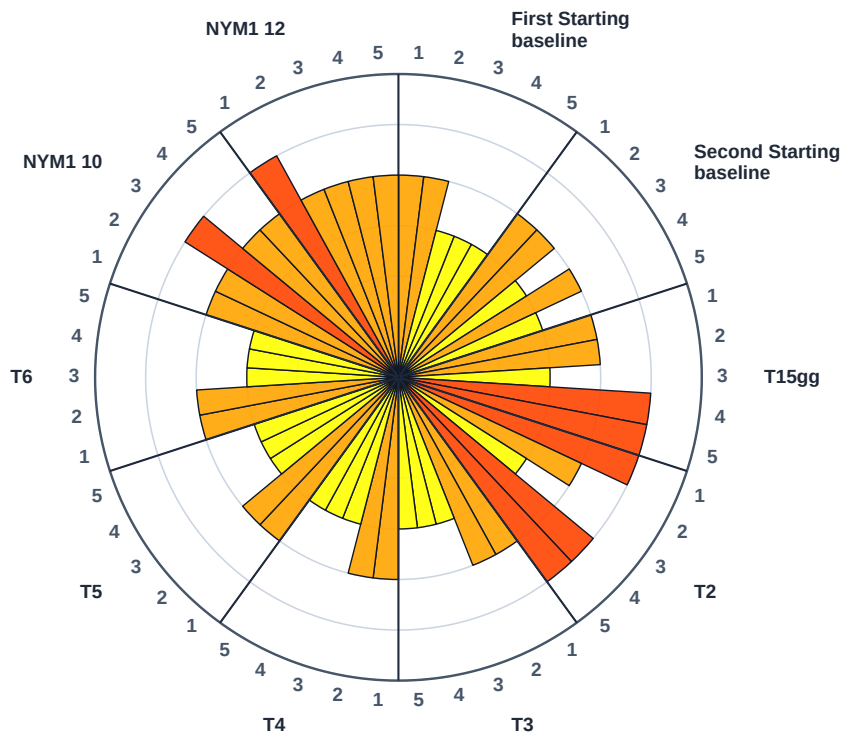


Ecotoxicology Analysis

During Remediation

Locality: Ferrara, Italy, ER-site
Method: In situ aerobic bioenhancement (NYM1)
Bioremediation method: During Bioremediation
Sample type: water
Collection date: 2024-12-19 – 2025-12-04



ORGANISMS

- 1 *Daphnids*
- 2 *Algae*
- 3 *Lettuce aquatic*
- 4 *A. fischeri 15*
- 5 *A. fischeri 30*

CATEGORIES

- A Non-toxic
- B Low toxicity
- C Medium toxicity
- D High toxicity
- E Very high toxicity
- F Extreme toxicity

Category Distribution (% of organism readings)

C: 38%

D: 48%

E: 14%

Resulting category: **E** Very high toxicity

Test Organisms by Type

Consumers:	<i>Daphnids</i>
Producers:	<i>Algae, Lettuce aquatic</i>
Destruent:	<i>A. fischeri 15, A. fischeri 30</i>

Most sensitive organism: *A. fischeri 15*

Critical ecotoxicological response recommended

Samples fall into category E. At 10% sample concentration inhibition is 51–100%, or EC50 is 1–10%. A severe toxic effect is present.

- It is recommended to implement immediate measures and conduct intensive monitoring.

Ecotoxicity Assessment Criteria

CATEGORY	DESCRIPTION	CRITERIA (ACTIVE RULES)
A	Non-toxic	Undiluted sample: inhibition / stimulation -19.99% – 19.99%
B	Low toxicity	Undiluted sample: stimulation 20% – 50%, or Undiluted sample: inhibition 20% – 50%
C	Medium toxicity	Undiluted sample: stimulation 51% – 90%, or Undiluted sample: inhibition 51% – 90%
D	High toxicity	At 10% sample concentration: inhibition / stimulation -50.99% – 50.99%, or EC50 10% – 50%
E	Very high toxicity	At 10% sample concentration: inhibition 51% – 100%, or EC50 1% – 10%
F	Extreme toxicity	At 1% sample concentration: inhibition 10.01% – 100%, or EC50 0% – 0.99%

Notes: A sample's category is the worst (most toxic) grade reached by any single test organism. Determination of EC50 takes precedence over the inhibition value. In a luminescence bacterial test, an undiluted sample corresponds to a sample concentration of 500 mL/L.

