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July 26, 2016

VIA HAND DELIVERY

Gary A. Fulton Jr., Administrator
Louisiana Department of Environmental Quality
Underground Storage Tank and Remediation Division
Post Office Box 4312
Baton Rouge, Louisiana 70821-4312

Remediation Services Division
Manager: *Shamm*
Team Leader: *Shepherd*
AI #: *197778*
TEMPO Task #: _____
Desk Copy File Room: *su*

RECEIPT
JUL 26 PM 2:31

RE: Response to LDEQ Comments
Sediment Summary Report Technical Review
Belle Isle (AI Number 197778)
Belle Isle (Sediment); Former LADNR Act 312 Legacy Site
South of Morgan City/East of Wax Lake Outlet Delta
St. Mary Parish, Louisiana

Dear Mr. Fulton:

Thank you for your comments, dated January 6, 2016, on the *Belle Isle Sediment Data* report, dated July 31, 2105, which was submitted by Michael Pisani & Associates (MP&A) to the Louisiana Department of Environmental Quality (LDEQ) on behalf of Apache Corporation (Apache). As noted in your comment letter, the Louisiana Department of Natural Resources (LDNR) requested your review of the *Belle Isle Sediment Data* report in support of closure by LDNR at Belle Isle under Statewide Order No. 29-B.

The comments presented in this letter were discussed in a meeting of MP&A and LDEQ on May 5, 2016. The purpose of discussing the comments, prior publishing this letter, was to insure that we (MP&A) understood LDEQ's comments and that our responses would be acceptable. The responses presented in this letter comply with LDEQ comments as we understand them and are also the responses that we discussed in the May 5, 2016 meeting. Rather than republish the *Belle Isle Sediment Data* report with changes based on the comments, we propose that this letter serve as a supplement to the *Belle Isle Sediment Data* report.

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It is the understanding of MP&A that LDNR relies on LDEQ for review of sediment data and that approval of this supplement letter is acceptable support for LDNR that no further action is required for the sediments at Belle Isle. If LDEQ finds the responses in this letter acceptable, we request that LDEQ respond with a letter indicating that no further action is needed (concerning the sediments at Belle Isle).

The next many paragraphs are a listing of LDEQ comments and MP&A responses on behalf of Apache. The original LDEQ comment letter is also presented as Attachment A.

LDEQ Sediment Data Comments

Comment 1: *Please provide a detailed discussion of the extraction and analytical methods used in this assessment. As you are aware, LDNR and LDEQ have different extraction methods and manage barium based on different forms (soluble versus insoluble).*

Response to Comment 1: Extraction and analytical methods used for barium in sediments in this project are (1) EPA SW-846 Method 6010 with EPA extraction method 3050B and (2) EPA SW-846 Method 1311 Toxic Characteristic Leaching Procedure (TCLP).

1. EPA SW-846 Method 6010 was used to quantify barium concentration in sediments. The method quantifies barium extracted from compounds in sediment that would be bioavailable in their natural setting to aquatic organisms as well as barium from compounds that would not be bioavailable to aquatic organisms. EPA Method 6010 is a standard method recommended for analysis of barium and uses a very strong acid digestion extraction (pH of 2.0). Samples are extracted using EPA method 3050B, an acid digestion process that uses nitric acid, hydrogen peroxide, and heating. Method 3050B is the EPA SW-846 Method for Acid Digestion of Sediments, Sludges, and Soils.
2. We used the TCLP method of analysis to establish whether or not the barium present in the sediments is in an easily solubilized form or in a more insoluble form. The purpose for this TCLP analysis is that easily solubilized barium is more toxic than barium that is insoluble and tightly bound to sulfate. The TCLP analysis is a testing method used on soil and sediment samples to simulate the leaching that would occur from 100 years of exposure to typical landfill conditions. TCLP sediment samples are extracted with acetic acid and water (pH of 2.88). The samples are tumbled for 18 hours with the extraction fluid and the resulting leachate is compared to standards to assess the presence of elevated constituents. In the case of this study, the TCLP analysis was used to identify if barium would solubilize from the sediment media into the extraction fluid. The absence of soluble barium would be evidence that the

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barium present in the sediment samples is not a soluble compound of barium, indicating not toxic to biological species.

Using the described 6010 analytical method/3050B extraction method, barium sediment concentrations were measured to range from 71 to 1534 mg/kg wet weight and 137 to 5970 mg/kg dry weight. Some of this measured barium may be available to organisms for absorption and uptake in a natural environmental setting and some would not be biologically available in a natural environmental setting, due to the barium being bonded in compounds that are insoluble in water and unavailable for uptake by organisms. The reason that the measured/reported concentrations of barium are higher than the amount of barium that is actually available to organisms in the environment is that the 3050B extraction method is a strong acid digestion that will digest/breakdown compounds that would not be broken down in this way in a natural sediment setting. That is, the extraction method will solubilize and release barium (to be measured in the analytical method) from compounds that are not naturally absorbable by humans and ecological species. This makes the measured amount of barium higher than what a measurement would be of only the barium that is in a form easily absorbed by living organisms.

Because the 6010/3050B analysis gives an overstated concentration as compared to the barium that would be available for uptake by ecological species and humans, we used the TCLP analysis to establish if the barium in sediments was in a form that would be readily solubilized, readily bioavailable. The results of the TCLP analyses are that of 34 sediment analyses, 32 analytical results were non-detect for barium, meaning that the barium did not solubilize in the acetic acid and water. That is, the barium remained undissolved in the water/acetic acid and remained bound in a molecular form to (likely) sulfate. Of the two sediment TCLP samples in which barium was detected, the concentrations of barium solubilized in the acetic acid and water were low (3.69 mg/L and 7.48 mg/L). Because the TCLP analyses demonstrate that the sediment barium at Belle Isle is predominantly insoluble (32 non-detect results out of 34), our conclusion is that the barium present in sediments is not in a form that is easily solubilized, and is therefore likely to be present in the form of barite (BaSO_4), typically associated with drilling sites and of low toxicity to aquatic species (Khangarot, B.S., and S. Das, 2009).

To summarize, the TCLP analytical results demonstrate that the compounds of barium present in sediments are predominantly insoluble. The presence of insoluble barium does not indicate health risks to humans or ecological species.

***Comment 2:** It is noted that PAHs were below their detection limits. Please provide a data evaluation discussion including the acceptability of the detection limits achieved by the laboratory for this investigation and assessment.*

Response to Comment 2: PAH detection limits achieved by the lab, Gulf Coast Analytical Laboratories in Baton Rouge, are acceptable as per RECAP data requirements

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for risk assessment. PAH detection limits are shown in Attachment B. Detection limits achieved by the lab for PAHs were 0.33 mg/kg, which is the published RECAP quantitation limit for the PAHs, benzo(a)pyrene, and dibenz(a,h)anthracene. The detection limits achieved by the lab for PAHs are also below the calculated sediment PAH standards presented in this letter for both the child and the adult receptor (Attachment B). It should be noted that at one location (MP&A SN215550 – 4) a PAH detection limit of 0.40 mg/kg, rather than 0.33 mg/kg, was achieved but at this location there were five other samples collected where the detection limit of 0.33 mg/kg was achieved.

***Comment 3:** The method for estimating the concentration of soluble barium is not consistent with RECAP methods.*

Response to Comment 3: In response to this comment, we have adjusted our approach and have only compared the 3050B extracted/6010 analyzed barium (as explained in response to Comment 1) to RECAP calculated sediment standards. We have used the results of the TCLP analyses only to demonstrate that the form of barium on site is primarily the insoluble, less toxic form, not for comparison to standards.

Sediment Evaluation: Human Health Screening Assessment

***Comment 4:** RECAP standards developed for soil are typically not applicable for the evaluation of sediments. It is unclear how RECAP soil standards are appropriate in this situation at the Belle Isle area. If there is potential for human contact with sediments in the area(s) of concern please provide that information and specifics of potential exposure. Would hunters, fisherman or other recreational users exhibit behaviors or have activities where they might be exposed to sediments?*

Response to Comment 4: To respond to this comment, we have calculated site-specific sediment standards, based on a reasonable maximum exposure scenario. We have calculated sediment standards that are protective of human health for an adult recreational receptor and a juvenile recreational receptor. We have compared the sediment standards to site sediment concentrations and all detected concentrations are below calculated recreational sediment standards. Sediment standard calculations are shown in Attachment C and are discussed below.

Adult Exposure Sediment Standard:

We calculated an adult sediment standard using the RECAP soil contact non-industrial algorithm and using RECAP default exposure parameters, with modifications to express Reasonable Maximum Recreational Exposure. Exposure pathways include incidental sediment ingestion and dermal contact. The following are the assumptions used to calculate standards:

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- Reasonable Maximum Exposure Frequency (EF) = 104 days per year (two days per week for 52 weeks). This frequency assumes regular visitation for hunting and fishing throughout the year, and assumes sediment ingestion and dermal contact during each visit.
- Exposure Duration (ED) = 30 years, which is the RECAP default assumption for residence in a single location.
- Body Surface Area = 6045 cm² including forearms, hands, and feet assumed to be in contact with sediment. Surface areas are 95 percentile values from Table 7-12 and 7-13 of the *Exposure Factors Handbook*, EPA, 2011.
- Body weight = 112.7 kg, which is an average of the male and female combined 95th percentiles from ages 16-80+ in Table 8-3 of the *Exposure Factors Handbook*, EPA, 2011.
- Soil Adherence Factor = 0.39, which is a weighted average of the hands, arms, and feet from Table 7-4 of the *Exposure Factors Handbook*, EPA, 2011.

Juvenile Exposure Sediment Standard:

We calculated a juvenile sediment standard using the RECAP soil contact non-industrial algorithm and using RECAP default exposure parameters, with modifications to express Reasonable Maximum Recreational Exposure for a juvenile ages 11 to 16 years old. This age best represents potential childhood exposure, as younger children would not reasonably be exposed as regularly to sediments. Exposure pathways include incidental sediment ingestion and dermal contact. The following are the assumptions used to calculate standards:

- Reasonable Maximum Exposure Frequency (EF) = 104 days per year (two days per week for 52 weeks). This frequency assumes regular visitation for hunting and fishing throughout the year, and assumes sediment ingestion and dermal contact during each visit.
- Exposure Duration (ED) = 6 years, age specific.
- Body Surface Area = 5300 cm², which includes arms, hands, and feet assumed to be in contact with sediment. Surface Areas are from Table 7-2 of the *Child-specific Exposure Factors Handbook*, EPA (2008).
- Body Weight = 88.8 kg, which is an average of the male and female combined 95th percentiles from ages 11-16 from Table 8-3 of the *Exposure Factors Handbook*, EPA, 2011.

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- Soil Adherence Factor = 5.64, which is a weighted average for a child playing in sediment for hands, arms, and feet from Table ES-1 of the *Child-specific Exposure Factors Handbook*, EPA (2008).

The calculated sediment standards and the associated sediment concentrations are shown below and are presented in Attachment C. No sediment constituent concentrations exceed calculated site specific sediment standards (SED_{ni}) for adults or for juveniles. Therefore, human exposure to sediments is not assessed to present adverse health risk.

Constituent	SED _{ni} Adult (mg/kg) wet weight	SED _{ni} Juvenile (mg/kg) wet weight	Maximum Sediment Concentration (mg/kg) wet weight
Barium	1.98E+05	1.56E+05	1.53E+03
Aliphatics >C12-C16	4.65E+04	3.66E+04	9.70E+01
Aliphatics >C16-C35	6.43E+05	9.25E+04	1.58E+02
Aromatics >C12-16	4.60E+04	6.62E+04	2.10E+01
Aromatics >C16-C21	1.21E+04	1.44E+03	4.30E+01

Comment 5: *The assumptions of potential exposure incorporated into RECAP soil standards do not address or include any typical scenario of potential exposure to sediments. It cannot be assumed that soil standards are protective of potential exposure to sediments due to the differences in the way potential receptors are exposed.*

Response to Comment 5: The response to Comment 4 addresses Comment 5 as well.

Comment 6: *It is stated the seafood ingestion pathway was not assessed because barium accumulates in non-edible portions of fish and TPH analysis in fish tissue is non-specific to TPH. It is the Department's experience that neither of these assumptions hold true. The ATSDR Toxicological Profile for Barium and Barium Compounds indicates a potential uptake of barium by fish. This would certainly be dependent on the form of barium. A detailed discussion of the forms of barium at the site in addition to submitting the references supporting the statement regarding barium and edible fish tissues should be provided.*

Response to Comment 6: To respond to this comment, we have assumed that both barium and Total Petroleum Hydrocarbon (TPH) fractions could accumulate in fish tissues and we have evaluated the effects of humans consuming those fish. To do this, we have estimated barium and TPH concentrations in fish tissues, and compared the concentrations to protective LDEQ screening standards. This evaluation is based on a reasonable maximum exposure scenario.

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The steps in this evaluation of human consumption of fish are (1) calculate LDEQ fish tissue screening standards, (2) estimate the concentrations of barium and TPH in fish, and (3) compare the estimated concentrations to the LDEQ screening standards. These three steps are discussed in the next few paragraphs:

Step 1: Calculate Fish Tissue Screening Standards

To determine if fish native to Belle Isle would be safe for human consumption, we used a comparison to Tissue Screening Level standards (TSLs). These screening standards are chemical concentrations in fish or shellfish tissue, below which there is not estimated to be a health threat due to fish consumption. To calculate TSLs for barium and TPH in fish tissues, we used an LDEQ algorithm from the *Tissue Screening Level Guidelines for Issuance of Public Health Advisories for Selected Contaminants*, LDEQ, 2012. The calculated TSL for barium in fish tissue is 467 mg/kg and the TSLs for the TPH fractions in fish tissues range from 70-4670 mg/kg. The calculations for the TSLs are provided in Attachment D.

Step 2: Estimate TPH and Barium Concentrations in Fish Tissue

To estimate barium and TPH concentrations in fish tissue (for comparison to the TSLs in Step 1), we made assumptions about the relationship between sediment concentrations and fish tissue concentrations. We assume that the barium concentration in fish tissue is on average eight percent of that in sediment, based on the scientific literature (Hamilton, 2003). Using this assumption, we can estimate the barium concentration in fish tissue at Belle Isle to be 142 mg/kg, based on the fish tissue concentration being 8 percent of the mean barium sediment concentration (Attachment E). The barium concentration in fish of 142 mg/kg is below the protective TSL of 467 mg/kg for barium in fish. Therefore, the estimated concentration of barium in fish tissue is below the LDEQ TSL, and not predicted to be a threat to human health based on consumption of fish.

To estimate potential TPH concentrations in fish tissue at Belle Isle, we have used a ratio of TPH in sediment to TPH in fish tissue from the scientific literature (Sinkkonen, 1982). The concentration of TPH in fish tissue as compared to TPH in sediment can range from no accumulation of TPH in fish tissue to a concentration in fish tissue that is 52 percent of what is found in the sediment (Sinkkonen, 1982). Although 52 percent is a higher percentage than we have seen in our experience, to be conservative, we have assessed the possibility that the fish tissues at Belle Isle could contain 52 percent of the concentration of TPH that is found in the sediment (Attachment E). Using this relationship and a reasonable maximum exposure scenario, we have calculated estimated TPH fish tissue concentrations to range from 22 to 70 mg/kg. No estimated TPH concentrations exceed protective TSLs, therefore no adverse human health effects are predicted based on consumption of fish.

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Step 3: Compare Fish Tissue Concentrations to TSLs

Estimated fish tissue concentrations and protective screening standards were compared. No estimated barium or TPH fish tissue concentrations exceed TSLs; therefore, adverse health effects associated with consuming fish from Belle Isle are not predicted. Estimated TPH and barium fish tissue concentrations and associated TSLs are shown below.

Constituent	Sediment Concentration 0-4' bgs 95% UCL ^a or max. value ^b (if UCL not possible) (dry weight mg/kg)	Accumulation Factor: Concentration Fish/ Concentration Sediment	Estimated Fish Tissue Concentration (mg/kg)	Fish Tissue Screening Level (mg/kg)
Barium	1774 ^a	0.08	142	467
Aliphatic >C12-C16	61 ^a	0.52	32	233
Aliphatic >C16-C35	93 ^a	0.52	48	4667
Aromatic >C12-C16	43 ^b	0.52	22	93
Aromatic >C16-C21	135 ^b	0.52	70	70

Comment 7: *The Department has observed and reviewed datasets of TPH in fish tissue that support the fact that the amount of petroleum hydrocarbon in fish is highly dependent on species. In addition, the availability of aliphatic and aromatic fractions for petroleum hydrocarbons associated with the site gives more dependable data on which to evaluate TPH in fish tissues.*

Comment 8: *Please provide any references and supporting information and discussion regarding TPH in fish tissue.*

Response to Comments 7 and 8: The response to Comment 6 also responds to Comments 7 and 8.

Comment 9: *It is stated that both soluble and insoluble forms of barium were compared to RECAP standards. The RECAP evaluation of barium is based on the assumption that barium is in the soluble form of barium chloride. Only those data reflecting the Department's preferred extraction and analytical methods for barium chloride would, therefore, be acceptable to compare to any RECAP standard. It is not appropriate to compare both soluble and insoluble barium concentrations to the same standards. This is secondary to the comment as noted above regarding soil standards not applicable to sediment evaluation.*

Response to Comment 9: This comment is addressed in our responses to Comment 1 and to Comment 3.

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***Comment 10:** The extraction and analytical methods for barium are of importance in the evaluation of barium, as is the assumption and information regarding the form of barium (soluble vs insoluble).*

Response to Comment 10: This comment is addressed in our responses to Comment 1 and to Comment 3.

***Comment 11:** It is suggested that the 29-B Submerged Wetlands criteria for barium would be applicable for comparison to sediment concentrations in this situation. Please provide a discussion as to the applicability of this approach.*

Response to Comment 11: Site-specific human health standards and standards based on ecological health have been used. Because these standards are protective of human and ecological health, we believe this is a conservative and appropriate risk based approach to addressing sediments.

Sediment Evaluation: Ecological Screening Assessment

***Comment 13:** It is noted that the sediment data is compared to USEPA Ecological, Invertebrate Soil Screening Levels for barium and for PAHs.*

***Comment 14:** Likewise for the comparison to soil RECAP standards above, it is expected that ecological standards for soil would not be applicable to comparison to sediment. The Department did find some freshwater sediment screening standards that may be more appropriate for use at this site.*

Response to Comments 13 and 14: In the originally submitted *Belle Isle Sediment Data* report, we compared all barium concentrations and PAH concentrations (all non-detect) to EPA Soil ECO-SSL values to assess potential ecological risk. In response to LDEQ comments, we have changed this approach.

For the PAH portion of this discussion, because all PAH values are non-detect and the detection limits for PAHs achieved are acceptable based on RECAP quantitation limits (0.33 mg/kg), the assessment is made that ecological risks associated with PAHs are not an issue and are not further discussed.

For the barium portion of this discussion, we have altered our approach to address the difference in the forms of barium present at the site. Because the toxic form of barium is the soluble free ion of barium and not the insoluble form, we have focused this assessment only on the two locations at Belle Isle that have been demonstrated to contain other than insoluble barium. To determine the presence of soluble barium, we used the TCLP analysis. This analysis demonstrates whether or not barium compounds in a sample will solubilize into in an extraction fluid. This indicates soluble barium in the sample. The

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6010 analysis/3050 B extraction was used to quantify barium in the sample, both soluble and insoluble. At each of 34 sampling locations, barium was analyzed by both the 3050B extraction/6010 analysis and by the TCLP method (see response to Comment 1). These two sets of analyses were done due to the fact that the site is a former oil and gas production site, and we wanted to illustrate that the barium present is primarily in an insoluble form, commonly used at drilling sites.

We have narrowed the focus of the ecological assessment to exclude sample results that do not demonstrate the presence of soluble barium. At 32 of 34 sediment locations tested, barium TCLP results are non-detect (below detection limits). The 32 locations with non-detect results are not further considered, because they do not demonstrate the presence of soluble barium. The two sediment locations with detectable soluble barium, (as per TCLP results), had concentrations of 3.69 mg/L barium and 7.48 mg/L barium (Attachment B) in the TCLP leachate solution. At each of these two sediment locations, barium was also quantified by the 6010 analysis. At the location with the TCLP result of 3.69 mg/L, the 6010 analysis barium concentration in sediment is 243 mg/kg dry weight and the 6010 result at the location with the 7.48 mg/L TCLP result is 1730 mg/kg dry weight.

We have compared the two barium concentrations from the 6010 analysis (243 mg/kg and 1730 mg/kg) to a benchmark value provided to us by LDEQ as a potential freshwater sediment benchmark of 287 mg/kg (MacDonald, 1999). LDEQ provided this value to us as a possible benchmark to use and suggested we investigate the form of barium that the standard is based on. We communicated with the author of the benchmark and learned that the standard of 287 mg/kg is based on some background barium concentrations, rather than based on effects to ecological species.

We did a search for effects-based barium ecological sediment benchmarks. We have identified some barium marine sediment benchmark values that are based on ecological effects. All of these values are based on studies of sediments that contain not only barium, but a mixture of compounds. The benchmarks we identified represent values generated from field data sets of sediments containing barium (and other compounds) below which adverse effects are not expected to occur. The benchmarks we identified for barium in sediments, along with the benchmark identified by LDEQ are listed below:

- 48 mg/kg – AET sediment benchmark (NOAA SQRT)
- 130 mg/kg – TEL sediment benchmark (NOAA SQRT)
- 287 mg/kg – background sediment value (MacDonald, 1999)
- 1718 to 2645 mg/kg – F-PNEC sediment benchmark (ERMS, 2006)

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We suggest that the two barium concentrations (243 mg/kg and 1730 mg/kg) from Belle Isle locations that have some amount of soluble barium, as per the TCLP analysis at the same locations, are acceptable concentrations for barium in sediment, as per comparison to the range of ecological benchmarks (48 to 2645 mg/kg) and as per the following discussion:

1. *It is appropriate to consider a range of benchmarks, rather than a single comparative standard.* Sediment effects-based benchmarks for barium range from 48 to 2645 mg/kg. These benchmarks are based on studies of field-collected sediments that contain barium as well as other constituents that may contribute to toxicity. Although the sediment benchmarks are reported by barium concentration, it is possible that the mixture of other compounds in a sediment (for a given benchmark) contributes to the measured toxicity of the sediment. For this reason, it is appropriate to consider the benchmarks as a range of values, and compare the two Belle Isle barium concentrations to that range.
2. *It is appropriate to compare sediment concentrations to marine sediment benchmarks.* Although Belle Isle is a freshwater setting, the benchmarks discussed here are based on studies of sediments in marine environments, because effect-based benchmarks for freshwater sediments have not been identified. However, the use of the marine benchmarks is appropriate because benchmarks for metals in marine and freshwater sediments are similar in value (NOAA SQRT, 2008). The range of benchmarks values for any individual metal generally falls within an order of magnitude when comparing freshwater and marine sediment benchmarks.
3. *Sediment barium concentrations at Belle Isle are within the range of benchmark values.* The two Belle Isle locations with some soluble barium, have barium concentrations (measured by the 6010/3050B methods) of 243 mg/kg and 1730 mg/kg, which fall within the range of barium sediment benchmarks: 48 to 2645 mg/kg.
4. *We recommend no further action to address sediments at Belle Isle.* Because there may be no observable ecological effects due to barium in aquatic sediments in concentrations up to 2645 mg/kg barium, and concentrations in sediments that contain soluble barium at Belle Isle are below this level, we recommend that there is no further action needed to address sediments at Belle Isle, due to barium concentrations.

Comment 15: *Again, both extraction and analytical methods consistent with regulatory requirements are necessary for implementation of RECAP.*

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Response to Comment 15: Our response to Comment 1 and Comment 3 responds to this comment as well.

Tables/Appendices

Comment 16: *The lab report indicates there may be some issue with detection limits for some compounds in some samples. Please provide a data quality and usability discussion for the data.*

Response to Comment 16: Detection limits are acceptable for risk assessment as described in Comment 2.

Comment 17: *Please provide the conversions from dry weight to wet weight used in this evaluation.*

Response to Comment 17: See Attachment B, conversions provided.

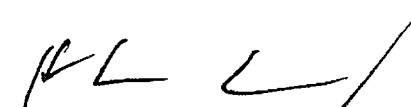
Comment 18: *The TCLP (x 20) method for estimating soluble barium concentrations is not consistent with RECAP analytical methods. The resulting concentrations should not be used to compare to standards presented in RECAP.*

Response to Comment 18: To respond to this comment, we have only compared barium analyzed and extracted by methods 6010/3050B to sediment standards.

Thank you for your review. With the information and technical efforts provided in this letter, we have complied and responded to all LDEQ comments in accordance to RECAP guidance. We would like to request approval of this supplement letter to the *Belle Isle Sediment Data* and a recommendation of no further action for sediments at Belle Isle. Please do not hesitate to be in touch with any questions or discussion.

Sincerely,

MICHAEL PISANI & ASSOCIATES, INC.



Helen R. Connelly, PhD

Attachments

cc: Carey Dicharry

References

- Bjørngesæter, A. 2006. Field based predicted no effect concentrations (F-PNECs) for macro benthos on the Norwegian Continental Shelf. Environmental Risk Management System Report no. 15.
- Hamilton, SJ and Buhl, KJ. 2003. Selenium and Other Trace Elements in Water, Sediment, Aquatic Plants, Aquatic Invertebrates, and Fish from Streams in Southeastern Idaho near Phosphate Mining Operations, USGS.
- Khargarot, B.S., and Das, S. 2009. Acute toxicity of metals and reference toxicants to a freshwater ostracod, *Cypris subglobosa* Sowerby, 1840 and correlation to EC(50) values of other test models. *J Hazard Mater*, 172(2-3):641-9.
- MacDonald, D. 1999. A Compendium of Environmental Quality Benchmarks, GBEI/EC-99-001, Appendix 3-1.
- National Oceanic Atmospheric Administration Screening Quick Reference Tables, http://www.gesamp.org/data/gesamp/files/file_element/4a2a322c8acb2c26cc0234685eac71fa/SQuiRTs.pdf, 2008.
- Sinkkonen, S. 1982. Oil residues in Baltic sediment, mussel and fish. II. Study of the Finnish Archipelago 1979-81, *Chemosphere*, Volume 11:8.
- Tissue Screening Level Guidelines for Issuance of Public Health Advisories for Selected Contaminants And Supporting Documentation; Louisiana Department of Environmental Quality, Louisiana Department of Health and Hospitals, Louisiana Department of Wildlife and Fisheries, Louisiana Department of Agriculture and Forestry, 2012.

LDEQ Comment Letter
Attachment A

BOBBY JINDAL
GOVERNOR



PEGGY M. HATCH
SECRETARY

State of Louisiana
DEPARTMENT OF ENVIRONMENTAL QUALITY
OFFICE OF ENVIRONMENTAL COMPLIANCE

January 6, 2016

Apache
c/o Michael Pisani & Associates
Attn.: Jon Miller
1100 Poydras
1430 Energy Center
New Orleans, LA 70163

RE: Sediment Summary Report Technical Review and Comments
Belle Isle; **AI Number 197778**
Belle Isle (Sediment); Former LADNR Act 312 Legacy Site
South of Morgan City/East of Wax Lake Outlet Delta
St. Mary Parish, Louisiana

Dear Mr. Miller:

The Louisiana Department of Environmental Quality (LDEQ) has completed the technical review of the document *Belle Isle Sediment Data* dated July 31, 2015. The Department understands that you requested for your client (Apache) a technical review of the sediment data as presented in the aforementioned submittal. It is also the Department's understanding that you requested the review, per LDNR (Gary Snellgrove), in support of closure under Statewide Order 29-B.

