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Dispute Resolution Proceeding Pursuant to Administrative Settlement Agreement and Order on Consent for Remedial Investigation and Feasibility Study, US EPA Region 2 CERCLA Docket No. 02-2007-2009

EPA Region 2 Staff Statement of Position

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INTRODUCTION

By letter dated July 25, 2011, the Lower Passaic River Study Area ("LPRSA") Cooperating Parties Group (CPG) invoked dispute resolution under Paragraph 64 of the Administrative Settlement Agreement and Order on Consent for Remedial Investigation and Feasibility Study ("RI/FS Settlement Agreement") for the LPRSA. The dispute resolution concerns the July 11, 2011 letter issued by the U.S. Environmental Protection Agency (EPA), Region 2, disapproving the CPG's Risk Analysis and Risk Characterization ("RARC") Plan, and EPA's "Technical Memorandum, Fish and Crab Consumption Rates for the LPRSA Human Health Risk Assessment," provided on July 25, 2011.

After invoking dispute resolution in its July 25, 2011 letter, the CPG set forth the details of its objections in a letter dated August 9, 2011 from Robert Law, a letter dated August 12, 2011 from William Hyatt, and a Position Paper dated September 2011 prepared by AECOM.

On December 1, 2011, EPA and the CPG met to discuss the disputed issues. EPA proposed revisions to some of the comments in its July 11, 2011 letter. EPA sent an email on December 5, 2011 providing its recommended revisions in writing. On December 8, 2011, the CPG gave EPA some comments on the recommended revisions.

Initially, the CPG sought dispute resolution on nine issues related to the baseline human health risk assessment ("HHRA"), and two issues related to the baseline ecological risk assessment ("BERA"). Of these 11 issues, seven have been withdrawn from the dispute resolution process as a result of discussions between EPA and the CPG. In several instances, issues were resolved because EPA withdrew the comments to which the CPG had objected. In other instances, EPA proposed compromise language and it was accepted by the CPG. Where the CPG has accepted compromise language proposed by EPA, it has done so while continuing to voice objections to EPA's directions and has stated its intention to continue to correspond with EPA about its objections. Prior to January 13, 2012, the date of the dispute resolution meeting, EPA anticipates that a written statement of the resolved issues will be completed, memorializing the resolution of those issues for the record.

Set forth below is the position of the U.S. Environmental Protection Agency ("EPA"), Region 2, on the four issues that remain in dispute. The first three issues concern EPA directions with respect to the baseline HHRA: 1) direction to use a combined current/future scenario to evaluate exposure; 2) instruction to remove statements attributing to EPA the exposure scenarios and parameter assumptions; and 3) directions on fish and crab consumption rates and Fraction Ingested. The final issue concerns the BERA, and EPA's instruction to remove the word "urban" when it appears with "reference."

Relevant documents are attached hereto as exhibits, as follows:

Exhibit A:	July 11, 2011 letter from EPA to CPG and enclosed comments, disapproving CPG's RARC Plan and directing changes thereto ("July 11, 2011 EPA letter").
Exhibit B:	EPA "Technical Memorandum, Fish and Crab Consumption Rates for the LPRSA Human Health Risk Assessment," provided on July 25, 2011 ("Technical Memorandum").
Exhibit C:	July 25, 2011 letter from CPG to EPA, invoking dispute resolution.
Exhibit D:	August 9, 2011 letter from CPG to EPA, listing the 11 issues subject to dispute.
Exhibit E:	August 12, 2011 letter from CPG to EPA, providing written statement of the CPG's objections to the 11 issues subject to dispute ("August 12, 2011 letter").
Exhibit F:	AECOM "Position Paper: Review of USEPA Region 2, July 11, 2011 Comments on Revised RARC Plan for the LPRSA, Human Health Risk Assessment Issues for Dispute Resolution" ("AECOM Position Paper").
Exhibit G:	EPA Staff Recommended Revisions to Select Comments Disputed by CPG, transmitted by email on December 5, 2011.
Exhibit H:	CPG Comments on EPA Staff Recommended Revisions, transmitted by email on December 8, 2011.
Exhibit I:	December 15, 2011 letter from CPG to EPA, summarizing issues and stating whether or not each issue remains in dispute ("December 15, 2011 letter").
Exhibit J:	Table: Region 2 Sites with Swimming Scenarios ("Table of Swimming Scenarios").

I. ISSUE 1[1]

The first open issue is Issue 1 in the CPG's August 12, 2011 letter (Exhibit E), described as: "Directive to evaluate only one set of exposure assumptions representing a hypothetical future scenario" (Comments 100, 101, 102, 105, 130). The CPG provides more detail on this issue in both the AECOM Position Paper, in Issue 1 (Exhibit F, p.2) and in the December 15, 2011 letter in item 1 (Exhibit I).

CPG Argument

The CPG does not agree with EPA's direction to use the current/future scenario to represent both current and future site conditions, or EPA's rationale for this approach, and asserts that such an approach is contrary to EPA guidance. The CPG indicates that the document should "include a set of assumptions that reflect current conditions, in addition to assumptions used to reflect potential future conditions" (AECOM Position Paper, Exhibit F, p. 4). While acknowledging that the recommended revisions proposed by EPA (Exhibit G) clarify EPA's earlier comments, the CPG maintains that using only one scenario provides an "overly conservative and unrealistic vision of the river" (December 15, 2011 letter, Exhibit I, p. 3). The CPG states that using one

[1] The issues identified by the CPG are numbered differently in the August 12, 2011 letter (Exhibit E) and AECOM Position Paper (Exhibit F). The numbering of the issues in this document follows the numbering in the August 12, 2011 letter.

scenario for the LPRSA eliminates the ability to distinguish between the two time periods. As an alternative position, the CPG suggests that the two time periods be considered separately, but, to "streamline this approach," the current use could be focused on those activities for which the CPG believes that there is a clear difference between the current and future site conditions, such as those involving contact with sediment and surface water. The CPG states that because of the complexity and potential cost implications of site remediation the decision-makers and the public need to have a "complete and transparent assessment of the full range of potential site risks" (AECOM Position Paper, Exhibit F, p. 4).

EPA Staff Position

In the July 11, 2011 EPA letter (Exhibit A), EPA directed the CPG to consider one current/future exposure scenario, not a hypothetical future scenario as described by the CPG. EPA considers that a current/future exposure scenario is entirely appropriate for the LPRSA and that the approach proposed by the CPG is not necessary. Because all the current/future exposure assumptions are applicable to at least some individuals under current conditions over the entire 17.4 mile study area, the exposure pathways are complete.

Further, the current/future scenario is consistent with EPA guidance. EPA's *Risk Assessment Guidance for Superfund* ("RAGS") Part D (EPA 2001), specifically contemplates the possibility of using a "current/future" scenario when performing a risk assessment. The definition of "Scenario Timeframe" included in the Glossary in Appendix B provides a picklist of Current, Future, Current/Future, and Not Documented; these same choices are offered throughout the tables found in Appendix B (templates for identifying and summarizing risks). Consequently, the choice of a current/future scenario is appropriate under EPA guidance and has been used at many other sites within Region 2.[2]

The current/future exposure scenario is appropriate for the LPRSA because the exposure pathways and assumptions used are applicable to at least some individuals under current conditions over the entire 17.4 miles of the LPRSA. The types of exposure identified for the River –fishing, wading, boating, swimming – will not change in the future, although the potential number of individuals exposed to the River will likely increase as improvements are made to the Passaic River and the shoreline, making the Passaic River more accessible and more appealing. This will not change the risk posed by each exposure pathway for the Reasonably Maximum Exposure ("RME") individual, only the size of the population potentially exposed. In case this was unclear in its comments in the EPA July 11, 2011 letter, EPA staff provided clarifying language in its Recommended Revisions on December 5, 2011 (Exhibit G).

The crux of the CPG's disagreement lies in its assertion that there is a difference between the current and "foreseeable" future scenarios and pathways. As stated by the CPG, "the ability to distinguish between risks for these two time periods and provide a realistic estimate of current

[2] Sites at which the risk assessment has used a current/future scenario include the Hudson River, Olean Wellfield, Hopewell Precision, Mercury Refining, Monitor Devices, Pohatcong Valley, Peter Cooper Gowanda, Crown Vantage, Bog Creek, Consolidated Iron and Metals, Hiteman Leather, Robintech, Liberty Finishing, Brookhaven National Laboratories, and Alcoa.

site risk, is lost." (December 15, 2011 letter, Exhibit I, p. 3.) In contrast, EPA thinks that the identified pathways are already complete and that the future will bring only a change in the number of individuals exposed through those activities. For example, parks and boating facilities are already present; and there is clear documentation that fishing and boating activities are currently taking place in the LPRSA. Wading occurs in the context of boating, if not other activities, and there is anecdotal information that swimming occurs in the upper miles of the LPRSA.[3]

Although for some of these exposures, no site-specific information exists, and in some instances no usable general population studies have been done, EPA has proposed reasonable, if conservative, values based on available information. For example, the EPA recommended swimming exposure time of 2.6 hours/event is based on the default value provided in RAGS Part A (EPA 1989). That document identifies this value as a mean and not a high end value. Moreover, this value is consistent with the values used at other sites in the Region.[4] (See "Table of Swimming Scenarios," Exhibit J.) The other exposure parameters are either based on site-specific data (as with boating) or on reasonable assumptions about known uses of the River, and are consistent with those used at other sites in the Region. While the approach that EPA is taking in this risk assessment is appropriately conservative, it is not unreasonable as argued by the CPG.

EPA Response to CPG Objections to Specific Comments

In an effort to address the CPG's concerns and resolve Issue 1, EPA offered changes to its comments describing the rationale for conducting a combined current/future scenario. In spite of this revised language, the CPG is still disputing the changes that EPA has directed. The specific comments disputed by the CPG, and the EPA staff recommendations for the resolution of the dispute, are as follows:

Comments 100, 101, and 102:

These comments all relate to the CPG's RARC Plan, page 90, Section 3.3.4, Paragraph 3:

> As stated in USEPA's September 10, 2010 comments, the scenarios and exposure parameter assumptions are intended to capture exposures under a future site condition,

[3] Even in the absence of site-specific information about swimming, it is reasonable to assume that someone may swim in the river, and, thus, the risk posed to this individual should be evaluated. This approach is similar to that taken at most land sites, which, even when fenced, evaluate a trespasser scenario

[4] Note also that EPA technical staff does not expect that the swimming pathway will be a risk driver; at other similar sites, the consumption of contaminated fish has been the major risk driver. EPA has advised the CPG that if the risk assessment shows that the swimmer scenario is driving the risk, EPA will revisit the approach to this aspect of the risk assessment. The CPG interprets this offer as a demonstration that the values "are unrealistic and unsupported for the LPRSA under current, or for that matter, future site uses." (December 15, 2011 letter, Exhibit I, p. 3). However, EPA's offer proceeds from the conclusion that because the number of hours spent swimming is not anticipated to be a driving force in the risk assessment, further debate on this point is not productive.

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when parks and open spaces have been improved and expanded or developed at sites currently under other uses. Such improvements could make people more likely to visit and spend more time along the river. USEPA Region 2 has directed that the same set of scenarios and exposure parameter assumptions be used to assess both current and potential future baseline site risks. As a revitalized and redeveloped riverfront is not the current condition, this approach will lead to overestimates of current exposures. However, as directed by USEPA Region 2, the same scenarios and exposure parameter assumptions are used to account for both current and future site conditions.

EPA staff recommendation: This paragraph should be deleted and replaced with:

In accordance with USEPA Guidance (USEPA 1989b, USEPA 2001b), the scenarios and exposure parameter assumptions are intended to capture exposures under both current and future site conditions. All of the exposure pathways are currently complete. While expected improvements to the river and shoreline will likely increase the number of individuals utilizing the river, the exposure frequency and duration for some individuals already utilizing the river will not likely increase. As such, the use of combined current/future exposure assumptions is appropriate.

Comment 105:

This comment relates to the CPG's RARC Plan, page 92, Section 3.3.4.2, last paragraph:

Because the likelihood of swimming in the LPRSA depends on several factors, including access, riverbank type, adjoining land, and waterway uses, it may not be appropriate to include swimming as a potential exposure pathway throughout the river. The applicability of the swimming scenario throughout the LPRSA will be evaluated based on consideration of the above factors, as discussed in Section 3.3.5.

EPA staff recommendation: This comment, and Comment 104 (which the CPG disputed under Issues #3 and #8, now resolved), both relate to Section 3.3.4.2 of the RARC Plan. The entire section should be deleted and replaced with:

3.3.4.2 Swimmer

It is assumed that recreational users of the LPRSA may occasionally engage in swimming in the river. Recreational swimmers include children (1 to 6 years), adolescents (7 to 18 years), and adults (>18 years). Given the visible deterrents to swimming along large sections of the river, including the presence of trash and debris and the generally urban setting of the river, the exposure frequency and duration for swimming is assumed to be relatively low, both currently and in the future. To be clear, the number of exposed individuals will likely increase as improvements to the shoreline and river are made, but the exposure frequency and duration for some individuals already engaging in this scenario are not likely to increase. It is assumed that the current/future swimmer may be exposed to COPCs in sediment and surface water while swimming via:

- Direct Contact (incidental ingestion and dermal contact) with near shore river and mudflat surface sediment;
- Direct contact (incidental ingestion and dermal contact) with river surface water; and
- Inhalation of COPCs that may volatilize into outdoor air from exposed mudflat sediment and/or surface water.

Note that swimming is included in New Jersey's designated uses of the freshwater portion of the river from the confluence with Second River to Dundee Dam (RM 8 – 17), where the water has a classification of FW2-NT/SE2, though this stretch of the river frequently does not meet the standards associated with this classification. While the lower portion of the river is not currently classified as suitable for swimming, New Jersey can change the classification as conditions warrant. The applicability of the swimming scenario throughout the LPRSA will be evaluated as part of the risk assessment, as discussed in Section 3.3.5 of this report.

Comment 130:

This comment relates to the CPG's RARC Plan, pages 102-103, Section 3.3.4.8, "Sediment and Surface Water Exposure Frequencies," 2nd paragraph:

> The USEPA Region2-directed sediment and surface water exposure frequencies for each receptor scenario are summarized in Table 3-5. The exposure frequencies reflect an improved and more attractive LPRSA where recreational activities involving contact with water are common (e.g., 259 days/year surface water exposure for the adult boater, 39 days/year sediment exposure for the adult swimmer). Since these frequencies do not represent current site conditions, their use will lead to overestimates of potential risks.

EPA staff recommendation: The paragraph should be deleted and replaced with the following:

> Sediment and surface water exposure frequencies for each receptor scenario are summarized in Table 3-5. The exposure frequencies for the angler, swimmer, wader, and boater reflect both current conditions on the river, as well as future conditions after shoreline improvements laid out in municipal master plans are carried out. To be clear, the number of exposed individuals will likely increase as improvements to the shoreline and river are made, but the exposure frequency and duration for some individuals already engaging in these scenarios are not likely to increase. Adult anglers, swimmers, and waders are assumed to fish, swim or wade in locations where they would contact sediment and surface water once a week during the summer months (13 weeks/year), or 13 days per year, for the RME scenario, and once every two weeks, or 7 days per year, for the CTE scenario. Adolescent anglers, swimmers, and waders are assumed to be exposed to sediment and surface water 3 days per week during the summer months, or 39 and 20 days per year respectively for the RME and CTE scenarios. Anglers may catch fish on more days than is assumed here, but are not expected to contact sediment and surface water every day that they fish.

The surface water and sediment exposure frequency for the older child boater who canoes or kayaks is assumed to be equal to other recreational scenarios like swimming or wading, and is therefore assumed to occur 13 days/year for the RME scenario and 7 days/year for the CTE scenario.

Surface water exposure frequencies for the adult and teenage (14 to 18 years old) boaters are based on information provided by Passaic River boating clubs (PRRA 2010, Nereid Boat Club 2010). The rowing season extends from March through mid-November (37 weeks). Adult boaters row up to 7 days/week, for 1 to 2 hours/day; average frequency is about 3 to 4 times per week. Based on this information, for adult boaters the RME frequency is 259 days/year (7 days/week x 37 weeks/year) and the CTE frequency is 111 days/year (3 days/week x 37 weeks/year). For the teenage boaters, the high school rowing season primarily is from late February through the end of May, and sometimes includes rowing minimally in the fall. The high school teams row 5 to 7 days per week for 1 to 2 hours per day. Based on this information, for teenage boaters (14 to 18 years old) the RME frequency is 98 days/year (7 days/week x 14 weeks/year) and the CTE frequency is 70 days/year (5 days/week x 14 weeks/year).

Exposure to sediment for the adult and teenage boaters will occur with a much lower frequency than exposure to surface water. Rowing locations south of Dundee Dam launch from docks, so contact with the riverbank happens when rowers flip out of the boat and need to wade in to get back in. It is, therefore, assumed that sediment contact occurs once a month for the RME scenario and once every two months for the CTE scenario. Accounting for the length of rowing season (37 weeks for adults and 14 weeks for teenage boaters), the adult sediment exposure frequency is 9 days/year for RME and 4 days/year for CTE; the teenage boater exposure frequency is 4 days/year for RME and 2 days/year for CTE.

Summary of Issue 1

Based on the information available relating to the Passaic River, use of the current/future exposure scenario is appropriate. Although the number of individuals exposed will likely increase as the River improves, the exposure pathways for recreational activities are currently complete. The current/future scenario is consistent with guidance and has been used at other sites throughout the Region. While the estimated exposures for swimming, for which EPA does not have site-specific information, are conservative, they are within the range of exposure assumptions used at other sites within the Region. The other exposure parameters are either based on site-specific data or on reasonable assumptions about known uses of the River.

II. ISSUE 4

The second open issue is Issue 4 in the August 12, 2011 letter (Exhibit E), described as: "Directive to remove all statements attributing EPA as source of directed exposure scenarios and parameter assumptions as well as language that provided the technical basis for alternative

positions." (Comments 7, 78, 95 and 99). The CPG elaborates on this position in the AECOM Position Paper, where it appears as Issue 8 (AECOM Position Paper, Exhibit F, p. 14).

CPG Argument

The CPG's position is that EPA has no basis to instruct it to remove from the RARC Plan the various statements the CPG has inserted, to the effect that EPA has directed the CPG to use the identified exposures scenarios and exposure assumptions in the baseline HHRA. The CPG acknowledges that EPA and the CPG may not agree on methods and assumptions to be used in the baseline HHRA, but it asserts that "it is important and appropriate that key areas of dissent be acknowledged in this public document to provide transparency and proper attribution, precisely because they represent areas of uncertainty of which risk managers should be apprised for decision-making purposes." Similarly, the CPG opines that risk managers should be aware of the CPG's alternative positions, including its alternative point of view on the RME and the Central Tendency Exposure ("CTE") exposure parameters, and the basis for these alternative positions; and thus, it is necessary to include the CPG's positions. It also recommends that the RARC Plan should identify key areas where a range of values is plausible, present alternative positions that are technically justified and discuss the relative conservatism of the selected value or approach.

EPA Staff Position

Since the RARC Plan is subject to EPA review and approval, and the baseline HHRA must be conducted according to EPA requirements, it is unnecessary to reiterate in the document that EPA has directed specific exposure scenarios and assumptions. The RI/FS, although conducted by the CPG, is an EPA document and should reflect the Agency's decisions in a clear and unambiguous manner. EPA and the CPG have engaged in lengthy discussions about the baseline HHRA, and the differences between the two are well documented in the exchanges of emails and letters. The CPG can provide this context in its cover letters and other communications with EPA. Within the text of the RARC Plan, rather than providing transparency, the CPG's language introduces confusion for the reader.

EPA also does not agree that presenting alternative positions and discussing the relative conservatism of the selected value or approach, i.e., conducting sensitivity analyses, is necessary or advisable. Calculation of the RME and CTE scenarios will provide a type of sensitivity analysis. The CPG may discuss the difference between the risks calculated using each of these scenarios in the uncertainty section of the Risk Characterization.

EPA Response to CPG Objections to Specific Comments

In an effort to address the CPG's concerns and resolve Issue 4, EPA offered changes to its instructions in three instances. The comments identified by the CPG as subject to dispute were Comments 7, 78, 95 and 99, and EPA offered language in its Recommended Revisions affecting Comments 78, 95 and 99 (Exhibit G, pp. 7-8). EPA did not offer any revisions to Comment 7, which accurately sets forth EPA's general position on this matter:

> Since the entire RARC is subject to USEPA approval, the terms "directed for use by USEPA Region 2" or "USEPA Region-2 directed" are unnecessary specifications and should be deleted. Specific comments below provide many instances.

For Comments 78, 95 and 99, EPA offered revisions. In response, the CPG recommended another change to Comment 99 in (see Exhibit H) and indicated in its December 15, 2011 letter (Exhibit I) that if EPA would make the CPG's change, in the interest of moving forward the CPG would accept the EPA's revisions. Because EPA does not agree with the change, Issue 4 remains unresolved.

The comment that has prevented resolution of Issue 4 is:

> Comment 99:

This comment relates to the CPG's RARC Plan, page 90, Section 3.3.4, 2nd paragraph:

> The values to be used for each of the RME and CTE exposure parameters are those that USEPA Region 2 directed CPG to use, were issued as directives on November 5, 2010, and are representative of USEPA default values. These values are presented in this Revised RARC Plan. On September 10, 2010, USEPA Region 2 provided comments on CPG's Draft RARC Plan. USEPA's comments included specific scenarios and exposure parameter values to be used in the baseline HHRA. The exposure pathways, receptors, and parameter values were provided in tabular form following *Risk Assessment Guidance for Superfund (RAGS) Part D* format (USEPA 2001c). These tabulated scenarios and parameter values are included as Appendix C of this Plan.

EPA staff recommendation: The July 11, 2011 EPA letter (Exhibit A) instructed the CPG to delete the above paragraph. EPA agreed in its December 5, 2011 Recommended Revisions (Exhibit G) that the CPG may leave this paragraph in the RARC Plan, if it replaces the first sentence with the following two sentences:

> The values to be used for each of the RME and CTE exposure parameters are generally those that USEPA Region 2 directed CPG to use. All of EPA's directions are consistent with EPA guidance, practices, and policies for conducting risk assessments.

The CPG asked that the word "generally" be stricken from the first sentence of the EPA staff recommended revision, indicating that EPA has directed *all* of the exposure parameters for the CPG to use (Exhibit H, p. 8). EPA does not agree with this change: in December 2010, EPA and the CPG met to discuss the baseline HHRA, and as a result of that meeting, EPA agreed to changes in the sediment dermal adherence factor for children and the areas for dermal contact with sediment for both adult and child swimmers. These changes show that EPA has not unilaterally decided upon the exposure parameters, and the word "generally" is appropriate.

The comments that EPA has addressed, tentatively resolving the CPG's concerns specific to these comments, are Comments 78 and 95:

Comment 78

This comment relates to the CPG's RARC Plan, page 64, Section 3.3, 2nd paragraph, last sentence:

> While use of some default or surrogate assumptions will be necessary in the remedial decision-making process, USEPA guidance documents stress the importance of using data that represent the characteristics of the local population(s) and site when possible and appropriate (USEPA 1989a, b, 1991a, 1997b, 1998a, 2000a).

The July 11, 2011 EPA letter (Exhibit A) instructed the CPG to delete this sentence and replace it with:

> However, USEPA guidance (USEPA 1991a) also allows the use of default values developed by USEPA when there is a lack of site-specific data or consensus on which parameter value to choose, given a range of possibilities.

EPA staff recommendation: EPA has agreed in the December 5, 2011 Recommended Revisions (Exhibit G) the CPG may add EPA's sentence after the CPG's sentence, rather than replacing it.

Comment 95

This comment relates to the CPG's RARC Plan, page 82, Section 3.3.2, 1st paragraph, 5th sentence:

> At the direction of USEPA Region 2, an additional receptor (Worker) not identified in the PFD has been included as a potential receptor.

EPA staff recommendation: The July 11, 2011 EPA letter (Exhibit A) instructed the CPG to delete the phrase "At the direction of USEPA Region 2" but EPA has agreed in the December 5, 2011 Recommended Revisions (Exhibit G) to retract Comment 95. The CPG may retain the reference to "the direction of USEPA Region 2" in this sentence.

Summary of Issue 4

EPA has agreed that the CPG may retain language identifying EPA as the source of exposure scenarios and parameters in several specific instances. Beyond these instances, the CPG should not be allowed to incorporate language that casts doubt on the validity of the risk assessment, introducing confusion and excessive uncertainty. Accordingly, EPA's Comments 7, 78, 95 and 99, with EPA recommended revisions but without the CPG's proposed change to Comment 99, should be incorporated into the RARC Plan.

III. ISSUE 5

The third open issue is Issue 5 in the CPG's letter dated August 12, 2011 (Exhibit E), described as: "Fish and crab consumption rates and assumption of FI [Fraction Ingested] of 1" (Comments 110b, 110d, 111, 113, 114 and Technical Memorandum Fish and Crab Consumption Rates for the LPRSA Human Health Risk Assessment, EPA, July 25, 2011). The CPG provides additional details on this position in the AECOM Position Paper (Exhibit F), where it appears as Issue 4 and the December 15, 2011 letter, where it appears as item 5 (Exhibit I, p. 14).

CPG Argument

In its August 12, 2011 letter, the CPG states that the Technical Memorandum (Exhibit B) conveys fish and crab consumption rates that are not supported and that are not reasonable surrogates (Exhibit E, p. 4). The August 12, 2011 letter and subsequent communications indicate that EPA should have relied on the results from the Creel Angler Survey performed by Tierra Solutions in 2000-2001 ("Tierra CAS") as the only source of site-specific fish consumption information, and that EPA's dismissal of the conclusions from the Tierra CAS was not justified. The CPG submittals indicate that the Technical Memorandum contains a number of inaccuracies and is the result of "flawed scientific review and analysis" and that the studies upon which the EPA consumption rates are based are inappropriate (December 15, 2011 letter, Exhibit I, p. 5). Further, the CPG states that a FI of 1 should not be used and that RAGS Part A supports the use of a FI of less than 1. CPG recommends that the fish and crab ingestion rates be based on survey data that will be generated in 2011-2012 from a new site-specific CAS that the CPG plans to conduct for the entire LPRSA. In the interim, CPG recommends that the following consumption rates be evaluated for both fish and crab: 17.5 grams/day ("g/day"), multiplied by a FI value of 0.5 for the adult RME; and 7.5 g/day, multiplied by a FI value of 0.25 for the average or CTE.

EPA Staff Position

The Technical Memorandum fully supports the development and use of 44 g/day for the RME adult angler consuming fish and a rate of 32 g/day for consumption of crab. The CTE rates for the adult are 13 g/day for fish and 16 g/day for crabs. The ingestion rates for the adolescent RME individual are 29 g/day for fish and 21 g/day for crab consumption with ingestion rates for the adolescent CTE individual of 9 g/day for fish and 11 g/day for crabs. The RME values for the young child (1 to 6 years) are 15 g/day for fish and 11 g/day for crabs with ingestion rates for the CTE individual of 4 g/day for fish and 5 g/day for crabs.

None of the arguments made by the CPG require EPA to amend its position or conclude that the above consumption rates are incorrect. Also, there is no requirement that EPA adopt a FI of less than 1. EPA is confident that these consumption rates and the FI of 1 are valid, reasonable and appropriate for this risk assessment.

The Consumption Rates developed in the Technical Memorandum are appropriate

All of the documents that enumerate guidelines for evaluating potentially relevant consumption studies allow EPA a great deal of flexibility and professional judgment in making selections of criteria to use and weights to be assigned to them in developing consumption rates. The Office of Water, *Guidance for Conducting Fish and Wildlife Consumption Surveys* (EPA-823-B-98-007, November 1998) indicates that when more than one survey approach will provide the required information:

> ... the selection of an approach should be based on other considerations such as personal preference, past experience, available resources (funds and personnel), or consistency with other local, regional, or national surveys. This last factor is particularly important if the purpose of the survey is to provide data for comparison with the results of another survey.

Guidance for Conducting Fish and Wildlife Consumption Surveys, p. ES-2.

In addition, even if there is consensus on the criteria, different parties – EPA and the CPG—can apply the criteria and come to different conclusions.

The CPG has pointed to some uncertainties associated with fish and crab consumption surveys, including the surveys on which EPA's consumption rates are based. EPA agrees that there are uncertainties associated with consumption studies. There is no one perfect way to gather data on fish consumption; studies that provide a "snap shot" of ingestion on a given day may provide a weaker estimate of long-term ingestion rates, while longer term studies may have issues with accuracy of recall or other factors. EPA considered all of these elements in evaluating the available studies and in selecting those on which it could rely in developing consumption rates.

In this instance, EPA reviewed and discussed in the Technical Memorandum a range of studies and their associated ingestion rates, and ultimately based its analysis on what it considers the two most representative surveys available for estimating the RME and CTE fish and crab ingestion rates in the vicinity of the LPRSA: Burger (2002) and Connelly *et al.* (1992) as analyzed and applied in the externally peer-reviewed Human Health Risk Assessment for the Hudson River in TAMS Consultants 2000).[5] These were the only two that (i) provided enough information to

[5] The CPG argues that in relying on the Burger and Connelly papers to develop consumption rates, EPA contravened the agreement described in Term Sheet issue #5, which memorialized discussions between EPA and the CPG in December 2010 as follows:

> EPA to provide CPG with analysis of rates used in other HHRAs, published literature, and angler surveys, with a focus on Region 2. As part of analysis, CPG requests that:
>
> - Comparability of waterbody to LPRSA be considered,
> - Consistent and balanced criteria be applied to verify quality and defensibility of methods, results, and analysis of all cited studies,
> - Burger's and Tierra's surveys be included.

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calculate statistical distributions and (ii) were, at least in part, conducted in the NY/NJ Harbor Estuary. Notably, while some of the other New Jersey studies reviewed by EPA lacked the information necessary for EPA to calculate high end fish ingestion estimates, the mean values for fish consumption in those studies were higher than the 44 g/day selected by EPA for the RME.[6]

The CPG has pointed out what it believes are significant weaknesses in the Burger (2002) and Connelly (1992) studies that would preclude their adequacy in developing ingestion rates in the LPRSA.[7] While no study is perfect, EPA found that the information in these studies provided a reasonable basis for developing consumption rates in the LPRSA.

First and foremost, the Burger study was designed to identify anglers and fish and crab consumption. Most published studies examine only fish consumption, yet this study provided data on individuals that consumed fish, crabs, and fish and crabs together.[8] While the CPG distinguishes this type of a survey from others, as one that gathers information relating to the "sociological reasons" for angling (AECOM Position Paper, Exhibit F, p. 8), the Burger survey succeeded in gathering information on those individuals who are anglers and who consume fish and crab in or near the LPRSA. The EPA risk assessment is concerned with those individuals who are consumers – not non-consumers.

The Burger survey meets other of the criteria that EPA considered important in evaluating the various studies. For example, the survey area is representative of the area of concern, insofar as the Lower Passaic River is part of the integrated waterbodies on which Burger performed the survey, and captures a demographic that is consistent with the general area that includes the Lower Passaic River. The intercept method of survey utilized is one of many types of survey

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EPA's evaluation meets the criteria outlined in the Term Sheet: the studies considered are based in the larger Hudson-Raritan Estuary; EPA applied the criteria outlined in guidance in comparing the studies against one another; and EPA considered Burger's study and Tierra's CAS.

[6] The CPG disagrees with the statements in the Technical Memorandum that, based on the surveys available, fish consumption may be higher in coastal New Jersey than in other parts of the country. At least in part, the higher consumption shown in the New Jersey studies may be related to the fact that the surveys conducted by Burger and colleagues (Burger 2002, Burger *et al.* 1998, May and Burger 1996) were specifically designed to identify fish/crab consumption among anglers during the months when crabs and specific fish species are most available. The methodology was designed to identify potentially exposed individuals and this approach logically may lead to a higher consumption rate than would be expected if individuals that did not consume fish or crabs were considered in the calculation of the ingestion rate.

[7] The CPG asserts that the Technical Memorandum itself contains inaccuracies and uses a flawed methodology. After reviewing these assertions, in instances where the CPG provided supporting information, EPA staff continues to find the conclusions reached in the Technical Memorandum to be valid.

[8] In addition to attacking the studies used by EPA to calculate consumption rates, and the Technical Memorandum in general, the CPG specifically takes issue with the possibility that a crab would have 70g of meat, as assumed in the Burger study, rather than the lower range 40 to 45 g reported by the CPG and the New Jersey Department of Environmental Protection ("NJDEP"). Of course, the smaller the fish or crab, the greater the number that would have to be eaten to achieve the consumption rate. Although EPA has no definitive explanation for the difference between the 70 g assumption in the Burger study, and the lower weights reported by the CPG, it is possible that someone crabbing for consumption would not keep smaller crabs.

methodologies used to assess fish ingestion rates and is more likely to identify the population of concern, which consists of anglers who are fishing/crabbing within this area. Of substantial importance to EPA is the extensive outreach techniques and interview process used in Burger (2002), which is detailed in Kirk Pflugh, *et al.* (1999).[9]

The CPG questions the relevance of the Burger study, noting that it was not cited in the 2009 revision of EPA's *Exposure Factors Handbook* ("EFH"). However, the Burger study is included in the recently-issued 2011 revision of the EFH, eliminating this concern about its relevance. In summarizing the utility of the Burger study, the 2011 EFH states:

> The advantages of this study are that it provides information for both fish and crab intake, and that it provides data on intake over a longer period of time than many of the other studies summarized in this chapter. However, the data are for individuals living in the Newark Bay area and may not be representative of the U.S. population as a whole. Also, there may be uncertainties in long-term intake estimates that are based on recall.

Exposure Factors Handbook, p. 10-32.

While identifying the limitations of long-term intake estimates based on recall, the EFH does not conclude that the study cannot be used for this purpose. Further, it is useful to note that the Tierra CAS asked "how many times did you fish in this part of the Passaic River in the past month?" and "What months do you usually fish in this part of the river?" (Kinnell *et al.* 2007, Finley *et al.* 2003). Thus the Tierra CAS could also be said to suffer from recall uncertainty.

Among other complaints, the CPG argues that the Burger study did not gather key information relating to species or parts consumed, cooking methods or sharing of catch. While all of this information would be useful, its absence does not undermine the value of the data collected regarding the self-caught fish consumed. The CPG also argues that because the study did not include sample weighting, frequent anglers will be more heavily represented, resulting in an overestimation of the target population distribution. However, as noted above (fn 9), while sites were visited regularly and repeatedly, each individual was interviewed only once during the

[9] The Burger study was designed to interview people angling at locations in the Newark Bay complex from May 15 to September 15. All sites were visited on a regular basis throughout this period, and all people present were approached, although through the course of the study, each person was interviewed only once. The sites were visited on weekdays and weekends and at all times of day. The interviewers identified themselves as researchers from Rutgers University who were interested in fishing behavior, consumption, and reasons for angling and the opportunity was provided for individuals to learn about the survey and the results after the interview. The refusal rate reported was 3%, which is very low.

The study is part of on-going research conducted by Dr. Burger and colleagues in this geographic area. As stated in the paper by May and Burger (1996), the "interview protocol was approved on April 28, 1994 by the Rutgers University Institutional Review Board." Burger (2002) indicates the survey was based on previous surveys in the region (Burger *et al.*, 1999a; Kirk Pflugh *et al.*, 1999). As discussed in Kirk Pflugh *et al.* (1999), conducting in-person interviews at selected fishing locations greatly increases the likelihood of reaching urban anglers who were fishing in the Newark Bay Complex. This paper also noted that a pretest of the survey was conducted.

course of the study. The data from the Burger study are still valid for estimating the RME and CTE ingestion rates for fish and crab.

The CPG also states that the Burger paper provides inadequate information for the development of statistical values. EPA disagrees. Although the raw data were not available, the data were summarized well enough in the paper to identify a high-end estimate of fish consumption for the surveyed population.

The CPG also identifies several perceived limitations with the Connelly *et al.* (1992) study and its usage in formulating a consumption rate.[10] The CPG argues that the Connelly *et al.* (1992) paper is not representative of the LPRSA in regard to the waterbody type or the target population. However, EPA based its assessment on the raw data from the Connelly study to narrow the focus to data collected for flowing waterbodies that include rivers. The CPG points out that the racial distribution in the Connelly *et al* (1992) report differs from that found in the area of the Lower Passaic River, with the Passaic River studies, such as Burger (2002) and the Tierra CAS, showing a much higher percentage of non-Caucasians. Based on the Burger (2002) study, which did specifically look at differences in fish consumption among different races, a higher percentage of non-Caucasian respondents reported high-end consumption rates (over 1,401 g/month) than did Caucasian respondents. This suggests that if non-Caucasian races had been more strongly represented in the Connelly *et al.* (1992) survey, the consumption rates would likely have been higher than the reported rates. The CPG also points out that the EFH identifies a limitation on the Connelly *et al.* (1992) study based on the lack of information relating to the weight of the fish consumed. However, the EFH also supplies the methodology to convert mean intake to meal size in the absence of the specific weight, suggesting that the EFH, while identifying it as a limitation, does not view it as a fatal flaw.

The CPG's primary argument about EPA's choice of consumption surveys is that the Tierra CAS, as reflected in Ray *et al.* (2007) and other papers, is the only site-specific creel/angler survey referred to in the Technical Memorandum, yet EPA did not rely on the Tierra CAS data in developing its consumption rate. Although EPA referenced it in the Technical Memorandum, EPA did not rely on the Tierra CAS for a number of reasons that have been discussed thoroughly with the CPG over many months of discussions and outlined in the various submittals by EPA to the CPG.

First, EPA disagreed with the survey approach taken in the Tierra CAS and, when asked to approve it, specifically disapproved it.[11] EPA's documented concerns with the work plan translated into concerns with the results of the subsequent survey. These concerns included:

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[10] The CPG argues that the information in Connelly *et al.* (1996) would be more appropriate because it was designed to collect long-term fish consumption data. EPA disagrees. First, Connelly *et al.* (1996), which was discussed in the Technical Memorandum (Exhibit B), focused on anglers who were known to fish in Lake Ontario, which is an entirely different type of waterbody than the LPRSA. Many of the fish species found in Lake Ontario were not found in the Passaic River sampling. Second, race could not be evaluated in the Connelly *et al.* (1996) study because of the small number of non-white participants, making it a significantly different population than that in the LPRSA.

[11] The CPG points out that EPA did not approve the work plans for either the Burger study or the Connelly study, but EPA was not asked to approve either of them.

- Limiting the interview locations to 1 of 5 pre-selected sites on a given day, focusing the study on population risks (including non-consumers) rather than risks to the RME and CTE individual.
- The reliance on purely statistical procedure to select sampling dates/times, not reflective of actual angling patterns, which can be influenced by many factors.
- The lack of community outreach, which has been used by or in cooperation with EPA in conducting surveys at other waterbodies.[12]

EPA believes that these methods may have limited the number of anglers found during the survey.

Second, as the CPG notes in several of its submittals, the way that studies are conducted can have an impact on the results of the study. Study responses can also be influenced by who is asking the questions, how they are asking them, and the perception of why they are asking them. Unlike the Burger study, the Tierra CAS did not perform extensive outreach within the community. While the CPG may object to the "social science approach" that Burger (2002) takes, that study was actively trying to find people fishing and/or crabbing, while the Tierra CAS was evaluating how many people were fishing/crabbing at particular locations. This may explain why the survey results generated a limited sample size for consumers, in which, regardless of the population size, only seven respondents who were interviewed reported consuming their catch. Both approaches are valid ways to conduct creel/angler surveys, but, because EPA is trying to determine the RME consumption rate of anglers in the LPRSA, the study that actually sought that information – Burger (2002)—is the best choice for EPA's purposes.

Finally, having disapproved the Tierra CAS workplan, EPA is entirely justified in concluding that there are limitations on the use of the study results. EPA did not ignore the Tierra CAS, but just chose not to rely on it. The data presented in Ray *et al.* (2007) included both non-consumers and consumers in the calculation of the ingestion rate, and so underestimated exposures to the consumers. The fish consumers-only data that could be gleaned from the paper were considered in the Technical Memorandum: two of the seven anglers consumed more than 20 g/day, with a maximum rate of 28 g/day.[13] Specific percentiles for the consuming population could not be determined from the summary of data provided in the paper. It is also important to note that a number of assumptions went into the analysis in Ray *et al.* (2007) for which data are not provided, such as the determination that 15 out of 30 individuals who kept fish, consumed fish.[14]

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[12] These studies include, among others, *Asian and Pacific Islander Seafood Consumption Study* (EPA 910/R-99-003), *A Fish Consumption Survey of the Tulalip and Squaxin Island Tribes of the Puget Sound Region*, 1996, and *Fish Consumption Survey of the Suquamish Indian Tribe of the Port Madison Indian Reservation, Puget Sound Region*, 2000.

[13] There is some dispute as to whether 28 g/day is the maximum rate among the fish consumers, or 23.95 g/day is the maximum and the higher value is an estimated number based on a sensitivity analysis. While the CPG objects to EPA's use of the 28 g/day number, even the December 15, 2011 letter concedes that paper is not clear on this point. (Exhibit I, p. 6.)

[14] Also, in the AECOM Position Paper, the CPG apparently relies on the Ray *et al.* (2007) paper in asserting that "subsistence fishing has been acknowledged as irrelevant in the LPRSA." (Exhibit F-Attachment B, p. 2.) Although the Technical Memorandum states that "no evidence of subsistence fishing has been observed in the LPRSA," there has been no specific focus on subsistence anglers and the statement presented in Ray *et al.* (2007)

In addition, the Tierra CAS was limited to the lower portion of the LPRSA, where there are fewer points of access than in the upper portion, so even the consumption rate based on fish consumers only identified in Ray *et al.* (2007) should be viewed as an underestimate of the actual consumption value.

As an alternative to the consumption values that EPA developed in its Technical Memorandum, the CPG suggests consumption rates (which are lower than the maximum consumption rate identified in Ray *et al.* (2007) of 28 g/day or 23.95 g/day). Not only are these consumption rates unacceptably low in considering the RME or CTE individual, they are not developed according to the site-specific criteria that the CPG espouses. Further, they are not based on data specifically relevant to anglers consuming their catch. Calculation of an RME or CTE depends upon "exposure." A non-consumer is by definition not exposed.[15]

The CPG proposes a value of 17.5 g/day for the RME for both fish and crab. This value is the 90th percentile per capita default consumption rate, used by EPA and NJDEP to derive water quality criteria protective of the general public (including both consumers and non-consumers) based on the U.S. Department of Agriculture's *Continuing Survey of Food Intake by Individuals* (CSFII) 1994-96 data (USDA 1998). This value is also estimated to correspond to the average consumption among sport anglers (USEPA 2000). It is not calculated to address the RME individual, which EPA is aiming to protect in the LPRSA context.

For the CTE, the CPG proposes a value of 7.5 g/day, which corresponds to a "one meal per month" consumption rate and was identified by the CPG as being considered "in remedial decision-making" at the Lower Duwamish Waterway. There is inadequate discussion of why a value used at a site in Washington State is more relevant to the LPRSA than consumption rate values from the 14 New Jersey and New York State sites identified in the Technical Memorandum. Further, the Baseline Human Health Risk Assessment for the Lower Duwamish Waterway includes a consumption rate of 97.5 g/day, excluding anadramous fish. The 7.5 g/day value was the value assigned to benthic fish consumption, one of the categories of fish and shellfish assumed to be ingested cumulatively.[16] Thus, this value was taken out of context.

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cannot be considered conclusive.

[15] RAGS Part A defines exposure as: "Contact of an organism with a chemical or physical agent. Exposure is quantified as the amount of the agent available at the exchange boundaries of the organism (e.g., skin, lungs, gut) and available for absorption." Page 6-2.

[16] *Lower Duwamish Waterway Remedial Investigation, Remedial Investigation Report, Appendix B: Baseline Human Health Risk Assessment, Final*, p. ES-4. See also, Table b.3-14, footnote a, which states: "Adult one-meal-per-month consumption was evaluated by individual seafood categories independently to provide information to the public and risk managers on consumption of various potential types of fish and shellfish. Risks from adult one-meal-per-month consumption are divided into four scenarios that address risks individually for each of the four main seafood consumption categories (i.e., benthic fish, pelagic fish, clams, and crabs). Each scenario assumes that one 227 gram (8 oz.) meal is consumed per month, which equates to 7.5 g/day."

A Fraction Ingested of 1 is appropriate

The CPG argues for application of a FI of less than 1. This is not appropriate for the LPRSA, for the reasons outlined in the Technical Memorandum (Exhibit B, pp 12-13).

In particular, while RAGS Part A allows for the application of a site-specific FI, it does not establish a procedure for developing a FI of less than 1 for RME or CTE for fish consumption. The only guidance offered by RAGS Part A in this regard is an indication that the FI for fish or shellfish is a pathway specific value and, to develop that number, local usage patterns should be considered. RAGS Part A, Exhibit 6-17, p. 6-45. For the LPRSA, there is not sufficient information to arrive at informed conclusions of local usage patterns. While as noted by the CPG, some individuals in the area have the ability to fish at several water bodies in the area, there are also many individuals in the population near the LPRSA who may not have the ability to travel as easily. Assuming that only half of their catch is from the LPRSA, as proposed by the CPG, would underestimate the exposure of these individuals. The CPG's assertion that crabbing is infrequent in the LPRSA as compared to Newark Bay is based on the Tierra CAS. Given EPA's concerns with the survey methodology used for the Tierra CAS, this position is not persuasive.

EPA Response to CPG objections to specific comments:

The specific comments disputed by the CPG, and the EPA staff recommendation for the resolution of the dispute, are as follows:

Comment 110 (combining 110b and 110d):

This comment relates to the CPG's RARC Plan, page 94, Section 3.3.4.7:

> The ingestion rate is the amount of fish that an individual consumes on a daily basis based on averaging the reported consumption rate in one year over 365 days (i.e., an annualized rate). As directed by USEPA Region 2 and listed in Appendix C, the USEPA's default fish ingestion rates for recreational freshwater anglers cited in USEPA's Exposure Factors Handbook (USEPA 1997b) will be used. These rates are based on mail surveys of licensed anglers who pursue sportfishing in Maine, New York (Lake Ontario), and Michigan (Great Lakes), and include both consumers and non-consumers (USEPA 1997b). The fish ingestion rates for the adult, adolescent, and child angler receptors as selected by USEPA Region 2 are as follows:
>
> - *Adult angler fish ingestion rate*: RME of 26 g/day (the 95th percentile in the USEPA's Exposure Factors Handbook), which is equivalent to approximately 40 half-pound meals/year, and CTE of 8 g/day (the recommended mean in the USEPA's Exposure Factors Handbook) (USEPA 1997b)
> - *Adolescent angler (ages 7 to 18 years) fish ingestion rate*: RME of 17 g/day and CTE of 5 g/day, based on USEPA's assumption that the intake of the adolescent is approximately two-thirds that of the adult (USEPA 1997b)

- *Child angler (ages 1 to 6 years) fish ingestion rate*: RME of 8 g/day and CTE of 3 g/day, based on USEPA's assumption that the intake of the child is approximately one-third that of the adult (USEPA 1997b)."

EPA Staff Recommendation: This section should be deleted and replaced with:

The ingestion rate is the amount of fish that an individual consumes on a daily basis, based on averaging the reported consumption rate in 1 year over 365 days. The following analysis of ingestion rates is based on EPA's Technical Memorandum on Fish and Crab Consumption Rates dated July 25, 2011. Ingestion rates for fish have been annualized and are presented in grams eaten per day (g/day). The ingestion rate assumes the fish are caught while angling from the LPRSA only. It is expected that ingestion of fish from local sources will be the main source of fish consumption for the anglers. For consumption of fish, ingestion rates based on data collected for recreational anglers may obtained from the Exposure Factors Handbook (EFH) (USEPA 1997b), three surveys conducted in New Jersey (Burger 2002, May and Burger 1996, Center for Public Interest Polling and New Jersey Marine Sciences 1993, Burger *et al.* 1998) and one survey conducted in New York (Connelly *et al.* 1992). Only the 1997 EFH, Burger 2002 and Connelly *et al.* 1992 contain enough information to calculate statistical distributions for the ingestion rates. Only the Burger 2002 and Connelly *et al.* 1992 (as analyzed and applied in the externally peer-reviewed Human Health Risk Assessment for the Hudson River in TAMS Consultants 2000) included data from the New York/New Jersey Harbor, which encompasses the tidal portion of the Lower Passaic River (the 1997 EFH data were from surveys of anglers in Michigan, Maine and the Great Lakes). Burger 2002 was from a survey conducted in the Newark Bay Complex. Connelly *et al.* (1992) was a New York Statewide Angler survey, whose data were used to calculate ingestion rates for the peer-reviewed Human Health Risk Assessment for the Hudson River (TAMS Consultants 2000). Therefore, the fish ingestion rate for the Lower Passaic River RME adult angler (44 g/day) is calculated by averaging the high end (approximately 90th percentile) estimates from Burger 2002 (57 g/day) and Connelly *et al.* 1992 (32 g/day). For the CTE value (13 g/day), the average of the mean of 22 g/day from Burger 2002 and the 50th percentile value of 4 g/day from Connelly *et al.* 1992 is used.

Ingestion rates for the adolescent and child are based on the assumption that the intake for the adolescent will be approximately two-thirds that of the adult and the intake for the child will be approximately one-third that of the adult (USEPA 1997b). This assumption is based on ratios of adolescent to adult and child to adult fish ingestion rates for total fish consumption provided in Table 10-1 of the EFH (USEPA 1997b), using data for a child aged 0 to 9 years, an adolescent aged 10 to 19 years, and an adult aged 20 to 70+ years (intake averaged over six adult age groups). Thus, for the RME, an ingestion rate of 15 g/day is used for the child receptor and 29 g/day is used for the adolescent receptor. For the CTE, an ingestion rate of 4 g/day is used for the child receptor and 9 g/day is used for the adolescent receptor.

A creel angler survey was conducted in the Lower Passaic River, as reported in Ray *et al.* 2007. The work plan for this survey was submitted to USEPA for review, but not approved; therefore, results from the survey cannot be used in this risk assessment.

> However, it is noted that the fish ingestion rates for the RME adult based on data from Burger 2002 (57 g/day) and Connelly *et al.* 1992 (32 g/day) are consistent with the ingestion rate calculated from data reported in Ray *et al.* 2007 (28 g/day). Ray *et al.* 2007 reported that only 7 anglers of those surveyed reported consuming fish. The small number of consumers limits statistical evaluation of the consumption rate to the maximum reported consumption rate of 28 g/day. (USEPA 1992d).

Also, EPA's Technical Memorandum on Fish and Crab Consumption Rates, dated July 25, 2011, should also be referenced as an appendix to the report.

Comment 113:

This comment relates to the CPG's RARC Plan, page 96, Section 3.3.4.7, Crab Ingestion Rate:

> For crabs, USEPA has directed that consumption rates be based on a 1999 survey of Newark Bay anglers, including crabbers (Burger 2002). Based on the responses of 110 anglers who reported consuming crab, a mean crab ingestion rate was derived by multiplying the number of crab meals eaten per month by the number of crabs eaten at each meal by the number of months per year that anglers go crabbing (and presumably eat their catch), assuming the average serving size from one crab is 70 g. Based on the Burger analysis, USEPA Region 2 has determined the following crab consumption rates:
>
> - *Adult receptor crab ingestion rate*: RME of 23 g/day and CTE of 16 g/day
> - *Adolescent receptor (ages 7 to 18 years) crab ingestion rate*: RME of 15 g/day and CTE of 11 g/day, based on the assumption that the intake for the adolescent is approximately two-thirds that of the adult (USEPA 1997b)
> - *Child receptor (ages 1 to 6 years) crab ingestion rate*: RME of 8 g/day and CTE of 5 g/day, based on the assumption that the intake for the child is approximately one-third that of the adult (USEPA 1997b)"

EPA staff recommendation: This section should be deleted and replaced with:

> The ingestion rate is the amount of crab that an individual consumes on a daily basis based on averaging the reported consumption rate in 1 year over 365 days. The following analysis of ingestion rates is based on EPA's Technical Memorandum on Fish and Crab Consumption Rates dated July 25, 2011. Ingestion rates for crab have been annualized and are presented in grams eaten per day (g/day). The ingestion rate assumes the crabs are caught while angling from the LPRSA only. It is expected that the main source of crab for ingestion is from the LPRSA.
>
> Two studies provided data on crab consumption (Burger 2002; Burger *et al.* 1998). Consistent with the recommendations in RAGS Part A, a crab consumption rate was calculated at the 90th percentile, since the 95th percentile was not available. In Burger (2002), for people who only crabbed, approximately 4% of all respondents (6.3% of "consumers only") ate more than 4,200 g/month. Similarly, about 15% of all respondents (23% of "consumers only") ate more than 1,400 g/month. Excluding the non-consumers,

> the 90th percentile crab ingestion rate for crab consumers is estimated to be 3,590 g/month, or 32 g/day (assuming crabs are consumed 3.3 months of the year, per Table 2 of the paper). The mean crab ingestion rate is 16 g/day, based on data provided in Table 2 of the Burger (2002) paper (assuming that 5,760 g/year is consumed during 3.3 months of the year). This mean crab ingestion rate is consistent with the mean value of 16.6 g/day from Barnegat Bay (Burger *et al.* 1998). Burger *et al.* 1998 did not report enough information to support statistical calculations of a 95th percentile ingestion rate. Other studies in this area reported crab consumption but an ingestion rate could not be calculated based on the information presented (Burger *et al.* 1999 and Kirk-Pflugh *et al.* 1999).
>
> The 90th percentile crab ingestion rate of 32 g/day is selected as the adult RME ingestion rate and the mean crab ingestion rate of 16 g/day is selected as the adult CTE rate. Ingestion rates for the child and adolescent receptors are estimated assuming rates 1/3 and 2/3 those of the adult ingestion rates, respectively, as is assumed for fish ingestion.

EPA's Technical Memorandum on Fish and Crab Consumption Rates, dated July 25, 2011, should also be referenced as an appendix to the report.

Summary of Issue 5

Although the CPG disagrees with EPA's choice of the studies relied on to develop consumption rates for the LPRSA and with the choice of an FI of one, this does not mean that EPA's decisions are incorrect. The positions detailed in the Technical Memorandum relating to the development of consumption rates, and the use of the FI of one, are reasonable and provide protection for the RME and CTE individuals. Based on the limited information available, the consumption rates developed by EPA and the FI of 1 are appropriately conservative and consistent with the overall goal of protection of human health.

IV. ECOLOGICAL RISK ASSESMENT ISSUE 1

The final open issue is Issue 1 in the ecological risk assessment discussion in the CPG's letter dated August 12, 2011 (Exhibit E) (a/k/a Issue 10), which states: "EPA has removed the term 'urban' from the RARC as it pertains to reference and background for river conditions." (Comments 8, 16, 68). The CPG has not elaborated on this issue in its subsequent submissions.

CPG Argument

The CPG asserts that deleting the word "urban" when linked with "reference or background" conditions is "counter to the entire premise for the Lower Passaic River Restoration Project." The CPG makes general statements about EPA's Urban River Restoration Initiative, and asserts that because EPA has used the word "urban" to describe the Passaic River, the CPG should be able to use the word in describing "types of reference and background conditions."

The CPG also states that the term "regional urban background" has been used in the remedial investigation, and is a base principle as it applies to both background and reference conditions. It also notes that an urban reference and background approach is planned and is in process pursuant to the EPA-approved PFD and Benthic QAPP.

EPA Staff Position

EPA does not object to the use of the term "urban background conditions" or, generally, to the use of the word "urban" to describe the setting of the Lower Passaic River. EPA's comments 8 and 16, requiring deletion of the word "urban," apply only to its use in connection with "reference." The PFD and the original RARC Plan (submitted in July 2010) both use the terms "urban regional background" and "urban background" which were and are acceptable to EPA.

In contrast, the revised RARC Plan (submitted in February 2011) includes the new terminology "background and urban regional reference levels" and "urban reference conditions." In fact, the CPG added a new section to the RARC Plan, Section 1.3, entitled "Development of Background and Urban Regional Reference Conditions." These changes were not made pursuant to any request or comment from EPA, and the CPG has offered no explanation for the change.

EPA Response to CPG Objections to Specific Comments

The specific comments disputed by the CPG, and the EPA staff recommendations for the resolution of the dispute are as follows:

Comment 8

EPA's Comment 8 is a general comment on the CPG's RARC Plan, as opposed to applying to a single section of the RARC Plan text. EPA's comment states:

> Until agreement is reached on the definition of reference condition through review and approval of the technical memorandum detailing the approach for developing background and reference conditions, terminology consistent with EPA guidance (1994b, 1997a) should be used. Delete "urban" before reference throughout document. This does not imply that EPA has made any decisions regarding the appropriateness of using urban conditions as reference sites, only that EPA would prefer to explore the issue thoroughly using the technical memorandum that is yet to be submitted.

EPA staff recommendation: No revision is recommended to this comment: the word "urban" should be deleted when it appears before "reference" throughout the RARC Plan, reverting to the terminology used in the PFD and the July 2010 RARC Plan.

In addition, the CPG should change Table 2.1 to revert to the language in the July 2010 RARC Plan, which is consistent with the PFD.

Comment 18

This comment relates to the CPG's RARC Plan, pages 6-8, Sections 1.3, 1.3.2, 1.3.3, which was added to the RARC Plan between July 2010 and February 2011 [reproduced in relevant part]:

1.3 Development of Background and Urban Regional Reference Conditions

Accounting for background and urban reference conditions is integral to evaluating risks posed by the release of hazardous substances in the LPRSA. USEPA (2002d) notes that a primary objective of CERCLA risk assessments is to provide information on risks that can be effectively addressed through remedial actions. Taking into account background and reference conditions during the risk assessment process provides a clear understanding of risks associated with site releases, as opposed to risks resulting from the presence of contaminants that may have migrated into the site, or that may reflect regional conditions related to human activities (Judd et al. 2003).

.....

1.3.2 Urban reference conditions

Urban reference conditions are intended to provide risk assessors with information pertaining to effects on biota from hazardous substances present in the environment as a result of human activities, but which can be differentiated from those effects associated with site releases (USEPA 2002d, 2005a). USEPA guidance (1994b, 1997a, 2005a) provides the following options for establishing urban reference conditions:

....

During the December 14, 2010, meeting between USEPA and CPG representatives, it was agreed that CPG would review existing regional data sets (NY/NJ Harbor Estuary and larger regional data sets between Delaware Bay and southern New England) to determine if they could be used as potential reference conditions. Following compilation of this information, USEPA and CPG will meet again to determine viable options for establishing urban reference conditions, as well as the types of data that will be used to define upstream background conditions.

1.3.3 General approach for LPRSA

....

In summary, background and urban reference condition data sets will be compiled for the following data types for evaluation in the BERA and/or baseline HHRA:

....

Comparison of site data with these background and urban reference condition data sets will allow for both 1) an evaluation of potential non-LPRSA contaminant sources, either

> historical or ongoing, and 2) an evaluation of site chemical concentrations relative to regional reference or background concentrations (Apitz et al. 2004). Therefore, acceptable data sets from individual studies and regional monitoring programs will be compiled, and a statistical summary will be presented.

EPA staff recommendation: No revision is recommended to this comment: the word "urban" should be deleted when it appears before "reference" throughout these sections (and the rest of the RARC Plan, as required by Comment 8).

Comment 68

This comment relates to the CPG's RARC Plan, pages 56-57, Section 2.5.1.2 (sediment toxicity data):

> To provide context for the toxicity text response data, the LPRSA toxicity data will also be compared to urban regional reference response levels. A revised technical memorandum detailing the proposed approach for developing background and urban regional reference conditions will be submitted to USEPA following a review of available data and ongoing discussions between USEPA and CPG. Details on the general background approach for the LPRSA are provided in Section 1.3.

EPA staff recommendation: Comment 68 provides directions on the procedures for interpreting sediment toxicity data, and does not relate to the use of the word "urban." It appears that the CPG objected to Comment 68, not because of the substance of the comment, but because this section of the RARC Plan includes the phrase "urban regional reference data" and therefore is affected by the instructions in Comment 8 that require the deletion of the word "urban" before the word "reference" throughout the RARC. No revision is recommended: the word "urban" should be deleted when it appears before "reference" throughout this section.

Summary of Eco Risk Assessment Issue 1

The CPG changed the language of the RARC Plan from "urban background" to "urban reference" and "urban regional reference" without explanation. EPA is not aware of any reason for the change and does not find it appropriate. The CPG should remove the word "urban" when it appears with "reference" throughout the RARC Plan, restoring the terminology of the approved PFD and the July 2010 RARC Plan.

CONCLUSION

EPA's comments on the CPG's RARC Plan are reasonable, valid and consistent with EPA's guidance, practices and policies with respect to risk assessment. In an effort to resolve this dispute, and the CPG's concerns, EPA has agreed to some changes described above clarifying its instructions, affecting HHRA Issues 1 and 4. Further changes to EPA's comments are undesirable for the reasons described above. The CPG's RARC Plan should be revised as directed by EPA.

R2-0022439

EXHIBIT A

UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
REGION 2
290 BROADWAY
NEW YORK, NY 10007-1866

JUL 11 2011

Robert H. Law, Ph.D
de maximis, inc.
186 Center Street, Suite 209
Clinton, New Jersey 08809

Dear Dr. Law:

The U.S. Environmental Protection Agency (EPA) has completed its review of the Revised Risk Analysis and Risk Characterization (RARC) Plan submitted on February 10, 2011, prepared as part of the Lower Passaic River Study Area Remedial Investigation/Feasibility Study (RI/FS) by Windward and AECOM on behalf of the Cooperating Parties Group (CPG). The Revised RARC Plan was to have addressed the comments provided by EPA in its letters dated September 10 and November 5, 2010, and the February 10, 2011 e-mail memorializing the results of discussions between EPA and CPG representatives on December 14 and 16, 2010.

Pursuant to Paragraph 44(d), EPA is disapproving the Revised RARC Plan of February 10, 2011, because the Revised RARC Plan does not fully address EPA's previous comments, and further, includes extensive discussions critiquing EPA's directions. We understand that the CPG does not agree with some of EPA's comments, and in your letter dated November 19, 2010, you stated that the CPG intended to accompany submission of the revised RARC Plan with a "separate letter for the administrative record" detailing its positions. If the CPG continues to wish to put forward its position with respect to EPA's comments, a separate letter, accompanying the revised submission, would be the appropriate vehicle. EPA is providing the enclosed comments to assist the CPG in removing its opinions of EPA's directions from the RARC Plan and in fully complying with previous directives.

The CPG is to resubmit the RARC Plan in thirty (30) days from receipt of this letter. If the CPG resubmits the RARC Plan without addressing the enclosed comments, EPA will conclude that the CPG submission is deficient, will modify the submission itself and may seek stipulated penalties.

If you have any questions or wish to discuss this matter, please do not hesitate to call me at 212-637-4427.

Sincerely yours,

Alice Yeh

Alice Yeh
Remedial Project Manager

Enclosure

COMMENTS

Revised Risk Analysis and Risk Characterization Plan Report, dated February 10, 2011

No.	General Comments on the Revised RARC Plan
1	Several documents related to the human health and ecological risk assessments either have not been submitted to USEPA (e.g., TRV Deliverable, background and regional reference conditions, etc...) or have been submitted but not yet approved by USEPA (e.g., Revised Data Usability Plan, etc...). Until all documents and issues related to the risk assessments are submitted and approved by USEPA, the approaches developed in the RARC Plan may still be subject to revision.
2	In several places, text associated with exposure parameters only argues against the parameter values, presenting the number as a directive and giving only reasons why it may not be applicable or may be an overestimate. A more balanced discussion must be provided that gives the basis for the values. Specific comments below provide text for that purpose.
3	Pathogenic contamination is mentioned in several places as a deterrent to wading and/or swimming. However, individuals visiting the river will not know what levels of pathogens are present when deciding when or how long they will wade or swim. References to pathogenic contamination as factor that will limit exposure are deleted in the specific comments below.
4	While the variability of the site setting is noted in earlier sections of the Revised RARC Plan, this variability is not mentioned in Section 3.3.4 of the Plan where human exposure parameters are discussed. Rather, the CPG has focused discussion only around site characteristics that may deter human exposure, and which are more prevalent in the lowest 3 miles of the LPRSA. Such characteristics are not present along the full 17.4 miles of the study area. A more balanced discussion is provided in the specific comments below.
5	Throughout text and figures: replace "homeless shelter" with "homeless camps", since shelter implies a permanent location established to help homeless people.
6	All references to draft documents not yet submitted to EPA, or submitted to EPA, but not yet approved by EPA, should be cited as "in preparation" without a date. Specific comments below provide many instances.
7	Since the entire RARC is subject to USEPA approval, the terms "directed for use by USEPA Region 2" or "USEPA Region 2-directed" are unnecessary specifications and should be deleted. Specific comments below provide many instances.
8	Until agreement is reached on the definition of reference condition through review and approval of the technical memorandum detailing the approach for developing background and reference conditions, terminology consistent with EPA guidance (1994b, 1997a) should be used. Delete "urban" before "reference" throughout document. This does not imply that EPA has made any decisions regarding the appropriateness of using urban conditions as reference sites, only that EPA would prefer to explore the issue thoroughly using the technical memorandum that is yet to be submitted.

No.	Section/Title	Specific Comments on the Revised RARC Plan
9	Page 1, Section 1, 2nd paragraph	Add at end "However, USEPA guidance (USEPA 1991a) also allows the use of default values developed by USEPA when there is a lack of site-specific data or consensus on which parameter value to choose, given a range of possibilities."
10	Page 2, Section 1.1, 1st paragraph, 3rd sentence	Delete and replace with "Adjacent land use is predominantly industrial in the lower river miles [RMs] (near Newark Bay) and transitions to commercial, residential and recreational near RM4. Land use is increasingly residential and recreational above RM8."
11	Page 2, Section 1.1, 1st paragraph	At end, add "However, it is now increasingly used for recreational activities such as boating, fishing and crabbing as parks and boat ramps are actively being restored or newly established (site-specific information provided by Passaic River Rowing Association 2010; Nereid Boat Club 2010; City of Newark 2010)."
12	Page 2, Section 1.1, 2nd paragraph	2nd sentence: "Tierra Solutions 2010" is not related to habitat assessment. Cite "Windward, in preparation" instead (as placeholder for Habitat Report, still being revised)

R2-0022442

No.	Section/Title	Specific Comments on the Revised RARC Plan
13	Page 2, Section 1.1, 2nd paragraph, last sentence	Delete and replace with "Many municipalities and counties along the Lower Passaic River have published master plans that call for the expansion and improvement of parks and open space along the river that, if implemented, will lead to greater access to the river and improved ecological habitat in the future (City of Newark 2010, City of Newark et al 2004, Clarke et al 2004, Clarke et al 1999, Heyer et al 2003, Heyer et al 2002, Borough of Rutherford et al 2007). The shift in use of the waterfront with increased public access and recreational use will be upstream of Sherwin Williams (approximately at RM 3.6). RMs 0 to 2 will remain active for commercial use into the future, and the stretch from RM 2 to 3.6 will likely be developed into Portfields/Brownfields. As noted in USEPA's *Land Use in the CERCLA Remedy Selection Process* (USEPA 1995), comprehensive community master plans are a valuable source of information in determining reasonably anticipated future land use for future risk scenarios."
14	Page 2, Section 1.1, 3rd paragraph	2nd sentence: Replace "kills" with "tidal straights" (because the term "kill" is typically used to refer to a creek).
15	Page 4/5, Section 1.2	The following bullet points need to be removed, since they refer to QAPPs that are not EPA approved (note that the descriptor for these bullet points is "USEPA-approved QAPPs"): • Last bullet on page 4 (small volume CWCM) • 1st bullet on page 5 (high volume CWCM) Update 5th bullet on page 4 to final document dated 3/2/11 (caged bivalve study). Update 2nd bullet on page 5 (TSI CWO-SWO) to final document (2011).
16	Page 5, Section 1.2	1st paragraph after bullets listing QAPPs: Replace reference to "Windward and AECOM 2010" with "Windward and AECOM, in prep".
17	Page 6, Section 1.3.1, 1st paragraph	1st sentence: Correct typo (replace "by" with "as")
18	Page 6-7, Sections 1.3, 1.3.2, 1.3.3	Delete "urban" before "reference" throughout these sections.
19	Page 9, Section 1.4, bullet points	1st bullet: delete entire bullet and replace with "The Revised Data Usability Plan (Windward and AECOM, in prep). 2nd bullet: delete end of bullet, starting with "which provides a more detailed approach..."
20	Page 10, Section 2	Future data collection activities, first 2 bullets (caged bivalve study, avian survey): Update and move to prior section of completed data collection activities.
21	Page 11, Section 2	2nd paragraph after data collection activities bullet points, last sentence: Replace "kills" with "tidal straights" (because the term "kill" is typically used to refer to a creek).
22	Page 13, Section 2, last set of bullets before Section 2.1, 2nd bullet	Delete "which was submitted to USEPA on July 31, 2010" (doesn't make sense for a document dated 2009). Update last sentence, since caged bivalve studies are completed.
23	Page 15, Section 2.1.2	Add a table that identifies the ten receptor groups listed in Section 2.1.2, the feeding guilds that apply to each receptor group, and the focal species that have been selected to provide a basis for estimating risks for each receptor group/feeding guild. This table will provide a useful link to the exposure factor summaries presented later in the document.
24	Pages 17-22, Table 2-1	All of the testable risk questions should be worded as they were in the PFD (2009). E.g., under Assessment Endpoint No. 2, the 1st question should be returned to its original wording.
25	Pages 17-22, Table 2-1	The term "receptor of concern" or "ROC" is used throughout Table 2-1. To avoid confusion, it would be better if the term "receptor group" were used to identify each group of organisms that will be evaluated in the BERA (e.g., sediment-probing birds). Then, the term "focal species" should be used to identify the species or species assemblages that will be used to represent the receptor group in the BERA (e.g., spotted sandpiper). The focal species does not need to use habitats throughout the site to be useful in the risk assessment, because they were selected to be representative of the receptor group as a whole.
26	Page 20, Table 2-1, 1st row	Clarify if site-specific BSAFs will be used in food web model. Literature and site-specific BSAFs should be presented and discussed to use the most appropriate values for the food web model.

