

Response to Comments on the Draft British Columbia Director's Criteria for Contaminated Sites

Submitted to:

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Response to Comments on the Draft British Columbia Director's Criteria for Contaminated Sites

Reviewer 1

Stakeholders Comments from Public Works and Government Services Canada (Kingman)

General Comments

This letter is in response to the Ministry's request for comments by December 13, 2002, on the three draft documents recently prepared for British Columbia's Sediment Technical Committee:

- Director's Criteria for Contaminated Sites - Criteria for Managing Contaminated Sediment in British Columbia;
- Criteria for Contaminated Sites - Criteria for Managing Contaminated Sediment in British Columbia - Technical Appendix; and,
- A Guidance Manual to Support the Assessment of Contaminated Sediments in Freshwater, Estuarine, and Marine Ecosystems.

Public Works and Government Services Canada recognizes that provincial criteria do not apply to federally owned lands. The comments in this letter are provided solely due to the fact that federally owned land is occasionally divested and may subsequently fall under provincial jurisdiction. Public Works and Government Services Canada has significant concerns with respect to the development process, and the technical validity of the criteria and supporting documentation.

Response to General Comments

No response required.

Comment #1

The amount of time that has been provided to review the criteria and supporting documentation has not been sufficient.

Response to Comment #1

Reviewers were provided with nearly 50 days to comment on the Director's Criteria and supporting documentation. This review period is substantially longer than the minimum review period (30 days) that is required under the Contaminated Sites Regulation (CSR).

Comment #2

Consultation with stakeholders, including federal departments, has not been sufficient.

Response to Comment #2

There has been substantial consultation with federal departments during the development of the Directors Criteria and supporting documentation. In fact, Fisheries and Oceans Canada and Environment Canada have been involved in the development of the sediment quality criteria (SedQC) since 1997. In addition, all stakeholders were provided with an opportunity to review the documents and provide comments. Further opportunities for consultation will be provided in the future (i.e., through the implementation of a multi-stakeholder workshop, budget permitting).

Comment #3

The biological goals and endpoints used in developing the criteria must be more clearly stated.

Response to Comment #3

The document, *Development and Applications of Sediment Quality Criteria for Managing Contaminated Sediment in British Columbia*, provides a description of the sediment management objectives (SMOs) that have been established for contaminated sediment sites. These SMOs articulate the biological goals for these sites. In addition, this document describes the endpoints that were used to develop the SedQC. More specific guidance regarding biological endpoints measured in toxicity tests and in benthic community surveys has been provided in Ingersoll and MacDonald (2003).

Comment #4

The complete database used to derive the criteria should be made available for review, and the methods used to derive the criteria from this database must be more clearly described.

Response to Comment #4

The methods that were used to derive the SedQC are described in detail in the document, entitled *Development and Applications of Sediment Quality Criteria for Managing Contaminated Sediment in British Columbia*. Moreover, this document provides a summary of the results of predictive ability analyses for the SedQC presented in Table 1 of the Director's Criteria document. The database that was developed for deriving and evaluating the numerical SedQC is proprietary in nature. Nevertheless, interested reviewers can obtain all or portions of the database from MESL for an access fee. A similar database has been developed by the National Oceanic and Atmospheric Administration and will be available through U.S. Environmental Protection Agency in the near future.

Comment #5

The criteria appear to have very high false positive rates, and therefore may not be appropriate for use as clean up standards.

Response to Comment #5

The SedQC for typical and sensitive sites are intended to identify the concentrations of sediment-associated COPCs that are associated with a 50% and a 20% probability of observing toxicity to amphipods (i.e., in 10-d toxicity tests for marine amphipods and 28-d toxicity tests for freshwater amphipods). The results of the evaluation of their reliability indicates that the SedQC are generally consistent with their narrative intent. Therefore, the false positive and false negative rates are appropriate, given the narrative intent of the SedQC. These results are presented in *Development and Applications of Sediment Quality Criteria for Managing Contaminated Sediment in British Columbia*.

Comment #6

A biological testing alternative to use in place of the chemical criteria should be provided as part of the "Generic Criteria" approach. If sediments are determined to be non-toxic, it should be possible for a "certificate of compliance" to be issued.

Response to Comment #6

Under the CSR, proponents may adopt one of two approaches for assessing sediment contaminated sites, including the criteria-based approach and the risk-based approach. Biological testing represents a key element of the risk-based approach and ought to be utilized at large and/or complicated contaminated sites. A Certificate of Compliance will be issued to the proponent upon successful completion of remedial actions at the site, regardless of which approach is utilized.

Comment #7

It is necessary to provide performance standards for site-specific cleanup standards in terms of protectiveness and predictive accuracy, and allow alternative methods to be used in calculating site-specific standards that meet these performance standards.

Response to Comment #7

The sediment management objectives that have been established to guide remedial action planning at sediment contaminated sites are described in *Development and Applications of Sediment Quality Criteria for Managing Contaminated Sediment in British Columbia*. This document also described the procedures that may be used to establish site-specific sediment quality standards using the criteria-based approach. Landis *et al.* (1997) describe the procedures that should be used to conduct Tier 1 ecological risk assessments in the province. The Ministry is contemplating updating this document to further address sediments and various aquatic receptors (budget permitting).

Comment #8

It is necessary to provide a clear decision framework for determining whether a site is a sensitive contaminated site (SCS) or a typical contaminated site (TCS).

Response to Comment #8

The criteria for determining if a site is a sensitive contaminated site (SCS) or a typical contaminated site (TCS) are presented in Schedule 2 of Criteria for Managing Contaminated Sediment in British Columbia: Technical Appendix. It is anticipated that project proponents will acquire the information required to make such a determination during the Stage I PSI. The Ministry and/or its designates will review this information to determine if the designation is appropriate.

Comment #9

The existing documents do not recognize that in urban harbours, expectations that TCS zones will be small and limited to a single contaminated property are unrealistic.

Response to Comment #9

The Ministry understands that sediment quality conditions in urban harbours can be influenced by COPC inputs from many sources. Nevertheless, the owners/operators of each contaminated property are required to assess and manage contaminated sediments in a manner that is consistent with the CSR. Proponents are encouraged to utilize appropriate methods (e.g., evaluation of the distribution of key indicator

substances) to help delineate site boundaries in these situations. Where COPC mixtures are present and have widespread influence, the option of adopting a wide area strategy exists.

Comment #10

The approach for using the criteria to identify a contaminated site should be simplified and be consistent with the methods used to select and assess reliability of the numeric criteria.

Response to Comment #10

The document entitled, *Criteria for Managing Contaminated Sediment in British Columbia: Technical Appendix*, describes a simple statistical approach for determining if a site is contaminated, as defined under the CSR. It would be difficult to make this procedure any simpler. The logic for having these procedures consistent with the methods to developing and evaluating the SedQC is not clear.

Comment #11

The existing guidance material appears to have been developed for other purposes, and has a very strong bias towards freshwater.

Response to Comment #11

Additional guidance has been provided on estuarine and marine sediment assessments (*Guidance Manual to Support the Assessment of Contaminated Sediments in Freshwater, Estuarine, and Marine Ecosystems in British Columbia: Volume IV - Supplemental Guidance on the Design and Implementation of Detailed Site Assessments in Marine and Estuarine Ecosystems*).

Comment #12

Guidance is required in the area of risk assessment directly pertaining to sediment investigation and cleanup decisions under the Contaminated Sites Program.

Response to Comment #12

Guidance on conducting Tier 1 ecological risk assessments in British Columbia is provided in Landis *et al.* (1997) and BCMELP (1998). Also, see response to comment #7 from Reviewer 1.

Comment #13

Guidance must be provided to indicate when subsurface sampling is necessary; this should be based on the biologically active zone, the contaminant sources, and whether sediments could reasonably be exposed through sediment transport or anthropogenic activities.

Response to Comment #13

Under the CSR, proponents are required to characterize sediment quality conditions in both surficial and deeper sediments. This requirement ensures that sufficient information is available to characterize the conditions that ecological receptors are currently exposed to or could be exposed to in the future. Site-specific conditions will dictate the extent of sub-surface sampling needs to be conducted, but sampling to depths of at least 100 cm is required at all sites. This depth represents the depth that certain organisms burrow to in freshwater (i.e., chironomids; aquatic plants) and marine (i.e., bivalve mollusks) sediments.

Comment #14

Clear guidance must be provided on when, if ever, porewater sampling would be required as part of a site investigation.

Response to Comment #14

Section 4.4 of the criteria state that “the Ministry does not propose to adopt prescriptive guidance or rules for the evaluation of sediment pore-water at contaminated sites.” The Ministry supports the recommendations developed by SETAC (2003; Pore water Toxicity Testing: Biological, Chemical, and Ecological Considerations).

Comment #15

Before proceeding with further development or implementation of these criteria, it is requested that the Sediment Technical Committee hold a meeting with representatives from all federal departments who administer federal property in British Columbia, in order to discuss these and any other concerns.

Response to Comment #15

The Ministry convened numerous meetings with representatives of DFO and EC to discuss issues and concerns related to the SedQC. Moreover, the Ministry has provided other federal departments with an opportunity to review the SedQC and supporting documentation. In the future, federal representatives and other stakeholders will likely be offered an opportunity to discuss these and other issues at a multi-stakeholder workshop on the SedQC (budget permitting).

Reviewer 2

Stakeholder Comments from Maritime Forces Pacific (Department of National Defence; Duane Freeman)

General Comments

The following comments are intended a general summary of the technical review for the BC Draft Criteria for Contaminated Sites which consisted of 2 main guidance documents and 3 technical appendices.

Comment #1 - Technical Backup and Reliability Analysis

Department of National Defense was unable to complete its review and technical evaluation of the draft criteria due to the incomplete or missing technical documentation. The supporting technical documentation does not contain sufficient information concerning the methodology used to derive the criteria, the reliability analysis, the logistical regression modelling or the biological basis for the criteria. For example the SedQC_{SCS} values listed are not 0.6 x PEL as stated in the documentation, but rather appear to be the former AEL from the earlier draft. This is not clearly explained in the supporting documentation.

Response to Comment #1

The methods that were used to develop the numerical sediment quality criteria for sensitive sites and typical sites are described in detail in the report, entitled *Development and Applications of Sediment Quality Criteria for Managing Contaminated Sediment in British Columbia*. Based on the information contained therein, it is clear that the SedQC_{SCS} were calculated as 0.62 times the PEL and the SedQC_{TCS} was calculated as 1.2 times the PEL. The SedQC in *Criteria for Managing Contaminated Sediment in British Columbia* have been corrected to reflect the stated derivation procedure.

Comment #2 - Reliability of Chemical Guidelines as Proposed

The proposed criteria will result in very high false positive rates when used to determine contaminated areas and establish remediation boundaries. As a result, these criteria alone will be of limited use and inefficient in establishing when sediment is contaminated, but will result in classifying significant areas of harbour floor as "contaminated". For example, in the instance where 20 % of probability of effects (thus 80 % probability of no effect) is used for establishing SedQC_{SCS}, this will likely result in a corresponding 80 % of sensitive areas requiring unnecessary remediation. To avoid undertaking unnecessary cleanups proponents will be required to undertake significant additional environmental

investigations and studies. An alternative approach is necessary to ensure such criteria are more useful in establishing when sediment is above acceptable levels and directing the need for additional work.

Response to Comment #2

See response to comment #5 from Reviewer 1.

Comment #3 - Application of Biological Testing Alternatives

The "Generic Criteria" approach to determining whether sediments are toxic or require cleanup should include a biological testing alternatives in addition to the existing chemical guidelines. Such consideration is more consistent with the CCME interpretation framework (CCME 1995). In the instance where no adverse effects are observed with appropriate biological tests a site should not be considered "contaminated" and a full certification of compliance should be provided. Since site specific biological testing provides a more accurate determination of actual toxicity, compared to chemical guidelines based on toxicity measurements, they provide a higher-level accuracy and protectiveness. Proper guidance and appropriate tests and numeric interpretation guidelines will be required.

Response to Comment #3

See response to comment #6 from Reviewer 1

Comment #4 - Alternative Site-Specific Cleanup Standards

It is necessary to allow alternative methods for calculating site-specific standards that meet performance standards in terms of protectiveness and predictive accuracy. Non CCME methods such as SQGs based on benthic approaches are used in other provincial jurisdictions and are often more appropriate when other stressors are present (e.g., outfalls). By establishing performance standards and acceptable methodologies, desired level of protection and accuracy can be set that still will allow flexibility in calculating appropriate site-specific guidelines.

Response to Comment #4

See response to comment #7 from Reviewer 1.

Comment #5 - Determining Sensitivity Contaminated Sites and Typical Contaminated Sites

The criteria provided to distinguish between Sensitive and Typical contaminated sites is unclear, vague, contains conflicting information and will be difficult to interpret and implement. For example, the current definition of sensitive sites could be interpreted as encompassing all marine areas. It is unclear if TCS will be the default for urban areas as stated, or just specific smaller areas within SCS, as stated elsewhere. It is also unsure, what provincial or federal agency will provide input or approval to such a determination? A more formal framework that provides certainty to the proponent is required to clearly and quickly determine when a site is sensitive or typical.