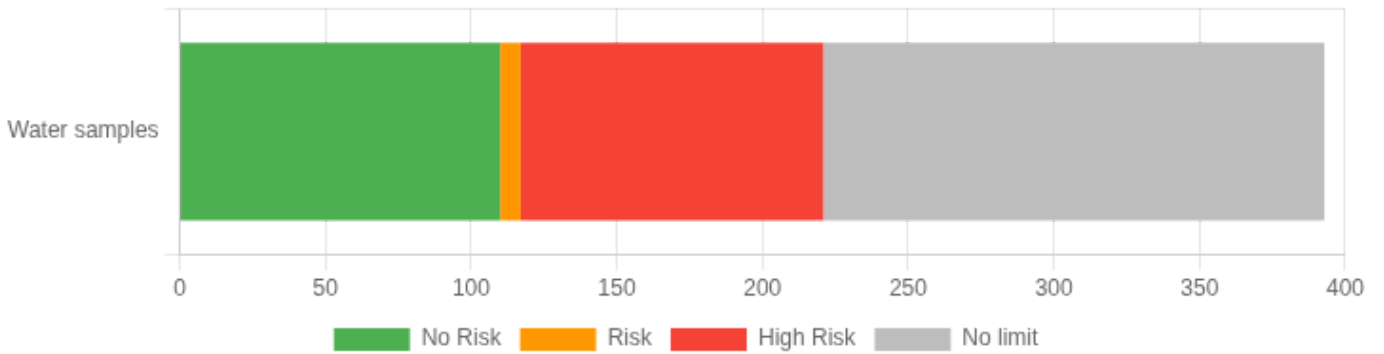
Chemical Risk Assessment

During Remediation

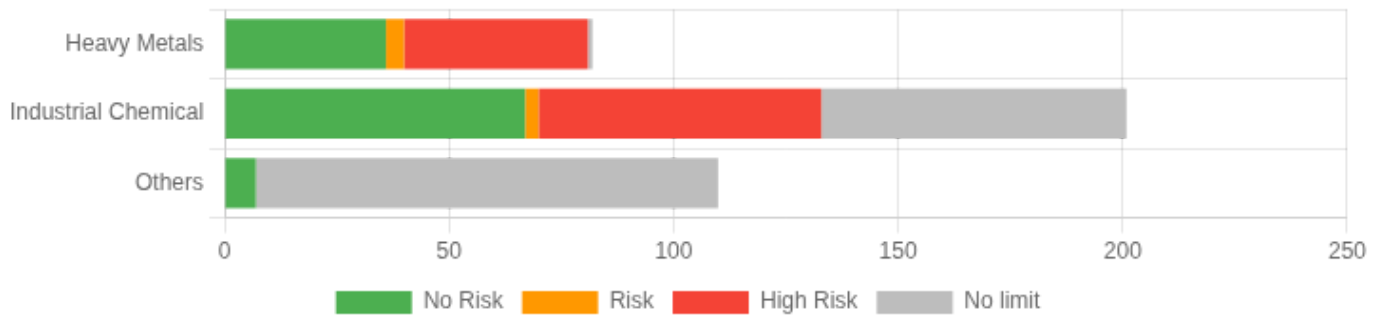
Locality: Ferrara, Italy, ER-site
Method: In situ aerobic bioenhancement (NYM1)
Bioremediation method: During Bioremediation
Sample type: water
Collection date: 2024-12-19 – 2025-12-04

- No Risk — at/below limit
- Risk — over limit (up to 50%)
- High Risk — more than 50% over limit
- No limit — not defined

Risk distribution by sample type



Water samples



No risk 28%

Risk 2%

High risk 26%

No limit 44%

CLASS	NUMBER	OVER LIMIT	SUM CONCENTRATION
Heavy Metals	82	45	250884.9959 µg/L
Industrial Chemical	201	66	2082592.7346 µg/L
Others	110	0	6846.8309 mg/L, 218976.4 µg/L, 504

SAMPLE	COMPOUND / ELEMENT	CLASS	MEASURED	UNIT
First Starting baseline	Arsenic	Heavy Metals	22.9	µg/L
First Starting baseline	Cobalt	Heavy Metals	1070	µg/L
First Starting baseline	Iron	Heavy Metals	28200	µg/L
First Starting baseline	Manganese	Heavy Metals	2460	µg/L
First Starting baseline	Nickel	Heavy Metals	32.6	µg/L
First Starting baseline	1,1-Dichloroethylene	Industrial Chemical	19.5	µg/L
First Starting baseline	Benzene	Industrial Chemical	7860	µg/L
First Starting baseline	Ethylbenzene	Industrial Chemical	7110	µg/L
First Starting baseline	n-Hexane	Industrial Chemical	99700	µg/L
First Starting baseline	Sum of organohalogen compounds	Industrial Chemical	253	µg/L
First Starting baseline	Toluene	Industrial Chemical	10600	µg/L
First Starting baseline	Vinyl chloride	Industrial Chemical	231	µg/L
NYM1 10	Arsenic	Heavy Metals	37.3	µg/L
NYM1 10	Cobalt	Heavy Metals	1110	µg/L
NYM1 10	Iron	Heavy Metals	32800	µg/L
NYM1 10	Manganese	Heavy Metals	2440	µg/L
NYM1 10	Nickel	Heavy Metals	40	µg/L
NYM1 10	1,1-Dichloroethylene	Industrial Chemical	19	µg/L
NYM1 10	Benzene	Industrial Chemical	8030	µg/L
NYM1 10	Ethylbenzene	Industrial Chemical	5090	µg/L
NYM1 10	Sum of organohalogen compounds	Industrial Chemical	476	µg/L
NYM1 10	Toluene	Industrial Chemical	12300	µg/L