The Department has completed the review of the sediment data and associated Risk Evaluation/Corrective Action Program (RECAP) evaluation presented in the document. The summary and conclusions cannot be approved prior to receipt of additional information as noted in the attached comments.

This facility has been assigned an internal tracking number which must appear on all correspondence submitted to the Department. The Agency Interest (AI) number for this facility is **197778**.

Apache (c/o Michael Pisani & Associates)
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Please direct all future correspondence regarding remediation issues in duplicate to:

Gary A. Fulton Jr., Administrator
Underground Storage Tank and Remediation Division
P.O. Box 4312
Baton Rouge, LA 70821-4312

If you have any questions concerning this matter, you may contact me at dana.shepherd@la.gov
or 225-219-3077.

Sincerely,



Dana C. Shepherd, MSPH
Underground Storage and Remediation Division

c: Imaging Operations – Solid Waste
Darlene Williams - USTRD

Gary Snellgrove
Louisiana Department of Natural Resources
Office of Conservation
617 North 3rd Street, 9th floor
Baton Rouge, LA 70802

Belle Isle Sediment Data
July 31, 2015
Apache
AI# 197778
Technical Review Comments

Sediment Data

- Please provide a detailed discussion of the extraction and analytical methods used in this assessment. As you are aware, LDNR and LDEQ have different extraction methods and manage barium based on different forms (soluble vs insoluble).
- It is noted that PAHs were below their detection limits. Please provide a data evaluation discussion including the acceptability of the detection limits achieved by the laboratory for this investigation and assessment.
- The method for estimating the concentration of soluble barium is not consistent with RECAP methods.

Sediment Evaluation: Human Health Screening Assessment

- RECAP standards developed for soil are typically not applicable for the evaluation of sediments. It is unclear how RECAP soil standards are appropriate in this situation at the Belle Isle area. If there is potential for human contact with sediments in the area(s) of concern please provide that information and specifics of potential exposure. Would hunters, fisherman or other recreational users exhibit behaviors or have activities where they might be exposed to sediments?
 - The assumptions of potential exposure incorporated into RECAP soil standards do not address or include any typical scenario of potential exposure to sediments. It cannot be assumed that soil standards are protective of potential exposure to sediments due to the differences in the way potential receptors are exposed.
- It is stated the seafood ingestion pathway was not assessed because barium accumulates in non-edible portions of fish and TPH analysis in fish tissue is non-specific to TPH.
 - It is the Department's experience that neither of these assumptions hold true.
 - The ATSDR Toxicological Profile for Barium and Barium Compounds indicates a potential uptake of barium by fish.
 - This would certainly be dependent on the form of barium. A detailed discussion of the forms of barium at the site in addition to submitting the references supporting the statement regarding barium and edible fish tissues should be provided.
 - The Department has observed and reviewed datasets of TPH in fish tissue that support the fact that the amount of petroleum hydrocarbon in fish is highly dependent on species. In addition, the availability of aliphatic and aromatic fractions for petroleum hydrocarbons associated with the site gives more dependable data on which to evaluate TPH in fish tissues.
 - Please provide any references and supporting information and discussion regarding TPH in fish tissue.
- It is stated that both soluble and insoluble forms of barium were compared to RECAP standards. The RECAP evaluation of barium is based on the assumption that barium is in the soluble form of barium chloride. Only those data reflecting the Department's preferred

extraction and analytical methods for barium chloride would, therefore, be acceptable to compare to any RECAP standard. It is not appropriate to compare both soluble and insoluble barium concentrations to the same standards. This is secondary to the comment as noted above regarding soil standards not applicable to sediment evaluation.

- The extraction and analytical methods for barium are of importance in the evaluation of barium, as is the assumption and information regarding the form of barium (soluble vs insoluble).
- It is suggested that the 29-B Submerged Wetlands criteria for barium would be applicable for comparison to sediment concentrations in this situation. Please provide a discussion as to the applicability of this approach.

Sediment Evaluation: Ecological Screening Assessment

- It is noted that the sediment data is compared to USEPA Ecological Invertebrate Soil Screening Levels for barium and for PAHs:
 - Likewise for the comparison to soil RECAP standards above, it is expected that ecological standards for soil would not be applicable to comparison to sediment. The Department did find some freshwater sediment screening standards that may be more appropriate for use at this site.
 - Again, both extraction and analytical methods consistent with regulatory requirements are necessary for implementation of RECAP.

Tables/Appendices

- The lab report indicates there may be some issue with detection limits for some compounds in some samples. Please provide a data quality and usability discussion for the data.
- Please provide the conversions from dry weight to wet weight used in the evaluation.
- The TCLP (x 20) method for estimating soluble barium concentrations is not consistent with RECAP analytical methods. The resulting concentrations should not be used to compare to standards presented in RECAP.

The summary and conclusions cannot be approved at this point in time prior to receipt of additional information as noted above.

Summary Table of Sediment Results
Attachment B

Human Health Assessment: Sediment Concentrations

Belle Isle Site
Morgan City, Louisiana

Constituent	Units	Sample Location		B-5		B-8		B-10		B-39	
		Adult Sediment Standard	Child Sediment Standard	MPA B-5A (0-6")	MPA SB-8A (0-6")	MPA SB-8-A (0-2')	MPA B-10A (0-6")	MPA SB-39-A (0-4')			
Barium											
Barium TCLP Method ^(a)	mg/L	NA	NA	3.69	ND(5)	7.48	ND(5)	7.48	ND(5)		
Barium 6010 Method ^(b)	mg/kg	1.98E+05	1.56E+05	165	578	1235	920	1235	1282		
Calculations:											
Ba 6010 dry wt. to wet wt.				243=(wet weight/67.8)x100	851=(wet weight/67.9)x100	1730=(wet weight/71.4)x100	1520=(wet weight/60.5)x100	2570=(wet weight/49.9)x100			
TPH Fractions		Adult Sediment Standard	Child Sediment Standard						Dry Weight Concentration	Wet Weight Detection Limit	Calculations: Dry Weight to Wet Weight
Aliphatic >C10-C12	mg/kg	5.79E+04	4.56E+04						ND(30)	14.97	30=(wet weight/49.8)x100
Aliphatic >C12-C16	mg/kg	4.65E+04	3.66E+04						ND(20)	9.98	20=(wet weight/49.8)x100
Aliphatic >C16-C35	mg/kg	6.43E+05	9.25E+04						ND(20)	9.98	20=(wet weight/49.8)x100
Aliphatic >C8-C10	mg/kg	2.97E+04	2.34E+04						ND(30)	14.97	30=(wet weight/49.8)x100
Aromatic >C10-C12	mg/kg	2.99E+04	2.35E+04						ND(20)	9.98	20=(wet weight/49.8)x100
Aromatic >C12-C16	mg/kg	4.60E+04	3.62E+04						ND(30)	14.97	30=(wet weight/49.8)x100
Aromatic >C16-C21	mg/kg	1.21E+04	1.44E+03						ND(30)	14.97	30=(wet weight/49.8)x100
Aromatic >C21-C35	mg/kg	2.72E+04	2.93E+03						ND(30)	14.97	30=(wet weight/49.8)x100
Aromatic >C8-C10	mg/kg	1.64E+04	1.29E+04						ND(20)	9.98	20=(wet weight/49.8)x100
PAHs											
2-Methylnaphthalene	mg/kg	5.60E+03	4.41E+03						-	-	
Acenaphthene	mg/kg	9.45E+04	7.44E+04						-	-	
Anthracene	mg/kg	5.53E+05	4.36E+05						-	-	
Benzo(a)anthracene	mg/kg	2.09E+00	2.09E+00						-	-	
Benzo(a)pyrene (c)	mg/kg	3.30E-01	3.30E-01						-	-	
Benzo(b)fluoranthene	mg/kg	2.09E+00	2.09E+00						-	-	
Benzo(k)fluoranthene	mg/kg	2.09E+01	2.09E+01						-	-	
Chrysene	mg/kg	2.08E+02	2.08E+02						-	-	
Dibenz(a,h)anthracene (c)	mg/kg	3.30E-01	3.30E-01						-	-	
Fluoranthene	mg/kg	3.14E+04	3.05E+03						-	-	
Fluorene	mg/kg	7.00E+04	5.51E+04						-	-	
Indeno(1,2,3-cd)pyrene	mg/kg	2.09E+00	2.09E+00						-	-	
Naphthalene	mg/kg	1.57E+03	1.23E+03						-	-	
Phenanthrene	mg/kg	5.33E+05	4.20E+05						-	-	
Pyrene	mg/kg	5.79E+04	4.57E+04						-	-	

Notes:

No sediment concentrations exceed RECAP standards.
 Detected concentrations are presented in wet weight. Non-detected values (ND) are presented in dry weight. Conversions between dry weight and wet weight are shown.
 (a) Analyzed by Method 1311 Toxic Characteristic Leaching Procedure (TCLP).
 (b) Analyzed by EPA SW-846 method 6010, extraction method 3050B
 (c) Based on RECAP quantitation limit for B(a)P, which is greater than risk-based value.

Human Health Assessment: Sediment Concentrations

Belle Isle Site
Morgan City, Louisiana

Sample Location		MPA B-41-B (0-3.5')		MPA B-41-C (0-3.5')		MPA-SB-45-A (0-6")		MPA-SB-45-A (0-4")	
Sample ID		05/10/12		05/10/12		05/23/12		05/23/12	
Percent Moisture		-		-		55.4		44.7	
Constituent	Units	Adult Sediment Standard	Child Sediment Standard	Dry Weight Concentration	Wet Weight Detection Limit	Dry Weight Concentration	Wet Weight Detection Limit	Dry Weight Concentration	Wet Weight Detection Limit
B-45									
Barium									
Barium TCLP Method ^(a)	mg/L	NA	NA	-	-	ND(5)	ND(5)	ND(5)	ND(5)
Barium 6010 Method ^(b)	mg/kg	1.98E+05	1.56E+05	-	-	79	79	420	420
Calculations: Ba 6010 dry wt. to wet wt.									
TPH Fractions									
Aliphatic >C10-C12	mg/kg	5.79E+04	4.56E+04	ND(31.1)	No Moisture Data	ND(30.3)	No Moisture Data	ND(27.1)	14.99
Aliphatic >C12-C16	mg/kg	4.65E+04	3.66E+04	ND(20.7)	No Moisture Data	ND(20.2)	No Moisture Data	ND(18.1)	10.01
Aliphatic >C16-C35	mg/kg	6.43E+05	9.23E+04	ND(31.1)	No Moisture Data	ND(30.3)	No Moisture Data	ND(18.1)	10.01
Aliphatic >C8-C10	mg/kg	2.97E+04	2.34E+04	ND(20.7)	No Moisture Data	ND(20.2)	No Moisture Data	ND(18.1)	10.01
Aromatic >C10-C12	mg/kg	2.99E+04	2.35E+04	ND(31.1)	No Moisture Data	ND(30.3)	No Moisture Data	ND(27.1)	14.99
Aromatic >C12-C16	mg/kg	4.60E+04	3.62E+04	ND(31.1)	No Moisture Data	ND(30.3)	No Moisture Data	ND(27.1)	14.99
Aromatic >C16-C21	mg/kg	1.21E+04	1.44E+03	ND(31.1)	No Moisture Data	ND(30.3)	No Moisture Data	ND(27.1)	14.99
Aromatic >C21-C35	mg/kg	2.72E+04	2.93E+03	ND(31.1)	No Moisture Data	ND(30.3)	No Moisture Data	ND(27.1)	14.99
Aromatic >C8-C10	mg/kg	1.64E+04	1.29E+04	ND(20.7)	No Moisture Data	ND(20.2)	No Moisture Data	ND(18.1)	10.01
Calculations: 760=(wet weight/55.3)x100									
PAHs									
2-Methylnaphthalene	mg/kg	5.60E+03	4.41E+03	-	-	-	-	-	-
Acenaphthene	mg/kg	9.45E+04	7.44E+04	-	-	-	-	-	-
Anthracene	mg/kg	5.33E+05	4.36E+05	-	-	-	-	-	-
Benzo(a)anthracene	mg/kg	2.09E+00	2.09E+00	-	-	-	-	-	-
Benzo(a)pyrene (c)	mg/kg	3.30E-01	3.30E-01	-	-	-	-	-	-
Benzo(b)fluoranthene	mg/kg	2.09E+00	2.09E+00	-	-	-	-	-	-
Benzo(k)fluoranthene	mg/kg	2.09E+01	2.09E+01	-	-	-	-	-	-
Chrysene	mg/kg	2.08E+02	2.08E+02	-	-	-	-	-	-
Dibenz(a,h)anthracene (c)	mg/kg	3.30E-01	3.30E-01	-	-	-	-	-	-
Fluoranthene	mg/kg	3.14E+04	3.05E+03	-	-	-	-	-	-
Fluorene	mg/kg	7.00E+04	5.51E+04	-	-	-	-	-	-
Indeno(1,2,3-cd)pyrene	mg/kg	2.09E+00	2.09E+00	-	-	-	-	-	-
Naphthalene	mg/kg	1.57E+03	1.23E+03	-	-	-	-	-	-
Phenanthrene	mg/kg	5.33E+05	4.20E+05	-	-	-	-	-	-
Pyrene	mg/kg	5.79E+04	4.57E+04	-	-	-	-	-	-

Notes:
 No sediment concentrations exceed RECAP standards.
 Detected concentrations are presented in wet weight. Non-detected values (ND) are presented in dry weight. Conversions between dry weight and wet weight are shown.
 (a) Analyzed by Method 1311 Toxic Characteristic Leaching Procedure (TCLP).
 (b) Analyzed by EPA SW-846 method 6010, extraction method 3050B
 (c) Based on RECAP quantitation limit for B(a)P, which is greater than risk-based value.

Human Health Assessment: Sediment Concentrations

Belle Isle Site
Morgan City, Louisiana

Sample Location		B-46		B-47		
Sample ID	MPA-SB-46-A (0-3.5')	MPA-SB-47-A (0-5')	MPA-SB-47-A (0-6')	MPA-SB-47-A (0-6')	MPA-SB-47-A (0-6')	
Sample Date	05/23/12	05/24/12				
Percent Moisture	48.4	47.5			58.9	
Constituent	Units	Adult Sediment Standard	Child Sediment Standard	Dry Weight Concentration	Wet Weight Detection Limit	Calculations: Dry Weight to Wet Weight
Barium						
Barium TCLP Method ^(a)	mg/L	NA	NA	ND(5)		
Barium 6010 Method ^(b)	mg/kg	1.98E+05	1.56E+05	443		
Calculations: Ba 6010 dry wt. to wet wt.						
TPH Fractions		Adult Sediment Standard	Child Sediment Standard	Dry Weight Concentration	Wet Weight Detection Limit	Calculations: Dry Weight to Wet Weight
Aliphatic >C10-C12	mg/kg	5.79E+04	4.56E+04	ND(29.1)	15.02	28.6=(wet weight/52.5)x100
Aliphatic >C12-C16	mg/kg	4.65E+04	3.66E+04	ND(19.4)	10.01	19=(wet weight/52.5)x100
Aliphatic >C16-C35	mg/kg	6.43E+05	9.25E+04	ND(19.4)	10.01	19=(wet weight/52.5)x100
Aliphatic >C8-C10	mg/kg	2.97E+04	2.34E+04	ND(29.1)	15.02	28.6=(wet weight/52.5)x100
Aromatic >C10-C12	mg/kg	2.99E+04	2.35E+04	ND(19.4)	10.01	19=(wet weight/52.5)x100
Aromatic >C12-C16	mg/kg	4.60E+04	3.62E+04	ND(29.1)	15.02	28.6=(wet weight/52.5)x100
Aromatic >C16-C21	mg/kg	1.21E+04	1.44E+03	ND(29.1)	15.02	28.6=(wet weight/52.5)x100
Aromatic >C21-C35	mg/kg	2.72E+04	2.93E+03	-	15.02	28.6=(wet weight/52.5)x100
Aromatic >C8-C10	mg/kg	1.64E+04	1.29E+04	ND(19.4)	9.98	19=(wet weight/52.5)x100
PAHs						
2-Methylnaphthalene	mg/kg	5.60E+03	4.41E+03	-		
Acenaphthene	mg/kg	9.45E+04	7.44E+04	-		
Anthracene	mg/kg	5.53E+05	4.36E+05	-		
Benzo(a)anthracene	mg/kg	2.09E+00	2.09E+00	-		
Benzo(a)pyrene (c)	mg/kg	3.30E-01	3.30E-01	-		
Benzo(b)fluoranthene	mg/kg	2.09E+00	2.09E+00	-		
Benzo(k)fluoranthene	mg/kg	2.09E+01	2.08E+02	-		
Chrysene	mg/kg	2.08E+02	2.08E+02	-		
Dibenz(a,h)anthracene (c)	mg/kg	3.30E-01	3.30E-01	-		
Fluoranthene	mg/kg	3.14E+04	3.05E+03	-		
Fluorene	mg/kg	7.00E+04	5.51E+04	-		
Indeno(1,2,3-cd)pyrene	mg/kg	2.09E+00	2.09E+00	-		
Naphthalene	mg/kg	1.57E+03	1.23E+03	-		
Phenanthrene	mg/kg	5.33E+05	4.20E+05	-		
Pyrene	mg/kg	5.79E+04	4.57E+04	-		

Notes:
 No sediment concentrations exceed RECAP standards.
 Detected concentrations are presented in wet weight. Non-detected values (ND) are presented in dry weight. Conversions between dry weight and wet weight are shown.
 (a) Analyzed by Method 1311 Toxic Characteristic Leaching Procedure (TCLP).
 (b) Analyzed by EPA SW-846 method 6010, extraction method 3050B
 (c) Based on RECAP quantitation limit for B(a)P, which is greater than risk-based value.

Human Health Assessment: Sediment Concentrations

Belle Isle Site
Morgan City, Louisiana

Sample Location		B-56		B-58		
Sample ID	MPA-SB-56-A (0-3')	MPA-SB-58-A (0-5')	MPA-SB-58-A (0-6')	MPA-SB-58-A (0-6')	MPA-SB-58-A (0-6')	
Sample Date	05/23/12	05/23/12	05/23/12	05/23/12	05/23/12	
Percent Moisture	67.7		54.4			
Constituent	Units	Adult Sediment Standard	Child Sediment Standard	Dry Weight Concentration	Wet Weight Detection Limit	Calculations: Dry Weight to Wet Weight
Barium						
Barium TCLP Method ^(a)	mg/L	NA	NA	ND(5)		
Barium 6010 Method ^(b)	mg/kg	1.98E+05	1.56E+05	762		
<i>Calculations: Ba 6010 dry wt. to wet wt.</i>						
TPH Fractions				2360=(wet weight/32.3)x100	1470=(wet weight/45.6)x100	545=(wet weight/28.9)x100
Aliphatic >C10-C12	mg/kg	5.79E+04	4.56E+04	ND(46.5)	20.37	32.9=(wet weight/45.6)x100
Aliphatic >C12-C16	mg/kg	4.65E+04	3.66E+04	ND(31)	13.58	22=(wet weight/45.6)x100
Aliphatic >C16-C35	mg/kg	6.43E+04	9.25E+04	ND(31)	13.58	22=(wet weight/45.6)x100
Aliphatic >C8-C10	mg/kg	2.97E+04	2.34E+04	ND(46.5)	20.37	32.9=(wet weight/45.6)x100
Aromatic >C10-C12	mg/kg	2.99E+04	2.35E+04	ND(31)	13.58	22=(wet weight/45.6)x100
Aromatic >C12-C16	mg/kg	4.60E+04	3.62E+04	ND(46.5)	20.37	32.9=(wet weight/45.6)x100
Aromatic >C16-C21	mg/kg	1.21E+04	1.44E+03	ND(46.5)	20.37	32.9=(wet weight/45.6)x100
Aromatic >C21-C35	mg/kg	2.72E+04	2.93E+03	ND(46.5)	20.37	32.9=(wet weight/45.6)x100
Aromatic >C8-C10	mg/kg	1.64E+04	1.29E+04	ND(31)	13.58	22=(wet weight/45.6)x100
PAHs						
2-Methylnaphthalene	mg/kg	5.60E+03	4.41E+03	-		
Acenaphthene	mg/kg	9.45E+04	7.44E+04	-		
Anthracene	mg/kg	5.53E+05	4.36E+05	-		
Benzo(a)anthracene	mg/kg	2.09E+00	2.09E+00	-		
Benzo(a)pyrene (c)	mg/kg	3.30E-01	3.30E-01	-		
Benzo(b)fluoranthene	mg/kg	2.09E+00	2.09E+00	-		
Benzo(k)fluoranthene	mg/kg	2.09E+01	2.09E+01	-		
Chrysene	mg/kg	2.08E+02	2.08E+02	-		
Dibenz(a,h)anthracene (c)	mg/kg	3.30E-01	3.30E-01	-		
Fluoranthene	mg/kg	3.14E+04	3.05E+03	-		
Fluorene	mg/kg	7.00E+04	5.51E+04	-		
Indeno(1,2,3-cd)pyrene	mg/kg	2.09E+00	2.09E+00	-		
Naphthalene	mg/kg	1.57E+03	1.23E+03	-		
Phenanthrene	mg/kg	5.33E+04	4.20E+05	-		
Pyrene	mg/kg	5.79E+04	4.57E+04	-		

Notes:
 No sediment concentrations exceed RECAP standards.
 Detected concentrations are presented in wet weight. Non-detected values (ND) are presented in dry weight. Conversions between dry weight and wet weight are shown.
 (a) Analyzed by Method 1311 Toxic Characteristic Leaching Procedure (TCLP).
 (b) Analyzed by EPA SW-846 method 6010, extraction method 3050B
 (c) Based on RECAP quantitation limit for B(a)P, which is greater than risk-based value.

Human Health Assessment: Sediment Concentrations

Belle Isle Site
Morgan City, Louisiana

Sample Location		B-62		B-63		
Sample ID	MPA-SB-62-A (0-4')	MPA-SB-63-A (0-4')				
Sample Date	05/23/12	05/23/12				
Percent Moisture	48.2	45.3				
Constituent	Units	Adult Sediment Standard	Child Sediment Standard	Wet Weight Detection Limit	Dry Weight Concentration	Calculations: Dry Weight to Wet Weight
Barium						
Barium TCLP Method ^(a)	mg/L	NA	NA		ND(5)	
Barium 6010 Method ^(b)	mg/kg	1.98E+05	1.56E+05		629	
<i>Calculations: Ba 6010 dry wt. to wet wt.</i>						
TPH Fractions						
Aliphatic >C10-C12	mg/kg	5.79E+04	4.56E+04	15.02	ND(29)	27.4=(wet weight/54.7)x100
Aliphatic >C12-C16	mg/kg	4.65E+04	3.66E+04	10.00	ND(19.3)	18.3=(wet weight/54.7)x100
Aliphatic >C16-C35	mg/kg	6.43E+05	9.25E+04	10.00	ND(19.3)	18.3=(wet weight/54.7)x100
Aliphatic >C8-C10	mg/kg	2.97E+04	2.34E+04	15.02	ND(29)	27.4=(wet weight/54.7)x100
Aromatic>C10-C12	mg/kg	2.99E+04	2.35E+04	10.00	ND(19.3)	18.3=(wet weight/54.7)x100
Aromatic>C12-C16	mg/kg	4.60E+04	3.62E+04	15.02	ND(29)	27.4=(wet weight/54.7)x100
Aromatic>C16-C21	mg/kg	1.21E+04	1.44E+03	15.02	ND(29)	27.4=(wet weight/54.7)x100
Aromatic>C21-C35	mg/kg	2.72E+04	2.93E+03	15.02	ND(29)	27.4=(wet weight/54.7)x100
Aromatic>C8-C10	mg/kg	1.64E+04	1.29E+04	10.00	ND(19.3)	18.3=(wet weight/54.7)x100
PAHs						
2-Methylnaphthalene	mg/kg	5.60E+03	4.41E+03		-	
Acenaphthene	mg/kg	9.45E+04	7.44E+04		-	
Anthracene	mg/kg	5.53E+05	4.36E+05		-	
Benzo(a)anthracene	mg/kg	2.09E+00	2.09E+00		-	
Benzo(a)pyrene (c)	mg/kg	3.30E-01	3.30E-01		-	
Benzo(b)fluoranthene	mg/kg	2.09E+00	2.09E+00		-	
Benzo(k)fluoranthene	mg/kg	2.09E+01	2.09E+01		-	
Chrysene	mg/kg	2.08E+02	2.08E+02		-	
Dibenz(a,h)anthracene (c)	mg/kg	3.30E-01	3.30E-01		-	
Fluoranthene	mg/kg	3.14E+04	3.05E+03		-	
Fluorene	mg/kg	7.00E+04	5.51E+04		-	
Indeno(1,2,3-cd)pyrene	mg/kg	2.09E+00	2.09E+00		-	
Naphthalene	mg/kg	1.57E+03	1.23E+03		-	
Phenanthrene	mg/kg	5.33E+05	4.20E+05		-	
Pyrene	mg/kg	5.79E+04	4.57E+04		-	

Notes:
 No sediment concentrations exceed RECAP standards.
 Detected concentrations are presented in wet weight. Non-detected values (ND) are presented in dry weight. Conversions between dry weight and wet weight are shown.
 (a) Analyzed by Method 1311 Toxic Characteristic Leaching Procedure (TCLP).
 (b) Analyzed by EPA SW-846 method 6010, extraction method 3050B
 (c) Based on RECAP quantitation limit for B(a)P, which is greater than risk-based value.