No.	Section/Title	Specific Comments on the Revised RARC Plan
27	Pages 17-22, Table 2-1	For benthic invertebrates, data on COPEC concentrations in near-bottom water collected from the LPRSA will be the most relevant for assessing risks associated with exposure to surface water. Such data should be used preferentially for estimating exposure point concentrations (EPCs) of COPECs. Near-bottom water quality data should not be used together with water column data to evaluate risk to benthic invertebrates, unless such an analysis is presented separately from the analysis conducted using near-bottom water chemistry alone.
28	Pages 17-22, Table 2-1	For the risk questions, measurement endpoints, data use objectives (DUOs), and LPRSA data pertaining to Assessment Endpoint No. 3, the term "benthic invertebrates" should be replaced by the term "benthic macroinvertebrates."
29	Pages 17-22, Table 2-1	For benthic macroinvertebrates, data on COPEC concentrations in near-bottom water collected from the LPRSA will be the most relevant for assessing risks associated with exposure to surface water.
30	Pages 17-22, Table 2-1	For Assessment Endpoint No. 4, the species used in the in situ caged bivalve study should be identified in the description of the measurement endpoint.
31	Pages 17-22, Table 2-1	For bivalve mollusks, data on COPEC concentrations in near-bottom water collected from the LPRSA will be the most relevant for assessing risks associated with exposure to surface water.
32	Pages 17-22, Table 2-1	For assessment Endpoint No. 4, the term "benthic invertebrates" should be replaced with the term "bivalve mollusks."
33	Pages 17-22, Table 2-1	"Assessment Endpoint No. 4", 1st question: Under "Description of Measurement Endpoint", delete "this measurement endpoint is being assessed per USEPA direction"
34	Pages 17-22, Table 2-1	The question posed relative to the egg number from estuarine benthic omnivores is not a risk question. This question needs to be revised to read, "Is the fecundity of estuarine benthic omnivores (e.g., mummichog) from the LPRSA similar to the fecundity of benthic omnivores from appropriately selected reference sites?"
35	Pages 17-22, Table 2-1	"Assessment Endpoint No. 5", last question: Under "Description of Measurement Endpoint", delete "this measurement endpoint is being assessed per USEPA direction"
36	Pages 17-22, Table 2-1	For Assessment Endpoint No. 6, omnivorous birds are identified as a feeding guild that will be evaluated in the BERA, yet no focal species was identified for this receptor group.
37	Pages 17-22, Table 2-1	Footnote a: replace reference to "Windward and AECOM 2010" with "Windward and AECOM, in prep" (since the 2010 document is not EPA-approved).
38	Pages 17-22, Table 2-1	Footnote b: delete
39	Pages 17-22, Table 2-1	Footnote e: delete "USEPA requested that surface water will be evaluated as part of the dietary assessment for fish; however;"
40	Page 23, Section 2.1.4, 3rd paragraph	Delete 5th & 6th sentence ("Based on the catches of the 2009.... On the basis of field observations...."), because they are conclusions that are not fully supported by data and analyses yet.
41	Page 24, Section 2.1.4, 4th paragraph	Replace "Windward 2010b" with "Windward, in prep", since the 2010 document is not EPA-approved.
42	Page 29, Section 2.2	Add at end of 1st paragraph: "A discussion of temporal variability due to data being collected at different times of the year, and its effect on the comparability of those data will be included in the BERA."
43	Page 29, Section 2.2	Add a section that describes how the results of the 28-d bioaccumulation tests will be adjusted to reflect steady-state conditions (see Table 4 of ASTM, 2010b, E1688, for more information on the percent of steady state conditions that is achieved during a 28-d exposure period for various COPECs and bioaccumulation test organisms). For each bioaccumulative COPEC, the results of the 28-d bioaccumulation tests should be plotted (with organic carbon-normalized sediment concentration on the x-axis and lipid-normalized tissue concentration on the y-axis) to develop bioaccumulation functions. The resultant regression equation can then be used to predict tissue concentrations at locations where sediment chemistry data were collected.
44	Page 29, Section 2.2, 2nd & 3rd paragraphs	Replace "Windward and AECOM 2010" with "Windward, in prep", since the 2010 document is not EPA-approved.
45	Page 30, Section 2.3, 1st paragraph	3rd sentence: Delete end of sentence, starting with "so that conservative estimates, as well..." and replace with "to provide a range of exposure point concentrations and ecological risk estimates."

R2-0022444

No.	Section/Title	Specific Comments on the Revised RARC Plan
46	Page 29-30, Section 2.3, 1st paragraph	Add new sentence at end of paragraph "Non-detects will be handled statistically through ProUCL."
47	Page 30, Section 2.3, 2nd paragraph	Delete last 2 sentences – during the 12/14/10 CPG-EPA meeting, it was agreed that physical stressors such as degraded habitat could be discussed in the risk characterization section (Section 2.5).
48	Page 30, Section 2.3.1.1, 1st paragraph	Replace "Windward and AECOM 2010" with "Windward and AECOM, in prep", since the 2010 document is not EPA-approved.
49	Page 31, Section 2.3.1.1, 1st paragraph	Add "In addition, sample sizes less than 10 will be evaluated and suggested statistical techniques for determining the most appropriate statistic discussed with USEPA. It should be noted that "decisions based upon statistics obtained using data sets of small sizes (e.g., 4 to 6 detected observations) cannot be considered reliable enough to make a remediation decision that affects human health and the environment" (EPA 2010b, ProUCL Version 4.00.05 User Guide). The ProUCL User Guide also states "at a minimum, a background sample should have at least 8 to 10 (more observations are preferable) detected observations to estimate background threshold values (BTVs) or to use hypotheses testing approaches" (EPA 2010b)."
50	Page 32, Section 2.3.1.3	Provide additional details on how the SQT will be presented, such as tabular with + and – or numerically. It is anticipated that a weight of evidence approach will be utilized similar to the tables (23-26) presented in "A Guidance Manual to Support the Assessment of Contaminated Sediments in Freshwater Ecosystems - EPA EPA-905-B02-001-C (EPA 2002). In addition, it is anticipated that the results will also be presented graphically with points or through the use of a krieging technique (see examples – 08UWISQTIMap.pdf and Caeiro_et_al2005.pdf [Figure 1]). Another good example of multiple lines of evidence approach is provided in California State sediment quality objectives (CSWRCB, 2011). Reference is: CSWRCB (California State Water Resources Control Board), 2011. Proposed draft amendments to the water quality control plan for enclosed bays and estuaries, Part I: Sediment Quality. Sacramento, CA. 28 pp.
51	Page 32, Section 2.3.1.3	Add text specifying that each of the three independent lines-of-evidence included in the SQT will be evaluated first. This is important for maintaining the transparency of the evaluation and ensuring that the methods are applied consistently to all of the data used in the BERA.
52	Page 32, Section 2.3.1.3	Add description of how data from stations with sediment chemistry only will be used in the BERA.
53	Page 32, Section 2.3.1.3	Add description of the procedures for estimating risks to benthic invertebrates at each station (*e.g.*, using the SQT).
54	Page 35, Section 2.3.1.4, "Tissue-residue Exposure"	2nd paragraph: Add a statement that metal and PAHs in fish tissue will be qualitatively discussed, as well as through dietary and surface water assessments.
55	Page 36, footnote 8	Delete "USEPA requested that surface water be evaluated as part of the dietary assessment for fish; however," and delete "unless USEPA can provide a source of water ingestion rates for fish that can be reviewed by CPG and applied with reasonable certainty."
56	Page 39-40, Section 2.3.1.5, "Bird Egg Tissue-residues"	1st paragraph, 2nd sentence: Delete "and the limited likelihood of belted kingfishers, herons, or egrets breeding in the LPRSA" Delete 2nd paragraph ("Given that few aquatic birds currently use the LPRSA…"). While these species may or may not be breeding in the study area currently, they could do so in the future.
57	Page 42, Section 2.3.1.7, 2nd paragraph, 3rd sentence	Delete end of sentence, starting with "however, the highly urbanized setting of the LPRSA…", because it is a conclusion that is not fully supported by data and analyses yet.

R2-0022445

No.	Section/Title	Specific Comments on the Revised RARC Plan
58	Page 43, Section 2.3.2.1, 1st bullet	Windward 2009a is not an EPA-approved document. Refer instead to: Windward. 2010. Memorandum dated May 21, 2010, to Robert Law, de maximis, inc.: Revised sample analysis plan for catfish/bullhead, carp, bass, white sucker, and northern pike tissue for the Lower Passaic River Restoration Project (Revised Fish Sample Analysis Plan, Part 1). Windward Environmental LLC, Seattle, WA.
59	Page 43, Section 2.3.2.1, "Percent moisture in prey"	Percent moisture in prey must be used on a sample-specific basis (rather than an average prey moisture for the entire LPRSA).
60	Page 44, Section 2.3.3	Section 2.3.3 ("Evaluation of habitat characteristics") should be moved to Section 2.5, in accordance with the agreement reached during the 12/14/10 CPG-EPA meeting that non-chemical stressors such as degraded habitat may be discussed in the risk characterization section. In addition to moving the section, the following edits must be made to the text: 1st sentence: Delete and replace with "While the BERA will be based on a quantitative evaluation of chemical stressors, it will also present a qualitative evaluation of site-specific physical stressors in the risk characterization section, including, but not limited to, the following:"
61	Pages 48-50, Table 2-2	All of the testable risk questions should be worded as they were in the PFD (2009).
62	Page 48, Table 2-2, "Benthic Invertebrate Community"	3rd question: Under "Effects Threshold Type" delete "SQT evaluation" and replace with "sediment threshold" and "concentration response" .
63	Page 48, Table 2-2, "Macroinvertebrate Populations"	Delete title and replace with "Crustaceans", since benthic invertebrates and mollusks are also macroinvertebrates and this title is therefore confusing.
64	Page 53, Section 2.5.1.1	1st bullet: Hazard quotients for benthic invertebrates, mollusks, crustaceans, fish, amphibians and reptiles should be based on sediment as well as water (only water is identified on page 53).
65	Page 54, Section 2.5.1.2	1st paragraph: Delete 2nd & 3rd sentences ("In the FSP2… This approach was incorporated…").
66	Page 55, Section 2.5.1.2, "Available Data Types"	1st paragraph, 3rd sentence: delete "in order to assess the effects of CERCLA hazardous substances and non-CERCLA factors (e.g., sulfides, organic carbon) on benthic invertebrate community health"
67	Page 56, Section 2.5.1.2, "Data Preparation"	Replace "Windward and AECOM 2010" with "Windward, in prep", since the 2010 document is not EPA-approved.
68	Page 56-57, Section 2.5.1.2, "Data Analysis", "Sediment toxicity data"	The procedures described for interpreting the sediment toxicity data are not consistent with application of the reference envelope approach. Application of this approach requires identification of candidate reference samples, evaluation of each candidate reference sample to determine if chemical and biological criteria are met, definition of the reference envelope for each toxicity test endpoint, and designation of sediment samples as toxic or not toxic. Samples from the LPRSA with response values within the reference envelope should be designated as having low toxicity, those with response levels up to 10% below the lower limit of the reference envelope should be identified as having moderate r the City of Newark. Prepared for the Central Planning Board City of Newark. Adopted December 6, 2004. - City of Newark. 2010. The Riverfront That Newark Wants, Progrss sediment toxicity.

R2-0022446

No.	Section/Title	Specific Comments on the Revised RARC Plan
69	Page 57, Section 2.5.1.2, "Data Analysis", "Sediment chemistry data"	Ecological screening criteria (ESC) in NJDEP's *Guidance for Sediment Quality Evaluations*, November, 1998, have been superseded by the ESC found in the NJDEP Ecological Screening Criteria Table (March 10, 2009 or most current version) at http://www.nj.gov/dep/srp/guidance/ecoscreening/. They are also attached to this comment letter.
70	Page 57, Section 2.5.1.2, "Data Analysis", "Sediment chemistry data"	More information is required on the procedures that will be used to evaluate the reliability of the SQGs that have been promulgated by the NJDEP. The criteria for reliability need to be submitted to USEPA for review and approval before being applied.
71	Page 58, Section 2.5.1.2, "SQT Risk Conclusions"	Delete end of paragraph, starting with "Given the complexity of the LPRSA environment, it is possible that no clear....", because it is too speculative at this point in the risk assessment process.
72	Page 59, Section 2.5.2	This section should also discuss uncertainties in the exposure assessment associated with the underlying data, including representativeness of data (spatially and temporally), completeness of the data, COPECs measured, species sampled, and models used to estimate exposure. Uncertainties associated with the effects assessment (not just the effects data) should also be discussed including the development and evaluation of site-specific toxicity thresholds. A discussion of the uncertainties in the risk characterization should also be included in this section including uncertainties associate with individual LOEs and integration of multiple LOEs.
73	Page 59, Section 2.5.2	The procedures that will be used to integrate multiple LOEs to assess risks to each Assessment Endpoint need to be described in the subject document and should also describe how the results of the uncertainty analysis will be used to inform the weight-of-evidence evaluation.
74	Page 60, Section 2.6	1st paragraph after bullets: Delete, because COCs for the protection of the benthic community must be identified.
75	Page 60, Section 2.6	The last two paragraphs seem to belong in the previous section on uncertainty.
76	Page 63, Section 3.2	1st & 2nd paragraph: Replace "Windward and AECOM 2010" with "Windward, in prep", since the 2010 document is not EPA-approved.
77	Page 64, Section 3.3, 2nd paragraph	1st sentence: add at end ", although in the future, most of the river is increasingly expected to be used for recreational activities."
78	Page 64, Section 3.3, 2nd paragraph	Last sentence: delete and replace with "However, USEPA guidance (USEPA 1991a) also allows the use of default values developed by USEPA when there is a lack of site-specific data or consensus on which parameter value to choose, given a range of possibilities."
79	Page 65, Section 3.3.1	1st paragraph after bullets: Add at end of 1st sentence "(USEPA 1989b)".
80	Page 66, Figure 3-1	Replace "direct contact" with "dermal" for consistency with RAGS Part D terminology.

R2-0022447

No.	Section/Title	Specific Comments on the Revised RARC Plan
81	Page 67, Section 3.3.1.1, after 1st paragraph	Add following new paragraphs: The NJAC Surface Water Quality Standards classifications for the Passaic River designates the following uses: • Mouth of river to Second River (RM 0 to RM 8) is classified as saline-estuarine 3 (SE3). Designated use for SE3 water includes secondary contact recreation (recreational activities where the probability of water ingestion is minimal and includes, but is not limited to, boating and fishing). • Second River to Dundee Dam (RM 8 to RM 17) is classified as freshwater 2 non-trout (FW2-NT) and saline-estuarine 2 (SE2). Designated use for FW2-NT and SE2 water includes secondary contact recreation (e.g., boating and fishing). Designated use for FW2-NT water also includes primary contact recreation: recreational activities that involve significant ingestion risks and includes, but is not limited to, wading, swimming, diving, surfing, and water skiing. Many municipalities and counties along the Lower Passaic River have published master plans that call for the expansion and improvement of parks and open space along the river that, if implemented, will lead to greater access to the river and improved ecological habitat in the future (City of Newark 2010, City of Newark et al 2004, Clarke et al 2004, Clarke et al 1999, Heyer et al 2003, Heyer et al 2002, Borough of Rutherford et al 2007). In accordance with USEPA guidance (USEPA 1995), comprehensive community master plans are a valuable source of information in determining reasonably anticipated future land use.
82	Page 69, Section 3.3.1.1, 2nd paragraph	2nd sentence: After "Access to the river" add "from RM 7.5 to RM 13.5", delete "most of"
83	Page 69, Section 3.3.1.1, 2nd paragraph	Delete 4th sentence ("The lower 6 miles are predominantly...") and replace with "Adjacent land use is predominantly industrial in the lower river miles (near Newark Bay) and transitions to commercial, residential and recreational near RM4. Land use is increasingly residential and recreational above RM8."
84	Figure 3-3b	Add "Potential Access to Shore" icons at Pathmark Parking Lot, RM 6.5 eastern bank; at RM 5.0, west bank (across street from NJPAC); at RM 4.0, south bank (across Raymond Blvd from Riverbank Park).
85	Pages 76-80	Since the risk assessment examines a residential scenario, include a photo of residences along the waterway (particularly in upper RMs).
86	Page 80, Section 3.3.1.1, "Lower River Segment", 1st sentence	Re-phrase to better characterize existing land use as "The Lower River Segment (preliminarily defined as RM 0 to RM 6 based on salinity) is characterized as predominantly industrial in the lower river miles (near Newark Bay) and transitions to commercial, residential and recreational near RM4."
87	Page 80, Section 3.3.1.1, "Lower River Segment", 3rd sentence	Delete and replace with "The shoreline along this stretch of the river consists of active or abandoned industrial areas up to RM4, but then transitions to thin strips of park land abutting the river as land use becomes more commercial and residential."
88	Page 80, Section 3.3.1.1, "Lower River Segment"	Add "The City of Newark has in recent years focused on building parks along the southern shore between RM 3.5-5.5 (such as Minish Park, Riverbank Park and parks near NJPAC). The shift in use of the waterfront with increased public access and recreational use is upstream of Sherwin Williams (approximately at RM 3.6) [City of Newark 2010]. RMs 0 to 2 will remain active for commercial use into the future, and the stretch from RM 2 to 3.6 will likely be developed into Portfields/Brownfields."
89	Page 81, Section 3.3.1.1, "Middle River Segment"	2nd sentence: Delete, because in conflict with later descriptions of parks allowing for access.

R2-0022448

No.	Section/Title	Specific Comments on the Revised RARC Plan
90	Page 81, Section 3.3.1.1, "Middle River Segment"	Next-to-last sentence: Delete end of sentence, starting with "although these activities are expected to be limited by..."
91	Page 81, Section 3.3.1.1, "Middle River Segment"	Add at end "Municipalities, particularly along the eastern bank, have published master plans that call for the expansion and improvement of parks and open space along the river that, if implemented, will lead to greater access to the river and improved ecological habitat in the future (Heyer et al 2002)."
92	Page 81, Section 3.3.1.1, "Upper River Segment"	1st sentence: Delete and replace with "The Upper River Segment (preliminarily defined as RM10 to the Dundee Dam) is the most residential and recreational segment of the river."
93	Page 81, Section 3.3.1.1, "Upper River Segment"	3rd sentence: Delete "Upper River Segment" and replace with "eastern bank".
94	Page 81, Section 3.3.1.1, "Upper River Segment"	Add at end "Municipalities, particularly along the eastern bank, have published master plans that call for the expansion and improvement of parks and open space along the river that, if implemented, will lead to greater access to the river and improved ecological habitat in the future (Borough of Rutherford 2007)."
95	Page 82, Section 3.3.2, 1st paragraph	5th sentence: Delete "At the direction of USEPA Region 2,"
96	Page 85, Section 3.3.2, 1st paragraph after Table 3-1	Combine 5th and 6th sentence into one "There is a lack of specific information on the exposure patterns for this population, and it is difficult to collect exposure information, so the homeless receptor will be addressed qualitatively in the uncertainty section of the risk assessment (Windward and AECOM 2009)."
97	Page 86, Section 3.3.3.1	At end, add "The derivation of an AAF which differs from the default for any site related contaminant will be submitted to USEPA for review and approval prior to use."
98	Page 90, Section 3.3.4, 1st paragraph	Delete 3rd sentence and replace with: "The RME individual represents the 90% or higher end of exposure consistent with the 1992 Exposure Assessment Guidelines. As stated in Risk Assessment Guidance for Superfund Part A, "Actions at Superfund sites should be based on an estimate of the reasonable maximum exposure (RME) expected to occur under both current and future land-use conditions. The reasonable maximum exposure is defined here as the highest exposure that is reasonably expected to occur at a site. RMEs are estimated for individual pathways.""
99	Page 90, Section 3.3.4	Delete 2nd paragraph (unnecessary explanation).
100	Page 90, Section 3.3.4, 3rd paragraph	1st sentence, delete "As stated in USEPA's September 10, 2010 comments" and replace with "In accordance with USEPA Guidance (USEPA 1989b)".
101	Page 90, Section 3.3.4, 3rd paragraph	3rd sentence, delete "USEPA Region 2 has directed that" (add "will" before "be used" to make complete sentence)
102	Page 90-91, Section 3.3.4, 3rd paragraph	Delete last 2 sentences.

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No.	Section/Title	Specific Comments on the Revised RARC Plan
103	Page 91, Section 3.3.4.1, 1st paragraph	Delete and replace with: The recreational angler receptors are defined as those individuals who consume self-caught fish and/or shellfish from the LPRSA in spite of the "eat none" fish/crab consumption advisories (NJDEP 2010). Adults and adolescents (ages 7 to 18 years old) are expected to participate in angling for fish and/or crabs. These anglers are assumed to share self-caught fish and/or crabs with family members (i.e., young children 1 to 6 years of age). Evaluation of subsistence fishing is not proposed, since there is no evidence of any individuals who rely solely on their daily catch. Anglers would be exposed to contaminants in fish and/or crabs from ingestion. Anglers could fish from a variety of locations along the shoreline, including bulkheads, bridges, boats, mudflats, and park land. Anglers are not expected to contact surface water or sediment on days when they fish from bulkheads or bridges. However, on days when anglers fish from areas such as mudflats or park land they may be exposed to contaminants in sediment and surface water. Anglers have been observed to wade in the Passaic River while fishing (EPA 2010, Nereid Boat Club 2010). While young children are expected to ingest fish or crabs caught by the adult or adolescent angler, they are expected to rarely accompany the family member who is fishing. Exposures would be much less than those experienced by children visiting the river specifically to wade or swim. Therefore, a young child angler exposure to sediment and surface water is not evaluated under the angling scenario. Therefore, it is assumed that the current/future recreational angler receptor may be exposed to COPCs while fishing via: • Consumption of fish and/or crabs. • <continue with 3 bullet points as written>
104	Page 91, Section 3.3.4.2, 1st paragraph	Delete and replace with " Individuals of all ages may visit the Passaic River to swim. Swimming is included in New Jersey's designated uses of the freshwater portion of the river from the confluence with Second River to Dundee Dam (RM8-17), where the water has a classification of FW2-NT/SE2. Swimming under current conditions may be limited by the visible presence of shoreline and floating debris, and trash. However, once the parks that are already under construction are completed, and when other recreational improvements in municipal master plans are undertaken, future conditions are expected to provide greater access to and be more conducive to swimming. Therefore, it is assumed that the current and future swimmer will be exposed to COPCs through contact with sediment while ~~entering and leaving the river, and while swimming.~~ Adult (≥18 years), adolescent (7 to 18 years old) and young child (1 to 6 years old) swimmers are assumed to be exposed to sediment and surface water via:"
105	Page 92, Section 3.3.4.2, last paragraph	Delete and replace with: "In accordance with USEPA guidance (USEPA 1995, 2001d), comprehensive community master plans are a valuable source of information in determining reasonably anticipated future land use. Many municipalities and counties along the Lower Passaic River have published master plans that call for the expansion and improvement of parks and open space along the river that will lead to higher exposure in the future (City of Newark 2010, City of Newark et al 2004, Clarke et al 2004, Clarke et al 1999, Heyer et al 2003, Heyer et al 2002, Borough of Rutherford et al 2007). While the general usage types of the river may remain the same in the future, the usage frequency and number of access locations should increase over time based on these plans. This increased usage is taken into account in the exposure parameters discussed in Section 3.3.5."
106	Page 92, Section 3.3.4.4, 1st paragraph	After 2nd sentence, add new sentences (from EPA 9/10/10 Technical Memo): "While children 7 to 13 years old are too young for team rowing, children within this age group may participate in recreational boating activities such as canoeing or kayaking. Young children (<7 years old) are not expected to participate in boating activities on the river; any such exposures would be rare and much less than those experienced by children visiting the river specifically to wade or swim. Therefore, a young child boater scenario is not evaluated."
107	Page 92, Section 3.3.4.4, 1st paragraph	Revise 7th sentence to read "Scullers typically wear spandex suits during most of the season (Nereid Boat Club 2010). In colder weather, they may also wear long sleeves, pants, gloves and hats."
108	Section 3.3.4.4, page 93	After sculling discussion, add "Pleasure boaters would not be expected to have such protective clothing or to adhere to specific rules. In addition, boaters get wet from the splashing of oars, rough water, and wakes made by powerboats (Nereid Boat Club 2010, PRRA 2010)."

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No.	Section/Title	Specific Comments on the Revised RARC Plan
109	Page 93, Section 3.3.4.5	Delete 1st sentence and replace with: "Residential properties are located adjacent to the Passaic River, especially above RM 10. Residents in houses adjacent to the river are conservatively assumed to contact sediment in their yards to the same degree as residential soil. Exposure to surface water is expected to occur during occasional wading near the home."
110	Page 94, Section 3.3.4.7	Delete 1st paragraph (including footnote 16). Under "Fish Ingestion Rate", delete and replace with (from EPA Technical Memo, in prep): The ingestion rate is the amount of fish that an individual consumes on a daily basis, based on averaging the reported consumption rate in 1 year over 365 days. Ingestion rates for fish have been annualized and are presented in grams eaten per day (g/day). The ingestion rate assumes the fish are caught while angling from the LPRSA only. It is expected that ingestion of fish from local sources will be the main source of fish consumption for the anglers. For consumption of fish, ingestion rates based on data collected for recreational anglers may obtained from the Exposure Factors Handbook (EFH) (USEPA 1997b), three surveys conducted in New Jersey (Burger 2002, May and Burger 1996, Center for Public Interest Polling and New Jersey Marine Sciences 1993, Burger et al 1998) and one survey conducted in New York (Connelly et al 1992). Only the 1997 EFH, Burger 2002 and Connelly et al 1992 contain enough information to calculate statistical distributions for the ingestion rates. Only the Burger 2002 and Connelly et al 1992 (as analyzed and applied in the externally peer-reviewed Human Health Risk Assessment for the Hudson River in TAMS Consultants 2000) included data from the New York/New Jersey Harbor, which encompasses the tidal portion of the Lower Passaic River (the 1997 EFH data were from surveys of anglers in Michigan, Maine and the Great Lakes). Burger 2002 was from a survey conducted in the Newark Bay Complex. Connelly et al (1992) was a New York Statewide Angler survey, whose data were used to calculate ingestion rates for the peer-reviewed Human Health Risk Assessment for the Hudson River (TAMS Consultants 2000). Therefore, the fish ingestion rate for the Lower Passaic River RME adult angler (44 g/day) is calculated by averaging the high end (approximately 90th percentile) estimates from Burger 2002 (57 g/day) and Connelly et al 1992 (32 g/day). For the CTE value (13 g/day), the average of the mean of 22 g/day from Burger 2002 and the 50th percentile value of 4 g/day from Connelly et al 1992 is used. Ingestion rates for the adolescent and child are based on the assumption that the intake for the adolescent will be approximately two-thirds that of the adult and the intake for the child will be approximately one-third that of the adult (USEPA 1997b). This assumption is based on ratios of ~~adolescent to adult and child to adult fish ingestion rates for total fish consumption provided in Table~~ 10-1 of the EFH (USEPA 1997b), using data for a child aged 0 to 9 years, an adolescent aged 10 to 19 years, and an adult aged 20 to 70+ years (intake averaged over six adult age groups). Thus, for the RME, an ingestion rate of 15 g/day is used for the child receptor and 29 g/day is used for the adolescent receptor. For the CTE, an ingestion rate of 4 g/day is used for the child receptor and 9 g/day is used for the adolescent receptor. A creel angler survey was conducted in the Lower Passaic River, as reported in Ray et al 2007. The work plan for this survey was submitted to USEPA for review, but not approved; therefore, results from the survey cannot be used in this risk assessment. However, it is noted that the fish ingestion rates for the RME adult based on data from Burger 2002 (57 g/day) and Connelly et al 1992 (32 g/day) are consistent with the ingestion rate calculated from data reported in Ray et al 2007 (28 g/day). Ray et al 2007 reported that only 7 anglers of those surveyed reported consuming fish. The small number of consumers limits statistical evaluation of the consumption rate to the maximum reported consumption rate of 28 g/day (USEPA 1992d).

No.	Section/Title	Specific Comments on the Revised RARC Plan
111	Page 95, Section 3.3.4.7, "Fraction Ingested for Fish"	Delete and replace with: The Risk Assessment Guidance for Superfund – Part A includes a term "Fraction Ingested" (FI) that is defined as "Fraction ingested from contaminated source (unitless)" (USEPA, 1989b). The guidance does not specifically address application of this factor for fish or crab consumption, but rather describes the application of this factor to adjust for ingestion rates for vegetables or other produce or ingestion of meat, eggs, and dairy products. However, within the overall recommendations on fish ingestion, the guidance states "Residents near major commercial or recreational fisheries or shell fisheries are likely to ingest larger quantities of locally caught fish and shellfish than inland residents." Consistent with the recommendations in RAGS Part A and in accordance with USEPA Region 2 practice at other contaminated sediment Superfund sites, an FI of one is used for the RME and CTE scenarios of all three angler populations for the following reasons: • The Lower Passaic River has adequate quantity and quality of fish and crabs to support the estimated level of fish and crab ingestion for the RME individual, both currently (as found in the fish community survey conducted by the CPG in 2010 [Windward, in prep]) and in the future. • The Lower Passaic River is in a highly developed urban area that supports a large population, with access to the river for fishing and crabbing through parks, boat docks, publicly-accessible parking lots abutting the river and residences on the river banks. Therefore, anglers have ample opportunities to return to areas where they have successfully caught fish or crabs, especially adolescents or lower income families, who may have limited means of transportation; workers have the opportunity to fish and/or crab during the work day or on their way to and from work; and there are so many municipalities along the river that there is the potential that individuals may move within the 17-mile study, and yet continue to fish, crab and consume fish/crab from the river. Although it is possible that an angler catches and consumes fish and crabs from other rivers in the area, the risk assessment assumes that 100 percent of the catch is obtained from the LPRSA.
112	Page 96, Section 3.3.4.7, "Cooking Loss for Fish"	Delete and replace with (from EPA 9/10/10 Technical Memo): "A cooking loss factor accounts for the amount of contaminant in tissue that is lost during the cooking process and not consumed by the receptor. For RME, a cooking loss of zero percent is used for all contaminants. For CTE, the 50th percentile cooking loss values for combined skin-on/skin-off as developed in Appendix C of the Draft Focused Feasibility Study (Battelle 2007) is used for organic contaminants. For metals, a cooking loss of zero percent is used for both RME and CTE scenarios, since cooking loss adjustments should not be ~~applied for metals in most cases (EPA 2000).~~"
113	Page 96, Section 3.3.4.7, "Crab Ingestion Rate"	Delete and replace with (from EPA Technical Memo, in prep): The ingestion rate is the amount of crab that an individual consumes on a daily basis based on averaging the reported consumption rate in 1 year over 365 days. Ingestion rates for crab have been annualized and are presented in grams eaten per day (g/day). The ingestion rate assumes the crabs are caught while angling from the LPRSA only. It is expected that the main source of crab for ingestion is from the LPRSA. Two studies provided data on crab consumption (Burger 2002; Burger et al 1998). Consistent with the recommendations in RAGS Part A, a crab consumption rate was calculated at the 90th percentile, since the 95th percentile was not available. In Burger (2002), for people who only crabbed, approximately 4% of all respondents (6.3% of "consumers only") ate more than 4,200 g/month. Similarly, about 15% of all respondents (23% of "consumers only") ate more than 1,400 g/month. Excluding the non-consumers, the 90th percentile crab ingestion rate for crab consumers is estimated to be 3,590 g/month, or 32 g/day (assuming crabs are consumed 3.3 months of the year, per Table 2 of the paper). The mean crab ingestion rate is 16 g/day, based on data provided in Table 2 of the Burger (2002) paper (assuming that 5,760 g/year is consumed during 3.3 months of the year). This mean crab ingestion rate is consistent with the mean value of 16.6 g/day from Barnegat Bay (Burger et al. 1998). Burger et al. 1998 did not report enough information to support statistical calculations of a 95th percentile ingestion rate. Other studies in this area reported crab consumption but an ingestion rate could not be calculated based on the information presented (Burger et al. 1999 and Kirk-Pflugh et al. 1999). The 90th percentile crab ingestion rate of 32 g/day is selected as the adult RME ingestion rate and the mean crab ingestion rate of 16 g/day is selected as the adult CTE rate. Ingestion rates for the child and adolescent receptors are estimated assuming rates 1/3 and 2/3 those of the adult ingestion rates, respectively, as is assumed for fish ingestion.

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No.	Section/Title	Specific Comments on the Revised RARC Plan
114	Page 96, Section 3.3.4.7, "Fraction Ingested for Crab"	Delete and replace with: "Fraction Ingested for crabs is discussed in the "Fraction Ingested for Fish" section above."
115	Page 97, Section 3.3.4.7, "Cooking Loss for Crab"	Delete and replace with "A cooking loss factor accounts for the amount of contaminant in tissue that is lost during the cooking process and not consumed by the receptor. Blue crabs are most often cooked whole by boiling or steaming (Sea Grant Marine Advisory Program 2006). Exposure to the contaminant depends not only of the specific part of the crab consumed, but also on the method of cooking. NJDEP (2010) reports that no specific cooking method can be relied on to reduce the chemical contaminant levels in blue crabs. Because the crab is cooked whole, even if the consumer does not eat the hepatopancreas, exposure to the chemical contaminant may still occur if the crab is cooked before the hepatopancreas is removed and if the liquid used to boil the crab is used in juices, sauces, bisques, or soups. It should be assumed that the cooking liquid is consumed along with the crabmeat. Therefore, cooking loss for crabs is assumed to be 0 percent for all contaminants under the RME and CTE scenarios, because data are not currently available from EPA or published literature to support any type of reduction in concentration under this type of exposure scenario. A study published by Zabik et al. (1992), entitled "Effect of Preparation and Cooking on Contaminant Distributions in Crustaceans: PCBs in Blue Crab," was reviewed. The study showed that boiling or steaming reduced PCB concentrations by greater than 20 percent in tissue, and that the cooking water contained about 80 percent of the PCBs that were lost from the crabs (the study author was contacted to confirm these results). Thus, most of the PCBs lost from the crabs could still be consumed if the cooking water is used to prepare soups, sauces, pasta, etc. Potential cooking loss assuming discarding the cooking water may be discussed in the uncertainty section of the risk assessment, but a cooking loss of 0 percent should still be assumed for the RME and CTE scenarios in the risk assessment."
116	Page 97, Section 3.3.4.8, 1st paragraph	Delete (unnecessary introduction)
117	Page 97, Section 3.3.4.8, "Incidental Ingestion of Sediment", 1st paragraph	Delete 2nd sentence and replace with "Therefore, default values provided in USEPA guidance may be ~~used (USEPA 1991a). The incidental sediment ingestion rates of anglers, swimmers, waders, boaters~~ and workers are assumed…"
118	Page 97, Section 3.3.4.8, "Incidental Ingestion of Sediment", 2nd paragraph	Delete paragraph and replace with "USEPA default residential exposure frequencies and soil ingestion rates may be used for the residential scenarios, because, beyond the lack of sediment data, there is also the possibility that surface soil in some yards does consist of sediment deposited by flooding of the Passaic River, particularly for the homes that abut the east bank of the river above RM 10 (but also elsewhere along the river). In cases where yards have been impacted by flooding events, residents could be exposed to those sediments outdoors in the yard and via sediment-derived dust inside the house. To address this scenario, residential soil ingestion rates of 100 mg/day and 200 mg/day for the RME adult and child, respectively, and 50 and 100 mg/day for the CTE adult and child, respectively (USEPA 1991a). 100% of the sediment is assumed to be from the LPRSA (FI equals 1)."
119	Page 98, Section 3.3.4.8, "Incidental Ingestion of Surface Water"	Make the 2 paragraphs one as follows "While a number of studies on drinking water ingestion rates have been conducted, as summarized in USEPA guidance (1997b, 2008), similar data for incidental surface water ingestion are generally lacking, especially for activities such as wading or boating. Therefore, USEPA default values will be used for this scenario (USEPA 1991a). The incidental surface water ingestion rate of anglers, waders, boaters and residents is assumed to be …." Correct incidental surface water ingestion rate units to be L/hr (as directed in EPA 9/10/10 Technical Memo).

No.	Section/Title	Specific Comments on the Revised RARC Plan
120	Page 98, Section 3.3.4.8, "Body Surface Areas in Contact with Sediment and Surface Water", 1st paragraph	Delete and replace with "The skin surface area exposed to sediment and surface water varies with the type of activity being performed, as summarized below. For the angler, wader and residential receptors, USEPA's default for residential soil exposures (i.e., feet, lower legs, hands, forearms and head) (USEPA 2004b) will be used for both sediment and surface water. For dermal contact with sediment and surface water, the angler, wader and resident are assumed to wear a short-sleeved shirt and shorts (no shoes); therefore, the exposed skin surface is limited to the head, hands, forearms, lower legs and feet. The exposed skin surface area for adult anglers, waders and residents is 6,100 square centimeter (cm2), the average of the 50th percentile for males and females greater than 18 years of age (EPA 1997). The exposed skin surface area for adolescent anglers and waders is 5,100 cm2, based on the weighted average surface area for males and females ages 7 to.<19 years (EPA 2008). The exposed skin surface area for child waders and residents is 2,500 cm2, based on the weighted average surface area for children ages 1 to <7 years (EPA 2008). "
121	Page 98, Section 3.3.4.8, "Body Surface Areas in Contact with Sediment and Surface Water"	Add new 2nd and 3rd paragraphs: "Boaters get wet from the splashing of oars, rough water or wakes made by powerboats (PRRA 2010). For dermal contact with sediment and surface water, the teenage and adult boaters that participate in sculling typically wear shoes and have indicated that when splashed by water, their exposure is usually limited to the hands, forearms and sometimes the face (Nereid Boat Club 2010). When the surface area is limited to these body parts, the exposed skin surface area for adult boaters is 2,500 cm2, the average of the 50th percentile for males and females older than 18 years of age (EPA 1997). The exposed skin surface area for teenage boaters is also 2,500 cm2, based on the weighted average surface area for males and females ages 14 to <19 years (EPA 2008). Recreational boaters participating in canoeing or kayaking on the river could have a different exposure pattern from the scullers. They are assumed to go boating less frequently, but may have their lower legs and feet exposed in addition to the other body parts listed for the sculler. Therefore, the surface area for older child recreational boaters is 4,400 cm2 based on the weighted average surface area of head, hands, forearms, lower legs and feet for children ages 7 to <14 years (EPA 2008)."
122	Page 98, Section 3.3.4.8, "Body Surface Areas in Contact with Sediment and Surface Water", 2nd paragraph	Delete and replace with "For the swimming receptor, the entire skin surface area will be used for contact with surface water: 18,000 cm2 for adults (Exhibit 3-2 of EPA 2004), 14,800 cm2 for adolescents (EPA 2008), and 6,600 cm2 for children (Exhibit 3-2 of EPA 2004). However, swimmers' dermal contact with sediment as they enter and leave the river is not likely to involve the entire body, but would be more similar to the exposure of a wader. Therefore, the exposed skin surface for sediment is assumed to be limited to the head, hands, forearms, lower legs and feet. The exposed skin surface area of these body parts for adults is 6,100 cm2, the average of the 50th percentile for males and females older than 18 years of age (EPA 1997). The exposed skin surface area for adolescents is 5,100 cm2, based on the weighted average surface area for males and females ages 7 to <19 years (EPA 2008). The exposed skin surface area for children is 2,500 cm2, based on the weighted average surface area for children ages 1 to <7 years (EPA 2008)."
123	Page 99, Section 3.3.4.8, "Body Surface Areas in Contact with Sediment and Surface Water", 3rd paragraph	Delete and replace with: "For dermal contact with sediment, the worker is assumed to wear a short-sleeved shirt, long pants, and shoes; therefore, the exposed skin surface is limited to the head, hands, and forearms. The resulting exposed skin surface area is 3,300 cm2, the average of the 50th percentile for males and females greater than 18 years of age (EPA 2004)."
124	Page 99, Table 3-2	In title, delete "directed for use by USEPA Region 2" and change "Swimmer" and "Boater" numbers to be consistent with above comments.
125	Page 100, Section 3.3.4.8, "Dermal Adherence Factors"	Delete 1st paragraph and replace with: "The dermal adherence factor of 0.3 mg/cm2 is assumed for adults, based on the 50th percentile weighted adherence factor measured for reed gatherers, the activity determined to represent a reasonable, high-end contact (EPA 2004)." 2nd paragraph: Delete "directed by USEPA Region 2"
126	Page 100, Table 3-3	In title, delete "directed for use by USEPA Region 2" and change numbers for children and adolescent receptors to be consistent with comment below.

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No.	Section/Title	Specific Comments on the Revised RARC Plan
127	Page 101, Section 3.3.4.8, "Dermal Adherence Factors", last paragraph	Delete and replace with "The Child-Specific Exposure Factors Handbook (EPA 2008) recommends adherence factors for adolescents and children based on a study of children engaging in shoreline play on tidal flats. This activity most accurately reflects the anticipated activity of receptors along the Passaic River. However, review of the original study by Shoaf et al. (2005), and discussions with Dr. Shoaf, revealed that the sediment in the study had a higher grain size than is typically found in the sediment from the banks of the Passaic River; 71 percent of the sediment in the Shoaf et al. study was characterized as medium to very coarse sand (grain size of 0.25 to 1.999 mm). Only 0.77 percent of the total sample mass was characterized as clay or silt. In contrast, Passaic River sediment near the banks is typically soft, organically enriched silt, while firmer, coarser sediments are observed in the deeper mid-section of the river (Germano & Associates, Inc. 2005). Grain size data from a Low Resolution Coring and Sediment Sampling event (ENSR et al. 2008) show that on average along the 17-mile study area more than 40 percent of surface sediment mass was characterized as fines (i.e., clay or silt). The adherence of sandy sediment as characterized in the Shoaf et al. (2005) study may not accurately reflect adherence of finer grain sediments. EPA (2004, 2008) also recommends adherence data from several other studies, including children playing indoors, at daycare, in dry soil, in wet soil, in mud, during gardening and while playing soccer. The activity and conditions that most closely align with receptor activities along the Passaic River is children playing in wet soil. Therefore, the adherence factor for children and adolescent receptors to be used is 0.2 mg/cm2, based on the 50th percentile surface area weighted soil adherence data for children playing in wet soil (EPA 2004)."
128	Page 101, Section 3.3.4.8, "Surface Water Exposure Time", 1st paragraph	Delete and replace with "The NJAC Surface Water Quality Standards classification for the Passaic River from RM0 to 8 includes secondary contact recreation (e.g., boating and fishing), and from RM 8 to 17 includes primary contact recreation (e.g., swimming and wading), among other uses. A number of boating and sculling clubs already make frequent use of the river (Passaic River Rowing Association 2010, Nereid Boat Club 2010) and improvements are being made to boat ramps throughout the 17 miles (City of Newark 2010). Swimming under current conditions may be limited by the visible presence of shoreline and floating debris and trash. However, once the parks that are already under construction are completed, and when other recreational improvements planned in municipal master plans are undertaken, future conditions are expected to provide greater access to and be more conducive to swimming (footnote). Therefore, exposure times and frequencies are designed for both current and future river users who will be exposed to COPCs in sediment and surface water, as summarized in Table 3-4." (footnote): The national average for time spent swimming is 2.6 hours/day (EPA 1989).
129	Page 102, Table 3-4	In title, delete "directed for use by USEPA Region 2".

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No.	Section/Title	Specific Comments on the Revised RARC Plan
130	Page 102-103, Section 3.3.4.8, "Sediment and Surface Water Exposure Frequencies", 2nd paragraph	Delete and replace with "Sediment and surface water exposure frequencies for each receptor scenario are summarized in Table 3-5. The exposure frequencies for the angler, swimmer, wader and boater reflect both current conditions on the river, as well as future conditions after shoreline improvements laid out in municipal master plans are carried out. Adult anglers, swimmers and waders are assumed to fish, swim or wade in locations where they would contact sediment and surface water once a week during the summer months (13 weeks/year), or 13 days per year, for the RME scenario, and once every two weeks, or 7 days per year, for the CTE scenario. Adolescent anglers, swimmers and waders are assumed to be exposed to sediment and surface water 3 days per week during the summer months, or 39 and 20 days per year respectively for the RME and CTE scenarios. Anglers may catch fish on more days than is assumed here, but are not expected to contact sediment and surface water every day that they fish. The surface water and sediment exposure frequency for the older child boater who canoes or kayaks is assumed to be equal to other recreational scenarios like swimming or wading, and is therefore assumed to occur 13 days/year for the RME scenario and 7 days/year for the CTE scenario. Surface water exposure frequencies for the adult and teenage (14 to 18 years old) boaters are based on information provided by Passaic River boating clubs (PRRA 2010, Nereid Boat Club 2010). The rowing season extends from March through mid-November (37 weeks). Adult boaters row up to 7 days/week, for 1 to 2 hours/day; average frequency is about 3 to 4 times per week. Based on this information, for adult boaters the RME frequency is 259 days/year (7 days/week x 37 weeks/year) and the CTE frequency is 111 days/year (3 days/week x 37 weeks/year). For the teenage boaters, the high school rowing season primarily is from late February through the end of May, and sometimes includes rowing minimally in the fall. The high school teams row 5 to 7 days per week for 1 to 2 hours per day. Based on this information, for teenage boaters (14 to 18 years old) the RME frequency is 98 days/year (7 days/week x 14 weeks/year) and the CTE frequency is 70 days/year (5 days/week x 14 weeks/year). Exposure to sediment for the adult and teenage boaters will occur with a much lower frequency than exposure to surface water. Rowing locations south of Dundee Dam launch from docks, so contact with the riverbank happens when rowers flip out of the boat and need to wade in to get back in. It is, therefore, assumed that sediment contact occurs once a month for the RME scenario and once every two months for the CTE scenario. Accounting for the length of rowing season (37 weeks for adults and 14 weeks for teenage boaters), the adult sediment exposure frequency is 9 days/year for RME and 4 days/year for CTE; the teenage boater exposure frequency is 4 days/year for RME and 2 days/year for CTE."
131	Page 103, Section 3.3.4.8, "Sediment and Surface Water Exposure Frequencies", 3rd paragraph	Delete and replace with "For the resident receptor's exposure to sediment, the USEPA default exposure frequency for residential soil is used, because surface soil in some yards adjacent to the river may consist of sediment deposited by flooding of the Passaic River, particularly for the homes that abut the east bank of the river above RM 10 (but also elsewhere along the river). In cases where yards have been impacted by flooding events, residents could be exposed to those sediments outdoors in the yard and via sediment-derived dust inside the house. While yards may be covered by snow during some portion of the winter, exposure may still occur via sediment-derived dust inside the home. Residential contact with surface water is expected to occur less frequently than contact with sediment. Residents are expected to wade occasionally in the river. Since houses are located adjacent to the river, residents have easy access to the water and are expected to wade with a greater frequency than the recreational wading receptors. Adult and child residents are assumed to contact surface water twice a week during the summer months (13 weeks/year), 26 days per year, for the RME scenario. The CTE exposure frequency for surface water is half of the RME value, or 13 days per year."
132	Page 103, Section 3.3.4.8, "Sediment and Surface Water Exposure Frequencies"	Add new paragraph: "Workers are assumed to be exposed once a week throughout the year for the RME scenario and once every two weeks for the CTE scenario, or 50 days per year and 25 days per year, respectively (50 work weeks per year, assuming a two-week vacation). "
133	Page 103, Table 3-5	In title, delete "directed for use by USEPA Region 2".

No.	Section/Title	Specific Comments on the Revised RARC Plan
134	Page 104, Section 3.3.4.9	Add: "The exposure duration for site workers is 25 years for the RME scenario, based on the 95th percentile value for job tenure for men in the manufacturing sector (EPA 2002). The CTE duration is 7 years based on the median occupation tenure of the working population (EPA 1997)."
135	Page 106, Section 3.3.4.11, "Preparation and Cooking Loss", 1st two paragraphs	Delete and replace with: "Cooking losses for fish and crab are discussed in Section 3.3.4.7. Cooking loss values for RME and CTE scenarios are summarized in Table 3-6.
136	Page 107, Table 3-6	In title, delete "directed for use by USEPA Region 2".
137	Page 108, Section 3.3.5.2, 1st paragraph, 2nd sentence	Delete and replace with "For the media with measurement data (sediment, surface water, fish tissue and crab tissue), the EPC will be defined as the 95% upper confidence limit (UCL) of the arithmetic mean for the RME and CTE scenarios. This value represents the arithmetic average of the concentration that is contacted over the exposure period, accounting for uncertainty and variability in the dataset, as noted in Supplemental Guidance to RAGS: Calculating the Concentration Term (EPA 1992) and Calculating Upper Confidence Limits for Exposure Point Concentrations at Hazardous Waste Sites (EPA 2002). These guidance documents state that because of the uncertainty associated with estimating the true average concentration at a site, 95 percent UCL of the arithmetic mean should be used for the exposure point concentration."
138	Page 108, Section 3.3.5.2, 1st paragraph, 3rd sentence	Delete sentence & associated footnote (24). Mean concentrations have not been accepted for EPCs for CTE scenarios. The risk assessment for the site that is mentioned (Koppers Pond Site) is still in draft and under review by EPA, so reference to this site in the text and footnote are to be removed.
139	Page 109, Section 3.3.5.2, 2nd-3rd paragraphs	Replace "Windward and AECOM 2010, currently undergoing revision" with "Windward, in prep"..
	Page 111, Section 3.4,	
140	5th paragraph ("Toxicity criteria will be selected according..")	Bullet point 3: Add at end "and approved by USEPA Superfund Health Risk Technical Support Center"
141	Page 112, Section 3.4, 6th paragraph	Delete paragraph ("The Superfund Health Risk Technical Support Center and USEPA Region 2 will be consulted..."), because information already presented in 3rd bullet on p.111.
142	Page 113, Section 3.5.1, 1st paragraph	Delete last sentence ("The American Cancer Society estimates that the lifetime probability of...")
143	Page 116, Section 3.6, 1st paragraph	3rd sentence: Delete "generally tends to" and replace with "may"; delete "rather than" and replace with "or". Last sentence: delete "not captured in regulatory risk assessment" and replace with "underestimated".
144	Page 116, Section 3.6, 2nd paragraph, last sentence	Delete "approaches taken and/or assumptions made to compensate for uncertainty, and the likely impact on the risk assessment results" and replace with "the key uncertainties and their impact on the risk assessment results"
145	Page 116, Section 3.6, 3rd paragraph, 3rd sentence	Delete "a more comprehensive characterization of risk than is possible in a deterministic (point estimate) approach" and replace with "another means of characterizing risk (USEPA 2001c)".
146	Page 116, Section 3.6, 3rd paragraph	4th sentence: delete. 5th sentence: add "key" before "exposure scenarios"

No.	Section/Title	Specific Comments on the Revised RARC Plan
147	Page 116-117, Section 3.6, last paragraph	Delete and replace with "Consistent with USEPA guidance (USEPA 2001c), a work plan detailing exposure distributions and planned analyses will need to be submitted to and approved by USEPA before any probabilistic risk assessment is conducted."
148	Page 117, Section 3.6.2, 1st paragraph, 2nd sentence	Delete "overestimate rather than underestimate potential effects on humans" and replace with "protect human health".
149	Page 117, Section 3.6.3, 1st paragraph, 2nd sentence	Delete, because it is a conclusion that is not fully supported by data and analyses.
150	Page 118, Section 3.6.4, last bullet point	Delete ", such as pathogens from CSOs and SWOs,[26] and non-hazardous substance list chemicals, such as pharmaceutical and personal care products, polybrominated dephenyl ethers, and non-hazardous substance list dioxin-like compounds", as directed by EPA on 11/5/10 and because there are no data to support such an analysis. [also delete footnote 26]

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No.	Section/Title	Specific Comments on the Revised RARC Plan
151	Section 4	For all documents submitted to EPA for review, but not approved, delete date and replace with "in preparation". Add following master plan references: - Clarke Caton Hintz, Ehrenkrantz Eckstut & Kuhn. 1999. Passaic Riverfront Revitalization, Newark, NJ. City of Newark (12/15/99). - Clarke Caton Hintz/Ehrenkrantz Eckstut & Kuhn. 2004. Passaic Riverfront Redevelopment Plan, Newark, NJ. City of Newark (Presentation 1/22/04). - City of Newark-Dept. of Economic & Housing Development, Philips Preiss Shapiro Associates, Inc. and Schoor DePalma. 2004. Land Use Element of the Master Plan for the City of Newark. Prepared for the Central Planning Board City of Newark. Adopted December 6, 2004. - City of Newark. 2010. The Riverfront That Newark Wants, Progress Report: 2009-2010 (Presentation June 2010). - Heyer, Gruel & Associates, 2002. Town of Kearny Master Plan Reexamination Report. - Heyer, Gruel & Associates, 2003. Harrison Waterfront Redevelopment Plan. - Borough of Rutherford and CMX 2007. 2007 Master Plan. Adopted December 20, 2007. Add following fish ingestion references: - Burger, J., Sanchez, and Gochfeld, M. 1998. Fishing, Consumption, and Risk Perception in Fisherfolk along an East Coast Estuary. Environmental Research, Section A 77: 25-35. - Burger, J., Kirk Pflugh, K., Lurig, L., von Hagen, L.A., and von Hagen, S. 1999. Fishing in urban NJ: Ethnicity effects information sources, perception and compliance. Risk Analysis 192, 217. - Connelly, N.A., Knuth, B.A., Bisogni, C.A. 1992. Effects of the health advisory and advisory changes on fishing habits and fish consumption in New York fisheries. Human Dimension Research Unit, Department of Natural Resources, New York State College of Agriculture and life Sciences, Cornell University, Ithaca, NY. - Center for Public Interest Polling and New Jersey Marine Sciences Consortium. 1993. New Jersey Household Fish Consumption Study. Conducted for the New Jersey Department of Environmental Protection and Energy. October to November 1993. Center for Public Interest Polling - Eagleton Institute of Politics, Rutgers, The State University of New Jersey and the New Jersey Marine Sciences Consortium, New Jersey. - Kirk Pflugh, K., Lurig, L., von Hagen, L.A., von Hagen, S., and Burger, J. 1999. Urban anglers perception of risk from contaminated fish. Science of the Total Environment 228:203. ~~- Ray, R., Craven, V., Bingham, M., Kinnell, J., Hastings, E., and Finley, B. 2007. Human health~~ exposure factor estimates based upon a creel/angler survey of the Lower Passaic River (Part 3). J. Toxicology and Environmental Health, Part A, 70:6, 512. - Sea Grant Marine Advisory Program. 2006. Blue Crab General Information. Virginia Institute of Marine Science, College of William and Mary. http://www.vims.edu/adv/ed/crab/general.html. - TAMS. 2000. Phase 2 Report. Further Site Characterization and Analysis. Volume 2F – Revised Human Health Risk Assessment Hudson River PCBs Reassessment RI/FS. Replace "Windward 2009a" (not EPA-approved document) with: Windward. 2010. Memorandum dated May 21, 2010, to Robert Law, de maximis, inc.: Revised sample analysis plan for catfish/bullhead, carp, bass, white sucker, and northern pike tissue for the Lower Passaic River Restoration Project (Revised Fish Sample Analysis Plan, Part 1). Windward Environmental LLC, Seattle, WA. Add the following EPA guidance documents: USEPA 1992d. Supplemental Guidance to RAGS: Calculating the Concentration Term. OSWER 9285.7-08I. Office of Solid Waste and Emergency Response, U.S. Environmental Protection Agency, Washington, DC. USEPA. 2001d. Reuse Assessments: A Tool to Implement the Superfund Land Use Directive. OSWER Directive 9355.7-06P. Office of Solid Waste and Emergency Response, U.S. Environmental Protection Agency, Washington, DC.
152	Appendix A, page 1, Section 1, 1st bullet	Delete end of sentence, starting at "revised based on USEPA September 10, 2010, comments, including those……" (unnecessary details).

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No.	Section/Title	Specific Comments on the Revised RARC Plan
153	Appendix A, page 1, Section 1, 2nd bullet	Replace "Windward and AECOM 2010, currently undergoing revision" with "Windward and AECOM, in prep". Delete end of sentence, starting at "revised based on USEPA September 10, 2010, comments, including those..." (unnecessary details).
154	Appendix A, page 1, Section 1, 3rd bullet	Delete end of sentence, starting at "which provides a more detailed approach..." (unnecessary details).
155	Appendix A, page 2, Section 1, 2nd paragraph after bullets	Replace "Windward and AECOM 2010, currently undergoing revision" with "Windward and AECOM, in prep".
156	Appendix A, page 3, Section 2, 2nd paragraph, 2nd bullet	Replace "Windward and AECOM 2010, currently undergoing revision" with "Windward and AECOM, in prep".
157	Appendix A, Section 2	Add attached tables as screening criteria to be used.
158	Appendix A, page 9, Section 3, 1st paragraph under bullets	Replace "Windward and AECOM 2010, currently undergoing revision" with "Windward and AECOM, in prep".
159	Appendix A, Page 12, Section 3.3, 2nd paragraph	Last sentence, add "approved by USEPA's Superfund Health Risk Technical Support Center" after "risk-based screening levels"
160	Appendix A, page 12, Section 3.3.1, 1st paragraph	Last sentence: Delete "as directed by USEPA Region 2 (see Appendix E of Revised RARC Plan for USEPA Region 2 directives dated November 5, 2010)"
161	Appendix A, page 12, Section 3.3.1, 2nd paragraph	2nd sentence: add "routinely" before "used for selecting sediment COPCs"; add "at Superfund sites" after "used for selecting sediment COPCs" and delete "as directed by USEPA Region 2".
162	Appendix A, page 13, Section 3.3.1, last paragraph	Add "Exposure area COPC refinements will be submitted for approval by USEPA before implementation."
163	Appendix A, page 13, Section 3.3.2, 1st paragraph	2nd sentence, delete "as directed by USEPA Region 2"; add "routinely uses" before "RSLs for tap water"; delete "will be used"
164	Appendix A, page 13, Section 3.3.2, 2nd paragraph	Delete (conclusion not supported by data or analyses).
165	Appendix A, page 13, Section 3.3.2, 3rd paragraph	Add "Exposure area COPC refinements will be submitted for approval by USEPA before implementation."
166	Appendix A, page 14, Section 3.4	Delete 2nd sentence and replace with "The baseline HHRA report will present all findings documenting the COPC selection process in the tables and worksheets found in Part D of the Risk Assessment Guidance for Superfund (USEPA 2001).

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No.	Section/Title	Specific Comments on the Revised RARC Plan
167	Appendix A, Section 4	For all documents submitted to EPA for review, but not approved, delete date and replace with "in preparation". Add reference to Risk Assessment Guidance for Superfund, Part D: Standardized Planning, Reporting and Review of Superfund Risk Assessments, Final, December, 2001.
168	Appendix B, Page 1, Section 1	1st paragraph, last sentence: Revise to say "These life history profiles will be prepared by CPG and reviewed by USEPA prior to use in the BERA."
169	Appendix B	Add tables to this appendix that illustrate the parameters with the Passaic River distribution (similar to Table 1) and a table that presents the recommended values for use in the BERA.
170	Appendix B, Section 8	Update draft documents to final ones approved by USEPA.
171	Appendix C	Appendix C must be updated to reflect EPA's additional directions on sediment adherence factor for children, exposed surface area for swimmers, exposed surface area for boaters and cooking loss in crabs described in the Technical Memorandum Revisions to Exposure Parameter Assumptions for the LPRSA Human Health Risk Assessment (sent on 2/11/11). Also update fish and crab ingestion rates as directed in these comments above. Also need to be corrected to reflect EPA's 9/10/10 Technical Memo, which specified incidental surface water ingestion rate units to be L/hr.
172	Appendix D	In determining the height for the surface water box models, 2 meters above the water surface will be used. Does this height incorporate the difference in height between the water surface and land surface? It is possible that the box height may need to higher to account for the difference in surface water and land heights. Indicate the timeframe for the "long term average observations" for temperature and surface wind speed. For Tier 3 analysis, AERMOD will be using 5 years of meteorological data. Using two different timeframes for the modeling runs could make for some difficulty in comparing the screening results with more detailed modeling.

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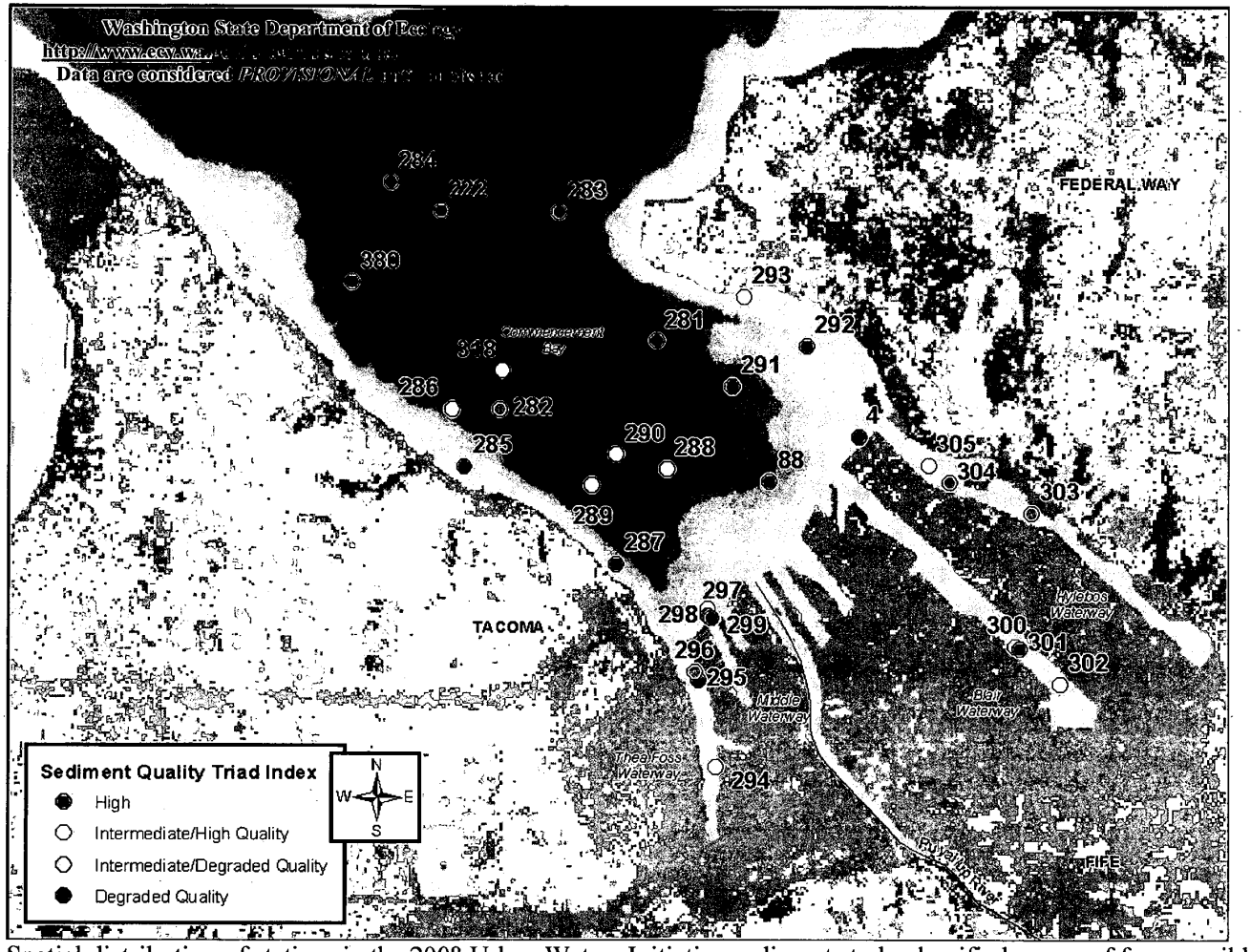

Spatial distribution of stations in the 2008 Urban Waters Initiative sediment study classified as one of four possible categories with the Sediment Quality Triad Index

Comment #30

Comment #50

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Assessing heavy metal contamination in Sado Estuary sediment: An index analysis approach

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Abstract

The Sado Estuary in Portugal is a good example of a site where human pressures and ecological values collide with each other. An overall contamination assessment has never been conducted in a way that is comprehensible to estuary managers. One of the aims of this work was to select different types of index to aggregate and assess heavy metal contamination in the Sado Estuary in an accessible manner. Another aim was to use interpolation surfaces per metal to compare and gauge the results of the indices and to assess the contamination separately per metal. Seventy-eight stations were sampled within the main bay of the estuary and a set of heavy metals and metalloids was established, Cd, Cu, Pb, Cr, Hg, Al, Zn and As. The sediment fine fraction content, organic matter and redox potential were also analysed. Various indices for contamination, background enrichment and ecological risk were used, tested, compared and performance-evaluated. All metals and metalloids were strongly correlated, and the indices appear to reflect heavy metal variability satisfactorily. Difficulties were found in some indices regarding boundary definition (minimum and maximum) and comparability with other estuaries, thus better methods of standardization should be a priority issue. According to the index that has the highest performance score within the group of ecological risk indices – the Sediment Quality Guideline Quotient – only 3% of the stations are highly contaminated and register a high potential for observing adverse biological effects, whereas 47% display moderate contamination. This index can be complemented with the contamination index, which allows more site-specific and accurate information on contaminant levels. If the aim of work on contamination evaluation is to assess the overall contamination of a study area, the indices are highly appropriate. For spatial and source evaluation per metal, interpolation surfaces should also be used.
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Keywords: Indicators and indices; Heavy metal assessment; Estuarine management; Sediment; Pollution

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1. Introduction

Estuaries receive significant anthropogenic inputs from both point and non-point upstream sources and from metropolitan areas, tourism and industries located along the estuarine edges. Estuarine sediment contamination is receiving increasing attention from the scientific community, since it is recognized as a major source of ecosystem health stress (Chapman and Wang, 2001; Riba et al., 2002b). Thus, the proper assessment of sediment contamination in estuaries and its biological and ecological significance is crucial.