SAMPLE	COMPOUND / ELEMENT	CLASS	MEASURED	UNIT
NYM1 10	Vinyl chloride	Industrial Chemical	397	µg/L
NYM1 12	Arsenic	Heavy Metals	41	µg/L
NYM1 12	Cobalt	Heavy Metals	1170	µg/L
NYM1 12	Iron	Heavy Metals	37600	µg/L
NYM1 12	Manganese	Heavy Metals	2960	µg/L
NYM1 12	Nickel	Heavy Metals	48	µg/L
NYM1 12	1,1-Dichloroethylene	Industrial Chemical	12.9	µg/L
NYM1 12	Benzene	Industrial Chemical	11699.9999	µg/L
NYM1 12	Ethylbenzene	Industrial Chemical	3730	µg/L
NYM1 12	Sum of organohalogen compounds	Industrial Chemical	325	µg/L
NYM1 12	Toluene	Industrial Chemical	12800	µg/L
NYM1 12	Vinyl chloride	Industrial Chemical	312	µg/L
Second Starting baseline	Cobalt	Heavy Metals	796	µg/L
Second Starting baseline	Iron	Heavy Metals	16700	µg/L
Second Starting baseline	Manganese	Heavy Metals	4700	µg/L
Second Starting baseline	Nickel	Heavy Metals	81	µg/L
Second Starting baseline	1,1-Dichloroethylene	Industrial Chemical	13	µg/L
Second Starting baseline	Benzene	Industrial Chemical	8370	µg/L
Second Starting baseline	Ethylbenzene	Industrial Chemical	4750	µg/L
Second Starting baseline	Sum of organohalogen compounds	Industrial Chemical	242	µg/L
Second Starting baseline	Toluene	Industrial Chemical	10500	µg/L
Second Starting baseline	Vinyl chloride	Industrial Chemical	189	µg/L
T15gg	Cobalt	Heavy Metals	379	µg/L
T15gg	1,1-Dichloroethylene	Industrial Chemical	13	µg/L
T15gg	Benzene	Industrial Chemical	7400	µg/L
T15gg	Benzo(a)pyrene	Industrial Chemical	0.042	µg/L
T15gg	Ethylbenzene	Industrial Chemical	4370	µg/L
T15gg	Sum of organohalogen compounds	Industrial Chemical	185	µg/L
T15gg	Toluene	Industrial Chemical	10500	µg/L
T15gg	Vinyl chloride	Industrial Chemical	172	µg/L
T2	Cobalt	Heavy Metals	1440	µg/L
T2	Iron	Heavy Metals	24200	µg/L
T2	Manganese	Heavy Metals	3170	µg/L
T2	Nickel	Heavy Metals	38.6	µg/L
T2	1,1-Dichloroethylene	Industrial Chemical	20.6	µg/L

SAMPLE	COMPOUND / ELEMENT	CLASS	MEASURED	UNIT
T2	Benzene	Industrial Chemical	11800	µg/L
T2	Ethylbenzene	Industrial Chemical	4580	µg/L
T2	Sum of organohalogen compounds	Industrial Chemical	225	µg/L
T2	Toluene	Industrial Chemical	13000	µg/L
T2	Vinyl chloride	Industrial Chemical	204	µg/L
T3	Cobalt	Heavy Metals	999	µg/L
T3	Manganese	Heavy Metals	3390	µg/L
T3	Nickel	Heavy Metals	39.5	µg/L
T3	1,1-Dichloroethylene	Industrial Chemical	5.8	µg/L
T3	Benzene	Industrial Chemical	5320	µg/L
T3	Ethylbenzene	Industrial Chemical	2930	µg/L
T3	Sum of organohalogen compounds	Industrial Chemical	75	µg/L
T3	Toluene	Industrial Chemical	8700	µg/L
T3	Vinyl chloride	Industrial Chemical	69	µg/L
T4	Cobalt	Heavy Metals	1580	µg/L
T4	Iron	Heavy Metals	21700	µg/L
T4	Manganese	Heavy Metals	3370	µg/L
T4	Nickel	Heavy Metals	44	µg/L
T4	1,1-Dichloroethylene	Industrial Chemical	22.2	µg/L
T4	1,2-Dichloroethane	Industrial Chemical	289	µg/L
T4	Benzene	Industrial Chemical	9990	µg/L
T4	Ethylbenzene	Industrial Chemical	4920	µg/L
T4	Sum of organohalogen compounds	Industrial Chemical	237	µg/L
T4	Toluene	Industrial Chemical	13200	µg/L
T4	Vinyl chloride	Industrial Chemical	242	µg/L
T5	Arsenic	Heavy Metals	17.2	µg/L
T5	Cobalt	Heavy Metals	1180	µg/L
T5	Iron	Heavy Metals	24600	µg/L
T5	Manganese	Heavy Metals	2640	µg/L
T5	Nickel	Heavy Metals	39.3	µg/L
T5	1,1-Dichloroethylene	Industrial Chemical	17.3	µg/L
T5	Benzene	Industrial Chemical	10300	µg/L
T5	Ethylbenzene	Industrial Chemical	6130	µg/L
T5	Sum of organohalogen compounds	Industrial Chemical	340	µg/L
T5	Toluene	Industrial Chemical	14600	µg/L

