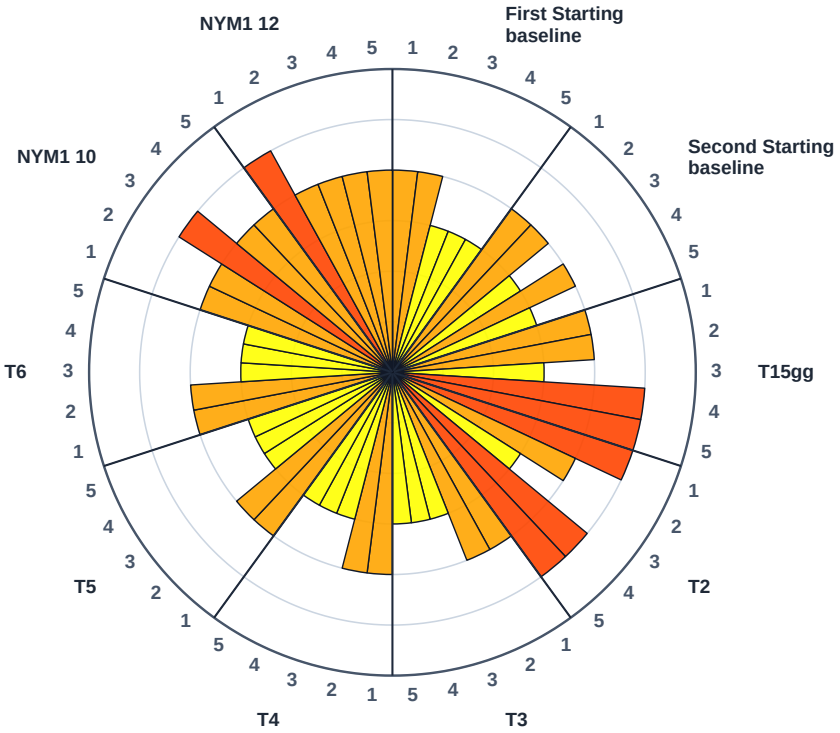
Ecotoxicology Analysis

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:	*Daphnids*
Producers:	*Algae*, *Lettuce aquatic*
Destruent:	*A. fischeri 15*, *A. fischeri 30*

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

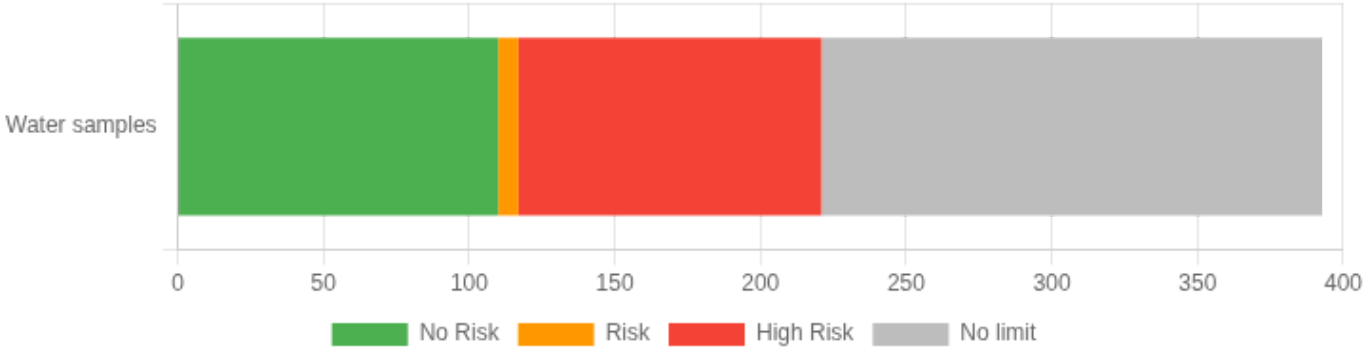
During Remediation

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

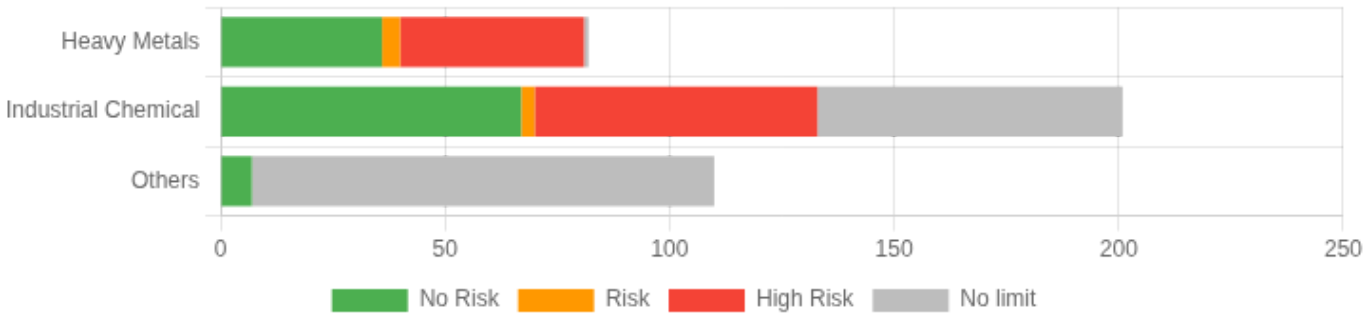
No Risk — at/below limit Risk — over limit (up to 50%) High Risk — more than 50% over limit

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 NH4)**	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 NH4)**	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 NH4)**	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%.