For better management of estuarine ecosystems their contamination assessment should be easily communicated to local managers and decision-makers. Environmental quality indicators and indices are a powerful tool for processing, analyzing and conveying raw environmental information to decision-makers, managers, technicians or the public (Ramos et al., 2002). Their spatial visualization through maps using a Geographical Information System makes their transmission even easier and more successful.

In recent decades different metal assessment indices applied to estuarine environments have been developed. Each one of them aggregates the concentration of metal contaminants and can be classified in three types—(i) *contamination indices*: which compare the contaminants with clean and/or polluted stations measured in the study area or simply aggregate the metal concentrations; (ii) *background enrichment indices*: which compare the results for the contaminants with different baseline or background levels, available in literature, that can be used for any study area; and (iii) *ecological risk indices*: which compare the results for the contaminants with Sediment Quality Guidelines or Values—SQG. They also differ in the aggregation methods used. Table A.1 (see Appendix A) presents an overview of indices to assess contaminants on the basis of their chronological evolution, their description and some comments and/or drawbacks.

When using summary indices, normalized for example to a reference value, substantial loss of information can occur during the conversion of multivariate data into single proportional indices, including spatial information. However, such indices have provided useful information in the past and continue to do so. They also provide a single and highly visual data presentation, which can be explained to and understood by non-scientists (Chapman, 1996).

SQGs are very useful to screen sediment contamination by comparing sediment contaminant concentration with the corresponding quality guideline. These guidelines evaluate the degree to which the sediment-associated chemical status might adversely affect aquatic organisms and are designed to assist sediment assessors and managers responsible for the interpretation of sediment quality (Wenning and Ingersoll, 2002). They have been largely developed for marine waters (e.g. Long et al., 1995) but a few have been specifically developed for estuarine waters (Chapman and Wang, 2001). The work by Wilson and Jeffrey (1987) is a rare example of SQGs developed specifically for estuaries. Donze et al. (1990) listed background concentration for several estuaries in Europe and the USA.

The Sado Estuary in Portugal is a good example of a site where human pressures and natural values compete with each other and where the degree of metal contamination has not been subject to overall assessment, for the outer estuary, in a way that managers can understand. The Sado Estuary is the second largest in Portugal, with an area of approximately 24,000 ha. It is located on the west coast of Portugal. Most of the estuary is classified as a natural reserve but it also plays an important role in the local and national economy. There are many industries, mainly on the northern margin of the estuary. The most polluting industries are those involving pulp and paper, pesticides, fertilizers, yeast, food and shipyards (Catarino et al., 1987). Furthermore, harbor-associated activities and the city of Setúbal, along with the copper mines on the Sado watershed, use the estuary for waste disposal purposes without suitable treatment. In other areas around the estuary intensive farming, mostly of rice, represents the main use for the land, together with traditional salt pans and increasingly intensive fish farms. The Sado Estuary is characterized by a North Channel with weaker residual currents and shear stress. This enhances the accumulation of sediment allowing locally introduced pollutants to settle rather than be transported away. The southern channel, separated from the North Channel by sand banks, is highly dynamic, with tides being the main cause of water circulation. Geomor-

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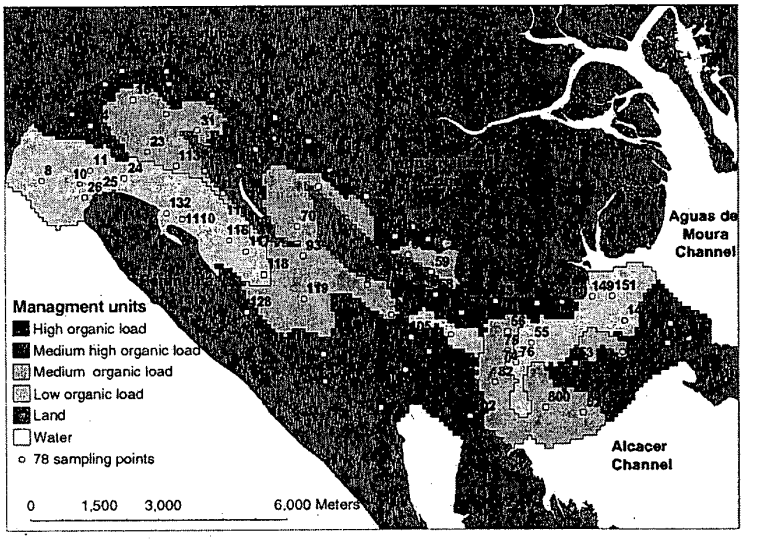

Fig. 1. Location of the sampling points in the Sado Estuary and the management units. These areas are divided into four groups according to their organic load (adapted from Caeiro et al. (2003)).

phological characteristics distinguish the outer estuary (our study area) from the inner one, which corresponds to a narrow channel (Alcacel Channel). The inner part of the outer estuary (entrances to Águas de Moura and Alcacer Channels) is quite shallow, with tidal flats (Neves, 1985).

One of the aims of this work is to select different types of indices to aggregate and assess the heavy metal contamination of the Sado Estuary sediment. The different types of indices are compared and discussed. Another aim is to evaluate the contamination per metal, also using interpolation surfaces to compare and gauge the results of the indices on the basis of a qualitative sensitivity analysis. The sediment metal assessment will be represented and evaluated in management units (spatially contiguous and homogeneous regions of sediment structure), which are to be part of a broad environmental data management framework applied to the Sado Estuary, though that is beyond the scope of this work. The support infrastructure of this framework is a set of management units delineated using multivariate geostatistical tools and sediment parameters like total organic matter (TOM), fine fraction (FF) and redox potential (Eh). These tools and this data allowed the computing of 19 management units, classified into four groups according to the increase in organic load (Fig. 1) (Caeiro et al., 2003).

2. Methods

2.1. Sampling design and analytical procedures

From November 2000 to January 2001, sediment samples were collected at 153 sites according to a systematic unaligned sampling design (500 m × 750 m), located using the Global Positioning System (Garmin GPS 12 × L). A systematic unaligned sampling design was adopted to provide pairs of close observations, required for modeling the short-scale variability, and uniform coverage of the area. This tends to reduce the average extrapolation error (Caeiro et al., 2003). For contaminant assessment, due to budget constraints, 78 locations were selected from the 153, using an optimization model to select the appropriate spatial distribution within the study area and within each type of management unit (Caeiro et al., 2004) (Fig. 1). At each location three replicates were taken with a *Petit Ponar*® grab (six in Scoopes 00890) and a composite sediment sample was formed. A set of concentrations of totally recoverable heavy metals: Cd, Cu, Pb, Cr, Hg, Al, Zn and the metalloid As was established. Accurately weighted aliquots of about 1 g of sediment were digested according to USEPA (1996) methods. The analytical technique used was inductively coupled plasma

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atomic emission spectroscopy (ICP–AES). In the case of mercury a CMA (concomitant metals analyser) system was used in the ICP–AES for an improvement in the detection limit. Certified reference material (like SPEX-QC-21-16-85AS-traceable to NIST) and spiked samples were used to evaluate the accuracy of the analytical methods. The maximum value for precision data ($n = 10$) was 5% and the bias data range was −20 to +6%. Total organic matter and sediment fine fraction (FF) and redox potential were also determined for each location (in the total 153-location dataset). Fine fraction was obtained by hydraulic separation (<63 μm), after organic matter destruction and disaggregation of particles. Redox potential was measured in situ using an electrode (Hanna Instruments, model H 13111). Total organic matter corresponds to the amount lost on ignition at 500 ± 25 °C for 4 h. The replicates had standard deviations lower than 20% (Caeiro et al., 2003).

2.2. Indices calculation

The indices used in this study were chosen from Table A.1 according to the following criteria: (i) input data was available (no data available for q, EQUATION, SQG-Q1 and NI_{geo}); (ii) all contaminants were integrated into a single value (p, SEF and ERF do not aggregate all metals into one value); and (iii) whenever there were two similar ones, only one was chosen (SQG-Q′ is the same as SQG-Q if the contaminants are only metals). The selected indices were then: DC (Eq. (A.2)), PLI (Eq. (A.6) and Eq. (A.7)), I (Eqs. (A.8) and (A.9)), MPI (Eq. (A.10)), NI (Eqs. (A.11) and (A.12)), SQG-Q (Eqs. (A.13) and (A.14)) and MSPI (Eq. (A.18)). A new pollution index, PIN (a background enrichment index), was adapted from PI, based on the Portuguese legislation on the classification of dredged materials (DR, 1995):

$$\mathrm{PIN} = \sum_{i=1}^{n} \frac{W_i^2 C_i}{B_{1i}} \quad (1)$$

where W_i is the class of the contaminant i considering the degree of contamination (from 1 to $n = 5$); C_i the concentration of the contaminant i; B_{1i} the concentration of contaminant i in Class 1 (baseline value – clean sediments).

The guidelines used for the selected indices are listed in Table 1.

According to the legislation mentioned above, the sediments (and the index) can be classified into five categories, from clean to highly contaminated sediments (Table 2). PIN values were normalized in a nominal scale from 1 to 5, according to the threshold classification values. Each index threshold was calculated using the W_i and C_i values for the corresponding class—Class 1 (clean): [0–7] Class 2 (trace contaminated): [7–95.1] Class 3 (lightly contaminated): [95.1–518.1] Class 4 (contaminated): [518.1–2548.6] and Class 5 (highly contaminated): [2548.6–∞].

For the indices I and NI, stations inside the management area at the entrance to the estuary were chosen as the reference stations (8, 10, 11, 24, 25, 26, 111, 116, 117, 118, 132, 1110). This area was considered as a clean reference area since it has high hydrodynamics, has a direct connection with the clean water coming from the sea and has no direct influence from any anthropogenic point and non-point sources. The concentrations of the heavy metals found in these stations are in accordance with, or even lower than, those reported in earlier work carried out in clean areas of the Sado Estuary (e.g. Quevauviller et al., 1989; Quintino, 1993) and are also equal to or less than estuarine baseline values (Wilson and Jeffrey, 1987; see Table 1). An ANOVA test was used to test differences between reference sites and the other stations (Chapman, 1996), after normality assumptions were tested. A cluster analysis was also computed using the seven heavy metals studied, As, Eh, FF and OM, to confirm that the reference stations were grouped together. The concentration values of each metal in the reference sites were calculated using the median values of those 12 stations.

For the PLI calculation the minimum found in all stations was used as the baseline value for each contaminant, since in our sampling points some metal concentrations were lower than the baseline values proposed by Wilson and Jeffrey (1987). Otherwise, the use of baseline values would produce an error in the index calculation (Table 1).

The probable effect level (PEL) was used for the SQG-Q index calculation. Although the PEL was originally developed for coastal waters, it can be used in the Sado estuarine study area with more confidence due to the low range of salinity (from 29 to 37‰)

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Table 1
Indices calculated in this study and guidelines used

Index	Classification	Guidelines (mg/kg)							
		Cd	Pb	Zn	Cu	As	Cr	Hg	TOM
New pollution index (PIN)	Clean sediments (DR, 1995)	1	50	100	35	20	50	0.5	–
Degree of contamination (DC)	Pre-industrial reference level (Hakanson, 1980)	1	70	175	50	15	90	0.25	–
Pollution load index (PLI)	Baseline (Wilson and Jeffrey, 1987)	0.5	10	20	5	5	5	0.05	1
	Minimum value in this study	0.2	2	2.1	1	1.1	0.6	0.02	0.5
	Threshold (Wilson and Jeffrey, 1987)	1.5	100	100	50	100	50	1.5	7.5
Sediment quality guideline-quotient (SQG-Q)	PEL (MacDonald et al., 1996)	4.21	112	271	108	41.6	160	0.7	–
Metal pollution index (MPI)	–	–	–	–	–	–	–	–	–
Index for ratio-to-reference (I)	Reference stations (LO1 management unit)	0.6	3.09	9.52	3.5	7.41	1.85	0.066	–
Index for new maximum RTR (NI)	Maximum RTR value	13.3	22.3	53.27	54.57	7.8	34	10.5	–
Marine sediment pollution index (MSPI)	Percentile 0–20	0.6	3.3	15.4	3.0	7.0	2.0	0.060	–
	Percentile 21–40	1.0	5.0	34.0	6.0	8.0	5.0	0.070	–
	Percentile 41–60	1.5	8.0	57.0	12.0	10.2	9.2	0.080	–
	Percentile 61–80	2.9	18.2	101.6	30.6	21.0	19.6	0.232	–
	Percentile 81–100	8.0	69.0	507.0	191.0	58.0	63.0	0.7	–

(Rodrigues and Quintino, 1993). The effects range-median (ERM) (Long et al., 1995) or other sediment quality guidelines could also be used.

For index performance evaluation the indices were scored on the basis of qualitative expert knowledge and judgment (the project research team), using the following criteria:

i. Comparability: the existence of a target level or threshold against which to compare it so that users are able to assess the significance of the values associated with it.
ii. Representativity: ability to provide a spatially representative picture of estuarine environmental states and impacts.
iii. Credibility: a good theoretical basis in technical and scientific terms; applicability to estuaries.
iv. Simplicity: ease of calculation and interpretation.
v. Sensitivity and robustness: responsiveness to change in the environment.
vi. Acceptable levels of uncertainty.

Each index was scored from 1 (lowest performance) to 3 (highest performance) for every criterion

Table 2
Classification of dredge material in coastal zones according to DR, 1995

Classes/contaminants (mg/kg)	Cd	Pb	Zn	Cu	As	Cr	Hg
Class 1: clean dredged material	<1	<50	<100	<35	<20	<50	<0.5
Class 2: trace contaminated dredged material	1–3	50–150	100–600	35–150	20–50	50–100	0.5–1.5
Class 3: lightly contaminated dredged material	3–5	150–500	600–1500	150–300	50–100	100–400	1.5–3.0
Class 4: contaminated dredged material	5–10	500–1000	1500–5000	300–500	100–500	400–1000	3.0–10
Class 5: highly contaminated dredged material	>10	>1000	>5000	>500	>500	>1000	>10

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Table 3
Score of the metal assessment indices, based on several criteria

	Contamination and background enrichment indices						Ecological risk indices	
	MPI	PIN	DC	I	NI	MSPI	PLI	SQG-Q
Simplicity	3	3	3	3	3	2	3	3
Representative	1	3	3	2	2	3	3	3
Credibility	2	3	1	3	3	3	2	3
Comparability	1	3	3	1	2	2	3	3
Sensitivity and robustness	1	2	3	3	3	3	3	2
Acceptable levels of uncertainty	2	2	2	2	2	3	2	3
Total	16	10	15	14	15	16	16	17

presented above, and a total performance score was summarized for all the indexes used (see Table 3).

In each management unit the indices were calculated using the median values of chemical concentration in all the locations belonging to each management area. This mode was also used where the index was nominal. These measures of the central tendency were used instead of an arithmetic mean as the objective of the analysis is to show the main trend in the index values for each management area. Moreover, the arithmetic mean should only be used for normal distributions and should not be used in the present of outliers (Wheater and Cook, 2002).

To gauge the results of the indices per management unit and evaluate sediment contamination separately per metal, a co-kriging interpolation for each heavy metal was computed. Sediment FF, a variable strongly correlated with all the heavy metals, was used as an auxiliary variable using the complete 153-location dataset. This interpolation method estimates the contaminants at an unmonitored location using a linear combination of neighboring index and FF values. The weights are such that the variance of the estimation error is minimal, under the constraint that the estimation is unbiased (Goovaerts, 1997). Co-kriging usually improves the prediction when secondary and well-correlated information is available and it explicitly accounts for the spatial cross-correlation between primary and secondary variables.

Statistical analyses were conducted using Statistica® 6.0 software. Data transformation was only performed for interpolation surfaces and multivariate analyses like principal component analysis (PCA) and hierarchical analysis, after normality was tested. When necessary, $\log(x + c)$ (where c = the lowest non-zero value found for each metal) was then computed (Chapman, 1996). To visualize the index results within the coastal area of the Sado Estuary and in management units, ArcGIS 8.0® GIS software was used. The classification of the classes for visualizing the indices was defined on the basis of the literature, when available (in the case of DC, SQG-Q and MSPI, see Table A.1). For I and NI an equal three interval was used for values above the reference stations and a classification from clean to highly contaminated given. In the case of MPI and PLI a geometric increment was employed, divided into four classes. MPI used a classification from clean to highly contaminated (as it is only a contamination index); for PLI a classification from unimpacted to highly polluted was given, according to the index author's classification (see Table A.1). The kriging interpolations of the contaminant concentrations were computed with the Geostatistical Analyst® ArcGiS 8.0 extension. The classification of the classes for visualizing the surfaces areas of the metals and metalloids were computed according to the Portuguese legislation on the classification of dredged materials (see Table 2).

3. Results and discussion

Metal and metalloid frequency distributions were positively skewed, so log transformation was used for interpolation surfaces of the contaminants and for further multivariate statistics. For the interpolation surfaces the contaminant and FF semivariogram models were fitted visually, using a linear model of coregionalization (Goovaerts, 1997). A geometric anisotropy model allowed the longer range to be captured in the direction of azimuth 120°, which corresponds to the water flow.

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A PCA was computed with the metals and metalloid, Al, TOC, FF and Eh. The first PCA component, strongly correlated with all variables (loading values greater than 0.8), explained 79.6% of the total variance in the dataset, while explaining only 5.8% of the second component. These correlations indicate that all the contaminants should be strongly correlated with each other and with the organic charge of the sediment. When only the contaminants Cd, Pb, Zn, As, Cu, Cr and Hg are included in the analysis, the first component explained 83.6% of the variance, also strongly correlated with all the variables (loading values greater than 0.85). Each of the other components only explained less than 5% of the variance. These later PCA factor loadings were used for the MSPI calculation and the PCA factor scores were used to compare the differences between the references and impact stations (for I and NI indices). The reference stations were different from the other stations (ANOVA, $F = 20.36$, $p = 0.000023$) and clustered in the same group.

3.1. Index comparison

The results of the indices per location and per area are shown in Fig. 2. Since the computed indices have different aims, their discussion will be divided into two groups: (i) contamination and background enrichment indices, which measure the contamination or enrichment levels and (ii) ecological risk indices, which evaluate the potential for observing adverse biological effects. Their performance scores (Table 3) will be compared within each group.

3.2. Contamination and background enrichment indices

Special care must be taken when comparing the different threshold and index classifications (Fig. 2). For example since MPI does not compare the contaminants with any value, the defined classes were classified according to earlier knowledge of the sampling station contaminant status and according to the other index classifications. That is why it has a low performance score according to the comparability and sensitivity criteria (Table 3). The PIN index has the advantage of being simple to compute and giving the results according to the dredged material classes of the Portuguese legislation. This allows comparison with other ecosystems. The problem is the low sensitivity to contamination of the thresholds defined in the sediment classifications of the legislation. Using the PIN index the stations analysed are only classified up to the level of "lightly contaminated", when in the other indices higher contamination levels are found. The DC index classifies most of the estuary management units with low impact. Although already tested successfully in coastal areas, the use of background levels defined for lakes may have induced underestimation. Also, the problem concerning natural background levels has already been well examined, with the discussion ranging from general geological reference levels to a pre-industrial or pre-civilization level for every location (Kwon and Lee, 1998). (See the low score for credibility criteria in Table 3.) However for the calculation of the DC index local reference data is not necessary, as with I and NI. Similarly to MPI, I and NI do not allow comparison of the classifications with other ecosystems and their class definition is also biased. Compared with I, NI has the advantage of normalizing the index values for the most contaminated station (maximum) and masking outlier values (DelValls et al., 1998b). Even so, its map visualization is equivalent in terms of area classification (Fig. 2).

MSPI has the advantage over the earlier indices that it gives different weights to each contaminant. The application of a PCA to identify important variables from a monitoring program can reduce sampling resources. Parameters that do not show significant spatial variations can be analysed with lesser frequency than those that have been identified as more important from the results of the PCA (Shin and Lam, 2001). Also the use of the PCA allows successful assessment of the source of the contamination, since this multivariate analysis tool does not need any linear assumption and establishes and quantifies the correlations among the original variables in the dataset when the goal is to reduce the number of variables (DelValls et al., 1998a). Given that our stations vary from unpolluted to highly polluted and can be rated from best to worst quality on the basis of dataset percentiles, it allows a more accurate index classification. The problem arises when comparing the results with other ecosystems with different contamination-range datasets. For example, if in a study area dataset there are

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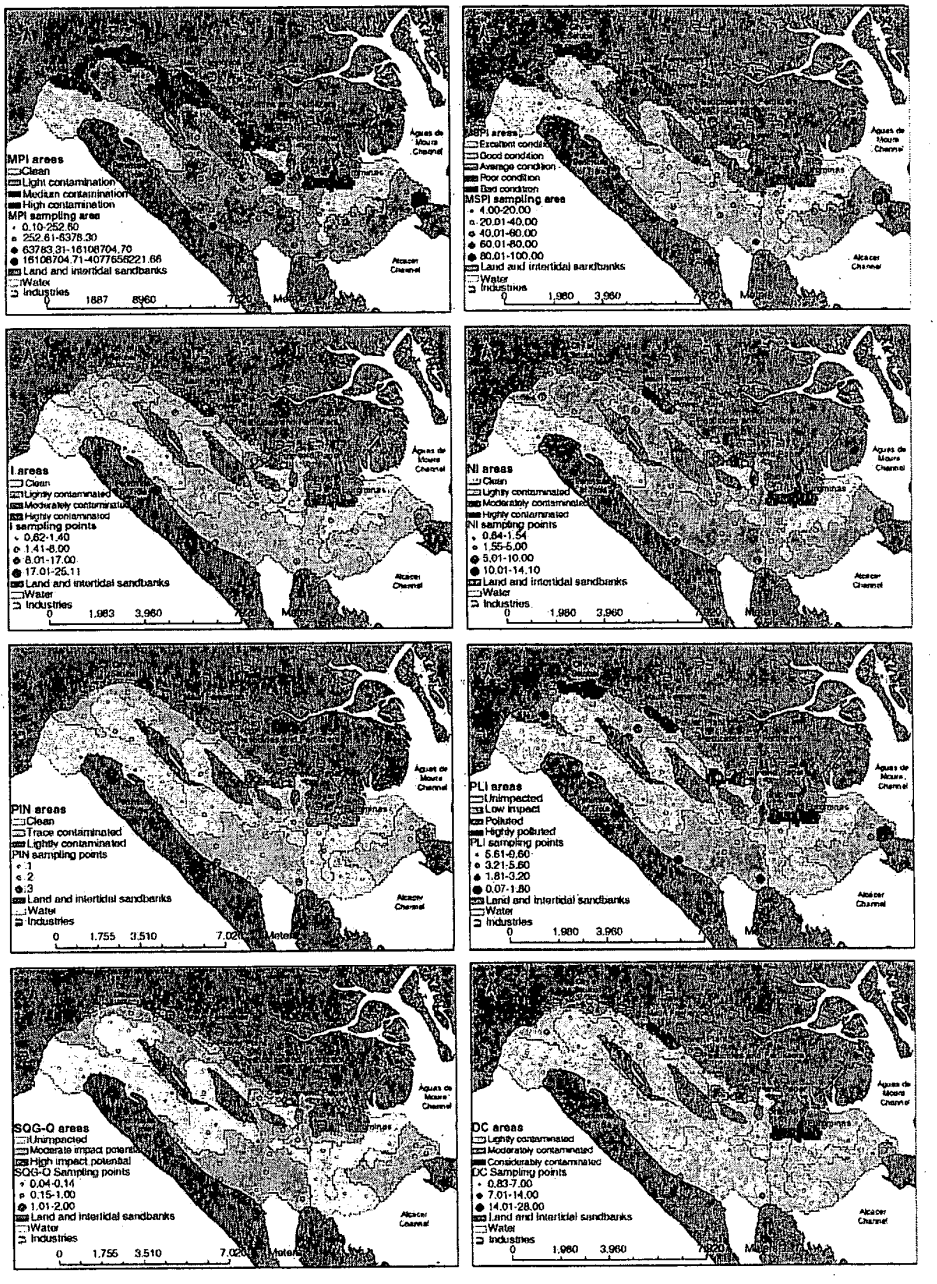

Fig. 2. Results of the contaminants indices for the sampling points and management units in the Sado Estuary.

only clean or lightly contaminated concentrations, the MSPI values in the category 80–100 will always be considered as sediment in a bad condition.

In an overall comparison of the contamination and background enrichment indices the PIN and MSPI indices have the highest performance scores, according to the indicator criteria and above discussion (Table 3), PIN due to its simplicity and comparability and MSPI due to its sensitivity, robustness and acceptable level of uncertainty. MPI has the lowest performance score since it does not allow comparison between ecosystems and has low sensitivity and limited ability to provide a representative picture of the environmental state of an estuary or any environmental impact on it.

3.3. Ecological risk indices

The PLI and SQG-Q indices are the two ecological indices calculated in this work, both of which allow the results to be compared with other ecosystems. In the case of PLI, for example, the most polluted station has a value of 0.07 (Station 43; Figs. 1 and 2). This value is low when compared with other highly contaminated European estuaries like the Tolka or Avoca in Ireland where stations with a PLI value equal to 4.3×10^{-3} and 10^{-6} can be found (Wilson and Elkaim, 1991).

For the PLI index calculation, the threshold and baseline values (see Table 1) were determined specifically for estuaries in which these values were found for sediment contamination in conjunction with depleted biological communities. The problem is that the guidelines were never updated after initial publication (1985). Also, the baseline values defined by the authors are higher than those found in our reference stations, which resulted in erroneous calculations and led us to make use of our own baseline values (from reference stations). In comparison, the guidelines used in the SQG-Q index are recent and their predictive ability has been widely tested (e.g. MacDonald et al., 1996; DelValls and Chapman, 1998; Long et al., 1998, 2000; Long and MacDonald, 1998; Hyland et al., 1999). However for the SQG-Q index no maximum level is defined, in contrast to the PLI. Hyland et al. (1999) found degraded benthic assemblages with a mean SQG-Q of <0.1, i.e. with a much lower range in concentrations of sediment contaminants. Regional variations in the magnitude of sediment contamination, the relatively insensitive bioindicators of toxicity used by Long et al. (1998) (amphipod survival test with bulk sediments), the measure of benthic community conditions that reflect the sensitivities of multiple-component species to longer-term exposures and potential interactions, may explain some of the differences that were observed in bioeffect levels. Although the use of empirically derived SQG in sediment monitoring and assessment has been the subject of debate, recent studies suggest SQG continues to be widely used to predict when chemical concentrations are likely to be associated with a measurable biological response (Fairey et al., 2001). In summary, according to the index performance criteria, SQG-Q has a higher score compared to PLI, due to the credibility and the acceptable level of uncertainty of the guidelines (Table 3).

In an overall evaluation of indicator criteria performance, SQG-Q evaluates the potential for adverse biological effects more effectively while MSPI measures the contamination level more satisfactorily. Nevertheless, most of these indices gave the same weights to the contaminant mixture, with the exception of MSPI, or did not account for synergies between contaminants as they exist in nature.

An assessment of Sado contamination will mainly be based on those two indices, in addition to the interpolation areas for an assessment per metal also used for indices and management unit gauging. Use of the many indices and approaches available is recommended for a better assessment of the quality of sediments and its development. They are fast and relatively simple to apply (Kwon and Lee, 1998). The use of these kinds of tool raises confidence when decisions about ecosystem and human health protection are being made.

3.4. Assessment of Sado Estuary metal contamination

The index classifications per management unit showed spatial patterns similar to those of the heavy metals, which led to the identification of the same 'clean' or 'showing levels do concern' (Figs. 2 and 3). In general, metals have similar spatial patterns and are associated with similar urban and industrial point

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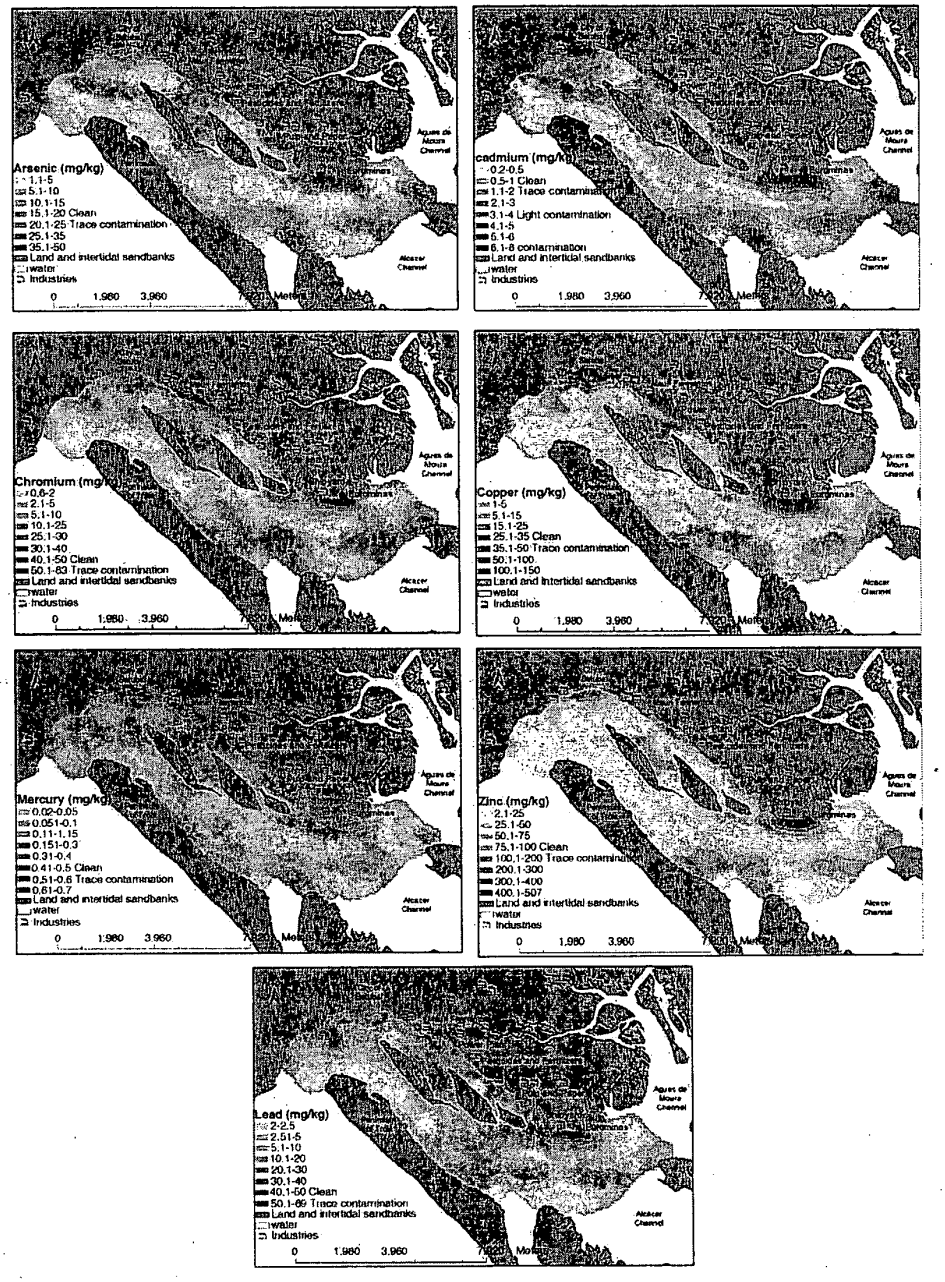

Fig. 3. Spatial distribution of the metals in the Sado Estuary. Classification according to DR (1995) (see Table 3). Industries adapted from Araujo et al. (2002).

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sources, as can be seen in Fig. 3. This fact is also confirmed by the strong correlation of all the metals in a single principal component in the PCA. Cd showed levels of concern followed by As and Cu; Zn, Pb, Cr, and Hg showed only trace contamination (Fig. 3 and Table 2).

The large area at the entrance to the estuary, the two areas on the right, at the entrance to Aguas de Moura, and two small areas near the smallest sandbank are unimpacted areas classified as in excellent condition.

The areas with contaminants of concern are located on the North Channel near certain industries: one near the shipyard and Eurominas; one near the pulp and paper plant; one near the power plant and yeast factory and one near the outfall of the City of Setubal and the fishing and urban ports. Although the conditions in these areas are considered bad in terms of contamination, according to the MSPI index, their ecological risk is only moderate (see the MSPI and SQG-Q indices in Fig. 2). Nevertheless, Stations 34, near the yeast factory, and 43, near the shipyard, have a high impact potential for adverse biological effects (see Figs. 1 and 2, SQG-Q index). According to the spatial distribution of the metals and metalloid, "hotspots" are found close to those anthropogenic sources (Fig. 3). The station near the power plant and yeast factory (34) has the highest values for Cd (8.0 mg/kg) and Cr (63.0 mg/kg). Sources of chromium are associated with the manufacture of chemicals, chrome plating and cooling towers (McConnell et al., 1996). Anthropogenic sources of cadmium could be pesticides and pigments. The highest mercury values (0.7 mg/kg) are also found in this area (Station 68). This metal is released into the environment by human activities such as the combustion of fossil fuels, waste disposal and industrial activities (Donze et al., 1990). Associated with the power plant is the discharge of heavy metals, oils, salts, acids and alkalines. Associated with the yeast factory are organic acids and sulphates (Catarino et al., 1987).

The station near the shipyard (43) has the highest values for Pb (69.0 mg/kg), Zn (507.0 mg/kg) and Cu (191.0 mg/kg). This area is under the influence of the wastewaters and water-runoff from that industrial activity (rich in heavy metals). The most important uses of Zn are protection against corrosion, Cu is used in construction materials and Pb was formerly used in paints, pigments and glass (Donze et al., 1990).

In the specific case of lead, other enriched stations are located near the outfall of Setubal City and the fishing ports (Fig. 3). Other work conducted in the study area has also related lead with urban contamination (Vale and Sundby, 1980). In addition, the areas near those ports and the pulp and paper factory are enriched with mercury.

The area between the sandbanks is also enriched with arsenic, reaching its highest value at Station 93 (59.0 mg/kg). One of the major sources of arsenic is pesticides and herbicides (Donze et al., 1990). The areas with high arsenic level can be related to currents and a high sediment deposition rate in the area. According to Neves (1985), the residual flow in the outer estuary shows a cyclonic vortex centred at the outer point of the sandbanks. This enrichment has only happened with arsenic so the indices classified these places as in good condition or with moderate impact potential.

A small unit at the entrance to the Águas de Moura channel and a station on the left at the entrance to the Alcacer Channel (Stations 102, 153, 156 and 157—see Fig. 1) have higher contamination levels and moderate ecological risk (MSPI and SQG-Q indices, Fig. 2). These locations register an increase in the concentration of most of the metals, especially Cd, Cr, Cu, As and Zn (Fig. 3). These locations are associated with shallow hydrodynamics and limited depth, so high organic loads can also be associated with non-point pollution runoff and deposition, due to aquaculture and rice field activities located upstream of these channels. Alcacer Channel may also be a source of heavy metals due to pyrite outcrop erosion and old mining activities in the river drainage basin, as has already been stressed by other authors (Quevauviller et al., 1989; Cortesão and Vale, 1995).

The concentrations of metals and metalloids are similar to the results presented in other work recently carried out in different parts of the outer estuary. In these studies, higher contamination was found near the power plant, yeast factory and Eurominas site. Exceptions were the higher cadmium values obtained here when compared with the work of Vale et al. (1997) and Gil et al. (1999). Our concentrations are also similar to measurements of Zn, Cu and Pb made 20 years ago (Vale and Sundby, 1980). Earlier work also associated Cd and Zn with sediments deposited in the upper limit of the estuary, related to river input

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(Quevauviller et al., 1989), but this area was not covered by this study. Though the number of industries has increased, cleaner technologies and industrial wastewater treatment improvements can explain the stability of these contamination levels.

4. Conclusions

The tools – interpolation surfaces, GIS and indices – used in this work for the evaluation of estuarine sediment contamination were shown to be very useful for aggregation, data transmission and visualization. Data aggregation in indices and its visualization using GIS, including the full GIS capabilities of overlaying spatial data, have many advantages. These tools are essential for decision-making processes and management involving natural resources. Loss of information can occur during the conversion of multivariate data into single indices. However, such indices offer useful information, provided that their limitations are recognized.

Different metal assessment indices were used and discussed. Some indices give equivalent information but others give complementary information (e.g. contamination or background enrichment indices and ecological risk indices) that can be developed for different purposes. There should be better methods of standardization for indices to allow better comparability between them (as several assess the same information).

According to the evaluation of the index criteria performance, SQG-Q had the highest score particularly in the group of ecological risk indices. This index can be complemented with the MSPI contamination index. MSPI does not evaluate the potential for adverse effects and the results from one ecosystem are more difficult to compare with others, but it allows more site-specific and accurate information on contamination levels. The results of the indices per management unit are in accordance with the surface areas of each metal. If the aim of contamination evaluation is to assess the overall contamination of a study area, the indices are highly appropriate. For spatial and source evaluation per metal, the interpolation surfaces should also be used.

In general the Sado Estuary has a low contamination level and a moderate potential for observing adverse biological effects. Of all the stations analysed, only 3% are highly contaminated and register a high potential for observing adverse biological effects, but 47% have moderate contamination. Nevertheless, some hotspots were found near industrialized zones and in areas with sediments rich in organic matter at the entrance to channels. All metals have similar spatial behavior and are mainly related to deposition areas. Metal with concentrations of concern is Cd, followed by As and Cu, Pb, Zn, Cr and Hg have shown only trace contamination. In the near future a new urban and industrial wastewater treatment plant will start working, so an improvement in water quality can be expected.

To link the index results more effectively with the pressures on the estuary, e.g. urban and industrial wastewater discharges and water-runoff, and thus evaluate them better, a sediment transport model (Painho et al., 2002) should be used to estimate which estuary management unit will suffer an effect caused by a certain pressure and the resulting impact.

Heavy metal assessment indices are not to be used as the only evidence of sediment quality. In future developments, organic compounds (pesticides, PAHs and PCBs) will be integrated into the contamination evaluation, which can be correlated with data on the different sources and spatial distribution of pollution. Furthermore, the integration of contamination assessment with biota and toxicity evaluation will be carried out in each management unit to allow a weigh of evidence for sediment quality assessment.

Acknowledgments

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Appendix A

See Table A.1.

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Table A.1
Indices applied to estuarine environments to assess contamination

Author	Index name: type	Description	Comments/drawbacks
Johanson and Johnson (1976) *fide* Ott (1978)	Pollution index (PI): *contamination index*	$PI = \sum_{i=1}^{n} W_i C_i$ (A.1) W_i is the weight for pollution variable i; C_i the highest concentration of pollution variable i reported in a location of interest. For each pollutant i, the weight was based on the reciprocal of the median of observed concentrations	This index allows the ide priority contaminations si implementation of decont action. It requires several in the same sampling loc No threshold classificatio unpolluted to high polluti
Hakanson (1980) and Kwon and Lee (1998)	Degree of contamination (DC) (sub-index of an ecological risk index): *background enrichment index*	$DC = \sum_{i=1}^{n} C_f^i = \sum_{i=1}^{n} \frac{\bar{C}_{0-1}^i}{C_n^i}$ (A.2) C_f^i is the contamination factor; $\bar{C}_{0-1}^i$ the mean content of the substance in question (i) from superficial sediment (0–1 cm) from accumulation areas (at least five samples); C_n^i the reference level (according to Hakanson, 1980); DC < n (no. of contaminants): low level of contamination; n < DC < $2n$: moderate degree of contamination; $2n$ < DC < $3n$: considerable degree of contamination; DC > $3n$: very high degree of contamination	This was developed and t although it has already be used for coastal areas (K 1998). It needs at least fi which provide an even a study area. Only built for contaminants (PCB, Hg, Pb, Cr)
Satsmadjis and Voutsinou-Taliadouri (1985)	Index of metals pollution in marine sediments (q): *contamination index*	The assessment of the degree of pollution of sediment by an element first requires the relation of its contents, c, to the granulometric composition of the substratum in a clean section of the investigated region, and the metal concentration estimation for uncontaminated sediment is then evaluated on the basis of the grain size composition: $f = g + \frac{t}{0.2g+5}$ (A.3) $c = EKd^{\log f/\log 5}$ (A.4) $q = \frac{C'}{c}$ (A.5) f is the clay equivalent; g the percentages of clay; t the percentages of silt; E and K the constants; d the enrichment constant, expresses the magnitude of the influence of the grain size on the concentration of the metal. The enrichment induced by fine particles is very slight for $d < 1.2$, moderate for $1.2 \leq d < 1.4$, substantial for $1.4 \leq d < 2$ great for $2 \leq d < 4$ and huge for $d \geq 4$; C' the true concentration of the metal. If it exceeds 1, measures the extent of the pollution by the metal in question	Calculated on the basis o specific place – Greek gu Not tested in other coasta According to the author i find the proper data to se compute Eq. (A.4), since discernible factors may b level of an element in a s virgin zone. It does not i all contaminants into one It requires the separate m of silt and clay. No thresh maximum pollution

Table A.1 (*Continued*)

Author	Index name: type	Description	Comments/drawbacks
Wilson and Jeffrey (1987)	Pollution load index (PLI): *ecological risk index*	For each contaminant the PLI is calculated using the formula: $\mathrm{PLI} = \mathrm{anti}\log_{10}\left(1 - \frac{C-B}{T-B}\right)$ (A.6) B is the baseline value—not contaminated; T the threshold, minimum concentrations associated with degradation or changes in the quality of the estuarine system. Wilson and Jeffrey (1987) define B and T for the different contaminants; C the concentration of the pollutant. For each place the PLI calculation takes into account all the n contaminants: $\mathrm{PLI} = (\mathrm{PLI}_1, \mathrm{PLI}_2, \ldots, \mathrm{PLI}_n)^{1/n}$ (A.7) Varies from 10 (unpolluted) to 0 (highly polluted)	This index allows the con several estuarine systems. implement. It has been ap in European estuaries (Wi Wilson and Elkaim, 1991: and US estuaries (Wilson, (1996) used this index wi aggregation methods like average and minimum sul obtained good results. Ev as it takes into account S(Values of baseline and thi defined locally for each c analysed and not recently
Chapman (1990)	Index for chemistry (ratio-to-reference RTR) of the sediment quality triad component (I): *contamination index*	$\mathrm{I} = \frac{\sum_{i=n} \mathrm{RTR}_i}{n} \quad \forall i$ (A.8) $\mathrm{RTR}_i = \frac{v_i}{(v_i)_0}$ (A.9) n is the total variable number; v_i the value of each parameter i; $(v_i)_0$ the value of each parameter at reference site	Useful in time-series mon summarizing changes by location. It needs referenc It may give imprecise val of the undue influence of measurements used in the values (DelValls et al., 19 threshold for maximum p
Usero et al. (1996)	Metal pollution index (MPI): *contamination index*	$\mathrm{MPI} = (M_1, M_2, M_3, \ldots, M_n)^{1/n}$ (A.10) M_n is the concentration of metal n expressed in mg/kg of dry weight	Simple but does not com contaminant concentratior baseline or guidelines. Nc classification from unpoll pollution. Geometric aver by Ott (1978), has advant compared with other aggr since it highlights concen
DelValls et al. (1998b)	Index for chemistry (new maximum RTR) of sediment quality triad component (NI): *contamination index*	$\mathrm{NI} = \frac{\sum_{i=1}^{n} \mathrm{RTM}_i}{(\sum_{i=1} \mathrm{RTM}_i)_0} \quad \forall i$ (A.11) $\mathrm{RTM}_i = \frac{\mathrm{RTR}_i}{\mathrm{RTR}-m_i}$ (A.12) $(\mathrm{RTR} - m_i)$ is the RTR maximum value obtained for the parameters i; $(\cdot)_0$ the reference site	The use of the maximum (polluted station reference a sediment quality triad (permits the classification variable between maximu It needs reference site val for maximum pollution

Long and MacDonald (1998)	Mean sediment quality guideline quotient (SQG-Q): *ecological risk index*	Takes into account a complex mixture of contaminants in each location (NSTP: National Status and Trend Program) $\text{SQG-Q} = \frac{\sum_{i=1}^{n} \text{PEL-Q}_i}{n}$ (A.13) $\text{PEL-Q} = \frac{\text{contaminant}}{\text{PEL}}$ (A.14) PEL-Q is the probable effect level quotient; PEL the probable effect level for each contaminant (concentration above which adverse effects frequently occur) (MacDonald et al., 1996). Sediment locations are then scored according to their impact level (MacDonald et al., 2000)—SQG-Q $\leq$ 0.1 unimpacted: lowest potential for observing adverse biological effects; 0.1 < SQG-Q < 1: moderate impact potential for observing adverse biological effects; SQG-Q $\geq$ 1: highly impacted potential for observing adverse biological effects	This mixes all contamina SQG, including metals, P. Evaluates toxicity, since i account SQG comparison. be used with other SQGs range-median (ERM) (Lo. or others. Other scores ca instead of 1. MacDonald used threshold of 1 and 2 better results with 1
Field et al. (1999, 2002)	Logistic regression models (p): *ecological risk index*	The logistic model evaluates the probability of observing acute toxicity effect (p for a probability of 20, 50 or 80%) for 37 chemicals (metals, PAH, PCB and organochlorine pesticides) based on amphipod mortality tests: $p = \frac{\exp[B0+B1(x)]}{1+\exp[B0+B1(x)]}$ (A.15) $B0$ is the intercept parameter; $B1$ the slope parameter; x the chemical concentration or log chemical concentration. Probability of observing a toxic effect from 0 to 1	Developed using a large c matching saltwater sedim and toxicity data for field samples compiled from a different sources and geo It does not aggregate all c into one value
Ingersoll et al. (1999) *fide* MacDonald et al. (2000)	Mean sediment quality guideline quotient (SQG-Q′): *ecological risk index*	Same procedure as in earlier SQG-Q, but calculates the quotient separately for each type of contaminant: metals, PCBs and PAHs, then the mean SQG-Q is calculated by determining the average for each SQG-Q type of contaminant (USEPA procedure). Sediment locations are scored in the same way as in NSTP	Evaluates toxicity, since i account SQG comparison. be used with other SQGs scored with other threshol
Ferreira (2000)	Equation sub-index sediment quality (EQUATION): *ecological risk index*	This sub-index is integrated in an estuarine quality index based on key physical and biogeochemical features. The sediment quality sub-index is evaluated through sediment contamination, bioaccumulation and biodiversity descriptors. The sediment contamination is evaluated in terms of area affected according to a probabilistic approach. The system is divided into a set of grid cells, and into contamination levels defined using the PEL. In each grid cell, the median value for each sampling station is determined and if any of the PEL values for indicator contaminants are exceeded, the stations is considered polluted. The contamination of a grid cell is based on the proportion of contaminated stations contained. Five grades are defined, ranging from light contamination (10% of area polluted) to gross pollution (>70% of area)	According to the author, of change in persistent po the sediment is usually lo eliminates the need for de synoptic sampling. Only for gross comparison betv not for detailed managem particular system

Table A.1 (*Continued*)

Author	Index name: type	Description	Comments/drawbacks
Fairey et al. (2001)	Mean sediment quality guideline quotient as indicator of contamination and acute toxicity (SQG-Q1): *ecological risk index*	$\text{SQG-Q1} = \frac{[\text{Cd}/4.21]+[\text{Cu}/270]+[\text{Pb}/112.18]+[\text{Ag}/1.77]+[\text{Zn}/410]+[T_{\text{chlordane}}/6]+[\text{dieldrin}/8]+[\text{TPAH}_{\text{ac}}/1800]+[\text{TPCB}/400]}{9}$ (A.16) The constant values correspond to PEL, in the case of Cd, Ag, Pb, ERM in the case of Cu, Zn, total chlordane and Dieldrin; consensus guideline defined by Swartz (1999) *fide* (Fairey et al., 2001) for total PAH and consensus guideline defined by MacDonald et al. (2000) *fide* Fairey et al. (2001) for total PCB. Sediments have a high probability of being toxic to amphipods when SQG-Q1 is high (>1.5) and a low probability of being toxic when SQG-Q1 is low (<0.5)	It is only meant to serve a tendency indicator. It min potential for impact from component. It is prudent t chemical exposure on an chemical basis in additior chemical matrix basis des SQG-Q1 ranges are them currently subject to invest It is focused on acute tox sediment to marine amphi the sole measure of biolo
Ruiz (2001)	New index of geoaccumulation (NI_{geo}): *background enrichment index*	$\text{NI}_{\text{geo}} = \log_2 \frac{C_n}{1.5 \times B_n}$ (A.17) B_n is the concentration of the metal n in unpolluted sediments, according to a list of regional backgrounds for the different grain sizes (medium sand, fine sand or silt and clay); C_n the concentration of the metal. Unpolluted $\text{NI}_{\text{geo}} < 1$; very lightly polluted $1 < \text{NI}_{\text{geo}} < 2$; lightly polluted $2 < \text{NI}_{\text{geo}} < 3$; moderately polluted $3 < \text{NI}_{\text{geo}} < 4$; highly polluted $4 < \text{NI}_{\text{geo}} < 5$; very highly polluted $\text{NI}_{\text{geo}} > 5$	The first version of this ir developed for rivers by M *fide* Ruiz (2001), but this has been applied in estuai a grain size classification sediment. Has the great a using a different backgrou depending on sediment gr C_n only developed for Cr, and Pb. It does not aggre contaminants into one val
Shin and Lam (2001)	Marine sediment pollution index (MSPI): *contamination index*	$\text{MSPI} = \frac{(\sum_{i=1}^{n} q_i w_i)^2}{100}$ (A.18) q_i is the sediment quality rating of the i contaminant; w_i the weight attributed to the i variable (proportion of eigenvalues obtained from the results of a principal component analysis, PCA). For each variable the sediment quality is rated (q_i) on the basis of the percentile in the dataset—MSPI 0-20: sediment in excellent condition; MSPI 21-40: sediment in good condition; MSPI 41-60: sediment in average condition; MSPI 61-80: sediment in poor condition; MSPI 81-100: sediment in bad condition. The index is also scored on this scale	Site-specific, making the i more accurate. It has a cc computation (PCA develo This index has shown sig correlation with benthic a
Riba et al. (2002a)	Metal enrichment index (SEF): *contamination index*	$\text{SEF} = \frac{C_i - C_0}{C_0}$ (A.19) C_i is the total concentration of each metal i measured in the sediment; C_0 the heavy metal background level established for the ecosystem studied	It does not aggregate all c into one value. No thresh maximum pollution

Riba et al. (2002a)	Potential ecological risk index (ERF): *ecological risk index*	$ERF = \frac{C_i - C_{SQV}}{C_{SQV}}$ (A.20) C_i is the total concentration of each metal i measured in the sediment; C_{SQV} the highest concentration of the heavy metal non-associated with biological effects (chemical concentration associated with adverse effects); polluted stations have values equal to or greater than 1	It does not aggregate all contaminants into one value. It uses site-specific sediment quality guidelines (DelValls and Chapman, 1998)

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Ecological Screening Criteria for Passaic River Study Area
Parameters Associated with Study Area

Toxic Substance	CAS Number	Sediment (mg/kg)			
		Fresh Water Criteria		Saline Water Criteria	
		Lowest Effects Level (LEL)[1]	Footnotes	Effects Range Low (ER-L)[4]	Footnotes
Aldrin	309-00-2	0.002	1	See Freshwater Criteria	6
Arsenic	7440-38-2	6	1	8.2	4
Benz(a)anthracene	56-55-3	0.320	1	0.261	4
Benzo(k)fluoranthene	207-08-9	0.240	1	0.240	6
Benzo(g,h,i)perylene	191-24-2	0.170	1	0.170	6
Benzo(a)pyrene (BaP)	50-32-8	0.370	1	0.430	4
Cadmium	7440-43-9	0.6	1	1.2	4
Chlordane	57-74-9	0.00324	1	0.00324	6
Chlorobenzene	108-90-7	0.291	8		
Chromium	7440-47-3	26	1	81	4
Copper	7440-50-8	31.6	1	13.318	2
DDX (Total DDD, DDE and DDT)[12]		0.00528	1	0.00158	2
Dibenz(a,h)anthracene	53-70-3	0.060	1	0.063	4
1,2-Dichlorobenzene	95-50-1	0.294	8		
1,4-Dichlorobenzene	106-46-7	0.318	8		
2,4-Dichlorophenol	120-83-2	0.0817	8		
Dieldrin	60-57-1	0.0019	1	0.271	2
Endrin	72-20-8	0.003	1	0.003	6
Hexachlorobenzene	118-74-1	0.020	1	0.020	6
Indeno(1,2,3-cd)pyrene	193-39-5	0.200	1	0.200	6
Lead	7439-92-1	35.8	1	10.606	2
Mercury	7439-97-6	0.18	1	0.037	2
Methoxychlor	72-43-5	0.0136	8		
Naphthalene	91-20-3	0.176	8	0.16	4
Nickel	7440-02-0	16	1	21	4
Pentachlorobenzene	608-93-5	0.024	8		
Pentachlorophenol	87-86-5	23	8		
PCB Aroclor 1016		0.007	1	0.007	6
PCB Aroclor 1248		0.030	1	0.030	6
PCB Aroclor 1254		0.060	1	0.060	6
PCB Aroclor 1260		0.005	1	0.005	6
Polychlorinated biphenyls (PCBs - Total Aroclor)[15]	1336-36-3	0.0598	1	0.0227	2
PCB 77	32598-13-3	0.0032	5	0.0032	5
PCB 81	70362-50-4	0.00065	5	0.00065	5
PCB 105	32598-14-4	0.062	5	0.062	5
PCB 114	74472-37-0	0.065	5	0.065	5
PCB 118	31508-00-6	0.079	5	0.079	5
PCB 123	70362-50-4	0.079	5	0.079	5
PCB 126	32598-14-4	0.000062	5	0.000062	5
PCB 156	74472-37-0	0.079	5	0.079	5
PCB 157	32598-13-3	0.079	5	0.079	5
PCB 167	70362-50-4	0.079	5	0.079	5
PCB 169	32598-13-3	0.079	5	0.079	5
PCB189	70362-50-4	0.43	5	0.43	5
Polychlorinated biphenyls (PCBs 209 Congeners)[15]		0.0598	1	0.0227	2
TEQ (PCBs 12 WHO Congeners)[13]		0.00000085	9, 14	0.0000025	2
TEQ (PCDD 7 WHO Congeners)[13]		0.00000085	9, 14	0.0000025	2
TEQ (PCDF 10 WHO Congeners)[13]		0.00000085	9, 14	0.0000025	2
Total TEQ (WHO -PCDD, PCDF and PCB)[13]		0.00000085	9, 14	0.0000025	2
1,2,4,5-Tetrachlorobenzene	95-94-3	1.252	8		
2,3,7,8-Tetrachlorodibenzo-p-dioxin	1746-01-6	0.00000085	9, 14	0.0000025	2
Tetrachloroethylene	127-18-4	0.99	8	0.45	7
1,2,4-Trichlorobenzene	120-82-1	5.062	8		
1,1,1-Trichloroethane	71-55-6	0.213	8		
Trichloroethylene	79-01-6	0.112	8	1.6	7
2,4,5-Trichlorophenol	95-95-4				
2,4,6-Trichlorophenol	88-06-2	0.208	8		
Vinyl chloride	75-01-4	0.202	8		
Low Molecular Weight PAHs[10]		0.07642	9, 14	0.552	2
High Molecular Weight PAHs[11]		0.193	9, 14	1.700	2
Total PAHs		1.61	9, 14	4.0	4

1. Lowest Effects Levels (LELs) indicate concentrations at which adverse benthic impact may begin to occur (level tolerated by most benthic organisms). Water column species and wildlife are at potential risk via bio-magnification (food chain toxicity) if site-related sediment concentrations of PCBs, organochlorine pesticides, or mercury are at or above the LEL. Other known biomagnifiers without ESC warrant case-by-case evaluation. Persaud, D., Jaagumagi, R., and Hayton, A. 1993. Guidelines for the protection and management of aquatic sediment quality in Ontario. ISBN 0-7729-9248-7. Ontario Ministry of the Environment, Ottawa, Ontario. 23p.
2. Sediment PRGs for Ecological Receptors for Passaic River Study Focused Feasibility Study.
3. Refer to Estuarine/Marine Screening Criteria when a freshwater parameter has no corresponding value. Since the biological activity of non-polar organics is not expected to differ greatly in the estuarine/marine environment, these screens can be used as surrogates. While uncertainty associated with the use of estuarine/marine metal screens as freshwater surrogates is greater than with non-polar organics, one surrogate metal (silver) is provided.
4. Long, E.R., MacDonald, D.D., Smith, S.L., and Calder, F.D. 1995. Incidence of adverse biological effects within ranges of chemical concentrations in marine and estuarine sediments. Environmental Management Vol.19, No.1. pp. 81-97.
5. Guidance for Assessing Bioaccumulative Chemicals of Concern in Sediment, State of Oregon Department of Environmental Quality, April 3, 2007
6. Refer to Freshwater Sediment Screening Criteria when a Saline parameter has no corresponding value.
7. Screening values were developed for the protection of marine receptors; however, for the purpose of this document they are considered surrogates for freshwater systems.
8. USEPA Region 5, RCRA Ecological Screening Levels (ESLs) represent a protective benchmark (e.g., water quality criteria, sediment quality guidelines/ criteria, and chronic no adverse effect levels) for 223 contaminants and are not intended to serve as cleanup levels, but are intended to function as screening levels. http://www.epa.gov/reg5rcra/ca/ESL.pdf
9. Sediment value from NOAA Screening Quick Reference Tables (SQuiRTs), http://response.restoration.noaa.gov/book_shelf/122_NEW-SQuiRTs.pdf.
10. Low Molecular Weight PAHs are defined as compounds composed of fewer than four rings.
11. High Molecular Weight PAHs are defined as compounds composed of four or more rings.
12. Value applies to DDT and metabolites.
13. Dioxin TEQ is the sum of TEF-adjusted concentrations of listed parameters detected per sample, with non-detects treated as "0."
14. USEPA Region 3, Freshwater Sediment Screening Benchmarks, http://www.epa.gov/reg3hwmd/risk/eco/btag/sbv/fwsed/screenbench.htm.
15. Screening criteria to be used for both total Aroclor and total congener, which are to be summed separately.

July 25, 2011

Technical Memorandum
Fish and Crab Consumption Rates for the LPRSA Human Health Risk Assessment

1.0 Summary of the Issue

Fish and crab ingestion rates are needed to develop a human health risk assessment that characterizes the risk posed to individuals who consume contaminated fish and crabs in the 17.4 miles of the Lower Passaic River Study Area (LPRSA), which is a tributary of the Newark Bay Estuary, in the New York/New Jersey Harbor Estuary. This document presents a detailed evaluation of LPRSA-pertinent angler and creel surveys to identify ingestion rates for the Lower Passaic River. The analysis provides a weight-of-evidence approach for evaluating consumption for the reasonably maximum exposure (RME). The RME is the highest exposure reasonably expected to occur at a site under both current and future uses (EPA 1989) and is consistent with the goals of the Superfund program to design remedies that are protective of all individuals who may be exposed at a site (55 FR 8710, March 8, 1990). U.S. Environmental Protection Agency (EPA) Superfund risk assessment guidance requires the evaluation of completed exposure pathways under current and future conditions (EPA 1989).

The Cooperating Parties Group (CPG[1]) proposed using a fish consumption rate of 1.8 g/day for the Lower Passaic River, taken from an angler and creel survey conducted in the lower six miles of the LPRSA described in Ray et al. (2007b) and Urban et al. (2009). This fish consumption rate was calculated by including a large majority of anglers (54 of 61 anglers) who stated that they did not consume the fish they caught and thus had zero fish consumption from the Lower Passaic River (Ray et al. 2007b). Anglers with zero fish consumption are not exposed through a fish consumption pathway and cannot be considered as part of the RME for individuals who may be exposed. Therefore, they should not have been included in the calculation of a fish ingestion rate for the RME individual. Fish consumption rates from Ray et al. (2007b) that are based only on anglers who consume fish from the Lower Passaic River are 23.95 g/day (maximum estimated using probabilistic calculations) and 28 g/day (the actual reported maximum). These two values are comparable to the 26 g/day consumption rate for anglers recommended in EPA's Exposure Factors Handbook (EPA 1997) (errata at www.epa.gov/ncea/pdfs/efh/addendum-table.pdf), which Urban et al. (2009) rejected because "use of the default values would clearly inflate actual fish consumption" in the Lower Passaic River.

However, the workplan for the survey described in Ray et al. (2007b) was submitted to EPA for review and was not approved, because it was inconsistent with EPA guidance in planning,

[1] The CPG is a group of potentially responsible parties who signed an agreement with EPA to implement a remedial investigation and feasibility study for the LPRSA, under EPA oversight.

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implementation and analysis. Therefore, the survey and its results may not be used in the LPRSA risk assessment without caveat. This technical memorandum considers all other relevant angler and creel surveys in order to develop fish and crab ingestion rates for the LPRSA.

1.1. Relevant Guidance

The 1992 Exposure Assessment Guidelines issued by EPA, defines exposure as contact between a chemical, physical, or biological agent and a target (e.g., exposed individual) [EPA 1992]. Based on this definition, this evaluation of fish consumption surveys will include consumption patterns only among anglers reporting consumption of fish and/or crabs. Non-consumers will not be further evaluated since the fish ingestion exposure pathway is not complete.

This approach of evaluating only fish consumers is consistent with the Risk Assessment Guidance for Superfund (RAGS) – Part A (EPA 1989) that defines the RME as the maximum exposure that is reasonably expected to occur under baseline conditions and is not a worst-case exposure scenario. This approach is reaffirmed in the National Oil and Hazardous Substances Pollution Contingency Plan (55 FR 8710, March 8, 1990) which clarified that only potential exposures that are likely to occur are included in the RME evaluation. RAGS Part A guidance (EPA 1989) further indicates that current and future exposures are evaluated in the absence of Institutional Controls such as the health advisories for fish and crab consumption that are in effect on the Lower Passaic River.

RAGS Part A recommends the following procedures for calculating a contact rate. "Contact rate reflects the amount of contaminated medium contacted per unit time or event. If statistical data are available for a contact rate, use the 95th percentile value for this variable" (EPA 1989, p.6-22). Consistent with this recommendation, in those cases where fish ingestion rate data are available and supportive of statistical calculations, the 95th percentile is used in the calculation and is noted in the text.

In accordance with the Superfund 1991 Standard Default Exposure Assumptions guidance, the fish pathway should be evaluated when there is access to a contaminated water body large enough to produce a consistent supply of edible-sized fish over the anticipated exposure period (EPA 1991). This criterion has been met for the Lower Passaic River. EPA also provides guidance recommending the use of default exposure assumptions to reduce unwarranted variability in the exposure assumptions used by Regional Superfund staff to characterize exposures to human populations in the baseline risk assessment (EPA 1991). Further, the guidance was developed to encourage a consistent approach to assessing exposures where there is lack of site-specific data or consensus on which parameter value to choose, given a range of possibilities (EPA 1991).

Based on these guidance documents, this analysis evaluates the number of anglers reporting fish consumption in the available surveys, variability in fish ingestion rates across surveys, and consistency with fish ingestion rates used by Region 2 in Records of Decision since 1991. The analysis also provides information regarding application of a Fraction Ingested value equal to one.

2.0 Published Studies

Fish and crab consumption surveys relevant to the 17.4-mile area of the LPRSA were identified based on the criteria outlined in EPA's 2000 Ambient Water Quality Guidance (EPA 2000). The analysis is organized by the following data sources:

(1) use of local data;
(2) use of data reflecting similar geography/population groups;
(3) use of data from national surveys; and
(4) use of EPA's default intake rates.

1. *Local Data.* One survey was identified in the lower six miles of the Passaic River (Ray et al., 2007a,b). A survey of the entire 17.4-mile study area was not found based on a literature review conducted for this document.

2. *Geographic Areas/Population Groups.* Three surveys were identified in the Newark Bay Estuary and the New York Bay Estuary, which are the watersheds encompassing the 17.4-mile LPRSA. Additional surveys in New Jersey were identified including surveys in Barnegat Bay and the 1993 New Jersey Statewide survey. The surveys listed below share similar geography, population groups and climatic conditions, and include:

   - Newark Bay Complex including Newark Bay, tidal portions of the Hackensack River, Passaic River, Arthur Kill, and Kill van Kull (Burger 2002; May and Burger 1996).

   - 1993 New Jersey Household Fish Consumption Study conducted by the Center for the Public Interest Polling (CPIP) and the New Jersey Marine Sciences Consortium (NJMSC) (1993) and an intercept survey conducted in Barnegat Bay (Burger et al. 1998).

   - New York Statewide Angler survey, a statewide mail survey of New York State anglers, with applicability to the New York Bay, conducted in 1991 (Connelly et al. 1992). The survey data was obtained by EPA and analyzed based on type of water body, flowing vs. still water, single waterbody vs. multiple waterbodies, the

climate, fishing regulations, and the availability of desired fish species. This analysis was presented in the externally peer-reviewed Human Health Risk Assessment for the Hudson River (TAMS 2000).

3. *National Surveys*. The 1997 Exposure Factors Handbook (EPA 1997) identified a national survey (EPA 1996) that provides daily average per capita fish consumption estimates based on the combined USDA 1989, 1990, and 1991 Continuing Survey of Food Intakes by Individuals (CSFII).

4. *National Default Fish Ingestion Rates*. Recommended fish ingestion rates are available in the following EPA guidance:

   - 1997 Exposure Factors Handbook (EPA 1997)
   - 1991 Standard Default Exposure Factors for Superfund (EPA 1991)
   - Office of Water Methodology for Deriving Ambient Water Quality Criteria (EPA 2000).

2.1 Survey Evaluation

a. Number of Survey Individuals

Number of individuals reporting fish consumption for the surveys described above was compiled and illustrated in Figure 1.

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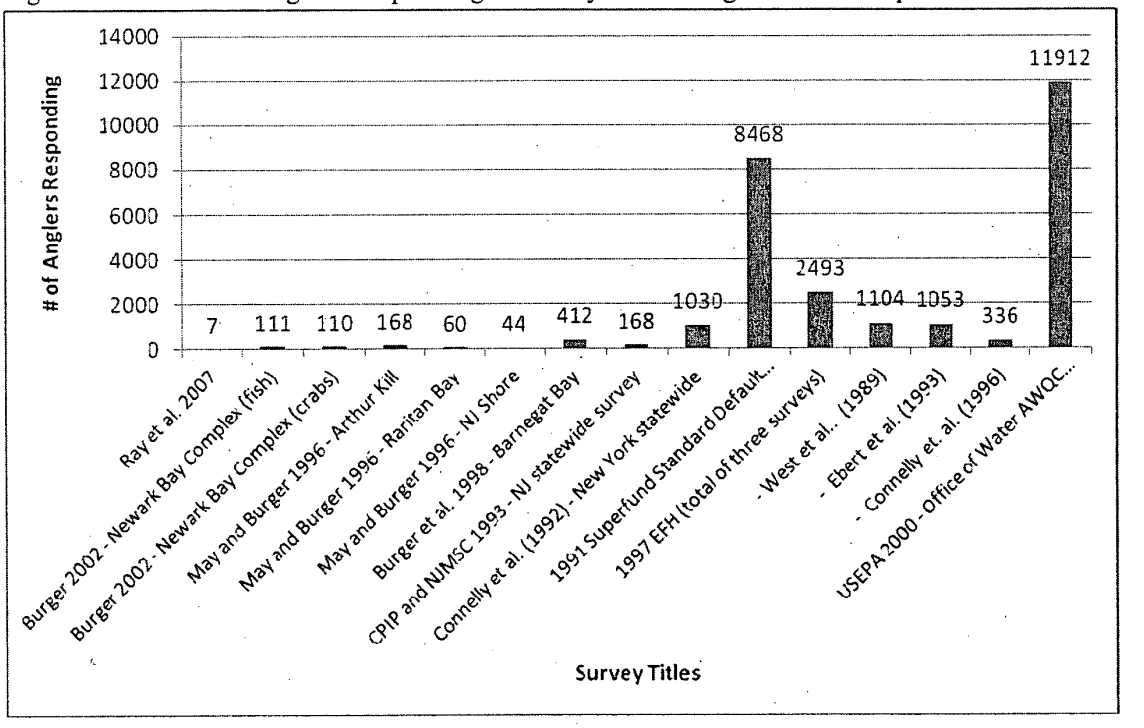
Figure 1. Number of Anglers Responding to Surveys Indicating Fish Consumption



As indicated in Figure 1, the one local survey conducted by Ray et al. (2007b) had 7 reported consumers and the lowest number of fish consumers of all of surveys analyzed. Table 6 in Ray et al. (2007b) reported that only 11% of those surveyed reported consuming fish (i.e., 7 out of 61 anglers surveyed). The small number of consumers limits further statistical analyses in that it would result in a large variance around the estimated ingestion rate. Therefore, in accordance with EPA guidance (EPA 1992), the small number of consumers and the minimal consumer-specific data provided by Ray et al. (2007b), limit evaluation of the consumption rate to the maximum reported consumption rate of 28 grams/day, which will be used in further evaluations of the data.