SAMPLE	COMPOUND / ELEMENT	CLASS	MEASURED	UNIT
T5	Vinyl chloride	Industrial Chemical	323	µg/L
T6	Arsenic	Heavy Metals	18.4	µg/L
T6	Cobalt	Heavy Metals	934	µg/L
T6	Iron	Heavy Metals	24800	µg/L
T6	Manganese	Heavy Metals	2150	µg/L
T6	Nickel	Heavy Metals	34.8	µg/L
T6	1,1-Dichloroethylene	Industrial Chemical	21.4	µg/L
T6	Benzene	Industrial Chemical	8790	µg/L
T6	Ethylbenzene	Industrial Chemical	3640	µg/L
T6	Sum of organohalogen compounds	Industrial Chemical	697	µg/L
T6	Toluene	Industrial Chemical	13600	µg/L
T6	Vinyl chloride	Industrial Chemical	676	µg/L
First Starting baseline	Benzo(a)pyrene	Industrial Chemical	0.0121	µg/L
T15gg	Manganese	Heavy Metals	60	µg/L
T15gg	Benzo(a)anthracene	Industrial Chemical	0.1069	µg/L
T15gg	Benzo(g,h,i)perylene	Industrial Chemical	0.0128	µg/L
T2	Arsenic	Heavy Metals	12	µg/L
T3	Iron	Heavy Metals	256	µg/L
T4	Arsenic	Heavy Metals	11.2	µg/L
First Starting baseline	Aluminium	Heavy Metals	23.1	µg/L
First Starting baseline	Cadmium	Heavy Metals	0.186	µg/L
First Starting baseline	Copper	Heavy Metals	32.4	µg/L
First Starting baseline	1,1-Dichloroethane	Industrial Chemical	7.45	µg/L
First Starting baseline	1,2-Dichloroethylene	Industrial Chemical	7.11	µg/L
First Starting baseline	1,2-Dichloroethylene	Industrial Chemical	5.53	µg/L
First Starting baseline	1,2-Dichloroethylene	Industrial Chemical	1.58	µg/L
First Starting baseline	Benzo(a)anthracene	Industrial Chemical	0.033	µg/L
First Starting baseline	Benzo(b)fluoranthene	Industrial Chemical	0.006	µg/L
First Starting baseline	Benzo(g,h,i)perylene	Industrial Chemical	0.0028	µg/L
First Starting baseline	Benzo(k)fluoranthene	Industrial Chemical	0.0015	µg/L
First Starting baseline	Chrysene	Industrial Chemical	0.0216	µg/L
First Starting baseline	Indeno(1,2,3-cd)pyrene	Industrial Chemical	0.0025	µg/L
First Starting baseline	Pyrene	Industrial Chemical	0.176	µg/L
First Starting baseline	Nitrites	Others	1.4999	mg/L
NYM1 10	Aluminium	Heavy Metals	11.2	µg/L

SAMPLE	COMPOUND / ELEMENT	CLASS	MEASURED	UNIT
NYM1 10	Copper	Heavy Metals	11.7	µg/L
NYM1 10	Mercury	Heavy Metals	0.157	µg/L
NYM1 10	1,1-Dichloroethane	Industrial Chemical	11.2	µg/L
NYM1 10	1,2-Dichloroethylene	Industrial Chemical	8.16	µg/L
NYM1 10	Benzo(a)anthracene	Industrial Chemical	0.0164	µg/L
NYM1 10	Benzo(a)pyrene	Industrial Chemical	0.0052	µg/L
NYM1 10	Chrysene	Industrial Chemical	0.0113	µg/L
NYM1 10	Pyrene	Industrial Chemical	0.111	µg/L
NYM1 10	Nitrites	Others	0.08	mg/L
NYM1 12	Aluminium	Heavy Metals	10.9	µg/L
NYM1 12	Copper	Heavy Metals	5.99	µg/L
NYM1 12	1,1-Dichloroethane	Industrial Chemical	12.6	µg/L
NYM1 12	1,2-Dichloroethylene	Industrial Chemical	14	µg/L
NYM1 12	Benzo(a)anthracene	Industrial Chemical	0.007	µg/L
NYM1 12	Benzo(a)pyrene	Industrial Chemical	0.0033	µg/L
NYM1 12	Benzo(b)fluoranthene	Industrial Chemical	0.005	µg/L
NYM1 12	Benzo(k)fluoranthene	Industrial Chemical	0.0015	µg/L
NYM1 12	Chrysene	Industrial Chemical	0.0054	µg/L
NYM1 12	Pyrene	Industrial Chemical	0.099	µg/L
NYM1 12	Nitrites	Others	0.06	mg/L
Second Starting baseline	Aluminium	Heavy Metals	2.78	µg/L
Second Starting baseline	Arsenic	Heavy Metals	8.1	µg/L
Second Starting baseline	Cadmium	Heavy Metals	0.148	µg/L
Second Starting baseline	Chromium VI	Heavy Metals	0.67	µg/L
Second Starting baseline	Copper	Heavy Metals	23.1	µg/L
Second Starting baseline	Mercury	Heavy Metals	0.189	µg/L
Second Starting baseline	1,1-Dichloroethane	Industrial Chemical	7.19	µg/L
Second Starting baseline	1,2-Dichloroethylene	Industrial Chemical	8.11	µg/L
Second Starting baseline	1,2-Dichloroethylene	Industrial Chemical	6.18	µg/L
Second Starting baseline	1,2-Dichloroethylene	Industrial Chemical	1.93	µg/L
T15gg	Aluminium	Heavy Metals	175	µg/L
T15gg	Arsenic	Heavy Metals	5.8	µg/L
T15gg	Copper	Heavy Metals	94	µg/L
T15gg	Iron	Heavy Metals	21.9	µg/L
T15gg	Nickel	Heavy Metals	14.6	µg/L

