

Delaware River Basin Commission

1,4-Dioxane in the Delaware River

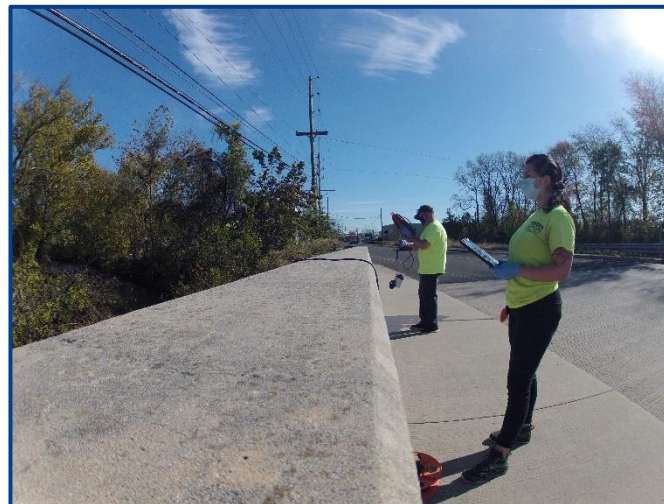
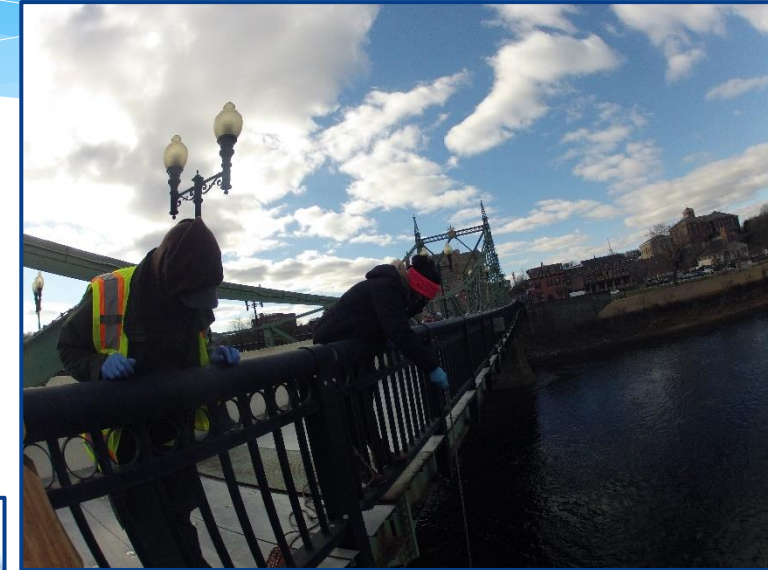
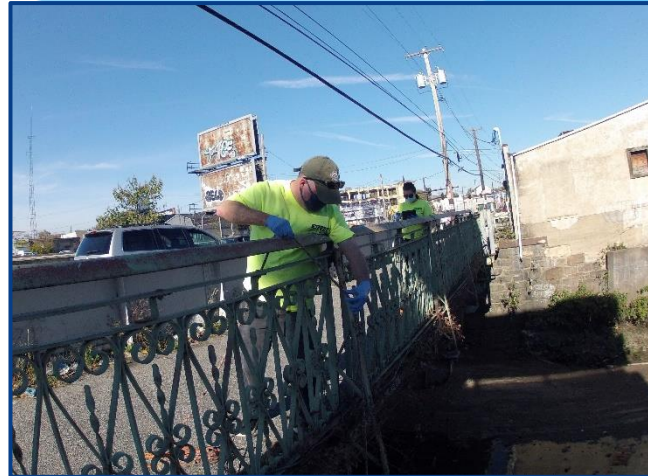
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Toxics Advisory Committee

Presented to an advisory committee of the DRBC January 28, 2021. Contents should not be published or re-posted in whole or in part without permission of DRBC.