Response to Comment #5

See response to comment #8 from Reviewer 1

Comment #6 - Identification of Contaminated Sites

The approach to identify a contaminated site appears to be overly complex and in one instance duplicate each other mathematically. The approach needs to be simplified and should be consistent with the methods used to select and assess reliability of the numeric criteria. It is recommended that contaminated sites be identified based the quotient method. The use of the SedQC-Quotients appears to be a better predictor of actual responses in bioassays and demonstrates a dose-response relationship.

Response to Comment #6

See response to comment #10 from Reviewer 1.

Comment #7 - Risk Assessment Guidance

The existing documentation does not provide sufficient risk assessment guidance for marine sediment investigations and cleanup requirements. Based on the conservative numerical criteria proposed, is likely that most proponents will utilize a risk assessment approach to address sediment contamination. Technical information contained in the supporting documents provided pertains almost entirely to freshwater sediments. This additional technical information is required prior to the finalization of the proposed criteria.

Response to Comment #7

See response to comment #11 and #12 from Reviewer 1.

Comment #8 - Subsurface Sediment Characterization

The need to characterize sediments to a depth of 100 cm is not clear and has not been sufficiently justified. There is a need for further practical guidance to determine when subsurface sampling is required. Such requirements should focus on the biological active zone, the type of sources at the site and whether sediments are likely to be exposed, based on existing water uses at the site and the natural characteristics of the environment.

Response to Comment #8

See response to comment #13 from Reviewer 1.

Comment #9 - Porewater Sampling Guidelines

It is unclear why the provision for collecting porewater samples is included in one of the technical documents when the requirement for such samples has been removed from the criteria. A clear and practical rationale for when pore-water sampling is required is necessary or it should be removed from all technical documents.

Response to Comment #9

See response to comment #14 from Reviewer 1.

Reviewer 3

Pottinger Gaherty Environmental Consultants Ltd. (Will Gaherty)

Comment #1

The standards should include clear instructions as to the calculation of mean SedQC_{SCS}-Q and mean SedQC_{TCS}-Q or just reference a paper, rather than a brief and cryptic summary and then reference to the literature. The instructions as now provided are unclear.

Response to Comment #1

Equations and an example which specifically describe how to calculate mean quotients are provided in Appendix 1 of the Technical Appendix document. In addition, citations of literature have been provided for additional detail.

Comment #2

In the mean SedQC-Q calculations, the denominator is shown as being 1, 2 or 3, corresponding to the number of classes of contaminants, however there are more than three classes of contaminants in Table 1. Is “n” limited to three classes, and if so, why? Perhaps the technical appendix could be beefed up in this area.

Response to Comment #2

Currently, the mean SedQC-Qs are calculated using information on the concentrations of metals, PAHs, and PCBs in whole sediment samples. The n is limited to the three classes of COPCs because this approach reflects the current state of the science (i.e., Ingersoll *et al.* 2001). The Ministry may consider other approaches in the future, once they have been published in the peer-reviewed literature.

Comment #3

On the matter of non-scheduled substances, it would be desirable to indicate what parameters were deliberately not regulated, if any (to differentiate them from those where insufficient data or resources were available to derive them). Nickel, for example, had criteria in previous drafts (nickel is also an interesting case because the standard for nickel in previous drafts was less than background concentrations of Fraser River sediments). Is it non-scheduled toxic, or just non-scheduled?

Response to Comment #3

As indicated in *Criteria for Managing Contaminated Sediment in British Columbia: Technical Appendix*, the Ministry should be consulted for guidance regarding the

significance of non-scheduled substances at a site. The additional guidance on the assessment of Non-Scheduled Toxic Substances (NSTS) is available from the Ministry and should also be consulted.

Comment #4

There is a problem with the footnote numbering in Table 1 (helpful feature of Word, no doubt).

Response to Comment #4

The footnotes in the tables in the *Criteria* document and in the *Technical Appendix* have been revised.

Comment #5

Guidance on actual sampling is going to be important for the interpretation of sample results to be consistent. For example, we have had MWLAP and FREMP express preferences with regards to subsampling of numerous increments of the top 100 cm of sediment and express frustration when results were in two or three increments rather than the requested five, but have consistently found that shallow sediments often do not lend themselves to sampling in discrete vertical intervals.

Response to Comment #5

The Ministry will continue to rely upon proponents to develop sampling programs that are consistent with the guidance provided. However, it is understood that site-specific considerations could require the design of monitoring programs that are not entirely consistent with Ministry guidance.

Reviewer 4

Transport Canada (1st Letter; Mike Langan)

General Comments

At the onset, our department would like to confirm that provincial sediment criteria do not apply to federal property and areas of federal jurisdiction. Our comments reflect our continuing programs to divest properties that will fall under the provincial regulatory regime. We have provided two sets of comments including one set of general comments related to urban harbours and another set related to small facilities. We have also provided similar comments to Environment Canada and Fisheries and Oceans Canada.

We recognize the significant effort made by BC MWLAP in preparing these draft criteria that represent significant improvement over the 1999 draft. However, Transport Canada still has considerable concerns with respect to the both the development process as well as the technical validity of the criteria and supporting documentation. We would recommend all of these comments be addressed prior to finalizing the proposed criteria and technical documentation.

Based on this initial review and analysis, we are concerned that the draft criteria, as proposed, contain fundamental deficiencies that will significantly impede their usefulness and appropriateness for managing sediments.

Within the time period allocated, we have prepared a number of comments concerning the draft criteria and the various supporting documents recently released, which are attached to this letter. In preparing these comments we have concentrated on assessing the impacts of the proposed criteria against data collected as part of our departments on-going environmental work. As part of these comments we have also begun to identify alternatives and suggestions to address these issues.

Below, is a summary of the main overall comments concerning the proposed criteria and supporting technical documents.

Comment #1

More time is required to fully review the proposed criteria and supporting documents to ensure their efficient and effective implementation. As in the past, Transport Canada would like to offer its assistance, extensive marine database and resources in conducting a peer based comprehensive review of the draft criteria.

Response to Comment #1

See response to comment #1 from Reviewer 1.

Comment #2

Based on our preliminary analysis of these requirements on various types of facilities, it would appear that these requirements would have a significant impact on the costs of conducting sediment investigations and remediation. In some cases the benefits to the environment are questionable. It would be advantageous to conduct a regulatory impact assessment on the proposed criteria.

Response to Comment #2

The current framework for assessing and managing sediment contaminated sites in British Columbia permits the application of two distinct approaches for establishing sediment quality standards, including the criteria-based approach and the risk-based approach. Proponents are permitted to select the approach that best meets their needs at a site. Due to the inherent flexibility in the framework, there is no need to conduct a regulatory impact assessment of the SedQC.

Comment #3

Alternative methodologies for establishing contamination, such as Sediment Quotients, appear to have a much greater degree of predictability and clear linkage between cause and effect than the criteria proposed, and should be incorporated.

Response to Comment #3

Use of quotients has been incorporated in the criteria.

Comment #4

It would be beneficial if further measures were undertaken to refine the Generic Criteria and avoid an anticipated increase in remediation and assessment costs. It would appear that the proposed Generic Criteria will result in a higher number of false negatives and result in a significant number of sensitive areas requiring unnecessary remediation, additional studies, disturbance and expenditure of resources, with no clear environmental benefit.

Response to Comment #4

See response to comment #5 from Reviewer 1.

Comment #5

Administrative procedures and supporting technical information contained in the criteria and technical documents for determining when sediment is contaminated are complex and

include conflicting directives. This will slow down site investigations and remedial efforts and require additional resources by all involved to resolve the ensuing conclusion.

Response to Comment #5

See response to comment #6 from Reviewer 2.

Comment #6

We would like to meet with you and your staff at your earliest convenience to review this material and discuss more specific comments. This would also provide an excellent opportunity to begin a full consultative process with affected government agencies and address the financial implications of complying with criteria of this nature. We look forward to future discussions and the opportunity to work with all government agencies to further refine these criteria to achieve cost effective and positive environmental impacts in our sediment management program.

Response to Comment #6

See response to comment #15 from Reviewer 1.

BC Draft “Criteria for Managing Contaminated Sediments in British Columbia: Comments related to Urban Harbours

Comment #7 - Regulatory Impact Assessment

An assessment should be conducted on the financial and other impacts of the proposed criteria would have on sediments in British Columbia. Based on Transport Canada initial evaluation, applying the proposed criteria to a variety of harbour facilities and conditions, it would appear these requirements would result in significant higher costs and efforts with conducting sediment investigations and remedial activities. It is further unclear if these efforts will have a corresponding benefit. A proper regulatory impact assessment should be conducted as part of the review of the draft criteria and technical documentation.

Response to Comment #7

See response to comment #2 from Reviewer 4.

Comment #8 - Technical Backup and Reliability Analysis

Transport Canada was unable to complete its review and technical evaluation of the draft criteria due to the incomplete or missing technical documentation. The supporting technical documentation does not contain sufficient information concerning the

methodology used to derive the criteria, the reliability analysis, the logistical regression modelling or the biological basis for the criteria. For example the SedQC_{SCS}, values listed are not 0.6 x PEL as stated in the documentation, but rather appear to be the former AEL from the earlier draft. This is not clearly explained in the supporting documentation.

Response to Comment #8

See response to comment #1 from Reviewer 2.

Comment #9 - Reliability of Chemical Guidelines As Proposed

The proposed criteria will result in very high false positive rates when used to determine contaminated areas and establish remediation boundaries. As a result, these criteria alone will be of limited use and inefficient in establishing when sediment is contaminated, but will result in classifying significant areas of harbour floor as “contaminated”. For example, in the instance where 20 % of probability of effects (thus 80 % probability of no effect) is used for establishing SedQC_{SCS}, this will likely result in a corresponding 80 % of sensitive areas requiring unnecessary remediation. To avoid undertaking unnecessary cleanups proponents will be required to undertake significant additional environmental investigations and studies. An alternative approach is necessary to ensure such criteria are more useful in establishing when sediment is above acceptable levels and directing the need for additional work.

Response to Comment #9

See response to comment #5 from Reviewer 1.

Comment #10 - Application of Biological Testing Alternatives

The "Generic Criteria" approach to determining whether sediments are toxic or require cleanup should include a biological testing alternatives in addition to the existing chemical guidelines. Such consideration is more consistent with the CCME interpretation framework (CCME 1995). In the instance where no adverse effects are observed with appropriate biological tests a site should not be considered "contaminated". Since site specific biological testing provides a more accurate determination of actual toxicity, compared to chemical guidelines based on toxicity measurements, they provide a higher-level accuracy and protectiveness. Proper guidance and appropriate tests and numeric interpretation guidelines will be required.

Response to Comment #10

See response to comment #6 from Reviewer 1.

Comment #11 - Alternative Site-Specific Cleanup Standards

It is necessary to allow alternative methods for calculating site-specific standards that meet performance standards in terms of protectiveness and predictive accuracy. Non CCME methods such as SQGs based on benthic approaches are used in other provincial jurisdictions and are often more appropriate when other stressors are present (e.g., outfalls). By establishing performance standards and acceptable methodologies, desired level of protection and accuracy can be set that still will allow flexibility in calculating appropriate site-specific guidelines.

Response to Comment #11

See response to comment #7 from Reviewer 1.

Comment #12 - Determining Sensitive Contaminated Sites and Typical Contaminated Sites

The criteria provided to distinguish between Sensitive and Typical contaminated sites, is unclear, vague, contains conflicting information and will be difficult to interpret and implement. For example, the current definition of sensitive sites could be interpreted as encompassing all marine areas. It is unclear if TCS will be the default for urban areas as stated, or just specific smaller areas within SCS, as stated elsewhere. It is also not clear which provincial or federal agencies has the responsibility and authority to make this determination. A more formal framework that provides certainty to the proponent is required to clearly and quickly determine when a site is sensitive or typical. Schedule 2 of the Technical Appendix is too general and puts responsible parties at the mercy of arbitrary third party decisions (e.g., municipal land use plans).

Response to Comment #12

See response to comment #8 from Reviewer 1.

Comment #13 - Identification of Contaminated Sites

The approach to identify a contaminated site appears to be overly complex and in one instance duplicate each other mathematically. The approach needs to be simplified and should be consistent with the methods used to select and assess reliability of the numeric criteria. It is recommended that contaminated sites be identified based the quotient method. The use of the SedQC-Quotients appears to be a better predictor of actual responses in bioassays and demonstrates a dose-response relationship.

Response to Comment #13

See response to comment #10 from Reviewer 1.

Reviewer 4 (continued)

Transport Canada (2nd Letter; Mike Langan)

General Comments

Transport Canada is very pleased to see the progress being made towards developing a framework for managing contaminated sediment and appreciates the time and effort that has gone into this initiative. Transport Canada has reviewed the draft Sediment Quality criteria proposed by your Ministry and would like to offer initial key comments for your consideration. This letter is one of two being sent by Transport Canada and relates to small sites; the second letter relates to urban harbour issues.

