Table S1. Process variables and code factors.

Process Variables	Code Factors	Units	Low Actual	High Actual	Low Coded	High Coded	Range	Average
Pb	A	mg/L	0.5	2.00	-1	1	1.5	1.25
Zn	B	mg/L	0.05	0.30	-1	1	0.25	0.175
Cu	C	mg/L	0.01	0.04	-1	1	0.03	0.025
As	D	mg/L	13.00	19.00	-1	1	6.00	16.00

Table S2. Box-Behnken design and responses results.

	Process Variables (mg/L)				Response Variable
Run	A (Pb)	B (Zn)	C (Cu)	D (As)	Ecological Risk Index
1	1.25 (0)	0.3 (1)	0.04 (1)	16 (0)	10.93
2	2 (1)	0.175 (0)	0.025 (0)	13 (-1)	9.07
3	1.25 (0)	0.3 (1)	0.01 (-1)	16 (0)	10.92
4	1.25 (0)	0.175 (0)	0.01 (-1)	19 (1)	12.92
5	1.25 (0)	0.175 (0)	0.025 (0)	16 (0)	10.92
6	1.25 (0)	0.05 (-1)	0.01 (-1)	16 (0)	10.92
7	1.25 (0)	0.175 (0)	0.025 (0)	16 (0)	10.92
8	0.5 (-1)	0.175 (0)	0.025 (0)	19 (1)	12.77
9	1.25 (0)	0.175 (0)	0.04 (1)	13 (-1)	8.93
10	1.25 (0)	0.175 (0)	0.04 (1)	19 (1)	12.93
11	2 (1)	0.175 (0)	0.01 (-1)	16 (0)	11.07
12	0.5 (-1)	0.175 (0)	0.025 (0)	13 (-1)	8.77
13	1.25 (0)	0.3 (1)	0.025 (0)	19 (1)	12.92
14	1.25 (0)	0.05 (-1)	0.04 (1)	16 (0)	10.92
15	1.25 (0)	0.175 (0)	0.025 (0)	16 (0)	10.92
16	0.5 (-1)	0.175 (0)	0.01 (-1)	16 (0)	10.77
17	2 (1)	0.175 (0)	0.025 (0)	19 (1)	13.07
18	1.25 (0)	0.175 (0)	0.01 (-1)	13 (-1)	8.92
19	2 (1)	0.175 (0)	0.04 (1)	16 (0)	11.08
20	1.25 (0)	0.05 (-1)	0.025 (0)	13 (-1)	13.60
21	0.5 (-1)	0.175 (0)	0.04 (1)	16 (0)	2.94
22	0.5 (-1)	0.05 (-1)	0.025 (0)	16 (0)	15.03
23	1.25 (0)	0.05 (-1)	0.025 (0)	19 (1)	6.87
24	0.5 (-1)	0.3 (1)	0.025 (0)	16 (0)	9.60
25	1.25 (0)	0.175 (0)	0.025 (0)	16 (0)	7.14
26	1.25 (0)	0.175 (0)	0.025 (0)	16 (0)	8.37
27	1.25 (0)	0.3 (1)	0.025 (0)	13 (-1)	6.94
28	2 (1)	0.05 (-1)	0.025 (0)	16 (0)	3.14
29	2 (1)	0.3 (1)	0.025 (0)	16 (0)	8.11

Table S3. The calculation of coded factors.

β coefficient		Calculation for Coded Factors
2.39	Y-intercept	
0.0139	A	$\frac{2 \times (A - 1.25)}{(1.5)}$
0.0001	B	$\frac{2 \times (B - 0.175)}{(0.25)}$
0.0002	C	$\frac{2 \times (C - 0.025)}{(0.03)}$
0.1852	D	$\frac{2 \times (D - 16.00)}{(6.00)}$
-0.0026	AD	$\left(\frac{2 \times (A - 1.25)}{(1.5)}\right) \times \left(\frac{2 \times (D - 16.00)}{(6.00)}\right)$

-0.0171	D^2	$\left(\frac{2 \times (D - 16.00)}{(6.00)}\right) \times \left(\frac{2 \times (D - 16.00)}{(6.00)}\right)$

Table S4. Fit summary results for response parameters.

Response	Significant model	Std. Dev.	R^2	Adj. R^2	Predicted R^2	Adeq Precision	F-value
ERI	Quadratic model	0.0002	1.0000	1.0000	1.0000	2653.2587	682375.55