The remaining surveys indicate a range of individuals reporting consumption of fish and/or crabs. Larger numbers of individuals reporting fish consumption provide a more robust dataset that can be used to represent the upper percentile consumption rate.

b. Survey Methodology Review Process

Funding and methodological review procedures for the surveys identified in Section 2.0 vary. All of the papers provided below were published in the peer-reviewed literature or by EPA

following an external review process. Following is a summary of the review process and considerations.

The survey methodology for the angler and creel survey conducted in the lower six miles of the LPRSA, described in Ray et al. (2007b), was reviewed by an expert panel (Finley et al. 2003, Kinnell et al. 2007). The survey results were analyzed using a statistical methodology described in a paper published in peer reviewed literature (Ray et al. 2007a,b). However, the work plan for this survey was submitted to EPA for review and specifically disapproved as not being consistent with EPA guidance. In addition, EPA and New Jersey Department of Environmental Protection (NJDEP) reviewed the data reported in Ray et al. (2007b) and identified several concerns with use of the survey data for the LPRSA human health risk assessment (Mugdan 2010, Buchanan 2010).

Surveys in the Newark Bay Complex were conducted by Rutgers University, including the Environmental and Occupational Health Sciences Institute, and NJDEP. Within each of these organizations, procedures exist for detailed reviews of proposed surveys and research before grants are submitted for funding (L. Lurig personal communication with M. Olsen 2011). Upon submission, grants are further evaluated by the funding Agencies listed in the published report: EPA Region 2; NJDEP Division of Science and Research; the Consortium for Risk Evaluation and Stakeholder Participation through the Department of Energy (DOE) Cooperative Agreement and the National Institutes of Environmental Health Sciences. Each organization has established review procedures prior to awarding grants. They include evaluation of budgets and timelines, scientific merit, and whether the grant rules, regulations and guidance are met. Upon funding of grants, typically reports are submitted to the funding Agency and reviewed by the Agency scientists for compliance with the approved grant. Finally, the survey methodologies and results were published in peer reviewed literature (Burger 2002, May and Burger 1996).

The New Jersey Statewide Survey of Fish Consumption was conducted in 1993 by the Center for Public Interest Polling (CPIP), Eagleton Institute of Politics, Rutgers, the State University of New Jersey and the New Jersey Marine Sciences Consortium (NJMSC) for the New Jersey Department of Environmental Protection and Energy. The grant followed State review procedures.

The 1991 New York State Angler survey was conducted under grants from the National Oceanic and Atmospheric Administration, Office of Sea Grant, U.S. Department of Commerce under Grant #NA90AA-D-SG078 to the New York Sea Grant Institute. This research underwent Cornell University reviews before submission to the grant agency and also underwent review by the Department of Commerce.

The 1997 Exposure Factors Handbook (EPA 1997) was reviewed internally by Agency scientists, made publicly available and then submitted for external review by EPA's Science Advisory Board. In addition, the Office of Water Methodology for Deriving Ambient Water Quality Criteria (EPA 2000) was submitted for public review and appropriate regulatory review. The 1991 Standard Default Exposure Factors for Superfund (EPA 1991) was also reviewed within the Agency (J. Dinan, EPA, personal communication with M. Olsen, 4/13/2011).

c. *Ingestion Rate for Fish Among Consuming Anglers*

The fish ingestion rates used in this analysis were obtained from the individual reports described above. Figure 2 provides an array of mean and high-end ingestion rates from each study, where available. For one study, Connelly et al. (1992), the value shown as a mean in the figure is actually the 50th percentile. "High-end" ingestion rates are (1) 95th percentiles, in cases where the number could be estimated or was provided, (2) other high percentiles, where the 95th percentile could not be calculated, or (3) a maximum value, as in the case of the limited data provided in the Ray et al. (2007b) survey.

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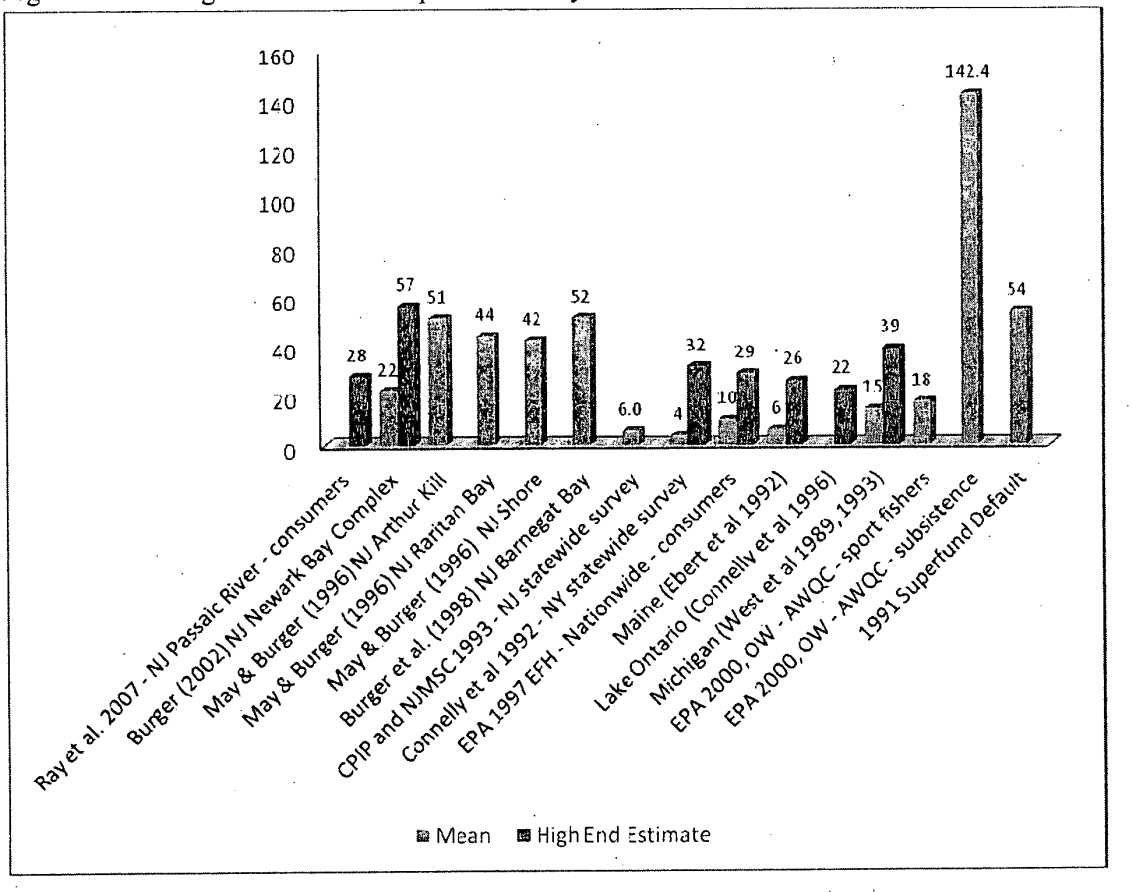
Figure 2. Fish Ingestion Rates for Specific Surveys



Based on the low response rate from the Ray et al. survey (2007b), the rate reported in Figure 2 represents the maximum reported ingestion rate. Ray et al. (2007b) stated that 2 of the 7 anglers consumed more than 20 g/day, with a maximum rate of 28 g/day. An average ingestion rate or other statistics (e.g., specific percentiles) for the 7 consumers could not be determined from the summary of data provided in the paper.

The Burger (2002) study in the Newark Bay Complex of New Jersey presents percentile distributions of consumption patterns (in Figure 2 of the paper). For people who only fished, approximately 7 percent of all respondents and 11.7 percent of "consumers only" ate more than 4,200 g/month. Thus, the high-end fish ingestion rate for fish consumers is estimated to be 4,200 g/month or 56.6 g/day, assuming fish are consumed 4.92 months of the year, per Table 2 of the paper. For fish consumers, this high-end value falls at approximately the 88th percentile; specific percentiles above this (e.g., the 90th or 95th percentiles) would be somewhere above 56.6 g/day, but cannot be estimated from the graph with certainty since the specific maximum fish ingestion rate is not shown (all three distributions shown in the figure have an upper bound of 40,000

g/month). The mean fish ingestion rate is 22 g/day, based on data provided in Table 2 of the paper (mean yearly consumption of self-caught fish is 8,120 g).

The May and Burger (1996) study in New Jersey's Arthur Kill, Raritan Bay, and the New Jersey shore, and the Burger et al. (1998) study in New Jersey's Barnegat Bay, present the mean number of times fish were eaten per month and mean serving sizes, each with their standard errors. The means were multiplied to estimate the mean fish ingestion rates for each area. Some individuals in these studies reported not eating the fish. It is not known whether the non-consumers were included in the presented summary statistics. Some respondents reported freezing fish to eat during the winter. Mean fish ingestion rates from these studies ranged from 42 to 52 g/day, assuming fish consumption 12 months/year. Upper percentile statistics for fish ingestion could not be estimated with accuracy from the data presented in the papers (i.e., without information about the shapes of the distributions or the degree of independence).

The 1993 New Jersey Household Fish Consumption Study involved interviews with a random probability sample of 1,000 New Jersey residents 18 years of age and older and was conducted between October 26 and November 20, 1993 (CPIP and NJMSC 1993). There were 225 anglers among those interviewed, 168 of whom reported eating fish in the past 7 days. These individuals ate an average of 4.81 pounds/year (or 6 g/day) of fish recreationally caught in New Jersey. Upper percentile statistics could not be calculated from the data presented. The data are based on extrapolation from a one-week period in the fall and the study notes that consumption of recreationally caught fish may vary significantly according to both seasonal and annual preferences and availability. While upper-percentile data are not available, the analysis indicates that the average consumption rate of 6 g/day for anglers consuming New Jersey recreationally caught fish is comparable to the 50th percentile from the New York statewide survey of 4 g/day (Connelly et al. 1992).

The Human Health Risk Assessment for the Hudson River (TAMS 2000, Table 3-1) summarized fish ingestion rate percentile values for the 1991 New York angler survey (Connelly et al. 1992), a statewide mail survey that included over 1,000 New York anglers who caught and consumed fish in 1991. The 50th percentile fish ingestion rate was 4.0 g/day and the 90th percentile was 31.9 g/day. This survey was also conducted to determine anglers' awareness and knowledge of fish advisories. About 85% of anglers were aware of fish consumption advisories, and almost half reported that they would eat more sport-caught fish if there were no problems with contaminants.

In the 1997 Exposure Factors Handbook, EPA's recommended mean and 95th percentile fish ingestion rates for recreational freshwater anglers are 8 g/day and 26 g/day (EPA 1997 and associated errata sheet). These are based on mailed questionnaire surveys of licensed fishermen in Michigan, Maine, and New York (Ebert et al. 1993; West et al. 1989, 1993; Connelly et al. 1992) and based on a survey involving mailed questionnaires, a diary study, and periodic

telephone interviews (Connelly et al. 1996) near Lake Ontario in New York. Similar to the Lower Passaic River, the fish ingestion rates from these studies reflect a situation in which fish consumption is advised against for certain water bodies and species and for certain human groups (Connelly et al. 1996).

A closer examination of the Exposure Factors Handbook (EFH) revealed that the recommended mean and 95th percentile for the Lake Ontario study (Connelly et al., 1996) included some non-consumers and discussions with the EFH author confirmed this finding. A recalculation performed for this technical memo resulted in mean and upper percentile values for consuming recreational freshwater anglers of 10.5 g/day and 29.1 g/day, derived by averaging the consumers-only values from the three populations surveyed in the studies.

- Maine (Ebert et al. 1993) data used in the defaults included non-consumers, but consumer-only percentiles for this survey are shown in Table 10-64 of the EFH. The 95th percentile fish ingestion rate for consuming anglers is 26 g/day.

- Lake Ontario, New York (Connelly et al. 1996) data used in the defaults included 16 percent of anglers who ate no sport caught fish. When non-consumers are excluded from the distribution, the 95th percentile fish ingestion rate for consumers is 22.3 g/day. Over 95% of the participants were aware of the New York State fish consumption advisories, and 32% indicated that they would eat more fish if there were no advisories.

- Michigan data (West et al. 1989, 1993) used in the defaults included consumers only. The 96th percentile fish ingestion rate for consumers is 39 g/day.

EPA's Office of Water identified 17.5 g/day as the average consumption among sport fishers based on averages in the studies reviewed. An upper percentile value for sport fishers is not provided. EPA's Office of Water also recommends a default of 142.4 g/day for subsistence fishers, which falls within the range of averages for this group (EPA 2000).

Thus, as presented in Figure 2, the average fish ingestion rates from the surveys examined range from 4 to 142 g/day, and the available high-end estimates of fish ingestion range from approximately 22 to 57 g/day.

Several factors were considered in the identification of the appropriate fish ingestion rate for use in the LPRSA baseline human health risk assessment: watershed in which the survey was conducted, diversity of survey methods, and consistency with local surveys from which high-end values were not available. Of the surveys identified, only the 1997 EFH (EPA 1997), Burger (2002) and Connelly et al. (1992) contain enough information to calculate statistical distributions for the ingestion rates. Only the Burger (2002) and Connelly et al. (1992) (as analyzed and

applied in the externally peer-reviewed Human Health Risk Assessment for the Hudson River in TAMS 2000) included data from the New York/New Jersey Harbor Estuary, which encompasses the tidal portion of the Lower Passaic River. Therefore, the fish ingestion rate for the Lower Passaic River RME adult angler (44 g/d) is calculated by averaging the high end estimates from Burger (2002) (57 g/d) and Connelly et al. (1992) (32 g/d). For the CTE value, the average of the mean of 22 g/day from Burger (2002) and the 50th percentile value of 4 g/day from Connelly et al. (1992) is used (CTE = 13 g/d).

From Figure 2, a comparisons of mean fish ingestion rates from other coastal areas of New Jersey (NJ Arthur Kill at 51 g/d, NJ Raritan Bay at 44 g/d and NJ Barnegat Bay at 52 g/d) indicate that the estimated mean rates in these NJ coastal areas tend to be higher than those found in surveys from other geographic areas (i.e., Maine at 6 g/d, Michigan at 15 g/d and NJ-wide at 6 g/d). While the data presented in the other NJ surveys do not provide the information necessary to calculate high end fish ingestion estimates, those surveys present means that indicate that NJ coastal fish ingestion rates tend to be higher than those from other parts of the country. Therefore, we conclude that the fish ingestion rate of 44 grams/day does not overestimate the ingestion rate for the Lower Passaic River.

d. Crab Ingestion Rate Among Consuming Anglers

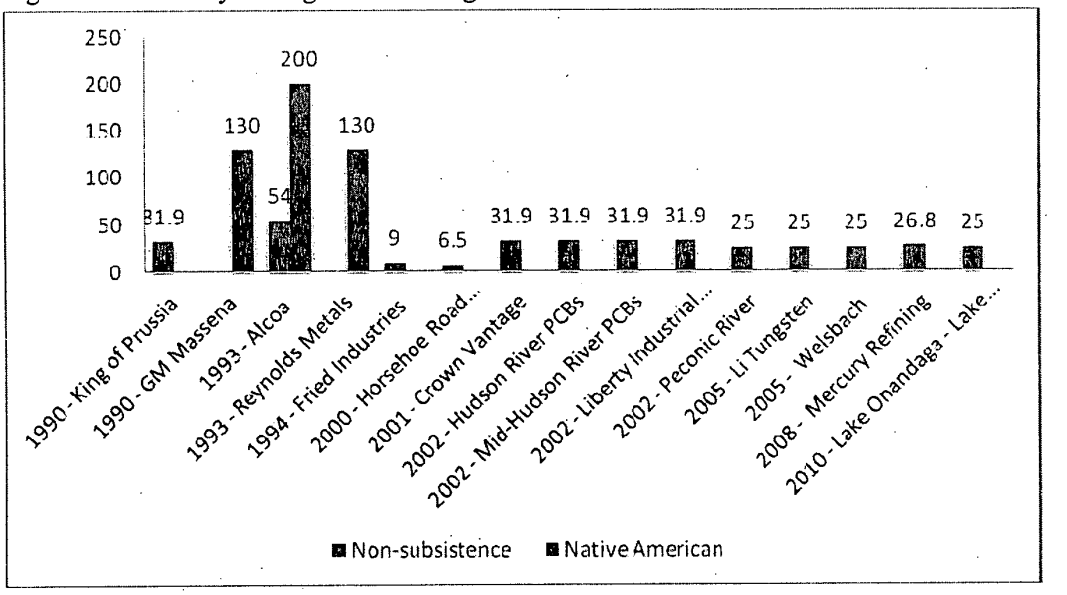
Two studies provided data on crab consumption (Burger 2002; Burger et al. 1998) and consistent with the recommendations in RAGS Part A (EPA 1989), a crab consumption rate was calculated at the 90th percentile since the 95th percentile was not available. In Burger (2002), for people who only crabbed, approximately 4 percent of all respondents (6.3 percent of "consumers only") ate more than 4,200 g/month. Similarly, about 15 percent of all respondents (23 percent of "consumers only") ate more than 1,400 g/month. Excluding the non-consumers, the 90th percentile crab ingestion rate for crab consumers is estimated to be 3,590 g/month, or 32 g/day (assuming crabs are consumed 3.3 months of the year, per Table 2 of the paper). The mean crab ingestion rate is 16 g/day, based on data provided in Table 2 of the Burger (2002) paper (assuming that 5,760 g/year is consumed during 3.3 months of the year). This mean crab ingestion rate is consistent with the mean value of 16.6 g/day from Barnegat Bay (Burger et al. 1998). Burger et al. 1998 did not report enough information to support statistical calculations of high end ingestion rates. Other studies in this area reported crab consumption but an ingestion rate could not be calculated based on the information presented (Burger et al. 1999 and Kirk-Pflugh et al. 1999).

3.0 Consistency with Region 2 Decisions

Figure 3 provides a comparison of the fish ingestion rates used in EPA Region 2 decisions since 1991 (see Appendix A for the list of Superfund Sites for which the decisions were made). As

noted in the Figure (in red), several decisions included consideration of fish ingestion rates by Native American Nations found in Massena, New York that were based on a site-specific survey of this population conducted by the New York State Department of Health in 1995 (NYSDOH 1995). This survey yielded an ingestion rate of 142 grams/day at the 90th percentile, which represents a subsistence fishing level. No evidence of subsistence fishing has been observed in the LPRSA. Averaging the other ingestion rates, in the absence of the ingestion rates for the Massena sites, yields an RME ingestion rate of 27.4 grams/day. The RME fish ingestion rate identified for the LPRSA (44 g/day) is higher than the average but within the range of ingestion rates used in EPA Region 2 decisions since 1991.

Figure 3. Summary of Region 2 Fish Ingestion Rates Since 1991.



4.0 Fraction Ingested

The CPG recommended applying a Fraction Ingested (FI) rate of < 1 for the Lower Passaic River Study Area. RAGS – Part A includes a term Fraction Ingested that is defined as "Fraction ingested from contaminated source (unitless)" (EPA 1989, p. 6-46). The guidance in the document does not specifically address application of this factor for fish consumption, but rather, on page 6-47, describes the application of this factor to adjust for ingestion rates for vegetables or other produce or ingestion of meat, eggs, and dairy products. The evaluation of various risk assessments conducted within Region 2 indicates the assessments were consistent with the overall directives on fish ingestion recommendations provided on page 6-43 that states "Residents near major commercial or recreational fisheries or shell fisheries are likely to ingest larger quantities of locally caught fish and shellfish than inland residents." Further, the fish

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ingestion rate focuses only on the contaminated source; a fraction ingested term would apply only if other sources of fish were included.

Consistent with the recommendations in RAGS Part A (EPA 1989), use of an FI less than one is not appropriate, because of the following:

- The Lower Passaic River has adequate quantity and quality of fish and crabs to support the estimated level of ingestion of fish and crabs for the RME individual, both currently (as found in the fish community survey conducted by the CPG in 2010 [Windward 2011]) and in the future;

- The Lower Passaic River is in a densely populated urban area, with access to the river for fishing and crabbing through parks, boat docks, publicly-accessible parking lots abutting the river and residences on the river banks. Therefore,

    - Anglers have ample opportunities to return to areas where they have successfully caught fish or crab, especially adolescents or lower income families, who have limited means of transportation;
    - Workers have the opportunity to fish and/or crab during the work day or on their way to and from work;
    - There are so many municipalities along the Lower Passaic River that there is the potential that individuals may move within the 17-mile study area, and yet continue to fish and crab, and consume fish/crabs from the Lower Passaic River.

- Many municipalities and counties along the Lower Passaic River have published master plans that call for the expansion and improvement of parks and open space along the Lower Passaic River that, if implemented, will make the area more amenable to fishing and crabbing (City of Newark 2010, City of Newark et al. 2004, Clarke et al. 2004, Clarke et al. 1999, Heyer et al. 2003, Heyer et al. 2002, Borough of Rutherford et al. 2007). As noted in EPA's Land Use in the CERCLA Remedy Selection Process (EPA 1995), comprehensive community master plans are a valuable source of information in determining reasonably anticipated future use for future risk scenarios.

Based on the various lines of evidence, a FI of 1 will be applied in the LPRSA human health risk assessment.

5.0 Conclusion

As shown in the discussion above, the RME fish ingestion rate of 44 grams per day and CTE fish ingestion rate of 13 g/day, as well as an RME crab ingestion rate of 32 grams per day and CTE

crab ingestion rate of 16 grams per day, are justified for use in the LPRSA human health risk assessment, because of the following reasons.

- The fish ingestion rate is based on the only two published surveys conducted in the New York/New Jersey Harbor estuary with enough information to calculate statistical distributions of ingestion rates. Those surveys use different sampling methods (i.e., intercept and licensed angler survey), yet result in comparable consumption rates. They also represent large angling populations from coastal New York and New Jersey watersheds.

- The fish ingestion rate is consistent with rates calculated from other surveys conducted within EPA Region 2 and nationally.

- The fish ingestion rate is consistent with rates used in various EPA decisions within Region 2 at sites with sediment contamination where fish ingestion was considered.

- The fish rate is consistent with ingestion rates at other large river bodies in Region 2 where more areas may be accessible for angling, which is anticipated under the future improvements to parks and open space along the Lower Passaic River.

- The crab ingestion rate is based on the only published survey conducted in the New York/New Jersey Harbor estuary with enough information to calculate statistical distributions of crab ingestion rates. The mean crab ingestion rate is consistent with the mean rate reported in another published survey conducted in the watershed that did not provide enough information to calculate high end ingestion rates.

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Appendix A
List of Superfund Sites and Associated Waterbody Used in Evaluation of Fish Ingestion Rates

Year of Record of Decision	Site Name	EPA ID Number	Waterbody
1990	King of Prussia	NJD980505341	Great Egg Harbor River
1990	General Motors (Central Foundry Division) GM Massena	NYD091972554	St. Lawrence and Raquette Rivers
1993	Reynolds Metal Company	NYD002245967	St. Lawrence River
1994	Fried Industries	NJD041828906	Raritan River
1995	Alcoa (Removal Action)	NYD980506232	Grasse River
2000	Horseshoe Road	NJD980663678	Raritan River
2001	Crown Vantage	NJN000204492	Delaware River
2002	Hudson River PCBs	NJ980763841	Hudson River
2002	Liberty Industrial	NYD000337295	Massapequa Creek and Ponds
2002	Brookhaven National Laboratory	NJD00337295	Peconic River
2005	Li Tungsten	NYD986882660	Glen Cove Creek
2005	Welsbach & General Gas Mantle (Camden Radiation)	NJD986620995	Newton Creek and Delaware River
2008	Mercury Refining	NYD00048148175	Unnamed Tributary and Patroon Creek and I-90 Pond
2010	Onondaga Lake	NYD986913580	Onondaga Lake

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July 25, 2011

BY FEDERAL EXPRESS AND ELECTRONIC DELIVERY

Ms. Alice Yeh
ATTN: Lower Passaic River Remedial Project Manager
Emergency and Remedial Response Division
U.S. Environmental Protection Agency, Region II
290 Broadway- 19th Floor
New York, New York 10007

Re: Notice of Dispute Resolution Pursuant to the Dispute Resolution Provisions of the Administrative Settlement Agreement and Order on Consent for Remedial Investigation and Feasibility Study, U.S. EPA Region II, CERCLA Docket No. 02-2007-2009, effective May 8, 2007

Dear Ms. Yeh:

This letter is written on behalf of the Settling Parties who are signatories to the above-referenced Administrative Settlement Agreement and Order on Consent for Remedial Investigation and Feasibility Study (RI/FS Settlement Agreement).

On July 11, 2011, EPA notified the Settling Parties that it disapproved the Risk Analysis and Risk Characterization (RARC) Plan documents submitted to EPA in February, 2011. On July 25, 2011, EPA provided the Settling Parties with a document entitled "Technical Memorandum, Fish and Crab Consumption Rates for the LPRSA Human Health Risk Assessment."

Pursuant to Section XV of the RI/FS Settlement Agreement, Settling Parties hereby invoke dispute resolution as to both of these matters. The Settling Parties request that EPA schedule a meeting pursuant to Paragraph 64 of the RI/FS Settlement Agreement at which EPA and the Settling Parties can seek to resolve these disputes.

Very truly yours,

William H. Hyatt, Jr.
Coordinating Counsel
LPRSA Cooperating Parties Group

cc: Eric Schaaf, Esquire
Sarah Flanagan, Esquire
Mr. Walter Mugdan
Mr. Raymond Basso
Settling Parties

NW-379374 v2

EXHIBIT D

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August 9, 2011

Mr. Ray Basso
Ms. Alice Yeh
Emergency and Remedial Response Division
USEPA, Region 2
290 Broadway, 19th Floor
New York, New York 10007

VIA ELECTRONIC MAIL

Re: Submission of Revised Risk Analysis and Risk Characterization (RARC) Plan, Lower Passaic River Study Area (LPRSA) Remedial Investigation/Feasibility Study (RI/FS) - CERCLA Docket No. 02-2007-2009

Dear Mr. Basso and Ms. Yeh:

With this letter, the Cooperating Parties Group (CPG) submits the *Revised Risk Analysis and Risk Characterization (RARC) Plan* for the Lower Passaic River Study Area (LPRSA) Remedial Investigation/Feasibility Study (RI/FS) in response to US Environmental Protection Agency's (EPA) (1) July 11, 2011 comments (Comments); and (2) July 25 Technical Memorandum on Fish and Crab Consumption Rates for the LPRSA Human Health Risk Assessment (Technical Memorandum). The CPG has made the changes to RARC directed by EPA in its July 11, 2011 comments; however, the CPG objects to the Comments and Technical Memorandum and submits the RARC Plan with full reservation of all rights.

On July 25, 2011, the CPG submitted a timely letter to EPA invoking dispute resolution with respect to EPA's Comments and the Technical Memorandum, in accordance with Section XV, paragraph 64 of the Administrative Order on Consent. The EPA in its August 2, 2011 letter acknowledged CPG's invocation of dispute resolution and requested that CPG provide details with respect to the issues in dispute.

The CPG will prepare detailed materials for discussion with EPA as part of the dispute resolution process. However, based on its review of the Comments and Technical Memorandum, the CPG has identified several documents cited by EPA that the CPG has not been able to obtain and it is requested that EPA provide them to the CPG in preparation for dispute resolution. These documents are listed in the attachment.

Notwithstanding the foregoing, and with full reservation of rights, the CPG anticipates that the issues outlined below are the areas that require discussion and resolution as part of the dispute resolution process. In several instances, the issues identified represent changes from approvals and/or agreements that EPA has made related to previous submissions, discussions and understandings between the EPA and the CPG. The CPG will provide additional details for each issue under separate cover.

Human Health Risk Assessment Issues

1. Directive to evaluate only one set of exposure assumptions representing a hypothetical future scenario (Comments 100, 101, 102, 105, 130)
2. Stipulated language, as well as re-wording or deletion of approved PFD language, that inaccurately portrays current conditions and land uses (Comments 4, 11, 83, 84, 86, 87, 89, 92)
3. Stipulated language regarding the impact of future land use changes on future exposures (Comments 4, 77, 81, 91, 94, 104, 105, 128)
4. Directive to remove all statements attributing EPA as source of directed exposure scenarios and parameter assumptions as well as language that provided the technical basis for alternative positions (Comments 7, 78, 95, 99, and several specific comments)
5. Fish and crab consumption rates and assumption of FI of 1 (Comments 110b, 110d, 111, 113 and Technical Memorandum - Fish and Crab Consumption Rates for the LPRSA Human Health Risk Assessment, EPA July 25, 2011))
6. Retraction of earlier agreement to discuss cooking loss options with CPG (Comments 112, 114, 115, 135)
7. Approach for evaluating exposure to sediment by residents (Comments 109, 118, 131)
8. Deletion of references to pathogenic contamination (Comments 3, 90, 104, 128, 150)
9. Deletion of statements supporting consideration of site-specific data (Comments 78, 110a)

Ecological Risk Assessment Issues

1. USEPA has removed the term "urban" from the RARC as it pertains to reference and background for the river conditions, (Comments 8, 18, 68)
2. Changing testable risk question from the USEPA-approved language in the PFD (Comment 34)

The CPG believes that the directed changes to the RARC related to the ERA in the EPA Comments are inconsistent with previously EPA-approved documents (e.g., PFD and QAPPs). Moreover, the changes that are mandated for the HHRA related to default approaches and assumptions that EPA has directed the CPG to use are incorrect and unfounded, and should not be used in the baseline HHRA. The use of non-site specific values such as those developed in the Technical Memorandum will result in unreasonably conservative and unrealistic results that are not representative of actual risks under current or foreseeable future conditions of the LPRSA. The CPG believes that, consistent with EPA guidance, site-specific information should be used in the baseline risk assessments.

The CPG respectfully requests that EPA not distribute the revised RARC to its oversight contractors and Partner Agencies until the dispute resolution process has been completed.

The CPG looks forward to meeting with EPA to resolve the issues that are in dispute with respect to the Human Health and Ecologic Risk Assessments. The CPG requests that this letter be included in the Administrative Record for the Diamond Alkali Superfund Site.

Please contact me with any questions or comments.

Very Truly Yours,
de maximis, Inc.

Robert H. Law, PhD.
CPG Project Coordinator

cc:
CPG Members
CPG Coordinating Counsel

Attachment - LPRSA CPG Request for Documents Cited by USEPA Region 2

August 9, 2011

The following documents were cited by USEPA Region 2 in their July 11, 2011 Comments, July 25, 2011 Technical Memorandum on Fish and Crab Consumption Rates for the LPRSA, and February 10, 2011 Technical Memorandum on Revisions to Exposure Parameter Assumptions for the LPRSA Human Health Risk Assessment. CPG has not been able to locate these documents via the internet. CPG requests a copy of each of the following documents cited by Region 2, including personal communication summaries, for inclusion in the project files.

Fish Consumption Study

Center for the Public Interest Polling (CPIP) and New Jersey Marine Sciences Consortium (NJMSC). 1993. New Jersey Household Fish Consumption Study. Conducted for New Jersey Department of Environmental Protection and Energy. October – November, 1993.

Municipal Plans/Presentations

City of Newark, Philips Preiss Shapiro, Schoor DePalma. 2004. Land use element of the master plan for the City of Newark. Prepared for the Central Planning Board, City of Newark. Adopted December 6, 2004. City of Newark Dept. of Economic and Housing Development; Philips Preiss Shapiro Associates, Inc.; Schoor DePalma., Newark, NJ.

Clarke Caton Hintz, Ehrenkrantz Eckstut & Kuhn. 1999. Passaic riverfront revitalization, Newark, NJ. City of Newark 12/15/99. Clarke Caton Hintz, Trenton, NJ; Ehrenkrantz Eckstut & Kuhn, New York, NY.

Clarke Caton Hintz, Ehrenkrantz Eckstut & Kuhn. 2004. Passaic riverfront redevelopment plan, Newark, NJ. Presentation 1/22/04 to City of Newark. Clarke Caton Hintz, Trenton, NJ; Ehrenkrantz Eckstut & Kuhn, New York, NY.

Heyer Gruel. 2002. Town of Kearny master plan reexamination report. Heyer, Gruel & Associates, Red Bank, NJ.

Personal Communications

EPA. 2010. Personal communication with C. Nace of EPA Region II, September 9, 2010.

Nereid Boat Club. 2010. Personal communication with David Dowd. September 9, 2010.

Passaic River Rowing Association (PRRA). 2010. Personal communication with Jeff Lahm. August 29, 2010.

EXHIBIT E

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August 12, 2011

Mr. Ray Basso
Director, Lower Passaic River Project
U.S. Environmental Protection Agency, Region II
290 Broadway
New York, New York 10007-1866

Re: Lower Passaic River Study Area
Administrative Settlement Agreement and Order on Consent for
Remedial Investigation and Feasibility Study, U.S. E.P.A. Region 2
CERCLA Docket No. 02-2007-2009
Notice of Dispute Resolution, dated July 25, 2011

Dear Mr. Basso:

This letter is submitted on behalf of the Settling Parties under the above-referenced Administrative Settlement Agreement and Order on Consent (AOC) (collectively referred to as the CPG), in response to your letter to me dated August 2, 2011. In that letter, you advise that EPA accepts the CPG's letter dated July 25, 2011 as having invoked the dispute resolution process under the AOC with respect to EPA's July 11, 2011 letter disapproving the Risk Analysis and Risk Characterization (RARC) Plan and EPA's "Technical Memorandum, Fish and Crab Consumption Rates for the LPRSA Human Health Risk Assessment," provided on July 25, 2011 (Technical Memorandum). As requested in your letter, the CPG hereby provides its written statement of objections related to these matters.

The following issues are most likely to affect the risk estimates and risk characteristics for the LPRSA. They largely relate to the Human Health Risk Assessment (HHRA), because of EPA's requirement to develop and rely upon overly conservative and unrealistic assumptions for the baseline HHRA (e.g., fish and crab ingestion rates, fraction of fish/crab from LPRSA, cooking loss, duration and frequency of swimming and other recreational activities, residential exposure to river sediment, presence of pathogens). In many cases, EPA's prescribed scenarios and assumptions reflect a hypothetical future vision of a restored river and do not rely on site-specific information that impacts current and foreseeable future exposures. There are two Ecological Risk Assessment (ERA) issues regarding changes made by EPA to language related to urban background and reference, and to a risk question from previously approved language.

Human Health Risk Assessment Issues

1. Directive to evaluate only one set of exposure assumptions representing a hypothetical future scenario (Comments 100, 101, 102, 105, 130)

- As CPG has previously commented to EPA, the directed exposure scenarios and associated assumptions to be used in the baseline HHRA are incomplete. The scenarios reflect only a hypothetical restored river when institutional controls have been removed, parks and open spaces improved and expanded, public access increased, and aesthetic improvements made. This hypothetical future scenario represents only part of the Risk Assessment Conceptual Site Model (CSM), in that current conditions and exposures are not considered.
- EPA is stipulating language that states the use of exposure scenarios and assumptions based on a future site condition is "in accordance with USEPA guidance" (USEPA, RAGS, 1989). While not untrue, this statement does not reflect the full intent of the guidance. RAGS states that "Actions at Superfund sites should be based on an estimate of the reasonable maximum exposure (RME) expected to occur under both current and future land use conditions." [emphasis added; p. 6-4 of USEPA, 1989]
- EPA acknowledges that there are exposure differences between current and future exposure scenarios, and this is reflected in EPA's stipulated language, including "the usage frequency and number of access locations should increase over time based on these plans," and "This increased usage is taken into account in the exposure parameters discussed in Section 3.3.5."
- EPA's directed revisions to the text result in internal contradictions and inconsistencies that cause unnecessary confusion. For example, EPA has stipulated the following language, "The exposure frequencies for the angler, swimmer, wader and boater reflect both current conditions on the river, as well as future conditions after shoreline improvements laid out in the municipal master plans are carried out."
- EPA has deleted text that conveys that this directed future use-only approach will lead to overestimates of current exposure.

2. Stipulated language, as well as re-wording or deletion of approved Problem Formulation Document (PFD)[1] language, that inaccurately portrays current conditions and land uses (Comments 4, 11, 83, 84, 86, 87, 89, 92)
   - EPA is revising language used in the approved PFD which stated that the lower 6 miles are predominantly commercial and industrial with little public access, to now state that land use transitions to commercial, residential and recreational

[1] Windward, AECOM. 2009. LPRSA human health and ecological risk assessment streamlined 2009 problem formulation. Final. Prepared for Cooperating Parties Group, Newark, New Jersey. Windward Environmental LLC, Seattle, WA; AECOM, Inc., Westford, MA.

near RM 4. This is not accurate. Based on the CPG's 2010 habitat survey and NJDEP's 2007 land use mapping, adjacent land use is currently industrial/commercial and infrastructure (e.g., rail), with some open/green space up to ~RM 6. The only residential land use currently located in RM 0-6 is a condominium development at ~RM 5.3, which is separated from the river by fencing, bulkhead and rip-rapped shoreline.

- EPA inaccurately states that the river "is now increasingly used for recreational activities such as boating, fishing and crabbing as parks and boat ramps are actively being restored or newly established." The purported "increased use" has not been substantiated by the Agency. There is no evidence that the LPR is or has been used for crabbing, based on past and recent survey data.
- EPA is deleting language in the RARC that is contained in the approved PFD that describes the limited access to the river from much of the shoreline in RM 6-10. This is a key feature of the western shoreline in the middle river segment.
- None of EPA's stipulated language and re-wording regarding increased recreational uses recognize conditions that limit direct access to or contact with the river, such as bulkheads, vertical drops to water, rail/infrastructure, highway, and fencing, particularly along the lower 7 miles and much of the western riverbank (e.g., NJ Route 21). In addition, EPA's language fails to acknowledge water quality conditions that would significantly limit or preclude recreational uses.

3. Stipulated language regarding the impact of future land use changes on future exposures (Comments 4, 77, 81, 91, 94, 104, 105, 128)
   - EPA's stipulated revisions to the "Swimmer" receptor include the following speculative statements: "the expansion and improvement of parks along the river will lead to higher exposure in the future" and "future conditions are expected to provide greater access to and be more conducive to swimming." These statements assume that park redevelopment will occur in the study area in the future, and ignore important factors that impact the likelihood of swimming, including access, riverbank type, adjoining land and waterway use, as well as ongoing pathogen and floating trash problems that will not be addressed by park restoration.
   - It is misleading to state that the water quality classification above RM 8 includes swimming when the river regularly does not achieve the bacterial standard designated by the state as safe for swimming. Based on a preliminary evaluation of publically available monitoring data for RM 8-17.4, there have been numerous occasions when the bacterial water quality standards for swimming have not been met.

- None of the municipal plans cited by EPA discuss improvements related to swimming areas, beaches, or related amenities.
- EPA's addition to a statement that "in the future, most of the river is increasingly expected to be used for recreational activities" is not supported and is too general to be useful for risk assessment purposes. EPA has not provided specific examples of the types and locations of future recreational activities to provide necessary context for accurate characterization of exposures.
- EPA has deleted the statement which provides CPG with the opportunity to amend exposure assumptions in the RARC Plan, with approval from USEPA, pending identification of additional exposure information in the future. It is appropriate to retain this flexibility, which is consistent with the concept of a "living" CSM that was put forth in the approved PFD.

4. Directive to remove all statements attributing EPA as source of directed exposure scenarios and parameter assumptions as well as language that provided the technical basis for alternative positions (Comments 7, 78, 95, 99, and several specific comments)
   - There is no basis for EPA's directive to remove all statements related to EPA directing the exposure scenarios and exposure assumptions values for CPG to be use in the baseline HHRA.
   - The RARC Plan needs to make clear to the reader that the RME and CTE exposure parameter values presented in the document are those that USEPA Region 2 directed CPG to use.
   - The text describing the basis of CPG-derived alternative positions should not be deleted from the text as it provides the risk manager with the context needed to evaluate the EPA directive values amongst the technical alternatives.

5. Fish and crab consumption rates and assumption of FI of 1 (Comments 110b, 110d, 111, 113 and Technical Memorandum Fish and Crab Consumption Rates for the LPRSA Human Health Risk Assessment, EPA July 25, 2011)
   - EPA's July 25 Technical Memorandum provides new fish and crab consumption rates that are not supported, and are not reasonable surrogates for the LPRSA baseline HHRA in lieu of site-specific data.
   - The Technical Memorandum makes several inaccurate statements that need to be corrected for the record.
   - The Technical Memorandum does not adequately address the agreed-upon resolution described in the Term Sheet documenting the 12/16/10 meeting between EPA and CPG to discuss HHRA issues. Specifically, resolution #5 of the Term Sheet requested that EPA apply consistent and balanced criteria to the studies under consideration, including the Burger and Tierra studies. This has

not been done.

- EPA's dismissal of the Tierra 2000-01 Creel Angler Survey (CAS) as a source of site-specific data due to lack of EPA approval of the work plan is not justified given that neither of the two studies (Burger 2002, and Connelly et al. 1992) used to derive the new RME fish consumption rate of 44 g/day followed an EPA-approved work plan.
- A detailed critique of EPA's Technical Memorandum is being prepared, which will identify the inaccuracies and present appropriate and technically-defensible alternatives for consumption rate and fraction ingested.
- EPA's statement that use of a fraction ingested (FI) of 1 is consistent with recommendations in guidance is not accurate. RAGS guidance clearly states that the decision to use a FI of less than 1 for the fish ingestion exposure pathway should take into account local angler usage patterns and water body characteristics.
- It is not appropriate to base an FI of 1 simply on a species' presence in a water body (e.g., blue crab), if other factors limit angling activity. While blue crabs are present in the LPRSA, crabbing is infrequent, particularly in comparison to Newark Bay, which has the same crabbing advisory. This disparity in crabbing activity should be reflected in the use of an FI value that is less than 1.

6. Retraction of earlier agreement to discuss cooking loss options with CPG (Comments 112, 114, 115, 135)
   - EPA has deleted language previously offered in their September 10, 2010 comments on the draft RARC Plan allowing for discussions on cooking loss factors. The rationale for this change in position is not justified, and deprives CPG of an opportunity for meaningful technical exchange with EPA on this topic. The CPG would like to engage EPA on this topic as originally planned.

7. Approach for evaluating exposure to sediment by residents (Comments 109, 118, 131)
   - The CPG has previously commented to EPA that the justification provided by EPA for the assumption that residents are exposed to river sediment on a year-round basis at a rate consistent with residential backyard soil and dust is implausible and will significantly overestimate potential sediment risk to residents.
   - River sediments that may be present in backyards due to past flooding comprise only a fraction of the native soil in residents' backyards. Some accounting for mixing needs to be made to avoid overestimating the sediment-derived concentration. To further assume that river sediment is contacted every day of the year at equivalent indoor and outdoor concentrations is flawed.

8. Deletion of references to pathogenic contamination (Comments 3, 90, 104, 128, 150)
   - EPA has added text citing the state's surface water classifications, and the inclusion of swimming as a designated use in the freshwater portion of the river, as justification for swimming as a current and future activity at the LPRSA. However, EPA has deleted text referring to the presence of pathogenic contamination, and the urban setting of the river, including the lack of public beaches. It is misleading to state that swimming is a designated use when the river frequently does not achieve the state bacterial standard considered safe for swimming.
   - EPA's stated rationale for deleting references to pathogenic contamination as a factor that limits exposure is that "individuals visiting the river will not know what levels of pathogens are present when deciding when or how long they will wade or swim." While it is likely that individuals visiting the LPRSA may not know specific levels of pathogens in the water, they are likely aware of the high potential for pathogenic contamination, due to the urbanized nature of the water way, its visual appearance, and visible CSOs.
   - As CPG has previously commented to EPA, microbial risks are a well-documented component of background risks to river users, and should be considered within the broader context of risk-based remedial decision-making at the LPRSA. It is inconsistent for EPA to establish a non-CERCLA objective of "fishable/swimmable," but then deny the CPG the opportunity to characterize and calculate risks due to pathogens, which are the primary risk driver to swimmers.

9. Deletion of statements supporting consideration of site-specific data (Comments 78, 110a)
   - EPA has stipulated deletion of text regarding guidance support for use of site-specific data in risk-based decision-making. In addition, EPA has deleted a statement that was previously revised based on EPA's 9/10/10 comments on the draft RARC Plan. The 9/10/10 comment directed that the word "may" be replaced by "will" in the following statement, "While use of some default or surrogate assumptions <u>may</u> be necessary in the remedial decision-making process, EPA guidance documents stress the importance of using data that represent the characteristics of the local populations(s) and site when possible and appropriate (EPA 1989a, b, 1991a, 1997b, 1998a, 2000a)." CPG made this change, and now EPA is directing that this statement be replaced entirely with new language that does not provide the same background or context: "However, EPA guidance (EPA 1991a) also allows the use of default values developed by EPA when there is a lack of site-specific data or consensus on which parameter

value to choose, given a range of possibilities."

- EPA's stipulated deletions result in the loss of acknowledgement of EPA guidance supporting consideration of site-specific information in the baseline risk assessment process. This is an important concept that should be reflected in the LPRSA's primary risk assessment planning document.

Ecological Risk Assessment Issues

1. EPA has removed the term "urban" from the RARC as it pertains to reference and background for the river conditions, (Comments 8, 18, 68)

- The removal of the word urban in relation to reference or background conditions is counter to the entire premise for the Lower Passaic River Restoration Project (LPRRP), which is founded on the specific and technically challenging issues of addressing degraded sediment and water quality in a highly urbanized river such as the Lower Passaic(see http://www.nan.usace.army.mil/project/newjers/factsh/pdf/lowerpass.pdf).
- EPA, in coordination with the US Army Corps of Engineers, selected the Passaic River as a demonstration pilot project under the Urban Rivers Restoration Initiative (see http://www.epa.gov/landreuse/urbanrivers/). Removal of the term "urban" at this stage would degrade the transparency of the RI/FS process. It is critical that the various interested parties clearly understand the direction the CPG and EPA are taking in evaluating the LPRSA. As recognized by EPA in Comment 8, the term "urban" may be applied to reference and background conditions at a later date. However, given the liberal use of the term "urban" by the EPA to date in describing the LPRSA, the term should remain in describing the types of reference and background conditions that will be relevant in differentiating affects associated with direct releases into the LPRSA from those associated with regional urban influences.
- The term "regional urban background" has been consistently used throughout the remedial investigation process to date, and is a base principle frequently discussed in the EPA-approved (PFD) (Windward and AECOM 2009) as it applies to both background and reference conditions. Therefore, EPA's request to remove the word "urban" before "reference" in the revised RARC is a change from the PFD and counter to the foundation of the LPRRP. The use of anthropogenic conditions that reflect the industrialized, urban setting to describe background/reference is also consistent with EPA guidance (EPA 2002)[2] and is a

[2] EPA. 2002. Role of background in the CERCLA cleanup program. OSWER 9285.6-07P. Office of Solid Waste and Emergency Response, Office of Emergency and Remedial Response, US Environmental Protection Agency, Washington, DC.

concept that the CPG and EPA have already agreed to for use in the BERA as discussed during the December 14, 2010 EPA-CPG Meeting and documented in the EPA-CPG Term sheet for that meeting (Appendix E, Windward and AECOM, [in prep]).[3] This is also documented in the EPA-approved Benthic QAPP (Windward 2009).[4]

- Per the EPA-approved PFD and the EPA-approved Benthic QAPP (Windward 2009) (see Worksheet No. 9 of the Benthic QAPP on CPG/EPA communications) an urban reference and background approach is planned and is in process for the LPRSA.
- Accounting for urban background and urban reference conditions is integral to evaluating risks posed by the site-related release of hazardous substances in the LPRSA. Background is meant to capture conditions of the LPRSA, with the exception of the CERCLA releases of hazardous substances at the site (EPA 2002). It is used in the risk characterization in both the ERA and HHRA, as well as in setting preliminary remediation goals (PRGs) and cleanup goals during the feasibility study (FS). Urban reference conditions are intended to provide risk assessors with information pertaining to effects on biota from substances present in the environment as a result of human activities, but which can be differentiated from those effects associated with site releases.
- EPA and CPG met on December 14, 2010, to discuss the background and reference approach, and it was agreed that the CPG would evaluate, as an initial step in the process of developing background and urban reference conditions for the LPRSA, existing regional datasets from the urbanized NY/NJ estuary. Once completed, CPG and EPA would discuss the sufficiency of the data in establishing background and urban reference conditions or whether additional data would need to be collected. Comparison of LPRSA site data with the existing regional data sets as an initial step in the process is consistent with EPA guidance (EPA 2002).

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[3] Windward, AECOM. [in prep]. Lower Passaic River Restoration Project. Revised risk analysis and risk characterization plan for the Lower Passaic River Study Area. Draft. Prepared for Cooperating Parties Group, Newark, New Jersey. Windward Environmental LLC, Seattle, WA; AECOM, Inc., Westford, MA.

[4] Windward. 2009. Lower Passaic River Restoration Project. Lower Passaic River Study Area RI/FS. Quality Assurance Project Plan: Surface sediment chemical analyses and benthic invertebrate toxicity and bioaccumulation testing. Final. Prepared for Cooperating Parties Group, Newark, New Jersey. Windward Environmental LLC, Seattle, WA.

2. EPA requested that the mummichog testable risk question be changed from that in the EPA-approved PFD: "What are the egg numbers (or mass) from estuarine benthic omnivores [i.e., mummichog] from the LPRSA" to: "Is the fecundity of estuarine benthic omnivores (e.g., mummichog) from the LPRSA similar to the fecundity of benthic omnivores from appropriately selected reference sites." Changing risk questions and testable hypotheses after the measurement endpoint data have been identified and collected to address the original question is clearly inappropriate and inconsistent with EPA risk assessment guidance.
    - EPA is changing fundamental test questions that drove the development of EPA-approved QAPPs and collection of field data. These QAPPs are completed and have been implemented.
    - No useable data currently exists for the LPRSA which can be used to address the risk question as modified by EPA. The EPA-approved Tissue QAPP indicated that either egg counts would be made, or alternatively, egg mass would be collected without an enumeration of the numbers of eggs associated with the collected mass. During sampling, the CPG recommended, and EPA concurred, that only egg mass would be determined in collected mummichog.
    - If the testable risk question remains in its proposed form then an entirely new study will need to be designed, a QAPP approved, and the field work implemented. Given the seasonally-limited timeframe for collecting spawning mummichog (i.e., late Spring under full moon conditions) it may not be possible the collect the required data until 2012, and possibly not until 2013, given that the CPG and EPA would have to agree on the selection of "appropriately selected reference sites" among other aspects of the study design. Since fecundity is influenced by a number of environmental variables that will have little to do with the presence of chemicals in LPRSA sediments, synoptic sampling of the LPRSA and all appropriate reference sites will be required. CPG disagreed with the original testable risk question and contends the question should be dropped altogether. Changing the question, which will entail new sampling events at this point, will not improve on a poor testable risk question.
    - EPA changed the "i.e. mummichog" to "e.g. mummichog", which is inconsistent with the EPA-approved PFD and EPA-approved QAPPs. Further, the fieldwork has been completed. It is imperative that EPA follow the approved documents that were developed based upon many discussions between EPA and CPG so the RI/FS can follow a logical and orderly process. Deviations of agreed-upon and documented processes and studies will result in delay in completing the RI/FS, especially given that there are no mummichog egg count data for the LPRSA. Moreover, CPG is not aware of any other egg fecundity studies that have been used within the RI/FS process to develop remedial areas for the FS.

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The CPG requests that EPA schedule a meeting pursuant to Paragraph 64 of the AOC at which EPA and the Settling Parties can seek to resolve these issues. Please include a copy of this letter in the Administrative Record for the Diamond Alkali Superfund Site.

Very truly yours,

William H. Hyatt, Jr.
Coordinating Counsel

AECOM Environment

Prepared for:
Lower Pasaic River CPG
Newark, NJ

Prepared by:
AECOM
Chelmsford, MA
60145884.J810
September 2011

Position Paper: Review of USEPA Region 2 July 11, 2011 Comments on Revised RARC Plan for the LPRSA, Human Health Risk Assessment Issues for Dispute Resolution

AECOM Environment

Prepared for:
Lower Pasaic River CPG
Newark, NJ

Prepared by:
AECOM
Chelmsford, MA
60145884.J810
September 2011

Position Paper: Review of USEPA Region 2 July 11, 2011 Comments on Revised RARC Plan for the LPRSA, Human Health Risk Assessment Issues for Dispute Resoluation

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Attachment B Critique of USEPA's July 25, 2011 Technical Memorandum, Fish and Crab Consumption Rates for the LPRSA Human Health Risk Assessment

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1.0 Introduction

On July 11, 2011, USEPA Region 2 (Region 2) issued comments on the Lower Passaic River Study Area (LPRSA) Cooperating Parties Group's (CPG) *Revised Risk Analysis and Risk Characterization (RARC) Plan* submitted to the Agency on February 10, 2011. The comments were followed by a Technical Memorandum prepared by Region 2 entitled, "Fish and Crab Consumption Rates for the LPRSA Human Health Risk Assessment" dated July 21, 2011. The July 21 Technical Memorandum was replaced by an updated version dated July 25, 2011, which included previously omitted information. On July 25, 2011, the CPG invoked dispute resolution pursuant to the Administrative Order on Consent (AOC), because of significant concerns regarding the comments and directives contained in Region 2's July 11, 2011 comments and the July 25 Technical Memorandum.

This Position Paper identifies nine specific issues that comprise the basis of CPG's dispute with Region 2's July 2011 comments pertaining to the human health risk assessment (HHRA). These nine issues were identified in AECOM's August 2, 2011 summary of the primary HHRA dispute resolution issues. For each issue, the basis of the dispute is presented, followed by a discussion of CPG's alternative position. The issues addressed in this Position Paper are as follows:

1. Directive to evaluate only one set of exposure assumptions representing a hypothetical future scenario
2. Stipulated language, as well as re-wording or deletion of approved Problem Formulation Document (PFD) language, that inaccurately portrays current conditions and land uses
3. Stipulated language regarding the impact of future land use changes on future exposures
4. Fish and crab consumption rates and the fraction ingested (FI) assumption of 1
5. Retraction of earlier agreement with CPG to discuss cooking loss options
6. Approach for evaluating exposure to sediment by residents
7. Deletion of references to pathogenic contamination
8. Directive to remove all statements attributing EPA as the source of directed exposure scenarios and parameter assumptions as well as language that provided the technical basis for alternative positions
9. Deletion of statements supporting consideration of site-specific data

For purposes of focusing the dispute resolution, the nine HHRA issues have been identified as Technical or Policy issues. Technical issues relate to the conduct of the baseline risk assessment and have potentially significant implications for risk calculations and outcomes. Policy issues relate to matters of principle or strategy, but do not necessarily have a direct bearing on the outcome of risk calculations. Issues 1 through 6 are identified as technical issues, while issues 7, 8 and 9 are identified as policy issues.

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2.0 Discussion of HHRA Dispute Resolution Issues

Issue #1 - Directive to evaluate only one set of exposure assumptions representing a hypothetical future scenario (Comments 100, 102, 105, 130)

Basis of Dispute

The goal of a human health risk assessment performed in support of CERCLA remedial investigations is to assist in the evaluation of the need for measures to reduce or eliminate exposures to hazardous substances at a given site in order to protect public health. This is accomplished by considering the range of activities and conditions at a given site that could result in exposure, and their implications for human health. The National Contingency Plan (NCP) requires, and USEPA guidance (USEPA, 1989) directs, that the human health risk assessment process present a description of exposures as they are occurring under current conditions at the site, with consideration of an individual or group reasonably expected to experience the highest levels of repeated exposure over an extended duration (e.g., 30 years). In addition to evaluating current conditions, the analysis is also to consider conditions at the site, such as human activities and land use that would be expected to change in the future, and describe how those changes would influence estimates of current exposures.

Region 2's July 11, 2011 directives do not allow the LPRSA HHRA to include a description and analysis of exposures in the LPRSA (the Site) that are reflective of current conditions. The Region 2 directives limit analysis to a hypothetical future condition. Additionally, Region 2 is requiring the application of assumptions that are not a reasonable reflection of activities at the Site. Incorporation of Region 2's directives results in an incomplete and unreasonable depiction of the risks to human health associated with conditions at the Site. Region 2's directed exposure scenarios and associated assumptions for the baseline HHRA reflect a hypothetical restored river when institutional controls have been removed, parks and open spaces improved and expanded, public access increased, and aesthetic improvements made. This hypothetical future scenario represents only part of the Risk Assessment Conceptual Site Model (CSM), in that current conditions and exposures are not considered. Region 2's approach is not consistent with the NCP, USEPA's Directive regarding the role of the baseline risk assessment (USEPA 1991) in Superfund remedy decision-making, and Risk Assessment Guidance for Superfund (RAGS) (USEPA 1989).

As stated in USEPA's Office of Solid Waste and Emergency Response (OSWER) 1991 Directive, *Role of the Baseline Risk Assessment in Superfund Remedy Selection Decisions:*

> The 1990 National Contingency Plan (NCP) (55 Federal Register 8665-8865 (March 8, 1990)) calls for a site-specific baseline risk assessment to be conducted, as appropriate, as part of the remedial investigation (Section 300.430(d)(1)). Specifically, the NCP states that the baseline risk assessment should "characterize the current and potential threats to human health and the environment that may be posed by contaminants migrating to groundwater or surface water, releasing to air, leaching through soil, remaining in the soil, and bioaccumulating in the food chain" (Section 300.430(d)(4)). The primary purpose of the baseline risk assessment is to provide risk managers with an understanding of the actual and potential risks to human health and the environment posed by the site and any uncertainties

> associated with the assessment. This information may be useful in determining whether a current or potential threat to human health or the environment exists that warrants remedial action. [p. 2]

USEPA's risk assessment guidance (RAGS; USEPA 1989) states that risk management decisions at Superfund sites should be based on consideration of current and future conditions:

> "Current exposure estimates are used to determine whether a threat exists based on existing exposure conditions at the site. Future exposure estimates are used to provide decision-makers with an understanding of potential future exposures and threats and include a qualitative estimate of the likelihood of such exposures occurring." [p. 1-6]
>
> "Actions at Superfund sites should be based on an estimate of the reasonable maximum exposure (RME) expected to occur under both current and future land use conditions." [p. 6-4]

In its July 11, 2011 comments (Comment 100), Region 2 is directing CPG to replace RARC language that attributes this incomplete approach to Region 2 directive (below in italics) with language stating that it is "in accordance with USEPA guidance" and cite RAGS (USEPA 1989).

> "As stated in USEPA's September 10, 2010 comments, the scenarios and exposure parameter assumptions are intended to capture exposures under a future site condition, when parks and open spaces have been improved and expanded or developed at sites currently under other uses."

Region 2's revised language is not accurate and misconstrues the intent of RAGS, as well as the NCP, in that "current threats to human health" will not be fully or accurately represented.

Region 2's prescriptive selection of assumptions that reflect a hypothetical future site condition and its directive to limit the baseline HHRA to only those assumptions will result in an inaccurate and incomplete risk assessment outcome. As an example, the prescribed exposure frequencies for activities with the potential for direct contact with surface water and sediment (e.g., swimming, wading, boating, fishing, crabbing) are based on the assumption that local plans for future waterfront redevelopment and revitalization will result in greater usage and more access locations. As stated in Comment 105, "While the general usage types of the river may remain the same in the future, the usage frequency and number of access locations should increase over time based on these plans. This increased usage is taken into account in the exposure parameters discussed in Section 3.3.5." [Note: the section reference should be 3.3.4; Section 3.3.5 addresses Exposure Point Concentrations.] As reflected in this comment, the prescribed exposure parameters are not representative of current conditions, but rather future conditions after proposed park improvements are implemented. Consequently, the approach prescribed by Region 2 will result in an inaccurate overestimate of current baseline risk at the LPRSA.

Region 2 has also directed the use of language that is internally inconsistent and results in unnecessary confusion. Comment 130 stipulates the following language be used in the discussion of Sediment and Surface Water Exposure Frequencies, "The exposure frequencies for the angler, swimmer, wader and boater reflect both current conditions on the river, as well as future conditions after shoreline improvements laid out in the municipal master plans are carried out" (emphasis added). It is not possible for one set of exposure frequencies to reflect both current and potential future conditions when they are acknowledged to not be the same. Such an approach is confusing and misleading. It is more logical, accurate and straightforward to acknowledge that the stipulated

exposure frequencies are based on anticipated future site conditions, and as such, their use in assessing exposures associated with current conditions will result in an overestimate of current baseline risk. However, Region 2 has directed that language acknowledging this overestimation be struck from the RARC Plan (Comment 102). Many of Region 2's directives, such as the stipulated language above and the deletion of text noting that the future-use only approach will lead to overestimates of current exposure, do not result in the "more balanced discussion" that Region 2 asserts (Comment 2); rather, it will lead to an overly conservative and unrealistic estimate of current risks. Further, Region 2 has not presented a reasoned analysis of the site-specific circumstances that justify use of its prescribed approach that is inconsistent with guidance.

Alternative Position

CPG recommends an alternative position consistent with the NCP and USEPA guidance, which will result in a more complete and accurate baseline human health risk assessment (HHRA), and support the development, evaluation, and selection of appropriate response alternatives. CPG recommends that the exposure scenarios and assumptions include a set of assumptions that reflect current conditions, in addition to assumptions used to reflect potential future conditions. To streamline this approach, the "current use" evaluation could be targeted at only the scenarios and pathways where there is clearly a difference between current and foreseeable future site conditions, such as the recreational scenarios involving contact with sediment and surface water. For scenarios that are not likely to change in the future, the assumptions can be designated for use in evaluating "Current/Future" scenarios. This approach will provide risk managers with a more complete understanding of "current and potential threats to human health," and allow for more informed remedial decision-making. Given the complexity of the LPRSA and the potential cost implications for site remediation, it is critical that decision-makers, as well as the public, have a complete and transparent assessment of the full range of potential site risks.

Issue #2 - Stipulated language, as well as re-wording or deletion of approved Problem Formulation Document language, that inaccurately portrays current conditions and land uses (Comments 4, 11, 83, 84, 86, 87, 89, 92)

Basis of Dispute

There are a number of instances where language stipulated by Region 2 changes or deletes, language taken directly from the approved Problem Formulation Document (PFD) (Windward/AECOM 2009). Further, much of this change results in an inaccurate portrayal of current conditions and land uses along the river. For example, in Comments 83, 86, and 87, Region 2 has revised language from the approved PFD to state that land use transitions to commercial, residential and recreational near RM 4. This is not an accurate depiction of current land use along the lower stretches of the LPRSA. Based on the CPG's 2010 habitat survey and NJDEP's 2007 land use mapping, adjacent land use is currently industrial/commercial and infrastructure (e.g., rail), with some open /green space up to ~RM 6-7. One multi-family development located on the east side at ~RM 5.3 is separated from the river by fencing, bulkhead and rip-rapped shoreline.

Region 2 has deleted language from the approved PFD that describes the limited access to the river from much of the shoreline in RM 6-10. This is a key feature of the western shoreline in the middle river segment that should be acknowledged in the RARC plan. Region 2's stipulated language regarding recreational uses of the river does not acknowledge conditions that limit direct access to or contact with the river, such as bulkheads, vertical drops to water, rail/infrastructure, highway, and fencing. These current conditions, which are present along the lower 7 miles and much of the western

riverbank, significantly limit the potential for direct contact with sediments and surface water in these areas. Region 2 has also stipulated language that conveys greater recreational usage of the river than is currently occurring; such usage is not supported with specific examples or evidence. In Comment 11, Region 2 has directed inclusion of the following language, the river "is now increasingly used for recreational activities such as boating, fishing and crabbing as parks and boat ramps are actively being restored or newly established." To state that the LPRSA is increasingly used for crabbing is not supported by a 2000-01 creel/angler survey of the river, which intercepted seven consuming anglers and no consumers of LPRSA crab. During that year-long survey, only five anglers reported catching crab; four reported not keeping the crabs and one reported using them for bait (Ray et al. 2007b). In addition, NJDEP has issued warnings advising crabbers not to harvest or consume blue claw crab from the Newark Bay Complex, including the LPRSA. Similarly, Region 2's assertion that the LPRSA is increasingly used for recreational boating (other than sculling/rowing) also has not been supported. While some interest in improving current boat launches has been expressed, pleasure boating continues to be limited due to numerous bridges, many with low clearance, and limited public boat ramps, with some in disrepair.

In the revised NCP rulemaking (55 Federal Register, March 8, 1990), USEPA clarified their policy regarding the exposure assessment process, and specifically that "exposure assumptions should result in an overall exposure estimate that is conservative but within a realistic range of exposures." USEPA goes on to clarify the definition of "reasonable maximum such that only potential exposures that are likely to occur will be included in the assessment of exposures" (55 Federal Register 8709-8711, March 8, 1990). CPG does not believe that the exposure assessment process followed by Region 2, including the identification of realistic exposures and assumptions under current site conditions, is consistent with the intent of the NCP.

Alternative Position

CPG recommends an alternative position that will result in a more accurate and complete characterization of current conditions at the LPRSA in the primary risk planning document. CPG recommends that language from the approved PFD describing current conditions be re-instated in the RARC Plan, since it still provides an accurate depiction of the study area. Unless Region 2 can support its statements, such as the increased crabbing and boating activity on the river, and transition to residential land uses at RM 4, CPG also recommends that language describing current adjoining land uses and recreational uses of the river be revised to accurately reflect current actual conditions. Any language describing potential future land use and conditions along the LPR should be supported by specific examples or references, as discussed below.

Issue #3 - Stipulated language regarding the impact of potential future land use changes on future exposures (Comments 4, 13, 77, 81, 88, 91, 94, 104, 105, 128)

Basis of Dispute

Region 2 has stipulated language that is speculative and, in some cases, misleading regarding the potential impact of future potential land use changes on future exposures. For example, Region 2's stipulated revisions to the "Swimmer" receptor include the following speculative statements: "the expansion and improvement of parks along the river will lead to higher exposure in the future" (Comment 105) and "future conditions are expected to provide greater access to and be more conducive to swimming" (Comments 104 and 128). These statements do not take into account important factors that impact the likelihood of swimming, including access, riverbank type, adjoining

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land and waterway use, as well as ongoing pathogenic contamination and debris; these factors that will not be addressed by park restoration.

None of the municipal plans cited by Region 2 discuss improvements related to swimming areas, beaches, or related bathing amenities. Based on a review of available plans cited by Region 2, as well as others that are publically available, none discuss plans for enhancing beach or swimming facilities along the river. The primary objective of the redevelopment plans in relation to the LPRSA is to improve or increase walkway, bikeway, boat launch, and green space, as well as aesthetics, for the benefit of local residents. Some waterfront redevelopment plans (e.g., Newark and Harrison) call for amenities such as marinas, floating boat docks, water taxis, esplanade and plaza space, as well as commercial, retail, and mixed use properties. It would be more accurate to state that a number of municipal plans developed by communities along the LPRSA call for redevelopment and restoration of green space and park land along the river which, provided they come to fruition, may lead to increased recreational opportunities, such as walking or biking next to the river, and boating. Attachment A summarizes available planning documents and statements relating to redevelopment and restoration along the LPRSA.

