

Tidal James River, Elizabeth River, and Tidal Tributaries PCB TMDL Technical Advisory Subcommittee Meeting (Piedmont Region)

Meeting Summary

March 25, 2021

1:00 p.m. until 3:00 p.m. via GoToMeeting

Meeting Recording: <https://attendee.gotowebinar.com/recording/7940561239488621825>

Attendance

Aaron Small, City of Williamsburg
Ann Marie Gathright, Environmental Standards, Inc.
Ashley Hall, Stantec
Christina Wilkerson, South Central Wastewater Authority
Charles Carter, Weanack Land LLC
Chris Burbage, HRSD
Chris Greatwood, MGC Advanced Polymers Incorporated
Darryl E. Walker, City of Petersburg
Dave Sanders
Dickie Thompson, Hopewell Water Renewal
Doug Fritz, GKY & Associates, Inc.
George Hayes, Chesterfield County
James Pletl, Lawnes Point
Jamie Brunkow, James River Association
Jeff McBride, Chesterfield County
Jen Cobb, Henrico County
Jen Rogers, VA DEQ
Jennifer Palmore, VA DEQ
Jian Shen, VIMS

Jimmy Parrish, Defense Supply Center Richmond
John Westerfield, LaBella Associates
Josh Byerly, Henrico County DPU-Solid Waste Division
KC Filippino, HRPDC
Kelley West, VA DEQ
Lawrence Heyd, Altria
Mark Richards, VA DEQ
Mike James, Auto Recyclers and Scrap Metal Recyclers
Oula Shehab-Dandan, Dominion Energy Services, Inc.
Paige Haley, VA DEQ
Patrick Bradley, Richmond DPU
Richard Sedgley, Aqualaw & VAMWA
Scott Flanigan, Chesterfield County
Scott Morris, Chesterfield County
Steve Barten, Waste Management of Virginia, Inc.
Waverly Smith, DuPont Specialty Products USA, LLC
Robert Barksdale, DuPont Teijin Films

Meeting started with asking the attendees to share their name and affiliation in the chat box followed by an introduction to GoToMeeting

Introductions

- VA DEQ and VIMS project staff introduced themselves
- This meeting is focusing on the upper reaches of the river from the fall line to the Williamsburg area

Mark Richards (VA DEQ) presented the following information:

Meeting agenda

- Objective and TAC role, TMDL development process, Overview of TMDL sources, PCB fate and transport model, Point source load allocations, and TMDL endpoint
- There will be opportunities for questions and responses throughout

Meeting objective

- To provide a more in depth overview of the PCB TMDL, and to discuss existing loading and allocations of loads for point sources
- NOT deep dive into the fish tissue, sediment, or water data – please refer to the public meeting for that information
- Will be seeking input on certain topics, like deciding on the appropriate river hydrology schematic to use

Role of TAC

- Play an advisory role on the tech aspects of the project, want to keep it realistic, reasonable, and reflective of local conditions
- TAC members may influence model assumptions, TAC members may be aware of other sources of PCBs, will discuss site specific endpoint, and allocations for different sources

Technical Advisory Subcommittee

- Needed to be divided based on size of watershed (there are 2 meetings)
- Hopefully will be consistent between the 2 meetings, but if one happens to be inconsistent between the meetings, then there will need to be a meeting with all members of the TAC to discuss the decision as a whole

Questions:

- none

Overview of the TMDL development process

Continuous Planning Process- required by CWA

- WQS- DEQ has designated uses that the state must meet via WQS, recreation, aquatic life and fish consumption uses, shellfish and PWS are not as widely used. Fish consumption is the primary reason for this meeting because that is the use that has been impacted. The numeric and narrative components of WQS was also mentioned.
- The steps of the process are monitoring and assessment, integrated report- tells us what waterbodies are impaired and stays that way until standards are met. If standards aren't met, DEQ moves on to TMDLs (the step we are on now), followed up with a possible IP after approval; the other component of TMDL is a WLA which for non-PCB pollutants turns into a VPDES permit limit. Then TMDL must be approved by SWCB and EPA.

