Groundwater Dilution Attenuation Factor (DAF) Derivation Summary

The following analyses were performed to re-examine the current DAF of 2.0 for the LAU assumed in the Biosolids Screening Tool (BST) and to establish DAFs for the newly added SI module:

Conduct location specific simulations with EPACMTP for five representative organics and the meteorological stations in the BST for an unlined LAU, and an unlined, clay-lined and composite-lined SI. Also conduct national simulations using HWIR default values for the same chemicals. Five organic chemicals corresponding to percentiles of Koc ~0, 25th 50th 75th and 95th were selected from the chemical database of IWEM for the simulations. The degradation rate was set to 0 for all chemicals.

CAS	CoC	logKOC
64-18-6	Formic acid	-2.700057
106-88-7	Epoxybutane 1,2-	0.903
75-15-0	Carbon disulfide	1.84
126-72-7	Tris(2,3-dibromopropyl)phosphate	3.19
309-00-2	Aldrin	6.18

Location-Specific Simulations

To generate constituent and location-specific input files, IWEM was run with random soil types and infiltration rates for each of the following three locations used in the BST: Charleston, SC, representing a wet climate; Chicago, IL, a moderate climate; and Boulder, CO, a dry climate.

Subsurface properties were modeled probabilistically based on the respective hydrogeologic environment corresponding to the meteorological station location (Charleston – Coastal beaches; Chicago – Limestone, Boulder - Bedded Sedimentary Rocks). See figure at bottom with yellow arrows point to the locations on the map of Hydrogeologic Regions.

Default values from the BST for LAU and SI area, SI depth, operating lives were used in the EPACMTP simulations

National Simulations

To generate nationally representative input files, an HWIR default file for an LAU based on the national distribution of LAUs using the regional site-based methodology described in EPACMTP documents was used for the simulation. An updated version for each chemical was developed. A similar set of files were developed for each of the three liner scenarios for a surface impoundment based on their respective HWIR default files.

The modeled well for all simulations was set at 5 m from the downgradient edge of LAU/SI (in the middle of the buffer) and constrained to be located in the top 10 m of the saturated zone or saturated thickness, whichever is less.

10,000 simulations were run using EPACMTP and subsequently post-processed by XTRCTSAT.exe. From the output file, the 5th and 10th percentile peak DAF for each of the 5 COCs and locations were extracted and tabulated.

Location- specific results are color-coded for easier comparison:

Location Color Codes
HWIR [National]
Charleston, SC [Wet]
Chicago, IL [Moderate]
Boulder, CO [Dry]

The results for the LAU below suggest that within each percentile group or climate designation, the DAFs are either consistent or only slightly increase with increasing logKOCs, except for the Boulder location (other than the 5th percentile for Epoxybutane 1,2-) and Aldrin for all locations. Those outliers are marked in red font.

CAS	**COC**	**LogKoc**	**Percentile**	**LAU DAFS**			
64-18-6	Formic acid	-2.70E+00	5	1.0	1.0	1.0	16
106-88-7	Epoxybutane 1,2-	9.03E-01	5	1.0	1.0	1.0	1.00
75-15-0	Carbon disulfide	1.84E+00	5	1.0	1.0	1.0	32
126-72-7	Tris(2,3-dibromopropyl)phosphate	3.19E+00	5	1.0	1.1	1.3	82
309-00-2	Aldrin	6.18E+00	5	82	8.5E+02	6.1E+03	1.0E+30
64-18-6	Formic acid	-2.70E+00	10	1.0	1.0	1.0	32
106-88-7	Epoxybutane 1,2-	9.03E-01	10	1.0	1.0	1.0	54
75-15-0	Carbon disulfide	1.84E+00	10	1.0	1.0	1.0	68
126-72-7	Tris(2,3-dibromopropyl)phosphate	3.19E+00	10	1.0	1.4	1.6	1.9e+2
309-00-2	Aldrin	6.18E+00	10	1.2e+2	7.4E+04	1.8E+06	1.0E+30

The results point to an appropriate conservative DAF of 1.0 to represent the groundwater pathway in the BST for LAUs.

The results for the SI below suggest that within each percentile group or climate designation, the DAFs are either consistent or only slightly increase with increasing logKOCs.

Location- specific results are color-coded for easier comparison:

Location Color Codes
HWIR [National]
Charleston, SC [Wet]
Chicago, IL [Moderate]
Boulder, CO [Dry]

CAS	COC	LogKoc	Percentile	Unlined DAFS			
64-18-6	Formic acid	-3E+00	10	1	1	1	1
106-88-7	Epoxybutane 1,2-	9E-01	10	1	1	1	1
75-15-0	Carbon disulfide	2E+00	10	1	1	1	1
126-72-7	Tris(2,3-dibromopropyl)phosphate	3E+00	10	1	1	1	1
309-00-2	Aldrin	6E+00	10	24	59	76	78