SAMPLE	COMPOUND / ELEMENT	CLASS	MEASURED	UNIT
T15gg	1,1-Dichloroethane	Industrial Chemical	9.51	µg/L
T15gg	1,2-Dichloroethylene	Industrial Chemical	5.64	µg/L
T15gg	Benzo(b)fluoranthene	Industrial Chemical	0.025	µg/L
T15gg	Benzo(k)fluoranthene	Industrial Chemical	0.0064	µg/L
T15gg	Chrysene	Industrial Chemical	0.101	µg/L
T15gg	Dibenzo(a,h)anthracene	Industrial Chemical	0.0044	µg/L
T15gg	Indeno(1,2,3-cd)pyrene	Industrial Chemical	0.0081	µg/L
T15gg	Pyrene	Industrial Chemical	0.45	µg/L
T15gg	Nitrites	Others	0.11	mg/L
T2	Aluminium	Heavy Metals	4.52	µg/L
T2	Copper	Heavy Metals	431	µg/L
T2	1,1-Dichloroethane	Industrial Chemical	13.6	µg/L
T2	1,2-Dichloroethylene	Industrial Chemical	9.6	µg/L
T2	1,2-Dichloroethylene	Industrial Chemical	9.6	µg/L
T2	Benzo(a)anthracene	Industrial Chemical	0.0199	µg/L
T2	Benzo(a)pyrene	Industrial Chemical	0.0076	µg/L
T2	Benzo(g,h,i)perylene	Industrial Chemical	0.0025	µg/L
T2	Chrysene	Industrial Chemical	0.0154	µg/L
T2	Pyrene	Industrial Chemical	0.118	µg/L
T2	Nitrites	Others	5.4	mg/L
T3	Aluminium	Heavy Metals	38.5	µg/L
T3	Arsenic	Heavy Metals	4.34	µg/L
T3	Copper	Heavy Metals	189	µg/L
T3	1,1-Dichloroethane	Industrial Chemical	4.75	µg/L
T3	1,2-Dichloroethylene	Industrial Chemical	2.64	µg/L
T3	Benzo(a)anthracene	Industrial Chemical	0.0108	µg/L
T3	Chrysene	Industrial Chemical	0.0082	µg/L
T3	Pyrene	Industrial Chemical	0.116	µg/L
T4	Aluminium	Heavy Metals	5.58	µg/L
T4	Chromium VI	Heavy Metals	0.463	µg/L
T4	Copper	Heavy Metals	254	µg/L
T4	Mercury	Heavy Metals	0.245	µg/L
T4	1,1-Dichloroethane	Industrial Chemical	13.2	µg/L
T4	1,2-Dichloroethylene	Industrial Chemical	12.5	µg/L
T4	Benzo(a)anthracene	Industrial Chemical	0.0117	µg/L

SAMPLE	COMPOUND / ELEMENT	CLASS	MEASURED	UNIT
T4	Benzo(g,h,i)perylene	Industrial Chemical	0.0067	µg/L
T4	Chrysene	Industrial Chemical	0.0095	µg/L
T4	Dibenzo(a,h)anthracene	Industrial Chemical	0.0077	µg/L
T4	Pyrene	Industrial Chemical	0.097	µg/L
T5	Aluminium	Heavy Metals	3.35	µg/L
T5	Cadmium	Heavy Metals	0.214	µg/L
T5	Chromium VI	Heavy Metals	0.807	µg/L
T5	Copper	Heavy Metals	49	µg/L
T5	1,1-Dichloroethane	Industrial Chemical	10.8	µg/L
T5	1,2-Dichloroethylene	Industrial Chemical	7.16	µg/L
T5	1,2-Dichloroethylene	Industrial Chemical	5.57	µg/L
T5	Benzo(a)anthracene	Industrial Chemical	0.0122	µg/L
T5	Chrysene	Industrial Chemical	0.0083	µg/L
T5	Pyrene	Industrial Chemical	0.147	µg/L
T5	Nitrites	Others	0.77	mg/L
T6	Aluminium	Heavy Metals	7.2099	µg/L
T6	Chromium VI	Heavy Metals	0.68	µg/L
T6	Copper	Heavy Metals	38.8	µg/L
T6	Mercury	Heavy Metals	0.317	µg/L
T6	1,1-Dichloroethane	Industrial Chemical	7.06	µg/L
T6	Benzo(a)anthracene	Industrial Chemical	0.0184	µg/L
T6	Chrysene	Industrial Chemical	0.0146	µg/L
T6	Pyrene	Industrial Chemical	0.176	µg/L
T6	Nitrites	Others	0.13	mg/L
First Starting baseline	Hydrocarbons C10–C40 as n-hexane	Industrial Chemical	2450	µg/L
First Starting baseline	Naphthalene	Industrial Chemical	772	µg/L
First Starting baseline	Sum of polycyclic aromatic hydrocarbons	Industrial Chemical	0.0126	µg/L
First Starting baseline	Tetrachloroethylene	Industrial Chemical	2.07	µg/L
First Starting baseline	Total hydrocarbons as hexane	Industrial Chemical	102000	µg/L
First Starting baseline	Xylene	Industrial Chemical	3750	µg/L
First Starting baseline	Xylene	Industrial Chemical	12300	µg/L
First Starting baseline	Ammonia nitrogen	Others	23.9	mg/L
First Starting baseline	Chlorides	Others	140	mg/L
First Starting baseline	Hydrocarbons C12–C14 (200–250 °C fraction)	Others	233	µg/L
First Starting baseline	Hydrocarbons C14–C16	Others	83	µg/L