Region 2 has directed that, at the end of this statement, "The LPRSA is a large and complex sediment site, and current site conditions reflect its long industrial history and urban setting" the following phrase be added, "in the future, most of the river is increasingly expected to be used for recreational activities" (Comment 77). This addition is vague and speculative, and does not provide the necessary context to characterize potential exposures associated with different types of recreational activities that could occur in the future. As previously noted, physical constraints in parts of the LPRSA, many of which are not expected to change in the foreseeable future, impact the types of recreational activities that could occur. These constraints, including lack of public access, steep, bulkheaded and/or rip-rapped riverbanks, adjacent industrial and urbanized land and waterway uses, as well as ongoing pathogenic contamination and debris, preclude or significantly limit the likelihood that recreational activities with a high potential for water contact, such as swimming and wading, will occur regularly in parts of the LPRSA. Similarly, new language stating that "greater access to the river and improved ecological habitat" (Comments 13, 91, 94) will be an outcome of future waterfront redevelopment needs proper context. For the redeveloped recreational and mixed use space planned along parts of the lower six miles, hardened shorelines are expected to remain, largely precluding any direct contact with sediment or surface water. Descriptive information and context that allows for accurate characterization of the types and locations of potential future exposures is lacking in the text provided by Region 2. Region 2 has also not provided adequate justification for the future use scenarios and site conditions. As part of the process of characterizing potentially exposed populations, RAGS (USEPA 1989) states:

> "Determine if any activities associated with a current land use are likely to be different under an alternate future land use." [p. 6-6] and,
>
> "Support the selection of any alternate land use with a logical, reasonable argument in the exposure assessment chapter of the risk assessment report. Also include a qualitative statement of the likelihood of the future land use occurring." [p. 6-6]

Region 2's language does not include any discussion of the likelihood of or timeframe for implementation of various redevelopment and restoration activities identified in the municipal redevelopment plans cited in several comments (13, 81, 91, 94, 105). Given that the directed exposure scenarios and assumptions are based on potential future conditions, these factors should be considered in the exposure assessment section of the RARC Plan, as recommended by guidance.

For example, projected timeframes and funding status (i.e., which plans are currently funded and restoration activities are underway, and which are contingent upon funding that is not yet appropriated) should be addressed to provide perspective on the likelihood of the restoration activities occurring.

Region 2 has also deleted a statement that provides for the opportunity to amend exposure assumptions in the RARC Plan, with approval from USEPA, pending identification of additional exposure information in the future. CPG believes it is appropriate to retain this flexibility in the RARC Plan; it is consistent with risk assessment planning guidance and the concept of a "living" CSM that was put forth in the approved PFD.

Alternative Position

CPG recommends that discussion of future site conditions and scenarios explicitly consider specific initiatives and waterfront features included in local redevelopment and restoration plans, including the likelihood, funding status, and timeframe for implementation. This characterization should be performed for each of the three segments of the river, since different municipalities abut the river in each segment. The documentation provided in Attachment A provides a foundation for this analysis. The outcome of this analysis should be discussed in a new section of the exposure assessment of the RARC Plan dedicated to "characterization of future site conditions." CPG believes that this type of logical, reasoned discussion would eliminate the need for speculative language and promote more accurate characterization of the types of exposure scenarios that can be anticipated in the foreseeable future throughout the LPRSA. CPG also recommends that the statement allowing for future amendment of assumptions pending identification of new exposure information in the future be retained.

Issue #4 - Fish and crab consumption rates and assumption of FI of 1 (Comments 110b, 110d, 111, 113, 114 and Technical Memorandum Fish and Crab Consumption Rates for the LPRSA Human Health Risk Assessment, EPA, July 25, 2011)

Basis of Dispute

Region 2's July 11, 2011 comments and July 25 Technical Memorandum provide new fish and crab consumption rates and fraction ingested (FI) value for use in the baseline HHRA for the LPRSA. The stipulated ingestion rates and FI value of 1 are not supported by Region 2's Technical Memorandum and are not reasonable surrogates for the LPRSA baseline HHRA. Several statements in the Technical Memorandum are inaccurate or incomplete, and the "weight of evidence" process used by Region 2 to evaluate the studies cited is neither objective nor sound. The criteria used by Region 2 to evaluate its selected studies and sources were deficient, in that key factors relevant for evaluating the adequacy of studies for the primary objective (i.e., to develop long-term fish and crab consumption rates for use in HHRA), were not addressed or even considered.

The EPA-CPG Term Sheet documenting the December 16, 2010 EPA-CPG meeting on HHRA issues shows agreement that Region 2 would apply a consistent and balanced set of criteria to the studies under consideration, including the Burger and Tierra studies. Region 2's July 25 Technical Memorandum does not adequately address this agreement. Region 2's Technical Memorandum does not provide a thorough and consistent analysis of each of the studies cited using clear and balanced review criteria, including their quality, suitability for deriving long-term consumption rates, and relevance to and representation of site-specific conditions. While published studies of other water

bodies or populations may be appropriate sources of surrogate consumption rates, it is critical that they be carefully evaluated to determine whether they are well-designed for the intended purpose and sufficiently representative and relevant for estimating site-specific consumption patterns. In making this determination, factors such as study design, hypotheses being tested, number of individuals interviewed within the survey, rates of consumption, and populations studied should be considered (USEPA 2004). Region 2's analysis was also received five months later than promised in Region 2's February 10, 2011 response to the Term Sheet. This delay, coupled with Region 2's simultaneous submission of directive comments on the revised RARC Plan, has resulted in the loss of an opportunity for meaningful dialogue between Region 2 and CPG on this important topic in advance of the comment process.

A number of studies have been compiled and considered for their relevance and appropriateness as the basis for consumption estimates for the LPRSA. Region 2's Technical Memorandum does not, however, discuss the quality of the data generated by the studies or their applicability to the LPRSA and the purpose at hand. This is an important issue because study results can be substantially impacted by the ways in which the studies are conducted and the purposes for which they are designed. Thus, while some of the studies discussed by Region 2 may have been well-designed for the purposes for which they were intended, this does not necessarily mean that they were well-designed for the purpose of estimating long-term consumption rates for individuals who fish or crab in the LPRSA. In fact, USEPA's Exposure Factors Handbook guidance (USEPA 1997) clearly states that "the type of survey used, its design and any weighting factors used in estimating consumption should be considered when interpreting survey data for exposure assessment purposes" [p. 10-1]. Region's 2 Technical Memorandum does not adequately consider these issues in the analysis of the studies included.

The Burger (2002) survey, which was selected by Region 2 as one of two surveys to provide the basis for developing the fish consumption rate and the sole basis of the crab consumption rate, was not designed to serve as a definitive study of fish and crab consumption rates[1]. The primary focus of the study was to collect information about sociological reasons for angling and general patterns of fishing behavior and consumption. As such, key pieces of information needed for accurate risk assessment were not collected. For example, information regarding species, parts consumed, preparation or cooking practices, and sharing was not collected. In addition, anglers were intercepted once during the warm weather period and asked to recall the number of self-caught fish or crab meals per month they consume, portion size, and the number of months of the year they go fishing or crabbing (Burger 2002). Based on the responses obtained during this one intercept, the data were summarized and averages of monthly consumption of fish and crab meals and number of months per year of fishing and crabbing were calculated. The accuracy and reliability of one-time recall data for estimating long-term consumption rates is known to be uncertain (USEPA 1997), yet, this uncertainty is not recognized by Region 2. Further, recall survey methods tend to bias consumption rates high, especially for more avid anglers and longer recall periods (USEPA 1998; Connelly and Brown 1995; Chu et al. 1992; Fisher et al. 1991). The description of the survey method and spatiotemporal sampling frame is also not sufficient to assess its statistical rigor. Based on the limited description of the survey methodology provided, it appears that the sampling plan was not based on valid probability sampling, which attempts to survey an accurate representation of the larger population, but rather

[1] It should be noted that Burger (2002) is not discussed at all in the detailed analysis of fish consumption studies presented in USEPA's draft 2009 version of the EFH (USEPA, 2009a).

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convenience sampling, which includes individuals who are most readily accessed to fill out the survey but cannot be generalized to the larger population.

In addition, Region 2's fish consumption rates are based only on the limited summary information that is provided in the published paper. In April, 2010, the CPG submitted a request to Dr. Burger for any supporting data from her 1999 angler survey of the Newark Bay Complex, including but not limited to actual study data, survey work plan, survey form, specific locations on the Passaic River that were surveyed, completed individual surveys, as well as any other backup information or summary report that was generated. On August 20, 2010, Dr. Burger noted that her survey did not specifically sample the Passaic River area, as she was mainly interested in Newark Bay itself (Burger 2010). Dr. Burger stated that she usually does not keep materials from studies done so long ago, and that it was unlikely that original forms would be available, although she indicated that she would check. She noted that at the time of the survey, no one showed any interest in the original data, and it is standard procedure to keep data only for 3-5 years after a study is completed (Burger 2010). Thus, the only available information upon which Region 2 could base its fish consumption estimates are very limited summary statistics and bar graphs for the entire population surveyed and unverified assumptions about how those data should be applied in estimating long-term consumption rates.

Region 2 also selected the 1991 New York Angler Survey (Connelly et al. 1992) as the other source of consumption rates for the LPRSA. This study was used by Region 2 for the development of fish consumption rates for the Hudson River baseline HHRA. There are a number of concerns with using the Connelly et al. (1992) dataset as the basis of consumption rates for the LPRSA, including the representativeness to the LPRSA of the data for the target population and the water bodies fished. This study was a mail survey of licensed New York state anglers conducted by Nancy Connelly and colleagues from Cornell University. This study focused on angling and consumption behavior as it related to fish consumption advisories. Using the study results, Region 2 estimated consumption rates using a "standard" assumed meal size rather than actual harvest or meal size data. There are other issues (including recall bias) associated with the Connelly et al. (1992) data, not least of which is Region 2's statement that it is representative of the New York-New Jersey Harbor anglers (New York state is quite different from the NY-NJ harbor area and the LPRSA, as indicated by a comparison of the different demographics of these two target populations).

In the July 25 Technical Memorandum, Region 2 also dismissed the one source of site-specific data on fish and crab consumption in the Lower Passaic River (Tierra's 2000-01 Creel Angler Survey (CAS) of RM 1-7 of the LPRSA). Region 2's reasons for dismissing this year-long survey are not justified. The first reason given, lack of Region 2's approval of the work plan, is not justified given that neither of the two studies used by Region 2 to derive the new RME fish consumption rate of 44 g/day followed a Region 2-approved work plan. Moreover, Region 2's rationale that the Burger (2002) and Connelly et al. (1992) studies were reviewed by their respective funding sources does not provide any increased confidence that the study was well designed for the purpose for which Region 2 is using it or that its results are of a higher quality than the Tierra CAS. It also does not provide any indication that those data are relevant and appropriate for deriving consumption rates for use in the LPRSA baseline HHRA.

The second reason given, that the number of consuming anglers intercepted was too small for meaningful statistics, is not sound. First, it does not reflect the large amount of effort expended over a full year to capture LPR anglers. Second, it shows a lack of understanding regarding a probability sample, which is statistically designed to capture a sample of the target population, and through use of sampling weights, calculate consumption statistics for the full target population. As discussed in Ray et al. (2007b), once the sampling weights have been properly calculated and applied, the size of the

consuming angler population in RM 1-7 is estimated to be 34, not 7. The Tierra CAS underwent peer review that included thorough vetting of the survey design and data analysis methods (Finley et al. 2003). To address Region 2's stated concerns and any questions regarding the Tierra CAS, CPG has offered to meet with Region 2 to discuss the design and data analysis methods; however, this offer has been declined. The results of this survey remain the best source of currently available data for estimating site-specific consumption rates for anglers using the LPRSA. Using the data analysis methodology described in Ray et al. (2007a,b), and in accordance with USEPA guidance (1997, 1998), valid and defensible consumption rates can be derived from the survey data. For the population of consuming anglers, the calculated upper bound and mean fish consumption rates are 17 g/day and 4.7 g/day, respectively. These rates, and not the maximum of 28 g/day cited by Region 2, should be used in the comparison with consumer-only rates taken from the other surveys presented in Region 2's Technical Memorandum.

Region 2's statement that assuming a fraction ingested (FI) of 1 is consistent with recommendations in guidance is not accurate. RAGS guidance (USEPA 1989; Exhibit 6-17) clearly states that the decision to use a FI of less than 1 for the fish ingestion exposure pathway should take into account local angler usage patterns and water body characteristics. It is not appropriate to base an FI of 1 simply on a species' presence in a water body (e.g., blue crab), if other factors limit angling activity. While crabs are present in the LPRSA, crabbing is an infrequent occurrence. Tierra's 2000-01 CAS intercepted only five people who reported catching crabs. Of those five, four reported not keeping them. The fifth reported not keeping crabs on one trip, using them as bait on another trip, and did not specify their disposition for the third trip. These results contrast with Burger's 1999 survey of Newark Bay Complex, including the Arthur Kill, where 110 crab consumers were reportedly intercepted over a four-month period (Burger 2002). Given that both water bodies have the same crab advisory (Do Not Catch, Do Not Eat), it is reasonable to conclude that the disparity in level of crabbing activity between the two water bodies is due to differences in site setting and water body characteristics that make the LPRSA a less desirable crabbing destination. It is appropriate and consistent with guidance to use a FI value less than 1 to account for this disparity in crabbing activity at the LPRSA.

A detailed critique of Region 2's Technical Memorandum is provided in Attachment B, which clarifies inaccuracies and flaws in Region 2's statements and analysis.

Alternative Position

CPG recommends that the fish and crab ingestion rates be based on a site-specific CAS to be conducted for the entire LPRSA[2]. In the interim, CPG recommends a range of consumption rates be evaluated for both fish and crab, such as the following:

- 17.5 g/day → fish/shellfish consumption rate used by USEPA and NJDEP to derive water quality criteria protective of the general public, as well as the average sport angler (USEPA 2000). The 17.5 g/day rate is based on per capita intake of freshwater and estuarine finfish and shellfish by the general population and represents the 90th percentile of the 1994-96 USDA CSFII Survey (Continuing Survey of Food Intakes by Individuals). As it is considered a national default intake rate, it would fall under the "fourth preference" in the hierarchy of options presented in Region 2's July 25 Technical Memorandum, which is taken from

[2] CPG recommends that survey data which will be generated in 2011-12 from a new CAS of the entire 17.4 mile study area be used in developing new study area-wide consumption rates for use in the baseline HHRA.

USEPA's Methodology for Deriving Ambient Water Quality Criteria for the Protection of Human Health (USEPA 2000).

- 7.5 g/day → "One meal per month" consumption rate used at other sediment sites to provide risk information to the public and decision-makers on potential risks associated with consumption of various types of recreationally caught fish/crabs. This type of approach has been used in other sediment site HHRAs where remediation is expected to take decades before advisories can be relaxed to provide a range of risk information for consideration in remedial decision-making (e.g., Lower Duwamish Waterway).

These rates provide reasonable policy alternatives to deriving rates based on studies that are not relevant or appropriate for estimating long-term consumption of fish and crabs from the LPRSA, and can be used for the RME and CTE scenarios. As a point of comparison, they are similar to the site-specific upper bound and mean fish consumption rates of 17 g/day and 4.7 g/day, respectively, for consuming anglers based on Tierra's 2000-01 CAS.

CPG also recommends that a FI value less than 1 be used for both the fish and crab ingestion scenarios. For the RME crabber, a FI value of 0.5 is recommended. This is considered very conservative, based on the documented minimal usage of the Study Area by anglers for crabbing. A FI value of 0.5 assumes that half of the crab consumed comes from outside of the LPRSA. This approach is supported by precedent at several other large sediment sites, including the Aberjona River and Sudbury River in Massachusetts, the Kalamazoo River in Michigan, and the West Branch of the Grand Calumet River in Indiana. At each of these sites, a FI value of 0.5 was used for the RME recreational angler fish consumption scenario, based on the fact that other desirable fishing locations were located within close proximity to the sites. A FI value of 0.25 is recommended for the CTE scenario, which is one-half of the RME FI value. The use of a CTE value that is one-half of the RME value is consistent with Region 2's approach for a number of other exposure parameters.

The use of a FI value less than 1 should be considered for the fish ingestion scenarios pending the results of the Study Area-wide CAS. Given the close proximity of several other desirable fishable water bodies in the immediate proximity of the LPRSA, it is likely that recreational anglers who fish at the LPRSA obtain a sizable portion of their catch outside of the Study Area. The CAS questionnaire has been designed to collect specific data on the amount of angling that occurs outside of the Study Area.

Issue #5 - Retraction of earlier agreement to discuss cooking loss options with CPG (Comments 112, 114, 115, 135)

Basis of Dispute

Region 2 has deleted language previously offered in its September 10, 2010 comments on the draft RARC Plan that allowed for discussions on cooking loss factors: CPG questions why Region 2 has retracted its offer to discuss cooking loss factors that was provided in the November 5, 2010 comments (Comment No. 48): "While the RME values specified are directive, EPA is willing to discuss the CTE values." The rationale for this change in position is not justified, and deprives CPG of an opportunity for meaningful technical exchange with Region 2 on this topic.

Alternative Position

The CPG would like to engage Region 2 on this topic as originally planned.

Issue #6 - Approach for evaluating exposure to sediment by residents (Comments 109, 118, 131)

Basis of Dispute

Region 2 has stipulated an approach for evaluating a resident's exposure to river sediment that is unrealistic: "For the resident receptor's exposure to sediment, the USEPA default exposure frequency for residential soil is used, because surface soil in some yards adjacent to the river may consist of sediment deposited by flooding of the Passaic River, particularly for the homes that abut the east bank of the river above RM 10 (but also elsewhere along the river)" (Comment 131). Region 2's justification for the assumption that residents are exposed to river sediment on a year-round basis at a rate consistent with residential backyard soil and indoor dust is implausible and will significantly overestimate potential sediment risk to residents.

River sediments that may be present in backyards due to past flooding could comprise only a fraction of the native soil in residents' backyards. Some accounting for mixing needs to be made to avoid overestimating the sediment-derived exposure concentration. To further assume that river sediment is contacted every day of the year at equivalent indoor and outdoor concentrations is flawed. Physical factors, such as climate or weather conditions that would preclude or significantly limit sediment contact (i.e., ice, cold temperatures) are not acknowledged, which is inconsistent with RAGS (USEPA 1989). The technical concerns were documented in CPG's February 10, 2011 Position Paper that accompanied the Revised RARC Plan submittal to Region 2. Region 2's comments and revised text do not address CPG's concerns.

In addition, the stipulated revisions delete important points relating to CPG's concerns about the directed approach, which is that the applicability of residential soil ingestion rates and a fraction ingested value of 1 is overly conservative, and does not take into account mixing that occurs between the river sediments and the native soil in the yard.

Alternative Position

CPG recommends that the concentrations of sediment-related constituents of potential concern (COPCs) in residential backyards be estimated by taking into account dilution from mixing with the native soil. This could be accomplished through site-specific modeling or a simple dilution factor that accounts for the fraction of river sediment likely present in the yard. Region 2's residential exposure scenario could still be used to provide a highly conservative assessment of this potential exposure pathway, including Region 2's unrealistic assumption that the resident's exposure to backyard soil occurs year-round via incidental ingestion of outdoor soil and indoor dust of outdoor soil origin. The CPG's alternative position of adjusting the exposure point concentrations to be more representative of river sediment in yards allows for a measure of realism to be incorporated into what is otherwise a purely hypothetical scenario.

Issue #7 - Deletion of references to pathogenic contamination (Comments 3, 90, 104, 128, 150)

Basis of Dispute

Region 2 has deleted text regarding pathogenic contamination from the discussion of swimming in the exposure assessment and from the discussion of background risk characterization in the uncertainty section. In the discussion of factors that limit swimming at the LPRSA, references to the presence of

pathogenic contamination, and the urban setting of the river, including lack of public beaches, have been deleted. Region 2 has added text describing the State of New Jersey's surface water classifications, including that swimming is a designated use of the freshwater portion of the river (RM 8-17.4) where the water has a classification of freshwater 2 non-trout and saline-estuarine 2 (FW2-NT/SE2) (Comments 81 and 104). Waters with a classification of primary contact recreation include uses such as swimming and other activities that potentially involve total body immersion and/or incidental water exposure. To provide balance and necessary context, there should also be acknowledgement that this stretch of the river frequently does not achieve the bacterial standard designated as safe for swimming. Based on a preliminary evaluation of publically available monitoring data for RM 8-17.4, there have been numerous occasions when the bacterial water quality standards for swimming have not been met (see Attachment C). It is misleading to state that swimming is a designated use when the river frequently does not achieve the state bacterial standard considered safe for swimming.

Region 2's rationale for deleting references to pathogenic contamination is that "individuals visiting the river will not know what levels of pathogens are present when deciding when or how long they will wade or swim." While it is likely that individuals visiting the LPRSA may not know specific levels of pathogens in the water, they are likely aware of the high potential for pathogenic contamination, due to the urbanized nature of the water way and visible combined sewer overflows (CSOs). Further, the swimming and wading exposure frequencies directed by Region 2, particularly for adolescents, are too high to be realistic for even a reasonable maximum exposure at a compromised water body, such as the LPRSA. Water quality, including pathogenic contamination, is an important baseline condition that should be acknowledged in the exposure assessment, as it factors into individuals' recreational site choice decisions. Region 2's deletions of all references to pathogenic contamination remove relevant context and result in an incomplete depiction of the site setting.

Region 2 has also deleted reference to pathogens and non-HSL chemicals from CSOs and stormwater overflows (SWOs) from the discussion of background risks associated with other sources in the study area, and states "there are no data to support such an analysis" (Comment 150). However, data are available to provide a qualitative, if not quantitative, understanding of background risks associated with these other stressors. In fact, the presence of significant pathogen risks in the LPRSA has been documented in past studies (Donovan et al. 2008a,b). Considerable pathogen data for LPRSA surface water exist, including samples collected between 2003 and 2009 at three to six locations in the LPRSA and analyzed for bacterial indicators, including fecal coliforms and enterococci (see Attachment C). As part of the CPG's Low Resolution Coring program, several sediment samples were also analyzed for pathogens. In addition to conducting risk assessments for recreational exposure to pathogens, USEPA has also developed draft guidance for conducting microbial risk assessments (USEPA 2009b). Thus, the methods and data are available to conduct a risk analysis of pathogens, which are a key component of background risks in the LPRSA under both current and foreseeable future site conditions.

Region 2 has also deleted the following statement that CPG was previously directed to add (Comment No. 58 of Region 2's September 10, 2010 comments), "It should be noted that regulation of pathogens from CSOs and SWOs is outside of the Superfund program; these risks are addressed by separate legislative mandates, such as the Clean Water Act" (Comment 150). It is inconsistent for Region 2 to establish a non-CERCLA objective of "fishable/swimmable" and then deny CPG the opportunity to characterize and calculate risks due to pathogens, which are the primary risk driver for swimmers, based on the rationale that pathogens are not a CERCLA contaminant.

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Alternative Position

As CPG has previously commented to Region 2, microbial risks are a well-documented component of background risks for river users, and should be considered within the broader context of risk-based remedial decision-making at the LPRSA. CPG recommends that relevant language regarding pathogen contamination as a deterrent to swimming and other recreational activities be reinstated in the RARC Plan. In addition, CPG recommends that the uncertainty analysis include an assessment of pathogen risks using available data and accepted risk assessment methods.

Issue #8- Directive to remove all statements attributing EPA as source of directed exposure scenarios and parameter assumptions as well as language that provided the technical basis for alternative positions (Comments 7, 78, 95, 99, and several specific comments)

Basis of Dispute

Region 2 is directing CPG to remove all statements related to Region 2 directing the exposure scenarios and exposure assumption values for CPG to use in the baseline HHRA. As an example, Comment 99 directs that the following text be deleted as it provides "unnecessary explanation."

> "The values to be used for each of the RME and CTE exposure parameters are those that USEPA Region 2 directed CPG to use, were issued as directives on November 5, 2010, and are representative of USEPA default values. These values are presented in this Revised RARC Plan."

CPG disputes this directive and Region 2's statement that such language is unnecessary explanation. There is no basis for removing all statements attributing Region 2 with directing the exposure scenarios and exposure parameter values for CPG to use in the baseline HHRA. It is understood that Region 2 and CPG may not agree on all methods and assumptions to be used in the baseline HHRA. However, it is important and appropriate that key areas of dissent be acknowledged in this public document to provide transparency and proper attribution, precisely because they represent areas of uncertainty of which risk managers should be apprised for decision-making purposes.

Further, some of the text deleted describes the basis of CPG-derived alternative positions. As such, it provides risk managers with the context needed to evaluate the Region 2 directive values amongst the technical alternatives, and should be retained in this risk planning document. It should be clear to the reader that the RME and CTE exposure parameter values presented in the document are those that USEPA Region 2 has directed CPG to use. On issues where there is a range of possible values, the alternative points of view and their potential implications should be clearly stated in the main body of the document and not discussed solely in the uncertainty section of the risk analysis. There is precedent for attributing specific approaches and assumptions to "EPA request/direction" in risk assessment documents prepared by potentially responsible parties within and outside of Region 2 (e.g., Alcoa 2002).

Alternative Position

CPG recommends that language be reinstated that attributes Region 2 with directing the exposure scenarios and assumptions to be evaluated in the baseline HHRA. Specifically, CPG recommends inclusion of language in the initial discussion of receptor-specific exposure parameters in Section 3.3.4, which provides important context and background to the reader. CPG proposes that, at a

minimum, the following statement from the second paragraph of Section 3.3.4 be retained, with the following minor rephrasing:

> "The values to be used for each of the RME and CTE exposure parameters are those that USEPA Region 2 has directed CPG to use."

CPG also recommends that the RARC Plan clearly identify key areas where a range of values is plausible, present alternative positions that are technically justified, and discuss the relative conservatism of the selected value or approach. This will ensure that the risk assessment process is transparent and is consistent with principles articulated by the National Academy of Sciences and adopted by USEPA in its risk assessment framework for decision-making (USEPA 1984).

Issue #9 - Deletion of statements supporting consideration of site-specific data (Comments 78, 110a)

Basis of Dispute

There are several instances where Region 2's stipulated revisions result in deletion of important text regarding guidance support for the use of site-specific data in risk-based decision-making. In addition, Region 2 has added language citing RAGS as the basis for a default assumption or approach. CPG does not agree with these changes, as they result in the loss of a valuable concept regarding the importance of and guidance support for site-specific data and approaches.

For example, Region 2 has deleted a statement that was previously revised based on Region 2's earlier comments on the draft RARC Plan. Region 2's September 10, 2010 comment directed that the word "may" be replaced by "will" in the following statement, "While use of some default or surrogate assumptions <u>may</u> be necessary in the remedial decision-making process, USEPA guidance documents stress the importance of using data that represent the characteristics of the local populations(s) and site when possible and appropriate (USEPA 1989a,b, 1991a, 1997b, 1998a, 2000a)" (Comment 78). CPG made this change, and now Region 2 is directing that this statement be replaced entirely with new language that does not provide the same background or context: "However, USEPA guidance (USEPA 1991a) also allows the use of default values developed by USEPA when there is a lack of site-specific data or consensus on which parameter value to choose, given a range of possibilities."

Under the fish and crab consumption exposure parameters (Section 3.3.4.7), Region 2 has deleted the following statement, "USEPA's guidance recognizes the importance of site specificity and states that many of the exposure factors are best quantified on a site- or situation-specific basis (USEPA 1989a, b, 1997b, 1998a, 2000c)" (Comment 110a). The concept of site-specificity is especially important for fish/crab consumption because of the variability in local populations and fishing and consumption practices (USEPA 1997, 2000).

In the revised NCP rulemaking, USEPA clarifies that baseline risk assessments should be site-specific (55 Federal Register 8711, March 8, 1990):

> "The decision to perform site-specific risk assessments is consistent with CERCLA section 104(i)(6), which requires the ATSDR to perform health assessments for facilities on the proposed and final NPL..., and should be "based on such site-specific factors as nature and extent of contamination and the existence of potential pathways of human exposure."

Alternative Position

Region 2's stipulated deletions result in the loss of acknowledgement of the NCP rulemaking and USEPA guidance supporting consideration of site-specific information in the baseline risk assessment process. This is an important concept that should be reflected in the CPG's primary risk assessment planning document. CPG recommends that text containing references to basic tenets of USEPA's guidance promoting use of site-specific data in the risk assessment process be reinstated in the RARC Plan document to provide the necessary context and background for selected positions. CPG also recommends that inappropriate references to RAGS as the basis for default assumptions or approaches be removed from the document.

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Attachment A

Summary of Review of Municipal, State, and Federal Planning Documents Related to Redevelopment and Restoration Along the LPRSA

September 2011

ATTACHMENT A

SUMMARY OF REVIEW OF MUNICIPAL, STATE, AND FEDERAL PLANNING DOCUM RELATED TO REDEVELOPMENT AND RESTORATION ALONG LPRSA

This attachment presents a summary of statements regarding plans for redevelopment and/or restoration al from municipal, state, federal and other organization's planning documents.

Municipality	Planning Document	Relevant Statements Regarding Redevelopment and/or Restoration along the LPRSA
City of Newark	City of Newark, 2010. The riverfront that Newark wants, progress report: 2009-2010. Presentation June 2010, City of Newark, NJ. 59 pp.	"In the spring of 2009, the City of Newark partnered with the Trust for Public Land and the County of Essex to begin design on Newark's first true riverfront park."
		"The plan includes a walkway/bikeway, lawns for relaxing, a boardwalk, and a floating boat dock."
		"It emphasizes environmental education with features like this overlook and osprey nook. The first piece will begin construction in 2010."
		"The most recent official land use action designated a "Special Waterfront Zone", but did not make any specific rules for building there."
		"We treated the riverfront in four pieces to address the unique conditions and opportunities of each. For each stretch, we tried to understand the needs and opportunities of upland neighborhoods as well as those of the river's edge. To catalyze public discussion, we boiled down the decisions faced by the City into 24 basic questions. North Ward: 1. New Parks 2. Land Use 3. Public Access Lower Broadway 4. New Parks 5. Land Use (North) 6. Land Use (South) 7. Density 8. Public Access

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Municipality	Planning Document	Relevant Statements Regarding Redevelopment and/or Restoration along the LPRSA	Page(s)
City of Newark	City of Newark, 2010. The riverfront that Newark wants, progress report. 2009-2010. Presentation June 2010, City of Newark, NJ. 59 pp.	"In the spring of 2009, the City of Newark partnered with the Trust for Public Land and the County of Essex to begin design on Newark's first true riverfront park."	Page 30
		"The plan includes a walkway/bikeway, lawns for relaxing, a boardwalk, and a floating boat dock."	Page 32
		"It emphasizes environmental education with features like this overlook and osprey rook. The first piece will begin construction in 2010."	Page 33
		"The most recent official land use action designated a "Special Waterfront Zone", but did not make any specific rules for building there."	Page 36
		"We treated the riverfront in four pieces to address the unique conditions and opportunities of each. For each stretch, we tried to understand the needs and opportunities of upland neighborhoods as well as those of the river's edge. To catalyze public discussion, we boiled down the decisions faced by the City into 24 basic questions. North Ward: 1. New Parks 2. Land Use 3. Public Access Lower Broadway 4. New Parks 5. Land Use (North) 6. Land Use (South) 7. Density 8. Public Access	Page 38, 45

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City of Newark	City of Newark, 2010. The riverfront that Newark wants, progress report. 2009-2010. Presentation June 2010, City of Newark, NJ. 59 pp. (con'd)	Downtown 9. New Parks (North) 10. Land Use (North) 11. Density (North) 12. Public Access (North) 13. New Parks (South) 14. Land Use (South) 15. Density (South) 16. Public Access (South) 17. Vehicular Access (South)	Page 38, 45 (con'd)
		Ironbound 18. New Parks (West) 19. Land Use (West) 20. Density (West) 21. Public Access (West) 22. New Parks (East) 23. Land Use (East) 24. Density (East)"	
		"After discussion and study, we prepared a draft vision for the riverfront, beginning with what people cared about most: a system of trails to provide access to and along the water's edge."	Page 49
		"Lower Broadway Land Use Recommendations: Preserve and encourage job-intensive light industrial uses; allow residential development between McCarter and riverfront with accompanying open space."	Page 51
		"Downtown Riverfront Access & Open Space Recommendations: Signature 8.5 acre open space; continuous riverfront walkway; create or improve 7 access points from upland."	Page 54-56

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City of Newark	City of Newark, Philips Preiss Shapiro, Schoor DePalma. 2004. Land use element of the master plan for the City of Newark. Prepared for the Central Planning Board, City of Newark. Adopted December 6, 2004. City of Newark Dept. of Economic and Housing Development. *[Also appears in 2010 Master Plan.]*	"The City is also embarking on its first major public open space project in many years. From Bridge Street to Brill Street, a Passaic Riverfront walkway of varying lengths is being developed. The Joseph G. Minish Restoration and Historic Area project, which is located on the Passaic River waterfront adjacent to the downtown, is designed to create more open space along the Riverfront which is accessible to the downtown and to residents and employees from the Ironbound neighborhood. The riverfront walkway and Minish Park will also help to build connections between the offices in the downtown and entertainment uses such as the New Jersey Performing Arts Center to Newark's residential areas as well as providing a scenic backdrop to the expected future development of offices, hotels and housing on the Passaic River waterfront. As part of this project, the Essex County Improvement Authority is developing park space between Mott Street and Brill Street which will include active recreational uses, such as baseball fields, soccer fields, an in-line hockey rink, and tennis courts."	Page 96
City of Newark	City of Newark, Philips Preiss Shapiro, Schoor DePalma. 2004. Land use element of the master plan for the City of Newark. Prepared for the Central Planning Board, City of Newark. Adopted December 6, 2004. City of Newark Dept. of Economic and Housing Development (con'd) *[Also appears in 2010 Master Plan.]*	"Review of the Riverfront Revitalization Study (1999): • The plan covers the development of a new waterfront park and greenway stretching from the Rte 1&9 bridge to the northern City line. • The plan is broad in scope and contains recommendations for the new waterfront park and greenway; commercial and residential development on waterfront sites; transportation and roadway upgrades and access; and design standards for the park and new development. The plan sets forth a number of design principles: • The creation of a "grand" amenity along the waterfront, comparable to the Battery Park City esplanade. • The creation of a plan for water-based activities, including recreational boating. . • Extending the street grid to the waterfront wherever possible, to maximize vehicular and pedestrian access. • Building on the NJPAC and plaza by extending the plaza and arts uses down to the water. • The plan targets a "key development area" consisting of the vacant property between Penn Station, the Legal Center, and the NJPAC. This area is also referred to in the plan at the "key development site". Under the Newark Land Use Plan in Chapter 5, the portion of this area between McCarter Highway, Raymond Blvd, and the water is designated S-W for Waterfront uses.... • The plan also recognizes the need and desirability of providing open space and green areas within the waterfront area."	Pages 110-111

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		"[Assumptions, Goals and Policies Underlying the Future Land Use Plan] Section 5.1.8 – Waterfront • To revitalize Newark's waterfront from the Belleville border to the Ironbound by capitalizing upon opportunities to create true mixed-use environments with an emphasis on waterfront related uses and open space, public access and waterfront views, and an emphasis on recreation and entertainment. • To include and encourage water-based activities on the Passaic River waterfront, including recreational boating. • To encourage an extension of public rights of way along Newark's street grid pattern to the waterfront wherever possible, to maximize vehicular and pedestrian access, and to protect view corridors along these rights of way. • To build on the NJPAC and plaza by extending the plaza and arts uses down to the water."	Page 152
City of Newark	City of Newark, Philips Preiss Shapiro, Schoor DePalma. 2004. Land use element of the master plan for the City of Newark. Prepared for the Central Planning Board, City of Newark. Adopted December 6, 2004. City of Newark Dept. of Economic and Housing Development (con'd) *[Also appears in 2010 Master Plan.]*	Section 5.6.5 S-W: Waterfront Use "This designation is applied to that portion of the Passaic River waterfront that the City intends to redevelop as a mixed-use environment—residential, retail, entertainment and open space and recreation uses and office uses—with a particular emphasis and orientation to waterfront activities, i.e., marinas, boating, walkways along the waterfront, outdoor cafes, etc. Design principles articulated in the Passaic Riverfront Redevelopment Plan should be incorporated into the zoning designation for this area which in addition to encouraging mixed uses and a waterfront orientation and public access, should call for a protection of view corridors, setbacks from the waterfront to provide waterfront esplanades with public access, active ground-floor uses at the water's edge, pedestrian connections to residential neighborhoods behind the waterfront, and a uniform set of design standards for public improvements, including such items as lighting, paving, landscaping, street furniture, signage, colors, materials and style. The area to be designated S-W not only include the area in the Passaic Riverfront Redevelopment Plan Study, i.e., the area of riverfront between Minish Park and Newark Bears and Eagles Riverfront Stadium, but all of the riverfront between the Passaic River and McCarter Highway stretching from the Belleville border in the north all the way to Penn Station in the downtown and then between the Passaic River and Raymond Boulevard from Penn Station into the North Ironbound neighborhood."	Pages 190-191

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ATTACHMENT A

SUMMARY OF REVIEW OF MUNICIPAL, STATE, AND FEDERAL PLANNING DOCUMENTS RELATED TO REDEVELOPMENT AND RESTORATION ALONG LPRSA

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		"As the market for waterfront development becomes established adjacent to the downtown and in the Passaic Riverfront Redevelopment area, it is hoped that such uses would spread northward and replace the older industrial and other uses along the waterfront." Section 5.6.6 S-P Parks and Open Space "The City also endorses the development of a greenway system – a series of linear pedestrian and bikeway connections which link areas of parks and open space in Newark – that was articulated in the NEDLUTP Study, in the future. A list of the parks in Newark so designated is included in the Appendix."	Pages 190-191
		"The Waterfront Redevelopment Area plan designates the waterfront border from Harrison Avenue to Frank E. Rodgers Boulevard for Public Access/Open Space Improvements....The entire Passaic River waterfront on the Newark side opposite Harrison is designated S-W Waterfront uses."	Page 222
City of Newark	Clarke Caton Hintz, Ehrenkrantz Eckstut & Kuhn. 2004. Passaic riverfront redevelopment plan, Newark, NJ. Presentation 1/22/04 to City of Newark.	Requested from EPA.	
City of Newark	Clarke Caton Hintz, Ehrenkrantz Eckstut & Kuhn. 1999. Passaic riverfront revitalization, Newark, NJ. City of Newark 12/15/99. Clarke Caton Hintz, Trenton, NJ	Requested from EPA.	
Harrison, NJ	Heyer Gruel. 2003. Harrison Waterfront redevelopment plan, New Brunswick, NJ. Heyer, Gruel & Associates, Red Bank, NJ. 80 pp.	"The Redevelopment Area is located within a mile of the NJPAC Riverfront stadium, and the downtown core of the City of Newark." "The Redevelopment Area is approximately 250 acres in area (32 percent of the Town's 1.2 square mile area) and is located on the Passaic River in the southern portion of the Town. It is located in the most industrial portion of the Town."	Page 8
		"The residents of Harrison will benefit from the redevelopment of the Area in numerous ways...greater access to improved public open space such as the waterfront parkway and the planned public park and plazas..."	Page 11

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SUMMARY OF REVIEW OF MUNICIPAL, STATE, AND FEDERAL PLANNING DOCUMENTS RELATED TO REDEVELOPMENT AND RESTORATION ALONG LPRSA

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Harrison, NJ	Heyer Gruel. 2003. Harrison Waterfront redevelopment plan, New Brunswick, NJ. Heyer, Gruel & Associates, Red Bank, NJ. 80 pp.	"The Plan provides for waterfront amenities, namely a waterfront walkway and park, that will give the Town a valuable resource that is currently sorely neglected in the existing framework of the Area."	Page 12, 24
		"The specific goals of the plan are… to acknowledge the significance of the Passaic River waterfront area, to incorporate public access to the River in the Plan and to locate appropriate uses along the River which will capitalize on the views and other attributes that the River affords."	Page 23
		"The Passaic River waterfront walkway is planned as a companion to the USACE flood control project. Rather than cordon the public off from the waterfront through construction of the floodwall, the Town decided to capitalize on the project by incorporating a public waterfront walkway and park component into the flood control plan…The walkway is envisioned to be a place of public recreation, relaxation and gathering throughout the day and evening…The walkway will extend from the Interstate 280 Stickel Bridge south to the Jackson St bridge and will terminate just east of the Jackson St bridge."	Page 26
		[Parks/walkway district, purpose] "To provide an area of open space and a continuous walkway for public access parallel to the water's edge for active and passive recreation, which will allow the public to benefit from the scenic view of the Passaic River.	Page 39
Kearny, NJ	Heyer Gruel. 2002. Town of Kearny master plan reexamination report. Heyer, Gruel & Associates, Red Bank, NJ.	Requested from EPA.	
Borough of Rutherford, NJ	Borough of Rutherford, CMX. 2007. Master plan. Adopted December 20, 2007.	(In the year 2025…) "Waterfront access has been improved and waterfront activities are now commonplace on the banks of the Passaic River."	Page 5
		"Expand active recreational opportunities in the Borough through the creation of new park facilities either at existing Borough parks, park/school sites or through the creation of new parks and facilities." (Note: this is a general statement and not specific to the waterfront.) "Provide better access to the Meadowlands area and to waterfront properties generally."	Pages 8, 31

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		"...there are only 8 acres of vacant land remaining in Rutherford outside of the Meadowlands, leaving minimal if any opportunity for preserving additional open space or creating new recreational land. In a mature town such as Rutherford, the concept of open space sometimes needs to be redefined. The vision of large green spaces, although desirable, is not always practical...The Borough's efforts to create a linear park/trail along the Erie rail bed is an example of an innovative approach to expanding open space and recreation opportunities and is supported by this plan." "Rutherford has access to two very unique open space and recreation opportunities – the Passaic River and the Meadowlands. These assets should also be considered important elements of the Borough's recreation inventory."	Page 34
		"Improve accessibility, aesthetic and recreational opportunities in the area surrounding the Passaic River through restoration and redevelopment programs."	Page 36
		"The Bergen County 2004 Open Space and Recreation Plan identifies the Passaic River Corridor as an "open space acquisition and preservation opportunity." Specifically, the County ORSP calls for the "addition of appropriate lands adjacent to or abutting existing state, county, or municipal parklands that further expand or enhance riverside conservation, preservation and recreation opportunities."	Page 37
Borough of Rutherford, NJ	Borough of Rutherford, CMX. 2007. Master plan. Adopted December 20, 2007 (con'd)	"The Rutherford OSRP is consistent with the County OSRP in that it also recommends the creation of passive recreation opportunities along the river corridor, and further recommends the preservation of the floodway and floodplain of the Passaic River and its tributaries... The remainder of the riverfront is almost entirely developed with just a few scattered vacant parcels. As recommended earlier under the "new open space" heading, properties, especially those abutting existing open space, that are impacted by natural or other disasters, abandoned, or exhibit severe deterioration, should be evaluated for possible acquisition...Public access to the river should also be enhanced by ensuring through the Borough's development ordinances that any future large scale development and redevelopment along the river provide reasonable access to the river in concert with applicable NJDEP requirements for waterfront development."	Page 37

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Planning documents that are not referenced by EPA Region 2 in July 11, 2011 revisions to RARC Plan.			
City of Garfield	Bergen County, City of Garfield. Garfield Historic Park. 10 pages. Available online at: http://www.passaicriver.org/images/PRC%20LANDS%20BOOK/Bergen%20County.pdf	" The Garfield Historic Park property is vacant urban land. Our goal is to assist the municipalities of the lower Passaic River Basin reconnect with the river and create a vibrant and natural waterfront park. The PRC property connects with Garfield City parkland on the Passaic River's floodplain below Dundee Dam. The city is planning a two-tiered park along the stretch of the Passaic River from the Outwater Bridge to the land above the Dundee Dam. The city specifically requested the PRC to purchase this land so that we would be a part of the planning process. E. Timothy Marshall, our recommended landscape architect, is designing this park, which will be a major attraction in this urban community. The lower bank contains petroglyphs and weirs for catching fish built by the Lenni-Lenape Indians hundreds of years ago."	Page 1
Township of Lyndhurst	Bergen County, Township of Lyndhurst. Lyndhurst Greenway. 10 pages. Available online at: http://www.passaicriver.org/images/PRC%20LANDS%20BOOK/Bergen%20County.pdf	" The PRC's Lyndhurst Greenway properties are the expansion and continuation of an open space corridor along the lower Passaic River. Set in an urban area, these four greenway segments will create new recreation opportunities and increase public access to the river. A greenway can help the community reconnect to the river, come to appreciate it both as an important natural resource in its own right, and one that adds value to their community... Once other, smaller parcels are acquired, a park will be developed along the river to the Route 3 bridge."	Page 4
Harbor Estuary including Passaic River Region	Hudson-Raritan Estuary Comprehensive Restoration Plan. Draft March 2009. US Army Corps of Engineers, The Port Authority of NY & NJ, in partnership with NY/NJ Harbor Estuary Program. 169 pp.	"The Newark Bay, Hackensack River, and Passaic River Planning Region offers substantial opportunities to restore coastal and freshwater wetlands, create and restore coastal upland habitats, repair human-induced habitat degradation, and provide increased public access to the waterfront."	Page 110
	Hudson-Raritan Estuary Comprehensive Restoration Plan. Draft March 2009. US Army Corps of Engineers, The Port Authority of NY & NJ, in partnership with NY/NJ Harbor Estuary Program. 169 pp	"This planning region would benefit from the creation of public access points. Although there are many opportunities along the upper reaches of the lower Passaic River and in the Hackensack Meadowlands, there are stretches along the Passaic and lower Hackensack rivers, and Newark Bay where very few access points exist. Public access facilities should be incorporated into future habitat restoration plans wherever feasible."	Page 113

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Essex County	Essex County Park System. Park, Recreation and Open Space Master Plan. April 2003. Prepared by T&M Associates, Passaic River Coalition, and E. Timothy Marshall Associates.	"The County of Essex will consider partnerships that create new recreational facilities to meet a wider County need such as, but not limited to, promoting active recreational use of the Passaic River and Newark Bay or the development of pedestrian and bike pathways and natural trail systems as part of County wide system of greenways to interconnect public parks and landmarks."	Pages 41, 204
		"The Joseph A. Minish Park, currently being developed along the waterfront in the City of Newark, will provide new access to the river in the heart of the City. The Ironbound Community Corporation has proposed a plan to develop the Passaic River waterfront as a continuous waterfront park from Chapel Street to Penn Station featuring passive and active recreation opportunities. Riverfront access for boating, as well as passive recreation, should be developed and linkages explored to connect the waterfront to other existing and proposed open space. The creation of a marina along the Passaic River or in Newark Bay should be explored as this area is redeveloped. As the dominant natural resource of eastern Essex County, the recreational potential of the river should be promoted by the County to provide new and improved access for greater use."	Page 199
City of Newark, NJ	Shifting Forward 2025, Newark Master Plan Re-Examination Report, February 2009, Volume I. 107 pp.	"Strategy #3: Make the Passaic River a regional asset: a continuous, redeveloped Passaic Riverfront for the benefit of all Newarkers and the region. By 2025, Newark must: • Develop at least 25 acres of riverfront open space • Achieve 150,000 annual visitors to the new riverfront parks & attractions • Ensure public access to the riverfront from all parts of the City • Connect the riverfront to all Newark neighborhoods	Page 21
		"As the City charts a path for the future, it must embrace the river again. The Riverfront has the capacity to accommodate at least 25 acres of new open space." "Connect the riverfront to all Newark neighborhoods: • Make the riverfront accessible to the entire City and bring a diversity of Newarkers to the water through programming. • Connect the waterfront users with Newark's cultural and historic destinations in close proximity to the waterfront • Support the development of a waterfront for living, working, and recreation • Create continuous public access along the entire riverfront	Pages 77, 78

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City of Newark, NJ	Shifting Forward 2025, Newark Master Plan Re-Examination Report, February 2009, Volume II. 76 pp. http://www.ci.newark.nj.us/userimages/downloads/MasterPlanReExamReportVolume2%20(CPB%20APPROVED%20DRAFT%20APPENDIX).pdf	Appendix B.46 presents a figure of public access points to the river.	Page B.46
City of Newark, NJ	Newark Draft Vision Plan, 2006. NJ, NY, CT Regional Plan Association. October 2006. http://www.rpa.org/pdf/NewarkFinalReport.pdf	"Expand the open space network in Newark, with a focus on a waterfront and neighborhood parks. Complete the waterfront park along the Passaic River from the northern edge of the city to the Pulaski Skyway in the Ironbound District."	Pages 5, 16
Hudson County	Hudson County Reexamination of the Master Plan, August 2008. Prepared by Heyer, Gruel & Associates.	"Land Use Goal #4: To assist in the implementation of the development and redevelopment of the waterfronts of the Hudson, Passaic and Hacksensack Rivers."	Page 2
		"Complete the Passaic River Walkway from the Bergen County border to the Jackson St bridge."	Page 7
		"Ensure that new development provides public access to waterfront areas, recreational facilities and open space." "Require developers to provide for co-ordinated public access in accordance with NJDEP's walkway standards for the Hudson River, Hackensack River and Passaic River Walkways plans."	Page 12
		"One of the goals of the Passaic Avenue Redevelopment Plan is to reclaim the Passaic waterfront for public use; the Plan establishes a walkway along the entire length of the Passaic River within the Area boundaries, and also calls for a riverfront park."	Pages 24, 105
East Rutherford Boro	NJDEP Green Acres Program, January 2008. Project Descriptions Funding Round 2008B	East Rutherford Boro – Two Carlton Avenue Passive Park. "East Rutherford would like to acquire a 0.93 acre parcel of land on Carlton Avenue to link planned and existing recreational facilities along the Passaic River in East Rutherford and Rutherford. Once acquired, the Borough will transform this abandoned industrial site, currently a Brownfields site, into a greenbelt linking East Rutherford's park system. The Borough sees the site as the critical missing piece in its vision of a planned park expansion."	Page 10

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Garfield City	NJDEP Green Acres Program, January 2008. Project Descriptions Funding Round 2008B	Historic Dundee Dam Pedestrian Way and Preserve. "With funding from the Green Acres Program, Garfield City is in the process of creating a linear park along the Passaic River, in the vicinity of the Dundee Dam... The City anticipates that the park will have two levels, one at the top of the bank containing pathways for walking, jogging and biking, as well as access to the river's edge from the lower level. The park will provide areas to view the magnificent Dundee Dam and abundant river wildlife."	Page 11
Rutherford Boro	NJDEP Green Acres Program, January 2008. Project Descriptions Funding Round 2008B	Rutherford Waterfront Park. "The Borough of Rutherford proposes to create a waterfront park on the Passaic River, along Riverside Avenue. The proposal includes removal of the old bulkhead, shoreline restoration, development of a public park area with a natural tidal pool, and the installation of a boat ramp. The new park is adjacent to a circa 1920 boathouse that has been restored through private section contributions and volunteer labor. The park will serve as an attractive recreational resource, enhancing the local community and the Passaic River waterfront, while also advancing the Passaic River Restoration Plan."	Page 12
City of Newark	NJDEP Green Acres Program, January 2008. Project Descriptions Funding Round 2008B	Riverfront Property Acquisition. "The Ironbound Community Corporation, in partnership with the County of Essex, plans to acquire a parcel located between Raymond Boulevard and the Passaic River. The acquisition will provide recreation opportunities and access to the Passaic River for the densely populated Ironbound community in Newark City. Future plans include revitalizing the property to be a waterfront park that will become part of Essex County's park system."	Page 52
Bergen, Essexm Morris, Somerset, Sussex, Union Counties	NJDEP Green Acres Program, January 2008. Project Descriptions Funding Round 2008B	Passaic River Preservation Project "The Passaic River Coalition has identified multiple priority acquisition areas throughout the Passaic River Basin. Properties to be acquired will provide watershed and water supply protection, and waterfront access." Lower Passaic River Greenway "Targeting properties to provide waterfront access in densely populated areas in Bergen, Essex, and Passaic counties."	Page 59
LPRSA	Lower Passaic River Canoe & Kayak Trail Action Plan, Draft. Prepared by the Dept. of the Interior National Park Service and Lower Passaic & Saddle River Alliance.	"The twenty or so proposed access points along the Lower Passaic Water Trail are located within a 20 minute drive of nearly 9 million Americans."	Page 6
		"Sites were evaluated for public access and paddlecraft launch suitability...Many of the sites recommended for inclusion of the trail require nothing more than an agreement with the land owner of managing agency, the installation of a sign, and its inclusion in the map and guide. Others require further development to enable safe, convenient access to the river, particularly in the tidal portion of the river."	Page 8

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		"The trail is located on the Lower Passaic River defined by NJDEP as Watershed Management Area 4. This section of river is between Two Bridges in Lincoln Park/Wayne and Newark Bay. The trail will be approximately 32 miles including approximately 20 public launch sites in the urban core of New Jersey."	Page 9
Garfield, NJ	Lower Passaic River Canoe & Kayak Trail Action Plan, Draft. Prepared by the Dept. of the Interior National Park Service and Lower Passaic & Saddle River Alliance.	Access Points: • Dundee Dam Portage (below Dundee Dam) • Garfield Ramp (at River Dr. and Division Ave. in Garfield) Site is a steep concrete ramp built as part of the dam renovation project. The ramp provides excellent access to the river just below the dam. Currently there is a lack of parking and safe and convenient portage route from above the dam. Garfield has plans for a riverfront park in the area and it would be ideal to work a portage into these plans.	Pages 42-45
Clifton, NJ	Lower Passaic River Canoe & Kayak Trail Action Plan, Draft. Prepared by the Dept. of the Interior National Park Service and Lower Passaic & Saddle River Alliance.	Access Point: Dundee Preserve (Ackerman Ave at Rt 21) Leased by NJDOT to the City of Clifton, site is adjacent to Rt 21 northbound and is a small forested parcel just below Dundee Dam. The parcel is bound on three sides by the river to the north and the Dundee Canal to the southwest. Recommendations: establish a take-out along the north side of Dundee Canal; stabilized footpath from take-out to naturalized shoreline put-in; create a narrow low-flow channel for canoes and kayaks through rocks.	Pages 46-47
Passaic, NJ	Lower Passaic River Canoe & Kayak Trail Action Plan, Draft. Prepared by the Dept. of the Interior National Park Service and Lower Passaic & Saddle River Alliance.	Access Point: Dundee Island Park (Passaic St/Wall St at Veteran's Court) Site is a newly constructed city park with a concrete ramp, play area and ballfield. It is located behind a church and between a larger park, railroad tracks and the river. It is impossible to see from the street and the turn into the park entrance is unsigned. Recommendations: incorporate into trail; install signs especially from street.	Pages 48-49
Wallington, NJ	Lower Passaic River Canoe & Kayak Trail Action Plan, Draft. Prepared by the Dept. of the Interior National Park Service and Lower Passaic & Saddle River Alliance.	Access Point: Parkway Ramp (Parkway at Maple Ave.) Site is at end of Parkway cul-de-sac. There is a concrete ramp through bulkhead. The ramp is kept locked. Recommendations: provide bypass access to ramp (bolalrds); incorporate into trail; install signs especially from street and river; remove silt from end of ramp.	Pages 50-51
		Emergency Take Out Only: End Lester Street (Lester St and Hathaway) Currently there is an existing pocket park with river access, recommend putting a sign on water identifying the location as emergency take-out	Page 68

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		Emergency Take Out Only: PVSC Pump Station (Rte 21 at River Dr) Existing floating dock, recommend putting a sign on water identifying the location as emergency take-out	Page 69
Rutherford, NJ	Lower Passaic River Canoe & Kayak Trail Action Plan, Draft. Prepared by the Dept. of the Interior National Park Service and Lower Passaic & Saddle River Alliance.	Access Point: Nereid Boat Club (Riverside Ave at West Newell) Site is an existing historic boat club with a club house, floating docks and concrete ramps. There is a plan to build a small park next to the club house that will include improved river access. Recommendations: add floating dock kayak module to existing docks; incorporate into trail.	Pages 52-53
		Emergency Take Out Only: Nereid II (Riverside Ave at Rte 3) Existing secondary boat storage for Nereid Boat Club with floating docks, recommend putting a sign on water identifying the location as emergency take-out.	Page 70
Nutley, NJ	Lower Passaic River Canoe & Kayak Trail Action Plan, Draft. Prepared by the Dept. of the Interior National Park Service and Lower Passaic & Saddle River Alliance.	Access Point: Nutley Boat Ramp (Rte 21 on-ramp at Park St/Kingsland) Site is an existing concrete boat ramp located at the beginning of the on-ramp to Rte 21 northbound. The ramp is suitable only to mid-tide when a mud flat condition develops to low-tide. The Passaic River Boat Club (Power Boating) is working to have the site improved and the mud flat dredged. Recommendations: incorporate into trail if/when mud flat issue is resolved; use only as an emergency take-out until site is improved.	Pages 54-55
North Arlington	Lower Passaic River Canoe & Kayak Trail Action Plan, Draft. Prepared by the Dept. of the Interior National Park Service and Lower Passaic & Saddle River Alliance.	Access Point: Riverside County Park (Riverside Ave at Wilson Ave) Site is the southern section of Riverside County Park where the Passaic River Rowing Association operates the new Bergen County Rowing Center. There is a large floating dock for crew teams and a boathouse. Recommendations: Incorporate into trail; add canoe/kayak floating modules to existing dock.	Pages 56-57
		Access Point: North Arlington Fire House (River Rd at Belmont & Arlington) Site is adjacent to firehouse and vest pocket park. There are a few off-street parking spaces for the park. There is also parking adjacent to firehouse, but "No Parking" signs should be posted. Recommendations: incorporate into trail; provide platform for fishing.	Pages 58-59
Kearny, NJ	Lower Passaic River Canoe & Kayak Trail Action Plan, Draft. Prepared by the Dept. of the Interior National Park Service and Lower Passaic & Saddle	Access Point: Riverbank Park Kearny (Passaic Ave at Bergen Ave) Site is an existing concrete boat ramp within a municipal park. There is adequate parking but no other amenities relating to boating. Recommendations: incorporate into trail; install floatable debris control boom; provide platform for fishing.	Pages 60-61

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	River Alliance.	Access Point: Kearny Point (Central Ave) This site has not been thoroughly surveyed yet because of private property issues. It is a very important location in that it would provide a direct link to the Hackensack River Water Trail and serve the dual purpose of anchoring both water trails. Recommendations: investigate site further, proposed potential launch location?	Pages 64-65
		Emergency Take Out Only: Kearny/Nutley Boathouse (Passaic Ave at Hathaway) Existing floating dock, recommend putting a sign on water identifying the location as emergency take-out.	Page 72
Newark, NJ	Lower Passaic River Canoe & Kayak Trail Action Plan, Draft. Prepared by the Dept. of the Interior National Park Service and Lower Passaic & Saddle River Alliance.	Access Point: Riverbank Park Newark (Raymond Blvd at Van Buren & Somme St) Site is on a small wedge of land on the north side of Raymond Blvd across from the park proper. This is a very important launch because it provides critically needed public access to the river in NJ's largest city. There is an opportunity to incorporate the access with the Army Corps salt marsh restoration project. Recommendations: incorporate into trail; incorporate floating dock access into Army Corps restoration plan, create strong visual and physical connection from park; provide fishing platform. We cannot overstate the critical importance of this site to the entire trail effort. By virtue of its location in Newark, NJ's largest city, we consider it a requirement of the project to provide public access here. The city presently suffers from a lack of sufficient public access to the river and this is an opportunity to increase it.	Pages 62-63
Lyndhurst	Lower Passaic River Canoe & Kayak Trail Action Plan, Draft. Prepared by the Dept. of the Interior National Park Service and Lower Passaic & Saddle River Alliance.	Emergency Take Out Only: Lyndhurst Ballfields (Riverside Ave at Tontine) Existing asphalt ramp in disrepair, recommend putting a sign on water identifying the location as emergency take-out.	Page 71

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	NJDOT, New Jersey's Position on the Future Navigational Use on the Lower Passaic River, RM 0-8, March 29, 2007. Contained in Appendix F of the Draft FFS document	"The surveys indicated that the communities in the Upper 9 miles of the Study Area reflect their objectives to enhance public access, preserve open space and improve the recreational uses (e.g. boating, fishing, ecotourism, parks/fields) along the river. In addition, the Passaic River Boat Club (among other non-profit organizations) are working to improve waterfront access (e.g. locations, adequate depths, overcoming bridge limitations for boating), provide facilities (e.g. marinas, docks, anchorages, restaurants to attract and supporting boating), and spearhead recreational regional events (e.g. Spring Fishing tournament, fall boat and maritime festival, eco-tours). The Lower Passaic and Saddle River Alliance has also proposed a water Kayak and Canoe Trail from Pompton River (RM 32) to the confluence with Newark Bay and up the Hackensack River."	Pages 5-6
Kearny	NJDOT, New Jersey's Position on the Future Navigational Use on the Lower Passaic River, RM 0-8, March 29, 2007. Contained in Appendix F of the Draft FFS document	Kearny's master plan (Heyer, Gruel & Associates, 2002) and survey indicated a focus on 2 areas designated as Kearny Urban Enterprise Zones (KUEZ) which has introduced new economic, residential and recreational opportunities to former industrial areas. The Passaic Avenue Redevelopment Plan (above mile 6.1) calls for the transformation of the industrial and commercial properties along the Passaic River into a regional, mixed use, urban entertainment destination featuring new housing, shopping (i.e., commercial retail) and recreational activities with public connections to a riverfront walkway. Plans for RM 7 to 8 include green acres, town parks and a hockey rink. In addition, a boat ramp at RM 7 (Bergen and Passaic Aves) and dock at RM 8 (Kearny Board of Education Crew Program) are focal points for public access. Although not included in Kearny's current master plan or survey, the use of water taxis, water tours and smaller ferries could be effective in optimizing waterfront usage within areas of the river above RM 4.8 (see Newark's plan). Enhancing already planned waterfront access points (e.g., marinas, boat docks) in upstream river segments would provide benefits to waterfront revitalization opportunities in the region. These commercial services could provide an opportunity for local residents to have access to areas downstream (NJPAC in Newark, Stadium in Harrison, etc) and provide surrounding residents with access to the proposed urban entertainment destination. The Kearny Redevelopment Area under the jurisdiction of the New Jersey Meadowlands Commission within the Harrison Reach (RM 2.5 to 3.6) is slated for open space and passive recreation. Much of this riverfront is occupied by the railroad tracks of the Port Authority Trans Hudson (PATH) system. Therefore, the future plans of the town of Kearny above mile 2.5 would require navigational depths suitable for recreational uses and commercial services (e.g. water taxis/ferries). The plans for Kearny Point also include public access and a waterfront walkway.	Pages 6-7

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Newark	NJDOT, New Jersey's Position on the Future Navigational Use on the Lower Passaic River, RM 0-8, March 29, 2007. Contained in Appendix F of the Draft FFS document	"...All four plans primarily focus on the redevelopment upstream of the "Industrial Zone" located below RM 3.6. These plans outline mixed use commercial development that provide recreational and entertainment uses including marinas, pleasure and dinner boating, crew racing, river festivals, and water taxis (to NYC or Jersey City). In addition, open space, parks and recreational ball fields (buffer between industrial zone and upstream) are of high priority for the waterfront." "Water taxis have been identified as an activity that would be the primary influencing factor for the recommendations for minimum depths in the areas downstream of the Amtrak's Dock Bridge (RM5). In addition, ferry service may also be considered as a potential future opportunity."	Page 7
		Table 1. Summary of Current and Recommended Navigational Depths: RM 3.6-8 – Future Recreational/commercial services (e.g. water taxis/ferries)	Page 14

Attachment B

Critique of USEPA's July 25, 2011 Technical Memorandum, Fish and Crab Consumption Rates for the LPRSA Human Health Risk Assessment

September 2011

Attachment B

Critique of USEPA Region 2's July 25, 2011 Technical Memorandum, Fish and Crab Consumption Rates for the LPRSA Human Health Risk Assessment

Executive Summary

USEPA Region 2's *Technical Memorandum, Fish and Crab Consumption Rates for the LPRSA Human Health Risk Assessment* (*Tech Memo*), dated July 25, 2011, presents the basis for new fish and crab consumption rates that CPG has been directed to use in the baseline human health risk assessment (HHRA) for the LPRSA. The *Tech Memo* also presents the Agency's rationale for using a Fraction Ingested (FI) value of 1 for both the fish and crab consumption scenarios.

USEPA Region 2's *Tech Memo* contains a number of incorrect statements that reflect a lack of understanding or consideration of the impact that differences in survey methodology and target population have when estimating long-term consumption rates. USEPA guidance is also frequently cited as support for positions by taking guidance statements out of context or inappropriately applying them. Numerous studies are also inappropriately cited as supporting the RME fish consumption rate even though the sources represent an assortment of angler surveys of various target populations, household and general population studies that are not specific to recreational fishing, as well as USEPA guidance documents which represent summaries or reviews of a wide variety of studies related to consumption of fish and/or foodstuffs in general. In addition to these general issues, CPG's review revealed a number of major technical issues with Region 2's *Tech Memo* and fish and crab consumption rates.

The fish and crab consumption rates established by Region 2 are based on weak and limited scientific evidence. Contrary to guidance provided in USEPA's Exposure Factors Handbook (EFH) (USEPA 1997) that "the type of survey used, its design and any weighting factors used in estimating consumption should be considered when interpreting survey data for exposure assessment purposes" [p. 10-1], Region 2 did not directly evaluate the study designs or their relevance for predicting long-term fish/crab consumption rates for the LPRSA HHRA. Despite agreement to use objective review criteria, Region 2's review was instead limited, including only geographic location, number of anglers reporting fish consumption, variability in consumption rates across surveys, and consistency with rates previously used by Region 2. Had Region 2 referred to its own guidance in establishing assessment criteria, it would have been readily apparent that a number of the studies used in establishing the fish/crab consumption rates are not acceptable for deriving long-term consumption rates.

Region 2 supports use of the Burger (2002) and Connelly et al. (Connelly et al. 1992) studies as the primary supportive studies for the fish/crab consumption rates derived for the LPRSA partially based on the fact that they were subjected to reviews by funding agencies before and after grant submittal.

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However, funding review criteria are established to ensure that studies are adequately designed to either prove or disprove specific scientific hypotheses. Since neither Burger (2002) nor Connelly et al. (1992) was designed for the purpose of establishing long-term fish/crab consumption rates, the funding agency reviews were unlikely to have evaluated whether the studies were adequate for that purpose. USEPA Region 2 acknowledges that the survey methodology for Tierra's 2000-01 CAS underwent peer review, and that the articles describing results (Kinnell et al., 2007; Ray et al., 2007a,b) were published in peer-reviewed journals, but then dismisses the only study specifically designed to evaluate long-term fish and crab consumption rates for the LPRSA, because the work plan was not approved by Region 2, even though neither of USEPA's preferred non-site-specific studies followed USEPA-approved work plans. Further, the data on which the Burger (2002) results are based are no longer available and, therefore, cannot be scrutinized. Consequently, issues such as identification of "non-consumers", portion size, monthly and annual fish and crab meal consumption estimates, and sample weighting cannot be verified.

Region 2 failed to acknowledge or address the limitations that make these studies unsuitable as the bases for fish and crab consumption rates for the LPRSA. Rather than using a statistically valid approach, the high-end consumption rate from each of the manipulated datasets from Burger (2002) and Connelly et al. (1992) were averaged and proposed as the Reasonable Maximum Exposure (RME) fish consumption rate for the LPRSA. In addition, while Region 2 cites a number of other studies as supporting the selected RME fish consumption rate of 44 g/day, correction of the numerous inappropriate assumptions made in deriving the consumer only fish ingestion rates from these studies demonstrates that the majority of these studies do not support this rate.

