Chesapeake Bay Program | Indicator Analysis and Methods Document
Toxic Contaminants | Updated October 2018

Indicator Title: Percent of Analyzed Tidal Tributaries with Partial or Full Impairments Due to Chemical Contaminants. (As determined by Virginia, Maryland, Delaware, and DC under Clean Water Act requirements)

Relevant Outcome(s): Toxic Contaminants Policy and Prevention

Relevant Goal(s): Toxic Contaminants

Location within Framework (i.e., Influencing Factor, Output or Performance): Performance

A. Data Set and Source

(1) Describe the data set. What parameters are measured? What parameters are obtained by calculation? For what purpose(s) are the data used?

Data were collected by MDE, VA DEQ, DE DNREC and DC to identify waters with fish tissue contamination or other water quality impairments at levels requiring Clean Water Act 303(d) listing and for inclusion in the 2016 update of the 303(d) lists.

Data was obtained from 2016 303(d) lists for MD, VA, DE, D.C., and EPA. Concentrations of contaminants in tissue of collected fish were measured by VA DEQ and MDE. Fish tissue results are the primary cause of PCB related impairments. In addition to fish tissue, the data include water column and sediment data to capture toxic contaminants that do not bio-accumulate in fish tissue. A variety of other methods are used to determine impairments by states. Detected concentrations that exceed the state's thresholds trigger jurisdictions' CWA 303(d) listings and TMDLs.

Specific listing categories included 4a (TMDL completed), 4b (expected to meet water quality standards for the specified pollutant by the next listing cycle), and 5 (TMDL needed). Waters were added to the indicator that were listed under categories 4a, 4b, and 5 for impairments due to PCBs, chlorpyrifos, metals (mercury, lead, copper, zinc, silver, selenium, and other metals), and organic contaminants (chlordane, PAHs, heptachlor epoxide, and other organic contaminants). No chlorpyrifos listings under 303(d) categories 4a, 4b, or 5 were published in 2016.

This indicator calculates the number of fully or partially impaired tidal segments as a percentage of the total number of the 92 tidal segments designated under the nitrogen and phosphorus TMDL. The result is an indicator value that is a calculated percentage based on jurisdictions' CWA 303(d) listings. The data are used to indicate the frequency of impairments that result from chemical contaminants. The coordination between the Chesapeake Bay Program and jurisdictions to utilize this data helps to ensure consistent communications among the Bay Program partners.

(2) List the source(s) of the data set, the custodian of the source data, and the relevant contact at the Chesapeake Bay Program.

Source:

Maryland's 303(d) list is available through the Maryland Department of the Environment (MDE), Virginia's is available through the Virginia Department of Environmental Quality (VADEQ). District of Columbia's is available through the DC Department of Energy and Environment (DOEE). Delaware's is available through the Delaware Department of Natural Resources and Environmental Control (DNREC). Supporting data was provided by contacts in these jurisdiction agencies.

A description of methodology is provided by the states (see the answer to question 3 below).

Maryland Contact: Matthew Stover (MDE) at matthew.stover@maryland.gov and Len Schugam (leonard.schugam@maryland.gov)
Virginia Contact: Matt Richardson at Matthew.Richardson@deq.virginia.gov
Delaware Contact: John Cargill at John.Cargill@state.de.us
District of Columbia Contact: Nicoline Shulterbrandt (DDOEE) at nicoline.shulterbrandt@dc.gov

Custodian/Chesapeake Bay Program Contact (name, email address, phone number): Greg Allen (allen.greg@epa.gov; 410-267-5746)

(3) Please provide a link to the location of the data set. Are metadata, data-dictionaries and embedded definitions included?

Maryland
https://mde.maryland.gov/programs/Water/TMDL/Integrated303dReports/Pages/ImpairmentMaps.aspx (includes searchable IR data)
https://mdewin64.mde.state.md.us/WSA/IR-TMDL/index.html (the "more information" button on the top right corner of the map has a drop down link to download spatial data)
Virginia:
http://www.deq.state.va.us/Programs/Water/WaterQualityInformationTMDLs/WaterQualityAssessments/2012305b303dIntegratedReport.aspx (includes downloadable spatial data)
D.C.:
http://ddoe.dc.gov/publication/integrated-report-epa-and-us-congress-regarding-dcs-water-quality (the 2016 report is available, but no downloadable data exists at this time for 2016. 2016 IR does indicate the same impairments with no change from 2014 for the tidal Anacostia and upper Potomac in DC)
Delaware:
http://www.dnrec.delaware.gov/swc/wa/Pages/WatershedAssessment305band303dReports.aspx (The 2016 report exists, but no downloadable data is available. Email correspondence confirmed no changes in indicator status since 2014 for the CB watershed portions of the C&D canal and Nanticoke river)

B. Temporal Considerations

(4) Data collection date(s): The data used in this indicator is the same data used by the states of Virginia, Maryland, Delaware, and DC to determine impairments for the 2016 impairments. The data that was used was accumulated during a period of time preceding the listing reports based on the jurisdictions' internal policies and methods.

