

Supplementary Material Table 1: Study material details

Study material	Physical form	Source	% wt DCM extract	Boiling range (°C)	Density (g/cm ³)	Kinematic viscosity (m ² /s)	Average molecular weight (g/mole)*
Petroleum gas oil	LNAPL	Product from an operational carbon plant	100	149-426	0.930±0.013	3.879	225
Heavy cycle oil	DNAPL	Product from an operational carbon plant	100	181-633	1.080±0.011	51.42	282
Spent oxide	Friable solid	Subsurface at a former gas works site	4	181-495	1.88±0.06	not determined	254
English solid coal tar	Semi-pliable solid	Subsurface at a former gas works site	45	203-610	1.56±0.50	not determined	261
Irish solid coal tar	Semi-friable solid	Subsurface at a former gas works site	42	205-618	1.04±0.09	not determined	263
Light cycle oil	LNAPL	Product from an operational refinery	100	121-402	0.894±0.013	1.666	128
Shale oil	Pliable solid	Subsurface at a former refinery	60	196-634	1.35±0.58	not determined	275
Creosote	LNAPL	Purchased from a hardware store	100	133-473	0.930±0.005	3.155	158
Liquid coal tar	DNAPL	Product obtained 20 years ago from an operational gas works	100	110-614	1.154±0.013	not determined	196
Coal carbonisation gas oil	LNAPL	Monitoring well at former gas works site	100	78-422	0.854±0.009	4.729	247
Sewage sludge	Aqueous liquid with solids	Sludge lagoon	0.3	248-640	0.998±0.073	not determined	366

* Average molecular weight determinations of NAPLs and dichloromethane extracts, based on GPC and SIMDIS data (33)

Supplementary Material Table 2: Mass transfer coefficients (h^{-1}) measured using the dialysis tubing, centrifugation and direct contact experimental methods

Study material	Petroleum gas oil		Coal carbonisation gas oil		Light cycle oil		Creosote		Spent oxide	
	Dialysis	Direct contact	Dialysis	Direct contact	Dialysis	Direct contact	Dialysis	Direct contact	Dialysis	Centrifugation
PAH										
Acenaphthylene	co	co	0.189 ± 0.012	0.216 ± 0.050	co	co	co	co	co	co
Acenaphthene	0.007 ± 0.013	0.899 ± 0.948	0.009 ± 0.011	0.205 ± 0.088	0.056 ± 0.028	0.181 ± 0.076	0.059 ± 0.008	0.264 ± 0.159	co	co
Fluorene	0.039 ± 0.018	0.302 ± 0.079	0.043 ± 0.014	0.264 ± 0.045	0.045 ± 0.013	0.191 ± 0.040	0.050 ± 0.012	0.182 ± 0.114	1.21 ± 1.43	0.246 ± 0.204
Phenanthrene	0.058 ± 0.028	0.288 ± 0.093	0.073 ± 0.033	0.295 ± 0.066	0.072 ± 0.034	0.207 ± 0.040	0.058 ± 0.042	0.285 ± 0.018	0.077 ± 0.013	0.313 ± 0.113
Anthracene	0.056 ± 0.031	0.829 ± 1.424	0.029 ± 0.013	0.241 ± 0.052	0.065 ± 0.041	0.175 ± 0.040	0.092 ± 0.054	0.184 ± 0.010	0.054 ± 0.016	0.403 ± 0.152
Fluoranthene	0.488 ± 0.287	0.779 ± 0.819	0.050 ± 0.043	0.258 ± 0.043	na	1.041 ± 1.33	na	0.006 ± 0.003	0.039 ± 0.013	0.313 ± 0.127
Pyrene	0.063 ± 0.023	0.879 ± 0.191	0.040 ± 0.037	0.256 ± 0.047	na	0.271 ± 0.05	na	0.001 ± 0.001		

co identification difficult due to the presence of closely eluting components

na not available

Supplementary Material Table 3: Logarithms of measured and predicted material-water partition coefficients

PAH	Heavy cycle oil	Creosote	Shale oil	Petroleum gas oil	Liquid coal tar	Light cycle oil	English solid coal tar	Irish solid coal tar	Coal carbon. gas oil
Acenaphthylene measured predicted	co co	co co	co co	co co	nq nq	co co	4.02 3.90	nq	4.31 3.92
Acenaphthene measured predicted	4.96 4.59	5.15 4.84	4.50 4.60	4.61 4.69	nq nq	5.11 4.93	4.23 4.63	nq	4.54 4.65
Fluorene measured predicted	5.16 4.69	5.24 4.94	4.69 4.70	4.96 4.79	5.06 4.85	5.21 5.03	4.62 4.72	4.64 4.72	4.99 4.74
Phenanthrene measured predicted	5.56 5.17	5.58 5.42	5.14 5.18	5.30 5.27	5.66 5.33	5.60 5.52	5.13 5.20	5.22 5.20	5.43 5.23
Anthracene measured predicted	5.73 5.18	5.79 5.43	5.20 5.19	4.18 5.28	5.80 5.33	5.49 5.52	5.35 5.21	5.31 5.21	5.38 5.23
Fluoranthene measured predicted	6.28 5.60	5.93 5.84	5.89 5.61	5.20 5.59	6.35 5.76	5.26 6.04	5.87 5.62	6.00 5.62	6.04 5.65
Pyrene measured predicted	6.36 5.79	6.21 6.06	6.01 5.81	6.19 5.89	6.36 5.95	6.14 6.14	5.99 5.83	6.06 5.82	6.16 5.85
Benz[a]anthracene measured predicted	na na	na na	na na	na na	6.75 5.79	na na	na na	6.75 5.66	na na
Chrysene measured predicted	na na	na na	na na	na na	6.66 5.48	na na	na na	6.78 5.35	na na

na; not available nq; not quantified, concentration outside calibration range co; not quantified due to closely eluting sample component