Please note that although provincial regulations do not apply federally, Transport Canada is often contractually agreeing to meet applicable provincial environmental laws in order to facilitate divestiture of our Public Port Facilities (PPFs). Transport Canada has tenure arrangements for provincial waterlots that are issued for PPFs. Transport Canada is in the process of transferring the operation of these PPFs and the assets located on these waterlots to new Port Operators under the principles established in the National Marine Policy. In order to achieve these transfers Transport Canada has agreed to terminate its tenure arrangements in order for tenure to be issued by the Province to the new Port Operator.

Comment #14

Evaluations utilizing the proposed criteria have been completed for six Transport Canada PPF sites and the results are attached for your information. Based on these evaluations and a review of the criteria documents, it is our opinion that deficiencies exist with the proposed framework especially as they apply to small sites. Given the importance of this issue, the criteria should not be implemented until these deficiencies are addressed.

Response to Comment #14

The ministry does not agree that deficiencies exist in the proposed framework as it applies to small sites. On the contrary, the Ministry is confident that the SedQC are directly applicable to small sites and provide a basis for expediting their assessment and management. The challenges referred to in the comment may be related to the sampling program designs that were applied at these sites.

Comment #15

Transport Canada's PPFs are within waterlots generally less than 1 hectare in area. The contamination typically found at these sites is different from that found at a high-risk site with significant volumes of impacted sediment and an easily defined source. The contamination at these sites is usually only found in isolated hot spots related to non-point

sources associated with the operation of the site, i.e., contaminants resulting from marine paints, casual boat maintenance, bilge water discharge, occasional dumping of materials, etc. The criteria do not allow for distinction between large contaminated sediment plumes and small discontinuous hotspots. Although the Technical Appendix acknowledges that caution needs to be applied when collecting samples with paint chips, solidified coal tar, etc. further guidance on sample preparation should be provided especially when these elements are observed. Despite any amount of caution being applied, inevitably a paint chip will skew a sample result. The criteria should allow for this issue to be addressed without prematurely considering the entire site contaminated.

Response to Comment #15

The challenges associated with design of sampling programs for small sites are similar to those that exist for large sites. In both cases, the goal of the sampling program should be to evaluate the nature, severity, and areal extent of sediment contamination.

Comment #16

It was evident through our review that the criteria fail to address creosote treated piles and the associated impacts to sediment. For example please refer to the data set provided for Saanichton Inlet (attached). Applying the criteria to this site would result in it being considered a contaminated site. This is based on one sample exceeding twice the SedQC for a PAH parameter. A review of the PAH signature for this sample clearly suggests that it is related to creosote, however the criteria does not allow for this distinction to be made.

Response to Comment #16

It is unclear to the Ministry why creosote contaminated sediments require special consideration. Creosote contains a number of substances that are known to be toxic to aquatic receptors, which is why it is used to treat pilings. Therefore, the SedQC are considered to be relevant to creosote-contaminated sites. Nevertheless, proponents may adopt the risk-based approach to the development of sediment quality standards for such a site. By adopting this approach, proponent may collect the information required to determine if creosote-contaminated sediments pose unacceptable risks to ecological receptors at the site. The Ministry recognizes the widespread use of such treated piles and their necessity. The Ministry has no plans to require remediation adjacent to such timbers or structures as long as the intended use and function by these structures remains. The Ministry has, on numerous occasions, recommended that sampling and analysis plans recognize these as sources and that proponents attempt to sample from within the halo of influence of these structures to avoid unnecessary bias.

Comment #17

The cost to collect subsurface samples down to 100 cm as suggested in the criteria would be significant given the remote location of many of Transport Canada's PPFs. Transport Canada questions the necessity and value of this sampling at depth. Clear guidance should be provided for when subsurface sampling is necessary, based on the biologically active zone, the type of sources at the site, and whether sediments could reasonably be exposed through sediment transport or anthropogenic activities.

Response to Comment #17

See response to comment #13 from Reviewer 1.

Comment #18

Transport Canada is concerned that the criteria may result in sediment being unnecessarily removed with a potential negative ecological impact. As acknowledged, at small sites the cost to collect detailed data needed to support risk assessments may often exceed remediation costs. In these cases many parties will choose to remove sediment, whether or not it is actually causing an effect. How does the Ministry propose to determine if impacts from remediation are more significant than leaving sediments in place? Especially for sites where no biological testing or data is available.

Response to Comment #18

As indicated previously, proponents may adopt the risk-based approach to the development of sediment quality standards for such a site. By adopting this approach, proponents may collect the information required to determine if contaminated sediments pose unacceptable risks to ecological receptors at the site. The risk-based approach also facilitates consideration of a range of remedial options based on the risks that they pose to ecological receptors, including leaving sediments in place.

Comment #19

Transport Canada is also concerned with the requirement that adverse effects on wildlife must be evaluated at all sites where bioaccumulative substances are present. It is inappropriate to require all sites, no matter how small or whether the site is responsible for the substance, to conduct a bioaccumulation investigation. An example of this is can be seen in the data set for Gold River PPF (attached) where dioxins and furans were measured due to the presence of a pulp mill on an adjacent property. The Ministry should develop some simple guidance to indicate when a bioaccumulation investigation is appropriate and who would be responsible for such an investigation.

Response to Comment #19

The Ministry requires an assessment of the potential for adverse effects at all sediment contaminated sites at which bioaccumulative COPCs were released into the aquatic ecosystems. If the COPCs were released from another source, then the goal would be to identify the responsible party and to take appropriate action to ensure that a proper assessment is completed. Although the tissue residue guidelines (TRGs; which were formerly termed tissue residue criteria; TRC) presented in Table 2 of the Director's Criteria document can be helpful in that respect, more comprehensive assessments may be needed at certain sites to assess the risks posed to ecological receptors associated with exposure to bioaccumulative COPCs. See Ingersoll and MacDonald (2003) for more guidance on conducting bioaccumulation assessments.

Comment #20

The criteria require Ministry consultation or approval at a number of stages and Transport Canada is concerned with the ability of the Ministry to deal with these requests in a timely manner. Transport Canada believes it is not the intention of the criteria to have Ministry resources tied up reviewing low-risk sites however in the current framework this is likely to be the case. This also does not seem to be consistent with recent recommended changes to the Contaminated Sites Regulations.

Response to Comment #20

The Ministry appreciates your concern regarding the use of its resources. The Ministry is moving to a new model that will influence its degree of involvement. Under the new model, the Ministry will require that sites make use of qualified professionals who are accountable for these sites. Licenced Environmental Professionals (LEPs)/Rostered professionals will have ultimate responsibility for oversight at lower risk sites.

Reviewer 5

Golder Associates Ltd. (Christine Thomas)

This letter documents Golder Associates Ltd. (Golder) comments on the recently released BC Ministry of Water Land and Air Protection (BCMWLAP) draft documents titled:

- Criteria For Managing Contaminated Sediment In British Columbia (referred to as CMCS, 2002).
- Criteria For Managing Contaminated Sediment In British Columbia – Technical Appendix (referred to as CMCS Technical Appendix, 2002).

Comment #1 - CMCS Framework and Approach

The framework and approach of the CMCS do not appear to be consistent with the direction suggested by the Advisory Panel on Contaminated Sites, in their Interim Report, dated September 3, 2002. The Advisory Panel calls for a redefinition of contaminated site based on “narrative” standards, requirement to remediate only if risk to human health or the environment exist, limit WLAP's involvement in review and approvals to high risk sites, and increased reliance on “experts” and their professional opinion. The approach and methods described in the draft CMCS are not consistent with a “narrative” remediation standard, they are prescriptive leaving little room for alternative approaches, and requires WLAP involvement in review and approvals at several different stages of the investigation (as described in the Technical Appendix).

Furthermore, given the technical guidance documents, protocols, etc. that have been developed for the CSR, it seems unnecessary to develop a separate set of guidance documents for sediment investigations (refer to Volume H - Design and Implementation of Sediment Quality Investigations). A better approach would be to revise the existing guidance documents (e.g. PSI and DSI) to include specific recommendations for sediment investigations. The guidance provided in the three companion Appendices is too general, sometimes duplicates, and often conflicts with existing documents. The information provided in these three documents should be considered as resource material for consideration by professionals conducting the work, however, it should be clear that alternative methods are equally acceptable.

Response to Comment #1

The ministry disagrees with this position. The application and intent for the sediment values offer consistency between the generic, site-specific, and risk-based remedial goals. Importantly, proponents can develop sediment quality standards using the generic criteria or using the risk-based approach.

Comment #2 - Criteria for Classifying A Site as Contaminated

The administrative rules for determining whether a site is potentially contaminated could be improved:

Rule #2: A concentration of greater than two times the applicable criteria, should trigger step-out investigation to determine whether the exceedance represents a "hot spot" or is part of a random distribution; rather than as a decision on whether the site is contaminated. This would be consistent with the guidance for soil investigation provided in reference to Technical Guidance #1.

Response to Comment #2

The existing framework for assessing sediment contaminated sites necessitates the identification of a site as contaminated if the SedQC for a substances is exceeded by more than a factor of two in one or more whole sediment samples. Upon designation of the site as contaminated, the responsible party would be required to conducted a Stage II PSI and/or DSI to better characterize the nature, severity, and areal extent of contamination. Step-out investigations from identified hot spots would be required as part of this follow-up investigation. This approach is consistent with previous Ministry guidance and ensures that follow-up investigations are appropriately designed and implemented.

Comment #3

Rules #3 and #4: The use of the mean quotients for sediment concentrations is interesting, and may have merit as a first "tier" numerical standard, especially for groups of chemicals such as PAH. However, it is unclear if this is a screen for potential additive/synergistic effects and if the procedure has been reconciled with the mode of toxic action. However, the calculation of the quotients currently has a flaw, insofar that the result can be "diluted" by the inclusion of results for additional chemicals that may not represent "primary contaminants of concern". A solution would be to exclude chemicals that are found at or near background levels.

Response to Comment #3

The procedures for calculating and evaluating the SQG-Qs have been reported in the peer-reviewed literature. The methods are currently being used in a variety of jurisdictions throughout North America and their use has been advocated in a recent publication from a SETAC workshop [Wenning and Ingersoll 2002. Use of sediment quality guidelines (SQGs) and related tools for the assessment of contaminated

sediments: Summary from a SETAC Pellston workshop. Pensacola Florida. SETAC Press].

Comment #4

In addition, if contaminants are grouped, the criteria for individual chemicals should then be changed to a different statistical level, for example the 50th percentile (meaning that up to one half of the samples can exceed the criterion for an individual chemical, as long as the rules for the mean quotients are met).

Response to Comment #4

The SedQC for sensitive sites and for typical sites are intended to represent the concentrations of COPCs that are associated with a 20% and 50% probability of being associated with sediment toxicity, respectively.

Comment #5

The notation used in the equations is confusing. The equations would be easier to understand if common mathematical notation was used (i,j,k).

Response to Comment #5

The equations are consistent with the descriptions of the quotients described in the peer-reviewed literature. See Appendix 1 of the Technical Appendix document for an example calculation of a mean SedQC quotient.

Comment #6 - Development of Site Specific Criteria

The ability to effectively apply site-specific numerical criteria, would expedite the investigation and remediation at contaminated sediment sites. Site specific criteria consider unique site conditions, potentially allowing for less intervention while still protecting human health and the environment. While site specific criteria are discussed, no recommended procedure is included for calculating site specific criteria (Companion Documents provide only general information). Guidance on acceptable methods and/or acceptable modifications of key parameters should be provided; alternatively "experts" should be encouraged to use defensible methods for setting site-specific criteria.

Response to Comment #6

The document entitled, *Development and Applications of Sediment Quality Criteria for Managing Contaminated Sediment in British Columbia*, provides guidance on the development of site-specific sediment quality criteria.

Comment #7

One potential method for calculating site specific criteria could be to use sediment toxicity information for sites with similar conditions. This could be best achieved by using the database used for the derivation of the proposed numerical criteria, however, we understand that the database is not publicly available (as discussed below).

Response to Comment #7

Agreed. The data contained in the SedTox database can be used to derive site-specific criteria. Proponents can access this information from the curator of the database (see response to comment #4 from Reviewer 1).

Comment #8 - Database Information and Availability

The description of the database (SEDTOX) used to derive the sediment quality criteria is insufficient. Information on how the database was assembled and quality assured, on the methods that were used to derive the criteria, and on the reliability analysis and the logistic regression modelling, should be included. The usefulness of the database for deriving site specific criteria is discussed above.

Response to Comment #8

The document entitled, *Development and Applications of Sediment Quality Criteria for Managing Contaminated Sediment in British Columbia*, provides information of the development of the project databases, the derivation of numerical criteria, and the evaluations that were conducted to determine their reliability.

Comment #9 - Tissue Residue Guidelines

Tissue residue guidelines are provided in Table 2. It is unclear, based on the discussion of these criteria in Section 4.3 (Technical Appendix) whether the Ministry expects that tissue will be collected for chemical analyses at all sites rather than leaving this data requirement up to the risk assessor.

