Chesapeake Bay Program | Indicator Analysis and Methods Document

Toxic Contaminants | Updated September 2025

Indicator Title: Percent of 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 (TCPP) 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?*

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 these data helps to ensure consistent communications among the Bay Program partners.

Data were collected by MDE, VA DEQ, DE DNREC and DC DOEE 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 2024 update of the 303(d) lists. For an impairment to be listed, the detected or modeled contaminant must exceed the state's water quality criteria. This triggers jurisdictions' CWA 303(d) listings and expected publication of total maximum daily loads (TMDLs).

Data were obtained from 2024 303(d) lists for MD, VA, DE, D.C., and EPA. All jurisdictions measured concentrations of contaminants in fish tissue, water column and sediment data to determine whether state water quality criteria have been exceeded. Fish tissue results are the primary cause of PCB related impairments.

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, PFAS, metals (including but not limited to mercury, lead, copper, zinc, silver, and selenium), and priority organic contaminants (including but not limited to chlordane, PAHs, heptachlor epoxide, and dioxin.).

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 question 3 below).

Maryland:

- *Toxic Contaminants Workgroup (TCW) State Rep:* Len Schugam at leonard.schugam@maryland.gov
- *303d Listings:* same as above

Virginia:

- *TCW State Rep:* Tony Timpano at Anthony.Timpano@deq.virginia.gov
- *303d Listings: A*manda Shaver at amanda.shaver@deq.virginia.gov and Cleo Baker at cleo.baker@deq.virginia.gov

Delaware:

- *TCW State Rep:* John Cargill at John.Cargill@delaware.gov
- *303d Listings:* Sakinat Ahmad at sakinat.ahmad@delaware.gov.

District of Columbia:

- *TCW State Rep:* George Onyullo at George.onyullo@dc.gov
- *303d Listings:* Nicoline Shulterbrandt at nicoline.shulterbrandt@dc.gov and Lucretia Brown at lucretia.brown@dc.gov

2025 Indicator Update Lead: Petra Baldwin, TCW staffer (Baldwin.Petra@epa.gov)
Custodian/Chesapeake Bay Program Contact: Keith Bollt, TCW Coordinator (Bollt.Keith@epa.gov)

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

Maryland:

- 2024 Integrated Report: https://mde.maryland.gov/programs/water/TMDL/Integrated303dReports/Pages/2024IR.aspx
- 2024 Water Quality Assessments (IR) and TMDLs Map Viewer: https://mdewin64.mde.state.md.us/WSA/IR-TMDL/index.html

Virginia:

- 2024 Integrated Report: https://www.deq.virginia.gov/our-programs/water/water-quality/assessments/integrated-report
- 2024 Final WQA IR Assessment – Estuaries Map Viewer: https://geohub-vadeq.hub.arcgis.com/datasets/abac9b1d68fd494b9c7e34158283fd99_4/explore

DC:

- 2024 Integrated Report: https://doee.dc.gov/sites/default/files/dc/sites/doee/publication/attachments/2024%20Final%20IR%2011-18-2024%20-%201.pdf
- No downloadable data are available. Email correspondence confirmed no changes in indicator status in 2024 for D.C.'s segments.

Delaware:

- 2024 Integrated Report: https://documents.dnrec.delaware.gov/Watershed/Assessment/Reports/2024-Integrated-Report/Combined-Watershed-Assessment-Report.pdf
- No downloadable data are available. Email correspondence confirmed no changes in indicator status in 2024 for Delaware's segments.

B. Temporal Considerations

4) *Data collection date(s):*

The data used in this indicator are the same data used by the states of Virginia, Maryland, Delaware, and DC to determine impairments for their 2024 Integrated

Reports. The data were accumulated during a period preceding the listing reports based on the jurisdictions' internal policies and methods. Please note that jurisdictions may have different time periods for inclusion of data in their Integrated Reports.

5) *Planned update frequency (e.g., annual, biannual, etc.):*

Source Data: States typically update 303(d) listings every even year.

Indicator: Updates to the TCPP indicator generally follow a biannual schedule to update in the odd years following even-year IR publication from the jurisdictions. If a report is delayed, the indicator updates will be delayed. This happened with both the 2020 and 2022 indicator updates.

6) *Date (month and year) next data set is expected to be available for reporting:*

The next Integrated Reports will be for 2026. The data from these may become available in late 2026 or early 2027.

C. Spatial Considerations

7) *What is the ideal level of spatial aggregation (e.g., watershed-wide, river basin, state, county, hydrologic unit code)?*

Data for 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. Note that the accompanying map on ChesapeakeProgress displays impairments at a sub-92 segment scale to better reflect the extent of impairment in partially impaired segments. However, the percentage of impairment for the indicator is calculated based on the 92 tidal segments. (See section F, question 22 for a list of these partial impairments.)