60 years
1961–2021



Delaware River Basin Commission

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1,4-Dioxane Timeline & Coordination

- NJ American Water found 1,4-dioxane in their Delaware River intake (~ RM 110) during EPA Unregulated Contaminant Monitoring Rule (UCMR) monitoring
- They reached out to DRBC in February 2020
- Added to Boat Run monitoring in March. Results showed detectable concentrations. Boat Run paused due to Covid-19, partially resumed in August.
- DRBC Coordinated results with NJ American, and NJDEP. Alerted PWD.
- Cooperative monitoring with NJ American Water support in November and December 2020 (4 events, a total of 29 samples) focused on non-tidal

What is 1,4-Dioxane?

- EPA likely human carcinogen, all routes of exposure
- Non-bioaccumulative & miscible
- A solvent stabilizer common among industries & federal facilities using chlorinated solvents, paint strippers, greases and waxes, also contaminated sites, landfills, and commercial soaps and detergents
- Treatment technologies include advanced oxidation and bioremediation
- May leach readily from soil to groundwater & migrates rapidly in groundwater

Federal and State standards / screening levels

All units ug/L

	Screening level for drinking water	Ground Water Quality Criterion	Surface WQ Standard	Guidance/ Advisory/ Screening Level	MCL	Drinking Water HAL
DE			None	0.46		
NJ		0.4			0.33*	
NY					1.0	
PA					6.4	
Federal	0.35 to 35				0.46	

USEPA 0.35 to 35 µg/L corresponds to a cancer risk of 1 in 1,000,000 and 1 in 10,000. In establishing stream quality objectives for carcinogens in the Delaware River, the level of risk is established at 1 in 1,000,000 humans exposed.

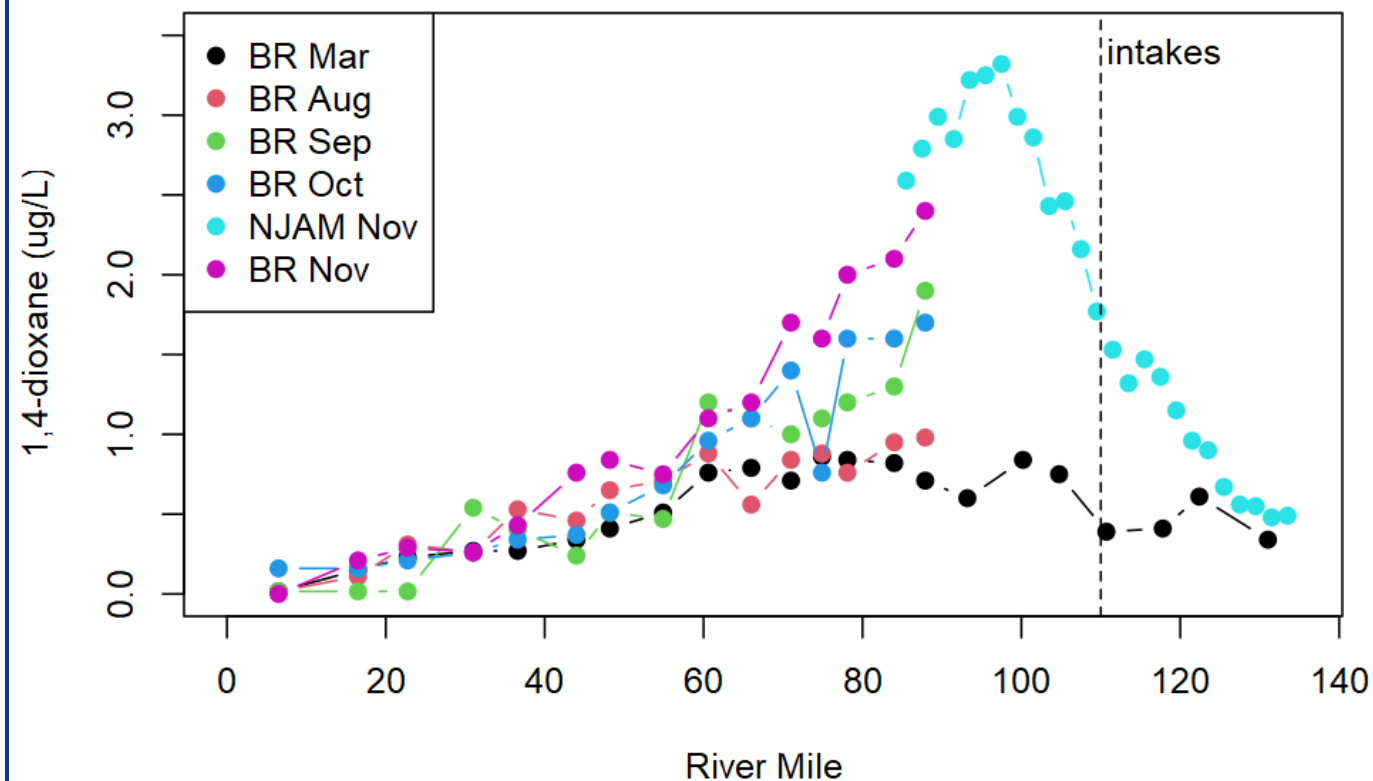
*The New Jersey Drinking Water Quality Institute, Health Effects Subcommittee has proposed 0.33 ug/L as a recommended health-based MCL