- Important note - PCB TMDLs do not turn into numeric limit, they are BMP based approaches, things that do have limits like metals or nutrients (non-numeric Water Quality Based Effluent Limit).

Water quality criterion for PCBs

- DEQ is 18 ppb (both are for fish tissue)- derived from 640 ppq, DEQ is 640 ppq for ambient water
- VDH is 100 ppb, exceedance leads to consumption advisory= impairment
- Will elaborate more on this later
- 18 ppb used to be 20 ppb, and that is based on 2022 guidance manual- draft for now

VDH fish consumption advisory

- This meeting had more focus on the upper half of the James River, but advisory does extend from 95 bridge all the way to the mouth and tributaries, and Elizabeth River

Problem identification

- PCB impairments are in the IR, table shows the area and the year they were listed

Affected water body	Listing year	Square miles
Upper James & tribs	2002, 2006, 2008, 2012	34.2
Middle James & tribs	2004, 2006	53.8
Lower James & tribs	2004, 2006	143.1
Elizabeth River & watershed	2004, 2006	17.0

Watershed map

- Map showing color coded waterbody sections. Today discussing the upper and middle tidal James impairments.
- Tidewater region subcommittee meeting on March 30 will cover the lower tidal James and the Elizabeth River.
- Ultimately, the plan is for the TMDL to have 4 different TMDL equations developed at each of the boundary conditions

PCBs

- Polychlorinated biphenyl, 209 compounds that comprise PCBs, total PCBs are a total concentration of all 209, were manufactured from late 1920s to the late 1970s, there is a current load of PCBs that have become problematic or a potential source due to the toxic substance control act

TMDL = WLA + LA + MOS

- TMDL = total maximum daily load, WLA = waste load allocation (point sources), LA = load allocation (non-point sources), MOS = margin of safety (to account for uncertainty in the models)
- Pollution budget that addresses multiple categories, looks at air, land, and water'

- Showed schematic of how TMDLs work- need to bring pollutant load down to TMDL end point to restore the designated use, must meet both numerical wq value and fish tissue threshold
- The goal is to reduce the existing PCB load to restore the fish consumption use, we need to meet two thresholds to restore, so we need to look at site specific value (WQC) and the threshold which are linked

The TMDL Process

- Identify problem, complete source assessment, link sources to targets (assess linkages, and estimate loading capacity), - this is the process that is still underway
- Then set TMDL allocations- reduce loadings from different sources to meet TMDL condition

TMDL Sampling Approach

- Primarily capture water column samples- (during high, low, and base flow conditions), and some sediment. Sampled 2009-2012, revisited 2016, revisited again in 2020.
- Objective of monitoring is to assist with source identification and provide support for model development and for BAF derived endpoints.
- Fish tissue is 2005, 2008, 2012, and 2016. Fish tissue monitoring will continue this summer (2021). Fish tissue concentrations have not diminished over time

Sources considered in the PCB TMDL Development Study

- Examples of sources are point sources through permitting program, atmospheric deposition (wet and dry), non-point sources (unknown contaminated sites), regulated stormwater from MS4s (urban areas), known contaminated sites, and PCB contaminated sediment

Point sources

- VPDES permitted facilities, 11 WWTPs, 136 industrial sources (IPs and ISWGP), 15 MS4s and VDOT, Richmond area = CSO (combined sewer overflow),
 - All will receive a WLA

MS4s

- 2013-2014 timeframe sampled MS4s around Richmond (non-MS4 is forested area), sampling captured residential, commercial, highway, industrial, etc.

Contaminated Sites

- TSCA-PCB sites (0)
- RCRA Corrective Action (16) – need to see if PCBs are associated with these, most are larger facilities, typically have a VPDES permit
- CERCLA (3) or superfund sites
- Voluntary remediation/Brownfield (3) are old facilities that may have had contamination, develop- site owner/operator has an agreement with DEQ to remediate to a certain level.
- Landfills are associated with PCBs but we do not typically see PCBs in groundwater samples from landfills when monitoring has occurred. This is because the analytical methods lack the sensitivity to detect PCBs.