Human Health Assessment: Sediment Concentrations

Belle Isle Site
Morgan City, Louisiana

Constituent	Units	Sample Location		Sample ID	Sample Date	Percent Moisture	Adult Sediment Standard	Child Sediment Standard	Calculations:
		MPA-SB-63-A (0-6")	B-65						
Barium	mg/L	MPA-SB-63-A (0-6")	MPA-SB-65-A (0-5')	MPA-SB-65-A (0-6")	05/23/12	63.5	NA	NA	B-66
Barium TCLP Method ^(a)	mg/kg	ND(5)	ND(5)	ND(5)	05/23/12	54.9	1.98E+05	1.56E+05	MPA-SB-66-A (0-4')
Barium 6010 Method ^(b)	mg/kg	131	907	706	05/23/12	70.1	102	102	(0-4')
Calculations: Ba 6010 dry wt. to wet wt.		339=(wet weight/36.5)x100	2010=(wet weight/45.1)x100	2360=(wet weight/29.9)x100	221=(wet weight/46.2)x100	53.8			05/23/12
TPH Fractions		Adult Sediment Standard	Child Sediment Standard						
Aliphatic >C10-C12	mg/kg	5.79E+04	4.56E+04	-	-	-	-	-	32.4=(wet weight/46.2)x100
Aliphatic >C12-C16	mg/kg	4.65E+04	3.66E+04	-	-	-	-	-	21.6=(wet weight/46.2)x100
Aliphatic >C16-C35	mg/kg	6.43E+05	9.25E+04	-	-	-	-	-	21.6=(wet weight/46.2)x100
Aliphatic >C8-C10	mg/kg	2.97E+04	2.34E+04	-	-	-	-	-	32.4=(wet weight/46.2)x100
Aromatic>C10-C12	mg/kg	2.99E+04	2.35E+04	-	-	-	-	-	21.6=(wet weight/46.2)x100
Aromatic>C12-C16	mg/kg	4.60E+04	3.62E+04	-	-	-	-	-	32.4=(wet weight/46.2)x100
Aromatic>C16-C21	mg/kg	1.21E+04	1.44E+03	-	-	-	-	-	32.4=(wet weight/46.2)x100
Aromatic>C21-C35	mg/kg	2.72E+04	2.93E+03	-	-	-	-	-	32.4=(wet weight/46.2)x100
Aromatic>C8-C10	mg/kg	1.64E+04	1.29E+04	-	-	-	-	-	21.6=(wet weight/46.2)x100
PAHs									
2-Methylnaphthalene	mg/kg	5.60E+03	4.41E+03	-	-	-	-	-	-
Acenaphthene	mg/kg	9.45E+04	7.44E+04	-	-	-	-	-	-
Anthracene	mg/kg	5.53E+05	4.36E+05	-	-	-	-	-	-
Benzo(a)anthracene	mg/kg	2.09E+00	2.09E+00	-	-	-	-	-	-
Benzo(a)pyrene (c)	mg/kg	3.30E-01	3.30E-01	-	-	-	-	-	-
Benzo(b)fluoranthene	mg/kg	2.09E+00	2.09E+00	-	-	-	-	-	-
Benzo(k)fluoranthene	mg/kg	2.09E+01	2.09E+01	-	-	-	-	-	-
Chrysene	mg/kg	2.08E+02	2.08E+02	-	-	-	-	-	-
Dibenz(a,h)anthracene (c)	mg/kg	3.30E-01	3.30E-01	-	-	-	-	-	-
Fluoranthene	mg/kg	3.14E+04	3.05E+03	-	-	-	-	-	-
Fluorene	mg/kg	7.00E+04	5.51E+04	-	-	-	-	-	-
Indeno(1,2,3-cd)pyrene	mg/kg	2.09E+00	2.09E+00	-	-	-	-	-	-
Naphthalene	mg/kg	1.57E+03	1.23E+03	-	-	-	-	-	-
Phenanthrene	mg/kg	5.33E+05	4.20E+05	-	-	-	-	-	-
Pyrene	mg/kg	5.79E+04	4.57E+04	-	-	-	-	-	-

Notes:
No sediment concentrations exceed RECAP standards.
Detected concentrations are presented in wet weight. Non-detected values (ND) are presented in dry weight. Conversions between dry weight and wet weight are shown.
(a) Analyzed by Method 1311 Toxic Characteristic Leaching Procedure (TCLP).
(b) Analyzed by EPA SW-846 method 6010, extraction method 3050B
(c) Based on RECAP quantitation limit for B(a)P, which is greater than risk-based value.

Human Health Assessment: Sediment Concentrations

Belle Isle Site
Morgan City, Louisiana

Constituent	Units	Sample Location			
		Adult Sediment Standard	Child Sediment Standard	B-67	B-84
Barium					
Barium TCLP Method ^(a)	mg/L	NA	NA	MPA-SB-67-A (0-5')	MPA-SB-84-A (0-4')
Barium 6010 Method ^(b)	mg/kg	1.98E+05	1.56E+05	05/23/12	05/24/12
Calculations: Ba 6010 dry wt. to wet wt.				68.2	70.6
				767	423
				ND(5)	ND(5)
				340	79
				1070=(wet weight/31.8)x100	184=(wet weight/43)x100
TPH Fractions		Adult Sediment Standard	Child Sediment Standard	Wet Weight Detection Limit	Calculations:
Aliphatic >C10-C12	mg/kg	5.79E+04	4.56E+04	15.01	Dry Weight to Wet Weight
Aliphatic >C12-C16	mg/kg	4.65E+04	3.66E+04		47.2=(wet weight/31.8)x100
Aliphatic >C16-C35	mg/kg	6.43E+05	9.25E+04		306=(wet weight/31.8)x100
Aliphatic >C8-C10	mg/kg	2.97E+04	2.34E+04	15.01	497=(wet weight/31.8)x100
Aromatic >C10-C12	mg/kg	2.99E+04	2.35E+04	10.02	47.2=(wet weight/31.8)x100
Aromatic >C12-C16	mg/kg	4.60E+04	3.62E+04	15.01	31.5=(wet weight/31.8)x100
Aromatic >C16-C21	mg/kg	1.21E+04	1.44E+03		47.2=(wet weight/31.8)x100
Aromatic >C21-C35	mg/kg	2.72E+04	2.93E+03	15.01	135=(wet weight/31.8)x100
Aromatic >C8-C10	mg/kg	1.64E+04	1.29E+04	10.02	47.2=(wet weight/31.8)x100
PAHs					
2-Methylnaphthalene	mg/kg	5.60E+03	4.41E+03		
Acenaphthene	mg/kg	9.45E+04	7.44E+04		
Anthracene	mg/kg	5.53E+05	4.36E+05		
Benzo(a)anthracene	mg/kg	2.09E+00	2.09E+00		
Benzo(a)pyrene (c)	mg/kg	3.30E-01	3.30E-01		
Benzo(b)fluoranthene	mg/kg	2.09E+00	2.09E+00		
Benzo(k)fluoranthene	mg/kg	2.09E+01	2.09E+01		
Chrysene	mg/kg	2.08E+02	2.08E+02		
Dibenz(a,h)anthracene (c)	mg/kg	3.30E-01	3.30E-01		
Fluoranthene	mg/kg	3.14E+04	3.05E+03		
Fluorene	mg/kg	7.00E+04	5.51E+04		
Indeno(1,2,3-cd)pyrene	mg/kg	2.09E+00	2.09E+00		
Naphthalene	mg/kg	1.57E+03	1.23E+03		
Phenanthrene	mg/kg	5.33E+05	4.20E+05		
Pyrene	mg/kg	5.79E+04	4.57E+04		

Notes:
 No sediment concentrations exceed RECAP standards.
 Detected concentrations are presented in wet weight. Non-detected values (ND) are presented in dry weight. Conversions between dry weight and wet weight are shown.
 (a) Analyzed by Method 1311 Toxic Characteristic Leaching Procedure (TCLP).
 (b) Analyzed by EPA SW-846 method 6010, extraction method 3050B
 (c) Based on RECAP quantitation limit for B(a)P, which is greater than risk-based value.

Human Health Assessment: Sediment Concentrations

Belle Isle Site
Morgan City, Louisiana

Constituent	Units	Sample Location		B-91		B-92	
		Adult Sediment Standard	Child Sediment Standard	MPA-SB-91-A (0-4)	MPA-SB-91-A (0-6")	MPA-SB-92-A (0-5')	MPA-SB-92-A (0-5')
Barium							
Barium TCLP Method ^(a)	mg/L	NA	NA	ND(5)	ND(5)	ND(5)	
Barium 6010 Method ^(b)	mg/kg	1.98E+05	1.56E+05	737	102	547	
Calculations: Ba 6010 dry wt. to wet wt.				1500=(wet weight/49.1)x100	240=(wet weight/42.7)x100	1290=(wet weight/42.4)x100	
TPH Fractions							
Aliphatic >C10-C12	mg/kg	5.79E+04	4.56E+04	ND(30.6)	30.6=(wet weight/49.1)x100	ND(35.3)	35.3=(wet weight/42.4)x100
Aliphatic >C12-C16	mg/kg	4.65E+04	3.66E+04	ND(20.4)	20.4=(wet weight/49.1)x100	ND(23.6)	23.6=(wet weight/42.4)x100
Aliphatic >C16-C35	mg/kg	6.43E+05	9.25E+04	ND(20.4)	20.4=(wet weight/49.1)x100	ND(23.6)	23.6=(wet weight/42.4)x100
Aliphatic >C8-C10	mg/kg	2.97E+04	2.34E+04	ND(30.6)	30.6=(wet weight/49.1)x100	ND(35.3)	35.3=(wet weight/42.4)x100
Aromatic>C10-C12	mg/kg	2.99E+04	2.35E+04	ND(20.4)	20.4=(wet weight/49.1)x100	ND(23.6)	23.6=(wet weight/42.4)x100
Aromatic>C12-C16	mg/kg	4.60E+04	3.62E+04	ND(30.6)	30.6=(wet weight/49.1)x100	ND(35.3)	35.3=(wet weight/42.4)x100
Aromatic>C16-C21	mg/kg	1.21E+04	1.44E+03	ND(30.6)	30.6=(wet weight/49.1)x100	ND(35.3)	35.3=(wet weight/42.4)x100
Aromatic>C21-C35	mg/kg	2.72E+04	2.93E+03	ND(30.6)	30.6=(wet weight/49.1)x100	ND(35.3)	35.3=(wet weight/42.4)x100
Aromatic>C8-C10	mg/kg	1.64E+04	1.29E+04	ND(20.4)	20.4=(wet weight/49.1)x100	ND(23.6)	23.6=(wet weight/42.4)x100
PAHs							
2-Methylnaphthalene	mg/kg	5.60E+03	4.41E+03	-	-	-	-
Acenaphthene	mg/kg	9.45E+04	7.44E+04	-	-	-	-
Anthracene	mg/kg	5.53E+05	4.36E+05	-	-	-	-
Benzo(a)anthracene	mg/kg	2.09E+00	2.09E+00	-	-	-	-
Benzo(a)pyrene (c)	mg/kg	3.30E-01	3.30E-01	-	-	-	-
Benzo(b)fluoranthene	mg/kg	2.09E+00	2.09E+00	-	-	-	-
Benzo(k)fluoranthene	mg/kg	2.09E+01	2.09E+01	-	-	-	-
Chrysene	mg/kg	2.08E+02	2.08E+02	-	-	-	-
Dibenz(a,h)anthracene (c)	mg/kg	3.30E-01	3.30E-01	-	-	-	-
Fluoranthene	mg/kg	3.14E+04	3.05E+03	-	-	-	-
Fluorene	mg/kg	7.00E+04	5.51E+04	-	-	-	-
Indeno(1,2,3-cd)pyrene	mg/kg	2.09E+00	2.09E+00	-	-	-	-
Naphthalene	mg/kg	1.57E+03	1.23E+03	-	-	-	-
Phenanthrene	mg/kg	5.33E+05	4.20E+05	-	-	-	-
Pyrene	mg/kg	5.79E+04	4.57E+04	-	-	-	-
Percent Moisture		50.9		57.3		57.6	

Notes:
 No sediment concentrations exceed RECAP standards.
 Detected concentrations are presented in wet weight. Non-detected values (ND) are presented in dry weight. Conversions between dry weight and wet weight are shown.
 (a) Analyzed by Method 1311 Toxic Characteristic Leaching Procedure (TCLP).
 (b) Analyzed by EPA SW-846 method 6010, extraction method 3050B
 (c) Based on RECAP quantitation limit for B(a)P, which is greater than risk-based value.

Human Health Assessment: Sediment Concentrations

Belle Isle Site
Morgan City, Louisiana

Sample Location		B-93							
Sample ID		MPA-SB-93-A (0-4)							
Sample Date		05/23/12							
Percent Moisture		59.1							
MPA SN215550 6 (0-3)		05/10/12							
MPA SN215550 6 (0-3)		61.9							
Constituent	Units	Adult Sediment Standard	Child Sediment Standard	Wet Weight Detection Limit	Dry Weight Concentration	Wet Weight Detection Limit	Dry Weight Concentration	Detects: Wet Wt. ND: Dry Wt.	Calculations: Dry Weight to Wet Weight
Barium									
Barium TCLP Method ^(a)	mg/L	NA	NA		ND(5)			-	
Barium 6010 Method ^(b)	mg/kg	1.98E+05	1.56E+05		109			-	
<i>Calculations: Ba 6010 dry wt. to wet wt.</i>									
TPH Fractions									
Aliphatic >C10-C12	mg/kg	5.79E+04	4.56E+04	14.97	ND(36.6)	14.97	36.6=(wet weight/40.9)x100	ND: Dry Wt.	39.3=(wet weight/38.1)x100
Aliphatic >C12-C16	mg/kg	4.65E+04	3.66E+04	9.98	ND(24.4)	9.98	24.4=(wet weight/40.9)x100	16	41.99=(wet weight/38.1)x100
Aliphatic >C16-C35	mg/kg	6.43E+05	9.25E+04	9.98	ND(24.4)	9.98	24.4=(wet weight/40.9)x100	20	52.49=(wet weight/38.1)x100
Aliphatic >C8-C10	mg/kg	2.97E+04	2.34E+04	14.97	ND(36.6)	14.97	36.6=(wet weight/40.9)x100	ND(39.3)	39.3=(wet weight/38.1)x100
Aromatic >C10-C12	mg/kg	2.99E+04	2.35E+04	9.98	ND(24.4)	9.98	24.4=(wet weight/40.9)x100	ND(26.2)	28.2=(wet weight/38.1)x100
Aromatic >C12-C16	mg/kg	4.60E+04	3.62E+04	14.97	ND(36.6)	14.97	36.6=(wet weight/40.9)x100	ND(39.3)	39.3=(wet weight/38.1)x100
Aromatic >C16-C21	mg/kg	1.21E+04	1.44E+03	14.97	ND(36.6)	14.97	36.6=(wet weight/40.9)x100	ND(39.3)	39.3=(wet weight/38.1)x100
Aromatic >C21-C35	mg/kg	2.72E+04	2.93E+03	14.97	ND(36.6)	14.97	36.6=(wet weight/40.9)x100	ND(39.3)	39.3=(wet weight/38.1)x100
Aromatic >C8-C10	mg/kg	1.64E+04	1.29E+04	9.98	ND(24.4)	9.98	24.4=(wet weight/40.9)x100	ND(26.2)	28.2=(wet weight/38.1)x100
PAHs									
2-Methylnaphthalene	mg/kg	5.60E+03	4.41E+03		-			ND(0.854)	.854=(wet weight/38.1)x100
Acenaphthene	mg/kg	9.45E+04	7.44E+04		-			ND(0.854)	.854=(wet weight/38.1)x100
Anthracene	mg/kg	5.53E+05	4.36E+05		-			ND(0.854)	.854=(wet weight/38.1)x100
Benzo(a)anthracene	mg/kg	2.09E+00	2.09E+00		-			ND(0.854)	.854=(wet weight/38.1)x100
Benzo(a)pyrene (c)	mg/kg	3.30E-01	3.30E-01		-			ND(0.854)	.854=(wet weight/38.1)x100
Benzo(b)fluoranthene	mg/kg	2.09E+00	2.09E+00		-			ND(0.854)	.854=(wet weight/38.1)x100
Benzo(k)fluoranthene	mg/kg	2.09E+01	2.09E+01		-			ND(0.854)	.854=(wet weight/38.1)x100
Chrysene	mg/kg	2.08E+02	2.08E+02		-			ND(0.854)	.854=(wet weight/38.1)x100
Dibenz(a,h)anthracene (c)	mg/kg	3.30E-01	3.30E-01		-			ND(0.854)	.854=(wet weight/38.1)x100
Fluoranthene	mg/kg	3.14E+04	3.05E+03		-			ND(0.854)	.854=(wet weight/38.1)x100
Fluorene	mg/kg	7.00E+04	5.51E+04		-			ND(0.854)	.854=(wet weight/38.1)x100
Indeno(1,2,3-cd)pyrene	mg/kg	2.09E+00	2.09E+00		-			ND(0.854)	.854=(wet weight/38.1)x100
Naphthalene	mg/kg	1.57E+03	1.23E+03		-			ND(0.854)	.854=(wet weight/38.1)x100
Phenanthrene	mg/kg	5.33E+05	4.20E+05		-			ND(0.854)	.854=(wet weight/38.1)x100
Pyrene	mg/kg	5.79E+04	4.57E+04		-			ND(0.854)	.854=(wet weight/38.1)x100

Notes:

No sediment concentrations exceed RECAP standards.
 Detected concentrations are presented in wet weight. Non-detected values (ND) are presented in dry weight. Conversions between dry weight and wet weight are shown.
 (a) Analyzed by Method 1311 Toxic Characteristic Leaching Procedure (TCLP).
 (b) Analyzed by EPA SW-846 method 6010, extraction method 3050B
 (c) Based on RECAP quantitation limit for B(a)P, which is greater than risk-based value.

Human Health Assessment: Sediment Concentrations

Belle Isle Site
Morgan City, Louisiana

Sample Location		SN215550 (Continued)							
Sample ID	MPA SN215550 3 (0-3)	MPA SN215550 2 (0-3)	05/10/12						
Sample Date	05/10/12								
Percent Moisture	32.8		60						
Constituent	Units	Adult Sediment Standard	Child Sediment Standard	Dry Weight Concentration	Wet Weight Detection Limit	Calculations: Dry Weight to Wet Weight	Dry Weight Concentration	Wet Weight Detection Limit	Calculations: Dry Weight to Wet Weight
Barium									
Barium TCLP Method ^(a)	mg/L	NA	NA	-	-				
Barium 6010 Method ^(b)	mg/kg	1.98E+05	1.56E+05	-	-				
<i>Calculations:</i>									
<i>Ba 6010 dry wt. to wet wt.</i>									
TPH Fractions									
Aliphatic >C10-C12	mg/kg	5.79E+04	4.56E+04	ND(22.3)	14.99	Calculations: Dry Weight to Wet Weight	ND(37.5)	15.00	Calculations: Dry Weight to Wet Weight
Aliphatic >C12-C16	mg/kg	4.65E+04	3.66E+04	ND(14.9)	10.01	22.3=(wet weight/67.2)x100	ND(25)	10.00	37.5=(wet weight/40)x100
Aliphatic >C16-C35	mg/kg	6.43E+05	9.25E+04	ND(14.9)	10.01	14.9=(wet weight/67.2)x100	ND(25)	10.00	25=(wet weight/40)x100
Aliphatic >C8-C10	mg/kg	2.97E+04	2.34E+04	ND(22.3)	14.99	22.3=(wet weight/67.2)x100	ND(37.5)	15.00	37.5=(wet weight/40)x100
Aromatic>C10-C12	mg/kg	2.99E+04	2.35E+04	ND(14.9)	10.01	14.9=(wet weight/67.2)x100	ND(25)	10.00	25=(wet weight/40)x100
Aromatic>C12-C16	mg/kg	4.60E+04	3.62E+04	ND(22.3)	14.99	22.3=(wet weight/67.2)x100	ND(37.5)	15.00	37.5=(wet weight/40)x100
Aromatic>C16-C21	mg/kg	1.21E+04	1.44E+03	ND(22.3)	14.99	22.3=(wet weight/67.2)x100	ND(37.5)	15.00	37.5=(wet weight/40)x100
Aromatic>C21-C35	mg/kg	2.72E+04	2.93E+03	ND(22.3)	14.99	22.3=(wet weight/67.2)x100	ND(37.5)	15.00	37.5=(wet weight/40)x100
Aromatic>C8-C10	mg/kg	1.64E+04	1.29E+04	ND(14.9)	10.01	14.9=(wet weight/67.2)x100	ND(25)	10.00	25=(wet weight/40)x100
PAHs									
2-Methylnaphthalene	mg/kg	5.60E+03	4.41E+03	ND(0.491)	0.33	Calculations: Dry Weight to Wet Weight	ND(0.817)	0.33	Calculations: Dry Weight to Wet Weight
Acenaphthene	mg/kg	9.45E+04	7.44E+04	ND(0.491)	0.33	.491=(wet weight/67.2)x100	ND(0.817)	0.33	.817=(wet weight/40)x100
Anthracene	mg/kg	5.53E+05	4.36E+05	ND(0.491)	0.33	.491=(wet weight/67.2)x100	ND(0.817)	0.33	.817=(wet weight/40)x100
Benzo(a)anthracene	mg/kg	2.09E+00	2.09E+00	ND(0.491)	0.33	.491=(wet weight/67.2)x100	ND(0.817)	0.33	.817=(wet weight/40)x100
Benzo(a)pyrene (c)	mg/kg	3.30E-01	3.30E-01	ND(0.491)	0.33	.491=(wet weight/67.2)x100	ND(0.817)	0.33	.817=(wet weight/40)x100
Benzo(b)fluoranthene	mg/kg	2.09E+00	2.09E+00	ND(0.491)	0.33	.491=(wet weight/67.2)x100	ND(0.817)	0.33	.817=(wet weight/40)x100
Benzo(k)fluoranthene	mg/kg	2.09E+01	2.09E+01	ND(0.491)	0.33	.491=(wet weight/67.2)x100	ND(0.817)	0.33	.817=(wet weight/40)x100
Chrysene	mg/kg	2.08E+02	2.08E+02	ND(0.491)	0.33	.491=(wet weight/67.2)x100	ND(0.817)	0.33	.817=(wet weight/40)x100
Dibenz(a,h)anthracene (c)	mg/kg	3.30E-01	3.30E-01	ND(0.491)	0.33	.491=(wet weight/67.2)x100	ND(0.817)	0.33	.817=(wet weight/40)x100
Fluoranthene	mg/kg	3.14E+04	3.05E+03	ND(0.491)	0.33	.491=(wet weight/67.2)x100	ND(0.817)	0.33	.817=(wet weight/40)x100
Fluorene	mg/kg	7.00E+04	5.51E+04	ND(0.491)	0.33	.491=(wet weight/67.2)x100	ND(0.817)	0.33	.817=(wet weight/40)x100
Indeno(1,2,3-cd)pyrene	mg/kg	2.09E+00	2.09E+00	ND(0.491)	0.33	.491=(wet weight/67.2)x100	ND(0.817)	0.33	.817=(wet weight/40)x100
Naphthalene	mg/kg	1.57E+03	1.23E+03	ND(0.491)	0.33	.491=(wet weight/67.2)x100	ND(0.817)	0.33	.817=(wet weight/40)x100
Phenanthrene	mg/kg	5.33E+05	4.20E+05	ND(0.491)	0.33	.491=(wet weight/67.2)x100	ND(0.817)	0.33	.817=(wet weight/40)x100
Pyrene	mg/kg	5.79E+04	4.57E+04	ND(0.491)	0.33	.491=(wet weight/67.2)x100	ND(0.817)	0.33	.817=(wet weight/40)x100

Notes:

No sediment concentrations exceed RECAP standards.
 Detected concentrations are presented in wet weight. Non-detected values (ND) are presented in dry weight. Conversions between dry weight and wet weight are shown.
 (a) Analyzed by Method 1311 Toxic Characteristic Leaching Procedure (TCLP).
 (b) Analyzed by EPA SW-846 method 6010, extraction method 3050B
 (c) Based on RECAP quantitation limit for B(a)P, which is greater than risk-based value.

Human Health Assessment: Sediment Concentrations

Belle Isle Site
Morgan City, Louisiana

Constituent		Units	Sample Location		MPA SN215550 1 (0-3)	MPA SN215550 2 (0-6")	SN21555
Barium			Adult Sediment Standard	Child Sediment Standard	05/10/12	05/10/12	
Barium TCLP Method ^(a)		mg/L	NA	NA			
Barium 6010 Method ^(b)		mg/kg	1.98E+05	1.56E+05			
Calculations: Ba 6010 dry wt. to wet wt.							
TPH Fractions			Adult Sediment Standard	Child Sediment Standard	58.9	59	
Aliphatic >C10-C12		mg/kg	5.79E+04	4.56E+04			
Aliphatic >C12-C16		mg/kg	4.65E+04	3.66E+04			
Aliphatic >C16-C35		mg/kg	6.43E+05	9.25E+04			
Aliphatic >C8-C10		mg/kg	2.97E+04	2.34E+04			
Aromatic>C10-C12		mg/kg	2.99E+04	2.35E+04			
Aromatic>C12-C16		mg/kg	4.60E+04	3.62E+04			
Aromatic>C16-C21		mg/kg	1.21E+04	1.44E+03			
Aromatic>C21-C35		mg/kg	2.72E+04	2.93E+03			
Aromatic>C8-C10		mg/kg	1.64E+04	1.29E+04			
Calculations: Dry Wt. to Wet Wt.							
Aliphatic >C10-C12			ND(36.5)	ND(36.5)			
Aliphatic >C12-C16			ND(24.4)	ND(24.4)			
Aliphatic >C16-C35			ND(24.4)	ND(24.4)			
Aliphatic >C8-C10			ND(36.5)	ND(36.5)			
Aromatic>C10-C12			ND(24.4)	ND(24.4)			
Aromatic>C12-C16			ND(36.5)	ND(36.5)			
Aromatic>C16-C21			ND(36.5)	ND(36.5)			
Aromatic>C21-C35			ND(36.5)	ND(36.5)			
Aromatic>C8-C10			ND(24.4)	ND(24.4)			
Calculations: Dry Wt. to Wet Wt.							
Aliphatic >C10-C12			36.5=(wet weight/41.1)x100	36.5=(wet weight/41.1)x100			
Aliphatic >C12-C16			24.4=(wet weight/41.1)x100	24.4=(wet weight/41.1)x100			
Aliphatic >C16-C35			24.4=(wet weight/41.1)x100	24.4=(wet weight/41.1)x100			
Aliphatic >C8-C10			36.5=(wet weight/41.1)x100	36.5=(wet weight/41.1)x100			
Aromatic>C10-C12			24.4=(wet weight/41.1)x100	24.4=(wet weight/41.1)x100			
Aromatic>C12-C16			36.5=(wet weight/41.1)x100	36.5=(wet weight/41.1)x100			
Aromatic>C16-C21			36.5=(wet weight/41.1)x100	36.5=(wet weight/41.1)x100			
Aromatic>C21-C35			36.5=(wet weight/41.1)x100	36.5=(wet weight/41.1)x100			
Aromatic>C8-C10			24.4=(wet weight/41.1)x100	24.4=(wet weight/41.1)x100			
PAHs			Dry Weight Concentration	Dry Weight Concentration	Wet Weight Detection Limit	Wet Weight Detection Limit	Calculations: Dry Weight to Wet Weight
2-Methylnaphthalene		mg/kg	ND(0.798)	ND(0.798)	0.33	0.33	.798=(wet weight/41.1)x100
Acenaphthene		mg/kg	ND(0.798)	ND(0.798)	0.33	0.33	.798=(wet weight/41.1)x100
Anthracene		mg/kg	ND(0.798)	ND(0.798)	0.33	0.33	.798=(wet weight/41.1)x100
Benzo(a)anthracene		mg/kg	ND(0.798)	ND(0.798)	0.33	0.33	.798=(wet weight/41.1)x100
Benzo(a)pyrene (c)		mg/kg	ND(0.798)	ND(0.798)	0.33	0.33	.798=(wet weight/41.1)x100
Benzo(b)fluoranthene		mg/kg	ND(0.798)	ND(0.798)	0.33	0.33	.798=(wet weight/41.1)x100
Benzo(k)fluoranthene		mg/kg	ND(0.798)	ND(0.798)	0.33	0.33	.798=(wet weight/41.1)x100
Chrysene		mg/kg	ND(0.798)	ND(0.798)	0.33	0.33	.798=(wet weight/41.1)x100
Dibenz(a,h)anthracene (c)		mg/kg	ND(0.798)	ND(0.798)	0.33	0.33	.798=(wet weight/41.1)x100
Fluoranthene		mg/kg	ND(0.798)	ND(0.798)	0.33	0.33	.798=(wet weight/41.1)x100
Fluorene		mg/kg	ND(0.798)	ND(0.798)	0.33	0.33	.798=(wet weight/41.1)x100
Indeno(1,2,3-cd)pyrene		mg/kg	ND(0.798)	ND(0.798)	0.33	0.33	.798=(wet weight/41.1)x100
Naphthalene		mg/kg	ND(0.798)	ND(0.798)	0.33	0.33	.798=(wet weight/41.1)x100
Phenanthrene		mg/kg	ND(0.798)	ND(0.798)	0.33	0.33	.798=(wet weight/41.1)x100
Pyrene		mg/kg	ND(0.798)	ND(0.798)	0.33	0.33	.798=(wet weight/41.1)x100
Calculations: Dry Weight to Wet Weight							
2-Methylnaphthalene			ND(0.799)	ND(0.799)	0.33	0.33	.799=(wet weight/41)x100
Acenaphthene			ND(0.799)	ND(0.799)	0.33	0.33	.799=(wet weight/41)x100
Anthracene			ND(0.799)	ND(0.799)	0.33	0.33	.799=(wet weight/41)x100
Benzo(a)anthracene			ND(0.799)	ND(0.799)	0.33	0.33	.799=(wet weight/41)x100
Benzo(a)pyrene (c)			ND(0.799)	ND(0.799)	0.33	0.33	.799=(wet weight/41)x100
Benzo(b)fluoranthene			ND(0.799)	ND(0.799)	0.33	0.33	.799=(wet weight/41)x100
Benzo(k)fluoranthene			ND(0.799)	ND(0.799)	0.33	0.33	.799=(wet weight/41)x100
Chrysene			ND(0.799)	ND(0.799)	0.33	0.33	.799=(wet weight/41)x100
Dibenz(a,h)anthracene (c)			ND(0.799)	ND(0.799)	0.33	0.33	.799=(wet weight/41)x100
Fluoranthene			ND(0.799)	ND(0.799)	0.33	0.33	.799=(wet weight/41)x100
Fluorene			ND(0.799)	ND(0.799)	0.33	0.33	.799=(wet weight/41)x100
Indeno(1,2,3-cd)pyrene			ND(0.799)	ND(0.799)	0.33	0.33	.799=(wet weight/41)x100
Naphthalene			ND(0.799)	ND(0.799)	0.33	0.33	.799=(wet weight/41)x100
Phenanthrene			ND(0.799)	ND(0.799)	0.33	0.33	.799=(wet weight/41)x100
Pyrene			ND(0.799)	ND(0.799)	0.33	0.33	.799=(wet weight/41)x100

Notes:

No sediment concentrations exceed RECAP standards.
Detected concentrations are presented in wet weight. Non-detected values (ND) are presented in dry weight. Conversions between dry weight and wet weight are shown.
(a) Analyzed by Method 1311 Toxic Characteristic Leaching Procedure (TCLP).
(b) Analyzed by EPA SW-846 method 6010, extraction method 3050B
(c) Based on RECAP quantitation limit for B(a)P, which is greater than risk-based value.