8) *Is there geographic (GIS) data associated with this data set? If so, indicate its format (e.g., point, line polygon).*

Yes (polygons). 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.*

There are previous iterations of the indicator map, but this is the only portrayal available.

D. Communicating the Data

11) *What is the target or threshold measured by this indicator? How was it established?*

The threshold measured is the extent to which 303(d) listings due to toxic contaminants are present in the tidal waters of Chesapeake Bay. Toxic contaminants do not benefit from a monitoring program that allows analysis of trends in the presence, concentrations and effects of toxic contaminants. As a result, the CBP uses the states 303(d) listings counting full or partial spatial coverage as a proxy for cross-watershed monitoring. The expectation is that the extent of toxic contaminant-related impairment listings will decline over time in support of the Toxic Contaminants Goal of ensuring that the Bay and its rivers are free of effects of toxic contaminants on living resources and human health.

12) *What is the current status in relation to the goal, target, threshold or expected outcome? Why? Would you define our outlook1 toward achieving the outcome goal or target as on course, off course, uncertain, or completed? Upon what basis are you forecasting the outlook?*

Based on the 2024 303(d) assessments of 92 tidal segments analyzed, 74 (80.4%) are fully or partially impaired due to PCBs, priority organic contaminants, metals, PFAS, unknown causes, or some combination of these causes. The time series of data points from this indicator shows no significant change (increase of 2%) since 2022 in full or impartial impairments due to toxic contaminants. The indicator is far from the goal, indicating it is unlikely that this outcome will be achieved by 2025. Therefore, the outlook for this outcome is “off course.”

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.

15) *What is the long-term data trend (since the start of data collection)?*

The percentage of segments with full or partial impairment has increased from 2006 (66% impaired) when data reporting began to 2024 (80%). Since 2014, the percentage of segments with full or partial impairments has remained between 78% and 83%. Trend analysis has not been conducted to determine if this trend is significant.

16) *What change(s) does the most recent data show compared to the last reporting period? To what do you attribute the change? Would you characterize that change in the recent progress2 as an increase, decrease, no change, or completed for this outcome?*

The number of impaired segments has increased by two since 2022 - from 72 to 74 fully or partially impaired segments (78.3% to 80.4%). Therefore, we characterize the recent progress as no change.

17) *What is the key story told by this indicator?*

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.

80.4% of segments in the Bay and its tidal tributaries contain partial or full impairments related to chemical contaminants. Metals, PCBs, PFAS, and priority organics are found exceeding state water quality criteria in part or the entirety of tidal tributaries and the mainstem of the Chesapeake Bay. This gives an indication of the extent of toxic contamination in Bay tidal waters. PCB listings are present in 91% of impaired or partially impaired segments, with 5 segments delisted in 2024.

Additionally, the 2020 cycle included the first PFAS listing and the 2024 cycle included 21 PFAS listings.

Due to the bioaccumulative nature of many of these substances, even if inputs to the tributaries decreases, fish tissue concentrations will not respond quickly. In addition, these substances end up in predatory species and potentially humans through fish consumption. 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.

E. Adaptive Management

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

- Broad geographic extent and distribution of PCBs
- 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)

For more information about these factors, please refer to the management strategy here: https://www.chesapeakebay.net/files/toxic_contaminanats_policy_and_prevention_management_strategy_v3.pdf

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

There are opportunities to coordinate on and share information about best practices of existing state and federal programs more effectively inside the Toxic Contaminants Workgroup.

Current Efforts and Gaps can be found in the TCPP Management Strategy linked here: https://www.chesapeakebay.net/files/toxic_contaminanats_policy_and_prevention_management_strategy_v3.pdf

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

The intention of this indicator is to build off the work jurisdiction and federal partners

are doing. The indicator's strategy is meant to be complementary of ongoing actions and not overlapping with duplicative efforts.

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.

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.*

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).

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 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. The associated map on ChesapeakeProgress indicates the partial impairments at a sub-92 segment scale. A table listing the partial impairments represented on ChesapeakeProgress can be found below.