Response to Comment #9

In general, tissue samples should be collected at all sites at which sediments are known or suspected to be contaminated by bioaccumulative COPCs.

Comment #10 - Risk Assessment Guidance

In addition, under Section 6.0 (Risk Based Standards) of the Technical Guidance, it is stated that the scale and scope of remediation can be legitimately reduced by demonstrating

to the Ministry 'that risks are less than or equal to those upon which the criteria are based'. Further clarification of this point is warranted since criteria have been developed based on a wide variety of data and are developed to be protective of a wide variety of environments. A risk-based approach includes the use of site-specific data and quite likely excludes data that would lead to more conservative remediation associated with less risk. In our view, separate guidance on how to conduct a sediment risk assessment, although useful, is not required. The CSR and other documents provide the necessary requirements for successful completion of a risk assessment by qualified professionals. Moreover, guidance regarding the application of a risk vs criteria based approach should also be left with qualified professionals.

Response to Comment #10

See response to comment #12 from Reviewer 1.

Comment #11 - Background Levels of Contaminants of Potential Concern

The Ministry notes that contaminated media must not be used as a reference for determining background concentrations. Establishing a reasonable background concentration for a contaminated site warrants a common sense approach. Clearly, a pristine environment could not reasonably be used for reference for sediments in a generally urban environment where pristine conditions could not, in reality, exist. Alternatively, pristine sediments could be used for evaluating the significance of environmental contamination in areas generally devoid of point source loadings and where pristine conditions might otherwise exist if not for the site in question. The suggestion that contaminated media must not be used as a reference also seems to conflict with the idea that different screening criteria apply to different 'types' of contaminated sites (i.e. SedQC_{TCS}, SedQC_{SCS}). Further clarification is warranted concerning the Ministry's position on this issue.

Response to Comment #11

The Ministry uses the following definition of reference sediment—a whole sediment near an area of concern used to assess sediment conditions exclusive of material(s) of interest. The reference sediment may be used as an indicator of localized sediment conditions exclusive of the specific pollutant input of concern. Such sediment would be collected near the site of concern and would represent the background conditions resulting from any localized pollutant inputs, as well as global pollutant input. This is the manner in which reference sediment is used in sediment assessments and in dredge material evaluations (ASTM 2003; USEPA 2000). Sediment tests include a control sediment (sometimes called a negative control). A control sediment is a sediment that is essentially free of contaminants and is used routinely to assess the acceptability of a test and is not necessarily collected near the site of concern. Any contaminants in control sediment are thought to originate from the global spread of

pollutants and do not reflect any substantial inputs from local or non-point sources. Comparing test sediments to control sediments is a measure of the toxicity of a test sediment beyond inevitable background contamination and organism health. A control sediment provides a measure of test acceptability, evidence of test organism health, and a basis for interpreting data obtained from the test sediments. A reference sediment is collected near an area of concern and is used to assess sediment conditions exclusive of material(s) of interest. Testing a reference sediment provides a site-specific basis for evaluating toxicity (ASTM 2003; USEPA 2000).

Comment #12 - Sediment Related Definitions and Sampling Guidance

Section 4.2.1 of the Technical Appendix, indicates that sampling will be required to define the different zones of sediment contamination (i.e., SedQC_{TCS}, SedQC_{SCS} and ambient SedQC). It is unclear how the SQG would be applied at a typical contaminated sediment site. The suggestion that the SedQC_{SCS} should be met outside the SedQC_{TCS} zone, and the SQG a further 10 m outside of the SedQC_{SCS} zone, implies a much broader area of investigation and potential remediation beyond that considered based on the criteria for a typical contaminated sediment site. It is important that unique conditions of sediment contaminated sites are reflected in the site designation. For example, harbours often represent "wide-area" sites, and sediment criteria zones for individual waterlots should in this context.

Response to Comment #12

See response to comment #9 from Reviewer 1.

Comment #13

The criteria apply to a depth of 100 cm unless the sediment is not stable. What is the justification for 100 cm as compared to for example 50 cm? Most sediment investigations involve collection of surface samples for ease of sampling and because the biological active zone is typically shallow. Sediment cores are appropriate for delineation of deeper contamination (if expected).

Response to Comment #13

See response to comment #13 from Reviewer 1.

Comment #14

It is assumed that the generic criteria indirectly include consideration of porewater concentrations, hence the absence of porewater criteria.

Response to Comment #14

See response to comment #9 from Reviewer 2.

Comment #15

Section 2.1 indicates that the sediment quality criteria were not expressly developed in consideration of materials such as paint chips, coal tar, hog fuel etc. It further states that criteria may be used at sites containing such materials; however the potential impacts are best addressed on a site-specific basis. It would be useful to provide some guidance regarding sampling techniques when these types of materials are present. For example, should the material be excluded from samples or if it is included in the sample and the analytical results are high, should the sample be excluded from the statistics.

Response to Comment #15

See response to comment #15 from Reviewer 4.

Comment #16

Inherent in many small craft harbours, marinas, public wharves and waterfront developments are creosote treated pilings. Although the CMCS does recognize that some level of contamination is expected with these types of operations, it does not specifically deal with creosote treated pilings. It is well documented that within 5 to 10 m of creosote treated pilings, PAH concentrations in excess of the applicable provincial and federal criteria/guidelines are expected. In theory an initial dilution zone around pilings could be considered, similar to dilution zones for an end of pipe wastewater discharge. The ministry should provide guidance on how site owners should approach investigation and potential remediation of their site when creosote treated pilings are involved. For example, would a site be considered contaminated if criteria were met except for adjacent to pilings (within an initial dilution zone)?

Response to Comment #16

See response to comment #16 from Reviewer 4.

Comment #17

As per the Ministry's suggestion, Golder Associates would welcome the opportunity of participating in a work shop on the issue of assessing contaminated sediments to discuss these issues further.

Response to Comment #17

No response required.

Reviewer 6

WLAP:EX (LMR CS Section Comments on Draft Sediment Documents; Alan W McCammon)

Comment #1

Criteria for Managing Contaminated Sediment in British Columbia (draft). *s. 5.1, pg 9: states that SedQC_{TCS} criteria can be adopted directly... where approved by the agencies and site specific numerical criteria can be adopted as remediation targets following review by the Ministry and/or federal agencies. Is the thinking that the federal agencies would provide this review/approval function at all non-high risk sites? I don't think we'll have staff to review anything but high risk.

Response to Comment #1

Input from both the federal and provincial agencies would go to the LEPs

Comment #2

Technical Appendix (draft) * s. 1.0, pg 5, last paragraph - title of criteria document referenced is inconsistent with that of P3 Draft (which is "Criteria for Managing Contaminated Sediment in British Columbia")

Response to Comment #2

The text has been modified to be consistent with the title of the document.

Comment #3

* s. 2.3, pg 8, last paragraph - advises that a sampling and analysis plan and associated quality assurance plan must be submitted to the Ministry prior to implementing the sampling plan. This level of ministry involvement seems incongruous with the ministry's service plan to only administer high risk sites.

Response to Comment #3

The Ministry will address high risk sites and the federal agencies may want to review the associated documentation. The LEPs will be responsible for the lower risk sites, however.

Comment #4

* s. 4.0, pg 11, Remedial Criteria: Is any level of contamination then acceptable below 100 cm (provided sediment bed is stable and no on-going transport of contaminants at depth into the shallower portions of the sediment bed...)?

Response to Comment #4

Yes, any level of contamination is acceptable below 100 cm provided the noted assumptions are validated.

Comment #5

* s. 5.4, pg 18, Criteria For Substances For Which Generic Criteria Are Not Available: References guidance on assessment of NSTS (WLAP 2002 in preparation) yet that draft NSTS package appears to specifically exclude sediments. This needs to be worked out.

Response to Comment #5

The Ministry will resolve this issue in the near future.

Reviewer 7

Peter Miasek - Imperial Oil

As you know, CPPI submitted comments, prepared on our behalf by Hemmera, on December 13 that raised numerous important points. Over the holidays, I reviewed the documents in more detail. Given below are additional comments not picked up by Hemmera that should be considered. By copy to Ted Stoner, please circulate to other CPPI members.

Director's Criteria Document

Comment #1

Section 2.0--As you know, the Minister's Advisory Panel (Interim Report, Sept 3/02) recommended redefining a contaminated site as one that posed an actual risk, not one that simply exceeded numerical standards. Thus the regulatory authority may, in the future, be altered.

Response to Comment #1

The SedQC for assessing and managing sediment contaminated sites in British Columbia are consistent with the narrative risk management goals established by the Ministry for aquatic receptors at contaminated sites. Any changes to these goals will be predicated on input from the Science Advisory Board.

Comment #2

Section 4.2--last para---Although I scanned the Ingersoll/MacDonald 2002 reference, I was unable to find procedures for calculating site specific numerical criteria. Perhaps more detail could be provided in the Tech Appendix on this important subject.

Response to Comment #2

See response to comment #6 from Reviewer 5.

Comment #3

Section 5.0--last para --Again, this definition of a "contaminated site" contradicts the Advisory Panel recommendation. Furthermore, this paragraph contradicts the Tech Appendix (e.g., Section 4.2.1) while gives rules based on 90 percentile, factors of 2 etc, not just a simple exceedance of a SedQC value.

Response to Comment #3

The text was revised to eliminate this inconsistency. However, further changes to the definition may be required once the new category model is advanced.

Comment #4

Section 6.0--last sentence--the most recent draft of the Directors Standard on NSTS that CPPI has seen provides no reference to non-scheduled substances in sediment. The reference to this document should be dropped.

Response to Comment #4

This is correct, the Director's Standard on NSTS does not reference non-scheduled substances in sediment. Reference to this document has been eliminated from the criteria documents.

Comment #5

Section 7.0--Title--this section discusses criteria for sites with elevated background. To avoid confusion, the title should be changed to "Elevated Background Levels....Concern". Otherwise the reader may get the impression that any risk-based standard requires cleanup to background.

Response to Comment #5

The text has been revised to eliminate confusion.

Comment #6

Section 8.0--the reference to 'additional factors (such as offsite impacts, etc)' is vague and unclear. Do you mean "potential for offsite impact"?

Response to Comment #6

Yes, the text has been revised appropriately.

Comment #7

There is no discussion on how to use Table 2.

Response to Comment #7

The text has been revised to provide guidance on how the tissue residue guidelines are to be applied.

Technical Appendix**Comment #8**

Section 4.1--the equation for mean SedQC_{SCS}-Q is confusing. And access to the Ingersoll 2001 paper may be difficult. A sample calculation would be of great assistance.

Response to Comment #8

An example calculation has been added in Appendix 1 of the Director's Criteria document.

Comment #9

Section 4.2, last para---This will supplement Hemmera's point #7. The requirement to show "a decline to near ambient SQG within 10 meters of the SedQC_{SCS} transition zone" is likely very unrealistic in urban water areas. In such urban areas, this appears to require that the proponent sample at great distances from their site, thus potentially encountering all sorts of other contaminated spots, from other sources.

Response to Comment #9

See response to comment #9 from Reviewer 1.

Comment #10

Section 5.4--see earlier comment on NSTS.

Response to Comment #10

See response to comment #4 from Reviewer 7.

Comment #11

Section 7.0--see earlier comment on adding the word "Elevated" to the Title

Response to Comment #11

See response to comment #5 from Reviewer 7.

Comment #12

Finally, I believe a workshop for proponents and consultants in this area would of value.

Response to Comment #12

No response required.

Reviewer 8

CRD, Environmental Programs (Laura Taylor)

Comments on the Proposed Criteria for Managing Contaminated Sediments in British Columbia

Comment #1 - Inter-Program Coordination

Recommendation: Provide a discussion of how the sediment and tissue criteria may be used by other Ministry programs, especially water quality and permitting. Provide specific details on how the criteria could affect permitted discharges under other regulations, such as the Municipal Sewage Regulation.

Discussion. There is currently no information on how the sediment and tissue criteria are related to or may be used by other departmental programs (i.e., water quality) or how they would be coordinated with other regulations within the Waste Management Act. Specific details on inter-program coordination should be provided. To avoid inter-program conflicts and unintended consequences, the document should be clear on how these sediment criteria are to be used in wastewater permitting and other departments. Otherwise, there is the possibility that some regulatory activities, such as source control and permitting, could create contaminated sites that would later have to be addressed by the clean-up program. To resolve this inconsistency and prevent future liability, the Ministry would need to provide an exemption from any future contaminated sites action along with any permits to discharge over these limits.

Key questions that remain: Could these criteria result in permit modifications for ongoing sources if a clean-up site is next to or overlaps with a permitted discharge? What if the clean-up site is the result of a permitted discharge that has an Initial Dilution Zone (IDZ)? If the clean-up standards are different from the standards applied by the water quality program, conflicts could arise. Specific concerns relate to certain statements in the Technical Appendix; in particular:

"the Sediment Quality Guidelines [CCME 1998] continue to represent the long-term targets for sediments in all areas, except those regulated under the CSR"

"The criteria are not intended to be applied or interpreted as thresholds to pollute up to, nor should they be interpreted as acceptable thresholds for ambient environmental quality outside of the boundaries of a contaminated site."