- Railyards and spurs used to have PCBs on trains where maintenance could have occurred there
- PREP spills (oil spills)
- Electric utility transformer pads
- *How do we find these sites?* Collaborative effort between DEQs TMDL program and Land division to determine what sites might have PCB contamination.
 - Look at DEQ's databases and GIS based services, coordination between EPA, look through CERCLA's databases, RCRA's databases, an intensive review of data and potential sites that may have been contaminated, we do look at CERCLA remediated sites to see if the washoff stormwater meets criteria.

Atmospheric deposition and contaminated sediment

- Atmospheric deposition a contributing source- Showed data from Delaware
 - can be a component, Dr. Shen will talk about this and sediment more

Question:

1. Has DEQ required landfills to do any PCB testing as other permitted facilities have been required to do in the past?

If it is a landfill that does have a permit, then yes. If it is a solid waste management facility regulated by our land division, then we have not looked at that much relative to method 1668. Sometimes where PCBs have been considered to be a problem, we have looked at groundwater around these areas using SW 846 method 8082 which targets aroclors, but it is not as effective in identifying low levels of PCBs.

Dr. Jian Shen took over presenting from here:

PCB TMDL Fate and Transport Model

- Described an overview of the model, see presentation slide for details

PCB transport process

- In a watershed – watershed model takes care of the surface runoff and the sub-surface flow which locally increases PCBs and discharges to the stream. The whole modeling process is non-point sources, we do not deal with the deep aquifer or groundwater (assume it is low concentration)
- In estuary –
 - Can be a long time- take a month to a year to move downstream and part of them will be buried and never come out, so all of this needs to be taken into account and the particulate and dissolved organic carbon (POC and DOC) are major substances absorb PCBs in estuary
 - Complex system with PCB sources including runoff, erosion process/deposition, direct deposition from the atmosphere, and subsurface exchange between water and atmosphere. Once PCB discharged into system, then portion of particulates would be dissolved. The dissolved PCBs can remain in the water as dissolved species or absorbed

by particulates or chlorophyll-a and DOC. Dissolved particulates can be exchanged with the atmosphere (PCBs lost from the system). Once PCB are sorbed by POC and chlorophyll-a, then they will settle to the bottom sediment and can be re-suspended again with the tides.

- Water column model- can simulate organic carbon
- Stream free flowing – more dominated by flow, in an estuary – more dominated by tides or wind, high tides or waves could re-suspend sediment and increase concentration

Estuarine model

- Simulates a biochemical process, an organic carbon based model, used organic carbon because PCBs are absorbed more by OC than sediment itself, couples the water column and the bottom sediment, models exchange of PCBs between Bay water and the atmosphere
- Used in the Baltimore Harbor PCB, peer reviewed and published in Ecological Modeling, also OC model is used in DEQ's assessment of chlorophyll-a in the James River, simulations of Chl a and OC are already available and are consistent
- Showed Flow chart of Estuarine model Elements
 - Dynamic model – simulates surface elevation, salinity, temp, and suspended sediment
 - Carbon model – basic eutrophication model, simulates dissolved particulate organic carbon and chlorophyll-a, add carbon into the PCB model, simulates sorption, settling, resuspension, and burying
 - PCB Model- can simulate PCB transport dynamic in water and bottom sediment coupled with carbon model

PCB Model sorption process

- Key process is the sorption/desorption
- Assumes equilibrium between water and dissolved and particulate carbon
- Carbon is divided into 4 pieces – dissolved PCB, particulate carbon bound PCB, algae bound PCB, and DOC bound PCB
- Each one has different partition coefficients based on equilibrium of the PCB homolog
- Model individual homologs to ensure a more accurate partition coefficient simulated PCB process

Selecting homologs

- Can see distribution of different homologs, selected the homologs to do the simulations
- If you select 3 major homologs, you get a good correlation coefficient. VIMS selected 4 major homologs and got a total PCB correlation of 0.9.