(5) Planned update frequency (e.g., annual, biannual, etc.):
- Source Data: States update 303(d) listings every even year. The next update from the jurisdictions will be 2018 IR data, which should be available in early 2019 to update the indicator in 2019.
- Indicator: Following 2019, updates to the toxic contaminants indicator may follow a biannual schedule to update in the odd years following even-year IR publication from the jurisdictions.

(6) Date (month and year) next data set is expected to be available for reporting: late 2018/early 2019 (approximate), depending on jurisdictions' submittals and EPA Region III review and approval.

C. Spatial Considerations

(7) What is the ideal level of spatial aggregation (e.g., watershed-wide, river basin, state, county, hydrologic unit code)? This indicator is aggregated to the CBP's 92 tidal segments for the Bay and its major tributaries, determining whether each tidal segment identified contains a partial or segment-wide impairment due to toxic contaminants.

(8) Is there geographic (GIS) data associated with this data set? If so, indicate its format (e.g., point, line polygon). The Chesapeake Bay Program has defined 92 tidal segments, and this indicator aggregates to the tidal segments from jurisdiction-defined monitoring areas.

(9) Are there geographic areas that are missing data? If so, list the areas. No areas are missing.

(10) Please submit any appropriate examples of how this information has been mapped or otherwise portrayed geographically in the past.
The jurisdictions' 2012 303(d) listings were mapped. The jurisdictions' 2014 listings were also mapped.

D. Communicating the Data

(11) What is the goal, target, threshold or expected outcome for this indicator? How was it established?

The goal is for 100% of segments analyzed to contain no impairments due to toxic chemicals. The goal was established though a consensus process involving the Chesapeake Bay Program signatory partners.

(12) What is the current status in relation to the goal, target, threshold or expected outcome?
Based on the 2016 303(d) assessments of 92 tidal segments analyzed, 75 are impaired due to PCBs, organic contaminants, metals, unknown causes or some combination of these causes.

(13) Has a new goal, target, threshold or expected outcome been established since the last reporting period? Why? No.

(14)Has the methodology of data collection or analysis changed since the last reporting period? How? Why?
No.
The 2014 indicator update involved meetings with a representative from Maryland Department of Environment where decisions were made as to how to represent Maryland segments CB1TF, CB3MH, CB4MH, CB5MH, and TANMH, where Maryland data overlaps with CBP segment boundaries were unclear. Those decisions are documented in the 2014 indicator data file. Maryland has not yet updated their IR segmentation scheme for 2016, but will do so for future updates to clarify those boundaries.

(15) What is the long-term data trend (since the start of data collection)?
The number of segments with full or partial impairment have increased in the 2010, 2012, 2014, and 2016 updates. An analysis to determine whether the increase is statistically significant or can be identified as a trend has not been conducted.

(16) What change(s) does the most recent data show compared to the last reporting period? To what do you attribute the change? Is this actual cause or educated speculation?

The number of impaired segments has increased slightly from 74 impaired segments in 2014 (80.4% impaired) to 75 impaired segments in 2016 (81.5% impaired). The change may be due to increased loads of contaminants in the ecosystem, but may also be due to enhancements in monitoring coverage or technology over previous years' updates.

(17) What is the key story told by this indicator?
Over eighty percent of segments in the Bay and its tidal tributaries contain partial or full impairments related to chemical contaminants. Metals, PCBs, and priority organics are found exceeding state water quality criteria in part or the entirety of tidal tributaries that deliver water to the main-stem of the Chesapeake Bay. This gives some idea

regarding the extent of toxic contamination in Bay tidal waters. PCB listings are present in 100% of impaired or partially impaired segments.

Due to the bioaccumulative nature of many of these substances, even if inputs to the tributaries decreases, fish tissue concentrations will not respond quickly. There may be little positive change seen in the short term for this indicator since a large majority of partially or fully impaired segments contain a PCB impairment based on fish tissue.