These statements fail to recognize the existence of IDZs permitted by the Ministry, and could be interpreted to endorse the CCME criteria for all areas outside contaminated sites, including areas near sources and within IDZs. This criteria document must at a minimum

recognize the fact that IDZs are permitted within which CCME criteria do not apply, and explain how these criteria may impact or interact with permitted IDZ sediment limits.

Response to Comment #1

The SedQC promulgated in the Criteria document are intended to be used for assessing and managing sediment contaminated sites only. They are not intended to be used in any other Ministry program. The contaminated sites regime relies on quantitation thresholds of toxicity (e.g., EC₂₀, EC₅₀) as opposed to NOAELs or more stringent values inherent in ambient criteria or objectives. As such, the contaminated sites regime does not recognize the use of initial dilution zones for contaminant attenuation. Although the Ministry does permit IDZs for surface water discharges, a number of conditions apply with these areas (i.e., acute toxicity is not permitted). The SedQC that have been established are not in conflict with the conditions that apply to the IDZs.

Comment #2 - Technical Backup and Reliability Analysis

Recommendation: A clearer discussion of the biological basis for the criteria should be presented in the Technical Appendix. In addition, the Technical Appendix should include complete details of how the database was assembled and quality assured, the methods that were used to derive the criteria, and the complete results of the reliability analysis and the logistic regression modelling demonstrating that the chemical criteria accurately and reliably represent the biological goals for the endpoints of concern.

Discussion. Although Section 3.2 currently provides some discussion of the narrative and reliability goals for the criteria, it is difficult to understand and unclear exactly what was used to select the final values. It is apparent that a fair amount of technical evaluation was conducted and provided to BC Water Land and Air Protection (MWLAP), Environment Canada (EC), and Fisheries and Oceans Canada (F&OC), but that this technical information has not been provided to the public for review in spite of repeated requests by various local and federal stakeholders dating back several years.

Full technical information should be made public, reviewed and discussed at a stakeholder workshop prior to these criteria being finalized. This information should include:

- Narrative and numeric biological goals that the criteria are intended to represent
- Target error rates (including both false positives and false negatives) or levels of uncertainty
- The complete database used to derive the criteria
- Methods used to assemble and quality assure the database
- A full description of methods used to calculate the criteria

- Complete results of any reliability or logistic regression analyses conducted

Should any of this information rely on other publications, these publications should be assembled on a CD or other information repository where they can be easily accessed by stakeholders. Subsequent to distribution of this information, the public should be given sufficient time to review and verify the results prior to a workshop. This is especially important since it appears there are errors in the document (addressed in more detail under Specific Comments). For example, the SedQC_{SCS} values listed in the criteria tables are not 0.6 x PEL as stated. Most are exactly the same as the old Level I values previously proposed which were AELs.

Response to Comment #2

The document entitled, *Development and Applications of Sediment Quality Criteria for Managing Contaminated Sediment in British Columbia*, provides much of the additional information that was requested.

Comment #3 - Uses and Reliability of Chemical Guidelines

Recommendation: Chemical guidelines should only be used as a first tier of a biological assessment, to screen areas that should undergo further biological testing. These criteria have very high false positive rates and should not be used to establish clean-up boundaries or set final clean-up standards for a site. Alternative chemical guidelines for benthic toxicity should be considered that have greater accuracy.

Discussion. The probabilities of adverse effects described in Section 3.2 of the Technical Appendix being used to set the SedQC_{SCS} and the SedQC_{TCS} are quite low and would result in a great deal of unnecessary clean-up. For example, the 20% probability of effects used to set the SedQC_{SCS} equates to an 80% probability of no effects. Therefore, if the SedQC_{SCS} criteria were used directly as clean-up standards for sensitive sites as envisioned and described in the criteria document, 80% of the sensitive areas would be cleaned up, dredged, or otherwise disturbed or destroyed for no environmental benefit. At the TCS level, this would be true for 50% of the areas cleaned up. It does not appear that these criteria effectively focus clean-up dollars on the areas that most need it and may actually cause needless destruction of sensitive habitats if used as described. The practical effect of this inefficient approach will be to force nearly all responsible parties into a risk assessment rather than using the criteria directly as clean-up standards. This is a particularly severe problem because essentially no guidance on conducting such risk assessments for sediments in the context of the Contaminated Sites program has been provided.

High false positive rates are problematic even when criteria are used as screening levels. Although exceedence of a chemical guideline may not immediately trigger clean-up action,

it will, at a minimum trigger, further biological testing and regulatory action. Site investigations can run into the millions of dollars before it is determined whether or not clean-up action is required. Agency staff can spend years overseeing site investigations (at some larger sediment sites, more than 10 years have passed prior to a final decision). Using very conservative values also creates an impression among public interest groups that these levels are actually toxic and raises expectations for clean-up that are costly and difficult to meet.

The CCME SQGs, because they are based on TELs, have even higher error rates than the proposed BC criteria. Therefore, they are inappropriate even as long-term targets for sediment quality. Simply because there are few effects observed below a particular value does not mean that effects will be observed above that value. The CCME and proposed BC criteria should be field-verified against actual effects data from the province prior to selecting these as targets for sediment quality.

Response to Comment #3

See response to comment 5 from Reviewer 1.

Comment #4 - Biological Testing Alternative and Interpretive Guidelines

Recommendation: Provide a biological testing alternative to use of the chemical guidelines as part of the "Generic Criteria" approach to determining whether sediments are toxic and require clean-up. Provide guidance on an appropriate suite of tests and numeric interpretation guidelines for each biological test. If sediments are determined to be non-toxic through biological testing, provide a full certificate of compliance.

Discussion. No chemical guidelines are perfect, and all SQGs currently in use still have significant error rates. There should be an option to conduct bioassay testing and/or benthic community analysis in place of chemical guidelines and demonstrate lack of toxicity. This approach would be far more consistent with the CCME interpretation framework (CCME 1995), as well as scientific consensus that sediment quality guidelines should be used as screening guidelines only, followed by biological testing to more accurately determine the actual toxicity of sediments at a site. As is clearly shown in Figure 2 of CCME (1995), SQGs are intended to be used only to identify the potential for biological effects during the screening step of the site investigation. If exceeded, the site investigation should be given the option to follow up with biological testing to confirm or refute this prediction. Please see the Biological Assessment section of CCME (1995) for more information on this approach. To date, no other provincial or state sediment quality programs have been adopted without a biological testing tier for interpretation of sediment toxicity.

To allow consistent interpretation of biological tests, numeric biological guidelines should be provided as an alternative to the chemical criteria. An example of a numeric biological guideline is as follows:

No more than 20% greater mortality in the 10-day amphipod bioassay compared to reference, where this difference is statistically significant ($p \leq 0.05$).

These biological guidelines would be used to interpret the results of the biological tests and should be the same guidelines used to determine hit/no-hit status in the original database used to derive chemical SQGs. Therefore, they would meet the same goals of protectiveness as the chemical SQGs. However, they would be more accurate since they would be actual measurements of toxicity at the site rather than SQGs derived from toxicity measurements. Because they are essentially more accurate versions of the SQGs, meeting these biological guidelines should be considered exactly the same as meeting the chemical SQGs in terms of protectiveness and regulatory status.

Demonstrating that biological guidelines are met should allow a regulated party to receive a full certificate of compliance. If no adverse effects are observed in appropriate biological tests, this indicates that the sediments are actually not toxic. It does not imply that there is a potential for toxicity that does not occur solely due to lack of exposure, as is assumed under the risk management alternative to site clean-up. Since there are no risks remaining at the site to manage, a conditional certificate of compliance should not be necessary.

Response to Comment #4

Section 6.0 of the Technical Appendix provides information on applying risk-based standards (e.g., site-specific toxicity tests). This option is available to all proponents and successful completion of remedial actions under this option does result in the issuance of a Certificate of Compliance. MacDonald and Ingersoll (2003a; 2003b) and Ingersoll and MacDonald (2003) provide additional guidance on how to determine if sediments are toxic or not (based on chronic laboratory toxicity tests or benthic community surveys). The proposed changes to the contaminated sites administrative regime will accommodate these concerns.

Comment #5 - Site-Specific Clean-up Standards

Recommendation: Provide performance standards for site-specific clean-up standards in terms of protectiveness and predictive accuracy, and allow alternative methods to be used in calculating site-specific standards that meet these performance standards.

Discussion. Non-CCME methods should be allowed for calculating site-specific clean-up standards, particularly at sites where conventionals may be a large part of the problem (i.e., wastewater outfalls). The CCME TEL/PEL approach relies on synoptic data sets

composed of sediment bioassays and chemical data and uses a fairly basic mathematical tool (constant percentiles across all chemicals) to calculate guidelines. More detailed and accurate mathematical methods and models are becoming available that should improve the reliability of SQGs over these older methods (i.e., Swartz 1995; Field *et al.* 1999; Michelsen 1999).

Benthic approaches to guideline derivation may be more appropriate and ecologically relevant for organically-enriched areas since they respond more directly to organic enrichment than bioassays. Most bioassays were originally designed for use in dredging programs, and were explicitly designed to minimize the effects of conventionals such as TOC and low DO on the response of test organisms. For this reason, SQGs based on bioassay data are not good predictors of toxicity at sites where conventionals play a large role in altering benthic communities. SQGs based on various benthic approaches are in use in other Canadian provinces, such as Ontario (OMEE 1993) and the Great Lakes states and provinces (NWRI 1998).

Consider providing performance standards (i.e., biological risk levels and error rates) that any site-specific guideline must meet, then allow a variety of methods to be used that provide the desired level of protection and accuracy (subject to Ministry review). There is no one method that is best for calculating guidelines; all have their strengths and weaknesses, and some are more applicable than others to certain types of sources. The bottom line should be a reliability analysis that demonstrates that the SQGs are protective and predictive of effects at the site.

To some extent, the Ministry has already moved toward this approach by assessing the reliability of PEL quotients and using logistic regression modelling. By doing this, the Ministry is moving away from reliance on a specific methodology and toward an approach that uses predictive reliability as the indicator of where the guideline should be set. It is not a large step from there to say that any reasonable method that improves the predictive reliability could be used, particularly when the nature of the site is such that bioassay-based methods may be unreliable.

Response to Comment #5

The methods that have been adopted by the Ministry are consistent with those of Swartz (1995). It is important to note that few sites will have sufficient data to implement the Field *et al.* (1999; 2002) approach. Therefore, it is not useful to recommend this approach for use on a site specific basis. Additionally, the approach that was developed by Michelsen (1999) has not been adequately evaluated on a site specific basis. For these reasons, the Ministry has chosen to rely on the selected methods, which are consistent with USEPA (2000), MacDonald *et al.* (2000), and Ingersoll *et al.* (2001).

The reviewer has described an approach to sediment quality assessment that is similar to the BEAST model that was developed by Environment Canada. It is important to note that this model has not been developed for freshwater systems outside the Fraser River Basin and does not apply to marine or estuarine sediments. Furthermore these biological approaches have not been adequately developed to establish criteria for clean up.

The risk-based approach provides a means of utilizing multiple types of data in assessments of sediment quality conditions, including benthic invertebrate community data. It should be noted, however, that benthic community data is not reliable in making estimates of effect concentrations in sediment primarily due to benthos responding to “conventionals” that can be accounted for in bioassays or in chemically-based SQGs.

Comment #6 - Sensitive Contaminated Sites vs. Typical Contaminated Sites

Recommendation: Provide a flowchart, scoring system, or other clear decision framework for determining whether a site is a sensitive contaminated site or a typical contaminated site. Recognize that in urban harbours, expectations that TCS zones will be small and limited to a single contaminated property are unrealistic.

Discussion. The criteria for distinguishing between the two sites have improved from the previously proposed version in that some criteria unrelated to risks from sediments have been removed and some of the more vague criteria have also been removed or clarified. However, there are still some criteria that seem vague and difficult to interpret, and the list provided, without any other decision framework surrounding it, may be insufficient to allow parties to objectively determine what type of site they have. Since this is the very first step in the site identification and clean-up process, it is important that it be relatively straightforward and easy to use.

As an example, one remaining guideline for a Sensitive Contaminated Site is "watercourses, wetlands, forested riparian areas, mudflats, and intertidal zones that are important to preservation of fish and wildlife." This could encompass almost anything. How does one determine what is "important to preservation of fish"? Left unanswered is who will decide which watercourses are important to fish and wildlife and how they will make this decision. Also, some of the information identified as being needed to determine if the TCS or SCS criteria apply seems unrealistic for most responsible parties to be able to reasonably obtain, especially at smaller sites. For example, "aquatic resource uses (i.e., utilization of habitats by fish, fish residence timing, fish and shellfish consumption by wildlife and humans, etc.)" Inclusion of such requirements, along with the relatively vague SCS criteria, may require consultation with resource agencies such as F&OC in order to

make a site determination. This could be problematic from several perspectives, including availability of F&OC staff, time required for review, and potential for over-protectiveness. It would be impossible for responsible parties to inventory and screen their properties on their own and determine whether they have potential sediment liabilities since they would not know which criteria to apply.