Current Understanding

- There appear to be 2 separate areas of elevated concentration
 - Delaware Estuary in the vicinity of RM 80 to 100
 - Lehigh River and downstream drainage
1. GIS Mapping
 - <https://drbc.maps.arcgis.com/apps/View/index.html?appid=b56b9cfc384046178ab9cbb731a276ea>
 2. Estuary Results
 3. Non-tidal and Lehigh Results
 4. Other Evaluations (UCMR, National Water Quality Data Portal)
 5. Next Steps and Discussion

Estuary 1,4-Dioxane profiles DRBC and NJ American

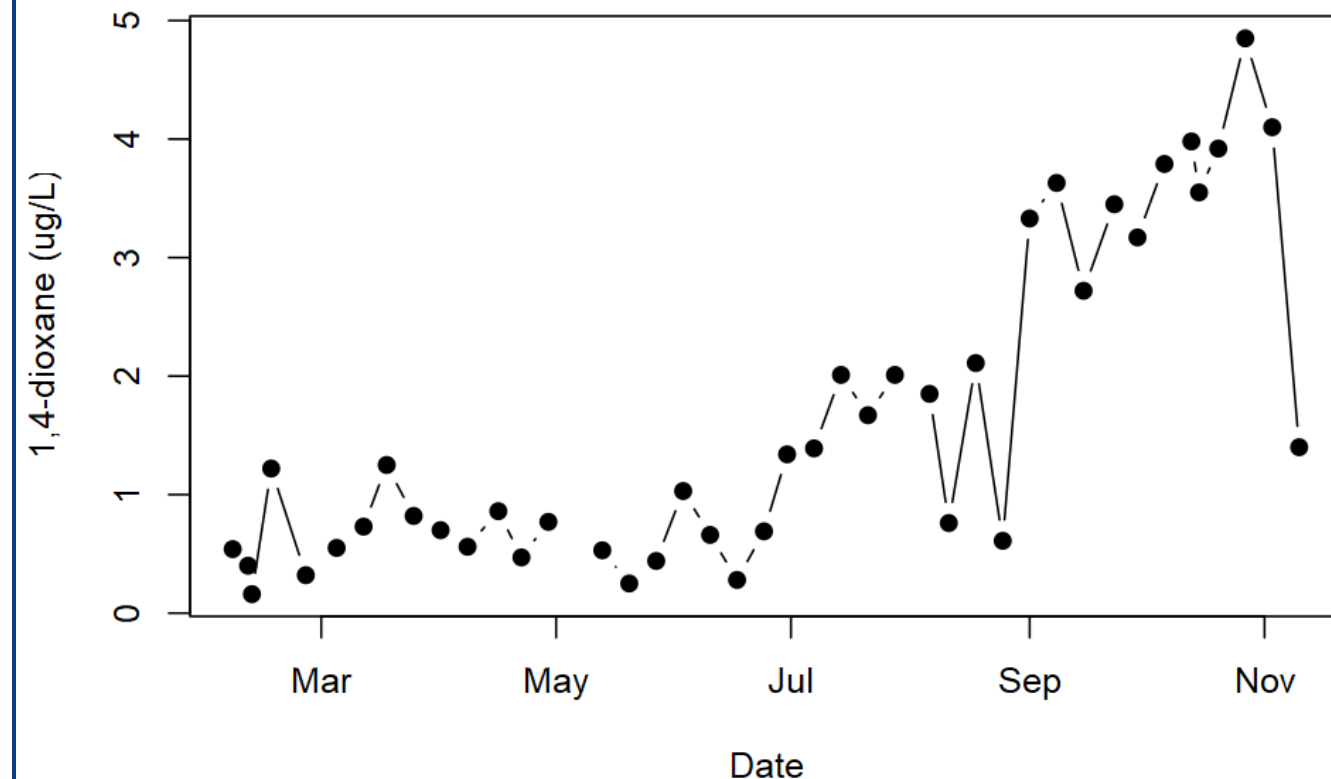
Delaware Estuary 1,4-dioxane
monitoring results 2020