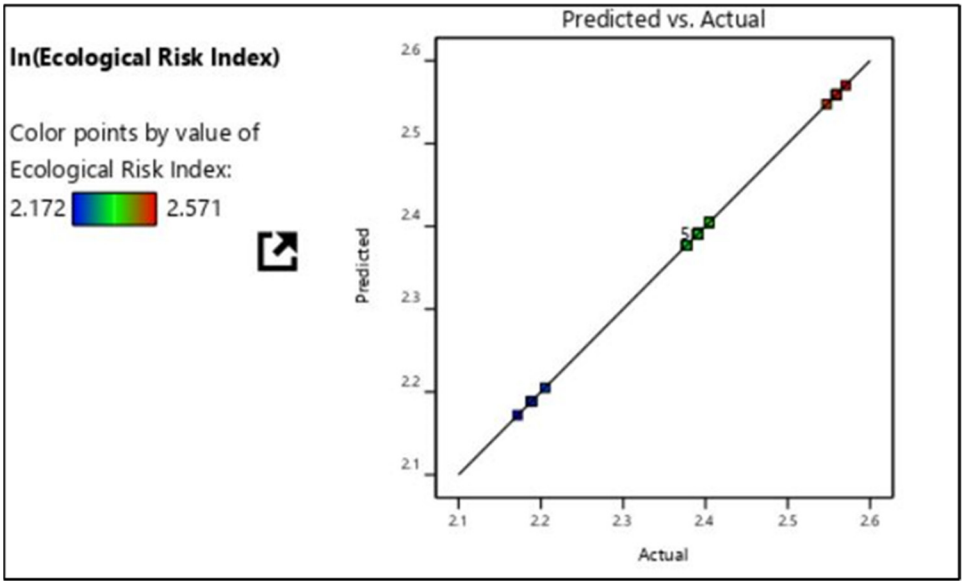


Figure S1. Predicted vs. actual values plot for ERI.

Table S5. Calculation for the validation of the models.

Beta coefficient for Coded Factors		Code	TCLP FA	Eq. 8	Total	BA	Eq. 8	Total	FA BA	Eq. 8	Total	SPLP FA	Eq. 8	Total	BA	Eq. 8	Total	FA BA	Eq. 8	Total
y-intercept	2.39				2.39			2.39			2.39			2.39			2.39			2.39
A	0.0139	Pb-A	0.902	-0.464	-0.00645	0.673	-0.76933	-0.01069	1.026	-0.29867	-0.00415	0.908	-0.456	-0.00634	0.683	-0.756	-0.01051	1.012	-0.31733	-0.00441
B	0.0001	Zn-B	0.216	-12.272	-0.00123	0.149	-12.808	-0.00128	0.196	-12.432	-0.00124	0.219	-12.248	-0.00122	0.151	-12.792	-0.00128	0.189	-12.488	-0.00125
C	0.0002	Cu-C	0.028	0.2	0.00004	0.027	0.133333	2.67E-05	0.033	0.533333	0.000107	0.03	0.333333	6.67E-05	0.028	0.2	0.00004	0.033	0.533333	0.000107
D	0.1852	As-D	15.117	-0.29433	-0.05451	14.655	-0.44833	-0.08303	18.546	0.848667	0.157173	15.227	-0.25767	-0.04772	14.636	-0.45467	-0.0842	18.605	0.868333	0.160815
AD	-0.0026			0.136571	-0.00036		0.344916	-0.0009		-0.25347	0.000659		0.117496	-0.00031		0.343728	-0.00089		-0.27555	0.000716
D2	-0.0171			0.086632	-0.00148		0.201003	-0.00344		0.720235	-0.01232		0.066392	-0.00114		0.206722	-0.00353		0.754003	-0.01289
			Ln(ERI)	2.326016			2.290687			2.530228			2.333343			2.289619			2.533085	
			ERI	10.23708			9.881724			12.55637			10.31236			9.871176			12.59229	

Beta coefficient for Actual Factors	Code	TCLP FA	Total	BA	Total	FA BA	Total	SPLP FA	Total	BA	Total	FA BA	Total

y-intercept	0.870324		0.870324		0.870324		0.870324		0.870324		0.870324
A	0.037472	Pb-A	0.902	0.0338	0.673	0.025219	1.026	0.038446	0.908	0.034025	0.683	0.025593	1.012	0.037922
B	0.002303	Zn-B	0.216	0.000497	0.149	0.000343	0.196	0.000451	0.219	0.000504	0.151	0.000348	0.189	0.000435
C	0.030839	Cu-C	0.028	0.000863	0.027	0.000833	0.033	0.001018	0.03	0.000925	0.028	0.000863	0.033	0.001018
D	0.12385	As-D	17	1.87224	14.655	1.815022	18.546	2.296922	15.227	1.885864	14.636	1.812669	18.605	2.304229
AD	-0.00116			-0.01582		-0.01144		-0.02207		-0.01604		-0.0116		-0.02184
D2	-0.0019			-0.4342		-0.40806		-0.65351		-0.44054		-0.407		-0.65768
		Ln(ERI)		2.327713		2.292238		2.531576		2.335067		2.291198		2.534 41
		ERI		10.25446		9.897063		12.57331		10.33015		9.886775		12.60899

Table S6. Validation of optimised model.

Ecological Risk Assessment of Heavy Metals		R_I (Experimental)	R_I (Predicted)		Error Percentage (%)	
			Coded Factor	Actual Factor	Coded Factor	Actual Factor
TCLP	FA	10.27×10^0	10.23708	10.25446	0.3205	0.1513
	BA	9.91×10^0	9.881724	9.897063	0.2853	0.1305
	FA + BA	12.58×10^0	12.55637	12.57331	0.1878	0.0532
SPLP	FA	10.34×10^0	10.31236	10.33015	0.2673	0.0953
	BA	9.90×10^0	9.871176	9.886775	0.2912	0.1336
	FA + BA	12.61×10^0	12.59229	12.60899	0.1404	0.0080