Region 2 also compares its upper-bound and mean consumption rates with fish and crab consumption rates used in other Region 2 site HHRAs over the past 20 years, and states that the estimates are within the range of rates previously used in Region 2. When the subsistence fishing consumption rates cited in Region 2's *Tech Memo* are appropriately discounted (subsistence fishing has been acknowledged as irrelevant for the LPRSA), Region 2's statement is not correct. The RME fish consumption rate of 44 g/day selected by Region 2 for the LPRSA adult recreational angler is higher than all of the other Region 2 sites cited with the exception of the Alcoa site, which used 54 g/day used in the 1993 HHRA (a rate of 32 g/day was used in the 2002 HHRA Update of the Alcoa Grasse River site). Many of the sites identified by Region 2 represent water bodies with sport fisheries and recreational angler target populations that are considerably different than the LPRSA (e.g., Lake Onondaga and Hudson River). Given these differences, Region 2's comparison of sites and corresponding rates to its new consumption rates is flawed and does not support use of an RME fish consumption rate for the LPRSA that is the highest of the rates used by Region 2 over the past 20 years. In addition, the RME crab consumption rate selected by Region 2 for the LPRSA is higher than the rate used at the other Region 2 site where crab consumption was evaluated. The rate of 6.5 g/day used in the 2000 HHRA for the Horseshoe Road site on the Raritan River is considerably lower than the RME crab consumption rate of 32 g/day identified for the LPRSA. Region 2 does not address this disparity in their Tech Memo.

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Region 2 also incorrectly concludes that the site-specific creel/angler survey results for the LPRSA cannot be used in estimating fish consumption rates because only seven consuming anglers were identified (Ray et al. 2007a,b). Not only does Region 2's conclusion disregard the large amount of effort expended over a full year to capture LPR anglers (i.e., 101 angler interview days and 143 angler count days), it also reflects a lack of understanding regarding a probability sample, which is statistically designed to capture a sample of the target population, and through use of sampling weights, calculate consumption statistics for the full target population.

Region 2 has directed use of a FI value of 1 for both the RME and CTE fish and crab consumption scenarios, stating that it is consistent with recommendations in RAGS Part A guidance (USEPA 1989), as well as Region 2 practice at other contaminated sediment sites. While not noted by Region 2 in the *Tech Memo*, USEPA (1989) also states that FI for fish and shellfish is a "pathway-specific value" and "should consider local usage patterns." [p. 6-43]. A household survey of recreational anglers (Bingham et al. 2011) in the Five County area around the LPRSA provide regional data that support the assumption that not all of the recreationally caught fish consumed by LPRSA anglers comes from the LPRSA. While crabs are present in the LPRSA, crabbing is an infrequent occurrence. A year-long angler survey on the LPR intercepted only five people who reported catching crabs, and none reported consuming them. These results contrast with those of Burger (2002), who reportedly intercepted 110 consuming crabbers over a four-month period in the Newark Bay complex, including the Arthur Kill. Given that consumption advisories are the same in the two water bodies, the disparity in the levels of crabbing activity can be attributed to differences in site setting and water body characteristics that make the LPRSA a less desirable crabbing destination.

CPG recommends an alternative position, consistent with USEPA guidance, which will result in a more complete and accurate baseline human health risk assessment (HHRA). CPG believes that data generated by a creel/angler survey to be conducted for the entire 17.4 miles of the LPRSA should be used to derive site-specific fish and crab consumption rates, once available. In the interim, CPG recommends a range of consumption rates be evaluated for both fish and crab, such as the following:

- 17.5 g/day → fish/shellfish consumption rate (used by USEPA and NJDEP to derive water quality criteria protective of the general public, as well as the average sport angler [USEPA 2000]) represents the 90th percentile of the 1994-96 USDA CSFII Survey (Continuing Survey of Food Intakes by Individuals), is supported by at least two of the studies included in Region 2's *Tech Memo* (Connelly et al. 1996 and Ray et al. 2007a,b), and can be used to estimate both fish and crab consumption (included both finfish and shellfish) risks.

- 7.5 g/day → "One meal per month" consumption rate used at other sediment sites where remediation is expected to take decades before advisories can be relaxed, to provide risk information to the public and decision-makers.

These rates provide reasonable policy alternatives to deriving rates based on studies that are not relevant or appropriate for estimating long-term fish and crab consumption in the LPRSA, and can be

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used for the RME and CTE scenarios. In addition, the use of a FI value less than 1 should be considered given the close proximity of the LPRSA to several other more desirable fishable water bodies, including the Passaic River above Dundee Dam, Hackensack River, Newark Bay, and nearby freshwater ponds. For the RME fisher and crabber, a FI value of at most 0.5 is recommended. A FI value of 0.5 assumes that half of the fish and crab consumed comes from outside of the LPRSA. This is highly conservative for crab, given the minimal crabbing that has been observed at the LPRSA. Use of a FI value less than 1 is also supported by precedent at several other large sediment sites based on the close proximity of other desirable fishing locations.

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Attachment B

Critique of USEPA Region 2's July 25, 2011 Technical Memorandum, Fish and Crab Consumption Rates for the LPRSA Human Health Risk Assessment

USEPA Region 2's *Technical Memorandum, Fish and Crab Consumption Rates for the LPRSA Human Health Risk Assessment* (*Tech Memo*), dated July 25, 2011, presents the basis for new fish and crab consumption rates that CPG has been directed to use in the baseline human health risk assessment (HHRA) for the LPRSA. The new consumption rates supercede Region 2's prior direction in their September 10, 2010 comments to use the USEPA default of 26 g/day and 8 g/day (RME and CTE, respectively) for fish consumption by adult recreational anglers, and 23 g/day and 16 g/day (RME and CTE, respectively) for crab consumption by adult recreational crabbers. Region 2's new fish and crab consumption rates are summarized below for the adult, older child, and young child age groups.

Receptor	Age Group	Fish Consumption Rate (grams/day)		Crab Consumption Rate (grams/day)	
		RME	CTE	RME	CTE
Recreational Angler	Adult	44	13	32	16
	Older Child	29	9	21	11
	Young Child	15	4	11	5

Region 2's *Tech Memo* presents a discussion of a variety of sources of fish/crab consumption rates, including angler surveys, household surveys, and guidance documents. It purports to follow a weight-of-evidence approach for evaluating each source to determine its relevance and appropriateness for estimating consumption for the reasonable maximum exposure (RME). The *Tech Memo* also presents the Region 2's rationale for using a Fraction Ingested (FI) value of 1 for both the fish and crab consumption scenarios.

Region 2's *Tech Memo* contains incorrect statements that reflect a lack of understanding or consideration of the impact that differences in survey methodology and target population have when estimating long-term consumption rates. USEPA guidance is also frequently cited as support for positions by taking guidance statements out of context or inappropriately applying them. CPG's technical review, as presented in this document, summarizes the major issues with Region 2's *Tech Memo* and the calculated fish and crab consumption rates presented. Detailed comments on Region 2's*Tech Memo*, including correction of inaccurate statements and identification of unsupported statements, are provided in Table 1.

<u>Weight-of-Evidence Approach</u>

In its July 25 *Tech Memo*, Region 2 has compiled a number of studies and considered them for their relevance and appropriateness as the basis for consumption estimates for the LPRSA. The *Tech Memo*

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states that the "analysis provides a weight-of-evidence approach for evaluating consumption for the reasonably maximum exposure (RME)." A true weight-of-evidence approach is a deliberate process by which individual lines of scientific evidence, some positive and some negative, are used in combination to make judgments about a particular conclusion or the selection of a particular assumption. The judgments made by Region 2 regarding the appropriate fish and crab consumption rates for use in the LPRSA HHRA are based on a weak and limited set of lines of scientific evidence. Furthermore, Region 2 did not directly evaluate the logic behind the study designs for the studies and surveys on which it relies or their relevance for predicting long-term fish/crab consumption rates for the LPRSA HHRA.

Of particular importance, Region 2 has not discussed the quality of the data generated by the studies cited or their applicability to the LPRSA and the purpose at hand (i.e., to identify appropriate fish and crab ingestion rates). This is an important issue because study results can be substantially impacted by the ways in which the studies are conducted and the purposes for which they are designed. Thus, while some of the studies discussed by Region 2 may have been well designed for the purposes for which they were intended, this does not necessarily mean that they were properly designed for the purpose of estimating long-term consumption rates for individuals who fish or crab from the LPRSA. USEPA's Exposure Factors Handbook (EFH) (USEPA 1997) clearly states that "the type of survey used, its design and any weighting factors used in estimating consumption should be considered when interpreting survey data for exposure assessment purposes" [p. 10-1].

During the USEPA-CPG December 16, 2010 meeting, the CPG asked USEPA Region 2 to develop and use a consistent and objective set of balanced review criteria to critically evaluate studies under consideration as a basis for the development of fish and crab consumption rates for the LPRSA HHRA. Suggestions for evaluation criteria included:

- Peer review;
- USEPA approval of work plan prior to study;
- Suitability of study design for development of long-term fish/crab consumption rates;
- Duration of survey;
- Number of observations/intercepts;
- Target population;
- Reproducibility of data, etc.

Although Region 2 agreed to use an objective set of review criteria in response to the CPG's "Term Sheet" (dated February 10, 2011), Region 2's review was instead limited, and did not address the validity or pertinence of each study for use in developing long-term consumption rates for the LPRSA HHRA. Factors considered in Region 2's review instead only included the geographic location, the number of anglers reporting fish consumption, consistency with consumption rates derived from other surveys, and consistency with rates used by Region 2 at sites with Records of Decision (ROD) since 1991. These do not provide a complete and objective set of criteria by which to judge the viability of a particular source for its relevance or appropriateness to the task at hand. USEPA's EFH provides General Assessment

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Factors that the Agency used in evaluating studies for their suitability for developing recommended exposure parameter values that may be used in HHRAs when site-specific data are not available. These factors include the adequacy of study approach, bias, representativeness, currency, data collection period, accessibility, reproducibility, quality assurance, variability in population, uncertainty, and peer review (USEPA 1997, 2009). It is unclear why Region 2 has not referred to Agency guidance to establish a framework and set of assessment criteria. Had Region 2 conducted its analysis using a rigorous set of review criteria, it would have been readily apparent that a number of the studies discussed in the *Tech Memo* are not acceptable for the intended purpose of deriving long-term consumption rates.

Despite the numerous studies cited by Region 2 in the *Tech Memo*, Region 2 settled on two studies by Burger (2002) and Connelly et al. (1992), stating that they were the only studies that contained enough information to calculate statistical distributions for the ingestion rates that also included data from the New York/New Jersey Harbor Estuary. While the CPG recognizes that use of surrogate studies to derive consumption rates can be a valid approach, the CPG takes issue with Region 2's decision for the LPRSA, as well as its choice of studies for several reasons, including:

- Aside from the unsupported assumptions of Burger (2002), the survey data collection and analysis methods cannot be vetted or re-analyzed because they are no longer available, and the limited data provided in Burger (2002) are not sufficient for deriving reliable and accurate statistical distributions that can be used to estimate long-term fish consumption;
- The 1991 statewide angler survey of Connelly et al. (1992) was a mail survey of licensed anglers that represents a very different demographic than LPRSA anglers, as well as different water bodies, and suffers from design issues that limit its usefulness for developing long-term consumption rates;
- Had Region 2 implemented a more objective and technically defensible set of selection criteria, the need for regional fish/crab consumption data based on the Region 2's selected studies would have been less critical, and the limitations of these two studies would have been apparent;
- Data from the year-long LPRSA-specific study reported in Ray et al. (2007) are the most pertinent regardless of the number of consumers identified, and are fully adequate and appropriate for calculation of statistical distributions.

These issues and others that contribute to CPG's dispute with Region 2's new fish and crab consumption rates are discussed in further detail in the following sections of this document.

Summary of the Peer Review Process

Region 2's *Tech Memo* includes a discussion of the "survey methodology review process" applied to the studies and sources cited. The *Tech Memo* notes that funding and methodological review procedures for the cited surveys vary, but that all were published in the peer-reviewed literature or by USEPA following an external review process. This is not entirely accurate, as the New Jersey Household Fish

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Consumption Study (1993) and Connelly et al. (1992) were not published in peer-reviewed journals or reviewed by USEPA. Region 2 states its support for the use of the Burger (2002) study, as well as other studies conducted by Rutgers University, and the study by Connelly and colleagues at Cornell University (Connelly et al. 1992) because they are subject to procedures for detailed reviews before grants are submitted for funding. Region 2 states that once submitted, grants are further evaluated by the funding Agencies listed in the published reports and that each organization has review procedures that they utilize prior to awarding grants. These procedures include evaluation of budgets and timelines, scientific merit, and whether the grant rules, regulations and guidance are met.

While grants for the two studies underwent a review before being funded, Region 2's position that review by the funding agencies validates them for use as the basis for long-term fish/crab consumption rates for LPRSA ignores the fact that neither study was specifically designed to characterize long-term, sport-caught fish consumption rates. Moreover, as previously noted, the results and subsequent analysis of both studies were not reviewed in an independent peer-review process. Region 2 fails to recognize that all surveys are not conducted for the same purpose. For example, Burger (2002) was not specifically designed to characterize long-term, sport-caught fish consumption rates by anglers who use the Newark Bay Complex. Its stated purpose was to examine "fishing behavior, consumption patterns, and the reasons that people fish in the Newark Bay Complex." The study's primary aim was to evaluate "differences among Asians, Blacks, Hispanics and Whites in their consumption patterns for fish and crabs and in the reasons that they fish or crab." Thus, while the Burger (2002) study may have been very well designed for its stated purpose, and thus passed all of the review criteria applied to it for that purpose, this does not mean that it would pass the criteria necessary for characterizing long-term, sport-caught fish or crab consumption rates for anglers who use the Newark Bay Complex, much less the LPRSA. In fact, based on the limited sampling frame, methodology used, and lack of sample weighting (all discussed in more detail below), it is very unlikely that it would have passed the review criteria for such a study.

The *Tech Memo* acknowledges that the survey methodology for Tierra's 2000-01 CAS underwent peer review, and that the articles describing results (Kinnell et al., 2007; Ray et al., 2007a,b) were published in peer-reviewed journals. Despite this acknowledgement, Region 2 then dismisses the study stating that the work plan was not approved by Region 2, which is also true of both Burger (2002) and Connelly et al. (1992),and notes issues with the use of the data for the LPRSA baseline risk assessment (Mugdan 2010; Buchanan et al. 2010). CPG takes issue with this position given that neither of Region 2's preferred non-site-specific studies followed USEPA-approved work plans, and in the case of Connelly et al. (1992), results were not subjected to external peer-review. Thus, it is apparent that Region 2's weight-of-evidence approach for objectively identifying appropriate studies for use in developing LPRSA consumption rates was neither objective nor consistent.

Issues with Selected Studies

The fish consumption rates presented in the *Tech Memo* are based on the average of rates calculated by Region 2 based on information provided in Burger, 2002 and Connelly et al., 1992. The RME fish

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consumption rate is the average of high-end values calculated by Region 2 from a 1999 on-site intercept survey of the Newark Bay Complex (Burger, 2002), and a 1991 statewide mail survey of licensed New York state anglers (Connelly et al, 1992). The CTE fish consumption rate is the average of the mean and median values from these two studies, respectively. The new RME crab consumption rate is a 90th percentile value calculated by Region 2 using limited summary information presented in the publication of the results of the Burger (2002) survey of the Newark Bay Complex. The CTE rate is the calculated mean from this study. For both fish and crab, rates for adolescent and young child age groups were assumed by Region 2 to be two thirds and one third the adult rates, respectively.

The two studies chosen by Region 2 to derive fish and crab consumption rates have numerous problems that limit their usefulness as the bases for consumption rates in the LPRSA HHRA. In fact, the Connelly et al. (1992) was discussed but **not considered a key study** in the analyses of sport-caught freshwater fish consumption conducted for either the USEPA's 1997 EFH or the 2009 proposed revision to that document. In discussing the approach used by Connelly et al. (1992), USEPA (1997, 2009) stated that "a limitation of this study with respect to estimating fish intake rates is that only the number of sport-caught meals was ascertained, not the weight of fish consumed. The focus of the study was not on consumption but on the knowledge of and impact of fish health advisories." USEPA (1997, 2009) reported that if one uses an assumed meal size of 150 g (based on Pao et al. 1982), the mean intake rate would be 4.5 g/day. USEPA (1997) did not attempt, however, to estimate an upper bound estimate of consumption for that study. The Burger (2002) study was not discussed at all in the detailed analysis of fish consumption studies in USEPA's 2009 revised EFH (it was not available at the time the 1997 EFH was published). Clearly USEPA did not regard it as a relevant study for estimating consumption by recreational anglers.

Burger (2002) is an angler survey of Newark Bay conducted in 1999 by Professor Joanna Burger of Rutgers University. It primarily focused on sociological aspects of fishing, but secondarily collected some consumption data during one interview with each angler. The Burger (2002) publication, however, provides only a general overview of the methodology, very limited information about the way in which the data were evaluated, and only a summary of the study results that presents means and standard errors for selected parameters as calculated for the entire population that was studied. The CPG requested Dr. Burger's data, work plan, and summary report last summer, but was informed that she no longer possesses the data (Burger 2010). Region 2 has confirmed that it was unable to obtain the data, but that limitation has not prevented Region 2 from using the paper, which only summarized the general survey results, to derive specific mean and upper-bound fish and crab consumption rates for use in the LPRSA HHRA.

Furthermore, Region 2 has modified the summarized results of the Burger (2002) survey by estimating the number of "non-consumers" and only including individuals who consumed in developing its new consumption rates. It is not clear whether the omitted anglers were truly non-consumers or how they were identified. Without the completed questionnaires, it is not possible to determine whether these individuals reported that they never ate fish from the area surveyed, or whether they were asked about frequency of meals during a specific time period and were categorized as non-consumers if they had not

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eaten any meals during that time. If it was the latter, then the individuals categorized as non-consumers from the Burger (2002) survey may not have been true non-consumers because they may sometimes have eaten fish from Newark Bay. If this was the case, then these anglers should not have been eliminated as they would comprise an important segment of the target population. Without more details about survey methodology and raw data, however, it cannot be determined whether these individuals truly were non-consumers or whether they were less frequent anglers who were misclassified as non-consumers.

Region 2 used a similar approach in their evaluation of Connelly et al. (1992), which was used as part of the Upper Hudson River human health risk assessment (HHRA) conducted by TAMS/Gradient (2000). Connelly et al. (1992) was a mail survey of licensed New York state anglers that was conducted by Nancy Connelly and colleagues from Cornell University. This study focused on angling and consumption behavior as it related to fish consumption advisories. Using the study results, Region 2 estimated consumption rates using a "standard" assumed meal size rather than actual harvest data. There were other issues (including recall bias) associated with the Connelly et al. (1992) data, which are discussed in more detail below. In addition, there is no support for Region 2's statement that the survey results are representative of the behaviors of New York-New Jersey Harbor anglers. In fact this is unlikely to be true because most of the freshwater fisheries in New York State are significantly different from the fishery in the New York-New Jersey Harbor area.

The Connelly et al. (1992) survey instrument instructed the respondents to place a "?" in the consumption matrix if they had consumed fish but could not recall the number of fish consumed. As discussed below, there were many cases where respondents placed a "?" and in some cases, respondents provided "?" for every entry in the matrix. TAMS/Gradient (2000) eliminated all cases for which a "?" was recorded; thus, those individuals who only provided a "?" for each meal were considered non-consumers and removed from the analysis despite the fact that they were consumers who simply could not remember the number of fish that they had consumed.

Despite the limitations reported in the EFH (1997 and 2009)for the Connelly et al. (1992) study and the lack of any consideration of the Burger (2002) study in developing its guidance, Region 2 has selected these two studies as the basis for its selected rates. Region 2 has not acknowledged or addressed the limitations associated with those studies that make them unsuitable as the basis for the fish consumption rates for the LPRSA. These studies and their limitations are discussed in more detail below.

Issues with Burger (2002) Study

Region 2 has used the information provided in the peer-reviewed publication by Burger (2002) as a partial basis for the recommended fish consumption rates. As previously noted, the publication has very little detail on the study methodology or the way in which the data analysis was completed. It does state that individual consumption rates were calculated for each individual based on their responses to questions about frequency of eating self-caught fish, meal size and the number of months fished.

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However, this per-individual detail is not provided in the published report. The only information provided by Burger (2002) on which fish and/or crab consumption rates can be estimated is the following:

- The overall mean number of times per month that the surveyed population reported eating self-caught crabs/fish;
- The overall estimated average of the serving sizes reported by all anglers; and
- The mean number of months per year that the surveyed population reported fishing and/or crabbing

It is not clear from the information published in the paper, however, whether the above data were specific to the location at which anglers were interviewed, the entire Newark Bay Complex, or to all areas fished by those individuals. Although these data may be representative of the general behavior of Newark Bay Complex anglers, the possibility that the survey also included information on the consumption of fish from locations outside of the Newark Bay Complex cannot be definitively ruled out.

Despite these uncertainties, which Region 2 fails to acknowledge, the above information (as provided in Table 2 of Burger 2002) was used in combination with a bar graph provided in Figure 2 of that publication to estimate consumption rates. Figure 2 presents the percentage of surveyed individuals who consumed fish and crabs at 6 different rate ranges (0, 100-400, 401-800, 801-1400, 1401-4200, 4200-40,000 g/month). Based on the information provided in Figure 2, USEPA eliminated roughly 40 percent of survey participants who were reported to be non-consumers of fish (consumed 0 g/day) and estimated that roughly 11 percent of the consumers consumed fish at a rate of 4,200 g/month or more. Region 2 then combined this rate with the average number of months fished (4.92 months per year reported in Table 2 for all participants) and divided the quotient by 365 days/year to derive an estimated upper bound annualized average daily fish consumption rate of 56.6 g/day.

A similar approach was used to estimate the RME crab consumption rate. After excluding non-consumers of crab (roughly 35 percent of survey participants based on Figure 2), Region 2 estimated that 6.3% of consumers consumed crab at a rate of 4,200 g/month or more, and 23% of consumers consumed crab at a rate of 1400 g/month. While not explained in the *Tech Memo*, Region 2 then interpolated between these two percentiles to estimate a 90th percentile consumption rate of 3590 g/month. Combining this monthly rate with the average number of months crabbed (3.3 months per year reported in Table 2 for all participants) and dividing the quotient by 365 days/year resulted in an estimated upper bound annualized daily crab consumption rate of 32 g/day.

There are numerous problems with this approach. The information provided in the publication is inadequate to estimate an upper bound consumption rate for the following reasons:

- While the original data analysis may have included per-individual estimates of consumption, only mean values or ranges are provided in the Burger (2002) publication.

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- There is not enough information provided in the Burger (2002) publication to substantiate the way in which the data were collected and analyzed. The questionnaire is not provided, and there is not enough detail reported to determine how questions were asked or how responses were recorded. Thus, there is no way to evaluate whether any unintentional bias was introduced into the survey design that may have affected responses.

- Individuals were asked to estimate their fish serving sizes based on a comparison with an 8-ounce portion size model. The publication does not describe, however, the way in which portion size estimates were made when reported meal sizes differed from the 8-ounce model.

- No information was collected on parts consumed, preparation or cooking practices, or sharing of the catch. For crab, an assumption was made that the edible mass of crab is 70 grams based on NJDEP data (not specified). Based on CPG's 2009 tissue sampling program, the average weight of edible tissue in LPRSA crabs is 45 grams, which is consistent with data reported by NJDEP on blue crab (average of 44 grams) (Horwitz et al., 2006). The unsupported assumption of Burger (2002), which is not acknowledged by Region 2, introduces considerable uncertainty and likely results in significantly overestimated consumption rates.

- It assumes, incorrectly, that the average number months of fishing is representative of only those who consumed fish and is synonymous with the number of months in which meals are consumed. Neither assumption can be substantiated using the information provided in the Burger (2002) publication. The average number of months fished is based on the total population surveyed, not just consumers, and fishing frequency is not necessarily correlated with consumption rate as many "catch and release" fishermen, who would be considered non-consumers, fish with high frequencies. Thus, Region 2 has made assumptions about the higher consumers that may or may not be appropriate. Because the study results are not available for inspection, it is not possible to verify the correct value for 1) the number of months that consuming anglers fished the Newark Bay Complex or 2) the number of months during which individuals actually consumed fish.

- The discussion of methodology does not explain how data on the frequency of meals per month were collected (i.e., whether individuals were asked to estimate their average consumption rate over all months in which self-caught fish or crabs are eaten or whether they were asked to report this activity during the month during which they were interviewed). It is likely that the frequency of fish meals varies from month to month and it is not clear how variable information (if it was in fact collected) was handled. It was also not apparent how the authors derived consumption estimates if the participants did not report eating fish at a consistent rate during all months.

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- The survey was conducted from May 15 to September 15 and did not capture the activities of individuals that may fish or crab from the area during the remaining eight months of the year. Because the behaviors of those individuals may differ from the behaviors of summer fishers/crabbers, these results cannot be considered representative of the total angler population that uses the area.

- Angler behaviors and consumption habits were gleaned from a single encounter with each participant during the warm weather period. While it is clear that participants were asked how many months of the year they fish, it is not clear whether they were asked to provide detailed information about their consumption patterns throughout the year. If they were only asked about the month during which they were interviewed, it is likely that the results are not representative of their year-long fishing and consumption habits. Individuals tend to report their activities based on their most recent behaviors and often, if they are re-interviewed, reported behaviors often differ. Further, recall survey methods tend to bias consumption rates high, especially for more avid anglers and with longer recall periods (USEPA 1998; Connelly and Brown 1995, Fisher et al. 1991).

- The Burger (2002) study does not appear to have included any sample weighting and it is clear that Region 2 has not considered weighting in estimating its upper-bound estimate. While only a single interview was conducted with each individual encountered, no adjustment was made, in either the original analysis or in Region 2's interpretation of those data, to correct for sampling weight. When conducting an intercept/creel survey, it is critical to consider the representativeness of the data collected. The Burger (2002) publication states that "[a]lthough the results of the study clearly represent those interviewed, there is no reason to assume that this does not represent the fishing public using this area because we interviewed nearly everyone present and sampled at all times of day, on both weekends and weekdays." However, it cannot be concluded that the results are representative of the entire population that fishes this area, due to the absence of sample weighting.

- Sampling weight is an important component of creel surveys. As discussed in USEPA's 1997 EFH, "in a creel survey, the target population is anyone who fishes at the locations being studied; generally in a creel study, the probability of being sampled is not the same for all members of the target population. For instance, if the survey is conducted for one day at a site, then it will include all persons who fish daily but only about 1/7th of the people who fish there weekly, 1/30th of the people who fish at the location monthly, etc. Thus, the probability of being sampled is seen to be proportional to the frequency of fishing (USEPA 1997, p. 10.1). It goes on to state that "[i]n the published analyses of most creel studies, there is no mention of sampling weights; by default all weights are set to 1, implying equal probability of sampling. However, since the sampling probabilities in a creel study, even with repeated interviewing at a site, are highly dependent on fishing frequency, the fish intake distributions reported for these surveys are not reflective of the corresponding target populations. Instead, those individuals with high

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fishing frequencies are given too big a weight and the distribution is skewed to the right, i.e., it overestimates the target population distribution." As stated in USEPA (1997 and 2009), "the type of survey used, its design, and any weighting factors used in estimating consumption should be considered when interpreting survey data for exposure assessment purposes" (p. 10-1). Because the survey results are no longer available, they cannot be used to weight the samples and develop more representative consumption estimates.

In summary, Region 2's analysis of the available information to estimate upper-bound rates of consumption using the published Burger (2002) study is inappropriate because it couples an estimated upper-bound average monthly consumption rate with an estimated average number of months spent fishing or crabbing per year. Region 2's analysis thereby assumes that all anglers who ate 4,200 g/month or more, repeated that behavior for the average number of months fished (calculated using data for the entire population). In doing so, Region 2 has made assumptions about behaviors without any scientific basis. Fishing and consumption behaviors tend to be highly variable. For example, some of the higher monthly consumption rates may have come from interviews with individuals who were visiting the area during a one-week summer vacation. If these individuals caught and ate a substantial amount of fish during that time, they might have reported a very high monthly consumption rate based on that activity. However, they may never have fished the area again. The assumption that they repeated that behavior monthly for five months would not have been appropriate or representative. Yet, these are exactly the types of assumptions that Region 2 has made in attempting to use the information provided in this publication to develop long-term, upper-bound fish consumption rates. The information contained in the publication should neither be used to estimate upper-bound rates of consumption, nor should they be assumed to be representative of the total angler population.

Issues with Connelly et al. (1992) Study

Region 2 has also based its fish consumption rate on the study conducted by Connelly et al. (1992) as it was interpreted and incorporated into the human health risk assessment (HHRA) for the Upper Hudson River, which was conducted by (TAMS/Gradient, 2000) on behalf of Region 2. Connelly et al. (1992) was a mail survey that collected information from a cross-section of licensed New York state anglers. The purposes of the study were to: 1) assess New York licensed angler awareness and knowledge about advisories, and fishing and fish-consuming behavior, and 2) identify changes since explanatory information in the advisory was expanded. A systematic sample of 2,000 licenses was selected for the license year beginning October 1, 1990 and ending September 30, 1991. The mail survey was implemented in January 1992, and up to three follow-up mailings were sent to non-respondents. A 52% response rate was achieved. A follow-up telephone survey was conducted with 100 non-respondents, which was used to adjust results for non-response bias.

Due to the methodology used, it was not necessary to develop sample weights (other than for non-response bias as discussed below) as is necessary when one is conducting a creel/intercept survey. In addition, the raw data are still available and it was possible for Region 2 to develop more relevant consumption estimates based on data collected for rivers. However, there are still a number of reasons

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(related to survey design) why the data were not the most reliable source for estimating consumption from the Upper Hudson River, and additional reasons why this survey should not provide the basis for the fish ingestion rates used for the LPRSA.

The Connelly et al. (1992) study was not designed to estimate long-term rates of sport-caught fish consumption. While the study did collect some information on fish consumption habits of the surveyed anglers, it was not designed to provide a reliable basis for estimating their long-term fish consumption rates. To make such estimates, numerous assumptions about the anglers' behaviors, for which there is no strong basis, must be made, resulting in substantial uncertainties in the rates derived. In addition, the biases associated with the data (people who don't respond are likely to be non- or low-level fish consumers) and Region 2's analysis of them indicates that consumption estimates are overstated.

Despite these problems, Region 2 (TAMS/Gradient 2000) used the data from this study to derive long-term consumption rates for use in the Upper Hudson River HHRA. Limitations of the survey for this purpose are further discussed below:

- The survey response rate reported by Connelly et al. (1992) was 52.3 percent, which is on the low-end of accepted standards for mail surveys. Brown et al. (1989) reported a range of response rates from 41.7 percent to 89.8 percent for 38 recreational surveys conducted by their research unit at Cornell University, with a mean response rate overall of 71.8 percent. A lower response rate is likely to bias fish consumption estimates toward higher level consumers, leading to an overestimate of fish consumption rates. This is because individuals who do not respond to surveys of this type are likely to consume considerably less fish than individuals who do respond (Connelly et al. 1992; West et al., 1989a,b).

- While Region 2 attempted to correct for this non-response bias by incorporating the data from the follow-up interviews with non-respondents, this adjustment was not made correctly. According to the HHRA (TAMS 2000), there were 919 non-respondents to the survey, of which 100 individuals were surveyed by telephone. Of these 100 individuals, 55 (55 percent) reported that they consumed at least one fish meal during the survey period. In attempting to correct for recall bias, Region 2 simply added the 55 consumers from the follow-up survey to the 226 anglers who consumed fish from flowing waters and then recalculated the consumption rate distribution for the resulting 281 individuals. This approach does not give adequate weight to the remainder of non-respondents. If it is assumed that the subsample of the 919 non-respondents to the survey is representative of the entire non-respondent population, this means that 55 percent of all non-respondents, or 505 individuals, were consumers of fish. According to the data provided by respondents to the survey, 37.6 percent of the respondents who ate fish consumed fish from flowing water bodies. If this same fraction is applied to the 505 non-respondents who consumed fish, it can be estimated that 190 non-respondents consumed fish from flowing water bodies during the survey period. These individuals should have been included in the correction for non-response bias to provide a total sample of 416 anglers (226 respondents plus 190 non-respondents). Inclusion of these additional, non-

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responding consumers would have resulted in substantially lower estimates of fish consumption for the total angler population. (It should be noted that it was not possible to duplicate Region 2's recalculation of consumption rates for respondents and non-respondents combined because adequate data to do so were not provided in the HHRA.)

- The Connelly et al. (1992) survey overestimates consumption rates as a result of the long-term recall bias (Westat Inc., 1989; West et al., 1989; Connelly et al., 1995).

- Connelly et al. (1992) did not request that the respondents record information about the sizes of the fish meals they reported. Given the lack of meal size data, Region 2 was forced to make assumptions about meal sizes, thereby adding considerable uncertainty to the fish ingestion estimates. For the Hudson River HHRA, Region 2 assumed that all meals were 0.5 pound in size (227 g). This assumption is unfounded. Meal sizes vary considerably among anglers and are often dependent upon the species of fish consumed. For example, the Connelly et al. (1996) diary study of New York anglers demonstrated that meal sizes varied considerably by species (unpublished analysis of raw data; GE 2000). While 65 percent of rock bass meals consumed by those anglers were ½ pound in size, 60 percent of calico bass meals were less than 0.5 pound (assumed by Connelly et al. 1996 to be 5 ounce portions). Over all sport-caught fish meal sizes reported in the Connelly et al. (1996) diary study, only 55 percent of them were 0.5 pound in size. Thus, by assuming a single portion size of 8 ounces, Region 2 may have substantially over- or underestimated intakes by individual anglers and did not consider the variability associated with this parameter.

- As previously mentioned, the instructions for completing the fish consumption matrix of the Connelly et al. (1992) survey instructed anglers to place a "?" in the appropriate box if they knew that they had eaten some fish but could not remember how many. A total of 179 of the individuals who completed the matrix marked a "?" for at least one recorded fish meal, and some individuals reported a "?" for all fish meals consumed. Because it was not possible to reliably assign a fish consumption rate to the "?" responses, Region 2 eliminated all cases where a "?" was marked. Thus, Region 2's approach eliminated individuals who were known to eat fish and thus added considerable uncertainty to consumption rates estimated.

- Region 2's analysis of the data attempted to segregate consumption by water body type and derive fish consumption rates for the Upper Hudson River based on reported consumption from all flowing waters in New York (TAMS/Gradient 2000). Unfortunately, out of 17,788 meals reported by the anglers that completed the consumption matrix, 5,816 (33 percent of total meals) had no source water body identified (GE 2000); thus those meals could not be apportioned by water body type. Region 2 attempted to offset this limitation by making assumptions about the relative rates of ingestion from standing vs. flowing water bodies but its inability to validate these assumptions contributed substantial uncertainty to the resulting fish ingestion rates.

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- The goal of the fish consumption portion of the Connelly et al. (1992) survey was to determine whether anglers were eating types, sizes, or amounts of fish that were specifically limited by applicable advisories. The species list in the survey was focused on those freshwater species and sizes that were listed in the statewide advisory. Thus, some species and sizes relevant to the Upper Hudson River were not included in the survey, and conversely, some species and sizes that were not relevant were included. For example, there was no provision for many of the pan fish species that are commonly caught and consumed by recreational anglers. The only way in which these other types of fish could be captured in the survey was through inclusion of an "Other" category. The omission of commonly consumed species and sizes other than the species and sizes listed may have impacted the ability of anglers to recall their meals of those other fish. Thus, this aspect of the survey contributed additional uncertainty to Region 2's fish ingestion estimates for the Upper Hudson River. Region 2's recommendation that the rate developed for the Upper Hudson River HHRA be used to estimate consumption from the LPRSA is even more problematic, because the LPRSA has different species and sizes of fish than are found in the Upper Hudson. Because the species targeted by anglers will differ in portions of the LPRSA, as will their sizes, this variability contributes an additional level of uncertainty to the consumption estimates derived for the Upper Hudson River when used as surrogate rates for the LPRSA.

- The fish consumption rates calculated by USEPA Region 2 (TAMS/Gradient 2000) from Connelly et al. (1992) for the Upper Hudson River are not supported by the fish consumption rates calculated by USEPA's (1997) Exposure Factors Handbook based on data collected from another statewide study of New York anglers conducted by Connelly et al. (1996), as shown below.

Consumption Rate Percentile	Connelly et al. 1992 New York Multiple Rivers[a]	Connelly et al. 1996 New York All Waters[b]
50th	4.0	2.2
90th	31.9	13.2
95th	63.4	17.9
Arith. Mean	17.3	4.9

a. TAMS/Gradient (2000) analysis (Upper Hudson HHRA)
b. USEPA (1997) analysis (Exposure Factors Handbook)

This later study by Connelly et al. (1996), which was specifically designed to collect long-term fish consumption data and avoid the limitations associated with the 1992 study, was selected by USEPA as one of four "Key" studies of freshwater fish consumption in the 1997 EFH.

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The Connelly et al. (1996) diary data do not permit fish meals to be segregated by water body type because individual meals were not attributed to a water body. Thus, consumption rates derived from the Connelly et al. (1996) data include total sport-caught consumption from all types of water bodies combined, including both standing and flowing waters. As such, it is very likely that they substantially overestimate consumption from a single river, especially since they include consumption from Great Lakes fisheries. Even so, the rates developed based on the Connelly et al. (1996) data are substantially lower than the rates that Region 2 is proposing based on the substantially less reliable Connelly et al. (1992) dataset.

Region 2 briefly discussed the Connelly et al. (1996) data but apparently did not select this study as a basis for estimating consumption rates for the LPRSA. No rationale was given as to why it was only discussed in the context of the recommendations from the 1997 EFH. In addition, the *Tech Memo* includes several statements implying that Connelly et al. (1996) is a study that only pertains to fish consumption from Lake Ontario, although this is incorrect. Connelly et al. (1996) was a survey that targeted anglers statewide who were known to fish Lake Ontario, but it also collected information about their consumption from all water bodies in the state of New York, including New York Harbor. The study was specifically designed to be a consumption study that targeted the long-term fish consumption rates of New York anglers. It used a diary approach to collect long term fish consumption data, minimize potential recall bias, differentiate between sport-caught and other fish, and identify portion sizes and preparation methods by meal and by species. While the survey focused on anglers who were known to fish Lake Ontario, the data collected were not limited to Lake Ontario, and specific information was collected about consumption, including many rivers and streams throughout the state. Thus, this survey provides valuable information about the consumption habits and preferences of New York anglers. In addition, Connelly et al. (1996) did not include a prescribed species list but instead asked respondents to list the species of each sport-caught meal consumed.

Region 2's analysis of the Connelly et al. (1992) data (TAMS/Gradient 2000) was also inconsistent with the limited findings on fish consumption reported by the authors of that study. In their report, Connelly et al. (1992) stated that the average number of meals consumed by responding anglers was 11 meals per year. If the meal size employed by Region 2, 0.5 pounds or 227 g, is applied to this consumption rate, the result is a mean estimated consumption rate of 6.8 g/day instead of the 17.3 g/day calculated by USEPA. This rate reported by TAMS/Gradient is more than 2.5 times higher than the rate reported by the authors of the original study.

Last, Region 2 has not addressed whether the demographics and target population covered by Connelly et al. (1992) are representative of the LPRSA. As stated in the Hudson River risk assessment (TAMS/Gradient, 2000), the demographics of the 1991 New York statewide angler survey reasonably match the demographics of the Upper Hudson angler population. However, the distribution of respondents by race in the New York statewide angler survey does not match the LPRSA well. Approximately 95% of respondents in the New York statewide angler survey were Caucasian, about 3% African-American, and 2% other. In the LPRSA, approximately 51% of the surveyed population is Caucasian, about 16% is African-American, and about 32% is of Hispanic descent (Ray et al. 2007b). The

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impact of this disparity, as well as differences among other demographic factors, on calculated consumption rates, is not addressed in the *Tech Memo*. This limitation of Region 2's analysis introduces significant uncertainty into the results.

Comparability of Data Sets Cited

The RME fish consumption rate of 44 g/day is higher than the consumption rates used in any of the other Region 2 HHRAs presented in Table 2 of the *Tech Memo*, except those for subsistence fishing populations, which Region 2 acknowledges is not relevant at the LPRSA. While Region 2 cites numerous studies as supporting the RME fish consumption rate, correction of the numerous inappropriate assumptions made in deriving the consumer only fish ingestion rates from these studies demonstrates that the majority of the studies cited do not support a fish consumption rate of 44 g/day. The results of various fish consumption studies presented in Figure 2 have been not critically evaluated, including discussion of differences among the study methodologies and targeted populations. Consequently, the impacts that these differences in approaches have on the estimated long-term consumption rates is not addressed in the *Tech Memo*. This is a major limitation of Region 2's approach and results. For example, while some of the studies are short-term creel /intercept surveys of recreational anglers (Burger 2002; May and Burger 1996; Burger et al. 1998), some are long-term intercept surveys (Ray et al. 2007), and others are long-term mail or diary surveys (Ebert et al. 1992; Connelly et al. 1992; Connelly et al. 1996). Still others are long-term surveys that were designed with short-term recall periods (West et al. 1989; 1993) or general population studies (CPIP and NJMSC 1993; 1991 Superfund Default) that are not specific to recreational fishing. In addition, some of the values presented (USEPA 1997, USEPA 2000) are not studies in and of themselves but are, instead, averages of multiple studies, most of which are already reported in Figure 2. Region 2's mixing of a variety of sources of data without clearly identifying their differences results in a confusing presentation, and confounds the ability to draw sound conclusions from the analysis.

The reporting of these data without qualifying them is misleading. As shown in the Figure 2, short-term intercept surveys or longer term surveys with short recall periods (Burger 2002; May and Burger 1996, Burger et al 1998; West et al. 1989 and 1993) result in higher estimates of consumption than do longer term surveys (Ray et al. 2007; Connelly et al. 1992; Ebert et al. 1993; Connelly et al. 1996). USEPA's guidance recognizes that extrapolation of short-term data to develop long-term estimates results in unreliable estimates of the upper bounds of the fish consumption distribution (USEPA 1997, 2009). The higher rates for the short-term studies are not likely to be a reflection of different behaviors within the surveyed populations but are, instead, a reflection of the survey methodologies used (USEPA 1997; Ebert et al. 1994). In addition, Region 2 has combined information about the arithmetic mean and standard errors associated with individual parameters in an effort to estimate upper-bound consumption estimates but the assumptions that are necessary to complete this calculation are not supported by the information that is provided in the source documents. All of this has contributed to highly uncertain overestimated rates of consumption for LPRSA anglers.

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Region 2 has included fish ingestion rates from general population surveys [CPIP and NJMSC 1993; Pao et al. 1982 (the latter is the basis for the 1991 Superfund Default value reported)] in their analysis. These types of surveys are generally not relevant to estimating consumption of sport-caught fish. While the CPIP and NJMSC (1993) did collect limited information on consumption of self-caught fish if the individuals surveyed reported that they consumed it, these individuals were not specifically targeted for the survey. As a result, only five percent of all of the fish meals consumed were sport-caught fish, and separate estimates of sport-caught fish consumption were not provided. Therefore, the consumption rates provided in the general population surveys and presented in Figure 2 of the *Tech Memo* are not specific to anglers who consume their own catch and they should not be compared to self-caught fish consumption rates.

Region 2 has also asserted that the available data appear to indicate that rates of consumption in New Jersey are higher than they are in other northeastern states or in the rest of the country. While the analysis presented in the *Tech Memo* would appear to support this statement, the higher rates of consumption in the New Jersey area are an artifact of the survey methodologies used to collect the data and the assumptions used to develop them. When one looks at studies that have been specifically designed to collect information about long-term fish consumption rates, and compares mean values across all studies, it is clear that the New Jersey studies (Burger 2002, Burger et al 1998, May and Burger 1996) are inconsistent with the other studies.

In addition, the Connelly et al. study (1992) used in Region 2's analysis and the Connelly et al. (1996) study selected by USEPA as a Key Study in the 1997 EFH, were both studies that evaluated consumption by anglers who fished New York's freshwaters. The Connelly et al. (1996) consumption rates, which is the more reliable of the two studies (for the reasons discussed above), are very consistent with the rates that have been reported for other relevant studies that are presented in Figure 2 and with the upper bound estimate of 17.5 g/day that is recommended by USEPA (2000) as the basis for establishing ambient water quality criteria that are protective of sport fishers.

Finally, Region 2 included a composite subsistence fish consumption rate in Figure 2 (source cited as USEPA, 2000), despite its acknowledgement that there is no evidence of subsistence fishing in the LPRSA. Since this rate is not relevant, it should be removed from the figure as it is not comparable to the other studies that are presented there and is not representative of consumption by the target population for the LPRSA.

Issues with Other Burger Surveys Cited

Region 2 uses the Burger et al. (1998) study of Barnegat Bay as support for its consumption rate of 56.6 g/day. Unfortunately, this study is subject to many of the same limitations as the Burger (2002) study, largely due to the fact that it was never designed to collect long-term estimates of self-caught fish consumption. It collected data during a three-month period in the summer, but did not collect any information during the remaining nine months of the year and did not incorporate sample weighting. It cannot be considered geographically or demographically comparable to the Newark Bay study in that

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these data were collected in a much more rural area that is subject to high levels of seasonal and tourist activity. In addition, while it reported a similar frequency of average fish meals per month (5.21 meals/month for men and 3.92 meals/month for women at Barnegat Bay compared to 4.06 meals/month reported for Newark Bay), this average meal frequency reported for the Barnegat Bay anglers represented total fish meal frequency (from all sources), and not the frequency of self-caught meals. According to Burger et al. (1998), men reported, on average that 49% of their meals were self-caught while women reported that an average of 25% of their meals were self caught. There was no information collected on the number of months during which fishing occurred. Region 2 calculated rates of approximately 50 g/day assuming that individuals fish and consume fish at these rates for 12 months/year. This is highly unlikely given the large number of tourists that were likely fishing. It should be noted that the fraction of tourists vs. residents and the rates for each were not reported. In addition, there is no reason to think that anglers in this more seasonal area would fish 12 months per year when the Burger (2002) study reported a value of 4.92 months per year as the average number of months fished during a year. If the Burger (2002) reported frequency of 4.92 meals/year was applied to the population surveyed at Barnegat Bay and combined with the number of sport-caught fish meals per month (on average 2.5 meals/month for men and 0.99 meals/month for women), then it would have resulted in annualized average consumption rate estimates of 9.7 g/day for men and 3.1 g/day for women. These data do not support the upper-bound estimated rate of 56.6 g/day that Region 2 has estimated based on Burger (2002) and do not even support the average rate of 22 g/day calculated by Region 2 based on Burger (2002).

Region 2 has also cited the May and Burger (1996) study as additional support for its estimated fish consumption rate. This study has limitations that are similar to those outlined for Burger (2002) and Burger et al. (1998). It was conducted from mid-May to the end of September along the Arthur Kill, and from July 15 to August 26 along Raritan Bay and the New Jersey shore. Thus, it only collected data for four months of the year on the Arthur Kill and slightly more than one month of the year for the other two areas. Most of the anglers interviewed on the Arthur Kill (85%) were local residents while the vast majority interviewed along Raritan Bay and the New Jersey shore were tourists (73% and 75%, respectively). Again, only overall average values were provided in the publication and there was no specific estimate of consumption of sport-caught fish. While 20% of the anglers reported that they only ate the fish that they caught, the number of fish meals for this segment of the survey participants was not provided in the publication. In addition, while 40% of the fishermen interviewed indicated that more than half the fish they ate were fish they caught themselves, no estimate of the number of sport-caught fish meals and no overall average was provided in the publication. The number of meals was reported on an average monthly basis but there was no estimate of the number of months fished. Seventy percent of the participants reported that they ate some of their catch.

If it is conservatively assumed that 50% of the fish meals consumed were sport-caught fish, then the average number of sport-caught fish meals eaten per month would range from 2.15 to 2.4 meals/month, depending on the area surveyed. Using this range combined with average meal sizes reported for each area (ranging from 10.3 to 11.5 ounces or 292 to 326 g), and the average number of months fished reported by Burger et al. (2002) (4.92 months/year), it can be estimated that anglers from

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the Arthur Kill, Raritan Bay, and the New Jersey Shore ate sport-caught fish at annualized average daily rates of 10.5, 9.1 and 8.7 g/day, respectively. Again, these do not support the estimates developed by Region 2 based on Burger (2002).

Comparison with Other Region 2 Sites

Region 2 has included, as additional justification for its selected rates of consumption, a comparison with rates that have been used at other Region 2 sites. Based on this comparison, Region 2 reports that its selected rate of 44 g/day is higher than the average across the relevant studies but is within the range of ingestion rates used in Region 2 decisions since 1991. There are two problems with these conclusions. First, since subsistence fishing is not a concern at the LPRSA, as acknowledged by Region 2 in the *Tech Memo* (p.12), it is misleading to include a comparison of the selected rates with those derived from studies pertaining to Native American populations. When those studies are removed from the figure, it can be seen that Region 2's statement is misleading and incorrect. The average of the two upper bound rates selected by Region 2 (44 g/day) is substantially higher than the rates used at other sites that do not include Native American populations. In addition, when considered separately, the rate derived from Burger (2002), 56.6 g/day, is even more inconsistent with the rates used at other sites. While the upper-bound rate derived from the Connelly et al. (1992) study is within the range of rates for other sites, this is largely because these same data and consumption estimates were used to derive values for five of the 12 relevant sites shown in Figure 3, but is higher than the rates used at other sites reported in the table.

The second problem is that not all sites are the same and not all water bodies have the same levels of fishing activity, fisheries, target populations, or consumption patterns. Region 2 appears to require uniformity in risk assessment for sites within the Region; however, such an approach is not appropriate or justified, particularly with regard to the fish/crab consumption exposure pathway. There is considerable USEPA guidance on fish consumption risk assessment (USEPA, 1989a,b; 1997; 1998; 2000a,b) and all stress the importance of considering site-specific factors when selecting appropriate consumption rates. This is also reflected in USEPA's decision to not present recommended default consumption rates for freshwater recreational anglers from the draft *EFH: 2009 Update* because of geographical diversity and site-specificity in recreational fishing patterns (USEPA, 2009).

Consistent with USEPA guidance, it is most important to consider site-specific characteristics when selecting a fish consumption rate rather than focusing on uniform ("one size fits all") approaches taken at other sites. The LPRSA is not directly comparable to any of the sites listed by Region 2 because it includes both freshwater and estuarine sections. As a result, while there is overlap, the species that are present there are not identical to either those in the larger Newark Bay Complex or in freshwater fisheries but are, instead, a combination of the two. In addition, the demographics differ from other sites. Given these differences, it is most important to attempt to capture, to the extent possible, the specific behaviors of the anglers who fish the LPRSA. Region 2's Tech Memo fails to adequately address this factor; rather it relies on rote uniformity that neglects consideration of site-specific characteristics.

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Consequently, Region 2's comparison of sites and corresponding rates to its new consumption rates is flawed.

Fraction Ingested

Region 2 has directed use of a FI value of 1 for both the RME and CTE fish and crab consumption scenarios. Region 2 cites as rationale for this assumption the adequate quantity and quality of the LPRSA fishery, the large population that lives and works in the vicinity of the site, and access to the river via parks, docks, parking lots, and residences abutting the river. Moreover, it relies heavily on redevelopment and restoration plans without regard to the probability that they will actually occur, stating that, "if implemented, will make the area more amenable to fishing and crabbing." Region 2 also states that use of a FI of 1 is consistent with recommendations in RAGS Part A guidance (USEPA 1989), as well as Region 2 practice at other contaminated sediment sites.

Region 2 has cited the following statement from USEPA (1989), "Residents near major commercial or recreational fisheries or shell fisheries are likely to ingest larger quantities of locally caught fish and shellfish than inland residents" [p. 6-43] as justification for assuming a FI value of 1. This quote does not support the tacit assumption that the assessment of fish/crab risk at sites located near major commercial or recreational fisheries should automatically assume a FI value of 1. Rather, it simply indicates that those living near such a fishery are more likely to ingest larger quantities of locally caught fish than inland residents, not that all their fish would be sport-caught fish from the single local source.

While not noted by Region 2 in the *Tech Memo*, USEPA (1989) also states that FI for fish and shellfish is a "pathway-specific value" and "should consider local usage patterns." [p. 6-43]. If a consumption rate that is not based on site-specific data is used to evaluate fish/crab risks specific to the LPRSA, then the use of a FI value less than 1 is warranted. A household survey of recreational anglers in the Five County area around the LPRSA (Essex, Hudson, Passaic, Bergen, and Union counties) found that these individuals fish at several water bodies in the area, including the LPRSA, the Passaic River above Dundee Dam, Newark Bay Complex, the Hackensack River, and numerous small ponds and rivers in the area (Bingham et al. 2011). Thus, there are data to support the assumption that not all of the recreationally caught fish consumed by LPRSA anglers comes from the LPRSA.

Use of a FI value less than 1 is supported by precedent at several other large sediment sites, including the Aberjona River and Sudbury River in Massachusetts, the Kalamazoo River in Michigan, and the West Branch of the Grand Calumet River in Indiana. At each of these sites, a FI value of 0.5 was used for the RME recreational angler fish consumption scenario in conjunction with a consumption rate based on a surrogate water body, based on the fact that other desirable fishing locations are located within close proximity.

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Summary and Conclusions

As previously discussed, despite agreement to do so, Region 2 did not apply a consistent or objective set of review criteria to critically evaluate studies under consideration as a basis for the development of fish and crab consumption rates for the LPRSA HHRA. Even though survey results can be substantially impacted by the manner and purpose for which the study is conducted (e.g., higher rates typically estimated from short-term studies due to survey methodologies [USEPA 1997; Ebert et al. 1994]), Region 2 failed to consider the impact of using a study designed to evaluate differences in fish/crab consumption patterns among various ethnicities and results of a mail survey focused on angling and consumption behavior as it relates to fish consumption advisories rather than studies specifically designed to provide data on long-term fish consumption rates as the primary bases for estimating fish consumption rates. Although raw data were not available, Region 2 eliminated reported non-consumers from the summary results of Burger (2002), even though it could not be determined whether they represented true "non-consumers" (i.e., never ate fish from the area) or they simply had not eaten any fish meals during the time specifically asked about in the survey. Similarly, all cases for which a "?" was recorded in the consumption matrix, indicating that the individual had consumed fish but could not recall how much, were eliminated from the Connelly et al. (1992) dataset. Region 2 has failed to acknowledge or address the limitations associated with these studies that make them unsuitable as the basis for the fish consumption rate for the LPRSA. In addition, rather than using a statistically valid approach, the high-end consumption rate from each of the manipulated datasets were then averaged and this average is proposed by Region 2 as the high-end fish consumption rate for the LPRSA.

Region 2 also incorrectly concludes that the site-specific fish consumption survey results for the lower six miles of the LPRSA cannot be used in estimating a RME fish consumption rate based on the identification of only seven consuming anglers from the 61 surveyed and cites several USEPA documents as supporting this position, although not one of them was confirmed to support the exclusion of non-consumers for the estimation of RME fish consumption rates. Furthermore, Region 2 failed to consider the differences in the edible mass of crab tissue assumed in Burger 2002 and the results of the CPG's 2009 crab sampling program (an approved EPA collection program) in identifying a crab consumption rate. Finally, Region 2 argues that use of a FI that is less than one is not appropriate for the LPRSA and states that this position is consistent with recommendations in RAGS (USEPA, 1989), while RAGS indicates that a FI of less than 1 for the fish ingestion exposure pathway should take into account local angler usage patterns and water body characteristics.

The flaws in Region 2's consumption rate estimates are numerous and the consumption rates themselves are not only unrealistic for the LPRSA, but they are substantially higher than rates used at other Region 2 sites without Native American subsistence fishing populations. There is considerable USEPA guidance on fish consumption risk assessment (USEPA, 1989a,b; 1997; 1998; 2000a,b) and all stress the importance of considering site-specific factors when selecting appropriate consumption rates. Furthermore, a fraction ingested (FI) value of 0.5 has been used in the fish consumption pathway in several sediment site risk assessments in the northeast based on proximity of other more desirable and/or accessible sportfishing/crabbing water bodies. Therefore, it is unclear why Region 2 has

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proposed fish/crab consumption rates and a FI that are not supported by guidance, standards for scientifically defensible data analysis, and valid site-specific data.

CPG Proposed Alternatives

Consistent with both the hierarchy set forth in Region 2's *Tech Memo* and USEPA guidance (2000), the fish and crab ingestion rates should be based on site-specific data to the extent possible. Thus, CPG believes that data generated by a CAS to be conducted by the CPG for the entire 17.4 miles of the LPRSA should be used to derive site-specific fish and crab consumption rates, once those data are available.[1] In the interim, CPG recommends a range of consumption rates be evaluated for both fish and crab, such as the following:

- 17.5 g/day → fish/shellfish consumption rate used by USEPA and NJDEP to derive water quality criteria protective of the general public, as well as the average sport angler (USEPA 2000). The 17.5 g/day rate is based on per capita intake of freshwater and estuarine finfish and shellfish by the general population and represents the 90th percentile of the 1994-96 USDA CSFII Survey (Continuing Survey of Food Intakes by Individuals). This rate is supported by at least two of the studies included in Region 2's *Tech Memo* (Connelly et al. 1996 and Ray et al. 2007a,b), both of which are superior to the two studies selected by Region 2 as the basis of the new consumption rates. Since the 17.5 g/day rate includes intake of both finfish and shellfish, it can be used to estimate both fish and crab consumption risks.

- 7.5 g/day → "One meal per month" consumption rate used at other sediment sites to provide information to the public and decision-makers on potential risks associated with consumption of various types of recreationally caught fish/crabs. This type of approach has been used in other sediment site HHRAs where remediation is expected to take decades before advisories can be relaxed to provide a range of risk information for consideration in remedial decision-making (e.g., Lower Duwamish Waterway).

These rates provide reasonable policy alternatives to deriving rates based on studies that are not relevant or appropriate for estimating long-term fish and crab consumption in the LPRSA, and can be used for the RME and CTE scenarios. They are comparable to the upper-bound and mean fish consumption rates of 17 g/day and 4.7 g/day, respectively, for consuming anglers based on Tierra's 2000-01 CAS.

CPG recommends that a FI value less than 1 be used for both the fish and crab ingestion scenarios. For the RME crabber, a FI value of 0.5 is recommended. This is considered very conservative, based on the documented minimal usage of the Study Area by anglers for crabbing. A FI value of 0.5 assumes that half of the crab consumed comes from outside of the LPRSA. A FI value of 0.25 is recommended for the

[1] CPG recommends that survey data which will be generated in 2011-12 from a new CAS of the entire 17.4 mile study area be used in developing new study area-wide consumption rates for use in the baseline HHRA.

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CTE scenario, which is one-half of the RME FI value. The use of a CTE value that is one-half of the RME value is consistent with Region 2's approach for a number of other exposure parameters.

The use of a FI value less than 1 should be considered for the fish ingestion scenarios pending the results of the Study Area wide CAS. Given the close proximity of several other desirable fishable water bodies to the LPRSA, it is likely that recreational anglers who fish at the LPRSA obtain a sizable portion of their catch outside of the Study Area. The CAS questionnaire has been designed to collect data on the amount of angling that occurs outside of the Study Area.

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Table 1: Summary of Statements from USEPA Region 2's July 25 Technical Memorandum Warranting Correction and/or Clarification

Comment	Page	Section	Statement from July 25 Tech Memo	Issue	Correction and/or Clarification
1	1	1.0	The Cooperating Parties Group (CPG) proposed using a fish consumption rate of 1.8 g/day for the Lower Passaic River	Incorrect	None of the LPRSA risk assessment planning documents submitted by CPG to USEPA Region 2 proposed use of a fish consumption rate of 1.8 g/day. Rather, CPG proposed conducting a new creel/angler survey (CAS) of the LPRSA, and estimating consumption rates based on the results of that survey. However, Region 2 has rejected CPG's proposal to conduct a CAS as part of the RI/FS for the site.
2	1	1.0	Anglers with zero fish consumption are not exposed through a fish consumption pathway and cannot be considered as part of the RME for individuals who may be exposed	Unsupported	The basis for Region 2's statement that non-consumers cannot be considered in developing a RME consumption rate is not clear and no verifiable source for this stated policy was located, despite checking the references cited by Region 2. In fact, the default consumption rates for recreational anglers presented in USEPA's *Exposure Factors Handbook* (the rates that Region 2 was previously proposing to use for the LPRSA baseline HHRA) are based on analyses that included both consuming and non-consuming anglers (USEPA 1997). USEPA's *Guidance for Conducting Fish and Wildlife Consumption Surveys* (1998) states the following (p.4-8): "The decision on whether to include these respondents [nonconsumers] in the consumption estimate or exclude them is dependent on the specific goal of the risk assessment. Per capita consumption rates by definition would include nonconsumers and consumers of fish. Including the zero-consumption respondents is a more accurate representation of the overall fish consumption rate for a population, but it also underestimates the mean consumption rate of

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					those who eat fish from the target site by diluting the estimated mean consumption with nonconsumer zeros. Thus using the estimated mean per capita fish consumption could seriously underestimate the risk to regular consumers of fish. An alternative approach, which is more conservative with regard to risk, is to use an upper percentile of the per capita fish consumption distribution, such as the 90th, 95th, or 99th percentile, for risk assessment purposes. If on the other hand, the decision is made to exclude nonconsumers of fish from the analysis of the survey results, the researcher must be able to distinguish between the respondents who never eat fish and the respondents who eat fish but did not eat fish during the recall period. The latter should be included in consumption rate calculations." While Region 2 has decided to exclude non-consumers in its calculation of consumption rates presented in the July 25 *Tech Memo*, Region 2 has not clearly demonstrated that excluded respondents represent true non-consumers. For both of the studies selected, it is possible that occasional consumers were miss-classified and inappropriately excluded from the analysis, thereby omitting an important segment of the target population, and resulting in overestimates of consumption rate for consuming anglers. This uncertainty is not acknowledged in Region 2's *Tech Memo*.
3	1	1.0	Fish consumption rates from Ray et al. (2007b) that are based only on	Incorrect	The maximum fish consumption rate from Ray et al. (2007b) is 23.95 g/day (Table 3), not 28 g/day as

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			anglers who consume fish from the Lower Passaic River are 23.95 g/day (maximum estimated using probabilistic calculations) and 28 g/day (the actual reported maximum)		stated by Region 2. The reported fish consumption rate of 28 g/day is the result of one of the sensitivity analyses that applied a 100% probability of catching a fish (see page 521-522 of Ray et al. (2007b)). Further, the maximum of 23.95 g/day was calculated using statistically derived sampling weights, not probabilistic calculations.
4	1	1.0	These two values are comparable to the 26 g/day consumption rate for anglers recommended in EPA's Exposure Factors Handbook (EPA 1997) (errata at www.epa.gov /ncea/pdfs/efh/addendum-table.pdf)	Incorrect	The default value from USEPA's Exposure Factors Handbook from 1997 of 26 g/day is an upper percentile, not maximum, rate based on consuming and non-consuming anglers as acknowledged in Region 2's technical memo on page 9 and is, therefore, not directly comparable to the maximum value from Ray et al. (2007). The equivalent rate from the 2000-2001 Creel Angler Survey (CAS) is 1.8 g/day. If calculations are based on consumers only, the 95th percentile rate from the 2000-2001 CAS is 17 g/day, which is 34% less than the default value of 26 g/day.
5	1	1.0	The work plan for the survey described in Ray et al. (2007b) was submitted to EPA for review and was not approved, because it was inconsistent with EPA guidance in planning	Taken out of context and incorrect	Region 2's dismissal of the 2000-01 CAS as a source of site-specific data due to lack of USEPA approval of the work plan is not justified given that neither of the two studies used to derive the new RME fish consumption rate of 44 g/day followed an USEPA-approved work plan. Further, the work plan was peer reviewed by an expert panel (Finley et al. 2003), and studies based on the survey were published in peer reviewed journals (Kinnell et al. 2007; Ray et al. 2007a,b). The work plan, implementation, and analysis of the 2000-2001 CAS were performed in accordance with USEPA guidance and recommendations. In fact,

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					performance of a CAS to satisfy the screening level human and ecological risk assessment at the LPRSA was originally mandated by Region 2. Region 2's decision to ultimately not approve the final CAS work plan was never clearly spelled out, and the Agency has yet to provide valid criticisms of the year-long survey. Region 2 has also used the results from the 2000–01 CAS in its own 2007 draft LPR human health risk assessment to determine which fish species were most commonly caught and consumed at this site. This is not surprising given that the peer-reviewed, year long CAS is the only study of its kind in the region. Clearly, the 2000-01 CAS provides value, and warrants greater recognition and consideration than it has been given by Region 2 in its *Tech Memo*.
7	2	1.1	Non-consumers will not be further evaluated since the fish ingestion exposure pathway is not complete.	Fish consumption by reported non-consumers is not necessarily zero	Reported non-consumers are sometimes an artifact of the survey methodology. It is not clear how non-consumers were identified in the Burger (2002) study, and therefore, it cannot be determined whether they were truly non-consumers (i.e., never consume self-caught fish or crab) or occasional consumers that were not captured in the analysis, as they represent an important segment of the target population.
8	2	1.1	Approach of evaluating only fish consumers is consistent with the Risk Assessment Guidance for Superfund (RAGS) – Part A (EPA 1989) that defines the RME as the maximum exposure that is reasonably expected to occur under	Taken out of context and does not directly support exclusion of non-	As stated in RAGS (pg. 6-21), some intake variables may not be at their individual maximum values but when in combination with other variables will result in estimates of the RME. Intake variable values for a given pathway should be selected so that the ***combination*** of all intake variables results in an estimate of the RME for that pathway. It is not

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			baseline conditions and is not a worst-case exposure scenario.	consumers	necessary or desirable to set each intake variable at its absolute maximum as the result will not likely be representative of any potentially exposed individual and, therefore, is not "reasonable".
9	2	1.1	RAGS Part A recommends the following procedures for calculating a contact rate. "Contact rate reflects the amount of contaminated medium contacted per unit time or event. If statistical data are available for a contact rate, use the 95th percentile value for this variable" (EPA 1989, p.6¬22). Consistent with this recommendation, in those cases where fish ingestion rate data are available and supportive of statistical calculations, the 95th percentile is used in the calculation and is noted in the text.	Taken out of context	RAGS further states in the next paragraph (pg. 6-22) that "Sometimes several separate terms are used to derive an estimate of contact rate. In such instances, ***the combination of variables*** used to estimate intake should result in an estimate approximating the 95th percentile value." Therefore, it is not necessary or desirable for each intake variable to be set at its individual 95th percentile. If a RME fish consumption rate that considers consumers only is used in combination with maximum or 95% UCL fish concentrations and 90th and 95th percentile exposure assumptions, the resulting exposure estimate will almost certainly be above that reasonably likely to occur in the population of concern (i.e., compounding conservatism from combining several upper bound assumptions).
10	3	1.1	"Based on these guidance documents, this analysis evaluates the number of anglers reporting fish consumption in the available surveys, variability in fish ingestion rates across surveys, and consistency with fish ingestion rates used by Region 2 in Records of Decision since 1991."	Inappropriate reference to USEPA guidance, and deficient list of evaluation criteria	The guidance documents referenced in this statement (USEPA 1989 and USEPA 1991) are of limited relevance to establishing a framework for evaluating consumption surveys, including the evaluation criteria that should be used to assess their suitability. Region 2's inference that USEPA (1989, 1991) provide a basis for focusing the analysis on the number of fish consumers surveyed, variability in ingestion rates across surveys, and consistency with rates used in Region 2 RODs represents flawed logic, as these criteria have little to no bearing on the suitability of a

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					particular survey to the task at hand. Variability in ingestion rates is expected based on the inherent differences in water bodies and angler populations. Consistency with rates used in prior regional RODs is also of limited usefulness in assessing the utility or quality of a particular study for the same reason. Each site is unique and warrants independent consideration of its site setting, water body and fishery characteristics, and target population. Use of criteria focused on consistency in an exposure parameter that is inherently variable will not result in an outcome that is useful or meaningful and undermines the importance of site-specific risk assessments.
11	3	2.0	Fish and crab consumption surveys relevant to the 17.4-mile area of the LPRSA were identified based on the criteria outlined in EPA's 2000 Ambient Water Quality Guidance (EPA 2000). The analysis is organized by the following data sources: (1) use of local data; (2) use of data reflecting similar geography/population groups; (3) use of data from national surveys; and (4) use of EPA's default intake rates.	USEPA 2000 does not outline criteria for identifying relevant studies or evaluating their quality	USEPA (2000) does not list criteria for identifying relevant studies or evaluating their quality; rather, it provides a hierarchy for identifying potential sources of consumption data. While use of the hierarchy is sound, Region 2 failed to establish a systematic process for identifying relevant studies for consideration and considering the ability of the survey designs to address consumption from the LPRSA. Thus, many of the studies that Region 2 identified as potential data sources are not relevant or appropriate for the task at hand. Because of design issues, several of the studies are not suitable for deriving long-term consumption rates. In several of the other studies, the population surveyed is not similar or the geography is not similar the LPRSA. More detail is provided in subsequent comments.
12	5	2.1a	As indicated in Figure 1, the one local survey conducted by Ray et al.	Not a valid reason for	It is true that the 2000-2001 CAS captured 7 consuming anglers. However, simply citing the

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			(2007b) had 7 reported consumers and the lowest number of fish consumers of all of surveys analyzed.	excluding the study	number of anglers interviewed does not reflect the level of study design to ensure that anglers in the LPRSA were properly captured and shows a lack of understanding regarding a probability sample. As an analogy, the U.S. decennial Census 2000 was statistically designed to account for factors such as deterrence and missed respondents, which would undercount segments of the population if direct, door-to-door interview of every household was attempted. The census was designed this way so that the data obtained from the fraction of the population that responded to the census can more accurately represent the entire U.S. population (Wright and Farmer 2000). Some of these same factors were also considered in surveying the Lower Passaic River anglers. Anticipating that the angling population in the LPRSA would be relatively small, and that angler visits to the area would be fairly infrequent, the CAS was not designed to employ a conventional random sampling of anglers fishing in the area. Instead, the CAS was designed to systematically capture a high proportion of anglers visiting the LPRSA, a study objective that required consistent and frequent survey visits over an extended period of time. Thus, a year-long survey was conducted that included boat-based counts performed on 143 days of which fishing activity as a percent of total count days was 66%. Plus, interviews were performed on 101 days. From the boat-based counts, anglers were counted 789 times and intercepted 84

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					times. This resulted in identifying 61 individual anglers, of which 7 stated that they would consume the fish they caught. Plus, these values do not account for the estimated sample weightings factors that would correspond to the data if it were a probability sample from the true population of anglers. Thus, incorporating the sampling weights resulted in an estimated angler population of 385 anglers, 34 fish-consuming anglers, and no anglers who reported consuming crab (Ray et al. 2007b, Table 2). Population rates that account for avidity are important because of the 7 consuming anglers, 5 were avid (sampling weights were 1), the other two had sampling weights of 4 and 7, plus estimates from the missed creel reports were included to round out the population to an estimated 34 fish-consuming anglers. The size of this population captured during a survey administered ten years ago may even be conservative given that the most popular fishing location in the 2000-2001 CAS, the Hess Gas Station, is no longer a viable fishing spot. Thus, contrary to Region 2's assumption on page 13 of the technical memo that in the future the river will be more accessible to fishing, we have witnessed that in the 10 year time span since the 2000-2001 CAS, there has been a loss of a popular fishing locations. All these issues, including Region 2's concern that the 2000-2001 CAS captured 7 consuming anglers, will no longer be an issue once the CAS of the entire LPRSA is complete.
13	5	2.1a	Table 6 in Ray et al. (2007b)	Incorrect	The fact that only seven consuming anglers were

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			reported that only 11% of those surveyed reported consuming fish (i.e., 7 out of 61 anglers surveyed). The small number of consumers limits further statistical analyses in that it would result in a large variance around the estimated ingestion rate.		identified simply indicates that the population of people who consume fish from the lower Passaic River is small. According to the Exposure Assessment Guidelines (USEPA, 1992), when statistically based sampling is used to generate data, relevance is a function of how well the sample represents the medium or parameter being characterized. Therefore, the most appropriate sample population from which to calculate statistically-derived fish consumption rates is the population surveyed in the year-long LPR CAS, regardless of the number of consumers identified. Region 2's statement also shows a lack of understanding regarding a probability sample, which is statistically designed to capture a sample of the target population, and through use of sampling weights, calculate consumption statistics for the full target population. As discussed in Ray et al. (2007b), once the sampling weights have been properly calculated and applied, the size of the consuming angler population in RM 1-7 is estimated to be 34, not 7.
14	5	2.1a	Therefore, in accordance with EPA guidance (EPA 1992), the small number of consumers and the minimal consumer specific data provided by Ray et al. (2007b), limit evaluation of the consumption rate to the maximum reported consumption rate	Incorrect	Region 2's has referenced 1992 guidance related to calculating the "concentration term" for use in risk assessment. This guidance is intended to be used to calculate upper-bound concentrations for environmental data sets, including those with limited numbers of samples. It is not intended for use in calculating statistics from survey data collected using a probability based methodology.
15	5	2.1b	All of the studies chosen for use in	Incorrect	This is not accurate for the New Jersey Statewide

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Comment	Page	Section	Statement from July 25 Tech Memo	Issue	Correction and/or Clarification
			estimating LPRSA fish consumption rates were published in the peer-reviewed literature or by EPA following an external review process		Survey conducted in 1993. It is also not clear whether Connelly et al. 1992 received peer review. It is cited in the USEPA Exposure Factors Handbook, but the study was published in a state document, not by USEPA, and was not published in the peer reviewed literature.
16	6	2.1b	Region 2 alludes to "several concerns with use of the [Ray et al. 2007a,b] survey data for the LPRSA human health risk assessment (Mugdan 2010, Buchanan 2010)."	Unsupported	This statement is based on two letters to the editor of Science of the Total Environment (STE) submitted by Region 2 (Mugdan, 2010) and NJDEP (Buchanan et al., 2010) in response to publication of the Urban et al. (2009) LPR HHRA in STE. In these letters to the editor: • USEPA indicated that the fish ingestion rates calculated by Ray et al. (2007a,b) were considered to be artificially low since they included non-consuming anglers and, therefore, were inappropriate for use in risk assessment as they would underestimate the exposure and health risks associated with LPR anglers (Mugdan, 2010); and • The NJDEP indicated that data collected during the 2000-01 LPR CAS were not valid for use in a LPR risk assessment because the CAS had not been approved by the USEPA due to unspecified "significant flaw[s]" (Buchanan et al., 2010). The CPG disputes the validity of both comments based on the fact that USEPA's default consumption rates include both consumers and non-consumers, and exclusion of the 2000-01 CAS data because the work plan was not approved is inappropriate when Region 2's preferred non-site-specific studies also did not follow an USEPA-approved work plan.