- DRBC Boat Run and NJ American Water profile data
- Partial Boat Runs (Paulsboro and downstream) August, September, and October
- Possible evidence of load(s) in vicinity of RM 80 to 100

Delaware Estuary at RM 110

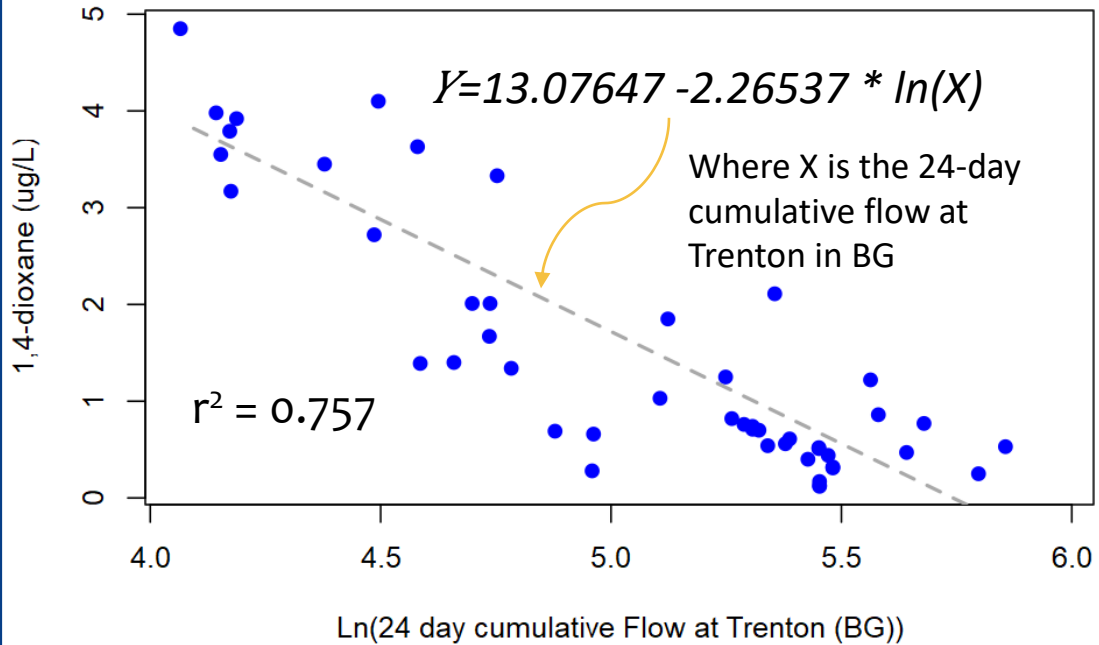
2020 Delaware River 1,4-dioxane
near River Mile 110