Human Health Assessment: Sediment Concentrations

Belle Isle Site
Morgan City, Louisiana

		Sample Location	0 (Continued)	
		Sample ID	MPA SN215550 I (0-6")	
		Sample Date	05/10/12	
		Percent Moisture	61.7	
Constituent	Units	Adult Sediment Standard	Child Sediment Standard	
Barium				
Barium TCLP Method ^(a)	mg/L	NA	NA	ND(5)
Barium 6010 Method ^(b)	mg/kg	1.98E+05	1.56E+05	1149
<i>Calculations:</i>				
<i>Ba 6010 dry wt. to wet wt.</i>				
TPH Fractions		Adult Sediment Standard	Child Sediment Standard	
Aliphatic >C10-C12	mg/kg	5.79E+04	4.56E+04	-
Aliphatic >C12-C16	mg/kg	4.65E+04	3.66E+04	-
Aliphatic >C16-C35	mg/kg	6.43E+05	9.25E+04	-
Aliphatic >C8-C10	mg/kg	2.97E+04	2.34E+04	-
Aromatic >C10-C12	mg/kg	2.99E+04	2.35E+04	-
Aromatic >C12-C16	mg/kg	4.60E+04	3.62E+04	-
Aromatic >C16-C21	mg/kg	1.21E+04	1.44E+03	-
Aromatic >C21-C35	mg/kg	2.72E+04	2.93E+03	-
Aromatic >C8-C10	mg/kg	1.64E+04	1.29E+04	-
PAHs				
2-Methylnaphthalene	mg/kg	5.60E+03	4.41E+03	-
Acenaphthene	mg/kg	9.45E+04	7.44E+04	-
Anthracene	mg/kg	5.53E+05	4.36E+05	-
Benzo(a)anthracene	mg/kg	2.09E+00	2.09E+00	-
Benzo(a)pyrene (c)	mg/kg	3.30E-01	3.30E-01	-
Benzo(b)fluoranthene	mg/kg	2.09E+00	2.09E+00	-
Benzo(k)fluoranthene	mg/kg	2.09E+01	2.09E+01	-
Chrysene	mg/kg	2.08E+02	2.08E+02	-
Dibenz(a,h)anthracene (c)	mg/kg	3.30E-01	3.30E-01	-
Fluoranthene	mg/kg	3.14E+04	3.05E+03	ND(0.848)
Fluorene	mg/kg	7.00E+04	5.51E+04	-
Indeno(1,2,3-cd)pyrene	mg/kg	2.09E+00	2.09E+00	-
Naphthalene	mg/kg	1.57E+03	1.23E+03	-
Phenanthrene	mg/kg	5.33E+05	4.20E+05	ND(0.848)
Pyrene	mg/kg	5.79E+04	4.57E+04	ND(0.848)
		Dry Weight Concentration	Wet Weight Detection Limit	Calculations: Dry Weight to Wet Weight
			0.32	.848=(wet weight/38.3)x100
			0.32	.848=(wet weight/38.3)x100
			0.32	.848=(wet weight/38.3)x100

Notes:
No sediment concentrations exceed RECAP standards.
Detected concentrations are presented in wet weight. Non-detected values (ND) are presented in dry weight. Conversions between dry weight and wet weight are shown.
(a) Analyzed by Method 1311 Toxic Characteristic Leaching Procedure (TCLP).
(b) Analyzed by EPA SW-846 method 6010, extraction method 3050B
(c) Based on RECAP quantitation limit for B(a)P, which is greater than risk-based value.

Sediment Standards Calculations
Attachment C

COMPARISON OF SEDIMENT DATA TO SEDIMENT RECREATIONAL STANDARDS

Belle Isle Site
Morgan City, Louisiana

Constituent	Sed _{in} Adult ^(b) (mg/kg)	Sed _{in} Juvenile ^(b) (mg/kg)	Additivity Divisor ^(c)	Final Sed _{in} Adult ^(d) (mg/kg)	Final Sed _{in} Juvenile ^(d) (mg/kg)	Maximum Concentration ^(e) (mg/kg)
Metals						
Barium	3.96E+05	3.12E+05	2	1.98E+05	1.56E+05	1.53E+03
TPH - Fractions						
Aliphatics >C12-C16	9.29E+04	7.32E+04	2	4.65E+04	3.66E+04	9.70E+01
Aliphatics >C16-C35	1.29E+06	1.85E+05	2	6.43E+05	9.25E+04	1.58E+02
Aromatics >C12-16	4.60E+04	3.62E+04	1	4.60E+04	3.62E+04	2.10E+01
Aromatics >C16-C21	2.42E+04	2.88E+03	2	1.21E+04	1.44E+03	4.30E+01

Notes:

- Concentrations are in milligrams per kilogram (mg/kg) wet weight
- Sed_{in} = site-specific RECAP Standard for sediment protective of human health for recreational land use
- (a) Calculated using RECAP soil contact algorithm with default exposure parameters, with the following modifications to express Reasonable Maximum Recreational Exposure. Exposure pathways include incidental sediment ingestion and dermal contact.
 - Exposure Frequency (EF) = 104 days/year (2 days per week for 52 weeks). This frequency assumes regular visitation for hunting and fishing throughout the year, and assumes sediment ingestion and dermal contact during each visit.
 - Exposure Duration (ED) = 30 years, RECAP and EPA default for residence in a single location
 - Body Surface Area = 6040 cm² including forearms, hands, and feet assumed to be in contact with sediment. Surface Areas are 95% percentile values from Table 7-12 and 7-13 of the EPA's Exposure Factors Handbook, EPA, 2011.
 - Body Weight = 112.7 kg, which is an average of the male and female combined 95th percentiles from ages 16-80+ in Table 8-3 of the Exposure Factors Handbook, EPA, 2011.
- (b) Soil Adherence Factor = 0.38, which is the weighted average of the hands, arms and feet from Table 7-4 of the Exposure Factors Handbook, EPA, 2011.
 - Calculated using RECAP soil contact algorithm with default exposure parameters, with the following modifications to express Reasonable Maximum Recreational Exposure for a juvenile 11 to 16 years old. This age best represents potential childhood exposure, as young children would not reasonably be exposed as regularly to sediments. Exposure pathways include incidental sediment ingestion and dermal contact.
 - Exposure Frequency (EF) = 104 days/year (2 days per week for 52 weeks)
 - Exposure Duration (ED) = 6 years, age specific
 - Body Surface Area = 5300 cm² including arms, hands, and feet assumed to be in contact with sediment. Surface Areas from Table 7-2 of the Child-specific Exposure Factors Handbook (2008).
 - Body Weight = 88.8 kg, which is an average of the male and female combined 95th percentiles from ages 11-16 in Table 8-3 of the Exposure Factors Handbook, 2011.
 - Soil Adherence Factor = 5.63 using a weighted average for child playing in sediment for hands, arms, and feet from Table ES-1 of the EPA's Child-specific Exposure Factors Handbook (2008).
- (c) Additivity divisor for non-carcinogenic effects on the same target/organ system applied as follows (RECAP Appendices D and G):
 - Barium = kidney
 - Aliphatics >C12-C16 = liver effects; hematological system effects
 - Aliphatics >C16-C35 = liver effects
 - Aromatics >C12-C16 = body weight
 - Aromatics >C16-C21 = kidney
- (d) Final SED_{in} = SED_{in} divided by additivity divisor
- (e) Depths 0-4' below ground surface

Sediment Adult Standard
 Algorithm: RECAP Soil_{ni}

SED_{ni} - Noncarcinogenic Effects- Inorganic Constituents (mg/kg):

(EQ4, Appendix H, RECAP 2003)

$$THQ \times BW_A \times AT_{nc} \times 365 \text{ days/year}$$

$$EF_{ni} \times ED_A \times \left(\left(\left(\frac{1}{RfD_o} \right) \times 10^{-6} \frac{kg}{mg} \times IRS_A \right) + \left(\left(\frac{1}{RfD_o} \right) \times SA_A \times AF_A \times ABS \times 10^{-6} \frac{kg}{mg} \right) \right)$$

Parameter	Definition (units)	Chemical Compound
		Barium
SED _{ni}	calculated non-industrial risk-based chemical concentration in sediment (mg/kg)	3.96E+05
THQ	target hazard quotient (unitless)	1 ^b
RfD _o	oral reference dose (mg/kg-day)	0.2 ^c
BW _A	average adult body weight ages 16-80+ (kg)	112.7 ^{d,g}
AT _{nc}	averaging time – noncarcinogens, adult (yr)	30 ^a
EF _{ni}	exposure frequency, recreational (days/yr)	104 ⁱ
ED _A	adult exposure duration (yr)	30 ^a
IRS _A	soil ingestion rate (mg/day)	200 ^a
SA _A	adult skin surface area (cm ² /day)	6045 ^{d,f}
AF _A	adult soil-to-skin adherence factor (mg/cm ²)	0.39 ^{d,h}
ABS	dermal absorption factor (unitless)	0 ^{c,a}

^a LDEQ default value.

^b Soil Screening Guidance: User's Guide, EPA 1996.

^c Chemical-specific, EPA, IRIS

^d U.S. EPA. Exposure Factors Handbook 2011 Edition (Final). U.S. Environmental Protection Agency, Washington, DC, EPA/600/R-09/052F, 2011.

^e Refer to Table H-6, RECAP 2003

^f 95th percentile of hands, arms, and feet (averaged male/female)

^g Average of 95th percentile, ages 16-80+

^h Weighted average of adherence factors of hands, arms, and feet

ⁱ Assuming recreational visitation every weekend

Sediment Child Standard
 Algorithm: RECAP Soil_{ni}

SED_{ni} - Noncarcinogenic Effects- Inorganic Constituents (mg/kg):

(EQ4, Appendix H, RECAP 2003)

$$THQ \times BW_c \times AT_{nc} \times 365 \text{ days/year}$$

$$EF_{ni} \times ED_c \times \left(\left(\left(\frac{1}{RfD_o} \right) \times 10^{-6} \frac{kg}{mg} \times IRS_c \right) + \left(\left(\frac{1}{RfD_o} \right) \times SA_c \times AF_c \times ABS \times 10^{-6} \frac{kg}{mg} \right) \right)$$

Parameter	Definition (units)	Chemical Compound
		<i>Barium</i>
SED _{ni}	calculated non-industrial risk-based chemical concentration in sediment (mg/kg)	3.12E+05
THQ	target hazard quotient (unitless)	1 ^b
RfD _o	oral reference dose (mg/kg-day)	0.2 ^c
BW _c	child body weight ages 11-16 (kg)	88.8 ^{d,g}
AT _{nc}	averaging time – noncarcinogens, child (yr)	6 ^b
EF _{ni}	exposure frequency, recreational (days/yr)	104 ⁱ
ED _c	child exposure duration ages 11-16 (yr)	6 ^b
IRS _c	child soil ingestion rate (mg/day)	200 ^b
SA _c	child skin surface area (cm ² /day)	5300 ^{d,f}
AF _c	child soil-to-skin adherence factor (mg/cm ²)	5.64 ^{d,h}
ABS	dermal absorption factor (unitless)	0 ^{c,e}

^a LDEQ default value.

^b Soil Screening Guidance: User's Guide, EPA 1996.

^c Chemical-specific, EPA, IRIS

^d U.S. EPA. Child-Specific Exposure Factors Handbook (Final Report) 2008. U.S. Environmental Protection Agency, Washington, DC, EPA/600/R-06/096F, 2008.

^e Refer to Table H-6, RECAP 2003

^f 95th percentile of hands, arms, and feet (averaged male/female)

^g Average of 95th percentile, ages 11-16

^h Weighted average of adherence factors of hands, arms, and feet

ⁱ Assuming recreational visitation every weekend

Sediment Adult Standard
 Algorithm: RECAP Soil_{ni}

SED_{ni} - Noncarcinogenic Effects- Organic Constituents (mg/kg):

(EQ4, Appendix H, RECAP 2003)

$$THQ \times BW_A \times AT_{nc} \times 365 \text{ days/year}$$

$$EF_{ni} \times ED_A \times \left(\left(\left(\frac{1}{RfD_o} \right) \times 10^{-6} \frac{kg}{mg} \times IRS_A \right) + \left(\left(\frac{1}{RfD_i} \right) \times IRA_A \times \left(\frac{1}{VF_{ni}} \right) \right) + \left(\left(\frac{1}{RfD_o} \right) \times SA_A \times AF_A \times ABS \times 10^{-6} \frac{kg}{mg} \right) \right)$$

Parameter	Definition (units)	Chemical Compound
		<i>Aliphatics >C8-C10</i>
SED _{ni}	calculated non-industrial risk-based chemical concentration in sediment (mg/kg)	2.97E+04
THQ	target hazard quotient (unitless)	1 ^b
RfD _o	oral reference dose (mg/kg-day)	0.1 ^c
RfD _i	inhalation chronic reference dose (mg/kg-day)	0.29 ^c
BW _A	average adult body weight ages 16-80+ (kg)	112.7 ^{d,g}
AT _{nc}	averaging time – noncarcinogens, adult (yr)	30 ^a
EF _{ni}	exposure frequency, recreational (days/yr)	104 ⁱ
ED _A	adult exposure duration (yr)	30 ^a
IRS _A	soil ingestion rate (mg/day)	200 ^a
IRA _A	inhalation rate (m ³ /day)	10 ^a
VF _{ni}	non-industrial soil-to-air volatilization factor (m ³ /kg)	3048.1 ^c
SA _A	adult skin surface area (cm ² /day)	6045 ^{d, f}
AF _A	adult soil-to-skin adherence factor (mg/cm ²)	0.39 ^{d, h}
ABS	dermal absorption factor (unitless)	0 ^{c,a}

^a LDEQ default value.

^b Soil Screening Guidance: User's Guide, EPA 1996.

^c Chemical-specific, EPA, IRIS

^d U.S. EPA. Exposure Factors Handbook 2011 Edition (Final). U.S. Environmental Protection Agency, Washington, DC, EPA/600/R-09/052F, 2011.

^e Refer to Table H-6.

^f 95th percentile of hands, arms, and feet(Averaged male/female)

^g Average of 95th percentile, ages 16-80+

^h Weighted average of adherence factors of hands, arms, and feet

ⁱ Assuming recreational visitation every weekend

Sediment Juvenile Standard
Algorithm: RECAP Soilni

SED_{ni} - Noncarcinogenic Effects- Organic Constituents (mg/kg):

(EQ4, Appendix H, RECAP 2003)

$$THQ \times BW_c \times AT_{nc} \times 365 \text{ days/year}$$

$$EF_{ni} \times ED_c \times \left(\left(\left(\frac{1}{RfD_o} \right) \times 10^{-6} \frac{kg}{mg} \times IRS_c \right) + \left(\left(\frac{1}{RfD_i} \right) \times IRA_c \times \left(\frac{1}{VF_{ni}} \right) \right) + \left(\left(\frac{1}{RfD_o} \right) \times SA_c \times AF_c \times ABS \times 10^{-6} \frac{kg}{mg} \right) \right)$$

Parameter	Definition (units)	Chemical Compound
		<i>Aliphatics >C8-C10</i>
SED _{ni}	calculated non-industrial risk-based chemical concentration in sediment (mg/kg)	2.34E+04
THQ	target hazard quotient (unitless)	1 ^b
RfD _o	oral reference dose (mg/kg-day)	0.1 ^c
RfD _i	inhalation chronic reference dose (mg/kg-day)	0.29 ^c
BW _c	child body weight ages 11-16 (kg)	88.8 ^{d,g}
AT _{nc}	averaging time – noncarcinogens, child (yr)	6 ^b
EF _{ni}	exposure frequency, recreational (days/yr)	104 ⁱ
ED _c	child exposure duration ages 11-16 (yr)	6 ^b
IRS _c	child soil ingestion rate (mg/day)	200 ^a
IRA _c	child inhalation rate ages(m ³ /day)	10 ^a
VF _{ni}	non-industrial soil-to-air volatilization factor (m ³ /kg)	3048.1 ^c
SA _c	child skin surface area (cm ² /day)	5300 ^{d,f}
AF _c	child soil-to-skin adherence factor (mg/cm ²)	5.64 ^{d,h}
ABS	dermal absorption factor (unitless)	0 ^{c,e}

^a LDEQ default value.

^b Soil Screening Guidance: User's Guide, EPA 1996.

^c Chemical-specific, EPA, IRIS

^d U.S. EPA. Child-Specific Exposure Factors Handbook (Final Report) 2008. U.S. Environmental Protection Agency, Washington, DC, EPA/600/R-06/096F, 2008.

^e Refer to Table H-6.

^f 95th percentile of hands, arms, and feet(Averaged male/female)

^g Average of 95th percentile, ages 11-16

^h Weighted average of adherence factors of hands, arms, and feet

ⁱ Assuming recreational visitation every weekend

Sediment Adult Standard
 Algorithm: RECAP Soil_{ni}

SED_{ni} - Noncarcinogenic Effects- Organic Constituents (mg/kg):

(EQ4, Appendix H, RECAP 2003)

$$THQ \times BW_A \times AT_{nc} \times 365 \text{ days/year}$$

$$EF_{ni} \times ED_A \times \left(\left(\left(\frac{1}{RfD_o} \right) \times 10^{-6} \frac{kg}{mg} \times IRS_A \right) + \left(\left(\frac{1}{RfD_i} \right) \times IRA_A \times \left(\frac{1}{VF_{ni}} \right) \right) + \left(\left(\frac{1}{RfD_o} \right) \times SA_A \times AF_A \times ABS \times 10^{-6} \frac{kg}{mg} \right) \right)$$

Parameter	Definition (units)	Chemical Compound
		<i>Aliphatics >C10-C12</i>
SED _{ni}	calculated non-industrial risk-based chemical concentration in sediment (mg/kg)	5.79E+04
THQ	target hazard quotient (unitless)	1 ^b
RfD _o	oral reference dose (mg/kg-day)	0.1 ^c
RfD _i	inhalation chronic reference dose (mg/kg-day)	0.3 ^c
BW _A	average adult body weight ages 16-80+ (kg)	112.7 ^{d,g}
AT _{nc}	averaging time – noncarcinogens, adult (yr)	30 ^a
EF _{ni}	exposure frequency, recreational (days/yr)	104 ⁱ
ED _A	adult exposure duration (yr)	30 ^a
IRS _A	soil ingestion rate (mg/day)	200 ^a
IRA _A	inhalation rate (m ³ /day)	10 ^a
VF _{ni}	non-industrial soil-to-air volatilization factor (m ³ /kg)	6904.8 ^c
SA _A	adult skin surface area (cm ² /day)	6045 ^{d,f}
AF _A	adult soil-to-skin adherence factor (mg/cm ²)	0.39 ^{d,h}
ABS	dermal absorption factor (unitless)	0 ^{c,a}

^a LDEQ default value.

^b Soil Screening Guidance: User's Guide, EPA 1996.

^c Chemical-specific, EPA, IRIS

^d U.S. EPA. Exposure Factors Handbook 2011 Edition (Final). U.S. Environmental Protection Agency, Washington, DC, EPA/600/R-09/052F, 2011.

^e Refer to Table H-6.

^f 95th percentile of hands, arms, and feet(Averaged male/female)

^g Average of 95th percentile, ages 16-80+

^h Weighted average of adherence factors of hands, arms, and feet

ⁱ Assuming recreational visitation every weekend

Sediment Juvenile Standard
 Algorithm: RECAP Soilni

SED_{ni} - Noncarcinogenic Effects- Organic Constituents (mg/kg):

(EQ4, Appendix H, RECAP 2003)

THQ x BW_c x AT_{nc} x 365 days/year

$$EF_{ni} \times ED_c \times \left(\left(\left(\frac{1}{RfD_o} \right) \times 10^{-6} \frac{kg}{mg} \times IRS_c \right) + \left(\left(\frac{1}{RfD_i} \right) \times IRA_c \times \left(\frac{1}{VF_{ni}} \right) \right) + \left(\left(\frac{1}{RfD_o} \right) \times SA_c \times AF_c \times ABS \times 10^{-6} \frac{kg}{mg} \right) \right)$$

Parameter	Definition (units)	Chemical Compound
		<i>Aliphatics >C10-C12</i>
SED _{ni}	calculated non-industrial risk-based chemical concentration in sediment (mg/kg)	4.56E+04
THQ	target hazard quotient (unitless)	1 ^b
RfD _o	oral reference dose (mg/kg-day)	0.1 ^c
RfD _i	inhalation chronic reference dose (mg/kg-day)	0.3 ^c
BW _c	child body weight ages 11-16 (kg)	88.8 ^{d,g}
AT _{nc}	averaging time – noncarcinogens, child (yr)	6 ^b
EF _{ni}	exposure frequency, recreational (days/yr)	104 ⁱ
ED _c	child exposure duration ages 11-16 (yr)	6 ^b
IRS _c	child soil ingestion rate (mg/day)	200 ^a
IRA _c	child inhalation rate ages(m ³ /day)	10 ^a
VF _{ni}	non-industrial soil-to-air volatilization factor (m ³ /kg)	6904.8 ^c
SA _c	child skin surface area (cm ² /day)	5300 ^{d, f}
AF _c	child soil-to-skin adherence factor (mg/cm ²)	5.64 ^{d, h}
ABS	dermal absorption factor (unitless)	0 ^{c, a}

^a LDEQ default value.

^b Soil Screening Guidance: User's Guide, EPA 1996.

^c Chemical-specific, EPA, IRIS

^d U.S. EPA. Child-Specific Exposure Factors Handbook (Final Report) 2008. U.S. Environmental Protection Agency, Washington, DC, EPA/600/R-06/096F, 2008.

^e Refer to Table H-6.

^f 95th percentile of hands, arms, and feet(Averaged male/female)

^g Average of 95th percentile, ages 11-16

^h Weighted average of adherence factors of hands, arms, and feet

ⁱ Assuming recreational visitation every weekend

Sediment Adult Standard
 Algorithm: RECAP Soil_{ni}

SED_{ni} - Noncarcinogenic Effects- Organic Constituents (mg/kg):

(EQ4, Appendix H, RECAP 2003)

THQ x BW_A x AT_{nc} x 365 days/year

$$EF_{ni} \times ED_A \times \left(\left(\left(\frac{1}{RfD_o} \right) \times 10^{-6} \frac{kg}{mg} \times IRS_A \right) + \left(\left(\frac{1}{RfD_i} \right) \times IRA_A \times \left(\frac{1}{VF_{ni}} \right) \right) + \left(\left(\frac{1}{RfD_o} \right) \times SA_A \times AF_A \times ABS \times 10^{-6} \frac{kg}{mg} \right) \right)$$

Parameter	Definition (units)	Chemical Compound
		<i>Aliphatics >C12-C16</i>
SED _{ni}	calculated non-industrial risk-based chemical concentration in sediment (mg/kg)	9.29E+04
THQ	target hazard quotient (unitless)	1 ^b
RfD _o	oral reference dose (mg/kg-day)	0.1 ^c
RfD _i	inhalation chronic reference dose (mg/kg-day)	0.3 ^c
BW _A	average adult body weight ages 16-80+ (kg)	112.7 ^{d,g}
AT _{nc}	averaging time – noncarcinogens, adult (yr)	30 ^a
EF _{ni}	exposure frequency, recreational (days/yr)	104 ⁱ
ED _A	adult exposure duration (yr)	30 ^a
IRS _A	soil ingestion rate (mg/day)	200 ^a
IRA _A	inhalation rate (m ³ /day)	10 ^a
VF _{ni}	non-industrial soil-to-air volatilization factor (m ³ /kg)	14773.66 ^c
SA _A	adult skin surface area (cm ² /day)	6045 ^{d, f}
AF _A	adult soil-to-skin adherence factor (mg/cm ²)	0.39 ^{d, h}
ABS	dermal absorption factor (unitless)	0 ^{c, a}

^a LDEQ default value.

^b Soil Screening Guidance: User's Guide, EPA 1996.