Loading estimation

- Upstream loading, atmospheric deposition, lateral loading, contaminated sites, point source/MS4s, and CSOs
- Atmospheric deposition – CBP did a survey of the atmospheric dep in 1999, 1 measurement in the James River basin showed wet and dry deposition of PCBs were 1.1 and 1.0 kg/yr respectively, the atmospheric deposition rate was about 3.08 micrograms/m²/year, estimated

loading is 569 g/yr. (assuming 1% of runoff) below fall line, direct deposition on the surface is 1,056 g/year (still high), net transport between atmosphere and estuary is out (PCB loss to atmosphere)

- Upstream loading estimation –1,027 g/yr. is low estimation and 2,327 g/yr. is high estimation, model used high estimation based on regression because there was a high correlation coefficient

Watershed model approach

- Used to simulate non-point sources loadings based on land use below fall-line (downstream of Richmond)
- Added point sources and contamination sites, and then calibrated based on measurements from the edge of stream
- Land use – used latest data from USGS, can partition for county or different areas, VA Beach and Norfolk very urbanized
- Contaminated and Remediated sites – not all have measurements, 11 sites have recorded PCB concentration measurements, 48 total sites, so the model used an average as a start, use downstream measurements to adjust the model for calibration, watershed model is a very fine resolution model because we can fine tune with direct measurements
- CSOs (Richmond) – CSO on the Richmond side with measurements gives us a guideline to estimate the flow and concentration
- Point sources – all discharge to this project area. Estimate loading based on concentration and flow or size of industrial property, Point sources in Tidewater area are much higher than Richmond area
- MS4– estimate based on land use for each county and then can estimate loads for MS4s based on the load from the counties
- Provided load estimation in areas without point sources

Preliminary model results

- Concentrations do not change much over time, so even data that is older is still good
- Have observations in the estuary – because the tide goes to Richmond, the loads can be transported upstream and downstream (high exchange), must model the entire estuary as one piece, all data points used for model calibration
- Example shows 2006-2013, observations were acquired during this time period, also James River chlorophyll-a project simulates the organic carbon and chlorophyll and the model requires nutrient input and runoff data provided by CBP, their data covers 2005-2013 so we can only simulate this period (for eutrophication model)
- Need to use a long period to compare PCB data against the model, if you model a long period (8 years), if you can catch the range of the data then you can have confidence (missing one or two data points is ok, missing many is bad)
- Model does seem to catch the data points ok
- 640 nanograms of tPCB is the guideline, if the values are above the guideline then you need to pay attention, if it is below, then it is not as big of a concern. If there are discrepancies, then we need to go back to the model to calibrate the loading again

- Data before 2006 in the sediment is used as the initial condition for the model

PCB Budget

- Diagram on slide shows an example from the Baltimore Harbor, but eventually James will have a similar diagram which shows the loads from all the different sources and the losses

TMDL Study

- Will not change quickly like bacteria TMDL, once you remove the point source, the sediment is still waiting to recover
- If you don't remove the source or reduce it, then you will not recover and will gradually increase
- The Baltimore Harbor did gradually decrease over time with the TMDL in place
- TMDL implementation improves water quality much faster

Flow distribution

- High discharge does not increase velocity in an estuary, velocity in an estuary increases due to the tide and wind, resuspension is mainly driven by the tide, and wind
- High flow does increase gravitational circulation, so the water in the surface layer will move PCBs out and the bottom water will move in, so if you have a low flow, gravitational circulation is not strong and less stuff moves out, versus high flow where more stuff moves out
- Two options for a TMDL – can use the free flow approach with the harmonic mean (using just one year to simulate flow), or you can use more realistic dynamics of estuary approach which is a combination of low flow, high flow, and mean flow (3 year window)
- In Baltimore harbor, used 3 year flow period.
- Dr. Shen prefers 3-year option because it is closer to reality- doesn't change much in TMDL, but changes recovery time.