It is important to communicate the prevalence of toxic contamination in fish tissue, sediment, and the water column as it has both an ecosystem and human health connection. Contamination due to bioaccumulative substances in fish tissue gives an indication of the overall presence of these substances in the Chesapeake Bay ecosystem. Due to their bioaccumulative nature, these substances will end up in predatory species and potentially humans through fish consumption.

The issue of chemical contamination within the Chesapeake Bay is often characterized as a localized problem pertaining to "hot spots" or the "Regions of Concern"; this indicator shows that chemical contaminants are a concern for segments beyond these emphasized areas.

E. Adaptive Management

(18) What factors influence progress toward the goal, target, threshold or expected outcome?

- Broad geographic extent and distribution of PCBs
- Political will to modify regulatory programs and/or create voluntary programs
- High cost of remedies
- Variety of sources and pathways for PCBs entering the environment that necessitate a wide-range of very different management responses
- Need to shift paradigm to acknowledge that there are ongoing sources of PCBs (i.e., PCBs are not static "legacy" contaminants)
- Knowledge gaps on relative sizes of PCB sources

For more information about these factors, please refer to the management strategy here: https://www.chesapeakeprogress.com/clean-water/toxic-contaminants-policy-and-prevention

(19) What are the current gaps in existing management efforts?

Available in current (2018-2020) management strategy, posted to Chesapeake Progress: https://www.chesapeakeprogress.com/clean-water/toxic-contaminants-policy-and-prevention

(20) What are the current overlaps in existing management efforts?

Available in current (2018-2020) management strategy, posted to Chesapeake Progress: https://www.chesapeakeprogress.com/clean-water/toxic-contaminants-policy-and-prevention

(21) According to the management strategy written for the outcome associated with this indicator, how will we (a) assess our performance in making progress toward the goal, target, threshold or expected outcome, and (b) ensure the adaptive management of our work?

To assess performance toward the goal, we do not currently have a means for assessing short-term progress. There is some potential for using jurisdiction fish tissue data or other data sets for short-term progress monitoring in the future. In the long-term, this assessment of jurisdiction impairments will assess progress toward the goal. Adaptive management, reducing uncertainty so that the highest-return interventions are implemented, will be done on a project specific basis where data and/or best-professional judgement will be used to continually improve the effectiveness of strategic actions that are taken.

F. Analysis and Interpretation

Please provide appropriate references and location(s) of documentation if hard to find.

(22) What method is used to transform raw data into the information presented in this indicator? Please cite methods and/or modeling programs.

The indicator represents the percent of tidal segments containing some impairment (partial or segment-wide). The calculated percentage, indicator title, and description are accurate and make clear what is being presented, however there is some concern that presenting 303(d) listings in this way could be misleading, as some partial impairments are due to local contamination and do not necessarily indicate conditions throughout an entire segment.

Impairments listed by MD, VA, DE, and DC are used as the raw data for this indicator. Following a pass or fail pattern, a segment containing one or more impairments "fails" and one containing no impairments within its boundaries "passes." The indicator value is the total number of "failing" segments as a percentage of the total number of segments considered. Each segment is given equal weighting toward this calculation. Raw data on impairments, such as tissue concentrations in fish, is collected by the states to develop their 303(d) lists. If concentrations exceed thresholds for designated uses, then part or all of a segment is listed with impairment due to that contaminant. These listings are used to develop the percentage of impaired rivers or river segments that is presented in the indicator. Listing categories included in this indicator data are 4a (TMDL completed), 4b (expected to meet water quality standards by next listing cycle), and 5 (needs a TMDL).

For several segments in Maryland, state monitoring area partially overlapped with a tidal segment in the 2014 indicator (see question 14). This overlap has been clarified for subsequent updates to MD's IR data for 2016.

(23) Is the method used to transform raw data into the information presented in this indicator accepted as scientifically sound? If not, what are its limitations? Yes.

(24) How well does the indicator represent the environmental condition being assessed?

The calculated percentage, indicator title, and description are accurate and make clear what is being presented, however there is some concern that presenting 303(d) listings in this way could be misleading, as some partial impairments are due to local contamination and do not necessarily indicate conditions throughout an entire segment.

There is also concern that an increase in the percentage of segments with full or partial impairments could be indicative of more extensive state monitoring, rather than a degradation of the actual environmental condition. State monitoring does not cover all waters in the state in a given year, so new information could become available in subsequent years that could actually relate to an existing (but yet unknown) impairment.

(25) Are there established reference points, thresholds, ranges or values for this indicator that unambiguously reflect the desired state of the environment?

States have identified concentrations of contaminants found in fish tissue and water that drive impairment listings. These are tied to ecological risk, fish consumption and human health. Similar criteria combined with best-professional-judgement are used to determine other listings in sediment or the water column. Please refer to jurisdiction environmental agencies for detailed documentation on methods used to determine impairments.