^c Chemical-specific, EPA, IRIS

^d U.S. EPA. Exposure Factors Handbook 2011 Edition (Final). U.S. Environmental Protection Agency, Washington, DC, EPA/600/R-09/052F, 2011.

^e Refer to Table H-6.

^f 95th percentile of hands, arms, and feet(Averaged male/female)

^g Average of 95th percentile, ages 16-80+

^h Weighted average of adherence factors of hands, arms, and feet

ⁱ Assuming recreational visitation every weekend

Sediment Juvenile Standard
 Algorithm: RECAP Soilni

SED_{ni} - Noncarcinogenic Effects- Organic Constituents (mg/kg):

(EQ4, Appendix H, RECAP 2003)

THQ x BW_c x AT_{nc} x 365 days/year

$$EF_{ni} \times ED_c \times \left(\left(\left(\frac{1}{RfD_o} \right) \times 10^{-6} \frac{kg}{mg} \times IRS_c \right) + \left(\left(\frac{1}{RfD_i} \right) \times IRA_c \times \left(\frac{1}{VF_{ni}} \right) \right) + \left(\left(\frac{1}{RfD_o} \right) \times SA_c \times AF_c \times ABS \times 10^{-6} \frac{kg}{mg} \right) \right)$$

Parameter	Definition (units)	Chemical Compound
		<i>Aliphatics >C12-C16</i>
SED _{ni}	calculated non-industrial risk-based chemical concentration in sediment (mg/kg)	7.32E+04
THQ	target hazard quotient (unitless)	1 ^b
RfD _o	oral reference dose (mg/kg-day)	0.1 ^c
RfD _i	inhalation chronic reference dose (mg/kg-day)	0.3 ^c
BW _c	child body weight ages 11-16 (kg)	88.8 ^{d,g}
AT _{nc}	averaging time – noncarcinogens, child (yr)	6 ^b
EF _{ni}	exposure frequency, recreational (days/yr)	104 ⁱ
ED _c	child exposure duration ages 11-16 (yr)	6 ^b
IRS _c	child soil ingestion rate (mg/day)	200 ^a
IRA _c	child inhalation rate ages(m ³ /day)	10 ^a
VF _{ni}	non-industrial soil-to-air volatilization factor (m ³ /kg)	14773.66 ^c
SA _c	child skin surface area (cm ² /day)	5300 ^{d, f}
AF _c	child soil-to-skin adherence factor (mg/cm ²)	5.64 ^{d, h}
ABS	dermal absorption factor (unitless)	0 ^{e,a}

^a LDEQ default value.

^b Soil Screening Guidance: User's Guide, EPA 1996.

^c Chemical-specific, EPA, IRIS

^d U.S. EPA. Child-Specific Exposure Factors Handbook (Final Report) 2008. U.S. Environmental Protection Agency, Washington, DC, EPA/600/R-06/096F, 2008.

^e Refer to Table H-6.

^f 95th percentile of hands, arms, and feet(Averaged male/female)

^g Average of 95th percentile, ages 11-16

^h Weighted average of adherence factors of hands, arms, and feet

ⁱ Assuming recreational visitation every weekend

Sediment Adult Standard
 Algorithm: RECAP Soil_{ni}

SED_{ni} - Noncarcinogenic Effects- Organic Constituents (mg/kg):

(EQ4, Appendix H, RECAP 2003)

$$THQ \times BW_A \times AT_{nc} \times 365 \text{ days/year}$$

$$EF_{ni} \times ED_A \times \left(\left(\left(\frac{1}{RfD_o} \right) \times 10^{-6} \frac{kg}{mg} \times IRS_A \right) + \left(\left(\frac{1}{RfD_i} \right) \times IRA_A \times \left(\frac{1}{VF_{ni}} \right) \right) + \left(\left(\frac{1}{RfD_o} \right) \times SA_A \times AF_A \times ABS \times 10^{-6} \frac{kg}{mg} \right) \right)$$

Parameter	Definition (units)	Chemical Compound
		<i>Aliphatics >C16-C35</i>
SED _{ni}	calculated non-industrial risk-based chemical concentration in sediment (mg/kg)	6.43E+05
THQ	target hazard quotient (unitless)	1 ^b
RfD _o	oral reference dose (mg/kg-day)	2 ^c
RfD _i	inhalation chronic reference dose (mg/kg-day)	2 ^c
BW _A	average adult body weight ages 16-80+ (kg)	112.7 ^{d,g}
AT _{nc}	averaging time – noncarcinogens, adult (yr)	30 ^a
EF _{ni}	exposure frequency, recreational (days/yr)	104 ⁱ
ED _A	adult exposure duration (yr)	30 ^a
IRS _A	soil ingestion rate (mg/day)	200 ^a
IRA _A	inhalation rate (m ³ /day)	10 ^a
VF _{ni}	non-industrial soil-to-air volatilization factor (m ³ /kg)	54000.96 ^c
SA _A	adult skin surface area (cm ² /day)	6045 ^{d, f}
AF _A	adult soil-to-skin adherence factor (mg/cm ²)	0.39 ^{d, h}
ABS	dermal absorption factor (unitless)	0.1 ^{c, a}

^a LDEQ default value.

^b Soil Screening Guidance: User's Guide, EPA 1996.

^c Chemical-specific, EPA, IRIS

^d U.S. EPA. Exposure Factors Handbook 2011 Edition (Final). U.S. Environmental Protection Agency, Washington, DC, EPA/600/R-09/052F, 2011.

^e Refer to Table H-6.

^f 95th percentile of hands, arms, and feet(Averaged male/female)

^g Average of 95th percentile, ages 16-80+

^h Weighted average of adherence factors of hands, arms, and feet

ⁱ Assuming recreational visitation every weekend

Sediment Juvenile Standard
Algorithm: RECAP Soilni

SED_{ni} - Noncarcinogenic Effects- Organic Constituents (mg/kg):

(EQ4, Appendix H, RECAP 2003)

$$THQ \times BW_c \times AT_{nc} \times 365 \text{ days/year}$$

$$EF_{ni} \times ED_c \times \left(\left(\left(\frac{1}{RfD_o} \right) \times 10^{-6} \frac{kg}{mg} \times IRS_c \right) + \left(\left(\frac{1}{RfD_i} \right) \times IRA_c \times \left(\frac{1}{VF_{ni}} \right) \right) + \left(\left(\frac{1}{RfD_o} \right) \times SA_c \times AF_c \times ABS \times 10^{-6} \frac{kg}{mg} \right) \right)$$

Parameter	Definition (units)	Chemical Compound
		<i>Aliphatics >C16-C35</i>
SED _{ni}	calculated non-industrial risk-based chemical concentration in sediment (mg/kg)	9.25E+04
THQ	target hazard quotient (unitless)	1 ^b
RfD _o	oral reference dose (mg/kg-day)	2 ^c
RfD _i	inhalation chronic reference dose (mg/kg-day)	2 ^c
BW _c	child body weight ages 11-16 (kg)	88.8 ^{d,g}
AT _{nc}	averaging time – noncarcinogens, child (yr)	6 ^b
EF _{ni}	exposure frequency, recreational (days/yr)	104 ⁱ
ED _c	child exposure duration ages 11-16 (yr)	6 ^b
IRS _c	child soil ingestion rate (mg/day)	200 ^a
IRA _c	child inhalation rate ages(m ³ /day)	10 ^a
VF _{ni}	non-industrial soil-to-air volatilization factor (m ³ /kg)	54000.96 ^c
SA _c	child skin surface area (cm ² /day)	5300 ^{d,f}
AF _c	child soil-to-skin adherence factor (mg/cm ²)	5.64 ^{d,h}
ABS	dermal absorption factor (unitless)	0.1 ^{c,a}

^a LDEQ default value.

^b Soil Screening Guidance: User's Guide, EPA 1996.

^c Chemical-specific, EPA, IRIS

^d U.S. EPA. Child-Specific Exposure Factors Handbook (Final Report) 2008. U.S. Environmental Protection Agency, Washington, DC, EPA/600/R-06/096F, 2008.

^e Refer to Table H-6.

^f 95th percentile of hands, arms, and feet(Averaged male/female)

^g Average of 95th percentile, ages 11-16

^h Weighted average of adherence factors of hands, arms, and feet

ⁱ Assuming recreational visitation every weekend

Sediment Adult Standard
 Algorithm: RECAP Soil_{ni}

SED_{ni} - Noncarcinogenic Effects- Organic Constituents (mg/kg):

(EQ4, Appendix H, RECAP 2003)

$$THQ \times BW_A \times AT_{nc} \times 365 \text{ days/year}$$

$$EF_{ni} \times ED_A \times \left(\left(\left(\frac{1}{RfD_o} \right) \times 10^{-6} \frac{kg}{mg} \times IRS_A \right) + \left(\left(\frac{1}{RfD_i} \right) \times IRA_A \times \left(\frac{1}{VF_{ni}} \right) \right) + \left(\left(\frac{1}{RfD_o} \right) \times SA_A \times AF_A \times ABS \times 10^{-6} \frac{kg}{mg} \right) \right)$$

Parameter	Definition (units)	Chemical Compound
		<i>Aromatics >C8-C10</i>
SED _{ni}	calculated non-industrial risk-based chemical concentration in sediment (mg/kg)	2.97E+04
THQ	target hazard quotient (unitless)	1 ^b
RfD _o	oral reference dose (mg/kg-day)	0.04 ^c
RfD _i	inhalation chronic reference dose (mg/kg-day)	0.06 ^c
BW _A	average adult body weight ages 16-80+ (kg)	112.7 ^{d,g}
AT _{nc}	averaging time – noncarcinogens, adult (yr)	30 ^a
EF _{ni}	exposure frequency, recreational (days/yr)	104 ⁱ
ED _A	adult exposure duration (yr)	30 ^a
IRS _A	soil ingestion rate (mg/day)	200 ^a
IRA _A	inhalation rate (m ³ /day)	10 ^a
VF _{ni}	non-industrial soil-to-air volatilization factor (m ³ /kg)	8721.08 ^c
SA _A	adult skin surface area (cm ² /day)	6045 ^{d, f}
AF _A	adult soil-to-skin adherence factor (mg/cm ²)	0.39 ^{d, h}
ABS	dermal absorption factor (unitless)	0 ^{c, a}

^a LDEQ default value.

^b Soil Screening Guidance: User's Guide, EPA 1996.

^c Chemical-specific, EPA, IRIS

^d U.S. EPA. Exposure Factors Handbook 2011 Edition (Final). U.S. Environmental Protection Agency, Washington, DC, EPA/600/R-09/052F, 2011.

^e Refer to Table H-6.

^f 95th percentile of hands, arms, and feet(Averaged male/female)

^g Average of 95th percentile, ages 16-80+

^h Weighted average of adherence factors of hands, arms, and feet

ⁱ Assuming recreational visitation every weekend

Sediment Juvenile Standard
Algorithm: RECAP Soilni

SED_{ni} - Noncarcinogenic Effects- Organic Constituents (mg/kg):

(EQ4, Appendix H, RECAP 2003)

THQ x BW_c x AT_{nc} x 365 days/year

$$EF_{ni} \times ED_c \times \left(\left(\left(\frac{1}{RfD_o} \right) \times 10^{-6} \frac{kg}{mg} \times IRS_c \right) + \left(\left(\frac{1}{RfD_i} \right) \times IRA_c \times \left(\frac{1}{VF_{ni}} \right) \right) + \left(\left(\frac{1}{RfD_o} \right) \times SA_c \times AF_c \times ABS \times 10^{-6} \frac{kg}{mg} \right) \right)$$

Parameter	Definition (units)	Chemical Compound
		<i>Aromatics >C8-C10</i>
SED _{ni}	calculated non-industrial risk-based chemical concentration in sediment (mg/kg)	2.34E+04
THQ	target hazard quotient (unitless)	1 ^b
RfD _o	oral reference dose (mg/kg-day)	0.04 ^c
RfD _i	inhalation chronic reference dose (mg/kg-day)	0.06 ^c
BW _c	child body weight ages 11-16 (kg)	88.8 ^{d,g}
AT _{nc}	averaging time – noncarcinogens, child (yr)	6 ^b
EF _{ni}	exposure frequency, recreational (days/yr)	104 ⁱ
ED _c	child exposure duration ages 11-16 (yr)	6 ^b
IRS _c	child soil ingestion rate (mg/day)	200 ^a
IRA _c	child inhalation rate ages(m ³ /day)	10 ^a
VF _{ni}	non-industrial soil-to-air volatilization factor (m ³ /kg)	8721.08 ^c
SA _c	child skin surface area (cm ² /day)	5300 ^{d, f}
AF _c	child soil-to-skin adherence factor (mg/cm ²)	5.64 ^{d, h}
ABS	dermal absorption factor (unitless)	0 ^{c,a}

^a LDEQ default value.

^b Soil Screening Guidance: User's Guide, EPA 1996.

^c Chemical-specific, EPA, IRIS

^d U.S. EPA. Child-Specific Exposure Factors Handbook (Final Report) 2008. U.S. Environmental Protection Agency, Washington, DC, EPA/600/R-06/096F, 2008.

^e Refer to Table H-6.

^f 95th percentile of hands, arms, and feet(Averaged male/female)

^g Average of 95th percentile, ages 11-16

^h Weighted average of adherence factors of hands, arms, and feet

ⁱ Assuming recreational visitation every weekend

Sediment Adult Standard
 Algorithm: RECAP Soil_{ni}

SED_{ni} - Noncarcinogenic Effects- Organic Constituents (mg/kg):

(EQ4, Appendix H, RECAP 2003)

THQ x BW_A x AT_{nc} x 365 days/year

$$EF_{ni} \times ED_A \times \left(\left(\left(\frac{1}{RfD_o} \right) \times 10^{-6} \frac{kg}{mg} \times IRS_A \right) + \left(\left(\frac{1}{RfD_i} \right) \times IRA_A \times \left(\frac{1}{VF_{ni}} \right) \right) + \left(\left(\frac{1}{RfD_o} \right) \times SA_A \times AF_A \times ABS \times 10^{-6} \frac{kg}{mg} \right) \right)$$

Parameter	Definition (units)	Chemical Compound
		<i>Aromatics >C10-C12</i>
SED _{ni}	calculated non-industrial risk-based chemical concentration in sediment (mg/kg)	2.99E+04
THQ	target hazard quotient (unitless)	1 ^b
RfD _o	oral reference dose (mg/kg-day)	0.04 ^c
RfD _i	inhalation chronic reference dose (mg/kg-day)	0.06 ^c
BW _A	average adult body weight ages 16-80+ (kg)	112.7 ^{d,g}
AT _{nc}	averaging time – noncarcinogens, adult (yr)	30 ^a
EF _{ni}	exposure frequency, recreational (days/yr)	104 ⁱ
ED _A	adult exposure duration (yr)	30 ^a
IRS _A	soil ingestion rate (mg/day)	200 ^a
IRA _A	inhalation rate (m ³ /day)	10 ^a
VF _{ni}	non-industrial soil-to-air volatilization factor (m ³ /kg)	20236.7 ^c
SA _A	adult skin surface area (cm ² /day)	6045 ^{d, f}
AF _A	adult soil-to-skin adherence factor (mg/cm ²)	0.39 ^{d, h}
ABS	dermal absorption factor (unitless)	0 ^{c, a}

^a LDEQ default value.

^b Soil Screening Guidance: User's Guide, EPA 1996.

^c Chemical-specific, EPA, IRIS

^d U.S. EPA. Exposure Factors Handbook 2011 Edition (Final). U.S. Environmental Protection Agency, Washington, DC, EPA/600/R-09/052F, 2011.

^e Refer to Table H-6.

^f 95th percentile of hands, arms, and feet(Averaged male/female)

^g Average of 95th percentile, ages 16-80+

^h Weighted average of adherence factors of hands, arms, and feet

ⁱ Assuming recreational visitation every weekend

Sediment Juvenile Standard
Algorithm: RECAP Soilni

SED_{ni} - Noncarcinogenic Effects- Organic Constituents (mg/kg):

(EQ4, Appendix H, RECAP 2003)

$$THQ \times BW_c \times AT_{nc} \times 365 \text{ days/year}$$

$$EF_{ni} \times ED_c \times \left(\left(\left(\frac{1}{RfD_o} \right) \times 10^{-6} \frac{kg}{mg} \times IRS_c \right) + \left(\left(\frac{1}{RfD_i} \right) \times IRA_c \times \left(\frac{1}{VF_{ni}} \right) \right) + \left(\left(\frac{1}{RfD_o} \right) \times SA_c \times AF_c \times ABS \times 10^{-6} \frac{kg}{mg} \right) \right)$$

Parameter	Definition (units)	Chemical Compound
		<i>Aromatics >C10-C12</i>
SED _{ni}	calculated non-industrial risk-based chemical concentration in sediment (mg/kg)	2.35E+04
THQ	target hazard quotient (unitless)	1 ^b
RfD _o	oral reference dose (mg/kg-day)	0.04 ^c
RfD _i	inhalation chronic reference dose (mg/kg-day)	0.06 ^c
BW _c	child body weight ages 11-16 (kg)	88.8 ^{d,g}
AT _{nc}	averaging time – noncarcinogens, child (yr)	6 ^b
EF _{ni}	exposure frequency, recreational (days/yr)	104 ⁱ
ED _c	child exposure duration ages 11-16 (yr)	6 ^b
IRS _c	child soil ingestion rate (mg/day)	200 ^a
IRA _c	child inhalation rate ages(m ³ /day)	10 ^a
VF _{ni}	non-industrial soil-to-air volatilization factor (m ³ /kg)	20236.7 ^c
SA _c	child skin surface area (cm ² /day)	5300 ^{d, f}
AF _c	child soil-to-skin adherence factor (mg/cm ²)	5.64 ^{d, h}
ABS	dermal absorption factor (unitless)	0 ^{c, a}

^a LDEQ default value.

^b Soil Screening Guidance: User's Guide, EPA 1996.

^c Chemical-specific, EPA, IRIS

^d U.S. EPA. Child-Specific Exposure Factors Handbook (Final Report) 2008. U.S. Environmental Protection Agency, Washington, DC, EPA/600/R-06/096F, 2008.

^e Refer to Table H-6.

^f 95th percentile of hands, arms, and feet(Averaged male/female)

^g Average of 95th percentile, ages 11-16

^h Weighted average of adherence factors of hands, arms, and feet

ⁱ Assuming recreational visitation every weekend

Sediment Adult Standard
Algorithm: RECAP Soil_{ni}

SED_{ni} - Noncarcinogenic Effects- Organic Constituents (mg/kg):

(EQ4, Appendix H, RECAP 2003)

THQ x BW_A x AT_{nc} x 365 days/year

$$EF_{ni} \times ED_A \times \left(\left(\left(\frac{1}{RfD_o} \right) \times 10^{-6} \frac{kg}{mg} \times IRS_A \right) + \left(\left(\frac{1}{RfD_i} \right) \times IRA_A \times \left(\frac{1}{VF_{ni}} \right) \right) + \left(\left(\frac{1}{RfD_o} \right) \times SA_A \times AF_A \times ABS \times 10^{-6} \frac{kg}{mg} \right) \right)$$

Parameter	Definition (units)	Chemical Compound
		<i>Aromatics >C12-C16</i>
SED _{ni}	calculated non-industrial risk-based chemical concentration in sediment (mg/kg)	4.60E+04
THQ	target hazard quotient (unitless)	1 ^b
RfD _o	oral reference dose (mg/kg-day)	0.04 ^c
RfD _i	inhalation chronic reference dose (mg/kg-day)	0.06 ^c
BW _A	average adult body weight ages 16-80+ (kg)	112.7 ^{d,g}
AT _{nc}	averaging time – noncarcinogens, adult (yr)	30 ^a
EF _{ni}	exposure frequency, recreational (days/yr)	104 ⁱ
ED _A	adult exposure duration (yr)	30 ^a
IRS _A	soil ingestion rate (mg/day)	200 ^a
IRA _A	inhalation rate (m ³ /day)	10 ^a
VF _{ni}	non-industrial soil-to-air volatilization factor (m ³ /kg)	46279.75 ^c
SA _A	adult skin surface area (cm ² /day)	6045 ^{d,f}
AF _A	adult soil-to-skin adherence factor (mg/cm ²)	0.39 ^{d,h}
ABS	dermal absorption factor (unitless)	0 ^{c,a}

^a LDEQ default value.

^b Soil Screening Guidance: User's Guide, EPA 1996.

^c Chemical-specific, EPA, IRIS

^d U.S. EPA. Exposure Factors Handbook 2011 Edition (Final). U.S. Environmental Protection Agency, Washington, DC, EPA/600/R-09/052F, 2011.

^e Refer to Table H-6.

^f 95th percentile of hands, arms, and feet(Averaged male/female)

^g Average of 95th percentile, ages 16-80+

^h Weighted average of adherence factors of hands, arms, and feet

ⁱ Assuming recreational visitation every weekend

Sediment Juvenile Standard
Algorithm: RECAP Soilni

SED_{ni} - Noncarcinogenic Effects- Organic Constituents (mg/kg):

(EQ4, Appendix H, RECAP 2003)

THQ x BW_c x AT_{nc} x 365 days/year

$$EF_{ni} \times ED_c \times \left(\left(\left(\frac{1}{RfD_o} \right) \times 10^{-6} \frac{kg}{mg} \times IRS_c \right) + \left(\left(\frac{1}{RfD_i} \right) \times IRA_c \times \left(\frac{1}{VF_{ni}} \right) \right) + \left(\left(\frac{1}{RfD_o} \right) \times SA_c \times AF_c \times ABS \times 10^{-6} \frac{kg}{mg} \right) \right)$$

Parameter	Definition (units)	Chemical Compound
		<i>Aromatics >C12-C16</i>
SED _{ni}	calculated non-industrial risk-based chemical concentration in sediment (mg/kg)	3.62E+04
THQ	target hazard quotient (unitless)	1 ^b
RfD _o	oral reference dose (mg/kg-day)	0.04 ^c
RfD _i	inhalation chronic reference dose (mg/kg-day)	0.06 ^c
BW _c	child body weight ages 11-16 (kg)	88.8 ^{d,g}
AT _{nc}	averaging time – noncarcinogens, child (yr)	6 ^b
EF _{ni}	exposure frequency, recreational (days/yr)	104 ⁱ
ED _c	child exposure duration ages 11-16 (yr)	6 ^b
IRS _c	child soil ingestion rate (mg/day)	200 ^a
IRA _c	child inhalation rate ages(m ³ /day)	10 ^a
VF _{ni}	non-industrial soil-to-air volatilization factor (m ³ /kg)	46279.75 ^c
SA _c	child skin surface area (cm ² /day)	5300 ^{d, f}
AF _c	child soil-to-skin adherence factor (mg/cm ²)	5.64 ^{d, h}
ABS	dermal absorption factor (unitless)	0 ^{c,a}

^a LDEQ default value.

^b Soil Screening Guidance: User's Guide, EPA 1996.

^c Chemical-specific, EPA, IRIS

^d U.S. EPA. Child-Specific Exposure Factors Handbook (Final Report) 2008. U.S. Environmental Protection Agency, Washington, DC, EPA/600/R-06/096F, 2008.

^e Refer to Table H-6.

^f 95th percentile of hands, arms, and feet(Averaged male/female)

^g Average of 95th percentile, ages 11-16

^h Weighted average of adherence factors of hands, arms, and feet

ⁱ Assuming recreational visitation every weekend

Sediment Adult Standard
 Algorithm: RECAP Soil_{ni}

SED_{ni} - Noncarcinogenic Effects- Organic Constituents (mg/kg):

(EQ4, Appendix H, RECAP 2003)

THQ x BW_A x AT_{nc} x 365 days/year

$$EF_{ni} \times ED_A \times \left(\left(\left(\frac{1}{RfD_o} \right) \times 10^{-6} \frac{kg}{mg} \times IRS_A \right) + \left(\left(\frac{1}{RfD_i} \right) \times IRA_A \times \left(\frac{1}{VF_{ni}} \right) \right) + \left(\left(\frac{1}{RfD_o} \right) \times SA_A \times AF_A \times ABS \times 10^{-6} \frac{kg}{mg} \right) \right)$$

Parameter	Definition (units)	Chemical Compound
		<i>Aromatics >C16-C21</i>
SED _{ni}	calculated non-industrial risk-based chemical concentration in sediment (mg/kg)	1.21E+04
THQ	target hazard quotient (unitless)	1 ^b
RfD _o	oral reference dose (mg/kg-day)	0.03 ^c
RfD _i	inhalation chronic reference dose (mg/kg-day)	0.03 ^c
BW _A	average adult body weight ages 16-80+ (kg)	112.7 ^{d,g}
AT _{nc}	averaging time – noncarcinogens, adult (yr)	30 ^a
EF _{ni}	exposure frequency, recreational (days/yr)	104 ⁱ
ED _A	adult exposure duration (yr)	30 ^a
IRS _A	soil ingestion rate (mg/day)	200 ^a
IRA _A	inhalation rate (m ³ /day)	10 ^a
VF _{ni}	non-industrial soil-to-air volatilization factor (m ³ /kg)	164276.2 ^c
SA _A	adult skin surface area (cm ² /day)	6045 ^{d,f}
AF _A	adult soil-to-skin adherence factor (mg/cm ²)	0.39 ^{d,h}
ABS	dermal absorption factor (unitless)	0.1 ^{c,a}

^a LDEQ default value.

^b Soil Screening Guidance: User's Guide, EPA 1996.

^c Chemical-specific, EPA, IRIS

^d U.S. EPA. Exposure Factors Handbook 2011 Edition (Final). U.S. Environmental Protection Agency, Washington, DC, EPA/600/R-09/052F, 2011.

^e Refer to Table H-6.

^f 95th percentile of hands, arms, and feet(Averaged male/female)

^g Average of 95th percentile, ages 16-80+

^h Weighted average of adherence factors of hands, arms, and feet

ⁱ Assuming recreational visitation every weekend

Sediment Juvenile Standard
Algorithm: RECAP Soilni

SED_{ni} - Noncarcinogenic Effects- Organic Constituents (mg/kg):

(EQ4, Appendix H, RECAP 2003)

THQ x BW_c x AT_{nc} x 365 days/year

$$EF_{ni} \times ED_c \times \left(\left(\left(\frac{1}{RfD_o} \right) \times 10^{-6} \frac{kg}{mg} \times IRS_c \right) + \left(\left(\frac{1}{RfD_i} \right) \times IRA_c \times \left(\frac{1}{VF_{ni}} \right) \right) + \left(\left(\frac{1}{RfD_o} \right) \times SA_c \times AF_c \times ABS \times 10^{-6} \frac{kg}{mg} \right) \right)$$

Parameter	Definition (units)	Chemical Compound
		<i>Aromatics >C16-C21</i>
SED _{ni}	calculated non-industrial risk-based chemical concentration in sediment (mg/kg)	1.44E+03
THQ	target hazard quotient (unitless)	1 ^b
RfD _o	oral reference dose (mg/kg-day)	0.03 ^c
RfD _i	inhalation chronic reference dose (mg/kg-day)	0.03 ^c
BW _c	child body weight ages 11-16 (kg)	88.8 ^{d,g}
AT _{nc}	averaging time – noncarcinogens, child (yr)	6 ^b
EF _{ni}	exposure frequency, recreational (days/yr)	104 ⁱ
ED _c	child exposure duration ages 11-16 (yr)	6 ^b
IRS _c	child soil ingestion rate (mg/day)	200 ^a
IRA _c	child inhalation rate ages(m ³ /day)	10 ^a
VF _{ni}	non-industrial soil-to-air volatilization factor (m ³ /kg)	164276.2 ^c
SA _c	child skin surface area (cm ² /day)	5300 ^{d, f}
AF _c	child soil-to-skin adherence factor (mg/cm ²)	5.64 ^{d, h}
ABS	dermal absorption factor (unitless)	0.1 ^{c,a}

^a LDEQ default value.