The SCS checklist should be simplified and provided with a clear flowchart, scoring method, or other objective approach that a responsible party can use to determine whether the SCS or TCS criteria apply. For example, a list of the features that would quickly identify a site as an SCS (i.e., presence of eelgrass beds, subtidal area used for spawning of rearing fish life stages, etc.) could be included.

Although the TCS is theoretically identified as the default for urban areas, reading the document more closely gives the impression that this is not really the case and that TCS zones will have to be approved by the Ministry in small areas within contaminated sites. More stringent standards (i.e., SedQC_{SCS} and federal ISQGs) are expected to apply outside these zones, however, this may be unrealistic in areas where there is harbour-wide contaminant transport and overlapping areas of contamination between adjacent sources and sites. Provision should be made for areas like Victoria Harbour, where the entire harbour exceeds ISQGs and SedQC_{SCS} levels, and the entire inner harbour exceeds SedQC_{TCS}. In these areas, larger TCS zones may need to be identified and there should not be an expectation that sediment concentrations will decline to the ISQGs outside of these zones.

Response to Comment #6

See responses to comment #8 and #9 from Reviewer 1.

Comment #7 - Identification of Contaminated Sites

Recommendation: Simplify the approach for using the criteria to identify a contaminated site, consistent with the methods used to select and assess reliability of the numeric criteria.

Discussion. There are now four separate methods for determining whether an area is a contaminated site, two of which relate to individual chemical concentrations and two of which relate to mean SedQC-Quotients. This approach may be overly complex; it is not clear that both approaches are needed, especially since one mathematically encompasses the other. It is recommended that the quotient method be used rather than comparison of individual chemical concentrations to criteria for two reasons. First, as discussed in Section 3.2 of the Technical Appendix, it appears from recent work done on a national level that the quotient approach is a better predictor of actual responses in bioassays and demonstrates a dose-response relationship with them. Second, it appears from the Technical Appendix that the logistic regression modelling used to select the multiple of the

PEL that set the criteria was based on the quotient approach. The PEL-Q approach is more likely to be predictive of effects in the field and hence, the Ministry should consider identifying sites on this basis.

Response to Comment #7

See response to comment #10 from Reviewer 1.

Comment #8 - Risk Assessment Guidance

Recommendation: Provide risk assessment guidance in the immediate future directly pertaining to sediment investigations and clean-up decisions under the Contaminated Sites Program. In the meantime, provide links to existing guidance documents that provide marine protocols and site investigation guidance.

Discussion. Because the false positive rates of the numeric criteria are so high, most responsible parties will choose the risk assessment approach. However, there is still little guidance on using this approach with sediments including which lines of evidence should be included, what metrics are available for marine sediments and how these lines of evidence should be combined in a decision framework for identifying sediments that require clean-up under the Contaminated Sites program. In spite of the title of the guidance documents made available along with the criteria, technical details contained within these documents pertain almost entirely to freshwater sediments. Yet, the majority of contaminated sites in BC are likely to be marine. Complete and up-to-date PEEP and PSDDA protocols for marine sediment investigations are available on-line which were developed specifically for Puget Sound and the Georgia Basin and should be referenced and made available to responsible parties and site managers working on marine sites.

In addition to these existing protocols, the Ministry needs to provide specific guidance on which of the many available elements of a site investigation it expects responsible parties to include in a site investigation, and exactly how each element will be used in making decisions about clean-up at the sites, as these Contaminated Sites-specific details are missing from the very general guidance documents provided so far. The guidance documents provided were clearly written for other purposes and have a strong US freshwater bias. Updating these documents and/or providing more specific guidance for the Contaminated Sites program should be completed concurrent with finalization of these criteria. The Ministry should not rely on upland risk assessment guidance, which is largely inapplicable to aquatic environments.

Response to Comment #8

Additional guidance on conducting assessments of sediment quality conditions in marine and estuarine ecosystems is provided in Volume IV of the Guidance Manual series. See response to comment #12 from Reviewer 1.

Comment #9 - Subsurface Sediments

Recommendation: Provide guidance for when subsurface sampling is necessary based on the biologically active zone, the type of sources at the site, and whether sediments could reasonably be exposed through sediment transport or anthropogenic activities.

Discussion. The Technical Appendix states that the criteria will be applicable to 100cm in depth, but does not state how a responsible party must demonstrate that. Since the biologically active zone in the Georgia Basin has been demonstrated to be approximately 10cm and this is also the practical depth limit of most grab sampling equipment, it is important to justify the need to conduct sampling any deeper than that. Otherwise, responsible parties would have to conduct core sampling at all sites, which would greatly increase the cost of field investigations and may be problematic at remote sites.

A concern about subsurface sediments is understandable under certain circumstances; for example, when dredging is likely to occur in the future or if there is significant sediment transport or erosion possible. However, it would be more effective to address this on a site-specific basis rather than imposing this burden on all sites, the majority of which may be depositional and outside navigation lanes that require dredging. Some guidelines should be provided for when surface sampling (i.e., 10 cm) is sufficient and when core sampling is necessary to demonstrate compliance in subsurface sediments.

Response to Comment #9

See response to comment #13 from Reviewer 1.

Comment #10 - Porewater Guidelines

Recommendation: Provide clear guidelines on when, if ever, porewater sampling would be appropriate or required as part of a site investigation.

Discussion. It is appreciated that porewater criteria were removed from the documents as was the strict requirement for porewater sampling at all sites. However, the technical appendix still seems to indicate that collecting porewater would be desirable, while acknowledging all the problems with doing so. The reader is left unclear on when porewater sampling should be included in an investigation (presumably only in a risk

assessment context). A clear rationale needs to be provided for when these elements should be included in a site investigation, if ever.

Response to Comment #10

See response to comment #14 from Reviewer 1.

Specific Comments

Criteria for Managing Contaminated Sites in British Columbia - Main Document

General Comments

This main document should contain the approach for distinguishing between SCS and TCS sites and the approaches for identifying a contaminated site. All information needed to use the criteria should be briefly contained in this main document, while technical background information on the development of the criteria not actually needed to use them should be in the Technical Appendix. Otherwise it is not clear how to use the numbers contained in this document.

Response to General Comments

See response to comment #8 from Reviewer 1.

Comment #11

Table 1. Why have the values for pesticides changed so much from the previous version? Footnotes 1 and 2 at the end of the list should be 6 and 7.

Response to Comment #11

The values for pesticides were revised to ensure that a consistent approach was used to derive the SedQC for all pesticides. The footnotes in the tables in the Criteria and in the Technical Appendix have been revised.

Comment #12

Table 2. The TRGs listed here need some explanation in the text. Are these TRGs only for consumption by higher trophic levels? In other words, what about protection of the fish and shellfish themselves? Are these assumed to be protected by the benthic criteria? And if not, which value should be used - mammalian or avian - since neither one really applies?

Response to Comment #12

See response to comment #19 from Reviewer 4.

Comment #13

Page 7, Section 4.2. How does one determine at the outset that one has a typical benthic community? Wouldn't benthic sampling have to be conducted to determine that? What is the intention behind this statement, and what would be done if it was somehow determined that the benthic community was atypical?

Response to Comment #13

The document was revised to remove the confusion regarding this guidance.

Comment #14

Page 8, first full paragraph. The end of this paragraph provides essentially the only guidance currently provided for conducting a sediment risk assessment and references an EC20 value. How exactly is this EC20 value expected to be used? It would be helpful if some examples were provided. In addition, this seems consistent with the conceptual selection of a 20% probability of effects used to derive the SCS values, but is not appropriate for level of protection stated to be the goal of the TCS level as described in the Technical Appendix. Is the Ministry still considering the use of an EC50 risk level for TCS sites? If not, what would be the difference in risk assessment targets between the two types of sites?

Response to Comment #14

Description of the guidance for conducting Tier 1 ecological risk assessments is beyond the scope of this document. The reviewer is directed to Landis *et al.* (1997) and BCMELP (1998) for this information.

Comment #15

Page 9, first full paragraph. This statement is problematic as it implies that any sediments anywhere in the province that exceed these levels will automatically become Contaminated Sites. Should this statement be clarified? How does this apply to permitted sediment levels within IDZs?

Response to Comment #15

See response to comment #10 from Reviewer 1.

Comment #16

Page 9, Section 5.1, last paragraph. This statement is appreciated but requires some clarification. Does this mean that alternative methods could be used to derive site-specific clean-up standards if approved by the Ministry (i.e., non-CCME methods) - for example, the benthic approach developed in consultation with the Ministry by the Capital Regional District (CRD) to set site-specific sediment warning and effects levels for Clover and Macaulay Point outfalls? And whatever methods are allowed, could use of these methods lead to a full certificate of compliance?

Response to Comment #16

Three approaches have been approved for developing sediment quality standards in the province, including direct adoption of the SedQC, development of site-adapted sediment quality standards using the methods described in the *Development and Use of Sediment Quality Criteria for Sediment Contaminated Sites in British Columbia*, and the development of site-adapted sediment quality standards using the risk-based approach. Other approaches will not be considered.

Criteria for Managing Contaminated Sediment in British Columbia - Technical Appendix

General Comments

This document contains a lot of duplication of the main criteria document and in some places is inconsistent with it. Care should be taken to separate the topics of the two documents so that there is no confusion about where to find things and what is required.

Response to General Comments

The main criteria document is an abbreviated version of the technical appendix; therefore, duplication is to be expected. The inconsistencies between the two documents have been corrected.

Comment #17

Page 6, first paragraph. The last sentence of this paragraph needs to be clarified with respect to concentrations that may be permitted within IDZs. This comment also applies to the bolded statement on page 7, following the first set of bullets.

Response to Comment #17

Contamination of sediments within an IDZ is not permitted in British Columbia. Therefore, the SedQC apply within these areas.

Comment #18

Page 7, Section 2.3. This list of bullets should be carefully evaluated to determine how much of this information responsible parties and site managers are really likely to have before a site investigation is even begun. The burden should be on the resource agencies to provide this information on a regional basis, particularly items like the first, second, and seventh bullets.

Response to Comment #18

This list identifies the information that a proponent will need to collect during a PSI and DSI to conduct a defensible sediment quality assessment program at a contaminated site. It is the proponent's responsibility to acquire the necessary information.

Comment #19

Page 8, first bullet. Reference areas and concentrations would best be determined by the agencies or regional stakeholder groups through coordinated studies, rather than on a site-by-site basis.

Response to Comment #19

The Ministry will take this suggestion under advisement.

Comment #20

Page 8, third bullet. This bullet does not make much sense and confuses the site identification and clean-up criteria with hot spot criteria. A hot spot should be an area of highly concentrated contamination within a site. By definition, the site boundaries will be determined by exceedence of the SedQC_{SCS} or SedQC_{TCS} levels, so they cannot also serve as hot spot criteria. Not to mention that this approach would define most of Victoria Harbour as a hot spot.

Response to Comment #20

This requirement makes it clear that proponents need to collect sufficient data at their site to be able to distinguish where hot spots are located, where exceedances of the

SedQC occur, and where exceedances of the ambient SQGs occur. In this way, it will be possible to define site boundaries based on levels of sediment contamination.

Comment #21

Page 9, Section 3.2. This section should be replaced by a much more complete set of results of the reliability analysis and logistic regression modelling, as it is currently confusing and hard to follow. There appears to be two separate discussions and analyses here; first, a more traditional reliability assessment of false positives and false negatives and second, the logistic regression modelling. It is unclear from the discussion in the second paragraph of the reliability assessment what the results were, whether the criteria selected met the reliability targets chosen, or indeed, whether this was used at all in the end in setting the criteria.

The approach described for the reliability assessment of evaluating only false negatives for the SedQC_{SCS} and only false positives for the SedQC_{TCS} is inappropriate. This approach has been widely used (with some criticism) for two-tiered decision frameworks in which one set of criteria are used as a lower screening level while a second, higher set of criteria, are used as clean-up standards or exclusionary criteria in the same decision process. However, this is not how these two sets of criteria are being used in the BC Contaminated Sites program. Both sets of criteria are used in exactly the same way, as both screening criteria and clean-up criteria, but at different kinds of sites. For that reason, any reliability assessment of these criteria should include both false positives and false negatives for each criteria set. It is disingenuous to claim that both false positives and false negatives were within 25%, since it is highly unlikely that either set of criteria meets both of these goals and only one set of criteria will be used at each site.

Response to Comment #21

See response to comment #4 from Reviewer 1.

Comment #22

Page 10, second paragraph. Here, there is recognition that the EC50 target level is appropriate for TCS sites, but this recognition does not appear anywhere else that the risk-based approach is discussed, making it unclear whether the Ministry will accept this as a risk-based goal for TCS sites.

Response to Comment #22

No, the narrative sediment management objectives indicate that a tolerable effect level for typical sites and for sensitive sites is an EC₂₀. However, the SedQC for typical sites were established by determining the concentrations of COPCs that are associated

with a 50% probability of observing an EC₂₀, while the SedQC for sensitive sites were established by determining the concentrations of COPCs that are associated with a 20% probability of observing an EC₂₀. Therefore, risk-based standards must be derived using the same target effect level (i.e., EC₂₀).

