# Supplementary Material

A screen shot of a graph

AI-generated content may be incorrect.

Figure S1. The pH in the leachate is becoming increasingly acidic with time. This is particularly visible for pH at the influent for both locations. For simplicity, both Boelstad and Spillhaug are displayed, but not coloured by location.

Table S1. Boelstad is listed at the top and Spillhaug at bottom of each row. Columns from left: Contaminants and mean values for influent and effluent, with minimum and maximum values in parenthesis. Threshold limits and values of similar landfills in parenthesis, according to European Parliament and Council (2013)\*,NGI (2012) \*\* and Knutsen et al. (2019)\*\*\*.

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| **Chemical Compound** | **Location** | **Influent Mean**  **(Min-Max)**  **[µg/l]** | **Effluent Mean**  **(Min-Max)**  **[µg/l]** | **AA-EQS fresh/coastal\***  **(Mean Values)\*\*/\*\*\* [µg/l]** | **<LOQ (Influent/Effluent) [%]** | **Median Removal [%]** | **Number of Samples** |
| *pH* | Boelstad | 6.9 (6.4-7.9) | 7.8 (7.1-8.2) | 7.0-7.1\*\* |  |  | 639 |
| Spillhaug | 6.9 (6.4-8.2) | 7.6 (7.3-8.6) | 284 |
| *Acenaphthene* | Boelstad | 0.2 (0.005-0.6) | 0.005 (0.005-0.005) | 3.8/3.8\* | 12/100 | 98 | *25* |
| Spillhaug | 0.1 (0.08-0.2) | 0.005 (0.005-0.005) | 0/100 | 96 | 15 |
| *Ammonium-N (NH4+-N)* | Boelstad | 52,800 (9,100-93,700) | 17,100 (10-52,400) | 68,000-87,000\*\* | 0/7 | 67 | 54 |
| Spillhaug | 18 900 (2,200-24,500) | 773 (20-13,900) | 0/25 | 99 | 20 |
| *BTEX* | Boelstad | 2 (0.05-8.4) | 3.8 (0-2.7) |  | 21/69 | 69 | 29 |
| Spillhaug | 7.1 (0.4-1.2) | 2.5 (0.05-0.5) | 0/100 | 69 | 16 |
| *Benzene* | Boelstad | 1.3 (0.1-4.8) | 1.2 (0.1-0.6) |  | 36/96 | 84 | 25 |
| Spillhaug | 7 (0.3-1.2) | 0.1 (0.05-0.1) | 0/100 | 87 | 16 |
| *COD* | Boelstad | 113,000 (45,700-238,000) | 75,000 (35,000-215,000) |  | 0/0 | 35 | 56 |
| Spillhaug | 46,000 (5,000-82,500) | 34,700 (17,400-60,000) | 5/0 | 29 | 20 |
| *Cr* | Boelstad | 2.5 (1.0-3.7) | 1.2 (0.5-7.7) | 3.4/3.4\*  7.1-18\*\* | 3/47 | 59 | 30 |
| Spillhaug | 1.8 (0.5-6.8) | 1.0 (0.5-6.1) | 24/65 | 55 | 17 |
| *Fluorene* | Boelstad | 0.1 (0.005-0,4) | 0.008 (0.005-0.01) | 1.5/1.5\* | 16/100 | 94 | 25 |
| Spillhaug | 0.05 (0,03-0,09) | 0.009 (0.005-0.01) | 0/100 | 81 | 15 |
| *Fe* | Boelstad | 23,500 (830-76,100) | 3,300 (12-34,800) | 13 800-28,100\*\* | 0/15 | 93 | 53 |
| Spillhaug | 17,800 (5-39,00) | 900 (5-7,500) | 5/30 | 99 | 20 |
| *Mn* | Boelstad | 1,500 (500-2,200) | 500 (1.5-3,700) |  | 0/22 | 82 | 32 |
| Spillhaug | 2,800 (0.5-4,000) | 200 (0.5-500) | 5/11 | 95 | 18 |
| *Ni* | Boelstad | 9.5 (5.0-14.3) | 7.2 (3.0-11.9) | 4/8.6\*(0-0.4)\*\*\* | 3/3 | 21 | 30 |
| Spillhaug | 3.6 (0.3-5.3) | 2.7 (0.3-5.1) | 33/38 | 25 | 18 |
| *N* | Boelstad | 59,000 (118,300-110,000) | 33,000 (12,300-61,200) | (68,000-96,200)\*\* | 0/0 | 45 | 54 |
| Spillhaug | 121,100 (4,300-33,200) | 10,000 (2,000-54,500) | 0/0 | 67 | 20 |
| *PFHxA* | Boelstad | 0.03 (0.01-0.04) | 0.04 (0.03-0.06) |  | 20/0 | (-)53 | 5 |
| Spillhaug | 0.03 (0.03-0.03) | 0.02(0.02-0.02) | 0/0 | 21 | 1 |
| *PFOA* | Boelstad | 0.07 (0.04-0.1) | 0.07 (0.05-0.08) | 9.1/9.1\* (0.07-1.8)\*\*\* | 00/0 | (-)1 | 7 |
| Spillhaug | 0.05 (0.05-0.05) | 0.04(0.04-0.04) | 0/0 | 25 | 1 |
| *PFOS* | Boelstad | 0.04 (0.02-0.06) | 0.06 (0.02-0.05) | 0.00065/  0.00013\*  (0.02-0.16) \*\*\* | 0/0 | (-)29 | 7 |
| Spillhaug | 0.03 (0.02-0.03) | 0.03 (0.02-0.02) | 0/0 | 27 | 1 |
| P | Boelstad | 172 (56-450) | 107 (5-850) |  | 0/7 | 25 | 43 |
| Spillhaug | 35 (5-213) | 16 (5-30) | 22/22 | (-)21 | 18 |
| Suspended matter | Boelstad | 77,800 (15,000-38,800) | 57,000(1,000-337,000) | 46,500-88,500 | 0/38 | 88 | 40 |
| Spillhaug | 33,500 (4,300-52,000) | 4,400 (1,000-42,000) | 0/83 | 94 | 18 |
| TOC | Boelstad | 40,600 (18,000-160,000) | 26,200 (12,600-82,300) |  | 0/0 | 29 | 52 |
| Spillhaug | 18,000 (7,500-28,000) | 11,000 (37,000 | 0/0 | 19 | 20 |
| Zn | Boelstad | 50.5 (1-561) | 18.8 (1-198) | 11/3.4\*  60-74\*\* | 9/31 | 66 | 32 |
| Spillhaug | 9.8 (2-30) | 15.5 (0.02-137) | 50/60 | 50 | 20 |