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Table 1: Summary of Statements from USEPA Region 2's July 25 Technical Memorandum Warranting Correction and/or Clarification

Comment	Page	Section	Statement from July 25 Tech Memo	Issue	Correction and/or Clarification
					The following responses were published in STE by the authors of the original LPR HHRA (Urban et al., 2010a,b) in response to the USEPA and NJDEP comments: • Urban et al. (2010a) noted that non-consuming anglers are included in the derivation of USEPA default fish ingestion rates (Ebert et al. 1993, Connelly et al., 1996), as stated explicitly in the USEPA's Exposure Factors Handbook (USEPA, 1997); • Urban et al. (2010a) also noted the expert panel that provided extensive review of the CAS design (Finley et al., 2003), and USEPA's own RAGS guidance, which recommends use of site-specific data over default values when such data are available (USEPA, 1989); • Urban et al. (2010b) noted that the USEPA used the results from the 2000–2001 LPR CAS in its own 2007 draft LPR HHRA to determine the fish species most commonly caught and consumed at this site and that it is doubtful that Region 2 would have relied on the results of a study that they deemed to contain significant flaws.
17	8	2.1c	Figure 2	Incorrect	The rate attributed to Ray et al. 2007b is incorrect. The maximum rate based only on anglers consuming fish from the 2000-01 CAS was 23.95 g/day. However, Figure 2 should be corrected to present the 95th percentile and mean consumption rates for consuming

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Comment	Page	Section	Statement from July 25 Tech Memo	Issue	Correction and/or Clarification
					anglers of 17 g/day and 4.7 g/day, respectively.
18	8	2.1c	Ray et al. (2007b) stated that 2 of the 7 anglers consumed more than 20 g/day, with a maximum rate of 28 g/day.	Taken out of context	This statement applies to the result of a sensitivity analysis performed that applied a 100% probability of catching a fish and is not part of the primary analysis. The maximum rate based only on anglers consuming fish from the 2000-2001 CAS was 23.95 g/day and the 95th percentile was 17 g/day.
19	8 -11	2.1c	Discussion of EPA default consumption rates cited as support for the RME fish consumption rate	Does not support exclusion of non-consumers	The recommended fish consumption values in the Exposure Factors Handbook (USEPA, 1997) are based on both consumers and non-consumers.
20	10	2.1c	Michigan data (West et al. 1989, 1993) used in the defaults included consumers only	Incorrect; both studies included non-consumers and consumers	West et al. 1989: Includes consuming and non-consuming anglers [See page 10-14 of EFH] "The distribution shown in Table 10-63 is based on respondents who consumed recreational caught fish. As mentioned above, these represent 75 percent of all respondents and 84 percent of respondents who reported having fished in the prior year. Among this latter population, the mean recreational fish intake rate is 14.4*0.84=12.1 g/day; the value of 38.7 g/day (95th percentile among consumers) corresponds to the 95.8th percentile of the fish intake distribution in this (fishing) population."] Assumed 8-oz. (228 g) meal size for all. West et al. 1993: Represents respondents who reported that they currently eat fish, although this may include respondents who did not eat fish in the 7 days of the recall survey. Thus, the calculated mean includes "non-consumers" during the 7-day survey

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Table 1: Summary of Statements from USEPA Region 2's July 25 Technical Memorandum Warranting Correction and/or Clarification

Comment	Page	Section	Statement from July 25 Tech Memo	Issue	Correction and/or Clarification
					period. Based on responses, meal sizes were assumed to be 5-oz (142.5 g), 8-oz. (228 g), or 10-oz. (285 g).
21	10	2.1c	Mention of EPA's Office of Water default recommendation of 142.4 g/day for subsistence fishers (EPA 2000)	Misleading	References to subsistence fisher consumption rate are not germane for the LPRSA since there is no evidence of subsistence there. Accordingly, the reference should be removed, or, at a minimum, qualified as to its irrelevance to this analysis.
22	10	2.1c	Of the surveys identified, only the 1997 EFH (EPA 1997), Burger (2002) and Connelly et al. (1992) contain enough information to calculate statistical distributions for the ingestion rates.	Incorrect	Burger (2002) does not contain enough information to calculate reliable and accurate statistical distributions for ingestion rates. The only data provided are means and standard errors for a subset of parameters used to estimate consumption rates, and a series of bar graphs that provide monthly consumption for six broad ranges by the percent of anglers interviewed. Because the original survey data and analysis are no longer available, Region 2 has used these limited data to estimate upper bound consumption rates that are not robust.
23	11	3.0	The RME fish ingestion rate identified for the LPRSA (44 g/day) is higher than the average but within the range of ingestion rates used in EPA Region 2 decisions since 1991	Incorrect and misleading	Since subsistence fishing is not a concern at the LPRSA, it is misleading to include a comparison of the proposed LPRSA rates with those derived from studies pertaining to Native American populations. When Native American studies are excluded, it is clear that the 44 g/day proposed by Region 2 for use in the LPRSA risk assessment is substantially higher than rates used at other Region 2 sites without Native American subsistence fishing populations.
24	13	4.0	Consistent with the recommendations in RAGS Part A (EPA 1989), use of an FI less than one is not appropriate	Incorrect	Region 2's statement that assuming a fraction ingested (FI) of 1 is consistent with recommendations in guidance is not accurate. RAGS guidance clearly states that the decision to use a FI of less than 1 for the fish

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					ingestion exposure pathway should take into account local angler usage patterns and water body characteristics. It is not appropriate to base an FI of 1 simply on a species' presence in a water body (e.g., blue crab), if other factors limit angling activity. While crabs are present in the LPRSA, crabbing is infrequent, particularly in comparison to Newark Bay, which has the same crabbing advisory. This disparity in crabbing activity should be reflected in the use of an FI value that is less than 1.
25	NA	NA	Deletion of language allowing for cooking loss considerations	No justification given	Region 2 has deleted language previously offered in their 9/10/10 comments on the draft RARC Plan allowing for discussions on cooking loss factors. The rationale for this change in position is not justified, and deprives CPG of an opportunity for meaningful technical exchange with Region 2 on this topic.

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Table 1: Summary of Statements from USEPA Region 2's July 25 Technical Memorandum Warranting Correction and/or Clarification

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Attachment C

Summary of Publically Available Pathogen Monitoring Data for LPRSA

September 2011

R2-0022606

Attachment C
Summary of Publically Available
Pathogen Monitoring Data for LPRSA

Publically available information regarding pathogens in the Lower Passaic River Study Area (LPRSA) was reviewed, including the classification of the LPRSA river sections within the New Jersey 303(d) List of Water Quality Limited Waters and sampling data for the LPRSA. The USEPA STORET database was accessed for this information (http://www.epa.gov/storet/).

The New Jersey 303(d) List is a list of water bodies that do not attain designated water quality standards for the specified use of the water body. The Lower Passaic River (LPR) from Dundee Dam to Newark Bay is not included in the NJ 303(d) List in 2000, 2002, and 2004. While not clear from the listing, this may be because monitoring was not conducted in the river those years[1]. In the 2006 List, however, the LPR from Dundee Dam to Newark Bay was listed in the 303(d) List for pathogens. In the 2008 and 2010 Lists, the stretch of river from Second River (~RM 8) to Saddle River (~RM 15.5) is listed for pathogens. The sections that are included on the 303(d) Lists are listed because the stretch of the LPR from the Second River to Dundee Dam is designated for use as a Primary Contact Recreation water body.

Based on the designated use of Primary Contact Recreation, the state water quality standards (NJAC 7:9B-1.14(d)) are listed below. New Jersey has also adopted the USEPA guidance for Fecal Coliform water quality standards (EPA 440/5-88-007, 1988). These pathogen criteria have been set to prevent acute gastrointestinal illness caused by the incidental ingestion of fecally contaminated water during recreational activities with direct water contact (i.e., involving full body submergence), such as swimming, water skiing and skin diving.

Pathogen	Geometric Mean *counts/100 ml*	Single Sample *counts/100 ml*
Enterococci	35	104
E. coli	126	235
Fecal Coliforms[A]	200	--

A: For Primary Contact Recreation water bodies. For SE3 waterbodies, which is the classification for the lower 8 miles, the fecal coliforms standard is <1500 counts/ml (geo mean).

The USEPA has also issued bacteriological Ambient Water Quality Criteria for Marine and Fresh Recreational Waters (EPA440/5-84-002, 1986) for Enterococci and *E. coli*. These criteria are:

[1] The USEPA STORET database goes back to 2000; if there were samples for 2000 or 2001, it is likely that they would have gone into the 2002 or 2004 reports.

Pathogen	Geometric Mean *counts/100 ml*	Single Sample[A] *counts/100 ml*
	Freshwater	
Enterococci	33	61 (61 – 151)
E. coli	126	235 - 575
	Marine	
Enterococci	35	104 (104 – 501)

A: USEPA water quality criteria for single samples depends on 4 different water body uses. NJ designation of Primary Contact Recreation considered equivalent to the USEPA classification of Designated Beach Area (upper 75% C.I.),

The United States Geological Survey (USGS) and the USEPA maintain databases of water quality information across the country. The USEPA STORET database has more than 1,000 water quality samples from within the LPRSA. The dates for these samples, which were collected by the New Jersey Harbor Dischargers Group, range from 2003 to 2009 for fecal coliforms and 2009 for enterococci. There are monitoring stations with periodic samples at three locations in the stretch of the LPR between Dundee Dam and Newark Bay (LPR at Rutgers St (RM 8.5), LPR at Union Ave (RM 12.8), and LPR at Dundee Dam (RM 17.0)). One station is located above the dam (LPR at Market St (RM 18.8)). The pathogen monitoring data for all four stations are shown in Figures 1a (single sample results) and 1b (geometric mean results). While outside of the LPRSA, the station at RM 18.8 is included for comparison purposes.

Figure 1a presents single sample results for fecal coliforms (upper graph). These data are plotted for illustrative purposes, since the fecal coliforms standard is for comparison with the geometric mean calculated over a 30 day period (assuming a minimum of 5 sampling events). As shown in Figure 1b (upper graph), the monthly geometric means for fecal coliforms exceeded the state standard of 200 counts/100 ml at all four sampling stations on numerous sampling events over the five year period between 2004 and 2009.

Figure 1a also presents the single sample results for enterococci (lower graph). As shown, a number of single sample results for enterococci exceed the state water quality criterion for a single sample of 104 counts/100 ml. As shown in Figure 1b (lower graph), all of the geometric means for enterococci at sampling stations located at RM 8.5 and RM 12.5 exceed the state standard of 35 counts/100 ml. A number of the means for the station at Dundee Dam also exceed the standard. Based on these 2009 data, there are numerous occasions when the levels of enterococci throughout the freshwater stretch of the LPRSA are above the levels considered safe for primary contact recreation.

In 2003, the Interstate Environmental Commission (New York) conducted a sampling program that included six sampling stations in the LPRSA (two stations above RM 8, one station around RM 8, and 3 stations below RM 8). These six stations were sampled six times between August 11, 2003 and September 22, 2003. The 2003 LPRSA pathogen data are summarized in the maps shown in Figure 2. Figure 2a presents the results for fecal coliforms; Figure 2b presents the results for fecal streptococcus; and Figure 2c presents the results for enterococci. For the three stations at or above RM 8 and for all six

sampling events, individual sampling results for fecal coliforms exceed the state standard of 200 counts/ml (geometric mean). While not calculated for this evaluation, the geometric mean would also be exceeded. As shown in Figure 2c, individual sampling results for enterococci exceed the state single sample standard of 104 counts/ml in 16 of the 18 samples collected at or above RM 8. Fecal streptococcus is included for illustrative purposes, as there is no standard for comparison.

Based on the findings of this review and analysis of publically available pathogen monitoring data, there have been numerous occasions over the past several years when the levels of pathogens in the stretch of the LPRSA classified as freshwater 2 non-trout (FW2-NT) and saline-estuarine 2 (SE2) exceed applicable criteria established by the state of NJ and USEPA as safe for primary contact recreational activities such as swimming. These findings are consistent with other published studies regarding pathogen levels in the LPR. Sampling of surface water directly from and around a discharging CSO in the LPR showed pathogen concentrations in excess of health-based water quality criteria and in some cases similar to raw sewage (Donovan et al., 2008).

Reference

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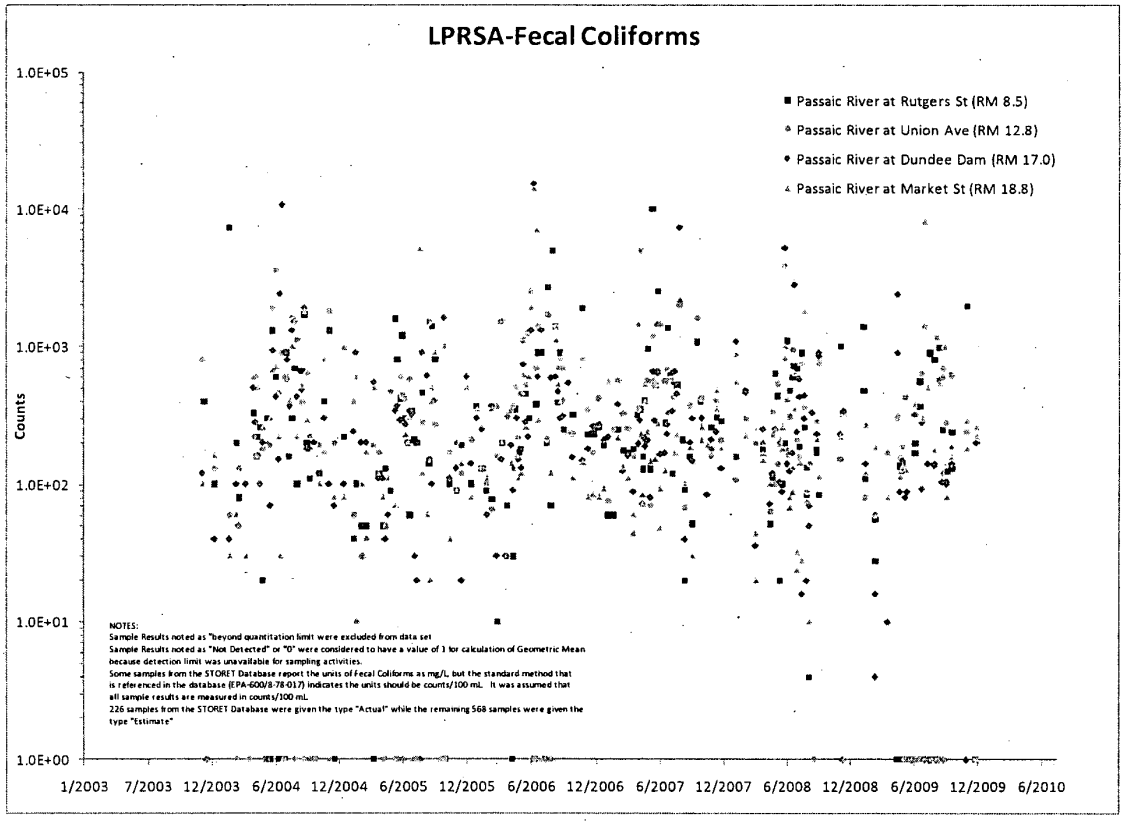
Figure 1 a – Single Sample Results



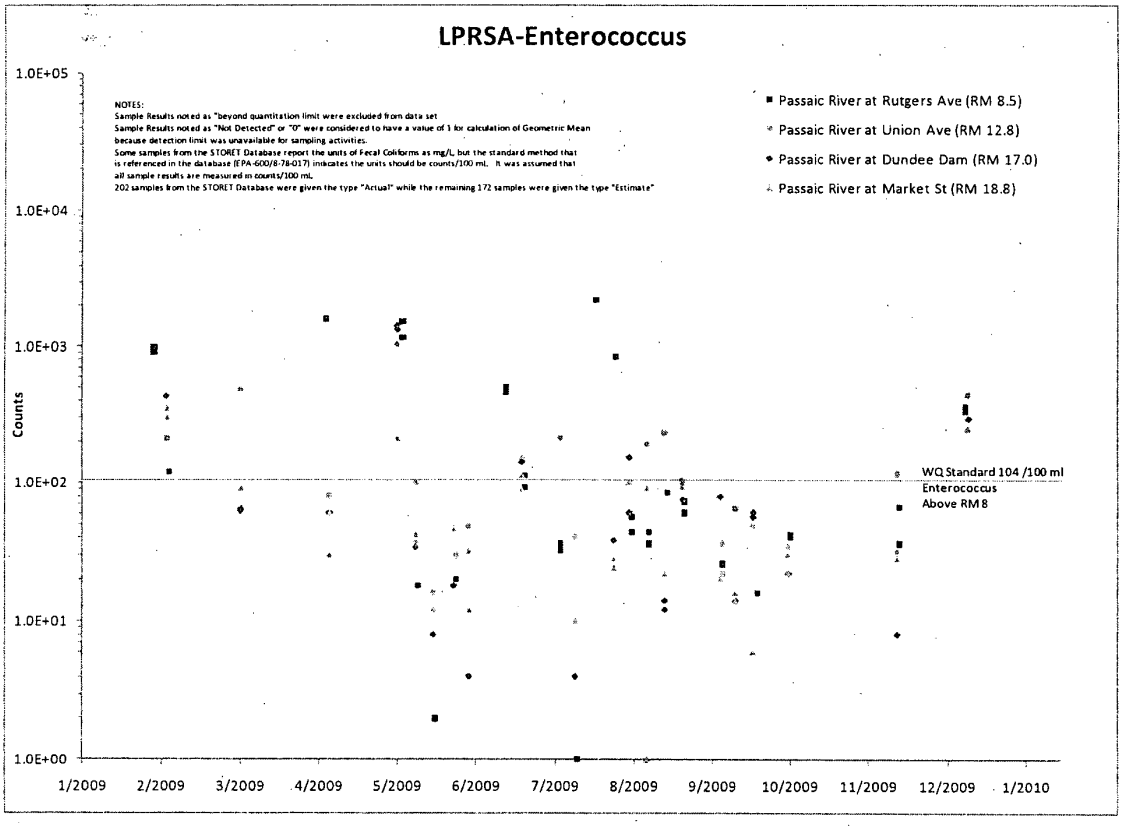
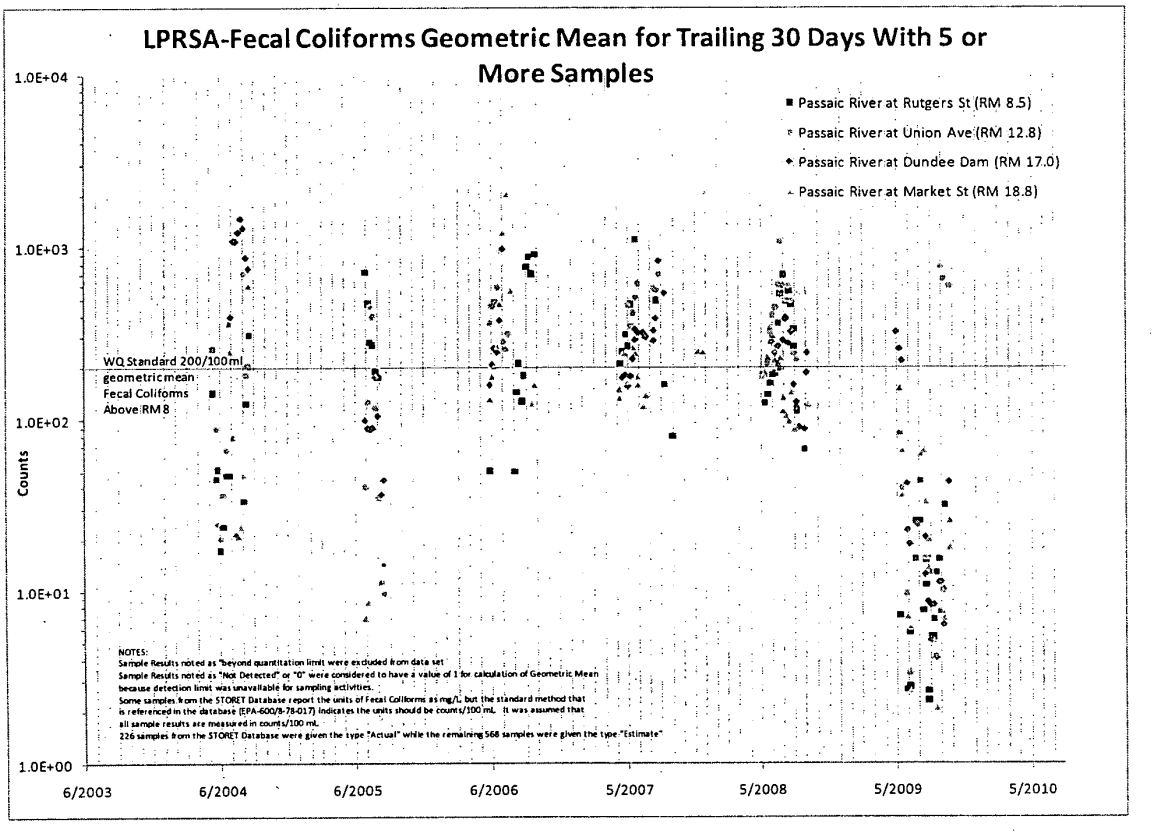
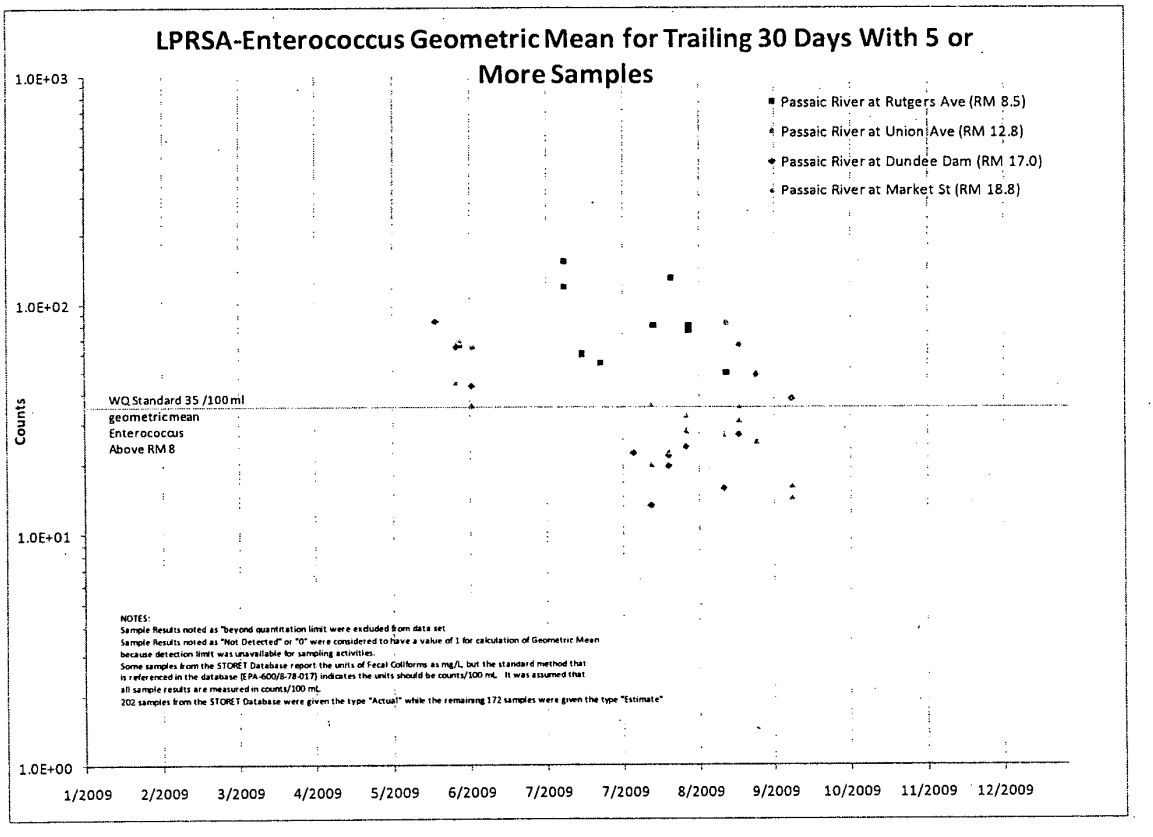


Figure 1 b – Geometric Mean Results





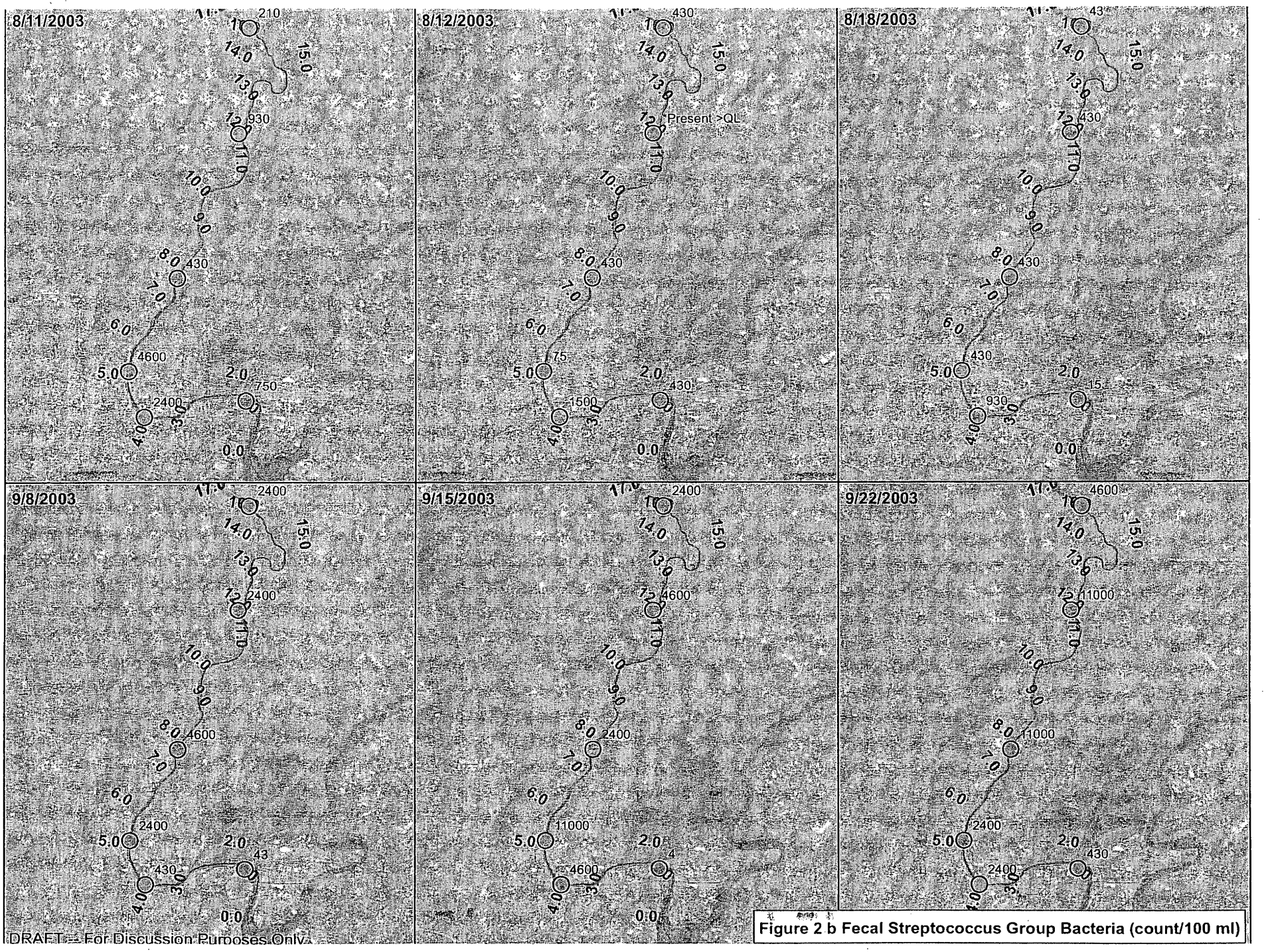


Figure 2 b Fecal Streptococcus Group Bacteria (count/100 ml)

DRAFT -- For Discussion Purposes Only

R2-0022612

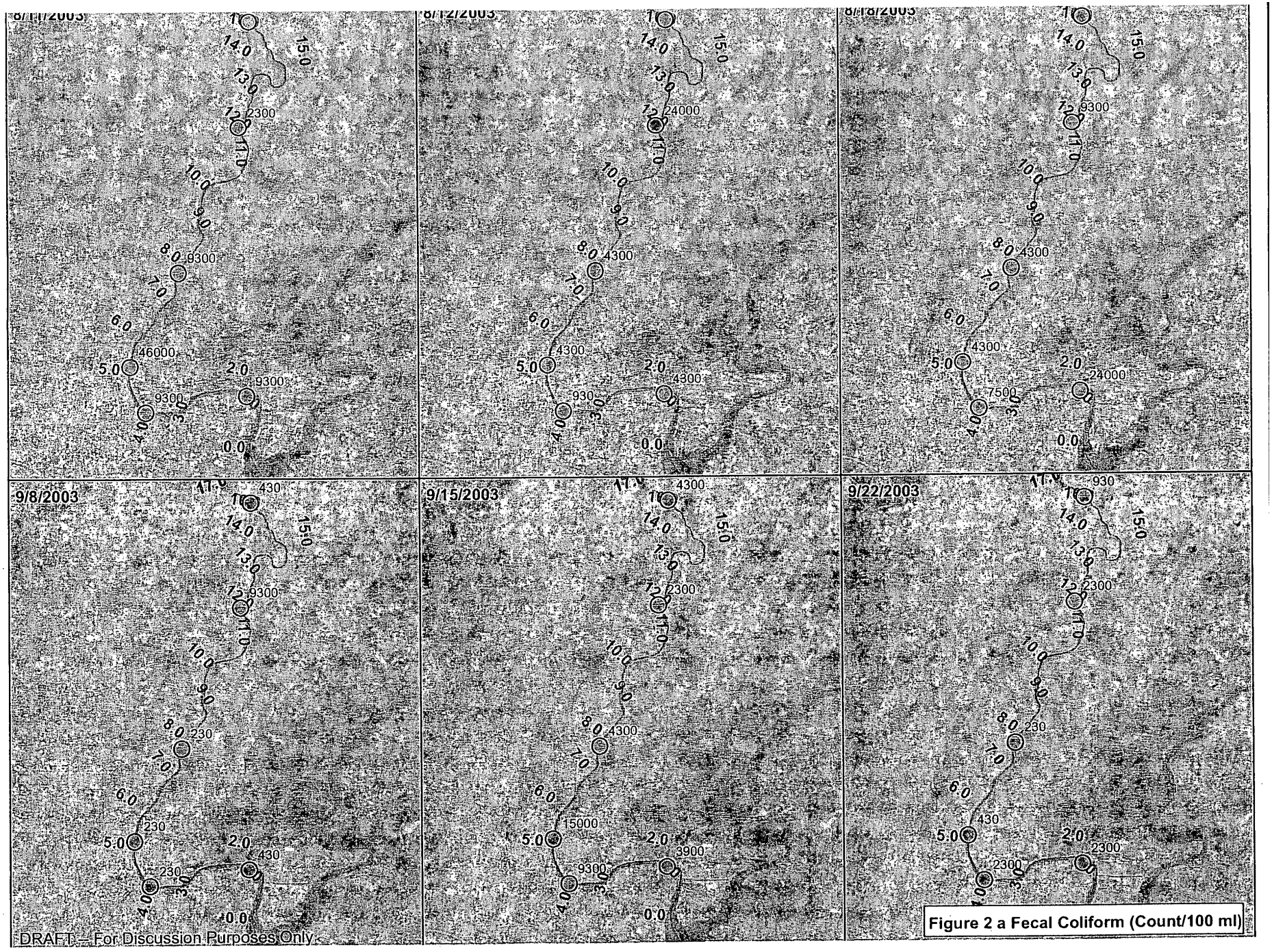


Figure 2 a Fecal Coliform (Count/100 ml)

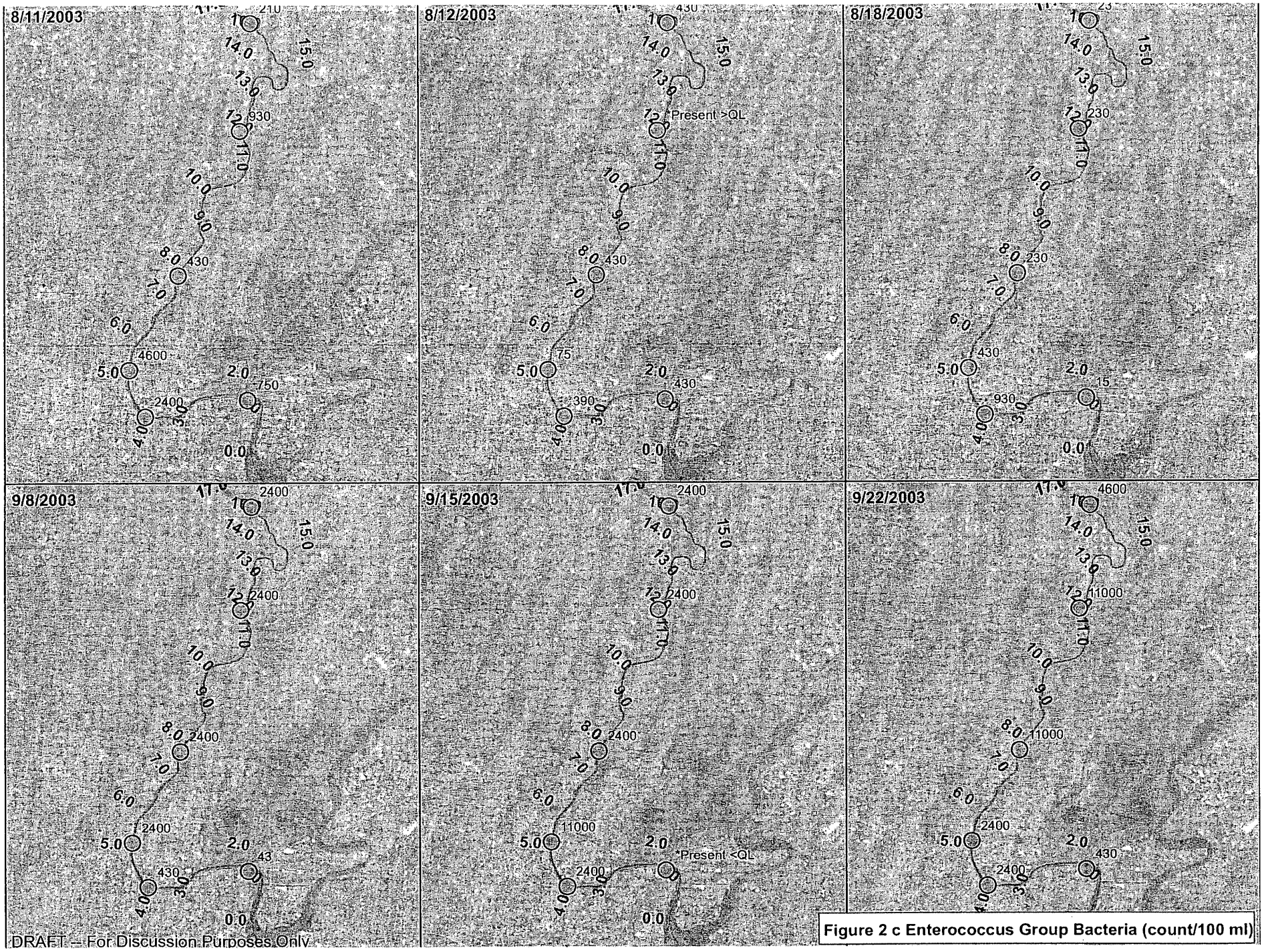


Figure 2 c Enterococcus Group Bacteria (count/100 ml)

DRAFT – For Discussion Purposes Only

R2-0022614

EXHIBIT G

EPA Staff Recommended Revisions to Select Comments Disputed by CPG

Human Health Risk Assessment

CPG Issue #1:

Comments 100, 101, and 102:

These comments all relate to Page 90, Section 3.3.4, Paragraph 3: "As stated in USEPA's September 10, 2010 comments, the scenarios and exposure parameter assumptions are intended to capture exposures under a future site condition, when parks and open spaces have been improved and expanded or developed at sites currently under other uses. Such improvements could make people more likely to visit and spend more time along the river. USEPA Region 2 has directed that the same set of scenarios and exposure parameter assumptions be used to assess both current and potential future baseline site risks. As a revitalized and redeveloped riverfront is not the current condition, this approach will lead to overestimates of current exposures. However, as directed by USEPA Region 2, the same scenarios and exposure parameter assumptions are used to account for both current and future site conditions."

EPA staff recommendation: Replace the entire paragraph that is referenced above with:

"In accordance with USEPA Guidance (USEPA 1989b, USEPA 2001c), the scenarios and exposure parameter assumptions are intended to capture exposures under both current and future site conditions. All of the exposure pathways are currently complete. While expected improvements to the river and shoreline will likely increase the number of individuals utilizing the river, the exposure frequency and duration for some individuals already utilizing the river will not likely increase. As such, the use of combined current/future exposure assumptions is appropriate."

Comment 105:

Page 92, Section 3.3.4.2, last paragraph: "Because the likelihood of swimming in the LPRSA depends on several factors, including access, riverbank type, adjoining land, and waterway uses, it may not be appropriate to include swimming as a potential exposure pathway throughout the river. The applicability of the swimming scenario throughout the LPRSA will be evaluated based on consideration of the above factors, as discussed in Section 3.3.5.

EPA July 11, 2011 comment: Delete and replace with: "In accordance with USEPA guidance (USEPA 1995, 2001d), comprehensive community master plans are a valuable source of information in determining reasonably anticipated future land use. Many municipalities and counties along the Lower Passaic River have published master plans that call for the expansion and improvement of parks and open space along the river that will lead to higher exposure in the future (City of Newark 2010, City of Newark et all 2004, Clarke et al 2004, Clarke et al 1999, Heyer et al 2003, Heyer et al 2002, Borough of Rutherford et al 2007). While the general usage types of the river may remain the same in the future, the usage frequency and number of access locations should increase over time based on these plans. This increased usage is taken into account in the exposure parameters discussed in Section 3.3.5."

EPA staff recommendation: This comment, and Comment 104 (which the CPG disputes under Issues #3 and #8), both relate to Section 3.3.4.2 of the RARC. The following language should be used to replace the language in Section 3.3.4.2, in its entirety:

R2-0022616

Section 3.3.4.3 Swimmer

It is assumed that recreational users of the LPRSA may occasionally engage in swimming in the river. Recreational swimmers include children (1 to 6 years), adolescents (7 to 18 years), and adults (>18 years). Given the visible deterrents to swimming along large sections of the river, including the presence of trash and debris and the generally urban setting of the river, the exposure frequency and duration for swimming is assumed to be relatively low, both currently and in the future. To be clear, the number of exposed individuals will likely increase as improvements to the shoreline and river are made, but the exposure frequency and duration for some individuals already engaging in this scenario are not likely to increase. It is assumed that the current/future swimmer may be exposed to COPCs in sediment and surface water while swimming via:

- Direct Contact (incidental ingestion and dermal contact) with near shore river and mudflat surface sediment;
- Direct contact (incidental ingestion and dermal contact) with river surface water; and
- Inhalation of COPCs that may volatilize into outdoor air from exposed mudflat sediment and/or surface water.

Note that swimming is included in New Jersey's designated uses of the freshwater portion of the river from the confluence with Second River to Dundee Dam (RM 8 – 17), where the water has a classification of FW2-NT/SE2, though this stretch of the river does not always meet the standards associated with this classification. While the lower portion of the river is not currently classified as suitable for swimming, New Jersey can change the classification as conditions warrant. The applicability of the swimming scenario throughout the LPRSA will be evaluated as part of the risk assessment, as discussed in Section 3.3.5 of this report.

Comment 130:

Page 102-103, Section 3.3.4.8, "Sediment and Surface Water Exposure Frequencies," 2nd paragraph: "The USEPA Region2-directed sediment and surface water exposure frequencies for each receptor scenario are summarized in Table 3-5. The exposure frequencies reflect an improved and more attractive LPRSA where recreational activities involving contact with water are common (e.g., 259 days/year surface water exposure for the adult boater, 39 days/year sediment exposure for the adult swimmer). Since these frequencies do not represent current site conditions, their use will lead to overestimates of potential risks."

EPA July 11, 2011 comment: Delete and replace with:

> Sediment and surface water exposure frequencies for each receptor scenario are summarized in Table 3-5. The exposure frequencies for the angler, swimmer, wader, and boater reflect both current conditions on the river, as well as future conditions after shoreline improvements laid out in municipal master plans are carried out. Adult anglers, swimmers, and waders are assumed to fish, swim or wade in locations where they would contact sediment and surface water once a week during the summer months (13 weeks/year), or 13 days per year, for the RME scenario, and once every two weeks, or 7 days per year, for the CTE scenario. Adolescent anglers, swimmers, and waders are assumed to be exposed to sediment and surface water 3 days per week during the summer months, or 39 and 20 days per year respectively for the RME

and CTE scenarios. Anglers may catch fish on more days than is assumed here, but are not expected to contact sediment and surface water every day that they fish.

The surface water and sediment exposure frequency for the older child boater who canoes or kayaks is assumed to be equal to other recreational scenarios like swimming or wading, and is therefore assumed to occur 13 days/year for the RME scenario and 7 days/year for the CTE scenario.

Surface water exposure frequencies for the adult and teenage (14 to 18 years old) boaters are based on information provided by Passaic River boating clubs (PRRA 2010, Nereid Boat Club 2010). The rowing season extends from March through mid-November (37 weeks). Adult boaters row up to 7 days/week, for 1 to 2 hours/day; average frequency is 250 days/year (7 days/week x 37 weeks/year) and the CTE frequency is 111 days/year (3 days/week x 37 weeks/year). For the teenage boaters, the high school rowing season primarily is from late February through the end of May, and sometimes includes rowing minimally in the fall. The high school teams row 5 to 7 days per week for 1 to 2 hours per day. Based on this information, for teenage boaters (14 to 18 years old) the RME frequency is 98 days/year (7 days/week x 14 weeks/year) and the CTE frequency is 70 days/year (5 days/week x 14 weeks/year).

Exposure to sediment for the adult and teenage boaters will occur with a much lower frequency than exposure to surface water. Rowing locations south of Dundee Dam launch from docks, so contact with the riverbank happens when rowers flip out of the boat and need to wade in to get back in. It is, therefore, assumed that sediment contact occurs once a month for the RME scenario and once every two months for the CTE scenario. Accounting for the length of rowing season (37 weeks for adults and 14 weeks for teenage boaters), the adult sediment exposure frequency is 9 days/year for RME and 4 days/year for CTE; the teenage boater exposure frequency is 4 days/year from RME and 2 days/year for CTE."

EPA staff recommendation: No change from July 11, 2011 comment letter, except to add the following sentence after the second sentence of EPA's recommended language:

"To be clear, the number of exposed individuals will likely increase as improvements to the shoreline and river are made, but the exposure frequency and duration for some individuals already engaging in these scenarios are not likely to increase."

[Note: EPA agrees that if the risk assessment shows that the swimmer scenario is driving the risk, we will revisit our approach to this aspect of the assessment.]

CPG Issue #2

Comment 11:

Page 2, Section 1.1, 1st paragraph, as submitted in February 2011 RARC : "The LPRSA was increasingly urbanized for more than two centuries; it has served as the receiving environment for industrial and municipal waste discharges since the nineteenth century."

EPA July 11, 2011 comment: Add after that line at the end of the paragraph: "However, it is now increasingly used for recreational activities such as boating, fishing, and crabbing as parks and boat

ramps are actively being restored or newly established (site-specific information provided by Passaic River Rowing Association 2010; Nereid Boat Club 2010; City of Newark 2010).

EPA staff recommendation: No change from the July 11, 2011 comment letter, except to remove "crabbing" from the list of activities.

Comment 83:

Page 69, Section 3.3.1.1, 2nd paragraph: "The lower 6 miles are predominantly commercial and industrial with little public access."

EPA July 11, 2011 comment: Delete and replace with the following: "Adjacent land use is predominantly industrial in the lower river miles (near Newark Bay) and transitions to commercial, residential and recreational near RM4. Land use is increasingly residential and recreational above RM 8."

EPA staff recommendation: Delete and replace with the following:

"Adjacent land use is predominantly industrial in the lower river miles (near Newark Bay) and starts to include more commercial, residential, and recreational uses around RM 4, with the locations of Riverbank and Minish Parks."

Comment 84:

EPA Comment in July 11, 2011 letter: Add "Potential Access to Shore" icons at Pathmark Parking Lot, RM 6.5 eastern bank; at RM 5.0, west bank (across street from NJPAC); at RM 4.0, south bank (across Raymond Blvd. from Riverbank Park).

EPA staff recommendation: Add "Potential Access to Shore" icons at Pathmark Parking Lot, RM 6.5 eastern bank and at RM 4.0, south bank (across Raymond Blvd. from Riverbank Park). It is not necessary to place an icon at RM 5.0, though we do have anecdotal evidence that people do go near the water there.

Comment 86:

Page 80, Section 3.3.1.1., "Lower River Segment," 1st sentence: "The Lower River Segment (preliminarily defined as RM 0 to RM 6 based on salinity) is characterized as predominantly industrial/commercial in nature, with very little public access to the shoreline."

EPA July 11, 2011 comment: Rephrase as follows: "The Lower River Segment (preliminarily defined as RM 0 to RM 6 based on salinity) is characterized as predominantly industrial in the lower river miles (near Newark Bay) and transitions to commercial, residential and recreational near RM 4."

EPA staff recommendation: Rephrase as follows:

"The Lower River Segment (preliminarily defined as RM 0 to RM 6 based on salinity) is characterized as predominantly industrial in the lower river miles (near Newark Bay) and starts to become more commercial, residential, and recreational near RM 4."

R2-0022619

Comment 87:

Page 80, Section 3.3.1.1, "Lower River Segment": "The shoreline along this stretch of the river consists of active or abandoned industrial areas."

EPA July 11, 2011 comment: Delete and replace with "The shoreline along this stretch of the river consists of active or abandoned industrial areas up to RM4, but then transitions to thin strips of park land abutting the river as land use becomes more commercial and residential."

EPA staff recommendation: Delete and replace with:

"The shoreline along this stretch of river consists mainly of active or abandoned industrial areas up to RM 4, but then starts to include more thin strips of park land abutting the river as land use starts to become more commercial, residential, and recreational."

Comment 92:

Page 81, Section 3.3.1.1., "Upper River Segment": "The Upper River Segment (preliminarily defined as RM 10 to the Dundee Dam) transitions, with increasing distance upriver, from a mixture of industrial, commercial and some residential areas and public parks to more residential areas, compared with other sections of the river."

EPA July 11, 2011 comment: Delete sentence and replace with "The Upper River Segment (preliminarily defined as RM10 to the Dundee Dam) is the most residential and recreational segment of the river."

EPA staff recommendation: The CPG may add EPA's sentence (without the parenthetical) after the CPG sentence, rather than delete the CPG sentence and replace it with EPA's sentence.

CPG Issue #3

Comment 77:

Page 64, Section 3.3, 2nd paragraph, 1st sentence: "The LPRSA is a large and complex sediment site, and current site conditions reflect its long industrial history and urban setting."

EPA July 11, 2011 comment: Insert at the end of the sentence the following clause: ", although in the future, most of the river is increasingly expected to be used for recreational activities."

EPA staff recommendation: Add modified clause at the end of the sentence:

", although in the future, large sections of the river are expected to be used increasingly for recreational activities."

R2-0022620

Comment 104:

Page 91, Section 3.3.4.2, 1st paragraph: "It is assumed that recreational users of the LPRSA may occasionally engage in swimming in the river. Recreational swimmers include children (1 to 6 years), adolescents (7 to 18 years), adults (>18 years). Given the visible presence of shoreline and floating debris and trash, the presence of pathogenic contamination, and the urban setting of the river, including lack of public beaches, it is anticipated that swimming now and in the foreseeable future will be limited. However, based on EPA's directive, it is assumed that both the current and future swimmer will be exposed to COPCs in sediment and surface water while swimming in the river via:.."

EPA July 11, 2011 comment: Delete and replace with the following: "Individuals of all ages may visit the Passaic River to swim. Swimming is included in New Jersey's designated use of the freshwater portion of the river from the confluence with Second River to Dundee Dam (RM 8-17), where the water has a classification of FW2-NT/SE2. Swimming under current conditions may be limited by the visible presence of shoreline and floating debris, and trash. However, once the parks that are already under construction are completed, and when other recreational improvements in municipal master plans are undertaken, future conditions are expected to provide greater access to and be more conducive to swimming. Therefore, it is assumed that the current and future swimmer will be exposed to COPCs through contact with sediment while entering and leaving the river, and while swimming. Adult (>18 years), adolescent (7 to 18 years old) and young child (1 to 6 years old) swimmers are assumed to be exposed to sediment and surface water via: ..."

EPA staff recommendation: See response to Comment 105 under CPG Issue #1. Use the language provided in that response to replace Section 3.3.4.2 in its entirety.

Comment 105:

See response for Comment 105 under CPG Issue #1.

Comment 128:

Page 101, Section 3.3.4.8, "Surface Water Exposure Time," 1st paragraph: "Given the highly developed and urbanized nature of the LPRSA, including the pathogenic contamination throughout the study area, frequent and extended periods of swimming, wading, or other activities involving intensive contact with surface water are not expected to occur under current or foreseeable future uses. Thus, the USEPA Region 20directed exposure times and frequencies for the receptor scenarios involving contact with surface water are likely to overestimate exposures in the LPRSA. The use of USEPA's national default swimming exposure time of 2.6 hours per event does not reflect site-specific conditions and was not intended for a water body with compromised water quality and no designated swimming areas. However, at the direction of USEPA, this default assumption is used in the baseline HHRA for the LPRSA. The USEPA-directed surface water exposure times for each receptor scenario are summarized in Table 3-4."

EPA July 11, 2011 comment: Delete and replace with the following, "The NJAC Surface Water Quality Standards classification for the Passaic River from RM 0 to 8 includes secondary contact recreation (E.G, boating and fishing), and from RM8 to 17 includes primary contact recreation (e.g., swimming and wading), among other uses. A number of boating and sculling clubs already make frequent use of the river (Passaic River Rowing Association 2010, Nereid Boat Club 2010) and improvements are being made

to boat ramps throughout the 17 miles (City of Newark 2010). Swimming under current conditions may be limited by the visible presence of shoreline and floating debris and trash. However, once the parks that are already under construction are completed, and when other recreational improvements planned in municipal master plans are undertaken, future conditions are expected to provide greater access to and be more conducive to swimming[1]. Therefore, exposure times and frequencies are designed for both current and future river users who will be exposed to COPCs in sediment and surface water, as summarized in Table 3-4."

EPA staff recommendation: Delete last sentence of EPA proposed language ("Therefore...") and replace with:

"The exposure times and frequencies summarized in Table 3-4 are designed to reflect both current and future river users. While the number of people utilizing the river in such a way as to be exposed to surface water will likely increase as improvements to the river are made, the exposure times and frequencies for particular individuals already utilizing the river in these ways are not expected to increase."

CPG Issue #4

Comment 7:

EPA July 11, 2011 comment: Since the entire RARC is subject to USEPA approval, the terms "directed for use by USEPA Region 2" or "USEPA Region 2-directed" are unnecessary specifications and should be deleted. Specific comments below provide many instances.

EPA staff recommendation: In general, no change from EPA's 7/11/11 comment, except as noted below.

Comment 78:

Page 64, Section 3.3, 2nd paragraph, last sentence: While use of some default or surrogate assumptions will be necessary in the remedial decision-making process, USEPA guidance documents stress the importance of using data that represent the characteristics of the local population(s) and site when possible and appropriate (USEPA 1989a, b, 1991a, 1997b, 1998a, 2000a).

EPA July 11, 2011 comment: delete and replace with "However, USEPA guidance (USEPA 1991a) also allows the use of default values developed by USEPA when there is a lack of site-specific data or consensus on which parameter value to choose, given a range of possibilities."

EPA staff recommendation: The CPG may add EPA's language after the CPG's last sentence, rather than delete it.

Comment 95:

Page 82, Section 3.3.2, 1st paragraph, 5th sentence: At the direction of USEPA Region 2, an additional receptor (Worker) not identified in the PFD has been included as a potential receptor.

[1] The national average for time spent swimming is 2.6 hours/day.

R2-0022622

EPA July 11, 2011 comment: Delete "At the direction of USEPA Region 2,"

EPA staff recommendation: EPA agrees to remove this comment; the referenced language may remain in the plan.

Comment 99:

Page 90, Section 3.3.4, 2nd paragraph: The values to be used for each of the RME and CTE exposure parameters are those that USEPA Region 2 directed CPG to use, were issued as directives on November 5, 2010, and are representative of USEPA default values. These values are presented in this Revised RARC Plan. On September 10, 2010, USEPA Region 2 provided comments on CPG's Draft RARC Plan. USEPA's comments included specific scenarios and exposure parameter values to be used in the baseline HHRA. The exposure pathways, receptors, and parameter values were provided in tabular form following *Risk Assessment Guidance for Superfund (RAGS) Part D* format (USEPA 2001c). These tabulated scenarios and parameter values are included as Appendix C of this Plan.

EPA July 11, 2011 comment: Delete 2nd paragraph (unnecessary explanation).

EPA staff recommendation: CPG may leave this paragraph in, rewording the beginning as follows:

"The values to be used for each of the RME and CTE exposure parameters are generally those that USEPA Region 2 directed CPG to use. All of EPA's directions are consistent with EPA guidance, practices, and policies for conducting risk assessments. These values are presented ...."

CPG Issue #5

Comment 110 (combining 110b and 110d):

Page 94, Section 3.3.4.7: The ingestion rate is the amount of fish that an individual consumes on a daily basis based on averaging the reported consumption rate in one year over 365 days (i.e., an annualized rate). As directed by USEPA Region 2 and listed in Appendix C, the USEPA's default fish ingestion rates for recreational freshwater anglers cited in USEPA's Exposure Factors Handbook (USEPA 1997b) will be used. These rates are based on mail surveys of licensed anglers who pursue sportfishing in Maine, New York (Lake Ontario), and Michigan (Great Lakes), and include both consumers and non-consumers (USEPA 1997b). The fish ingestion rates for the adult, adolescent, and child angler receptors as selected by USEPA Region 2 are as follows:

- *Adult angler fish ingestion rate*: RME of 26 g/day (the 95th percentile in the USEPA's Exposure Factors Handbook), which is equivalent to approximately 40 half-pound meals/year, and CTE of 8 g/day (the recommended mean in the USEPA's Exposure Factors Handbook) (USEPA 1997b)
- *Adolescent angler (ages 7 to 18 years) fish ingestion rate*: RME of 17 g/day and CTE of 5 g/day, based on USEPA's assumption that the intake of the adolescent is approximately two-thirds that of the adult (USEPA 1997b)
- *Child angler (ages 1 to 6 years) fish ingestion rate*: RME of 8 g/day and CTE of 3 g/day, based on USEPA's assumption that the intake of the child is approximately one-third that of the adult (USEPA 1997b)17

EPA July 11, 2011 comment: Delete and replace with, "The ingestion rate is the amount of fish that an individual consumes on a daily basis, based on averaging the reported consumption rate in 1 year over 365 days. Ingestion rates for fish have been annualized and are presented in grams eaten per day (g/day). The ingestion rate assumes the fish are caught while angling from the LPRSA only. It is expected that ingestion of fish from local sources will be the main source of fish consumption for the anglers. For consumption of fish, ingestion rates based on data collected for recreational anglers may obtained from the Exposure Factors Handbook (EFH) (USEPA 1997b), three surveys conducted in New Jersey (Burger 2002, May and Burger 1996, Center for Public Interest Polling and New Jersey Marine Sciences 1993, Burger et al 1998) and one survey conducted in New York (Connelly et al 1992). Only the 1997 EFH, Burger 2002 and Connelly et al 1992 contain enough information to calculate statistical distributions for the ingestion rates. Only the Burger 2002 and Connelly et al 1992 (as analyzed and applied in the externally peer-reviewed Human Health Risk Assessment for the Hudson River in TAMS Consultants 2000) included data from the New York/New Jersey Harbor, which encompasses the tidal portion of the Lower Passaic River (the 1997 EFH data were from surveys of anglers in Michigan, Maine and the Great Lakes). Burger 2002 was from a survey conducted in the Newark Bay Complex. Connelly et al (1992) was a New York Statewide Angler survey, whose data were used to calculate ingestion rates for the peer-reviewed Human Health Risk Assessment for the Hudson River (TAMS Consultants 2000). Therefore, the fish ingestion rate for the Lower Passaic River RME adult angler (44 g/day) is calculated by averaging the high end (approximately 90th percentile) estimates from Burger 2002 (57 g/day) and Connelly et al 1992 (32 g/day). For the CTE value (13 g/day), the average of the mean of 22 g/day from Burger 2002 and the 50th percentile value of 4 g/day from Connelly et al 1992 is used.

A creel angler survey was conducted in the Lower Passaic River, as reported in Ray et al 2007. The work plan for this survey was submitted to USEPA for review, but not approved; therefore, results from the survey cannot be used in this risk assessment. However, it is noted that the fish ingestion rates for the RME adult based on data from Burger 2002 (57 g/day) and Connelly et al 1992 (32 g/day) are consistent with the ingestion rate calculated from data reported in Ray et al 2007 (28 g/day). Ray et al 2007 reported that only 7 anglers of those surveyed reported consuming fish. The small number of consumers limits statistical evaluation of the consumption rate to the maximum reported consumption rate of 28 g/day (USEPA 1992d)."

EPA staff recommendation: No change from language in July 11, 2011 comment letter, except to add the following language after the first sentence, "The following analysis of ingestion rates is based on EPA's Technical Memorandum on Fish and Crab Consumption Rates dated July 25, 2011." The memorandum should also be referenced as an appendix to the report.

Comment 113:

Page 96, Section 3.3.4.7, Crab Ingestion Rate: For crabs, USEPA has directed that consumption rates be based on a 1999 survey of Newark Bay anglers, including crabbers (Burger 2002). Based on the responses of 110 anglers who reported consuming crab, a mean crab ingestion rate was derived by multiplying the number of crab meals eaten per month by the number of crabs eaten at each meal by the number of months per year that anglers go crabbing (and presumably eat their catch), assuming the average serving size from one crab is 70 g. Based on the Burger analysis, USEPA Region 2 has determined the following crab consumption rates:

- *Adult receptor crab ingestion rate*: RME of 23 g/day and CTE of 16 g/day

- *Adolescent receptor (ages 7 to 18 years) crab ingestion rate*: RME of 15 g/day and CTE of 11 g/day, based on the assumption that the intake for the adolescent is approximately two-thirds that of the adult (USEPA 1997b)
- *Child receptor (ages 1 to 6 years) crab ingestion rate*: RME of 8 g/day and CTE of 5 g/day, based on the assumption that the intake for the child is approximately one-third that of the adult (USEPA 1997b)

EPA July 11, 2011 comment: Delete and replace with, "The ingestion rate is the amount of crab that an individual consumes on a daily basis based on averaging the reported consumption rate in 1 year over 365 days. Ingestion rates for crab have been annualized and are presented in grams eaten per day (g/day). The ingestion rate assumes the crabs are caught while angling from the LPRSA only. It is expected that the main source of crab for ingestion is from the LPRSA.

Two studies provided data on crab consumption (Burger 2002; Burger et al 1998). Consistent with the recommendations in RAGS Part A, a crab consumption rate was calculated at the 90th percentile, since the 95th percentile was not available. In Burger (2002), for people who only crabbed, approximately 4% of all respondents (6.3% of "consumers only") ate more than 4,200 g/month. Similarly, about 15% of all respondents (23% of "consumers only") ate more than 1,400 g/month. Excluding the non-consumers, the 90th percentile crab ingestion rate for crab consumers is estimated to be 3,590 g/month, or 32 g/day (assuming crabs are consumed 3.3 months of the year, per Table 2 of the paper). The mean crab ingestion rate is 16 g/day, based on data provided in Table 2 of the Burger (2002) paper (assuming that 5,760 g/year is consumed during 3.3 months of the year). This mean crab ingestion rate is consistent with the mean value of 16.6 g/day from Barnegat Bay (Burger et al. 1998). Burger et al. 1998 did not report enough information to support statistical calculations of a 95th percentile ingestion rate. Other studies in this area reported crab consumption but an ingestion rate could not be calculated based on the information presented (Burger et al. 1999 and Kirk-Pflugh et al. 1999).

The 90th percentile crab ingestion rate of 32 g/day is selected as the adult RME ingestion rate and the mean crab ingestion rate of 16 g/day is selected as the adult CTE rate. Ingestion rates for the child and adolescent receptors are estimated assuming rates 1/3 and 2/3 those of the adult ingestion rates, respectively, as is assumed for fish ingestion."