Comment #23

Page 10, third paragraph. The claim that these criteria can predict both the presence and absence of toxicity is not supported by the information provided which tends to suggest the opposite. At the SCS level, there is only a 20% probability of effects, suggesting that the presence of effects is not well-predicted at these low levels. At the TCS level, there is a 50% probability of effects, which is not good predictive accuracy either for the presence or absence of effects - no better than random.

Response to Comment #23

This statement is not correct. The probability of observing toxicity to freshwater and marine amphipods is generally <20% when COPC concentrations are below the SedQC for sensitive sites. Above these values, the probability of observing toxicity to freshwater and marine amphipods is generally >50%. The probability of observing toxicity to freshwater and marine amphipods is even higher when COPC concentrations exceed the SedQC for typical sites, generally about 70%. Therefore, the SedQC do provide an accurate basis for predicting the presence and absence of sediment toxicity.

Comment #24

Page 10, bullets. The paragraph following the bullets is vague about how the results of the reliability assessment and the logistic regression modelling were actually used in setting the criteria. Detailed information and a rationale should be provided so that the decision process is transparent to everyone.

Response to Comment #24

The document entitled, *Development and Applications of Sediment Quality Criteria for Managing Contaminated Sediment in British Columbia*, provides much of the additional information that was required.

Comment #25

Page 11, Section 4.1. The goals of this section are puzzling. Because these criteria are used directly as clean-up criteria (not as screening criteria), it does not make sense to set

them so low that 80% of the time the area does not actually need cleaning up. Sensitive areas are particularly prone to damage from unnecessary disturbance, far more so than TCS sites, which are often routinely disturbed by prop wash, dredging and other in-water construction activities. Some consideration should be given to whether the criteria for sensitive sites should be set at a level that is more likely to exhibit actual adverse effects or the clean-up may cause more harm than good.

Secondly, it is not clear why the level of 0.6 PEL-Q was chosen, when Section 3.2 indicates that the target risk level of 20% effects would be associated with a PEL-Q of around 0.8 - 1.0. Finally, the values listed in the criteria tables for the SedQC_{SCS} are not actually 0.6 x PEL; they are in fact the same AEL values as were previously proposed. In most cases, 0.6 x PEL would be somewhat higher than the old AELs. These numbers should be adjusted upward until they actually meet the stated 20% goal (0.8 - 1.0 PEL), given that this goal is already quite low and may have unintended adverse consequences on the environment.

Response to Comment #25

See response to comment #23 from Reviewer 8.

Comment #26

Page 11, first bullet. How was the depth of 100cm chosen? In a depositional, non-navigational area, there should be no need to go below the top 10-15cm, within which well over 95% of the benthic organisms reside. These areas can also be expected to undergo natural recovery if sources are controlled.

Response to Comment #26

See response to comment #13 from Reviewer 1.

Comment #27

Page 14, sentence below box. This comment is unrealistic. Some provision must be made for urban areas where large areas of the harbour will exceed SedQC_{TCS}, and there may be overlapping sources of contamination that cannot all be addressed at once. The last paragraph on this page is even more problematic. Concentrations of contaminants in urban harbours cannot be expected to decline to TELs outside of designated contaminated sites and it should not be the responsibility of the party to address contamination from area-wide sources that may surround or impinge on his site.

Response to Comment #27

The Ministry is committed to implementing the SedQC consistently throughout the province. The fact that there may be multiple sources of COPCs within a waterbody does not obviate the need to address sediment quality conditions in the vicinity of each of those sources. In such situations, the Ministry supports the concept of identifying the responsible party or parties.

Comment #28

Page 15, second paragraph. Because several of these substances are global contaminants, they will exist in measurable concentrations at all sites, at some low level. However, it is inappropriate to require all sites, no matter how small, to conduct a bioaccumulation investigation. The Ministry should develop some simple guidance to indicate when a bioaccumulation investigation is appropriate based on comparisons to background concentrations (in sediments or ambient fish tissues), whether or not that chemical has ever been used or discharged from the site, and whether there are other obvious nearby sources. Because bioaccumulation is a large-scale issue, in most cases it will be best to conduct such investigations on an area-wide basis rather than at individual sites.

Response to Comment #28

See response to comment #9 from Reviewer 5.

Comment #29

Page 15, Section 4.4. This section currently leaves the reader unclear on what the Ministry will expect with respect to pore-water sampling. Clear guidance should be provided on when, if ever, this type of sampling would be required, and how the data would be interpreted.

Response to Comment #29

See response to comment #14 from Reviewer 1.

Comment #30

Page 29, Schedule 2. This checklist should be carefully assessed to determine whether it is realistic for a responsible party and/or site manager to easily evaluate these criteria prior to the start of a site investigation. Several of the criteria are still quite vague and could be applied to almost any water body (especially the second and third bullets). The Ministry should provide references for sources of information that will help parties identify whether

or not they are in these areas and ensure that these sources are accessible and easy to use. A few dry runs of this process might be helpful to identify any problem areas.

Response to Comment #30

The criteria presented in Schedule 2 need to be evaluated during the Stage I PSI, not prior to it. The proponent is responsible for acquiring the necessary information from the relevant sources to support a determination as to whether the SedQC for typical or sensitive sites apply.

Reviewer 9

Michael Geraghty - Hemmera Envirochem Inc. and Gary Mann and Patrick Allard, Azimuth Consulting Group

The province recently put forth sediment quality criteria for use in the assessment and remediation of contaminated sediment under the Contaminated Sites Regulation (CSR) in a document entitled Director's Criteria for Contaminated Sites - Criteria for Managing Contaminated Sediment in British Columbia (October 2002) and its accompanying Technical Appendix and guidance documents. These documents were developed by a technical committee consisting of representatives of the BC Ministry of Water Land and Air Protection (MWLAP), Environment Canada and the Department of Fisheries and Oceans (DFO). Both documents are comprised of nine sections with the Technical Appendix providing additional information relevant to each of the sections discussed in the Director's Criteria document.

Briefly, the sediment quality criteria (SedQC) consist of two levels SedQC_{SCS} (sensitive contaminated sites) and SedQC_{TCS} (typical contaminated sites) that differ in their degree of conservatism according to the sensitivity of the site in question. The SedQC_{SCS} are the most conservative and should be applied at sites with sensitive or unique habitats, and sites used by rare, vulnerable or threatened species. The SedQC_{TCS} are less conservative and were developed as the default criteria for use at most contaminated sites in BC.

The following are comments focussing on the approaches used for deriving the SedQC, the proposed administrative rules for their application, and the issues related to their implementation.

Director's Criteria for Contaminated Sites

Comment #1

This document states that these Director's Criteria have legal standing. Therefore the logical assumption would be that a "Determination" that a site is not a contaminated site can be made if the concentrations do not exceed the criteria and Certificate of Compliance (C of C) can be obtained for sites where contaminated sediments have been remediated. This needs to be clarified by MWLAP.

Response to Comment #1

Correct, the SedQC can be used to determine if a site is contaminated or to determine if a site has been adequately remediated.

Comment #2

Typically, many sites, especially petroleum marine sites, have both upland lots and waterlots. MWLAP should clarify if, for the purposes of obtaining a C of C, the upland lot and the waterlot must be considered together or can the two areas be remediated separately and have separate C of Cs.

Response to Comment #2

The two areas can be remediated separately, in which case two C of Cs will be issued. However, in such cases, the proponent may be required to agree to address concerns related to the waterlot and provide a schedule for doing so.

Comment #3

Criteria based approach is to be applied to sites with typical TOC, benthic community assemblages where the concentrations in sediments are above background. MWLAP have not made it clear what happens if these conditions are not met. MWLAP should clarify if the risk-based approach is then mandatory or is development of site-specific criteria mandatory.

Response to Comment #3

See response to comment #7 from Reviewer 1.

Comment #4

Section 5 of the Director's Criteria document states that the first step in applying the proposed SedQC at a particular site is to establish the designated use of the aquatic ecosystems at and nearby the site (i.e., to determine whether the sensitive or typical SedQC should be used and where). Currently, the delineation of the various zones for applying the SedQC_{SCS}, SedQC_{TCS}, and ambient sediment quality guidelines (SQGs) at a given site is apparently arbitrary and subject to approval by the "agencies" (see Section 4.2.1 of the Technical Appendix). The agencies need to be specified (presumably they are DFO, Environment Canada and MWLAP). It should also be clarified as to which one is the lead agency and whether or not all agencies have to agree. The timeframe and mechanism for approval also need to be outlined. It also does not state whether this approval is mandatory. If so, this reliance on agency approval will result in delays in project implementation at all stages (e.g., PSI, DSI, SAP/QAP for the risk assessment). MWLAP needs to provide specific a priori guidance on delineation of these zones in order to streamline use of the proposed SedQC.

Response to Comment #4

The criteria for determining if a site is a typical site or a sensitive site are presented in Schedule 2. The proponent is responsible for acquiring the information needed to make this determination. Although the required information will need to be acquired from several agencies, the Ministry will be responsible to reviewing and approving the determination made by proponent.

Comment #5

Section 7.0 of the Director's Criteria document states that "if the risk-based approach has been selected to support remedial planning then the risk levels associated with exposure to background concentrations of contaminants of potential concern (COPCs) in sediments become the applicable risk-based standard for the site." This sentence is somewhat confusing. This sentence could mean that if unacceptable risks are associated with the background concentrations then risk-based criteria developed for the site can be to the same level of unacceptable risk, or it could mean that background concentrations become the applicable risk-based criteria for the site. Also this section refers to the "applicable risk-based standard". MWLAP should be requested to clarify this language and whether these are criteria or standards.

Response to Comment #5

This language is included in the document to recognize that certain sites contain elevated concentrations of COPCs under natural conditions. At such sites, it will not be possible to implement remedial actions that would reduce COPC concentrations below such natural background levels. Therefore, the goal of an ecological risk assessment would be to assess the incremental risks to receptors at the site, with the risk levels associated with background conditions at the site becoming the applicable risk-based standard for the site.

Comment #6

Section 7 of the Director's Criteria document states that "Contaminated media must not be used as a reference for determining background concentrations." Comparisons to reference or background sediments are typically made to determine whether concentrations of certain contaminants at a particular site exceed those associated with the prevailing conditions of the area (i.e., ambient conditions). This information is used to make management decisions regarding the site since remediation to sediment quality exceeding prevailing conditions is not practical. Given that ambient conditions in developed parts of the coastline (e.g., harbours) can exceed either the SedQC_{TCS} or the SedQC_{TCS} due to a variety of reasons (e.g., non-point and point sources unrelated to the site), a comparison to uncontaminated media only may not be appropriate or relevant. Rather, the pattern of

contamination associated with the site should be used to determine whether there are or were on-site sources of COPCs, or whether the observed pattern is best explained by sources that are not related to the site in question. These factors should be taken into account by MWLAP in consideration of "background levels".

Response to Comment #6

See response to comment #27 from Reviewer 8.

Comment #7

Section 7 of the Director's Criteria document states that "the median...concentration... is used to establish numerical criteria." Use of the median concentration to determine whether a contaminant is a COPC is not defensible. By definition, the median value represents the concentration that will be exceeded by 50% of the background samples. Thus, even if there were no sources of contamination at a site, comparisons to the median background concentration should statistically result in exceedences for half of any samples collected at a site. MWLAP should give consideration to using only the 95th percentile concentration and taking into account the pattern of contamination (see above comment).

Response to Comment #7

Agreed. The Ministry will accept the 95th percentile concentration of COPCs as an estimate of the upper limit of naturally-occurring background concentrations. Such estimates must be based on data for at least 25 samples from uncontaminated sediments collected in the general vicinity of the site.

Comment #8

MWLAP has recently appeared to be more open to risk management of Special Waste sediments rather than specifying removal. Section 9.0 of the Director's Criteria document implies that this is no longer the case and that Special Waste sediments **MUST** be removed where practical. MWLAP should clarify if Special Waste sediments must be "removed" or is in-situ treatment acceptable.

Response to Comment #8

The Ministry is clear that sediments that qualify as special wastes must be removed to the extent feasible. The Ministry will review the information provided by proponents and make a determination as to the feasibility of removing the material.

Technical Appendix

Comment #9

Section 2.1 of the Technical Appendix states that the criteria should be applied with caution at sites with substrates where gravel, cobbles, hog fuel, logs, tires, slag, etc. are present. It does not state whether MWLAP or the other agencies have to be consulted under these circumstances.

Response to Comment #9

The Ministry should be consulted if proponents have any questions about the applicability of the SedQC.

Comment #10

In both Sections 4.1.1 and 4.2.1 of the Technical Appendix, reference is made to the SedQC being derived based on the probability of observing toxicity in freshwater and marine sediments. Specifically, the SedQC_{SCS} uses a P20 value and the SedQC_{TCS} uses a P50 value. While the P values indicate the numerical probability of observing an "effect", the degree of response (i.e., percent reduction in an endpoint relative to the laboratory control) used for defining the "effect" is not provided. Both the frequency and magnitude of effects are needed to understand the underlying protection goals of the criteria. This also has implications for interpreting toxicity test results as part of more detailed assessments (e.g., are the effects levels the same for sensitive and typical sites, or should they also use the different thresholds such as 20% response for SCS and 50% response for TCS?). MWLAP needs to clarify these issues.