- Delaware River at RM 110 time series
- NJ American Water data

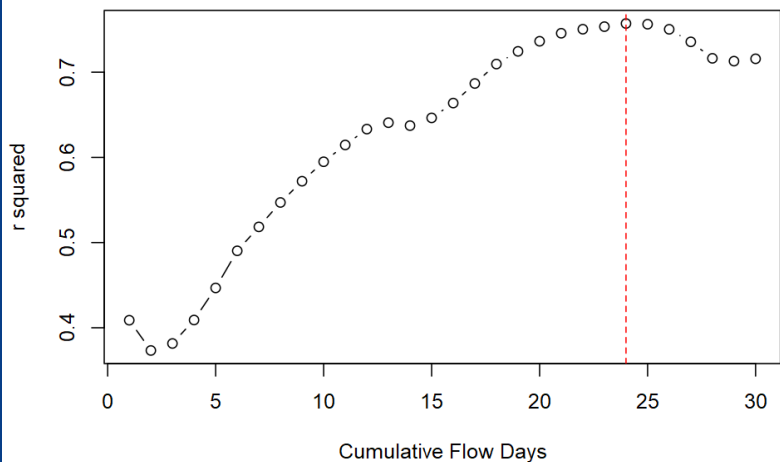
Modeled concentration at RM 110

1,4-dioxane at RM 110 as a function of Discharge at Trenton



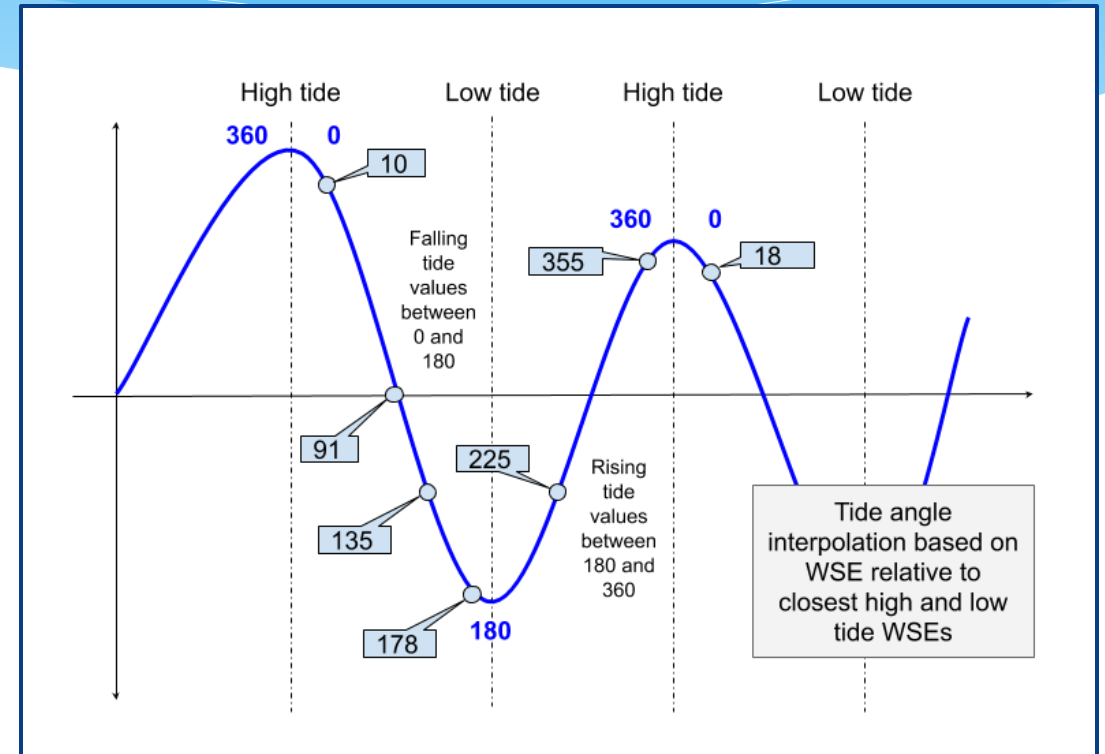
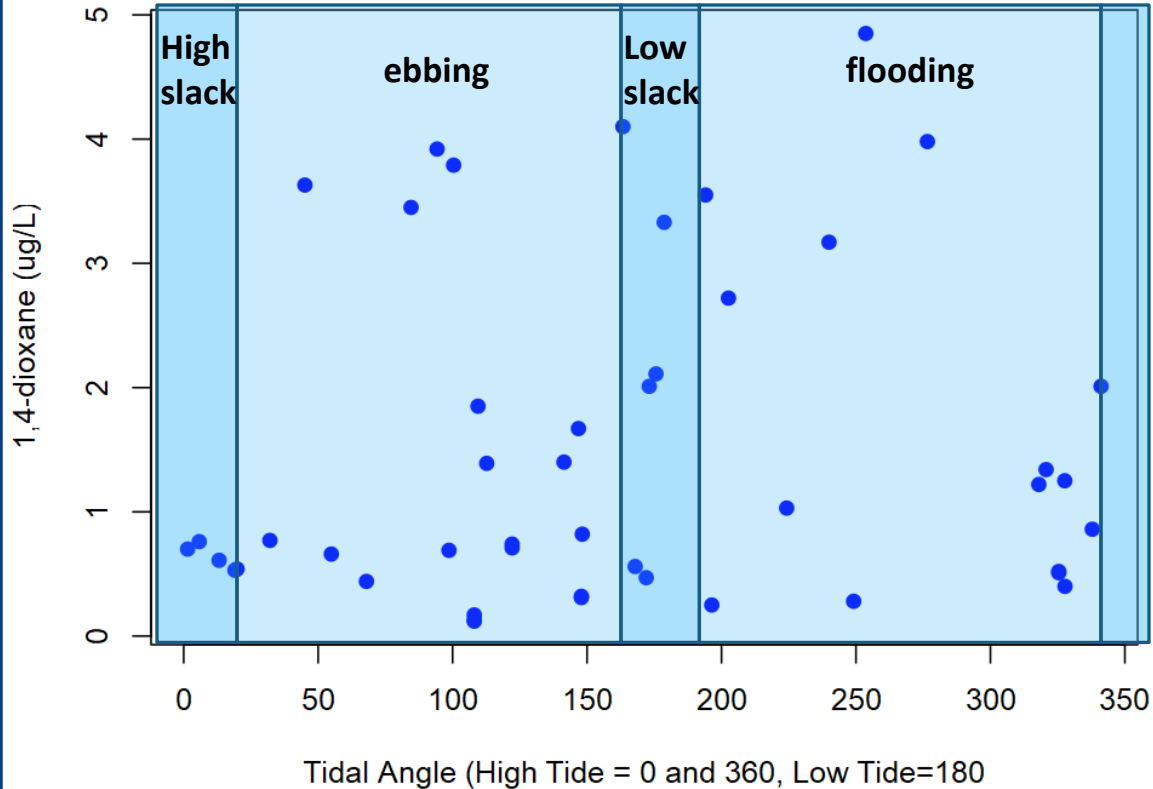
- 24-day cumulative flow at Trenton yields the best predictor (highest r^2) of concentration at RM 110
- Relatively good model of concentration as a function of flow at Trenton suggests relatively constant loads
- Tidal angle did not improve the model