Name	CBSEG_92	State	Impairment Code	Impairment_Name
Anacostia River Tidal Fresh DC	ANATF_DC	DC	8	PCBs, Priority Organics and Metals
Tidal Basin	ANATF_DC	DC	7	PCBs and Priority Organics
Upper Mainstem Bay	CB1TF	MD	9	No Impairments Listed
Lower Susquehanna	CB1TF	MD	11	PCBs, PFAS
Aberdeen Proving Ground	CB1TF	MD	10	Unknown Toxics
Middle Chesapeake Bay Mesohaline Mainstem	CB4MH	MD	9	No Impairments Listed
Middle Chesapeake Bay Mesohaline Herring Bay	CB4MH	MD	11	PCBs, PFAS
Upper Choptank River	CHOTF	MD	9	No Impairments Listed
Tuckahoe Creek	CHOTF	MD	9	No Impairments Listed
Lower Chester River	CHSMH	MD	9	No Impairments Listed
Corsica River and Langford Creek	CHSMH	MD	9	No Impairments Listed
Upper James River Upper Tidal Fresh	JMSTF2	VA	2	PCBs
Upper James River Upper Tidal Fresh to Fall Line	JMSTF2	VA	3	PCBs, Metals
Western Branch Lynnhaven River, Broad Bay, Linkhorn Bay	LYNPH	VA	9	No Impairments Listed
Eastern Branch Lynnhaven River,	LYNPH	VA	2	PCBs

Upper Linkhorn Bay				
Middle River	MIDOH	MD	11	PCBs, PFAS
Seneca Creek	MIDOH	MD	2	PCBs
Patapsco River Mesohaline	PATMH	MD	13	PCBs, priority organics, PFAS
Patapsco River Northwest Branch, Inner Harbor	PATMH	MD	15	PCBs, metals, priority organics, PFAS
Bear Creek	PATMH	MD	15	PCBs, metals, priority organics, PFAS
Piankatank River Mesohaline	PIAMH	VA	2	PCBs
Harper Creek, Dragon Swamp, and Upper Piankatank River	PIAMH	VA	3	PCBs, Metals
Lower Potomac River Mesohaline MD	POTMH_ MD	MD	11	PCBs, PFAS
Breton and St Clements Bay, Wicomico and St Mary's River	POTMH_ MD	MD	9	No Impairments Listed
Upper Machodoc Creek, Monroe Bay, Nomini Creek, Yeocomico River, Coan River	POTMH_VA	VA	2	PCBs
Potomac River Mesohaline	POTMH_VA	VA	9	No Impairments Listed
Potomac River Tidal Fresh VA, Belmont Bay	POTTF_VA	VA	2	PCBs
Four Mile Run	POTTF_VA	VA	7	PCBs, Priority Organics
York River Mesohaline	YRKMH	VA	2	PCBs
Lower Pamunkey and Mattaponi River	YRKMH	VA	3	PCBs, Metals

For several segments in Maryland, state monitoring areas partially overlapped with a tidal segment in the 2014 indicator (see section H, question 37). This overlap was clarified for subsequent updates to MD's 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. Also, state monitoring does not cover all waters in the state each year, so new information could become available in subsequent years that could reflect a previous 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 when those concentrations exceed water quality standards. 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)?*

No extrapolation of this data is recommended.

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, the data was collected and processed according to the most current version of each jurisdictions' EPA approved QAPP. However, most agencies do not upload their QAPPs online and the Chesapeake Bay Program stopped doing so because EPA wants to ensure 508-compliance. Copies of each jurisdiction's QAPP can be provided by reaching out to Durga Gosh (dghosh@chesapeakebay.net), who oversees QA compliance at the Bay Program.

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 3 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 are 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 levels of uncertainty are available for the indicator and/or the underlying data set.

35) *For chemical data reporting: How are data below the Method Detection Limit (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?*

There are currently no noteworthy limitations or gaps in the data record.

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.*

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 to present the indicator using the CBP-designated spatial segments. This spatial discrepancy led to the decision to represent some segments as partial impairments rather than full reported impairments for a given CBP segment. Partial impairments are separated spatially in the accompanying map to indicate visually which parts of the CBP segment are impaired and which are not, however the percentage of impairment for the indicator is calculated based on the 92 tidal segments.

Data assumptions from previous updates can be found in the "Data Assumptions" tab in the downloadable data file on ChesapeakeProgress.

1Outlook: Outlook is the forecasted trajectory for whether the Chesapeake Bay Program is on course to achieving the outcome. An outcome's outlook may be on course, off course, uncertain, or completed. This information will be incorporated into the outcome's progress page. An outcome's course outlook is reviewed and updated during the outcome's Strategy Review System (SRS) Quarterly Progress Meeting in addition to when recent progress is assessed.

2Recent Progress: Recent Progress describes the change in the indicator based on the most recent data collected since the last reporting period. The recent progress icon will reflect this change as an increase, decrease, no change, or completed, depending upon this progress. This information will be discussed at the outcome's Strategy Review System (SRS) Quarterly Progress Meeting.