Response to Comment #10

See response to comment #23 from Reviewer 8. MacDonald *et al.* (2002) evaluated the relationship between concentration and response for 100 whole-sediment samples collected in the Calcasieu Estuary, LA. The results of this evaluation showed that toxicity thresholds were similar regardless of whether frequency or magnitude of toxicity was considered. Therefore, only incidence of toxicity was considered for developing SedQC for contaminated sites in British Columbia.

Comment #11

In both the Director's Criteria document and the Technical Appendix, one of the main changes being proposed to the sediment chemistry screening process involves the use of screening quotients (SedQC-Q) to account for contaminant mixtures. MWLAP should provide additional information regarding 1) the added value of this tool for either

identifying COPCs or classifying sites as contaminated compared to screening based on individual contaminants (i.e., 90 th percentile and 2xSedQC), and 2) the technical basis behind averaging quotients within and among contaminant groups when individual contaminants may have vastly different dose-response characteristics and mechanisms of toxicity.

Response to Comment #11

The document entitled, ***Development and Applications of Sediment Quality Criteria for Managing Contaminated Sediment in British Columbia***, provides much of the additional information that was required. More information on the development and applications of the quotient approach is provided in MacDonald *et al.* (2000), USEPA (2000), and Ingersoll *et al.* (2001).

Comment #12

Has MWLAP given any thought to associate a degree of risk to various levels of SedQC-Q or mean SedQC-Q (i.e. if the SedQC-Q is > 10 is this a medium or a high risk site)?

Response to Comment #12

Not yet, but this suggestion will be taken under advisement.

Comment #13

Sections 4.1.1 and 4.2.1 of the Technical Appendix refer to the application of the SedQC_{SCS} and SedQC_{TCS} to a depth of 1 m in stable sediments and to a depth greater than 1m in unstable sediments. The mode of contamination (e.g., deposition of particulate-bound contaminants vs. groundwater plume from upland site) should be considered in evaluating whether subsurface sampling is required at a site. MWLAP should recognize that, pending the mode of contamination, coring, and the additional expense associated with it, may or may not be required. Consequently, further guidance should be provided for determining if and when subsurface samples are necessary.

Response to Comment #13

See response to comment #13 from Reviewer 1.

Comment #14

If contamination above the applicable SedQC is detected in deeper sediments (<1.0 m) but not in the overlying sediments, MWLAP need to state whether they would consider the site to be contaminated.

Response to Comment #14

A site with elevated levels of COPCs in deeper sediments is considered to be a sediment contaminated site. However, the measures that would be applied to address such contamination would differ depending on the potential fate of those COPCs.

Comment #15

If SedQC_{TCS} apply to most (i.e. "typical") contaminated sites, then it seems unreasonable that the SedQC_{SCS} should be applied to the areas immediately beyond the SedQC_{TCS} boundary if that area is not a "sensitive site". For example, if the site is in a working harbour, like many sites in BC, most or all of the sediments may be contaminated from other non-point sources in addition to those at the site. As such, the SedQC_{SCS} cannot realistically be applied to the area beyond the SedQC_{TCS} boundary since that area is not, by definition, "a sensitive site" and may be contaminated. MWLAP will need to clarify these questions.

Response to Comment #15

Agreed. The ambient sediment quality guidelines should be applied outside the boundaries of a typical contaminated site. It should be noted that a proponent is not required to take any action outside the boundaries of the site, once they have been established.

Comment #16

Tissue Residue Guidelines (TRGs) are being proposed for bioaccumulative substances. As stated in Section 4.3 of the Technical Appendix, these substances include metals and PAHs. However, with the exception of mercury, no TRGs are proposed for these chemicals. Notwithstanding, the collection of tissue data is being required for virtually all sites (i.e., presence and not magnitude of concentrations of a contaminant in sediment would trigger tissue sampling). This would represent a significant undertaking (with respect to both time and cost) at many sites (i.e., to ensure that these data are collected using proper study designs and target organisms), including those where no contaminants exceed the SedQC. MWLAP should consider the use of a tiered approach, which would rely first on the results of sediment chemistry screening, exposure pathway analysis and presence of receptors of concern before undertaking tissue sampling.

Response to Comment #16

Sampling to determine the levels of COPCs in the tissues of aquatic organisms is required at all sites at which the release of bioaccumulative substances has occurred or is suspected to have occurred. The TRGs should be used to assess the significance of the measured COPC concentrations, when they are available. Alternatively, the risk-based approach should be used to assess conditions at the site and develop sediment quality standards.

Comment #17

Section 5.3 of the Technical Appendix refers to a Table 3, but no Table 3 is present in the document.

Response to Comment #17

The reference to Table 3 has been eliminated.

Comment #18

In Section 6.0 of the Technical Appendix, MWLAP stresses that source control is a key step that needs to be addressed before cleaning up contaminated sediments. This is a laudable approach but does not take into considerations sites where the source is off-site and is not readily identifiable (i.e., the site is in a working harbour with multiple current and historic point and non-point sources and widely dispersed or ubiquitous contamination).

Response to Comment #18

The intent of this statement was to make it clear that sources at the site need to be controlled before cleaning up contaminated sediments.

Comment #19

There appears to be an inconsistency between the CSR and the recommended framework for assessing and managing SedQC (MacDonald and Ingersoll, 2002) in the use of the term Detailed Site Investigation (DSI). In the former, DSI is primarily intended to characterize contamination and serves as the foundation for both the standards-based and risk-based approaches to site management. However, in the latter, the scope of the DSI appears to have been increased to include the effects components that are normally part of the risk assessment process. MWLAP should clarify the definition and scope of the DSI to ensure consistency with past programs. These additional studies will significantly increase the

cost associated with investigating a site and do not appear consistent with the concept of a "criteria based approach".

Response to Comment #19

Under the criteria-based approach, the DSI would involve sampling and analyses to assess the magnitude and areal extent of sediment contamination. However, a broad range of information types would likely be collected under the risk-based approach. Again, proponents have the option to select the approach that is most relevant for their needs.

Comment #20

There are currently no SedQC proposed for EPHs. Would you recommend using the 1000 mg/kg CSR numerical soil standard as a screening tool for LEPHs and HEPHs? Do you happen to know the rationale for developing the number?

Response to Comment #20

No, the CSR numerical soil standard should not be used as a screening tool for LEPHs or HEPH. Rather, the Ministry is planning to develop a SedQC for EPHs as a high priority in the near term. At sites that are known or suspected to contain these substances, whole-sediment bioassays should be conducted to assess toxicity.

General Comments

The Minister's Panel on Contaminated Sites has recommended in their report that they feel that licensed environmental professionals (LEPs) should be given a greater role for addressing low and moderate risk sites and that the Ministry should only get involved in high risk sites. The frequent requirements in these documents for MWLAP and/or "agency" approval of items as basic as PSI sampling plans, will add significant delay and cost to investigating and remediating contaminated sediments. A qualified professional should not have any difficulty producing a suitable sediment sampling plan for a site. While we agree that MWLAP should be consulted where there are specific questions regarding a site that require clarification, the need for MWLAP or other agencies to "approve" a sampling plan does not appear to be in keeping with the spirit of the Panel's report. The process outlined in these documents seems overly prescriptive in nature and does not appear consistent with the current government's focus on results-based regulation.

Based on the work of Goyette and Brooks (1998), MWLAP have stated previously that their policy is to NOT require remediation of PAH contaminated sediments within the immediate area of creosote treated pilings. This policy does not appear to be reflected in the Director's Criteria. MWLAP need to clarify if this policy is still in place.

Response to General Comments

The Ministry is committed to implementing the recommendations provided by the Advisory Panel. As indicated, qualified professionals will be given latitude to design and implement PSI at low and moderate risk sites. Nevertheless, proponents are advised to consult with the Ministry when making determinations that affect the type or scope of the assessment that will be conducted at the site. This will help to avoid problems later when the Ministry or its designates audit the work that was completed.

References Cited

- ASTM (American Society for Testing and Materials). 2003. Standard test methods for measuring the toxicity of sediment-associated contaminants with freshwater invertebrates. E1706-00. *In*: ASTM 2003 Annual Book of Standards Volume 11.05. West Conshohocken, Pennsylvania.
- BCMELP (British Columbia Ministry of Environment, Lands and Parks). 1998. Recommended guidance and checklist for Tier 1 ecological risk assessment of contaminated sites in British Columbia. Prepared by Landis, W.G., A.J. Markiewicz, V. Wilson, A. Fairbrother, and G. Mann. Prepared for Industrial Wastes and Hazardous Contaminants Branch. Victoria, British Columbia.
- Field, L.J., D.D. MacDonald, S.B. Norton, C.G. Severn, and C.G. Ingersoll. 1999. Evaluating sediment chemistry and toxicity data using logistic regression modeling. *Environmental Toxicology and Chemistry* 18(6):1311-1322.
- Field, L.J., D.D. MacDonald, S.B. Norton, C.G. Ingersoll, C.G. Severn, D.E. Smorong, and R.A. Lindscoog. 2002. Predicting amphipod toxicity from sediment chemistry using logistic regression models. *Environmental Toxicology and Chemistry* 21:1993-2005.
- Ingersoll, C.G. and D.D. MacDonald. 2003. A guidance manual to support the assessment of contaminated sediments in freshwater, estuarine, and marine ecosystems in British Columbia. Volume 3: Interpretation of the results of sediment quality investigations. Prepared for the Environmental Management Branch. British Columbia Ministry of Water, Land and Air Protection. Victoria, British Columbia.
- Ingersoll, C.G., D.D. MacDonald, N. Wang, J.L. Crane, L.J. Field, P.S. Haverland, N.E. Kemble, R.A. Lindscoog, C.G. Severn, and D.E. Smorong. 2001. Predictions of sediment toxicity using consensus-based freshwater sediment quality guidelines. *Archives of Environmental Contamination and Toxicology* 41:8-21.
- Landis, W.G., A.J. Markiewicz, V. Wilson, A. Fairbrother, G. Mann. 1997. Recommended guidance and checklist for Tier 1 ecological risk assessment of contaminated sites in British Columbia: Review Draft. Pollution Prevention and Remediation Branch. Environmental and Resource Management Branch. Ministry of Environment Land and Parks. Victoria, British Columbia.
- MacDonald, D.D. and C.G. Ingersoll. 2003a. A guidance manual to support the assessment of contaminated sediments in freshwater, estuarine, and marine ecosystems, Volume 1: An ecosystem-based framework for assessing and managing contaminated sediments. Prepared for the Environmental Management Branch. British Columbia Ministry of Water, Land and Air Protection. Victoria, British Columbia.

- MacDonald, D.D. and C.G. Ingersoll. 2003b. A guidance manual to support the assessment of contaminated sediments in freshwater, estuarine, and marine ecosystems, Volume 2: Design and implementation of sediment quality investigations. Prepared for the Environmental Management Branch. British Columbia Ministry of Water, Land and Air Protection. Victoria, British Columbia.
- MacDonald, D.D., C.G. Ingersoll, and T.A. Berger. 2000. Development and evaluation of consensus-based sediment quality guidelines for freshwater ecosystems. *Archives of Environmental Contamination and Toxicology* 39:20-31.
- MacDonald, D.D., C.G. Ingersoll, D.R.J. Moore, M. Bonnell, R.L. Breton, R.A. Lindskoog, D.B. MacDonald, Y.K. Muirhead, A.V. Pawlitz, D.E. Sims, D.E. Smorong, R.S. Teed, R.P. Thompson, and N. Wang. 2002. Calcasieu Estuary remedial investigation/feasibility study (RI/FS): Baseline ecological risk assessment (BERA). Technical report plus appendices. Contract No. 68 W5 0022. Prepared for CDM Federal Programs Corporation and United States Environmental Protection Agency. Dallas, Texas.
- Michelsen, T.C. 1999. Principles for assessing the reliability of sediment quality guidelines. Letter to the Editor: *Human and Ecological Risk Assessment* 5(4):645-656.
- SETAC (Society of Environmental Toxicology and Chemistry). 2003. Porewater toxicity testing: Biological, chemical, and ecological considerations. R.S. Carr and M. Nipper (Eds.). SETAC Press. Pensacola, Florida.
- Swartz, R.C., D.W. Schults, R.J. Ozretich, J.O. Lamberson, F.A. Cole, T.H. DeWitt, M.S. Redmond, and S.P. Ferraro. 1995. PAH: A model to predict the toxicity of polynuclear aromatic hydrocarbon mixtures in field-collected sediment. *Environmental Toxicology and Chemistry* 14(11):1977-1987.
- USEPA (United States Environmental Protection Agency). 2000. Prediction of sediment toxicity using consensus-based freshwater sediment quality guidelines. EPA 905/R-00/007. Great Lakes National Program Office. Chicago, Illinois.