SAMPLE	COMPOUND / ELEMENT	CLASS	MEASURED	UNIT
First Starting baseline	Organic nitrogen	Others	6.1	mg/L
First Starting baseline	Potassium	Others	7.1	mg/L
First Starting baseline	TOC	Others	454	mg/L
First Starting baseline	Total inorganic nitrogen	Others	19000	µg/L
First Starting baseline	Total nitrogen	Others	25.3	mg/L
NYM1 10	GRO as hexane	Industrial Chemical	52300	µg/L
NYM1 10	Hydrocarbons C10–C40 as n-hexane	Industrial Chemical	1700	µg/L
NYM1 10	Naphthalene	Industrial Chemical	147	µg/L
NYM1 10	Tetrachloroethylene	Industrial Chemical	9.46	µg/L
NYM1 10	Total hydrocarbons as hexane	Industrial Chemical	54000	µg/L
NYM1 10	Trichloroethylene	Industrial Chemical	51	µg/L
NYM1 10	Xylene	Industrial Chemical	10600	µg/L
NYM1 10	Ammonia nitrogen (as NH4)	Others	33.6	mg/L
NYM1 10	Chlorides	Others	170	mg/L
NYM1 10	Hydrocarbons C12–C14 (200–250 °C fraction)	Others	62	µg/L
NYM1 10	Organic nitrogen	Others	7.9	mg/L
NYM1 10	Potassium	Others	6.8	mg/L
NYM1 10	TOC	Others	361	mg/L
NYM1 10	Total inorganic nitrogen	Others	26200	µg/L
NYM1 10	Total nitrogen	Others	34.8	mg/L
NYM1 10	Turbidity	Others	504	—
NYM1 12	GRO as hexane	Industrial Chemical	56400	µg/L
NYM1 12	Hydrocarbons C10–C40 as n-hexane	Industrial Chemical	660	µg/L
NYM1 12	Naphthalene	Industrial Chemical	171	µg/L
NYM1 12	Sum of polycyclic aromatic hydrocarbons	Industrial Chemical	0.0063	µg/L
NYM1 12	Total hydrocarbons as hexane	Industrial Chemical	57100	µg/L
NYM1 12	Xylene	Industrial Chemical	21100	µg/L
NYM1 12	Ammonia nitrogen (as NH4)	Others	37.9	mg/L
NYM1 12	Chlorides	Others	100	mg/L
NYM1 12	Hydrocarbons C12–C14 (200–250 °C fraction)	Others	67	µg/L
NYM1 12	Hydrocarbons C14–C16	Others	85	µg/L
NYM1 12	Hydrocarbons C20–C22	Others	32	µg/L
NYM1 12	Organic nitrogen	Others	10.7	mg/L
NYM1 12	Potassium	Others	7.3	mg/L
NYM1 12	TOC	Others	601	mg/L