^b Soil Screening Guidance: User's Guide, EPA 1996.

^c Chemical-specific, EPA, IRIS

^d U.S. EPA. Child-Specific Exposure Factors Handbook (Final Report) 2008. U.S. Environmental Protection Agency, Washington, DC, EPA/600/R-06/096F, 2008.

^e Refer to Table H-6.

^f 95th percentile of hands, arms, and feet(Averaged male/female)

^g Average of 95th percentile, ages 11-16

^h Weighted average of adherence factors of hands, arms, and feet

ⁱ Assuming recreational visitation every weekend

Sediment Adult Standard
 Algorithm: RECAP Soil_{ni}

SED_{ni} - Noncarcinogenic Effects- Organic Constituents (mg/kg):

(EQ4, Appendix H, RECAP 2003)

$$THQ \times BW_A \times AT_{nc} \times 365 \text{ days/year}$$

$$EF_{ni} \times ED_A \times \left(\left(\left(\frac{1}{RfD_o} \right) \times 10^{-6} \frac{kg}{mg} \times IRS_A \right) + \left(\left(\frac{1}{RfD_i} \right) \times IRA_A \times \left(\frac{1}{VF_{ni}} \right) \right) + \left(\left(\frac{1}{RfD_o} \right) \times SA_A \times AF_A \times ABS \times 10^{-6} \frac{kg}{mg} \right) \right)$$

Parameter	Definition (units)	Chemical Compound
		<i>Aromatics >C21-C35</i>
SED _{ni}	calculated non-industrial risk-based chemical concentration in sediment (mg/kg)	2.72E+04
THQ	target hazard quotient (unitless)	1 ^b
RfD _o	oral reference dose (mg/kg-day)	0.03 ^c
RfD _i	inhalation chronic reference dose (mg/kg-day)	0.03 ^c
BW _A	average adult body weight ages 16-80+ (kg)	112.7 ^{d,g}
AT _{nc}	averaging time – noncarcinogens, adult (yr)	30 ^a
EF _{ni}	exposure frequency, recreational (days/yr)	104 ⁱ
ED _A	adult exposure duration (yr)	30 ^a
IRS _A	soil ingestion rate (mg/day)	200 ^a
IRA _A	inhalation rate (m ³ /day)	10 ^a
VF _{ni}	non-industrial soil-to-air volatilization factor (m ³ /kg)	1700573 ^c
SA _A	adult skin surface area (cm ² /day)	6045 ^{d,f}
AF _A	adult soil-to-skin adherence factor (mg/cm ²)	0.39 ^{d,h}
ABS	dermal absorption factor (unitless)	0.1 ^{c,a}

^a LDEQ default value.

^b Soil Screening Guidance: User's Guide, EPA 1996.

^c Chemical-specific, EPA, IRIS

^d U.S. EPA. Exposure Factors Handbook 2011 Edition (Final). U.S. Environmental Protection Agency, Washington, DC, EPA/600/R-09/052F, 2011.

^e Refer to Table H-6.

^f 95th percentile of hands, arms, and feet(Averaged male/female)

^g Average of 95th percentile, ages 16-80+

^h Weighted average of adherence factors of hands, arms, and feet

ⁱ Assuming recreational visitation every weekend

Sediment Juvenile Standard
Algorithm: RECAP Soilni

SED_{ni} - Noncarcinogenic Effects- Organic Constituents (mg/kg):

(EQ4, Appendix H, RECAP 2003)

$$THQ \times BW_c \times AT_{nc} \times 365 \text{ days/year}$$

$$EF_{ni} \times ED_c \times \left(\left(\left(\frac{1}{RfD_o} \right) \times 10^{-6} \frac{kg}{mg} \times IRS_c \right) + \left(\left(\frac{1}{RfD_i} \right) \times IRA_c \times \left(\frac{1}{VF_{ni}} \right) \right) + \left(\left(\frac{1}{RfD_o} \right) \times SA_c \times AF_c \times ABS \times 10^{-6} \frac{kg}{mg} \right) \right)$$

Parameter	Definition (units)	Chemical Compound
		<i>Aromatics >C21-C35</i>
SED _{ni}	calculated non-industrial risk-based chemical concentration in sediment (mg/kg)	2.93E+03
THQ	target hazard quotient (unitless)	1 ^b
RfD _o	oral reference dose (mg/kg-day)	0.03 ^c
RfD _i	inhalation chronic reference dose (mg/kg-day)	0.03 ^c
BW _c	child body weight ages 11-16 (kg)	88.8 ^{d,g}
AT _{nc}	averaging time – noncarcinogens, child (yr)	6 ^b
EF _{ni}	exposure frequency, recreational (days/yr)	104 ⁱ
ED _c	child exposure duration ages 11-16 (yr)	6 ^b
IRS _c	child soil ingestion rate (mg/day)	200 ^a
IRA _c	child inhalation rate ages(m ³ /day)	10 ^a
VF _{ni}	non-industrial soil-to-air volatilization factor (m ³ /kg)	1700573 ^c
SA _c	child skin surface area (cm ² /day)	5300 ^{d,f}
AF _c	child soil-to-skin adherence factor (mg/cm ²)	5.64 ^{d,h}
ABS	dermal absorption factor (unitless)	0.1 ^{c,a}

^a LDEQ default value.

^b Soil Screening Guidance: User's Guide, EPA 1996.

^c Chemical-specific, EPA, IRIS

^d U.S. EPA. Child-Specific Exposure Factors Handbook (Final Report) 2008. U.S. Environmental Protection Agency, Washington, DC, EPA/600/R-06/096F, 2008.

^e Refer to Table H-6.

^f 95th percentile of hands, arms, and feet(Averaged male/female)

^g Average of 95th percentile, ages 11-16

^h Weighted average of adherence factors of hands, arms, and feet

ⁱ Assuming recreational visitation every weekend

Sediment Adult Standard
Algorithm: RECAP Soil_{ni}

SED_{ni} - Noncarcinogenic Effects- Organic Constituents (mg/kg):

(EQ4, Appendix H, RECAP 2003)

THQ x BW_A x AT_{nc} x 365 days/year

$$EF_{ni} \times ED_A \times \left(\left(\left(\frac{1}{RfD_o} \right) \times 10^{-6} \frac{kg}{mg} \times IRS_A \right) + \left(\left(\frac{1}{RfD_i} \right) \times IRA_A \times \left(\frac{1}{VF_{ni}} \right) \right) + \left(\left(\frac{1}{RfD_o} \right) \times SA_A \times AF_A \times ABS \times 10^{-6} \frac{kg}{mg} \right) \right)$$

Parameter	Definition (units)	Chemical Compound
		<i>2-Methylnaphthalene</i>
SED _{ni}	calculated non-industrial risk-based chemical concentration in sediment (mg/kg)	5.60E+03
THQ	target hazard quotient (unitless)	1 ^b
RfD _o	oral reference dose (mg/kg-day)	0.02 ^c
RfD _i	inhalation chronic reference dose (mg/kg-day)	0.00086 ^c
BW _A	average adult body weight ages 16-80+ (kg)	112.7 ^{d,g}
AT _{nc}	averaging time – noncarcinogens, adult (yr)	30 ^a
EF _{ni}	exposure frequency, recreational (days/yr)	104 ⁱ
ED _A	adult exposure duration (yr)	30 ^a
IRS _A	soil ingestion rate (mg/day)	200 ^a
IRA _A	inhalation rate (m ³ /day)	10 ^a
VF _{ni}	non-industrial soil-to-air volatilization factor (m ³ /kg)	191868.7 ^c
SA _A	adult skin surface area (cm ² /day)	6045 ^{d, f}
AF _A	adult soil-to-skin adherence factor (mg/cm ²)	0.39 ^{d, h}
ABS	dermal absorption factor (unitless)	0 ^{c, a}

^a LDEQ default value.

^b Soil Screening Guidance: User's Guide, EPA 1996.

^c Chemical-specific, EPA, IRIS

^d U.S. EPA. Exposure Factors Handbook 2011 Edition (Final). U.S. Environmental Protection Agency, Washington, DC, EPA/600/R-09/052F, 2011.

^e Refer to Table H-6.

^f 95th percentile of hands, arms, and feet(Averaged male/female)

^g Average of 95th percentile, ages 16-80+

^h Weighted average of adherence factors of hands, arms, and feet

ⁱ Assuming recreational visitation every weekend

Sediment Juvenile Standard
Algorithm: RECAP Soilni

SED_{ni} - Noncarcinogenic Effects- Organic Constituents (mg/kg):

(EQ4, Appendix H, RECAP 2003)

THQ x BW_c x AT_{nc} x 365 days/year

$$EF_{ni} \times ED_c \times \left(\left(\left(\frac{1}{RfD_o} \right) \times 10^{-6} \frac{kg}{mg} \times IRS_c \right) + \left(\left(\frac{1}{RfD_i} \right) \times IRA_c \times \left(\frac{1}{VF_{ni}} \right) \right) + \left(\left(\frac{1}{RfD_o} \right) \times SA_c \times AF_c \times ABS \times 10^{-6} \frac{kg}{mg} \right) \right)$$

Parameter	Definition (units)	Chemical Compound
		<i>2-Methylnaphthalene</i>
SED _{ni}	calculated non-industrial risk-based chemical concentration in sediment (mg/kg)	4.41E+03
THQ	target hazard quotient (unitless)	1 ^b
RfD _o	oral reference dose (mg/kg-day)	0.02 ^c
RfD _i	inhalation chronic reference dose (mg/kg-day)	0.00086 ^c
BW _c	child body weight ages 11-16 (kg)	88.8 ^{d,g}
AT _{nc}	averaging time – noncarcinogens, child (yr)	6 ^b
EF _{ni}	exposure frequency, recreational (days/yr)	104 ⁱ
ED _c	child exposure duration ages 11-16 (yr)	6 ^b
IRS _c	child soil ingestion rate (mg/day)	200 ^a
IRA _c	child inhalation rate ages(m ³ /day)	10 ^a
VF _{ni}	non-industrial soil-to-air volatilization factor (m ³ /kg)	191868.7 ^c
SA _c	child skin surface area (cm ² /day)	5300 ^{d, f}
AF _c	child soil-to-skin adherence factor (mg/cm ²)	5.64 ^{d, h}
ABS	dermal absorption factor (unitless)	0 ^{c, a}

^a LDEQ default value.

^b Soil Screening Guidance: User's Guide, EPA 1996.

^c Chemical-specific, EPA, IRIS

^d U.S. EPA. Child-Specific Exposure Factors Handbook (Final Report) 2008. U.S. Environmental Protection Agency, Washington, DC, EPA/600/R-06/096F, 2008.

^e Refer to Table H-6.

^f 95th percentile of hands, arms, and feet(Averaged male/female)

^g Average of 95th percentile, ages 11-16

^h Weighted average of adherence factors of hands, arms, and feet

ⁱ Assuming recreational visitation every weekend

Sediment Adult Standard
 Algorithm: RECAP Soil_{ni}

SED_{ni} - Noncarcinogenic Effects- Organic Constituents (mg/kg):

(EQ4, Appendix H, RECAP 2003)

$$THQ \times BW_A \times AT_{nc} \times 365 \text{ days/year}$$

$$EF_{ni} \times ED_A \times \left(\left(\left(\frac{1}{RfD_o} \right) \times 10^{-6} \frac{kg}{mg} \times IRS_A \right) + \left(\left(\frac{1}{RfD_i} \right) \times IRA_A \times \left(\frac{1}{VF_{ni}} \right) \right) + \left(\left(\frac{1}{RfD_o} \right) \times SA_A \times AF_A \times ABS \times 10^{-6} \frac{kg}{mg} \right) \right)$$

Parameter	Definition (units)	Chemical Compound
		<i>Acenaphthene</i>
SED _{ni}	calculated non-industrial risk-based chemical concentration in sediment (mg/kg)	9.45E+04
THQ	target hazard quotient (unitless)	1 ^b
RfD _o	oral reference dose (mg/kg-day)	0.06 ^c
RfD _i	inhalation chronic reference dose (mg/kg-day)	0.06 ^c
BW _A	average adult body weight ages 16-80+ (kg)	112.7 ^{d,g}
AT _{nc}	averaging time – noncarcinogens, adult (yr)	30 ^a
EF _{ni}	exposure frequency, recreational (days/yr)	104 ⁱ
ED _A	adult exposure duration (yr)	30 ^a
IRS _A	soil ingestion rate (mg/day)	200 ^a
IRA _A	inhalation rate (m ³ /day)	10 ^a
VF _{ni}	non-industrial soil-to-air volatilization factor (m ³ /kg)	19530045.4 ^c
SA _A	adult skin surface area (cm ² /day)	6045 ^{d,f}
AF _A	adult soil-to-skin adherence factor (mg/cm ²)	0.39 ^{d,h}
ABS	dermal absorption factor (unitless)	0 ^{c,a}

^a LDEQ default value.

^b Soil Screening Guidance: User's Guide, EPA 1996.

^c Chemical-specific, EPA, IRIS

^d U.S. EPA. Exposure Factors Handbook 2011 Edition (Final). U.S. Environmental Protection Agency, Washington, DC, EPA/600/R-09/052F, 2011.

^e Refer to Table H-6.

^f 95th percentile of hands, arms, and feet(Averaged male/female)

^g Average of 95th percentile, ages 16-80+

^h Weighted average of adherence factors of hands, arms, and feet

ⁱ Assuming recreational visitation every weekend

Sediment Juvenile Standard
Algorithm: RECAP Soilni

SED_{ni} - Noncarcinogenic Effects- Organic Constituents (mg/kg):

(EQ4, Appendix H, RECAP 2003)

THQ x BW_c x AT_{nc} x 365 days/year

$$EF_{ni} \times ED_c \times \left(\left(\left(\frac{1}{RfD_o} \right) \times 10^{-6} \frac{kg}{mg} \times IRS_c \right) + \left(\left(\frac{1}{RfD_i} \right) \times IRA_c \times \left(\frac{1}{VF_{ni}} \right) \right) + \left(\left(\frac{1}{RfD_o} \right) \times SA_c \times AF_c \times ABS \times 10^{-6} \frac{kg}{mg} \right) \right)$$

Parameter	Definition (units)	Chemical Compound
		<i>Acenaphthene</i>
SED _{ni}	calculated non-industrial risk-based chemical concentration in sediment (mg/kg)	7.44E+04
THQ	target hazard quotient (unitless)	1 ^b
RfD _o	oral reference dose (mg/kg-day)	0.06 ^c
RfD _i	inhalation chronic reference dose (mg/kg-day)	0.06 ^c
BW _c	child body weight ages 11-16 (kg)	88.8 ^{d,g}
AT _{nc}	averaging time – noncarcinogens, child (yr)	6 ^b
EF _{ni}	exposure frequency, recreational (days/yr)	104 ⁱ
ED _c	child exposure duration ages 11-16 (yr)	6 ^b
IRS _c	child soil ingestion rate (mg/day)	200 ^a
IRA _c	child inhalation rate ages(m ³ /day)	10 ^a
VF _{ni}	non-industrial soil-to-air volatilization factor (m ³ /kg)	19530045.4 ^c
SA _c	child skin surface area (cm ² /day)	5300 ^{d, f}
AF _c	child soil-to-skin adherence factor (mg/cm ²)	5.64 ^{d, h}
ABS	dermal absorption factor (unitless)	0 ^{c,a}

^a LDEQ default value.

^b Soil Screening Guidance: User's Guide, EPA 1996.

^c Chemical-specific, EPA, IRIS

^d U.S. EPA. Child-Specific Exposure Factors Handbook (Final Report) 2008. U.S. Environmental Protection Agency, Washington, DC, EPA/600/R-06/096F, 2008.

^e Refer to Table H-6.

^f 95th percentile of hands, arms, and feet(Averaged male/female)

^g Average of 95th percentile, ages 11-16

^h Weighted average of adherence factors of hands, arms, and feet

ⁱ Assuming recreational visitation every weekend

Sediment Adult Standard
 Algorithm: RECAP Soil_{ni}

SED_{ni} - Noncarcinogenic Effects- Organic Constituents (mg/kg):

(EQ4, Appendix H, RECAP 2003)

$$THQ \times BW_A \times AT_{nc} \times 365 \text{ days/year}$$

$$EF_{ni} \times ED_A \times \left(\left(\left(\frac{1}{RfD_o} \right) \times 10^{-6} \frac{kg}{mg} \times IRS_A \right) + \left(\left(\frac{1}{RfD_i} \right) \times IRA_A \times \left(\frac{1}{VF_{ni}} \right) \right) + \left(\left(\frac{1}{RfD_o} \right) \times SA_A \times AF_A \times ABS \times 10^{-6} \frac{kg}{mg} \right) \right)$$

Parameter	Definition (units)	Chemical Compound
		<i>Anthracene</i>
SED _{ni}	calculated non-industrial risk-based chemical concentration in sediment (mg/kg)	5.53E+07
THQ	target hazard quotient (unitless)	1 ^b
RfD _o	oral reference dose (mg/kg-day)	x ^c
RfD _i	inhalation chronic reference dose (mg/kg-day)	x ^c
BW _A	average adult body weight ages 16-80+ (kg)	112.7 ^{d,g}
AT _{nc}	averaging time – noncarcinogens, adult (yr)	30 ^a
EF _{ni}	exposure frequency, recreational (days/yr)	104 ⁱ
ED _A	adult exposure duration (yr)	30 ^a
IRS _A	soil ingestion rate (mg/day)	200 ^a
IRA _A	inhalation rate (m ³ /day)	10 ^a
VF _{ni}	non-industrial soil-to-air volatilization factor (m ³ /kg)	x ^c
SA _A	adult skin surface area (cm ² /day)	6045 ^{d,f}
AF _A	adult soil-to-skin adherence factor (mg/cm ²)	0.39 ^{d,h}
ABS	dermal absorption factor (unitless)	x ^{c,a}

^a LDEQ default value.

^b Soil Screening Guidance: User's Guide, EPA 1996.

^c Chemical-specific, EPA, IRIS

^d U.S. EPA. Exposure Factors Handbook 2011 Edition (Final). U.S. Environmental Protection Agency, Washington, DC, EPA/600/R-09/052F, 2011.

^e Refer to Table H-6.

^f 95th percentile of hands, arms, and feet(Averaged male/female)

^g Average of 95th percentile, ages 16-80+

^h Weighted average of adherence factors of hands, arms, and feet

ⁱ Assuming recreational visitation every weekend

Sediment Juvenile Standard
Algorithm: RECAP Soilni

SED_{ni} - Noncarcinogenic Effects- Organic Constituents (mg/kg):

(EQ4, Appendix H, RECAP 2003)

THQ x BW_c x AT_{nc} x 365 days/year

$$EF_{ni} \times ED_c \times \left(\left(\left(\frac{1}{RfD_o} \right) \times 10^{-6} \frac{kg}{mg} \times IRS_c \right) + \left(\left(\frac{1}{RfD_i} \right) \times IRA_c \times \left(\frac{1}{VF_{ni}} \right) \right) + \left(\left(\frac{1}{RfD_o} \right) \times SA_c \times AF_c \times ABS \times 10^{-6} \frac{kg}{mg} \right) \right)$$

Parameter	Definition (units)	Chemical Compound
		<i>Anthracene</i>
SED _{ni}	calculated non-industrial risk-based chemical concentration in sediment (mg/kg)	4.36E+05
THQ	target hazard quotient (unitless)	1 ^b
RfD _o	oral reference dose (mg/kg-day)	x ^c
RfD _i	inhalation chronic reference dose (mg/kg-day)	x ^c
BW _c	child body weight ages 11-16 (kg)	88.8 ^{d,g}
AT _{nc}	averaging time – noncarcinogens, child (yr)	6 ^b
EF _{ni}	exposure frequency, recreational (days/yr)	104 ⁱ
ED _c	child exposure duration ages 11-16 (yr)	6 ^b
IRS _c	child soil ingestion rate (mg/day)	200 ^a
IRA _c	child inhalation rate ages(m ³ /day)	10 ^a
VF _{ni}	non-industrial soil-to-air volatilization factor (m ³ /kg)	x ^c
SA _c	child skin surface area (cm ² /day)	5300 ^{d, f}
AF _c	child soil-to-skin adherence factor (mg/cm ²)	5.64 ^{d, h}
ABS	dermal absorption factor (unitless)	x ^{c,e}

^a LDEQ default value.

^b Soil Screening Guidance: User's Guide, EPA 1996.

^c Chemical-specific, EPA, IRIS

^d U.S. EPA. Child-Specific Exposure Factors Handbook (Final Report) 2008. U.S. Environmental Protection Agency, Washington, DC, EPA/600/R-06/096F, 2008.

^e Refer to Table H-6.

^f 95th percentile of hands, arms, and feet(Averaged male/female)

^g Average of 95th percentile, ages 11-16

^h Weighted average of adherence factors of hands, arms, and feet

ⁱ Assuming recreational visitation every weekend

Sediment Adult Standard
Algorithm: RECAP Soil_{ni}

SED_{ni} - Noncarcinogenic Effects- Organic Constituents (mg/kg):

(EQ4, Appendix H, RECAP 2003)

$THQ \times BW_A \times AT_{nc} \times 365 \text{ days/year}$

$$EF_{ni} \times ED_A \times \left(\left(\left(\frac{1}{RfD_o} \right) \times 10^{-6} \frac{kg}{mg} \times IRS_A \right) + \left(\left(\frac{1}{RfD_i} \right) \times IRA_A \times \left(\frac{1}{VF_{ni}} \right) \right) + \left(\left(\frac{1}{RfD_o} \right) \times SA_A \times AF_A \times ABS \times 10^{-6} \frac{kg}{mg} \right) \right)$$

Parameter	Definition (units)	Chemical Compound
		<i>Fluoranthene</i>
SED _{ni}	calculated non-industrial risk-based chemical concentration in sediment (mg/kg)	3.14E+04
THQ	target hazard quotient (unitless)	1 ^b
RfD _o	oral reference dose (mg/kg-day)	0.04 ^c
RfD _i	inhalation chronic reference dose (mg/kg-day)	0.04 ^c
BW _A	average adult body weight ages 16-80+ (kg)	112.7 ^{d,g}
AT _{nc}	averaging time – noncarcinogens, adult (yr)	30 ^a
EF _{ni}	exposure frequency, recreational (days/yr)	104 ⁱ
ED _A	adult exposure duration (yr)	30 ^a
IRS _A	soil ingestion rate (mg/day)	200 ^a
IRA _A	inhalation rate (m ³ /day)	10 ^a
VF _{ni}	non-industrial soil-to-air volatilization factor (m ³ /kg)	1665463 ^c
SA _A	adult skin surface area (cm ² /day)	6045 ^{d,f}
AF _A	adult soil-to-skin adherence factor (mg/cm ²)	0.39 ^{d,h}
ABS	dermal absorption factor (unitless)	0.13 ^{c,a}

^a LDEQ default value.

^b Soil Screening Guidance: User's Guide, EPA 1996.

^c Chemical-specific, EPA, IRIS

^d U.S. EPA. Exposure Factors Handbook 2011 Edition (Final). U.S. Environmental Protection Agency, Washington, DC, EPA/600/R-09/052F, 2011.

^e Refer to Table H-6.

^f 95th percentile of hands, arms, and feet(Averaged male/female)

^g Average of 95th percentile, ages 16-80+

^h Weighted average of adherence factors of hands, arms, and feet

ⁱ Assuming recreational visitation every weekend

Sediment Juvenile Standard
 Algorithm: RECAP Soilni

SED_{ni} - Noncarcinogenic Effects- Organic Constituents (mg/kg):

(EQ4, Appendix H, RECAP 2003)

$THQ \times BW_c \times AT_{nc} \times 365 \text{ days/year}$

$$EF_{ni} \times ED_c \times \left(\left(\left(\frac{1}{RfD_o} \right) \times 10^{-6} \frac{kg}{mg} \times IRS_c \right) + \left(\left(\frac{1}{RfD_i} \right) \times IRA_c \times \left(\frac{1}{VF_{ni}} \right) \right) + \left(\left(\frac{1}{RfD_o} \right) \times SA_c \times AF_c \times ABS \times 10^{-6} \frac{kg}{mg} \right) \right)$$

Parameter	Definition (units)	Chemical Compound
		<i>Fluoranthene</i>
SED _{ni}	calculated non-industrial risk-based chemical concentration in sediment (mg/kg)	3.05E+03
THQ	target hazard quotient (unitless)	1 ^b
RfD _o	oral reference dose (mg/kg-day)	0.04 ^c
RfD _i	inhalation chronic reference dose (mg/kg-day)	0.04 ^c
BW _c	child body weight ages 11-16 (kg)	88.8 ^{d,g}
AT _{nc}	averaging time – noncarcinogens, child (yr)	6 ^b
EF _{ni}	exposure frequency, recreational (days/yr)	104 ⁱ
ED _c	child exposure duration ages 11-16 (yr)	6 ^b
IRS _c	child soil ingestion rate (mg/day)	200 ^a
IRA _c	child inhalation rate ages(m ³ /day)	10 ^a
VF _{ni}	non-industrial soil-to-air volatilization factor (m ³ /kg)	1665463 ^c
SA _c	child skin surface area (cm ² /day)	5300 ^{d,f}
AF _c	child soil-to-skin adherence factor (mg/cm ²)	5.64 ^{d,h}
ABS	dermal absorption factor (unitless)	0.13 ^{c,a}

^a LDEQ default value.

^b Soil Screening Guidance: User's Guide, EPA 1996.

^c Chemical-specific, EPA, IRIS

^d U.S. EPA. Child-Specific Exposure Factors Handbook (Final Report) 2008. U.S. Environmental Protection Agency, Washington, DC, EPA/600/R-06/096F, 2008.

^e Refer to Table H-6.