(26) How far can the data be extrapolated? Have appropriate statistical methods been used to generalize or portray data beyond the time or spatial locations where measurements were made (e.g., statistical survey inference, no generalization is possible)? See answer to question 24 of this document.

G. Quality

Please provide appropriate references and location(s) of documentation if hard to find.

(27) Were the data collected and processed according to a U.S. Environmental Protection Agency-approved Quality Assurance Project Plan? If so, please provide a link to the QAPP and indicate when the plan was last reviewed and approved. **If not, please complete questions 29-31.** Yes.

QA/QC documentation for VA data is available online:

http://www.deq.state.va.us/export/sites/default/wqa/pdf/2008ir/appendices/ir08_AppendixD_Data_Sets_Considered.pdf

https://mde.maryland.gov/programs/water/TMDL/Integrated303dReports/Pages/index.aspx

(28) *If applicable:* Are the sampling, analytical and data processing procedures accepted as scientifically and technically valid? N/A

(29) *If applicable:* What documentation describes the sampling and analytical procedures used? N/A

(30) *If applicable:* To what extent are procedures for quality assurance and quality control of the data documented and accessible? N/A

(31) Are descriptions of the study design clear, complete and sufficient to enable the study to be reproduced? Yes.

(32) Were the sampling, analytical and data processing procedures performed consistently throughout the data record? The Chesapeake Bay Program relied upon the state QA procedures and oversight by EPA Region III to eliminate unacceptable data and data outliers and ensure methods are consistent.

(33) If data sets from two or more sources have been merged, are the sampling designs, methods and results comparable? If not, what are the limitations?
Data is supplied to the states from multiple sources. Each must follow a procedure that allows all data sets to be deemed comparable if they are to be included in 303(d) determination. These procedures are within each state with some oversight provided by EPA Region 3 during review of the draft Integrated 305(b) and 303(d) reports. However, there are some differences between the jurisdictions in data collection, sampling, analysis and reporting that may contribute to differences in how states determine impairments in different water bodies.

For example, many PCB listings are driven by fish tissue contamination. VA DEQ includes migratory fish tissue data in determining their tidal 303(d) listings, but MD does not sample migratory fish for their listings since it cannot be determined where migratory fish in tidal waters accumulated PCBs in their tissues.

(34) Are levels of uncertainty available for the indicator and/or the underlying data set? If so, do the uncertainty and variability impact the conclusions drawn from the data or the utility of the indicator? No.

(35) For chemical data reporting: How are data below the MDL reported (i.e., reported as 0, censored, or as < MDL)? If parameter substitutions are made (e.g., using orthophosphate instead of total phosphorus), how are data normalized? How does this impact the indicator? The jurisdictions have established policies

for assessing data reported as <MDL. Please refer to jurisdiction environmental agencies for detailed documentation on the approach used to process <MDL data.

(36) Are there noteworthy limitations or gaps in the data record?
Frequently more data is available where there are known contamination issues. The process that jurisdictions use to determine impairments may be based on a small dataset due to the cost of chemical contaminant monitoring. However, many impairment decisions are based on the ubiquitous presence of PCBs in fish tissue, which reduces the potential for under-reporting the extent of impairment.

Spatial reporting of water quality impairments at the state level is established at different scales and spatial boundaries than the Chesapeake Bay Program's segmentation scheme (92 tidal segments). State-reported data is re-aggregated and sorted by CBP staff in order to present the indicator using the CBP-designated spatial segments. This spatial discrepancy led to the decision to report some segments as partial impairments rather than full reported impairments for a given CBP segment.

H. Additional Information (*Optional)*

(37) Please provide any further information you believe is necessary to aid in communication and prevent any potential misrepresentation of this indicator.

Under Executive Order 13508, EPA released a technical report titled Toxic Contaminants in the Chesapeake Bay and its Watershed: Extent and Severity of Occurrence and Potential Biological Effects. This report is available at http://executiveorder.chesapeakebay.net/page/Reports-Documents.aspx.

The indicator update for 2016 was not assessed for quality assurance until March 2019. One segment's impairment category was updated following QA/QC, changing the overall indicator from 82.6% full or partial impairments to 81.5% full or partial impairments. Segment POCMH in Maryland was changed from code 2 (PCBs) to code 9 (no impairment). The number of segments impaired changed from 76 to 75 segments. This update was not included in the published Bay Barometer but was included in the indicator online on Chesapeake Progress.