SAMPLE	COMPOUND / ELEMENT	CLASS	MEASURED	UNIT
NYM1 12	Total inorganic nitrogen	Others	29600	µg/L
NYM1 12	Total nitrogen	Others	41	mg/L
Second Starting baseline	GRO as hexane	Industrial Chemical	103000	µg/L
Second Starting baseline	Hydrocarbons C10–C40 as n-hexane	Industrial Chemical	3140	µg/L
Second Starting baseline	Naphthalene	Industrial Chemical	486	µg/L
Second Starting baseline	Tetrachloroethylene	Industrial Chemical	37	µg/L
Second Starting baseline	Total hydrocarbons as hexane	Industrial Chemical	106000	µg/L
Second Starting baseline	Trichloromethane	Industrial Chemical	3.29	µg/L
Second Starting baseline	Xylene	Industrial Chemical	3230	µg/L
Second Starting baseline	Xylene	Industrial Chemical	11300	µg/L
Second Starting baseline	Ammonia nitrogen (as NH4)	Others	25.7	mg/L
Second Starting baseline	Chlorides	Others	150	mg/L
Second Starting baseline	Hydrocarbons C12–C14 (200–250 °C fraction)	Others	256	µg/L
Second Starting baseline	Hydrocarbons C14–C16	Others	84.3	µg/L
Second Starting baseline	Organic nitrogen	Others	1.36	mg/L
Second Starting baseline	Potassium	Others	5.4	mg/L
Second Starting baseline	TOC	Others	466	mg/L
Second Starting baseline	Total inorganic nitrogen	Others	20100	µg/L
Second Starting baseline	Total nitrogen	Others	21.8	mg/L
T15gg	Total chromium	Heavy Metals	3.25	µg/L
T15gg	GRO as hexane	Industrial Chemical	107000	µg/L
T15gg	Hydrocarbons C10–C40 as n-hexane	Industrial Chemical	2290	µg/L
T15gg	Naphthalene	Industrial Chemical	429	µg/L
T15gg	Sum of polycyclic aromatic hydrocarbons	Industrial Chemical	0.052	µg/L
T15gg	Total hydrocarbons as hexane	Industrial Chemical	109000	µg/L
T15gg	Xylene	Industrial Chemical	3630	µg/L
T15gg	Xylene	Industrial Chemical	9970	µg/L
T15gg	Ammonia nitrogen (as NH4)	Others	29.8	mg/L
T15gg	Chlorides	Others	140	mg/L
T15gg	Hydrocarbons C12–C14 (200–250 °C fraction)	Others	114	µg/L
T15gg	Hydrocarbons C14–C16	Others	41	µg/L
T15gg	Organic nitrogen	Others	2.84	mg/L
T15gg	Potassium	Others	7.6	mg/L
T15gg	TOC	Others	547	mg/L
T15gg	Total inorganic nitrogen	Others	23300	µg/L

SAMPLE	COMPOUND / ELEMENT	CLASS	MEASURED	UNIT
T15gg	Total nitrogen	Others	25.5	mg/L
T2	GRO as hexane	Industrial Chemical	97100	µg/L
T2	Hydrocarbons C10–C40 as n-hexane	Industrial Chemical	1790	µg/L
T2	Naphthalene	Industrial Chemical	271	µg/L
T2	Sum of polycyclic aromatic hydrocarbons	Industrial Chemical	0.0025	µg/L
T2	Total hydrocarbons as hexane	Industrial Chemical	98900	µg/L
T2	Tribromomethane	Industrial Chemical	6.38	µg/L
T2	Xylene	Industrial Chemical	3480	µg/L
T2	Xylene	Industrial Chemical	13400	µg/L
T2	Ammonia nitrogen (as NH ₄)	Others	24.7	mg/L
T2	Chlorides	Others	130	mg/L
T2	Hydrocarbons C12–C14 (200–250 °C fraction)	Others	157.2	µg/L
T2	Hydrocarbons C14–C16	Others	52.8	µg/L
T2	Organic nitrogen	Others	2.11	mg/L
T2	Potassium	Others	7.2	mg/L
T2	Sulfide	Others	0.331	mg/L
T2	TOC	Others	530	mg/L
T2	Total inorganic nitrogen	Others	20500	µg/L
T2	Total nitrogen	Others	23.2	mg/L
T3	Dichloromethane	Industrial Chemical	1100	µg/L
T3	GRO as hexane	Industrial Chemical	49000	µg/L
T3	Hydrocarbons C10–C40 as n-hexane	Industrial Chemical	2570	µg/L
T3	Naphthalene	Industrial Chemical	471.9999	µg/L
T3	Total hydrocarbons as hexane	Industrial Chemical	51600	µg/L
T3	Xylene	Industrial Chemical	2110	µg/L
T3	Xylene	Industrial Chemical	5790	µg/L
T3	Ammonia nitrogen (as NH ₄)	Others	25.3	mg/L
T3	Chlorides	Others	110	mg/L
T3	Hydrocarbons C12–C14 (200–250 °C fraction)	Others	112	µg/L
T3	Organic nitrogen	Others	2.65	mg/L
T3	Potassium	Others	7.8	mg/L
T3	TOC	Others	630	mg/L
T3	Total inorganic nitrogen	Others	20400	µg/L
T3	Total nitrogen	Others	22.9	mg/L
T4	GRO as hexane	Industrial Chemical	78400	µg/L