Procedure for how to allocate

- Will allocate loads for each jurisdiction (city, county, or federal land)
- Regulated area for each jurisdiction is based on GIS layer for each land
- Two options for estimating loading – the first is to compute the % of regulated area to total jurisdiction area and use the % to partition loads for each sub-watershed then sum the load for all sub-watersheds, the second is to estimate loading based on land use and then partition based on % of land use for each jurisdiction, a method which is harder.

Climate change

- Most uncertain part is dynamics transport
- Sea level rise is going to increase salinity intrusion and will change estuarine circulation (top layer will move out and bottom layer will bring water in from the Bay). Will help to reduce PCB concentrations in James as PCB concentration in the lower Bay is low
- changes in discharge will change the residence time (an increase in residence time will increase concentrations), temperature will change the carbon distribution, PCB TMDL is basically a carbon TMDL, so if you change temperature it will increase growth rate, respiration rate, and grazing will change the model

- Have already looked to update the TMDL based on climate change – temperature will affect growth and respiration rates, loading from nutrients in the watersheds, CBP already looked at this
- How does this impact things? Red and blue lines take into account transport change and temperature change, and the changes are very minor, based on the current scenario, there will not be a dramatic effect on the carbon
 - Change in transport
 - Change in temperature- increase temp=increase algae
- Bringing in more water from the Bay will help with PCB cleanup because the Bay is low in PCBs, so climate change will not impact our TMDL significantly

Questions:

2. The USGS data is not as good as Virginia data and the resolution is not as good.

The loading is more important than the land use. The current and previous land use are being taken into consideration and would be amended if there were discrepancies. If you know of any discrepancies, let us know and we will take it into consideration.

3. Can we get a copy of Shen et al.?

Yes, he can share with those interested.

4. In the limiting case of zero PCB discharge from all point sources in the watershed, would the WQS be achieved?

A test was done to remove all the point sources, and it is achieved in some cases and in others it wasn't. When the sediment is cleaned, then it makes a difference. Cleaning the sediment is the most important part.

5. What is the recommendation for the flow for the fate and transport model?

He recommends we use the high flow, low flow, and mean flow, it is more tidal and circulation driven, for the recovery period at a more realistic flow then it is 15 years, does not affect the TMDL much, but instead affects the recovery time

6. What timeframe does this need to be decided upon?

Have not started to do it yet, so it's okay, we will need to have that information when we get started. Not that urgent! Only important in load allocations

Mark Richards took over presenting again from here:

VPDES load calculations

- Developed outside the model, applicable to WWTP, ISWGP, and IPs, all calculated on a spreadsheet through the standard method
- This is very transparent and easily reviewed how it is derived
- Once TMDL developed, DEQ will have a full idea as to how the WLAs were developed and can be updated if necessary.
- Prefer to use the permit data, but in lieu of the data we use standard concentrations derived from the statewide PCB data using SIC codes
- One of the first steps after TMDL is developed is for facilities to generate real data from which the existing load is recalculated and then compared to the WLA.
- Monitoring requirements are included in TMDL GM 14-2004 for permittees measuring concentrations
- WLA concentration is calculated by substituting the TMDL endpoint
- Municipal – Use design flow for WLA and 8 years monthly average flow for existing load
- ISWGP – flow calculated from industrial activity and impervious activity acreage
- IPs – process water and comingled = mean DMR monthly average flow for existing load, mean of DMR daily max flow for WLA, stormwater = acreage to outfall drainage area
- Larger facilities with many outfalls, load is summed for that facility and is written like that into the TMDL

Question:

7. Do you envision we will one day base loading values based on the toxicology of the individual congeners in lieu of looking at only total PCBs?