^f 95th percentile of hands, arms, and feet(Averaged male/female)

^g Average of 95th percentile, ages 11-16

^h Weighted average of adherence factors of hands, arms, and feet

ⁱ Assuming recreational visitation every weekend

Sediment Adult Standard
 Algorithm: RECAP Soil_{ni}

SED_{ni} - Noncarcinogenic Effects- Organic Constituents (mg/kg):

(EQ4, Appendix H, RECAP 2003)

$$THQ \times BW_A \times AT_{nc} \times 365 \text{ days/year}$$

$$EF_{ni} \times ED_A \times \left(\left(\left(\frac{1}{RfD_o} \right) \times 10^{-6} \frac{kg}{mg} \times IRS_A \right) + \left(\left(\frac{1}{RfD_i} \right) \times IRA_A \times \left(\frac{1}{VF_{ni}} \right) \right) + \left(\left(\frac{1}{RfD_o} \right) \times SA_A \times AF_A \times ABS \times 10^{-6} \frac{kg}{mg} \right) \right)$$

Parameter	Definition (units)	Chemical Compound
		<i>Fluorene</i>
SED _{ni}	calculated non-industrial risk-based chemical concentration in sediment (mg/kg)	7.00E+04
THQ	target hazard quotient (unitless)	1 ^b
RfD _o	oral reference dose (mg/kg-day)	0.04 ^c
RfD _i	inhalation chronic reference dose (mg/kg-day)	0.04 ^c
BW _A	average adult body weight ages 16-80+ (kg)	112.7 ^{d,g}
AT _{nc}	averaging time – noncarcinogens, adult (yr)	30 ^a
EF _{ni}	exposure frequency, recreational (days/yr)	104 ⁱ
ED _A	adult exposure duration (yr)	30 ^a
IRS _A	soil ingestion rate (mg/day)	200 ^a
IRA _A	inhalation rate (m ³ /day)	10 ^a
VF _{ni}	non-industrial soil-to-air volatilization factor (m ³ /kg)	382436.7 ^c
SA _A	adult skin surface area (cm ² /day)	6045 ^{d,f}
AF _A	adult soil-to-skin adherence factor (mg/cm ²)	0.39 ^{d,h}
ABS	dermal absorption factor (unitless)	0 ^{c,a}

^a LDEQ default value.

^b Soil Screening Guidance: User's Guide, EPA 1996.

^c Chemical-specific, EPA, IRIS

^d U.S. EPA. Exposure Factors Handbook 2011 Edition (Final). U.S. Environmental Protection Agency, Washington, DC, EPA/600/R-09/052F, 2011.

^e Refer to Table H-6.

^f 95th percentile of hands, arms, and feet(Averaged male/female)

^g Average of 95th percentile, ages 16-80+

^h Weighted average of adherence factors of hands, arms, and feet

ⁱ Assuming recreational visitation every weekend

Sediment Juvenile Standard
Algorithm: RECAP Soilni

SED_{ni} - Noncarcinogenic Effects- Organic Constituents (mg/kg):

(EQ4, Appendix H, RECAP 2003)

$THQ \times BW_c \times AT_{nc} \times 365 \text{ days/year}$

$$EF_{ni} \times ED_c \times \left(\left(\left(\frac{1}{RfD_o} \right) \times 10^{-6} \frac{kg}{mg} \times IRS_c \right) + \left(\left(\frac{1}{RfD_i} \right) \times IRA_c \times \left(\frac{1}{VF_{ni}} \right) \right) + \left(\left(\frac{1}{RfD_o} \right) \times SA_c \times AF_c \times ABS \times 10^{-6} \frac{kg}{mg} \right) \right)$$

Parameter	Definition (units)	Chemical Compound
		<i>Fluorene</i>
SED _{ni}	calculated non-industrial risk-based chemical concentration in sediment (mg/kg)	5.51E+04
THQ	target hazard quotient (unitless)	1 ^b
RfD _o	oral reference dose (mg/kg-day)	0.04 ^c
RfD _i	inhalation chronic reference dose (mg/kg-day)	0.04 ^c
BW _c	child body weight ages 11-16 (kg)	88.8 ^{d,g}
AT _{nc}	averaging time – noncarcinogens, child (yr)	6 ^b
EF _{ni}	exposure frequency, recreational (days/yr)	104 ⁱ
ED _c	child exposure duration ages 11-16 (yr)	6 ^b
IRS _c	child soil ingestion rate (mg/day)	200 ^a
IRA _c	child inhalation rate ages(m ³ /day)	10 ^a
VF _{ni}	non-industrial soil-to-air volatilization factor (m ³ /kg)	382436.7 ^c
SA _c	child skin surface area (cm ² /day)	5300 ^{d,f}
AF _c	child soil-to-skin adherence factor (mg/cm ²)	5.64 ^{d,h}
ABS	dermal absorption factor (unitless)	0 ^{c,a}

^a LDEQ default value.

^b Soil Screening Guidance: User's Guide, EPA 1996.

^c Chemical-specific, EPA, IRIS

^d U.S. EPA. Child-Specific Exposure Factors Handbook (Final Report) 2008. U.S. Environmental Protection Agency, Washington, DC, EPA/600/R-06/096F, 2008.

^e Refer to Table H-6.

^f 95th percentile of hands, arms, and feet(Averaged male/female)

^g Average of 95th percentile, ages 11-16

^h Weighted average of adherence factors of hands, arms, and feet

ⁱ Assuming recreational visitation every weekend

Sediment Adult Standard
 Algorithm: RECAP Soil_{ni}

SED_{ni} - Noncarcinogenic Effects- Organic Constituents (mg/kg):

(EQ4, Appendix H, RECAP 2003)

$$THQ \times BW_A \times AT_{nc} \times 365 \text{ days/year}$$

$$EF_{ni} \times ED_A \times \left(\left(\left(\frac{1}{RfD_o} \right) \times 10^{-6} \frac{kg}{mg} \times IRS_A \right) + \left(\left(\frac{1}{RfD_i} \right) \times IRA_A \times \left(\frac{1}{VF_{ni}} \right) \right) + \left(\left(\frac{1}{RfD_o} \right) \times SA_A \times AF_A \times ABS \times 10^{-6} \frac{kg}{mg} \right) \right)$$

Parameter	Definition (units)	Chemical Compound
		<i>Naphthalene</i>
SED _{ni}	calculated non-industrial risk-based chemical concentration in sediment (mg/kg)	1.57E+03
THQ	target hazard quotient (unitless)	1 ^b
RfD _o	oral reference dose (mg/kg-day)	0.02 ^c
RfD _i	inhalation chronic reference dose (mg/kg-day)	0.00086 ^c
BW _A	average adult body weight ages 16-80+ (kg)	112.7 ^{d,g}
AT _{nc}	averaging time – noncarcinogens, adult (yr)	30 ^a
EF _{ni}	exposure frequency, recreational (days/yr)	104 ⁱ
ED _A	adult exposure duration (yr)	30 ^a
IRS _A	soil ingestion rate (mg/day)	200 ^a
IRA _A	inhalation rate (m ³ /day)	10 ^a
VF _{ni}	non-industrial soil-to-air volatilization factor (m ³ /kg)	47954.59 ^c
SA _A	adult skin surface area (cm ² /day)	6045 ^{d, f}
AF _A	adult soil-to-skin adherence factor (mg/cm ²)	0.39 ^{d, h}
ABS	dermal absorption factor (unitless)	0 ^{c,a}

^a LDEQ default value.

^b Soil Screening Guidance: User's Guide, EPA 1996.

^c Chemical-specific, EPA, IRIS

^d U.S. EPA. Exposure Factors Handbook 2011 Edition (Final). U.S. Environmental Protection Agency, Washington, DC, EPA/600/R-09/052F, 2011.

^e Refer to Table H-6.

^f 95th percentile of hands, arms, and feet(Averaged male/female)

^g Average of 95th percentile, ages 16-80+

^h Weighted average of adherence factors of hands, arms, and feet

ⁱ Assuming recreational visitation every weekend

Sediment Juvenile Standard
 Algorithm: RECAP Soilni

SED_{ni} - Noncarcinogenic Effects- Organic Constituents (mg/kg):

(EQ4, Appendix H, RECAP 2003)

$THQ \times BW_c \times AT_{nc} \times 365 \text{ days/year}$

$$EF_{ni} \times ED_c \times \left(\left(\left(\frac{1}{RfD_o} \right) \times 10^{-6} \frac{kg}{mg} \times IRS_c \right) + \left(\left(\frac{1}{RfD_i} \right) \times IRA_c \times \left(\frac{1}{VF_{ni}} \right) \right) + \left(\left(\frac{1}{RfD_o} \right) \times SA_c \times AF_c \times ABS \times 10^{-6} \frac{kg}{mg} \right) \right)$$

Parameter	Definition (units)	Chemical Compound
		<i>Naphthalene</i>
SED _{ni}	calculated non-industrial risk-based chemical concentration in sediment (mg/kg)	1.23E+03
THQ	target hazard quotient (unitless)	1 ^b
RfD _o	oral reference dose (mg/kg-day)	0.02 ^c
RfD _i	inhalation chronic reference dose (mg/kg-day)	0.00086 ^c
BW _c	child body weight ages 11-16 (kg)	88.8 ^{d,g}
AT _{nc}	averaging time – noncarcinogens, child (yr)	6 ^b
EF _{ni}	exposure frequency, recreational (days/yr)	104 ⁱ
ED _c	child exposure duration ages 11-16 (yr)	6 ^b
IRS _c	child soil ingestion rate (mg/day)	200 ^a
IRA _c	child inhalation rate ages(m ³ /day)	10 ^a
VF _{ni}	non-industrial soil-to-air volatilization factor (m ³ /kg)	47954.59 ^c
SA _c	child skin surface area (cm ² /day)	5300 ^{d,f}
AF _c	child soil-to-skin adherence factor (mg/cm ²)	5.64 ^{d,h}
ABS	dermal absorption factor (unitless)	0 ^{e,a}

^a LDEQ default value.

^b Soil Screening Guidance: User's Guide, EPA 1996.

^c Chemical-specific, EPA, IRIS

^d U.S. EPA. Child-Specific Exposure Factors Handbook (Final Report) 2008. U.S. Environmental Protection Agency, Washington, DC, EPA/600/R-06/096F, 2008.

^e Refer to Table H-6.

^f 95th percentile of hands, arms, and feet(Averaged male/female)

^g Average of 95th percentile, ages 11-16

^h Weighted average of adherence factors of hands, arms, and feet

ⁱ Assuming recreational visitation every weekend

Sediment Adult Standard
Algorithm: RECAP Soil_{ni}

SED_{ni} - Noncarcinogenic Effects- Organic Constituents (mg/kg):

(EQ4, Appendix H, RECAP 2003)

THQ x BW_A x AT_{nc} x 365 days/year

$$EF_{ni} \times ED_A \times \left(\left(\left(\frac{1}{RfD_o} \right) \times 10^{-6} \frac{kg}{mg} \times IRS_A \right) + \left(\left(\frac{1}{RfD_i} \right) \times IRA_A \times \left(\frac{1}{VF_{ni}} \right) \right) + \left(\left(\frac{1}{RfD_o} \right) \times SA_A \times AF_A \times ABS \times 10^{-6} \frac{kg}{mg} \right) \right)$$

Parameter	Definition (units)	Chemical Compound
		<i>Phenanthrene</i>
SED _{ni}	calculated non-industrial risk-based chemical concentration in sediment (mg/kg)	5.30E+07
THQ	target hazard quotient (unitless)	1 ^b
RfD _o	oral reference dose (mg/kg-day)	0.3 ^c
RfD _i	inhalation chronic reference dose (mg/kg-day)	0.3 ^c
BW _A	average adult body weight ages 16-80+ (kg)	112.7 ^{d,g}
AT _{nc}	averaging time – noncarcinogens, adult (yr)	30 ^a
EF _{ni}	exposure frequency, recreational (days/yr)	104 ⁱ
ED _A	adult exposure duration (yr)	30 ^a
IRS _A	soil ingestion rate (mg/day)	200 ^a
IRA _A	inhalation rate (m ³ /day)	10 ^a
VF _{ni}	non-industrial soil-to-air volatilization factor (m ³ /kg)	443359.9 ^c
SA _A	adult skin surface area (cm ² /day)	6045 ^{d,f}
AF _A	adult soil-to-skin adherence factor (mg/cm ²)	0.39 ^{d,h}
ABS	dermal absorption factor (unitless)	0 ^{c,a}

^a LDEQ default value.

^b Soil Screening Guidance: User's Guide, EPA 1996.

^c Chemical-specific, EPA, IRIS

^d U.S. EPA. Exposure Factors Handbook 2011 Edition (Final). U.S. Environmental Protection Agency, Washington, DC, EPA/600/R-09/052F, 2011.

^e Refer to Table H-6.

^f 95th percentile of hands, arms, and feet(Averaged male/female)

^g Average of 95th percentile, ages 16-80+

^h Weighted average of adherence factors of hands, arms, and feet

ⁱ Assuming recreational visitation every weekend

Sediment Juvenile Standard
Algorithm: RECAP Soilni

SED_{ni} - Noncarcinogenic Effects- Organic Constituents (mg/kg):

(EQ4, Appendix H, RECAP 2003)

$THQ \times BW_c \times AT_{nc} \times 365 \text{ days/year}$

$$EF_{ni} \times ED_c \times \left(\left(\left(\frac{1}{RfD_o} \right) \times 10^{-6} \frac{kg}{mg} \times IRS_c \right) + \left(\left(\frac{1}{RfD_i} \right) \times IRA_c \times \left(\frac{1}{VF_{ni}} \right) \right) + \left(\left(\frac{1}{RfD_o} \right) \times SA_c \times AF_c \times ABS \times 10^{-6} \frac{kg}{mg} \right) \right)$$

Parameter	Definition (units)	Chemical Compound
		<i>Phenanthrene</i>
SED _{ni}	calculated non-industrial risk-based chemical concentration in sediment (mg/kg)	4.20E+05
THQ	target hazard quotient (unitless)	1 ^b
RfD _o	oral reference dose (mg/kg-day)	0.3 ^c
RfD _i	inhalation chronic reference dose (mg/kg-day)	0.3 ^c
BW _c	child body weight ages 11-16 (kg)	88.8 ^{d,g}
AT _{nc}	averaging time – noncarcinogens, child (yr)	6 ^b
EF _{ni}	exposure frequency, recreational (days/yr)	104 ⁱ
ED _c	child exposure duration ages 11-16 (yr)	6 ^b
IRS _c	child soil ingestion rate (mg/day)	200 ^a
IRA _c	child inhalation rate ages(m ³ /day)	10 ^a
VF _{ni}	non-industrial soil-to-air volatilization factor (m ³ /kg)	443359.9 ^c
SA _c	child skin surface area (cm ² /day)	5300 ^{d,f}
AF _c	child soil-to-skin adherence factor (mg/cm ²)	5.64 ^{d,h}
ABS	dermal absorption factor (unitless)	0 ^{c,a}

^a LDEQ default value.

^b Soil Screening Guidance: User's Guide, EPA 1996.

^c Chemical-specific, EPA, IRIS

^d U.S. EPA. Child-Specific Exposure Factors Handbook (Final Report) 2008. U.S. Environmental Protection Agency, Washington, DC, EPA/600/R-06/096F, 2008.

^e Refer to Table H-6.

^f 95th percentile of hands, arms, and feet(Averaged male/female)

^g Average of 95th percentile, ages 11-16

^h Weighted average of adherence factors of hands, arms, and feet

ⁱ Assuming recreational visitation every weekend

Sediment Adult Standard
 Algorithm: RECAP Soil_{ni}

SED_{ni} - Noncarcinogenic Effects- Organic Constituents (mg/kg):

(EQ4, Appendix H, RECAP 2003)

$$THQ \times BW_A \times AT_{nc} \times 365 \text{ days/year}$$

$$EF_{ni} \times ED_A \times \left(\left(\left(\frac{1}{RfD_o} \right) \times 10^{-6} \frac{kg}{mg} \times IRS_A \right) + \left(\left(\frac{1}{RfD_i} \right) \times IRA_A \times \left(\frac{1}{VF_{ni}} \right) \right) + \left(\left(\frac{1}{RfD_o} \right) \times SA_A \times AF_A \times ABS \times 10^{-6} \frac{kg}{mg} \right) \right)$$

Parameter	Definition (units)	Chemical Compound
		<i>Pyrene</i>
SED _{ni}	calculated non-industrial risk-based chemical concentration in sediment (mg/kg)	5.79E+04
THQ	target hazard quotient (unitless)	1 ^b
RfD _o	oral reference dose (mg/kg-day)	0.03 ^c
RfD _i	inhalation chronic reference dose (mg/kg-day)	0.03 ^c
BW _A	average adult body weight ages 16-80+ (kg)	112.7 ^{d,g}
AT _{nc}	averaging time – noncarcinogens, adult (yr)	30 ^a
EF _{ni}	exposure frequency, recreational (days/yr)	104 ⁱ
ED _A	adult exposure duration (yr)	30 ^a
IRS _A	soil ingestion rate (mg/day)	200 ^a
IRA _A	inhalation rate (m ³ /day)	10 ^a
VF _{ni}	non-industrial soil-to-air volatilization factor (m ³ /kg)	2090117 ^c
SA _A	adult skin surface area (cm ² /day)	6045 ^{d,f}
AF _A	adult soil-to-skin adherence factor (mg/cm ²)	0.39 ^{d,h}
ABS	dermal absorption factor (unitless)	0 ^{c,a}

^a LDEQ default value.

^b Soil Screening Guidance: User's Guide, EPA 1996.

^c Chemical-specific, EPA, IRIS

^d U.S. EPA. Exposure Factors Handbook 2011 Edition (Final). U.S. Environmental Protection Agency, Washington, DC, EPA/600/R-09/052F, 2011.

^e Refer to Table H-6.

^f 95th percentile of hands, arms, and feet(Averaged male/female)

^g Average of 95th percentile, ages 16-80+

^h Weighted average of adherence factors of hands, arms, and feet

ⁱ Assuming recreational visitation every weekend

Sediment Juvenile Standard
Algorithm: RECAP Soilni

SED_{ni} - Noncarcinogenic Effects- Organic Constituents (mg/kg):

(EQ4, Appendix H, RECAP 2003)

$$THQ \times BW_c \times AT_{nc} \times 365 \text{ days/year}$$

$$EF_{ni} \times ED_c \times \left(\left(\left(\frac{1}{RfD_o} \right) \times 10^{-6} \frac{kg}{mg} \times IRS_c \right) + \left(\left(\frac{1}{RfD_i} \right) \times IRA_c \times \left(\frac{1}{VF_{ni}} \right) \right) + \left(\left(\frac{1}{RfD_o} \right) \times SA_c \times AF_c \times ABS \times 10^{-6} \frac{kg}{mg} \right) \right)$$

Parameter	Definition (units)	Chemical Compound
		<i>Pyrene</i>
SED _{ni}	calculated non-industrial risk-based chemical concentration in sediment (mg/kg)	4.57E+04
THQ	target hazard quotient (unitless)	1 ^b
RfD _o	oral reference dose (mg/kg-day)	0.03 ^c
RfD _i	inhalation chronic reference dose (mg/kg-day)	0.03 ^c
BW _c	child body weight ages 11-16 (kg)	88.8 ^{d,g}
AT _{nc}	averaging time – noncarcinogens, child (yr)	6 ^b
EF _{ni}	exposure frequency, recreational (days/yr)	104 ⁱ
ED _c	child exposure duration ages 11-16 (yr)	6 ^b
IRS _c	child soil ingestion rate (mg/day)	200 ^a
IRA _c	child inhalation rate ages(m ³ /day)	10 ^a
VF _{ni}	non-industrial soil-to-air volatilization factor (m ³ /kg)	2090117 ^c
SA _c	child skin surface area (cm ² /day)	5300 ^{d,f}
AF _c	child soil-to-skin adherence factor (mg/cm ²)	5.64 ^{d,h}
ABS	dermal absorption factor (unitless)	0 ^{e,a}

^a LDEQ default value.

^b Soil Screening Guidance: User's Guide, EPA 1996.

^c Chemical-specific, EPA, IRIS

^d U.S. EPA. Child-Specific Exposure Factors Handbook (Final Report) 2008. U.S. Environmental Protection Agency, Washington, DC, EPA/600/R-06/096F, 2008.

^e Refer to Table H-6.

^f 95th percentile of hands, arms, and feet(Averaged male/female)

^g Average of 95th percentile, ages 11-16

^h Weighted average of adherence factors of hands, arms, and feet

ⁱ Assuming recreational visitation every weekend

Sediment Adult Standard
Algorithm: RECAP Soil_{ni}

SED_{ni} - Carcinogenic Effects- Organic Constituents (mg/kg):

(EQ1, Appendix H, RECAP 2003)

$TR \times AT_c \times 365 \text{ days/year}$

$$EF_{ni} \times \left(\left(SF_o \times 10^{-6} \frac{kg}{mg} \times IRS_{adj} \right) + \left(SF_i \times IRA_{adj} \times \left(\frac{1}{VF_{ni}} \right) \right) + \left(SF_o \times 10^{-6} \frac{kg}{mg} \times ABS \times IRD_{adj} \right) \right)$$

Parameter	Definition (units)	Chemical Compound
		<i>Benzo(a)anthracene</i>
SED _{ni}	calculated non-industrial risk-based chemical concentration in sediment (mg/kg)	2.09E+00
TR	target excess individual lifetime cancer risk (unitless)	10 ⁻⁶ ^a
SF _o	oral cancer slope factor ((mg/kg-day) ⁻¹)	0.73 ^c
SF _i	inhalation cancer slope factor ((mg/kg-day) ⁻¹)	0.31 ^c
AT _c	averaging time – carcinogens (yr)	70 ^a
EF _{ni}	exposure frequency, recreational (days/yr)	104 ^b
IRS _{adj}	age-adjusted soil ingestion rate (mg-yr/kg-day)	114 ^d
IRA _{adj}	age-adjusted inhalation rate (m ³ -yr/kg-day)	1 ^d
IRD _{adj}	age-adjusted dermal contact rate (mg-yr/kg-day)	360 ^d
VF _{ni}	non-industrial soil-to-air volatilization factor (m ³ /kg)	1.07E+07 ^{c,e}
ABS	dermal absorption factor (unitless)	0.13 ^{c,f}

^a *Soil Screening Guidance: User's Guide, EPA 1996.*

^b Refer to Section 2.14.3, RECAP 2003

^c Chemical-specific.

^d Human Health Medium-Specific Screening Levels, EPA Region VI, 2003.

^e Refer to EQ12, RECAP 2003

^f Refer to Table H-6, RECAP 2003

^g Assuming recreational exposure every weekend

Sediment Adult Standard
 Algorithm: RECAP Soil_{ni}

SED_{ni} - Carcinogenic Effects- Organic Constituents (mg/kg):

(EQ1, Appendix H, RECAP 2003)

$$EF_{ni} \times \left(\left(SF_o \times 10^{-6} \frac{kg}{mg} \times IRS_{adj} \right) + \left(SF_i \times IRA_{adj} \times \left(\frac{1}{VF_{ni}} \right) \right) + \left(SF_o \times 10^{-6} \frac{kg}{mg} \times ABS \times IRD_{adj} \right) \right) \times \frac{TR \times AT_c \times 365 \text{ days/year}}{}$$

Parameter	Definition (units)	Chemical Compound
		<i>Benzo(a)pyrene</i>
SED _{ni}	calculated non-industrial risk-based chemical concentration in sediment (mg/kg)	2.09E-01
TR	target excess individual lifetime cancer risk (unitless)	10 ⁻⁶ ^a
SF _o	oral cancer slope factor ((mg/kg-day) ⁻¹)	7.3 ^c
SF _i	inhalation cancer slope factor ((mg/kg-day) ⁻¹)	3.1 ^c
AT _c	averaging time – carcinogens (yr)	70 ^a
EF _{ni}	exposure frequency, recreational (days/yr)	104 ^g
IRS _{adj}	age-adjusted soil ingestion rate (mg-yr/kg-day)	114 ^d
IRA _{adj}	age-adjusted inhalation rate (m ³ -yr/kg-day)	1 ^d
IRD _{adj}	age-adjusted dermal contact rate (mg-yr/kg-day)	360 ^d
VF _{ni}	non-industrial soil-to-air volatilization factor (m ³ /kg)	1.90E+07 ^{c,e}
ABS	dermal absorption factor (unitless)	0.13 ^{c,f}

^a Soil Screening Guidance: User's Guide, EPA 1996.

^b Refer to Section 2.14.3, RECAP 2003

^c Chemical-specific.

^d Human Health Medium-Specific Screening Levels, EPA Region VI, 2003.

^e Refer to EQ12, RECAP 2003

^f Refer to Table H-6, RECAP 2003

^g Assuming recreational exposure every weekend

Sediment Adult Standard
Algorithm: RECAP Soil_{ni}

SED_{ni} - Carcinogenic Effects- Organic Constituents (mg/kg):

(EQ1, Appendix H, RECAP 2003)

$TR \times AT_c \times 365 \text{ days/year}$

$$EF_{ni} \times \left(\left(SF_o \times 10^{-6} \frac{kg}{mg} \times IRS_{adj} \right) + \left(SF_i \times IRA_{adj} \times \left(\frac{1}{VF_{ni}} \right) \right) + \left(SF_o \times 10^{-6} \frac{kg}{mg} \times ABS \times IRD_{adj} \right) \right)$$

Parameter	Definition (units)	Chemical Compound
		<i>Benzo(b)fluoranthene</i>
SED _{ni}	calculated non-industrial risk-based chemical concentration in sediment (mg/kg)	2.09E+00
TR	target excess individual lifetime cancer risk (unitless)	10 ⁻⁶ ^a
SF _o	oral cancer slope factor ((mg/kg-day) ⁻¹)	0.73 ^c
SF _i	inhalation cancer slope factor ((mg/kg-day) ⁻¹)	0.31 ^c
AT _c	averaging time – carcinogens (yr)	70 ^a
EF _{ni}	exposure frequency, recreational (days/yr)	104 ^g
IRS _{adj}	age-adjusted soil ingestion rate (mg-yr/kg-day)	114 ^d
IRA _{adj}	age-adjusted inhalation rate (m ³ -yr/kg-day)	1 ^d
IRD _{adj}	age-adjusted dermal contact rate (mg-yr/kg-day)	360 ^d
VF _{ni}	non-industrial soil-to-air volatilization factor (m ³ /kg)	1.08E+07 ^{c,e}
ABS	dermal absorption factor (unitless)	0.13 ^{c,f}

^a *Soil Screening Guidance: User's Guide, EPA 1996.*

^b Refer to Section 2.14.3, RECAP 2003

^c Chemical-specific.

^d Human Health Medium-Specific Screening Levels, EPA Region VI, 2003.

^e Refer to EQ12, RECAP 2003

^f Refer to Table H-6, RECAP 2003

^g Assuming recreational exposure every weekend

Sediment Adult Standard
Algorithm: RECAP Soil_{ni}

SED_{ni} - Carcinogenic Effects- Organic Constituents (mg/kg):

(EQ1, Appendix H, RECAP 2003)

$$EF_{ni} \times \frac{TR \times AT_c \times 365 \text{ days/year}}{\left(SF_o \times 10^{-6} \frac{kg}{mg} \times IRS_{adj} \right) + \left(SF_i \times IRA_{adj} \times \left(\frac{1}{VF_{ni}} \right) \right) + \left(SF_o \times 10^{-6} \frac{kg}{mg} \times ABS \times IRD_{adj} \right)}$$

Parameter	Definition (units)	Chemical Compound
		<i>Benzo(k)fluoranthene</i>
SED _{ni}	calculated non-industrial risk-based chemical concentration in sediment (mg/kg)	2.09E+01
TR	target excess individual lifetime cancer risk (unitless)	10 ⁻⁶ ^a
SF _o	oral cancer slope factor ((mg/kg-day) ⁻¹)	0.073 ^c
SF _i	inhalation cancer slope factor ((mg/kg-day) ⁻¹)	0.031 ^c
AT _c	averaging time – carcinogens (yr)	70 ^a
EF _{ni}	exposure frequency, recreational (days/yr)	104 ^g
IRS _{adj}	age-adjusted soil ingestion rate (mg-yr/kg-day)	114 ^d
IRA _{adj}	age-adjusted inhalation rate (m ³ -yr/kg-day)	1 ^d
IRD _{adj}	age-adjusted dermal contact rate (mg-yr/kg-day)	360 ^d
VF _{ni}	non-industrial soil-to-air volatilization factor (m ³ /kg)	2.75E+07 ^{c,e}
ABS	dermal absorption factor (unitless)	0.13 ^{c,f}

^a Soil Screening Guidance: User's Guide, EPA 1996.