SAMPLE	COMPOUND / ELEMENT	CLASS	MEASURED	UNIT
T4	Hydrocarbons C10–C40 as n-hexane	Industrial Chemical	1770	µg/L
T4	Naphthalene	Industrial Chemical	330	µg/L
T4	Sum of polycyclic aromatic hydrocarbons	Industrial Chemical	0.0067	µg/L
T4	Total hydrocarbons as hexane	Industrial Chemical	80200	µg/L
T4	Xylene	Industrial Chemical	3630	µg/L
T4	Xylene	Industrial Chemical	9600	µg/L
T4	Ammonia nitrogen (as NH4)	Others	26.5	mg/L
T4	Chlorides	Others	110	mg/L
T4	Hydrocarbons C12–C14 (200–250 °C fraction)	Others	140.4	µg/L
T4	Hydrocarbons C14–C16	Others	25.2	µg/L
T4	Hydrocarbons C16–C18	Others	6	µg/L
T4	Hydrocarbons C18–C20 (300–350 °C fraction)	Others	7.2	µg/L
T4	Hydrocarbons C20–C22	Others	4.2	µg/L
T4	Hydrocarbons C22–C24	Others	4.8	µg/L
T4	Hydrocarbons C24–C26	Others	5.4	µg/L
T4	Hydrocarbons C26–C28	Others	13.8	µg/L
T4	Hydrocarbons C28–C30	Others	7.8	µg/L
T4	Hydrocarbons C30–C32	Others	9	µg/L
T4	Hydrocarbons C32–C34	Others	12.6	µg/L
T4	Hydrocarbons C34–C36	Others	13.2	µg/L
T4	Organic nitrogen	Others	4.2	mg/L
T4	Potassium	Others	6.9	mg/L
T4	TOC	Others	549	mg/L
T4	Total inorganic nitrogen	Others	20700	µg/L
T4	Total nitrogen	Others	29.1	mg/L
T5	GRO as hexane	Industrial Chemical	98800	µg/L
T5	Hydrocarbons C10–C40 as n-hexane	Industrial Chemical	3150	µg/L
T5	Naphthalene	Industrial Chemical	460	µg/L
T5	Total hydrocarbons as hexane	Industrial Chemical	102000	µg/L
T5	Xylene	Industrial Chemical	4470	µg/L
T5	Xylene	Industrial Chemical	12000	µg/L
T5	Ammonia nitrogen (as NH4)	Others	21.6	mg/L
T5	Chlorides	Others	97	mg/L
T5	Hydrocarbons C12–C14 (200–250 °C fraction)	Others	407	µg/L
T5	Hydrocarbons C14–C16	Others	302	µg/L

SAMPLE	COMPOUND / ELEMENT	CLASS	MEASURED	UNIT
T5	Hydrocarbons C16–C18	Others	375	µg/L
T5	Hydrocarbons C18–C20 (300–350 °C fraction)	Others	55.2	µg/L
T5	Hydrocarbons C20–C22	Others	41.6	µg/L
T5	Organic nitrogen	Others	3.5	mg/L
T5	Potassium	Others	5.8	mg/L
T5	TOC	Others	371	mg/L
T5	Total inorganic nitrogen	Others	17000	µg/L
T5	Total nitrogen	Others	20.4	mg/L
T6	GRO as hexane	Industrial Chemical	73300	µg/L
T6	Hydrocarbons C10–C40 as n-hexane	Industrial Chemical	2310	µg/L
T6	Naphthalene	Industrial Chemical	617	µg/L
T6	Total hydrocarbons as hexane	Industrial Chemical	75600	µg/L
T6	Xylene	Industrial Chemical	10500	µg/L
T6	Ammonia nitrogen (as NH ₄)	Others	24.7	mg/L
T6	Chlorides	Others	160	mg/L
T6	Hydrocarbons C12–C14 (200–250 °C fraction)	Others	66.7	µg/L
T6	Organic nitrogen	Others	3.59	mg/L
T6	Potassium	Others	5.8	mg/L
T6	TOC	Others	369	mg/L
T6	Total inorganic nitrogen	Others	19300	µg/L
T6	Total nitrogen	Others	23.1	mg/L

Chemical Assessment Criteria

Chemical data exceed the limit values

Exceedances of limit values indicate the presence of chemical risk. The remediation is insufficient or ineffective for the substances concerned. It is recommended to identify the source of contamination, reassess the remediation strategy, and propose additional measures. Exceedances are considered relevant above 0.5 µg/L for water samples and 0.5 mg/kg for soil samples.

Supportive Methods

During Remediation

Locality: Ferrara, Italy, ER-site
Method: In situ aerobic bioenhancement (NYM1)
Bioremediation method: During Bioremediation

Per-sample evaluation

Sample	Type	Diversity — Shannon (H')	Diversity — Simpson (1-D)	Nitrification	Respiration	Conformity
First Starting baseline	Water	6.6396 expected: Moderate or gradually increasing	0.9794 expected: Low to moderate		QR 0.51 QR above 0.5 — verify the aerobic heterotrophic bacteria (AHB) count Nonconforming	Nonconforming
T2	Water	6.3737 expected: Moderate or gradually increasing	0.9811 expected: Low to moderate			—
T3	Water	6.4578 expected: Moderate or gradually increasing	0.9778 expected: Low to moderate			—
T4	Water	6.4365 expected: Moderate or gradually increasing	0.9782 expected: Low to moderate			—
T5	Water	6.1551 expected: Moderate or gradually increasing	0.9791 expected: Low to moderate			—
T6	Water	5.9665 expected: Moderate or gradually increasing	0.9706 expected: Low to moderate		QR 0.64 QR above 0.5 — verify the aerobic heterotrophic bacteria (AHB) count Nonconforming	Nonconforming
NYM1 10	Water	7.6719 expected: Moderate or gradually increasing	0.9865 expected: Low to moderate	25.3% Exceeds ±20% — significant effect on the nitrifying community Nonconforming	QR 0.1 Acceptable — QR ≤ 0.5 Conforming	Nonconforming

Diversity (Shannon / Simpson): read as a trend across the before / during / after phases (rising = recovery), compared with the expected level per phase. **Respiration:** QR ≤ 0.5 acceptable; above that the AHB count is checked (≥ 1000 CFU/g = not suitable, below = not suitable without microbial augmentation). **Nitrification:** inhibition / stimulation within ±20%.