. In fact, all of the distributions that fall into the Very Low, Low or Moderate categories, would also appear to fall into the “High” category since at least 25% of the distributions would be ≥ 0.5. These apparent inconsistencies should be resolved or clarified before adoption of the SQO Provisions.

Recommendation. The Site Sediment Linkage Categories should be revised and/or clarified.