Loop through cumulative flow days to find best predictor of 1,4-dioxane



Tidal Angle and 1,4-Dioxane at RM 110

Influence of Tide on 1,4-dioxane concentration at Delaware Estuary, River Mile 110



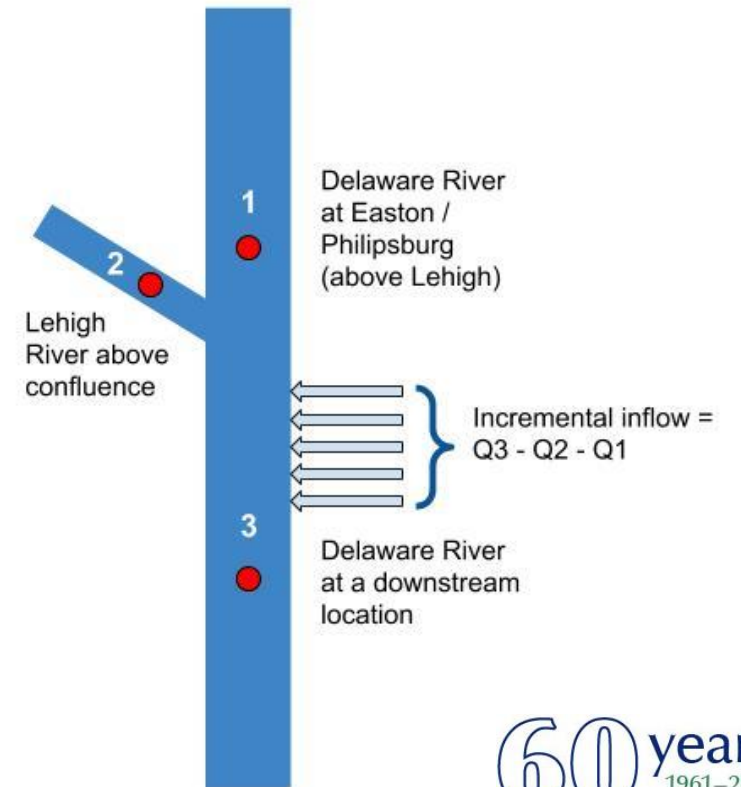
Non-tidal Delaware and Lehigh data summary

- All Delaware River observations (5) upstream of the Lehigh are non-detect
- All Delaware River observations (13) downstream of the Lehigh are quantified
- Observations in the Lehigh just upstream of its confluence with the Delaware (3) are elevated (48.36, 13.66, and 8.25 ug/L)
- All Lehigh observations at Allentown (2) are non-detect
- Low or ND concentrations in Lehigh tributaries

Mass Balance Computations

How much of the observed concentration in the non-tidal Delaware is explainable by the concentration and flow in the Lehigh?

- Concentration at 1 was ND for all 3 dates considered
- Had sampling for locations 1, 2, and 3 on Oct. 23, Nov. 12, and Dec. 10, 2020
- Used 24-hour mean flow for those dates from USGS gages
- For ungaged locations, estimated flow using drainage area ratios
- Assumed $ND = \frac{1}{2} DL$ $DL = 0.07 \text{ ug/L}$
- Assumed incremental inflow had a concentration $\frac{1}{2} DL$



Results of Mass Balance Computation

Date	Delaware Above Lehigh 14D ug/L	Lehigh near confluence 14D ug/L	Downstream Location	Observed 14D ug/L	Computed 14D ug/L
Oct 23, 2020	ND	48.36	Upper Black Eddy (RM 168.4)	9.13	10.63
			Bulls Island* (RM 156.5)	4.9	10.19
Nov 12, 2020	ND	13.66	Bulls Island (RM 156.5)	4.53	4.68
Dec 10, 2020	ND	8.25	Milford (168.4)	2.12	2.06

* Bulls Island samples were collected in the D&R canal. Composed of 100% Delaware River water from immediately upstream

Other Evaluations

- Older data in the National Water Quality Data Portal suggests elevated concentrations in some southeast PA tributaries
- Evaluation of co-pollutants (Trichloroethylene and 1,1,1-Trichloroethane) may be useful in finding 1,4-dioxane hot spots
- Review of point discharge VOC data collected in 2001-2002

1,4-Dioxane External Working Group

- NJDEP Convened a 1,4-dioxane External Working Group - met December 10, 2020
- NJDEP, NJAWC, DRBC, and PADEP
- NJDEP response to 1,4-dioxane <https://www.nj.gov/dep/14-dioxane/>
- Parties agreed to share sampling data and results
 - Track down monitoring strategy workgroup - met January 15, 2021
 - Maps/GIS coverages workgroup
 - Communication workgroup
- Larger group will meet ~ monthly

DRBC Next Steps

- Development of a QAPP for additional monitoring / trackdown under 106 grant
 - Draft QAPP to EPA by January 30th
 - Monitoring to begin early spring 2021
 - Approx. 75 samples in several waves
- Continued 1,4-dioxane monitoring in the Delaware Estuary via the boat run
 - Beginning March 2021
 - Full estuary profile
- Continued staff support to working groups for
 - Trackdown and Monitoring Strategy
 - GIS and Mapping
 - Communication Strategy

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