CAS	COC	LogKoc	Percentile	Unlined DAFS			
64-18-6	Formic acid	-3E+00	10	1	2	2	6
106-88-7	Epoxybutane 1,2-	9E-01	10	1	2	2	6
75-15-0	Carbon disulfide	2E+00	10	1	2	2	6
126-72-7	Tris(2,3-dibromopropyl)phosphate	3E+00	10	2	3	5	8
309-00-2	Aldrin	6E+00	10	8E+04	6E+07	1E+08	3E+08

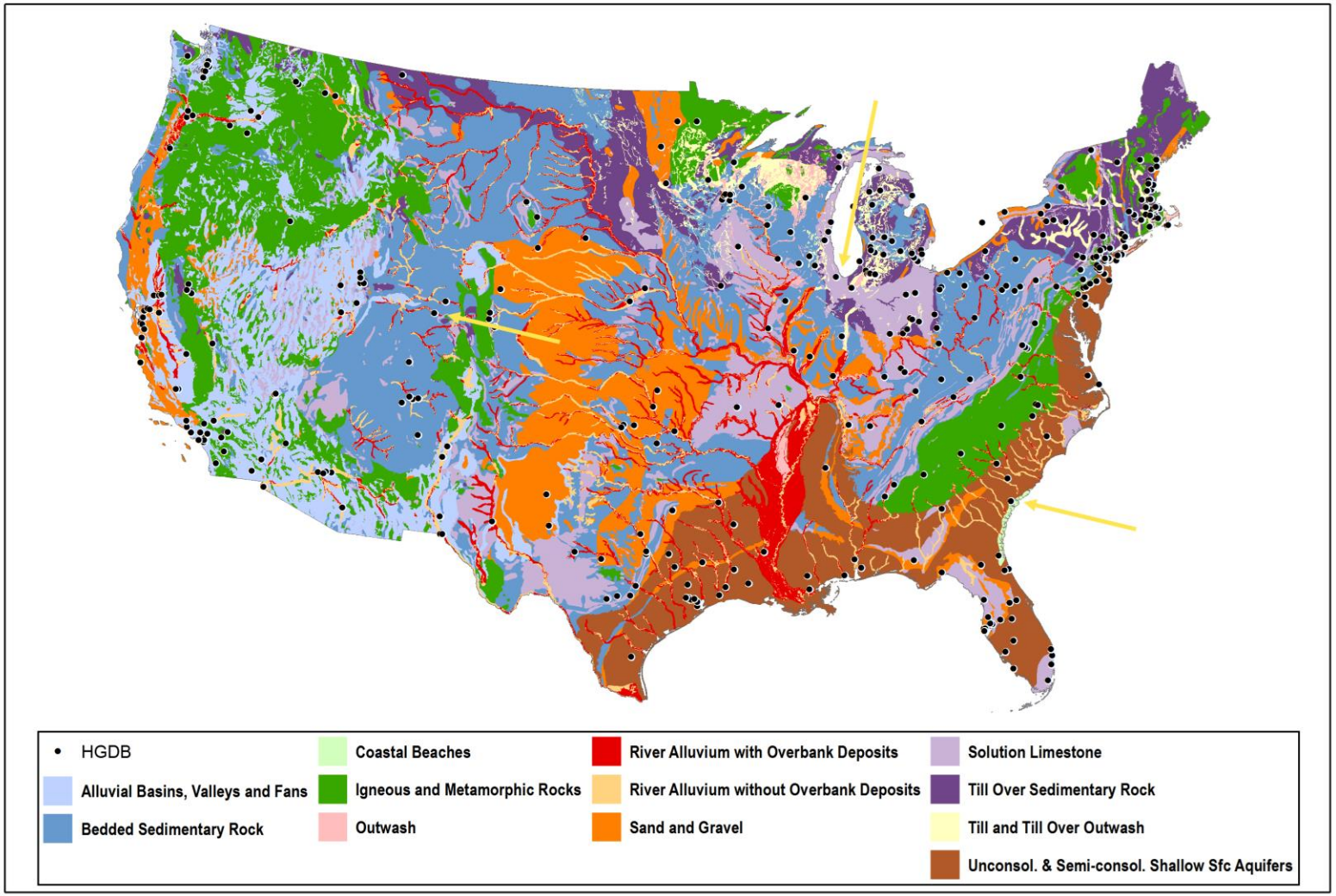
CAS	COC	LogKoc	Percentile	Unlined DAFS			
64-18-6	Formic acid	-3E+00	10	3E+06	1E+07	7E+07	1E+08
106-88-7	Epoxybutane 1,2-	9E-01	10	5E+05	9E+06	1E+07	1E+07
75-15-0	Carbon disulfide	2E+00	10	6E+05	1E+07	2E+07	2E+07
126-72-7	Tris(2,3-dibromopropyl)phosphate	3E+00	10	8E+10	7E+12	2E+14	2E+14
309-00-2	Aldrin	6E+00	10	1E+30	1E+30	1E+30	1E+30

The results point to the following appropriate conservative DAFS:

Unlined SI - 1.0

Clay-lined SI – 2.0

Composite-lined SI- 1E+07



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