^b Refer to Section 2.14.3, RECAP 2003

^c Chemical-specific.

^d Human Health Medium-Specific Screening Levels, EPA Region VI, 2003.

^e Refer to EQ12, RECAP 2003

^f Refer to Table H-6, RECAP 2003

^g Assuming recreational exposure every weekend

Sediment Adult Standard
 Algorithm: RECAP Soil_{ni}

SED_{ni} - Carcinogenic Effects- Organic Constituents (mg/kg):

(EQ1, Appendix H, RECAP 2003)

$$EF_{ni} \times \left(\frac{TR \times AT_c \times 365 \text{ days/year}}{\left(SF_o \times 10^{-6} \frac{kg}{mg} \times IRS_{adj} \right) + \left(SF_i \times IRA_{adj} \times \left(\frac{1}{VF_{ni}} \right) \right) + \left(SF_o \times 10^{-6} \frac{kg}{mg} \times ABS \times IRD_{adj} \right)} \right)$$

Parameter	Definition (units)	Chemical Compound
		<i>Chrysene</i>
SED _{ni}	calculated non-industrial risk-based chemical concentration in sediment (mg/kg)	2.08E+02
TR	target excess individual lifetime cancer risk (unitless)	10 ⁻⁶ ^a
SF _o	oral cancer slope factor ((mg/kg-day) ⁻¹)	0.0073 ^c
SF _i	inhalation cancer slope factor ((mg/kg-day) ⁻¹)	0.0031 ^c
AT _c	averaging time – carcinogens (yr)	70 ^a
EF _{ni}	exposure frequency, recreational (days/yr)	104 ^b
IRS _{adj}	age-adjusted soil ingestion rate (mg-yr/kg-day)	114 ^d
IRA _{adj}	age-adjusted inhalation rate (m ³ -yr/kg-day)	1 ^d
IRD _{adj}	age-adjusted dermal contact rate (mg-yr/kg-day)	360 ^d
VF _{ni}	non-industrial soil-to-air volatilization factor (m ³ /kg)	6.25E+06 ^{c,e}
ABS	dermal absorption factor (unitless)	0.13 ^{c,f}

^a Soil Screening Guidance: User's Guide, EPA 1996.

^b Refer to Section 2.14.3, RECAP 2003

^c Chemical-specific.

^d Human Health Medium-Specific Screening Levels, EPA Region VI, 2003.

^e Refer to EQ12, RECAP 2003

^f Refer to Table H-6, RECAP 2003

^g Assuming recreational exposure every weekend

Sediment Adult Standard
Algorithm: RECAP Soil_{ni}

SED_{ni} - Carcinogenic Effects- Organic Constituents (mg/kg):

(EQ1, Appendix H, RECAP 2003)

$TR \times AT_c \times 365 \text{ days/year}$

$$EF_{ni} \times \left(\left(SF_o \times 10^{-6} \frac{kg}{mg} \times IRS_{adj} \right) + \left(SF_i \times IRA_{adj} \times \left(\frac{1}{VF_{ni}} \right) \right) + \left(SF_o \times 10^{-6} \frac{kg}{mg} \times ABS \times IRD_{adj} \right) \right)$$

Parameter	Definition (units)	Chemical Compound
		<i>Dibenz(a,h)anthracene</i>
SED _{ni}	calculated non-industrial risk-based chemical concentration in sediment (mg/kg)	2.09E-01
TR	target excess individual lifetime cancer risk (unitless)	10 ⁻⁶ ^a
SF _o	oral cancer slope factor ((mg/kg-day) ⁻¹)	7.3 ^c
SF _i	inhalation cancer slope factor ((mg/kg-day) ⁻¹)	3.1 ^c
AT _c	averaging time – carcinogens (yr)	70 ^a
EF _{ni}	exposure frequency, recreational (days/yr)	104 ^g
IRS _{adj}	age-adjusted soil ingestion rate (mg-yr/kg-day)	114 ^d
IRA _{adj}	age-adjusted inhalation rate (m ³ -yr/kg-day)	1 ^d
IRD _{adj}	age-adjusted dermal contact rate (mg-yr/kg-day)	360 ^d
VF _{ni}	non-industrial soil-to-air volatilization factor (m ³ /kg)	3.51E+07 ^{c,e}
ABS	dermal absorption factor (unitless)	0.13 ^{e,f}

^a *Soil Screening Guidance: User's Guide, EPA 1996.*

^b Refer to Section 2.14.3, RECAP 2003

^c Chemical-specific.

^d Human Health Medium-Specific Screening Levels, EPA Region VI, 2003.

^e Refer to EQ12, RECAP 2003

^f Refer to Table H-6, RECAP 2003

^g Assuming recreational exposure every weekend

Sediment Adult Standard
 Algorithm: RECAP Soil_{ni}

SED_{ni} - Carcinogenic Effects- Organic Constituents (mg/kg):

(EQ1, Appendix H, RECAP 2003)

$$EF_{ni} \times \left(\left(SF_o \times 10^{-6} \frac{kg}{mg} \times IRS_{adj} \right) + \left(SF_i \times IRA_{adj} \times \left(\frac{1}{VF_{ni}} \right) \right) + \left(SF_o \times 10^{-6} \frac{kg}{mg} \times ABS \times IRD_{adj} \right) \right) \times TR \times AT_c \times 365 \text{ days/year}$$

Parameter	Definition (units)	Chemical Compound
		<i>Indeno(1,2,3-cd)pyrene</i>
SED _{ni}	calculated non-industrial risk-based chemical concentration in sediment (mg/kg)	2.09E+00
TR	target excess individual lifetime cancer risk (unitless)	10 ⁻⁶ ^a
SF _o	oral cancer slope factor ((mg/kg-day) ⁻¹)	0.73 ^c
SF _i	inhalation cancer slope factor ((mg/kg-day) ⁻¹)	0.31 ^c
AT _c	averaging time – carcinogens (yr)	70 ^a
EF _{ni}	exposure frequency, recreational (days/yr)	104 ^b
IRS _{adj}	age-adjusted soil ingestion rate (mg-yr/kg-day)	114 ^d
IRA _{adj}	age-adjusted inhalation rate (m ³ -yr/kg-day)	1 ^d
IRD _{adj}	age-adjusted dermal contact rate (mg-yr/kg-day)	360 ^d
VF _{ni}	non-industrial soil-to-air volatilization factor (m ³ /kg)	4.53E+07 ^{c,e}
ABS	dermal absorption factor (unitless)	0.13 ^{c,f}

^a Soil Screening Guidance: User's Guide, EPA 1996.

^b Refer to Section 2.14.3, RECAP 2003

^c Chemical-specific.

^d Human Health Medium-Specific Screening Levels, EPA Region VI, 2003.

^e Refer to EQ12, RECAP 2003

^f Refer to Table H-6, RECAP 2003

^g Assuming recreational exposure every weekend

Calculations of Tissue Screening Levels
Attachment D

Tissue Screening Levels in Fish

Tissue Screening Level Calculations

<u>Input Parameters</u>	<u>Value</u>
Target Hazard Quotient	1
Body Weight (kg)	70
Averaging Time (yr)	30
Exposure Frequency (days/yr)	365
Exposure Duration (yrs)	30
Ingestion Rates (g/day)	30

<u>Constituent</u>	<u>RfD₀ (mg/kg-day)</u>	<u>Calculated Tissue Screening Level in Fish (mg/kg)</u>
<i>TPH Fraction</i>		
Aliphatic >C ₁₂ -C ₁₆	0.1	2.33E+02
Aliphatic >C ₁₆ -C ₃₅	2	4.67E+03
Aromatic >C ₁₂ -C ₁₆	0.04	9.33E+01
Aromatic >C ₁₆ -C ₂₁	0.03	7.00E+01
<i>Metals</i>		
Barium	0.2	4.67E+02

Reference:

Tissue Screening Level Guidelines For Issuance of Public Health Advisories For Selected Contaminants and Supporting Documentation,
 March 2012, Louisiana Department of Environmental Quality, Louisiana Department of Health and Hospitals, Louisiana Department of Wildlife and Fisheries,
 Louisiana Department of Agriculture and Forestry

Tissue Screening Level Algorithm

$$\text{Noncarcinogenic TSL} = \frac{THQ \times BW \times AT \times 365 \text{ days / yr}}{EF \times ED \times (RfD_0 \times IRF)}$$

Where:

Parameter	Definition (units)	Input value
TSL	Tissue screening level (mg/kg)	***
THQ	Target hazard quotient	1
BW	Body weight (kg)	70
AT	Averaging time (years)	30
EF	Exposure frequency (days/year)	365
ED	Exposure duration (years)	30
RfD	Reference dose (mg/kg-day)	Chemical-specific
IRF	Fish ingestion rate (g/day)	30

Statistical Calculations
Attachment E

Normal UCL Statistics for Uncensored Full Data Sets

User Selected Options

Date/Time of Computation ProUCL 5.17/15/2016 10:57:19 AM
 From File WorkSheet.xls
 Full Precision OFF
 Confidence Coefficient 95%

DRY 0-6

General Statistics

Total Number of Observations	15	Number of Distinct Observations	14
		Number of Missing Observations	0
Minimum	177	Mean	1504
Maximum	5970	Median	851
SD	1592	SD of logged Data	1.187
Coefficient of Variation	1.059	Skewness	1.667

Normal GOF Test

Shapiro Wilk Test Statistic	0.801	Shapiro Wilk GOF Test
5% Shapiro Wilk Critical Value	0.881	Data Not Normal at 5% Significance Level
Lilliefors Test Statistic	0.202	Lilliefors GOF Test
5% Lilliefors Critical Value	0.22	Data appear Normal at 5% Significance Level

Data appear Approximate Normal at 5% Significance Level

Assuming Normal Distribution

95% Normal UCL		95% UCLs (Adjusted for Skewness)	
95% Student's-t UCL	2228	95% Adjusted-CLT UCL (Chen-1995)	2369
		95% Modified-t UCL (Johnson-1978)	2257

Suggested UCL to Use

95% Student's-t UCL	2228
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When a data set follows an approximate (e.g., normal) distribution passing one of the GOF test

When applicable, it is suggested to use a UCL based upon a distribution (e.g., gamma) passing both GOF tests in ProUCL

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL. Recommendations are based upon data size, data distribution, and skewness.

These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).

However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

Gamma UCL Statistics for Uncensored Full Data Sets

User Selected Options

Date/Time of Computation ProUCL 5.17/15/2016 10:59:02 AM
 From File WorkSheet.xls
 Full Precision OFF
 Confidence Coefficient 95%
 Number of Bootstrap Operations 2000

DRY ALL

General Statistics

Total Number of Observations	34	Number of Distinct Observations	31
		Number of Missing Observations	0
Minimum	137	Mean	1331
Maximum	5970	Median	1110
SD	1175	SD of logged Data	1.013
Coefficient of Variation	0.883	Skewness	1.931

Gamma GOF Test

A-D Test Statistic	0.626	Anderson-Darling Gamma GOF Test	
5% A-D Critical Value	0.769	Data appear Gamma Distributed at 5% Significance Level	
K-S Test Statistic	0.119	Kolmogorov-Smirnov Gamma GOF Test	
5% K-S Critical Value	0.154	Data appear Gamma Distributed at 5% Significance Level	

Data appear Gamma Distributed at 5% Significance Level

Gamma Statistics

k hat (MLE)	1.339	k star (bias corrected MLE)	1.241
Theta hat (MLE)	994.1	Theta star (bias corrected MLE)	1073
nu hat (MLE)	91.07	nu star (bias corrected)	84.37
MLE Mean (bias corrected)	1331	MLE Sd (bias corrected)	1195
		Approximate Chi Square Value (0.05)	64.2
Adjusted Level of Significance	0.0422	Adjusted Chi Square Value	63.33

Assuming Gamma Distribution

95% Approximate Gamma UCL (use when n>=50)	1750	95% Adjusted Gamma UCL (use when n<50)	1774
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Suggested UCL to Use

95% Adjusted Gamma UCL	1774
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Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL. Recommendations are based upon data size, data distribution, and skewness. These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006). However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

Lognormal UCL Statistics for Uncensored Full Data Sets

User Selected Options

Date/Time of Computation ProUCL 5.17/15/2016 10:58:18 AM
 From File WorkSheet.xls
 Full Precision OFF
 Confidence Coefficient 95%
 Number of Bootstrap Operations 2000

WET 0-6

General Statistics

Total Number of Observations	15	Number of Distinct Observations	15
		Number of Missing Observations	0
Minimum	72.75	Mean	564.3
Maximum	1534	Median	577.8
SD	487.2	Std. Error of Mean	125.8
Coefficient of Variation	0.863	Skewness	0.597

Lognormal GOF Test

Shapiro Wilk Test Statistic	0.868	Shapiro Wilk Lognormal GOF Test
5% Shapiro Wilk Critical Value	0.881	Data Not Lognormal at 5% Significance Level
Lilliefors Test Statistic	0.215	Lilliefors Lognormal GOF Test
5% Lilliefors Critical Value	0.22	Data appear Lognormal at 5% Significance Level

Data appear Approximate Lognormal at 5% Significance Level

Logged Statistics

Minimum of Logged Data	4.287	Mean of logged Data	5.847
Maximum of Logged Data	7.336	SD of logged Data	1.113

Lognormal Maximum likelihood Estimates (MLEs)

MLE Mean	643.3	MLE Standard Deviation	1007
MLE Median	346.4	MLE Skewness	8.53
MLE Coefficient of Variation	1.565	80% MLE Quantile	883.6
90% MLE Quantile	1442	95% MLE Quantile	2160
99% MLE Quantile	4611		

Lognormal Minimum Variance Unbiased Estimates (MVUEs)

MVUE Mean	605.5	MVUE SD	780.7
MVUE Median	332.3	MVUE SEM	192.5

Assuming Lognormal Distribution

95% H-UCL	1536	90% Chebyshev (MVUE) UCL	1183
95% Chebyshev (MVUE) UCL	1444	97.5% Chebyshev (MVUE) UCL	1807
99% Chebyshev (MVUE) UCL	2520		

Nonparametric Distribution Free UCLs

95% CLT UCL	771.3	95% Jackknife UCL	785.9
95% Standard Bootstrap UCL	771.6	95% Bootstrap-t UCL	827.5
95% Hall's Bootstrap UCL	786.1	95% Percentile Bootstrap UCL	780.1
95% BCA Bootstrap UCL	771.3		
90% Chebyshev(Mean, Sd) UCL	941.7	95% Chebyshev(Mean, Sd) UCL	1113
97.5% Chebyshev(Mean, Sd) UCL	1350	99% Chebyshev(Mean, Sd) UCL	1816

Suggested UCL to Use

95% Chebyshev (Mean, Sd) UCL	1113
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Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL. Recommendations are based upon data size, data distribution, and skewness. These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006). However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

Gamma UCL Statistics for Uncensored Full Data Sets

User Selected Options

Date/Time of Computation ProUCL 5.17/15/2016 10:58:55 AM
 From File WorkSheet.xls
 Full Precision OFF
 Confidence Coefficient 95%
 Number of Bootstrap Operations 2000

WET ALL

General Statistics

Total Number of Observations	34	Number of Distinct Observations	34
		Number of Missing Observations	0
Minimum	70.97	Mean	562.6
Maximum	1534	Median	562.4
SD	402.2	SD of logged Data	0.987
Coefficient of Variation	0.715	Skewness	0.463

Gamma GOF Test

A-D Test Statistic	1.236	Anderson-Darling Gamma GOF Test
5% A-D Critical Value	0.766	Data Not Gamma Distributed at 5% Significance Level
K-S Test Statistic	0.153	Kolmogorov-Smirnov Gamma GOF Test
5% K-S Critical Value	0.154	Data appear Gamma Distributed at 5% Significance Level

Data appear to Follow Approximate Gamma Distribution at 5% Significance Level

Gamma Statistics

k hat (MLE)	1.494	k star (bias corrected MLE)	1.382
Theta hat (MLE)	376.6	Theta star (bias corrected MLE)	407.2
nu hat (MLE)	101.6	nu star (bias corrected)	93.95
MLE Mean (bias corrected)	562.6	MLE Sd (bias corrected)	478.6
		Approximate Chi Square Value (0.05)	72.59
Adjusted Level of Significance	0.0422	Adjusted Chi Square Value	71.66

Assuming Gamma Distribution

95% Approximate Gamma UCL (use when n>=50)	728.1	95% Adjusted Gamma UCL (use when n<50)	737.5
Suggested UCL to Use			
95% Adjusted Gamma UCL	737.5		

When a data set follows an approximate (e.g., normal) distribution passing one of the GOF test
 When applicable, it is suggested to use a UCL based upon a distribution (e.g., gamma) passing both GOF tests in ProUCL

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL. Recommendations are based upon data size, data distribution, and skewness. These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006). However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

Normal UCL Statistics for Data Sets with Non-Detects

User Selected Options

Date/Time of Computation ProUCL 5.17/17/2016 2:11:03 PM
 From File WorkSheet.xls
 Full Precision OFF
 Confidence Coefficient 95%
 Number of Bootstrap Operations 2000

Aliphatic >C12-C16 Wet

General Statistics

Total Number of Observations	20	Number of Distinct Observations	20
Number of Detects	4	Number of Non-Detects	16
Number of Distinct Detects	4	Number of Distinct Non-Detects	16
Minimum Detect	14	Minimum Non-Detect	9.975
Maximum Detect	97	Maximum Non-Detect	13.58
Variance Detects	1660	Percent Non-Detects	80%
Mean Detects	48.75	SD Detects	40.74
Median Detects	42	CV Detects	0.836
Skewness Detects	0.418	Kurtosis Detects	-3.617
Mean of Logged Detects	3.551	SD of Logged Detects	0.989

Normal GOF Test on Detects Only

Shapiro Wilk Test Statistic 0.869 Shapiro Wilk GOF Test
 5% Shapiro Wilk Critical Value 0.748 Detected Data appear Normal at 5% Significance Level
 Lilliefors Test Statistic 0.289 Lilliefors GOF Test
 5% Lilliefors Critical Value 0.375 Detected Data appear Normal at 5% Significance Level
 Detected Data appear Normal at 5% Significance Level

Kaplan-Meier (KM) Statistics using Normal Critical Values and other Nonparametric UCLs

KM Mean	17.73	KM Variance	5.713
KM SD	22.12	KM Standard Error of Mean	489.5
95% KM (BCA) UCL	N/A	97.5% KM (BCA) UCL	N/A
95% KM (t) UCL	27.61	95% KM (Percentile Bootstrap) UCL	N/A
95% KM (z) UCL	27.13	95% KM Bootstrap t UCL	N/A
90% KM Chebyshev UCL	34.87	95% KM Chebyshev UCL	42.63
97.5% KM Chebyshev UCL	53.4	99% KM Chebyshev UCL	74.57

DL/2 Statistics

DL/2 Normal		DL/2 Log-Transformed	
Mean in Original Scale	13.84	Mean in Log Scale	2.013
SD in Original Scale	24.14	SD in Log Scale	0.884
95% t UCL (Assumes normality)	23.17	95% H-Stat UCL	18.27

DL/2 is not a recommended method, provided for comparisons and historical reasons

Suggested UCL to Use

95% KM (t) UCL 27.61

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL. Recommendations are based upon data size, data distribution, and skewness.

These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).

However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

Normal UCL Statistics for Data Sets with Non-Detects

User Selected Options

Date/Time of Computation ProUCL 5.17/17/2016 2:11:03 PM
 From File WorkSheet.xls
 Full Precision OFF
 Confidence Coefficient 95%
 Number of Bootstrap Operations 2000

Aliphatic >C16-C35 Wet

General Statistics

Total Number of Observations	20	Number of Distinct Observations	20
Number of Detects	4	Number of Non-Detects	16
Number of Distinct Detects	4	Number of Distinct Non-Detects	16
Minimum Detect	20	Minimum Non-Detect	9.975
Maximum Detect	158	Maximum Non-Detect	13.58
Variance Detects	4503	Percent Non-Detects	80%
Mean Detects	80.5	SD Detects	67.1
Median Detects	72	CV Detects	0.834
Skewness Detects	0.328	Kurtosis Detects	-3.978
Mean of Logged Detects	4.043	SD of Logged Detects	1.014

Normal GOF Test on Detects Only

Shapiro Wilk Test Statistic 0.884 Shapiro Wilk GOF Test
 5% Shapiro Wilk Critical Value 0.748 Detected Data appear Normal at 5% Significance Level
 Lilliefors Test Statistic 0.279 Lilliefors GOF Test
 5% Lilliefors Critical Value 0.375 Detected Data appear Normal at 5% Significance Level
 Detected Data appear Normal at 5% Significance Level

Kaplan-Meier (KM) Statistics using Normal Critical Values and other Nonparametric UCLs

KM Mean	24.08	KM Variance	9.904
KM SD	38.36	KM Standard Error of Mean	1471
95% KM (BCA) UCL	N/A	97.5% KM (BCA) UCL	N/A
95% KM (t) UCL	41.2	95% KM (Percentile Bootstrap) UCL	N/A
95% KM (z) UCL	40.37	95% KM Bootstrap t UCL	N/A
90% KM Chebyshev UCL	53.79	95% KM Chebyshev UCL	67.25
97.5% KM Chebyshev UCL	85.93	99% KM Chebyshev UCL	122.6

DL/2 Statistics

DL/2 Normal		DL/2 Log-Transformed	
Mean in Original Scale	20.19	Mean in Log Scale	2.111
SD in Original Scale	40.85	SD in Log Scale	1.072
95% t UCL (Assumes normality)	35.98	95% H-Stat UCL	28.77

DL/2 is not a recommended method, provided for comparisons and historical reasons

Suggested UCL to Use

95% KM (t) UCL 41.2

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL. Recommendations are based upon data size, data distribution, and skewness.

These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).

However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

Normal UCL Statistics for Data Sets with Non-Detects

User Selected Options

Date/Time of Computation ProUCL 5.17/17/2016 2:11:03 PM
 From File WorkSheet.xls
 Full Precision OFF
 Confidence Coefficient 95%
 Number of Bootstrap Operations 2000

Aliphatic >C12-C16 Dry

General Statistics

Total Number of Observations	23	Number of Distinct Observations	21
Number of Detects	4	Number of Non-Detects	19
Number of Distinct Detects	4	Number of Distinct Non-Detects	17
Minimum Detect	34	Minimum Non-Detect	14.9
Maximum Detect	306	Maximum Non-Detect	31
Variance Detects	16006	Percent Non-Detects	82.61%
Mean Detects	130.2	SD Detects	126.5
Median Detects	90.5	CV Detects	0.971
Skewness Detects	1.268	Kurtosis Detects	0.82
Mean of Logged Detects	4.48	SD of Logged Detects	1.035

Normal GOF Test on Detects Only

Shapiro Wilk Test Statistic	0.86	Shapiro Wilk GOF Test
5% Shapiro Wilk Critical Value	0.748	Detected Data appear Normal at 5% Significance Level
Lilliefors Test Statistic	0.257	Lilliefors GOF Test
5% Lilliefors Critical Value	0.375	Detected Data appear Normal at 5% Significance Level

Detected Data appear Normal at 5% Significance Level

Kaplan-Meier (KM) Statistics using Normal Critical Values and other Nonparametric UCLs

KM Mean	34.96	KM Variance	15.23
KM SD	63.24	KM Standard Error of Mean	3999
95% KM (BCA) UCL	N/A	97.5% KM (BCA) UCL	N/A
95% KM (t) UCL	61.11	95% KM (Percentile Bootstrap) UCL	N/A
95% KM (z) UCL	60.01	95% KM Bootstrap t UCL	N/A
90% KM Chebyshev UCL	80.64	95% KM Chebyshev UCL	101.3
97.5% KM Chebyshev UCL	130	99% KM Chebyshev UCL	186.5

DL/2 Statistics

DL/2 Normal		DL/2 Log-Transformed	
Mean in Original Scale	31.5	Mean in Log Scale	2.729
SD in Original Scale	65.81	SD in Log Scale	0.917
95% t UCL (Assumes normality)	55.07	95% H-Stat UCL	37.44

DL/2 is not a recommended method, provided for comparisons and historical reasons

Suggested UCL to Use

95% KM (t) UCL 61.11

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL. Recommendations are based upon data size, data distribution, and skewness. These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006). However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

Normal UCL Statistics for Data Sets with Non-Detects

User Selected Options

Date/Time of Computation ProUCL 5.17/17/2016 2:11:03 PM
 From File WorkSheet.xls
 Full Precision OFF
 Confidence Coefficient 95%
 Number of Bootstrap Operations 2000

Aliphatic >C16-C35 Dry

General Statistics

Total Number of Observations	23	Number of Distinct Observations	21
Number of Detects	4	Number of Non-Detects	19
Number of Distinct Detects	4	Number of Distinct Non-Detects	17
Minimum Detect	52.49	Minimum Non-Detect	14.9
Maximum Detect	497	Maximum Non-Detect	31
Variance Detects	42436	Percent Non-Detects	82.61%
Mean Detects	213.4	SD Detects	206
Median Detects	152	CV Detects	0.965
Skewness Detects	1.198	Kurtosis Detects	0.501
Mean of Logged Detects	4.968	SD of Logged Detects	1.05

Normal GOF Test on Detects Only

Shapiro Wilk Test Statistic	0.871	Shapiro Wilk GOF Test
5% Shapiro Wilk Critical Value	0.748	Detected Data appear Normal at 5% Significance Level
Lilliefors Test Statistic	0.257	Lilliefors GOF Test
5% Lilliefors Critical Value	0.375	Detected Data appear Normal at 5% Significance Level

Kaplan-Meier (KM) Statistics using Normal Critical Values and other Nonparametric UCLs

KM Mean	49.42	KM Variance	25.47
KM SD	105.8	KM Standard Error of Mean	11194
95% KM (BCA) UCL	N/A	97.5% KM (BCA) UCL	N/A
95% KM (t) UCL	93.16	95% KM (Percentile Bootstrap) UCL	N/A
95% KM (z) UCL	91.32	95% KM Bootstrap t UCL	N/A
90% KM Chebyshev UCL	125.8	95% KM Chebyshev UCL	160.5
97.5% KM Chebyshev UCL	208.5	99% KM Chebyshev UCL	302.9

DL/2 Statistics

DL/2 Normal		DL/2 Log-Transformed	
Mean in Original Scale	45.96	Mean in Log Scale	2.813
SD in Original Scale	109.4	SD in Log Scale	1.092
95% t UCL (Assumes normality)	85.11	95% H-Stat UCL	56.05

DL/2 is not a recommended method, provided for comparisons and historical reasons

Suggested UCL to Use

95% KM (t) UCL 93.16

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL. Recommendations are based upon data size, data distribution, and skewness.

These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).

However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.