No, it will not change based individual congeners, the EPA has studied the congeners in the beginning of PCB research, but a lot is unknown about individual congeners, best to just use tPCB to manage the unknowns

Discuss TMDL endpoints

- Why is there a disparity between VDH and DEQ? Screening value is directly related to the 640, the WQC follows the method the EPA has decided to use, uses an actual numeric water quality criterion, it is set to keep the water safe throughout the state (difference between DEQ and VDH = keep water from getting contaminated vs. keep fish safe to eat after water has been contaminated)
- TMDL must be consistent with the WQS, because fish tissue threshold is consistent with the WQC it requires us to adhere to the DEQ numbers, not VDH's
- In support of the values – narrative WQS says specific substances must be controlled, including those toxic substances that bioaccumulate

How was the WQC calculated?

- Follows EPA guidelines
- WQC and fish screening value differs in the BCF (bioconcentration factor), ultimately it develops a fish screening value that is safe for humans to consume fish and then is translated to a water based number and becomes the WQC.

- Weakness of this approach is that BCF only accounts for a fraction of the PCBs that these fish are exposed to. What about other exposure pathways? Looking at a different approach to be more protective. This EPA based approach is called bioaccumulation factor process.

Biannual WQA guidance

- Guidance memo used for several years, in 2012 the values were similar and then VDH changed their values because they wanted to account for assumptions that went into their risk assessment.
- Most recent Assessment guidance document is undergoing final internal review (it was public noticed) – value will be 18. This is not a TMDL or watersheds program decision, this has been entrenched in DEQ for a long time.
- Triennial review is in the early stages (may move from 640 to 580), change because exposure factors have changed

Why is a BAF more reasonable approach?

- As you move up in chlorine content in PCBs, the homologs are more hydrophobic and less dissolved. The assumption for the Bioconcentration is that PCBs are dissolved (for the large part they are not).
- Biomagnification of PCBs increases concentration dramatically, the trophic levels that we consume now are the ones higher in PCBs, this is not taken into account in BCF
- Bioaccumulation deals with exposure from water, food, and sediment. Bioconcentration is exposure from water only.
- Graphs shows the fish tissue values (x-axis) versus average water concentrations (y-axis), graph is divided into A, B, C, and D quadrants by fish tissue WQC and water concentration WQC, shows that fish are getting PCBs from more than just the water column because
- ***Newest data is in the slides from the meeting, not in the handouts provided 3/25/2021***
- EPA method supports the use of BAF

BAF in a nutshell

- Home range versus watershed, determines a ratio of PCBs in the water column versus in the fish themselves, normalized based on freely dissolved PCBs and fish tissue lipid content, also normalized for each fish species
- Fish tissue threshold value is divided by the 18 and then we get a site specific value for the species

BAF endpoint selection

- BAFs are calculated for each fish species in the four TMDL watershed sections (not shared today because they need to be updated based on the information that went into the derivations)
- If we do decide on site specific endpoints, then we can consider recreational and commercial interest on those species, fish advisories, or use a central tendency statistic

- Knowing the upper James TMDL will reduce the load that comes over the fall line, we will need to take that into account to decide which endpoint is derived/used for the upper tidal portion of the watershed; VIMS can model different scenarios
- Will revise the endpoints based on comments we received, like the use of older fish tissue data sets. At what point should we cut that data off? How do we account for changes in analytical methods? We have always used VIMS, so that is consistent but it can be investigated

Anticipated timeline

- First meeting today, second TAC is this summer (will be an opportunity to share what allocation scenarios), third TAC will be when a draft is ready
- Certain groups (i.e. MS4s) may reach out to have a specific interest meetings as well (like with City of Richmond about CSOs)

Next steps

- Still working on responses to public comments
- TAC contact list – A list of all members will be shared with all participants. Let Jen Rogers know if you are not comfortable being included on the list.
- Watershed modeling will go on throughout 2021
- Please fill out meeting comment form!

The Tidewater Technical Advisory Subcommittee meeting will be held Tuesday, March 30 from 1-3pm. It will focus more on the lower tidal James and the Elizabeth River, but most of the content will be consistent.