EPA staff recommendation: No change from language in July 11, 2011 comment letter, except to add the following language after the first sentence, "The following analysis of ingestion rates is based on EPA's Technical Memorandum on Fish and Crab Consumption Rates dated July 25, 2011." The memorandum should also be referenced as an appendix to the report.

CPG Issue #6

<u>Comments 112, 114, and 135:</u>

[The CPG has agreed to send EPA studies relevant to its request to discuss CTE scenarios with EPA. EPA staff will review the studies to determine whether we think there is a basis to engage in those discussions – and therefore withdraw this issue from the dispute resolution process.]

R2-0022625

Comment 115:

Page 97, Section 3.3.4.7, Cooking Loss for Crab: As directed by USEPA Region 2, for both the RME and CTE crab consumption scenarios, a preparation and cooking loss factor of zero percent will be used for all contaminants. This is based on USEPA Region 2's assumption that anglers consume the cooking water every time they eat crab. The assumption of no cooking loss is a very conservative assumption, particularly for the CTE scenario. Based on NJDEP survey data, most individuals who catch and consume crabs do not eat the hepatopancreas, and many remove it prior to cooking (Macro 2007, 2008; NJDEP 2002; ORC Macro 2006). Even if the hepatopancreas is not removed prior to cooking, contaminants in the hepatopancreas that may be released during cooking do not result in higher concentrations in the muscle tissue (Zabik et al. 1992). Removal of the hepatopancreas prior to cooking and discarding the cooking water is also recommended by NJDEP's crab consumption advisory (NJDEP and NJDHSS 2010). USEPA Region 2 has agreed to review the appropriateness of assuming no cooking loss for the CTE crab consumption scenario; the values to be used in the baseline HHRA may be amended pending the outcome of USEPA Region 2's review.

EPA July 11, 2011 comment: Delete and replace with, "A cooking loss factor accounts for the amount of contaminant in tissue that is lost during the cooking process and not consumed by the receptor. Blue crabs are most often cooked whole by boiling or steaming (Sea Grant Marine Advisory Program 2006). Exposure to the contaminant depends not only of the specific part of the crab consumed, but also on the method of cooking. NJDEP (2010) reports that no specific cooking method can be relied on to reduce the chemical contaminant levels in blue crabs. Because the crab is cooked whole, even if the consumer does not eat the hepatopancreas, exposure to the chemical contaminant may still occur if the crab is cooked before the hepatopancreas is removed and if the liquid used to boil the crab is used in juices, sauces, bisques, or soups. It should be assumed that the cooking liquid is consumed along with the crabmeat. Therefore, cooking loss for crabs is assumed to be 0 percent for all contaminants under the RME and CTE scenarios, because data are not currently available from EPA or published literature to support any type of reduction in concentration under this type of exposure scenario. A study published by Zabik et al. (1992), entitled "Effect of Preparation and Cooking on Contaminant Distributions in Crustaceans: PCBs in Blue Crab," was reviewed. The study showed that boiling or steaming reduced PCB concentrations by greater than 20 percent in tissue, and that the cooking water contained about 80 percent of the PCBs that were lost from the crabs (the study author was contacted to confirm these results). Thus, most of the PCBs lost from the crabs could still be consumed if the cooking water is used to prepare soups, sauces, pasta, etc. Potential cooking loss assuming discarding the cooking water may be discussed in the uncertainty section of the risk assessment, but a cooking loss of 0 percent should still be assumed for the RME and CTE scenarios in the risk assessment."

EPA staff recommendation: Since EPA will allow the use of a cooking loss of 20% for PCBs under the CTE scenario, please use the following revised language:

"A cooking loss factor accounts for the amount of contaminant in tissue that is lost during the cooking process and not consumed by the receptor. Blue crabs are most often cooked whole by boiling or steaming (Sea Grant Marine Advisory Program 2006). Exposure to the contaminant depends not only of the specific part of the crab consumed, but also on the method of cooking. NJDEP (2010) reports that no specific cooking method can be relied on to reduce the chemical contaminant levels in blue crabs. Because the crab is cooked whole, even if the consumer does not eat the hepatopancreas, exposure to the chemical contaminant may still occur if the crab is cooked before the hepatopancreas is removed and if the liquid used to boil the crab is used in juices, sauces, bisques, or soups. It should be assumed

that the cooking liquid is consumed along with the crabmeat. Therefore, cooking loss for crabs is assumed to be 0 percent for all contaminants under the RME, because data are not currently available from EPA or published literature to support any type of reduction in concentration under this type of exposure scenario. A study published by Zabik et al. (1992), entitled "Effect of Preparation and Cooking on Contaminant Distributions in Crustaceans: PCBs in Blue Crab," was reviewed. The study showed that boiling or steaming reduced PCB concentrations by greater than 20 percent in tissue, and that the cooking water contained about 80 percent of the PCBs that were lost from the crabs (the study author was contacted to confirm these results). Thus, most of the PCBs lost from the crabs could still be consumed if the cooking water is used to prepare soups, sauces, pasta, etc. Potential cooking loss assuming discarding the cooking water may be discussed in the uncertainty section of the risk assessment, but a cooking loss of 0 percent should still be assumed for the RME scenario. A PCB cooking loss of 20% based on Zabik et al. should be assumed for the CTE scenario in the risk assessment."

CPG Issue # 7

Comment 109:

Page 93, Section 3.3.4.5, 1st sentence: The resident is assumed to reside adjacent to the river.

EPA staff recommendation: The residential scenario should be evaluated qualitatively in the risk assessment. Results from the recent sampling of the recreational fields may be considered in the qualitative evaluation. This scenario will need to be evaluated quantitatively at some point. Since the residential scenario will no longer be evaluated quantitatively in this risk assessment, but rather in the future, this section can be deleted in its entirety.

Comment 118:

Page 97, Section 3.3.4.8, Incidental Ingestion of Sediment, 2nd paragraph.

EPA staff recommendation: Since the residential scenario will no longer be evaluated quantitatively in this risk assessment, but rather in the future, this paragraph can be deleted in its entirety.

Comment 131:

Page 103, Section 3.3.4.8, Sediment and Surface Water Exposure Frequencies, 3rd paragraph.

EPA staff recommendation: Since the residential scenario will no longer be evaluated quantitatively in this risk assessment, but rather in the future, this paragraph can be deleted in its entirety.

CPG Issue #8

Comment 104:

See response to Comment 105 under CPG Issue #1.

Comment 128:

See response to Comment 128 under CPG Issue #3.

CPG Issue #9

Comment 78:

See response to Comment 78 under CPG Issue #4.

Baseline Ecological Risk Assessment

CPG Issue #10

Comment 8:

EPA July 11, 2011 comment: Until agreement is reached on the definition of reference condition through review and approval of the technical memorandum detailing the approach for developing background and reference conditions, terminology consistent with EPA guidance (1994b, 1997a) should be used. Delete "urban" before "reference" throughout document. This does not imply that EPA has made any decisions regarding the appropriateness of using urban conditions as reference sites, only that EPA would prefer to explore the issue thoroughly using the technical memorandum that is yet to be submitted.

EPA staff recommendation: No change from EPA's 7/11/11 comment. In addition, please change the wording used in Table 2.1 back to what was used in the original RARC submitted in July 2010, and as consistent with the PFD.

CPG Issue #11

Comment 34

Table 2-1 (pp 17-22).

EPA July 11, 2011 comment: The question posed relative to the egg number from estuarine benthic omnivores is not a risk question. This question needs to be revised to read "Is the fecundity of estuarine benthic omnivores (e.g. mummichog) from the LPRSA similar to the fecundity of benthic omnivores from appropriately selected reference sites."

EPA staff recommendation: The CPG may leave the risk question as it is, consistent with the wording in the PFD. However, egg numbers from literature must be presented in the risk assessment to provide context for evaluating the Passaic River numbers.

R2-0022628

EXHIBIT H

EPA Staff Recommended Revisions to Select Comments Disputed by CPG

Human Health Risk Assessment

CPG Issue #1:

Comments 100, 101, and 102:

These comments all relate to Page 90, Section 3.3.4, Paragraph 3: "As stated in USEPA's September 10, 2010 comments, the scenarios and exposure parameter assumptions are intended to capture exposures under a future site condition, when parks and open spaces have been improved and expanded or developed at sites currently under other uses. Such improvements could make people more likely to visit and spend more time along the river. USEPA Region 2 has directed that the same set of scenarios and exposure parameter assumptions be used to assess both current and potential future baseline site risks. As a revitalized and redeveloped riverfront is not the current condition, this approach will lead to overestimates of current exposures. However, as directed by USEPA Region 2, the same scenarios and exposure parameter assumptions are used to account for both current and future site conditions."

EPA staff recommendation: Replace the entire paragraph that is referenced above with:

"In accordance with USEPA Guidance (USEPA 1989b, USEPA 2001c), the scenarios and exposure parameter assumptions are intended to capture exposures under both current and future site conditions. All of the exposure pathways are currently complete. While expected improvements to the river and shoreline will likely increase the number of individuals utilizing the river, the exposure frequency and duration for some individuals already utilizing the river will not likely increase. As such, the use of combined current/future exposure assumptions is appropriate."

Comment [e1]: What guidance is this? RARC lists EPA 2001c as RAGS Part A, Process for Conducting Probabilistic RA, which does not seem relevant to the discussion.

Comment 105:

Page 92, Section 3.3.4.2, last paragraph: "Because the likelihood of swimming in the LPRSA depends on several factors, including access, riverbank type, adjoining land, and waterway uses, it may not be appropriate to include swimming as a potential exposure pathway throughout the river. The applicability of the swimming scenario throughout the LPRSA will be evaluated based on consideration of the above factors, as discussed in Section 3.3.5.

EPA July 11, 2011 comment: Delete and replace with: "In accordance with USEPA guidance (USEPA 1995, 2001d), comprehensive community master plans are a valuable source of information in determining reasonably anticipated future land use. Many municipalities and counties along the Lower Passaic River have published master plans that call for the expansion and improvement of parks and open space along the river that will lead to higher exposure in the future (City of Newark 2010, City of Newark et all 2004, Clarke et al 2004, Clarke et al 1999, Heyer et al 2003, Heyer et al 2002, Borough of Rutherford et al 2007). While the general usage types of the river may remain the same in the future, the usage frequency and number of access locations should increase over time based on these plans. This increased usage is taken into account in the exposure parameters discussed in Section 3.3.5."

EPA staff recommendation: This comment, and Comment 104 (which the CPG disputes under Issues #3 and #8), both relate to Section 3.3.4.2 of the RARC. The following language should be used to replace the language in Section 3.3.4.2, in its entirety:

R2-0022630

Section 3.3.4.3 Swimmer

It is assumed that recreational users of the LPRSA may occasionally engage in swimming in the river. Recreational swimmers include children (1 to 6 years), adolescents (7 to 18 years), and adults (>18 years). Given the visible deterrents to swimming along large sections of the river, including the presence of trash and debris and the generally urban setting of the river, the exposure frequency and duration for swimming is assumed to be relatively low, both currently and in the future. To be clear, the number of exposed individuals will likely increase as improvements to the shoreline and river are made, but the exposure frequency and duration for some individuals already engaging in this scenario are not likely to increase. It is assumed that the current/future swimmer may be exposed to COPCs in sediment and surface water while swimming via:

- Direct Contact (incidental ingestion and dermal contact) with near shore river and mudflat surface sediment;
- Direct contact (incidental ingestion and dermal contact) with river surface water; and
- Inhalation of COPCs that may volatilize into outdoor air from exposed mudflat sediment and/or surface water.

Note that swimming is included in New Jersey's designated uses of the freshwater portion of the river from the confluence with Second River to Dundee Dam (RM 8 – 17), where the water has a classification of FW2-NT/SE2, though this stretch of the river does not always meet the standards associated with this classification. While the lower portion of the river is not currently classified as suitable for swimming, New Jersey can change the classification as conditions warrant. The applicability of the swimming scenario throughout the LPRSA will be evaluated as part of the risk assessment, as discussed in Section 3.3.5 of this report.

Comment [e2]: It would be more accurate to state "frequently does not meet".

Comment 130:

Page 102-103, Section 3.3.4.8, "Sediment and Surface Water Exposure Frequencies," 2nd paragraph: "The USEPA Region2-directed sediment and surface water exposure frequencies for each receptor scenario are summarized in Table 3-5. The exposure frequencies reflect an improved and more attractive LPRSA where recreational activities involving contact with water are common (e.g., 259 days/year surface water exposure for the adult boater, 39 days/year sediment exposure for the adult swimmer). Since these frequencies do not represent current site conditions, their use will lead to overestimates of potential risks."

EPA July 11, 2011 comment: Delete and replace with:

> Sediment and surface water exposure frequencies for each receptor scenario are summarized in Table 3-5. The exposure frequencies for the angler, swimmer, wader, and boater reflect both current conditions on the river, as well as future conditions after shoreline improvements laid out in municipal master plans are carried out. Adult anglers, swimmers, and waders are assumed to fish, swim or wade in locations where they would contact sediment and surface water once a week during the summer months (13 weeks/year), or 13 days per year, for the RME scenario, and once every two weeks, or 7 days per year, for the CTE scenario. Adolescent anglers, swimmers, and waders are assumed to be exposed to sediment and surface water 3 days per week during the summer months, or 39 and 20 days per year respectively for the RME

and CTE scenarios. Anglers may catch fish on more days than is assumed here, but are not expected to contact sediment and surface water every day that they fish.

The surface water and sediment exposure frequency for the older child boater who canoes or kayaks is assumed to be equal to other recreational scenarios like swimming or wading, and is therefore assumed to occur 13 days/year for the RME scenario and 7 days/year for the CTE scenario.

Surface water exposure frequencies for the adult and teenage (14 to 18 years old) boaters are based on information provided by Passaic River boating clubs (PRRA 2010, Nereid Boat Club 2010). The rowing season extends from March through mid-November (37 weeks). Adult boaters row up to 7 days/week, for 1 to 2 hours/day; average frequency is 250 days/year (7 days/week x 37 weeks/year) and the CTE frequency is 111 days/year (3 days/week x 37 weeks/year). For the teenage boaters, the high school rowing season primarily is from late February through the end of May, and sometimes includes rowing minimally in the fall. The high school teams row 5 to 7 days per week for 1 to 2 hours per day. Based on this information, for teenage boaters (14 to 18 years old) the RME frequency is 98 days/year (7 days/week x 14 weeks/year) and the CTE frequency is 70 days/year (5 days/week x 14 weeks/year).

Exposure to sediment for the adult and teenage boaters will occur with a much lower frequency than exposure to surface water. Rowing locations south of Dundee Dam launch from docks, so contact with the riverbank happens when rowers flip out of the boat and need to wade in to get back in. It is, therefore, assumed that sediment contact occurs once a month for the RME scenario and once every two months for the CTE scenario. Accounting for the length of rowing season (37 weeks for adults and 14 weeks for teenage boaters), the adult sediment exposure frequency is 9 days/year for RME and 4 days/year for CTE; the teenage boater exposure frequency is 4 days/year from RME and 2 days/year for CTE."

EPA staff recommendation: No change from July 11, 2011 comment letter, except to add the following sentence after the second sentence of EPA's recommended language:

"To be clear, the number of exposed individuals will likely increase as improvements to the shoreline and river are made, but the exposure frequency and duration for some individuals already engaging in these scenarios are not likely to increase."

[Note: EPA agrees that if the risk assessment shows that the swimmer scenario is driving the risk, we will revisit our approach to this aspect of the assessment.]

CPG Issue #2

Comment 11:

Page 2, Section 1.1, 1st paragraph, as submitted in February 2011 RARC : "The LPRSA was increasingly urbanized for more than two centuries; it has served as the receiving environment for industrial and municipal waste discharges since the nineteenth century."

EPA July 11, 2011 comment: Add after that line at the end of the paragraph: "However, it is now increasingly used for recreational activities such as boating, fishing, and crabbing as parks and boat

ramps are actively being restored or newly established (site-specific information provided by Passaic River Rowing Association 2010; Nereid Boat Club 2010; City of Newark 2010).

EPA staff recommendation: No change from the July 11, 2011 comment letter, except to remove "crabbing" from the list of activities.

Comment 83:

Page 69, Section 3.3.1.1, 2nd paragraph: "The lower 6 miles are predominantly commercial and industrial with little public access."

EPA July 11, 2011 comment: Delete and replace with the following: "Adjacent land use is predominantly industrial in the lower river miles (near Newark Bay) and transitions to commercial, residential and recreational near RM4. Land use is increasingly residential and recreational above RM 8."

EPA staff recommendation: Delete and replace with the following:

"Adjacent land use is predominantly industrial in the lower river miles (near Newark Bay) and starts to include more commercial, residential, and recreational uses around RM 4, with the locations of Riverbank and Minish Parks."

Comment 84:

EPA Comment in July 11, 2011 letter: Add "Potential Access to Shore" icons at Pathmark Parking Lot, RM 6.5 eastern bank; at RM 5.0, west bank (across street from NJPAC); at RM 4.0, south bank (across Raymond Blvd. from Riverbank Park).

EPA staff recommendation: Add "Potential Access to Shore" icons at Pathmark Parking Lot, RM 6.5 eastern bank and at RM 4.0, south bank (across Raymond Blvd. from Riverbank Park). It is not necessary to place an icon at RM 5.0, though we do have anecdotal evidence that people do go near the water there.

Comment 86:

Page 80, Section 3.3.1.1., "Lower River Segment," 1st sentence: "The Lower River Segment (preliminarily defined as RM 0 to RM 6 based on salinity) is characterized as predominantly industrial/commercial in nature, with very little public access to the shoreline."

EPA July 11, 2011 comment: Rephrase as follows: "The Lower River Segment (preliminarily defined as RM 0 to RM 6 based on salinity) is characterized as predominantly industrial in the lower river miles (near Newark Bay) and transitions to commercial, residential and recreational near RM 4."

EPA staff recommendation: Rephrase as follows:

"The Lower River Segment (preliminarily defined as RM 0 to RM 6 based on salinity) is characterized as predominantly industrial in the lower river miles (near Newark Bay) and starts to become more commercial, residential, and recreational near RM 4."

Comment [e3]: This new phrasing ("starts to become more") also needs to be made in Section 1.1, 1st paragraph, 3rd sentence (Comment #10).

Comment 87:

Page 80, Section 3.3.1.1, "Lower River Segment": "The shoreline along this stretch of the river consists of active or abandoned industrial areas."

EPA July 11, 2011 comment: Delete and replace with "The shoreline along this stretch of the river consists of active or abandoned industrial areas up to RM4, but then transitions to thin strips of park land abutting the river as land use becomes more commercial and residential."

EPA staff recommendation: Delete and replace with:

"The shoreline along this stretch of river consists mainly of active or abandoned industrial areas up to RM 4, but then starts to include more thin strips of park land abutting the river as land use starts to become more commercial, residential, and recreational."

Comment 92:

Page 81, Section 3.3.1.1., "Upper River Segment": "The Upper River Segment (preliminarily defined as RM 10 to the Dundee Dam) transitions, with increasing distance upriver, from a mixture of industrial, commercial and some residential areas and public parks to more residential areas, compared with other sections of the river."

EPA July 11, 2011 comment: Delete sentence and replace with "The Upper River Segment (preliminarily defined as RM10 to the Dundee Dam) is the most residential and recreational segment of the river."

EPA staff recommendation: The CPG may add EPA's sentence (without the parenthetical) after the CPG sentence, rather than delete the CPG sentence and replace it with EPA's sentence.

CPG Issue #3

Comment 77:

Page 64, Section 3.3, 2nd paragraph, 1st sentence: "The LPRSA is a large and complex sediment site, and current site conditions reflect its long industrial history and urban setting."

EPA July 11, 2011 comment: Insert at the end of the sentence the following clause: ", although in the future, most of the river is increasingly expected to be used for recreational activities."

EPA staff recommendation: Add modified clause at the end of the sentence:

", although in the future, ~~large sections of~~ the river ~~are~~ is expected to be used ~~increasingly~~ to a greater extent for recreational activities."

Comment [e4]: Phrasing is awkward – suggest alternate language shown in track changes.

Comment 104:

Page 91, Section 3.3.4.2, 1st paragraph: "It is assumed that recreational users of the LPRSA may occasionally engage in swimming in the river. Recreational swimmers include children (1 to 6 years), adolescents (7 to 18 years), adults (>18 years). Given the visible presence of shoreline and floating debris and trash, the presence of pathogenic contamination, and the urban setting of the river, including lack of public beaches, it is anticipated that swimming now and in the foreseeable future will be limited. However, based on EPA's directive, it is assumed that both the current and future swimmer will be exposed to COPCs in sediment and surface water while swimming in the river via:.."

EPA July 11, 2011 comment: Delete and replace with the following: "Individuals of all ages may visit the Passaic River to swim. Swimming is included in New Jersey's designated use of the freshwater portion of the river from the confluence with Second River to Dundee Dam (RM 8-17), where the water has a classification of FW2-NT/SE2. Swimming under current conditions may be limited by the visible presence of shoreline and floating debris, and trash. However, once the parks that are already under construction are completed, and when other recreational improvements in municipal master plans are undertaken, future conditions are expected to provide greater access to and be more conducive to swimming. Therefore, it is assumed that the current and future swimmer will be exposed to COPCs through contact with sediment while entering and leaving the river, and while swimming. Adult (>18 years), adolescent (7 to 18 years old) and young child (1 to 6 years old) swimmers are assumed to be exposed to sediment and surface water via: ..."

EPA staff recommendation: See response to Comment 105 under CPG Issue #1. Use the language provided in that response to replace Section 3.3.4.2 in its entirety.

Comment 105:

See response for Comment 105 under CPG Issue #1.

Comment 128:

Page 101, Section 3.3.4.8, "Surface Water Exposure Time," 1st paragraph: "Given the highly developed and urbanized nature of the LPRSA, including the pathogenic contamination throughout the study area, frequent and extended periods of swimming, wading, or other activities involving intensive contact with surface water are not expected to occur under current or foreseeable future uses. Thus, the USEPA Region 20directed exposure times and frequencies for the receptor scenarios involving contact with surface water are likely to overestimate exposures in the LPRSA. The use of USEPA's national default swimming exposure time of 2.6 hours per event does not reflect site-specific conditions and was not intended for a water body with compromised water quality and no designated swimming areas. However, at the direction of USEPA, this default assumption is used in the baseline HHRA for the LPRSA. The USEPA-directed surface water exposure times for each receptor scenario are summarized in Table 3-4."

EPA July 11, 2011 comment: Delete and replace with the following, "The NJAC Surface Water Quality Standards classification for the Passaic River from RM 0 to 8 includes secondary contact recreation (E.G, boating and fishing), and from RM8 to 17 includes primary contact recreation (e.g., swimming and wading), among other uses. A number of boating and sculling clubs already make frequent use of the river (Passaic River Rowing Association 2010, Nereid Boat Club 2010) and improvements are being made

to boat ramps throughout the 17 miles (City of Newark 2010). Swimming under current conditions may be limited by the visible presence of shoreline and floating debris and trash. However, once the parks that are already under construction are completed, and when other recreational improvements planned in municipal master plans are undertaken, future conditions are expected to provide greater access to and be more conducive to swimming[1]. Therefore, exposure times and frequencies are designed for both current and future river users who will be exposed to COPCs in sediment and surface water, as summarized in Table 3-4."

Comment [e5]: Does this plan cover boat ramps throughout the LPRSA, or are additional references appropriate?

Comment [e6]: Suggest going with same text proposed by EPA for section 3.3.4.3 Swimmer.

"Given the visible deterrents to swimming along large sections of the river, including the presence of trash and debris and the generally urban setting of the river..."

EPA staff recommendation: Delete last sentence of EPA proposed language ("Therefore...") and replace with:

"The exposure times and frequencies summarized in Table 3-4 are designed to reflect both current and future river users. While the number of people utilizing the river in such a way as to be exposed to surface water will likely increase as improvements to the river are made, the exposure times and frequencies for particular individuals already utilizing the river in these ways are not expected to increase."

CPG Issue #4

Comment 7:

EPA July 11, 2011 comment: Since the entire RARC is subject to USEPA approval, the terms "directed for use by USEPA Region 2" or "USEPA Region 2-directed" are unnecessary specifications and should be deleted. Specific comments below provide many instances.

EPA staff recommendation: In general, no change from EPA's 7/11/11 comment, except as noted below.

Comment 78:

Page 64, Section 3.3, 2nd paragraph, last sentence: While use of some default or surrogate assumptions will be necessary in the remedial decision-making process, USEPA guidance documents stress the importance of using data that represent the characteristics of the local population(s) and site when possible and appropriate (USEPA 1989a, b, 1991a, 1997b, 1998a, 2000a).

EPA July 11, 2011 comment: delete and replace with "However, USEPA guidance (USEPA 1991a) also allows the use of default values developed by USEPA when there is a lack of site-specific data or consensus on which parameter value to choose, given a range of possibilities."

EPA staff recommendation: The CPG may add EPA's language after the CPG's last sentence, rather than delete it.

Comment 95:

Page 82, Section 3.3.2, 1st paragraph, 5th sentence: At the direction of USEPA Region 2, an additional receptor (Worker) not identified in the PFD has been included as a potential receptor.

[1] The national average for time spent swimming is 2.6 hours/day.

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EPA July 11, 2011 comment: Delete "At the direction of USEPA Region 2,"

EPA staff recommendation: EPA agrees to remove this comment; the referenced language may remain in the plan.

Comment 99:

Page 90, Section 3.3.4, 2nd paragraph: The values to be used for each of the RME and CTE exposure parameters are those that USEPA Region 2 directed CPG to use, were issued as directives on November 5, 2010, and are representative of USEPA default values. These values are presented in this Revised RARC Plan. On September 10, 2010, USEPA Region 2 provided comments on CPG's Draft RARC Plan. USEPA's comments included specific scenarios and exposure parameter values to be used in the baseline HHRA. The exposure pathways, receptors, and parameter values were provided in tabular form following *Risk Assessment Guidance for Superfund (RAGS) Part D* format (USEPA 2001c). These tabulated scenarios and parameter values are included as Appendix C of this Plan.

EPA July 11, 2011 comment: Delete 2nd paragraph (unnecessary explanation).

EPA staff recommendation: CPG may leave this paragraph in, rewording the beginning as follows:

"The values to be used for each of the RME and CTE exposure parameters are generally those that USEPA Region 2 directed CPG to use. All of EPA's directions are consistent with EPA guidance, practices, and policies for conducting risk assessments. These values are presented ...."

Comment [e7]: Recommend that "generally" be struck from this sentence, as all of the exposure parameters are directed by EPA for CPG to use.

CPG Issue #5

Comment 110 (combining 110b and 110d):

Page 94, Section 3.3.4.7: The ingestion rate is the amount of fish that an individual consumes on a daily basis based on averaging the reported consumption rate in one year over 365 days (i.e., an annualized rate). As directed by USEPA Region 2 and listed in Appendix C, the USEPA's default fish ingestion rates for recreational freshwater anglers cited in USEPA's Exposure Factors Handbook (USEPA 1997b) will be used. These rates are based on mail surveys of licensed anglers who pursue sportfishing in Maine, New York (Lake Ontario), and Michigan (Great Lakes), and include both consumers and non-consumers (USEPA 1997b). The fish ingestion rates for the adult, adolescent, and child angler receptors as selected by USEPA Region 2 are as follows:

- *Adult angler fish ingestion rate*: RME of 26 g/day (the 95th percentile in the USEPA's Exposure Factors Handbook), which is equivalent to approximately 40 half-pound meals/year, and CTE of 8 g/day (the recommended mean in the USEPA's Exposure Factors Handbook) (USEPA 1997b)
- *Adolescent angler (ages 7 to 18 years) fish ingestion rate*: RME of 17 g/day and CTE of 5 g/day, based on USEPA's assumption that the intake of the adolescent is approximately two-thirds that of the adult (USEPA 1997b)
- *Child angler (ages 1 to 6 years) fish ingestion rate*: RME of 8 g/day and CTE of 3 g/day, based on USEPA's assumption that the intake of the child is approximately one-third that of the adult (USEPA 1997b)17

EPA July 11, 2011 comment: Delete and replace with, "The ingestion rate is the amount of fish that an individual consumes on a daily basis, based on averaging the reported consumption rate in 1 year over 365 days. Ingestion rates for fish have been annualized and are presented in grams eaten per day (g/day). The ingestion rate assumes the fish are caught while angling from the LPRSA only. It is expected that ingestion of fish from local sources will be the main source of fish consumption for the anglers. For consumption of fish, ingestion rates based on data collected for recreational anglers may obtained from the Exposure Factors Handbook (EFH) (USEPA 1997b), three surveys conducted in New Jersey (Burger 2002, May and Burger 1996, Center for Public Interest Polling and New Jersey Marine Sciences 1993, Burger et al 1998) and one survey conducted in New York (Connelly et al 1992). Only the 1997 EFH, Burger 2002 and Connelly et al 1992 contain enough information to calculate statistical distributions for the ingestion rates. Only the Burger 2002 and Connelly et al 1992 (as analyzed and applied in the externally peer-reviewed Human Health Risk Assessment for the Hudson River in TAMS Consultants 2000) included data from the New York/New Jersey Harbor, which encompasses the tidal portion of the Lower Passaic River (the 1997 EFH data were from surveys of anglers in Michigan, Maine and the Great Lakes). Burger 2002 was from a survey conducted in the Newark Bay Complex. Connelly et al (1992) was a New York Statewide Angler survey, whose data were used to calculate ingestion rates for the peer-reviewed Human Health Risk Assessment for the Hudson River (TAMS Consultants 2000). Therefore, the fish ingestion rate for the Lower Passaic River RME adult angler (44 g/day) is calculated by averaging the high end (approximately 90th percentile) estimates from Burger 2002 (57 g/day) and Connelly et al 1992 (32 g/day). For the CTE value (13 g/day), the average of the mean of 22 g/day from Burger 2002 and the 50th percentile value of 4 g/day from Connelly et al 1992 is used.

A creel angler survey was conducted in the Lower Passaic River, as reported in Ray et al 2007. The work plan for this survey was submitted to USEPA for review, but not approved; therefore, results from the survey cannot be used in this risk assessment. However, it is noted that the fish ingestion rates for the RME adult based on data from Burger 2002 (57 g/day) and Connelly et al 1992 (32 g/day) are consistent with the ingestion rate calculated from data reported in Ray et al 2007 (28 g/day). Ray et al 2007 reported that only 7 anglers of those surveyed reported consuming fish. The small number of consumers limits statistical evaluation of the consumption rate to the maximum reported consumption rate of 28 g/day (USEPA 1992d)."

Comment [e8]: As discussed at 12/1 meeting, the maximum consumption rate from Ray et al. is 23.95 g/day (Table 3 of Ray et al. 2007) not 28 g/day. The 28 g/day rate listed on page 525 of Ray et al. 2007 is the result of a sensitivity analysis, although this is not clearly spelled out in the text of the article.

As also discussed at the 12/1 meeting, the maximum is not the correct statistic for comparison. For a correct comparison with Burger's 57 g/day and Connelly et al's 32 g/day (both 90th percentile values for consuming anglers), a 90th percentile rate for LPR consuming anglers should be used, which is 11.5 g/day.

EPA staff recommendation: No change from language in July 11, 2011 comment letter, except to add the following language after the first sentence, "The following analysis of ingestion rates is based on EPA's Technical Memorandum on Fish and Crab Consumption Rates dated July 25, 2011." The memorandum should also be referenced as an appendix to the report.

Comment 113:

Page 96, Section 3.3.4.7, Crab Ingestion Rate: For crabs, USEPA has directed that consumption rates be based on a 1999 survey of Newark Bay anglers, including crabbers (Burger 2002). Based on the responses of 110 anglers who reported consuming crab, a mean crab ingestion rate was derived by multiplying the number of crab meals eaten per month by the number of crabs eaten at each meal by the number of months per year that anglers go crabbing (and presumably eat their catch), assuming the average serving size from one crab is 70 g. Based on the Burger analysis, USEPA Region 2 has determined the following crab consumption rates:

- *Adult receptor crab ingestion rate*: RME of 23 g/day and CTE of 16 g/day

- *Adolescent receptor (ages 7 to 18 years) crab ingestion rate*: RME of 15 g/day and CTE of 11 g/day, based on the assumption that the intake for the adolescent is approximately two-thirds that of the adult (USEPA 1997b)
- *Child receptor (ages 1 to 6 years) crab ingestion rate*: RME of 8 g/day and CTE of 5 g/day, based on the assumption that the intake for the child is approximately one-third that of the adult (USEPA 1997b)

EPA July 11, 2011 comment: Delete and replace with, "The ingestion rate is the amount of crab that an individual consumes on a daily basis based on averaging the reported consumption rate in 1 year over 365 days. Ingestion rates for crab have been annualized and are presented in grams eaten per day (g/day). The ingestion rate assumes the crabs are caught while angling from the LPRSA only. It is expected that the main source of crab for ingestion is from the LPRSA.

Two studies provided data on crab consumption (Burger 2002; Burger et al 1998). Consistent with the recommendations in RAGS Part A, a crab consumption rate was calculated at the 90th percentile, since the 95th percentile was not available. In Burger (2002), for people who only crabbed, approximately 4% of all respondents (6.3% of "consumers only") ate more than 4,200 g/month. Similarly, about 15% of all respondents (23% of "consumers only") ate more than 1,400 g/month. Excluding the non-consumers, the 90th percentile crab ingestion rate for crab consumers is estimated to be 3,590 g/month, or 32 g/day (assuming crabs are consumed 3.3 months of the year, per Table 2 of the paper). The mean crab ingestion rate is 16 g/day, based on data provided in Table 2 of the Burger (2002) paper (assuming that 5,760 g/year is consumed during 3.3 months of the year). This mean crab ingestion rate is consistent with the mean value of 16.6 g/day from Barnegat Bay (Burger et al. 1998). Burger et al. 1998 did not report enough information to support statistical calculations of a 95th percentile ingestion rate. Other studies in this area reported crab consumption but an ingestion rate could not be calculated based on the information presented (Burger et al. 1999 and Kirk-Pflugh et al. 1999).

The 90th percentile crab ingestion rate of 32 g/day is selected as the adult RME ingestion rate and the mean crab ingestion rate of 16 g/day is selected as the adult CTE rate. Ingestion rates for the child and adolescent receptors are estimated assuming rates 1/3 and 2/3 those of the adult ingestion rates, respectively, as is assumed for fish ingestion."

EPA staff recommendation: No change from language in July 11, 2011 comment letter, except to add the following language after the first sentence, "The following analysis of ingestion rates is based on EPA's Technical Memorandum on Fish and Crab Consumption Rates dated July 25, 2011." The memorandum should also be referenced as an appendix to the report.

CPG Issue #6

Comments 112, 114, and 135:

[The CPG has agreed to send EPA studies relevant to its request to discuss CTE scenarios with EPA. EPA staff will review the studies to determine whether we think there is a basis to engage in those discussions – and therefore withdraw this issue from the dispute resolution process.]

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Comment 115:

Page 97, Section 3.3.4.7, Cooking Loss for Crab: As directed by USEPA Region 2, for both the RME and CTE crab consumption scenarios, a preparation and cooking loss factor of zero percent will be used for all contaminants. This is based on USEPA Region 2's assumption that anglers consume the cooking water every time they eat crab. The assumption of no cooking loss is a very conservative assumption, particularly for the CTE scenario. Based on NJDEP survey data, most individuals who catch and consume crabs do not eat the hepatopancreas, and many remove it prior to cooking (Macro 2007, 2008; NJDEP 2002; ORC Macro 2006). Even if the hepatopancreas is not removed prior to cooking, contaminants in the hepatopancreas that may be released during cooking do not result in higher concentrations in the muscle tissue (Zabik et al. 1992). Removal of the hepatopancreas prior to cooking and discarding the cooking water is also recommended by NJDEP's crab consumption advisory (NJDEP and NJDHSS 2010). USEPA Region 2 has agreed to review the appropriateness of assuming no cooking loss for the CTE crab consumption scenario; the values to be used in the baseline HHRA may be amended pending the outcome of USEPA Region 2's review.

EPA July 11, 2011 comment: Delete and replace with, "A cooking loss factor accounts for the amount of contaminant in tissue that is lost during the cooking process and not consumed by the receptor. Blue crabs are most often cooked whole by boiling or steaming (Sea Grant Marine Advisory Program 2006). Exposure to the contaminant depends not only of the specific part of the crab consumed, but also on the method of cooking. NJDEP (2010) reports that no specific cooking method can be relied on to reduce the chemical contaminant levels in blue crabs. Because the crab is cooked whole, even if the consumer does not eat the hepatopancreas, exposure to the chemical contaminant may still occur if the crab is cooked before the hepatopancreas is removed and if the liquid used to boil the crab is used in juices, sauces, bisques, or soups. It should be assumed that the cooking liquid is consumed along with the crabmeat. Therefore, cooking loss for crabs is assumed to be 0 percent for all contaminants under the RME and CTE scenarios, because data are not currently available from EPA or published literature to support any type of reduction in concentration under this type of exposure scenario. A study published by Zabik et al. (1992), entitled "Effect of Preparation and Cooking on Contaminant Distributions in Crustaceans: PCBs in Blue Crab," was reviewed. The study showed that boiling or steaming reduced PCB concentrations by greater than 20 percent in tissue, and that the cooking water contained about 80 percent of the PCBs that were lost from the crabs (the study author was contacted to confirm these results). Thus, most of the PCBs lost from the crabs could still be consumed if the cooking water is used to prepare soups, sauces, pasta, etc. Potential cooking loss assuming discarding the cooking water may be discussed in the uncertainty section of the risk assessment, but a cooking loss of 0 percent should still be assumed for the RME and CTE scenarios in the risk assessment."

EPA staff recommendation: Since EPA will allow the use of a cooking loss of 20% for PCBs under the CTE scenario, please use the following revised language:

"A cooking loss factor accounts for the amount of contaminant in tissue that is lost during the cooking process and not consumed by the receptor. Blue crabs are most often cooked whole by boiling or steaming (Sea Grant Marine Advisory Program 2006). Exposure to the contaminant depends not only of the specific part of the crab consumed, but also on the method of cooking. NJDEP (2010) reports that no specific cooking method can be relied on to reduce the chemical contaminant levels in blue crabs. Because the crab is cooked whole, even if the consumer does not eat the hepatopancreas, exposure to the chemical contaminant may still occur if the crab is cooked before the hepatopancreas is removed and if the liquid used to boil the crab is used in juices, sauces, bisques, or soups. It should be assumed

that the cooking liquid is consumed along with the crabmeat. Therefore, cooking loss for crabs is assumed to be 0 percent for all contaminants under the RME, because data are not currently available from EPA or published literature to support any type of reduction in concentration under this type of exposure scenario. A study published by Zabik et al. (1992), entitled "Effect of Preparation and Cooking on Contaminant Distributions in Crustaceans: PCBs in Blue Crab," was reviewed. The study showed that boiling or steaming reduced PCB concentrations by greater than 20 percent in tissue, and that the cooking water contained about 80 percent of the PCBs that were lost from the crabs (the study author was contacted to confirm these results). Thus, most of the PCBs lost from the crabs could still be consumed if the cooking water is used to prepare soups, sauces, pasta, etc. Potential cooking loss assuming discarding the cooking water may be discussed in the uncertainty section of the risk assessment, but a cooking loss of 0 percent should still be assumed for the RME scenario. A PCB cooking loss of 20% based on Zabik et al. should be assumed for the CTE scenario in the risk assessment."

Comment [e9]: Other lipophilic chemicals present in the crab tissue are expected to behave in a similar fashion. Why is the CTE cooking loss factor limited to PCBs?

CPG Issue # 7

Comment 109:

Page 93, Section 3.3.4.5, 1st sentence: The resident is assumed to reside adjacent to the river.

EPA staff recommendation: The residential scenario should be evaluated qualitatively in the risk assessment. Results from the recent sampling of the recreational fields may be considered in the qualitative evaluation. This scenario will need to be evaluated quantitatively at some point. Since the residential scenario will no longer be evaluated quantitatively in this risk assessment, but rather in the future, this section can be deleted in its entirety.

Comment 118:

Page 97, Section 3.3.4.8, Incidental Ingestion of Sediment, 2nd paragraph.

EPA staff recommendation: Since the residential scenario will no longer be evaluated quantitatively in this risk assessment, but rather in the future, this paragraph can be deleted in its entirety.

Comment 131:

Page 103, Section 3.3.4.8, Sediment and Surface Water Exposure Frequencies, 3rd paragraph.

EPA staff recommendation: Since the residential scenario will no longer be evaluated quantitatively in this risk assessment, but rather in the future, this paragraph can be deleted in its entirety.

CPG Issue #8

Comment 104:

See response to Comment 105 under CPG Issue #1.

R2-0022641

Comment 128:

See response to Comment 128 under CPG Issue #3.

CPG Issue #9

Comment 78:

See response to Comment 78 under CPG Issue #4.

Baseline Ecological Risk Assessment

CPG Issue #10

Comment 8:

EPA July 11, 2011 comment: Until agreement is reached on the definition of reference condition through review and approval of the technical memorandum detailing the approach for developing background and reference conditions, terminology consistent with EPA guidance (1994b, 1997a) should be used. Delete "urban" before "reference" throughout document. This does not imply that EPA has made any decisions regarding the appropriateness of using urban conditions as reference sites, only that EPA would prefer to explore the issue thoroughly using the technical memorandum that is yet to be submitted.

EPA staff recommendation: No change from EPA's 7/11/11 comment. In addition, please change the wording used in Table 2.1 back to what was used in the original RARC submitted in July 2010, and as consistent with the PFD.

CPG Issue #11

Comment 34

Table 2-1 (pp 17-22).

EPA July 11, 2011 comment: The question posed relative to the egg number from estuarine benthic omnivores is not a risk question. This question needs to be revised to read "Is the fecundity of estuarine benthic omnivores (e.g. mummichog) from the LPRSA similar to the fecundity of benthic omnivores from appropriately selected reference sites."

EPA staff recommendation: The CPG may leave the risk question as it is, consistent with the wording in the PFD. However, egg numbers from literature must be presented in the risk assessment to provide context for evaluating the Passaic River numbers.

R2-0022642

EXHIBIT I

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December 15, 2011

Sarah Flanagan, Esquire
USEPA Region 2
290 Broadway
New York, New York 10002

Re: Risk Assessment and Risk Characterization (RARC) Work Plan Dispute Resolution - Lower Passaic River Study Area (LPRSA) Remedial Investigation/Feasibility Study (RI/FS) - CERCLA Docket No. 02-2007-2009

Dear Ms. Flanagan:

I am writing on behalf of the Lower Passaic River Cooperating Parties Group (CPG) in continuance of Region 2 and CPG's ongoing dispute resolution process on the Risk Assessment and Risk Characterization (RARC) Plan. As requested by Region 2, this letter summarizes the CPG's current understanding of, and position on, each of the eleven dispute resolution issues identified in CPG's August 12, 2011 letter to Region 2 and discussed at our December 1, 2011 meeting. As a follow-up to the December 1, 2011 meeting, on December 8, the CPG provided comments on Region 2's document entitled, "*EPA Staff Recommended Revisions to Select Comments Disputed by CPG*" (dated December 5, 2011) ("Recommended Revisions"). CPG's comments included recommended editorial revisions to improve clarity and consistency, questions on two references cited, and identification of an issue that was raised during the December 1 meeting, but not adequately addressed in Region 2's Recommended Revisions.

The CPG does not agree with the proposed resolutions detailed in Region 2's Recommended Revisions for RARC HHRA Issues 2, 3, 4, 8, and 9; however, in the interest of moving forward, the CPG has decided to work within the confines that Region 2 has established for these five issues, but reserves its right to independently document, through the use of transmittal and cover letters, as well other correspondence, its continuing differences with EPA on these five issues. The CPG's understanding of the status on the other six issues is summarized below:

- *HHRA Issue 6 – Dialogue on Cooking Loss.* The CPG has provided EPA with relevant technical references and a synopsis of the issue, and is awaiting Region's 2 feedback regarding engaging in a technical dialogue on this topic outside of the dispute resolution process.
- *HHRA Issue 7 - Residential Sediment Exposure.* The CPG accepts Region 2's decision to evaluate the residential scenario qualitatively in the HHRA. The CPG understands that Region 2 is internally deliberating the approach for evaluating potential residential exposures at some point in the future; as such, the CPG requests that EPA keep the CPG informed and involved in this process.
- *ERA Issue 10 – Urban Background Definition.* The CPG wishes to discuss this issue, specifically to point out that the term "urban" was used in the Region 2-approved Problem Formulation Document (PFD) and therefore, Region 2's directive to strike the

word "urban" from the entirety of the RARC is inconsistent as well as unfounded. "Urban" should be used in a manner consistent with the approved PFD.

- *ERA Issue 11 – Mummichog Testable Risk Hypothesis.* CPG understands that Region 2 has withdrawn its comment on this issue.

Finally, with respect to HHRA Issue 1 (Combined/Single Exposure Scenarios) and HHRA Issue 5 (Fish and Crab Ingestion Rates and Fraction Ingested of 1), the CPG does not agree that Region 2's Recommended Revisions satisfactorily address the core of CPG's dispute, and respectfully requests that these issues be the focus of discussions at the next EPA-CPG dispute resolution meeting.

The CPG recognizes EPA's responsibility to ensure protectiveness in the face of scientific uncertainty and how that responsibility is carried out in risk assessments. The CPG appreciates EPA's desire for, and mandate to apply, appropriate conservatism to ensure health-protectiveness. However, the CPG strongly believes that Region 2 has developed and directed a level of conservatism that is inconsistent with the concept of Reasonable Maximum Exposure (RME), and is unnecessary and inappropriate for developing exposure parameters and scenarios for the baseline human health risk assessment (HHRA) of the LPRSA. Moreover, the net effect of these multiple compounding conservatisms directed by Region 2 will be estimates of exposure that go far beyond the intent of the RME as laid out in the Agency's own guidance and policy (USEPA 1989, 1992, 2001, 2004).

The HHRA would be more informative and better fulfill its purpose as a remedial decision-making tool if the recognized variability and uncertainty inherent in human exposures at the LPRSA were explicitly acknowledged in the RARC and considered in the risk assessment process. Region 2's prescriptive approach of allowing only one current/future exposure scenario defined by one set of unrealistic and largely unsupported RME (and Central Tendency Exposure (CTE)) assumptions is inappropriate and imprudent, particularly given the complexity of the LPRSA, the substantial scope of the Remedial Investigation and Feasibility Study (RI/FS), the level of sophistication and site-specificity invested in other aspects of the project, and the anticipated significant remedial costs. As stated in the Agency's *Policy for Risk Characterization* memorandum (USEPA, 1995):

> ". . . we must fully, openly, and clearly characterize risks. In doing so, we will disclose the scientific analyses, uncertainties, assumptions, and science policies which underlie our decisions. . . There is value in sharing with others the complexities and challenges we face in making decisions in the face of uncertainty."

The path that EPA is choosing for the HHRA fails to adequately separate the baseline risk assessment and risk management processes. It is CPG's position that the process is being reversed for the LPRSA, with risk management decisions preceding the baseline assessment results. This approach is contrary to the Agency's *Guidance on Risk Characterization for Risk Managers and Risk Assessors* (USEPA, 1992), which clearly defines expectations for risk assessments and the need to avoid a "short-hand" approach that does not fully convey the range of information considered and used in developing the assessment, and necessary for informed decision-making. The approach also contradicts the current administrations and

EPA's current initiatives to incorporate sound science throughout its regulatory programs in order to provide "the foundation for credible decision-making." Region 2's desire for simplicity and internal consistency (i.e., regional precedence) and its resistance to applying sound scientific principles to key aspects of the risk assessment process, including the derivation of site-specific fish and crab consumption rates, will result in an outcome that has little value to the CPG, stakeholders, and ultimately, EPA.

Summary of CPG Position on Dispute Resolution Issues

1. ***Directive to evaluate only one set of exposure assumptions representing a hypothetical future scenario (Comments 100, 101, 102, 105, 130)***

   CPG Position: The CPG does not agree with Region 2's decision or rationale to evaluate only one set of scenarios to represent exposures under both current and future site conditions. While Region 2's recommended revisions to the RARC text reconcile some of the internal contradictions contained in Region 2's original comments providing its directive text changes, the fundamental issue of basing current exposure scenarios on an overly conservative and unrealistic vision of the river remains. Region 2's offer to revisit the swimming scenario assumptions if the pathway ends up driving site risk demonstrates that Region 2 recognizes that the directed assumptions (e.g., adolescents ages 7 to 12 swim 39 days per year for 2.6 hours per event for 12 years) are unrealistic and unsupported for the LPRSA under current, or for that matter, future site conditions.

   By providing directive values for one site condition that is intended to represent both the current and future conditions at the LPRSA, the ability to distinguish between risks for these two time periods and provide a realistic estimate of current site risk, is lost. As discussed at the December 1 meeting, the risk assessment process is intended to consider a range of alternative scenarios, both current and future, to allow EPA to develop an informed risk management decision. This type of an approach is being followed in the Baseline Ecological Risk Assessment (BERA) for the LPRSA. At a minimum, the alternatives to the various exposure parameters, and their associated variability and uncertainty, should be fully discussed in the RARC Plan and the HHRA itself. Under its current construct, the RARC provides for human health risk estimates that will be driven by a limited, unrealistic, and in some instances non-site specific (e.g., use of a national default exposure time of 2.6 hours for each swimming event[1]), set of assumptions and provide minimal context regarding the full range of uncertainty.

2. ***Stipulated language, as well as re-wording or deletion of approved Problem Formulation Document language, that inaccurately portrays current conditions and land uses (Comments 4, 11, 83, 84, 86, 87, 89, 92)***

   CPG Position: CPG accepts Region 2's December 5 recommended revisions to the above comments, with the recommended clarifications identified in CPG's December 7 comments

[1] As documented in the CPG's February 10, 2011 Position Paper (Table A-3 of Appendix A), swimming exposure times (ET) that are less than 2.6 hours and better reflect site characteristics have been used in HHRAs both inside and outside of Region 2, including Aberjona River in Massachusetts, Grasse River and Peconic River in New York, Lower Fox River in Wisconsin, and Calcasieu Estuary in Louisiana.

on revised text for comment 86 to ensure consistency throughout the RARC. The CPG reserves its rights to continue to document its disagreement with Region 2 on this issue.

3. ***Stipulated language regarding the impact of future land use changes on future exposures (Comments 4, 77, 81, 91, 94, 104, 105, 128)***

   CPG Position: CPG accepts Region 2's December 5 recommended revisions to the above comments, with the recommended clarifications identified in CPG's December 7 comments on revised text for comments 77 and 128 to ensure consistency throughout the RARC. The CPG reserves its rights to continue to document its disagreement with Region 2 on this issue.

4. ***Directive to remove all statements attributing EPA as source of directed exposure scenarios and parameter assumptions as well as language that provided the technical basis for alternative positions (Comments 7, 78, 95, 99, and several specific comments)***

   CPG Position: CPG accepts Region 2's December 5 recommended revisions to the above comments, with the recommended clarification identified in CPG's December 7 comments on revised text for comment 99 to ensure accuracy.

5. ***Fish and crab consumption rates and assumption of FI of 1 (Comments 1110b, 110d, 111, 113 and USEPA July 25, 2011 Tech Memo)***

   CPG Position: CPG does not accept Region 2's recommended revisions to the above comments. CPG has multiple concerns and significant issues with Region 2's analysis and description of the fish and crab ingestion rates and fraction ingested assumption of 1. CPG's disagreements with Region 2's fish and crab consumption rates and fraction ingested (FI) value, including EPA's July 25 Technical Memorandum on this topic, were documented in its September 6, 2011 Position Paper. These differences were not adequately discussed during the December 1 meeting and EPA's position is wholly inadequate and not technically supported by its July 25, 2011 Technical Memorandum (Tech Memo) which has serious and significant technical flaws. Key concerns are summarized here as they relate to the discussion of this topic in Region 2's December 5 Recommended Revisions document; however, all of the comments provided in CPG's review and critique of EPA's July 25 Tech Memo should be considered in the analysis of this dispute. One of the CPG's primary concerns regarding Region 2's RARC text summarizing the basis of the selected consumption rates is its lack of acknowledgement of the variability and uncertainty in the studies used and the range of plausible rates. Given the importance of the fish and crab consumption pathways, the limited and inaccurate summary provided in the Recommended Revisions document is completely inadequate.

   Key concerns on the specific text provided in the Recommended Revisions are as follows:

   > *EPA July 11, 2011 Comment 110, first paragraph, third and fourth sentences*: "For consumption of fish, ingestion rates based on data collected for recreational anglers may [sic] obtained from the Exposure Factors Handbook (EFH) (USEPA 1997b),

three surveys conducted in New Jersey (Burger 2002, May and Burger 1996, Center for Public Interest Polling and New Jersey Marine Sciences 1993, Burger et al 1998) and one survey conducted in New York (Connelly et al 1992). Only the 1997 EFH, Burger 2002 and Connelly et al 1992 contain enough information to calculate statistical distributions for the ingestion rates. Only the Burger 2002 and Connelly et al 1992 (as analyzed and applied in the externally peer-reviewed Human Health Risk Assessment for the Hudson River in TAMS Consultants 2000) included data from the New York/New Jersey Harbor."

There are multiple issues and inaccuracies in these statements, including:

1. EFH (1997) is now out of date;
2. The household fish consumption survey conducted by the Center for Public Interest Polling and New Jersey Marine Sciences (1993) is a statewide survey that is not relevant to developing long-term ingestion rates for recreational anglers at the LPRSA ;
3. Connelly et al. (1996) should be included as one of the New York surveys given that it was designed to collect long-term fish consumption data and avoid the limitations associated with the Connelly et al. (1992) study;
4. Given that Connelly et al. (1992) was a statewide angler survey, it is misleading to say it is representative of fishing in the NY/NJ harbor area, as evidenced by the differing demographics of the angler population in Connelly et al. (1992) and LPRSA anglers; and
5. There is only one site-specific creel/angler survey for the Lower Passaic River. The survey conducted by Tierra Solutions in 2000-01 should be listed, as it provides data sufficient for calculating statistical distributions for ingestion rates (and Region 2 was provided these data in 2002). Preemptive to Region 2's disagreement with the use of, and sanctions against even citing this work, the 2000-01 creel/angler survey was not only favorably peer reviewed by a panel of experts, it won high praise for the design, execution, and precedent-setting thoroughness.

The CPG believes that many of the inaccurate statements stem from the flawed scientific review and analysis process presented in EPA's July 25 Tech Memo. The study selection and review criteria were incomplete, largely irrelevant, and inconsistent with those used by EPA in evaluating studies for their suitability for developing recommended exposure parameter values presented in the EFH.[2] Had Region 2 implemented a more objective and technically defensible set of selection and review criteria, including soundness, applicability and utility to the task at hand, clarity and completeness, variability and uncertainty, and peer review, the inadequacies of the two studies selected by Region 2 to derive consumption

[2] EPA's Exposure Factors Handbook (EFH) 2011 considerations for study selection include: (1) soundness (adequacy of approach and minimal or defined bias); (2) applicability and utility (focus on the exposure factor of interest, representativeness of the population, currency of the information, and adequacy of the data collection period); (3) clarity and completeness (accessibility, reproducibility, and quality assurance); (4) variability and uncertainty (variability in the population and uncertainty in the results); and (5) evaluation and review (level of peer review and number and agreement of studies).

rates would have been apparent. None of these significant issues and limitations are acknowledged or addressed in either the Recommended Revisions or EPA's July 25 Tech Memo.

EPA July 11, 2011 comment 110, second paragraph: "A creel angler survey was conducted in the Lower Passaic River, as reported in Ray et al 2007. The work plan for this survey was submitted to USEPA for review, but not approved; therefore, results from the survey cannot be used in this risk assessment. However, it is noted that the fish ingestion rates for the RME adult based on data from Burger 2002 (57 g/day) and Connelly et al 1992 (32 g/day) are consistent with the ingestion rate calculated from data reported in Ray et al 2007 (28 g/day). Ray et al 2007 reported that only 7 anglers of those surveyed reported consuming fish. The small number of consumers limits statistical evaluation of the consumption rate to the maximum reported consumption rate of 28 g/day (USEPA 1992d)."

The CPG has numerous issues with this paragraph, including:

1. The fact that the 2000-01 Tierra Creel/Angler Survey (CAS) work plan was not approved is a wholly inadequate basis for dismissing results of the <u>only</u> site-specific study for the Lower Passaic River, particularly given that it was peer reviewed, and neither of the two studies selected by Region 2 was performed using an EPA-approved work plan;
2. The maximum consumption rate from Ray et al. (2007) is 23.95 g/day not 28 g/day. The 28 g/day rate listed on page 525 of Ray et al. (2007) is the result of a sensitivity analysis, although this is not clearly spelled out in the text of the article – this point has been made to Region 2 in both the CPG's September 6, 2011 Position Paper and during the December 1 meeting;
3. It is not appropriate to apply EPA's (1992) guidance for calculating exposure point concentrations to the statistical analysis of the CAS survey data. The proper statistical analysis of these data requires use of angler-specific survey weights, as described in Ray et al. (2007) and the CAS work plan; and
4. Region 2 has incorrectly compared the maximum from the Tierra CAS with the 90th percentile rates derived by Region 2 from the Burger (2002) and Connelly et al. (1992) studies, and stated that the rates are "consistent." When comparable statistics are used for comparison, it is readily apparent that the ingestion rates based on Burger (2002) (57 g/day) and Connelly et al. (1992) (32 g/day) are <u>not consistent</u> with the 90th percentile rate for LPR consuming anglers of 11.5 g/day calculated from the Tierra CAS.

EPA July 11, 2011 comment 113, second paragraph: "Two studies provided data on crab consumption (Burger 2002; Burger et al 1998). Consistent with the recommendations in RAGS Part A, a crab consumption rate was calculated at the 90th percentile, since the 95th percentile was not available. In Burger (2002), for people who only crabbed, approximately 4% of all respondents (6.3% of "consumers only") ate more than 4,200 g/month. Similarly, about 15% of all respondents (23% of "consumers only") ate more than 1,400 g/month. Excluding the non-consumers, the

> 90th percentile crab ingestion rate for crab consumers is estimated to be 3,590 g/month, or 32 g/day (assuming crabs are consumed 3.3 months of the year, per Table 2 of the paper). The mean crab ingestion rate is 16 g/day, based on data provided in Table 2 of the Burger (2002) paper (assuming that 5,760 g/year is consumed during 3.3 months of the year). This mean crab ingestion rate is consistent with the mean value of 16.6 g/day from Barnegat Bay (Burger et al. 1998). Burger et al. 1998 did not report enough information to support statistical calculations of a 95th percentile ingestion rate. Other studies in this area reported crab consumption but an ingestion rate could not be calculated based on the information presented (Burger et al. 1999 and Kirk-Pflugh et al. 1999)."

The CPG has previously documented numerous concerns with the use of the Burger (2002) study to derive crab (as well as fish) consumption rates, most recently articulated in the September 6, 2011 Position Paper. These include:

- the lack of reproducibility of Burger's data and limited statistics provided in Burger (2002),
- the inappropriateness of the data for estimating long-term consumption rates due to the survey methodology, including lack of a sound sampling design, recall bias (crabbing and consuming behaviors are based on one interview with each crabber during warm weather), and data collection methods;
- the lack of any discussion of survey weighting in the data analysis; and
- numerous unsupported assumptions used in calculating the annual consumption rate, including an assumed edible crab weight (70 grams) that is considerably higher than typical weights reported by CPG and NJDEP (40-45 grams).

These uncertainties are then compounded by Region 2's flawed methodology for utilizing the Burger (2002) data to develop an RME consumption rate, which is poorly described and documented in the Recommended Revisions. Following Region 2's analysis, the RME crab consumption rate of 32 g/day equates to consumption of approximately 263 crabs from the LPRSA per year[3]. When coupled with Region 2's assumed 30 year exposure duration for the recreational angler, this equates to nearly 8000 crabs from the LPRSA over a lifetime. When put into these terms, the absurdity of Region 2's RME and CTE crab consumption rates for the LPRSA is obvious, and underscores the inappropriateness of Region's 2 assumption that all of the crab consumed comes from the LPRSA (i.e., fraction ingested value is 1). All of these issues confirm that Region 2's consumption rates and fraction ingested values are not valid or appropriate for use in the baseline HHRA for the LPRSA. The CPG maintains that the ongoing year-long creel/angler survey of the entire Study Area will provide the data needed to derive robust, site-specific consumption rates for use in the baseline HHRA.

[3] Calculated assuming 3,590 grams of LPRSA crab/month, 3.3 months/year of crab consumption, and edible tissue weight of 45 grams/crab (average for LPRSA crabs caught in CPG's FSP2 2009 tissue sampling program).

6. ***Retraction of earlier agreement to discuss cooking loss options with CPG (Comments 112, 114, 115, 135)***

   CPG Position:

   The CPG provided a document to Region 2 on December 7, 2011 entitled, *"Literature on Cooking Loss in Fish Tissue"* and agreed to provide copies of the relevant papers to Region 2 during the week of December 12. In addition, on December 12, 2011, the CPG provided a document entitled, "Synopsis on Cooking Loss Topic" which outlines the basis of the issue that the CPG wishes to discuss with Region 2. To provide for a meaningful technical dialogue on this topic, the CPG recommends that this exchange be conducted outside of the dispute resolution process. This dialogue should include Region 2's Recommended Revision to include a CTE cooking loss factor of 20% for only PCBs in crab based on Zabik et al. (1992), and the compound-specific fish cooking loss values for PCBs, chlorinated pesticides and dioxins, given that lipophilic chemicals present in crab or fish tissue are expected to behave in a similar fashion.

7. ***Approach for evaluating exposure to sediment by residents (Comments 109, 118, 131)***

   CPG Position: CPG accepts Region 2's recommendation to remove the residential scenario from the quantitative HHRA. As noted above, CPG wishes to better understand Region 2's position on this issue, and have the opportunity to collaborate and participate with EPA on developing an approach for evaluating the residential scenario.

8. ***Deletion of references to pathogenic contamination (Comments 3, 90, 104, 128, 150)***

   CPG Position: While CPG accepts Region 2's decision to exclude references to pathogens from the RARC, for the record, CPG does not agree with this decision. CPG maintains that inclusion of pathogens in the discussion of background risks in the baseline HHRA provides useful and valuable context to stakeholders and risk managers. There is both site-specific data and established (EPA) methodology for assessing pathogen risks to users of the river. Inclusion of an analysis of these data does not diminish the significance of the CERCLA risks, but simply provides additional, relevant context regarding risks to river users. Further, CPG maintains that there is a contradiction in EPA's requirement for the CPG to evaluate swimming exposures in the baseline HHRA when there are frequent excursions in the freshwater segment of the bacterial standards established by the state of New Jersey for protecting public health. The CPG reserves its rights to continue to document its disagreement with Region 2 on this issue. The CPG accepts Region 2's December 5 recommended revision to comments 104 and 105, with the recommended clarification identified in CPG's December 7 comments on revised text to ensure accuracy ("though this stretch of the river *frequently does not* meet the standards associated with this classification").

9. ***Deletion of statements supporting consideration of site-specific data (Comments 78, 110a)***

   CPG Position: CPG accepts Region 2's December 5 recommended revisions to the above comments, with the recommended clarification identified in CPG's December 7 comments on revised text for comment 78 to ensure accuracy. The CPG reserves its rights to continue to document its disagreement with Region 2 on this issue.

10. ***EPA has removed the term "urban" from the RARC as it pertains to reference and background for the river conditions (Comments 8, 18, 68)***

    CPG Position: CPG understands that Region 2 has not changed its position from its July 11, 2011 comment. CPG wishes to discuss the specific language to be used since the word "urban" is used in the Region 2-approved PFD.

11. ***EPA has requested that the mummichog testable risk question be changed from that in the EPA-approved PFD.***

    CPG Position: CPG understands that Region 2 has withdrawn this comment, and the risk question may be left as is, consistent with the wording in the PFD. CPG also understands that egg numbers from the literature must be presented in the BERA to provide context for evaluating the LPRSA results.

The CPG appreciates Region's 2 decisions to address positively some of the RARC dispute resolution issues (i.e., HHRA Issue 6 and ERA Issue 2). The CPG believes that the following overarching issues that caused the CPG to invoke and identify the original eleven dispute resolution issues remain unresolved and have not been adequately addressed by the process to date:

- Compounding conservatism – risk estimates will be the product of multiple extreme and overly conservative assumptions that do not represent reasonable maximum exposures for the LPRSA;
- Lack of consideration for the true range of potential site-specific exposures (variability and uncertainty are not adequately acknowledged in the RARC) – human health estimates will be driven by a limited set of assumptions that provide minimal realistic site-specific context for decision-makers; and,
- Lack of separation of the baseline risk assessment and risk management processes – the process is reversed for the LPRSA with management decisions preceding the baseline assessment

These overarching issues are exemplified by Region 2's positions and unwillingness to discuss current and future exposure scenarios (HHRA Issue 1) and fish and crab ingestion rates/fraction ingested (HHRA Issue 5). It is the CPG's hope that Region 2 will provide an opportunity for the CPG to present and discuss its views on conducting a realistic and site-specific human health risk assessment for the LPRSA.

The CPG requests that Region 2 include this letter in the administrative record for Operable Unit 2 of the Diamond Alkali Superfund Site, including the documents referenced in this letter that were provided to Region 2 on December 7, December 8, and December 12.

Very Truly Yours,

William H. Hyatt, Esq.
CPG Coordinating Counsel

Table of Swimming Scenarios

	Exposure Assumptions					
	Young Child	Adolescent		Adult		
Site Name	(1 to 6 years)			(18 years +)	Waterbody	Swimming Rate
	(days/year)	Age Range	days/year	days/year		
Passaic River	13	7 to 18 years	39	13	Lower Passaic River	2.6 hours/day
Hudson River						
- RME Individual	13	7 to 18 years	39	13	Hudson River	2.6 hours/day
- Avid Recreator	104	7 to 18 years	104	104	Hudson River	2.6 hours/day
Brookhaven National Laboratory						
- Trespassers		7 to 18 years	64		Peconic River	2.6 hours/day
- Future Residents accessing the site	150			64	Peconic River	2.6 hours/day
Alcoa - Massena New York						
- 1993 Version	143			78	Grasse River	2 hours/day
- Revised Draft Update	13	7 to 18 years	39	13	Grasse River	2 hours/day
General Motors (Central Foundary) - Massena		7 to 15 years	75		Unnamed Tributary	2 hours/day
		7 to 15 years	39		Raquette River	2 hours/day
		7 to 15 years	39		St. Lawrence River	2 hours/day
Pohatcong Valley	52	7 to 18 years	52	52	Pohatcong/Merrill Creeks & Edison Quarry	2.6 hours/day
Crown Vantage	36	7 to 18 years	36	36	Delaware River	2 hours/day
Li Tungsten			120	120	Glen Cove Creek	2 hours/day Also evaluated risk to site worker and future adult resident.
					Captain's Cove	

Table of Swimming Scenarios

	Exposure Assumptions					
	Young Child	Adolescent		Adult		
Site Name	(1 to 6 years)			(18 years +)	Waterbody	Swimming Rate
A. O. Polymer		6 to 12 years	44		Wallkill River	2 hours/day
King of Prussia			78		Great Egg Harbor River	4 hours/day
Liberty Finishing		6 to 14 years	52		Massapequa Creek	1 hour/day
Solvent Savers		6 to 15 years	88		Mud Creek is classified as a trout stream	2.6 hours/day
102 nd Street Landfill				25	Niagara River	2.6 hours/day based on dermal exposure and ingestion.
Hertel Landfill		9 to 18 years	90		Black Creek 5.8 acre pond and wetland located west of the entrance road	4 hours/day
Peter Cooper - Gowanda		6 to 17 years	39	26	Cataragus Creek	3 hours/event (Adolescent)
Average (days/year)	66		61	49		