Table S3. Overview of the statistical results from the linear mixed-effect model. Contaminants with a statistically significant association between predictor variables and the response variable (p < 0.05) are highlighted in bold.

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
|  | **Fixed Effects** | | | | **Random Effects** | | |
| **Contaminant** | **Variable** | **Estimate** | **Std.Error** | **Pr(>|t|)** | **Groups** | **Variance** | **Std.**  **Dev.** |
| Acenaphthene  (Yeo- Johnson transformed) | Intercept | -0,065 | 0,321 | 0,875 | Location | 0,168 | 0,410 |
| pH | -0,420 | 0,151 | **0,009** |
| Temperature | -0,129 | 0,143 | 0,373 | Residual | 0,731 | 0,855 |
| Year | -0,303 | 0,148 | **0,049** |
| Precipitation | 0,187 | 0,138 | 0,184 |
| **Contaminant** | **Variable** | **Estimate** | **Std.Error** | **Pr(>|t|)** | **Groups** | **Variance** | **Std.Dev.** |
| Ammonium-N  (Yeo- Johnson transformed) | Intercept | -0,190 | 0,621 | 0,811 | Location | 0,757 | 0,870 |
| pH | 0,145 | 0,114 | 0,209 |
| Temperature | 0,273 | 0,084 | **0,002** | Residual | 0,576 | 0,760 |
| Year | 0,222 | 0,117 | 0,061 |
| Precipitation | -0,219 | 0,082 | **0,009** |
| **Contaminant** | **Variable** | **Estimate** | **Std.Error** | **Pr(>|t|)** | **Groups** | **Variance** | **Std.Dev.** |
| BTEX (no transformation) | Intercept | -7,346 | 0,403 | **0,043** | Location | 0,244 | 0,494 |
| pH | -0,404 | 0,220 | 0,076 |
| Temperature | -0,326 | 0,213 | 0,135 | Residual | 1,45 | 1,21 |
| Year | -0,324 | 0,256 | 0,215 |
| Precipitation | -0,276 | 0,196 | 0,168 |
| **Contaminant** | **Variable** | **Estimate** | **Std.Error** | **Pr(>|t|)** | **Groups** | **Variance** | **Std.Dev.** |
| Chromium (Cr)  (log-transformed (ln)) | Intercept | -6,65 | 0,127 | **0,023** | Location | 0,019 | 0,137 |
| pH | -0,068 | 0,108 | 0,530 |
| Temperature | -0,108 | 0,081 | 0,193 | Residual | 0,254 | 0,504 |
| Year | -0,293 | 0,108 | **0,011** |
| pH\*Temperature | -0,05 | 0,080 | 0,508 |
| **Contaminant** | **Variable** | **Estimate** | **Std.Error** | **Pr(>|t|)** | **Groups** | **Variance** | **Std.Dev.** |
| Fluorene  (Yeo- Johnson transformed) | Intercept | -0,099 | 0,441 | 0,860 | Location | 0,351 | 0,593 |
| pH | -0,371 | 0,150 | **0,019** |
| Temperature | -0,080 | 0,143 | 0,577 | Residual | 0,725 | 0,851 |
| Year | -0,216 | 0,148 | 0,153 |
| Precipitation | 0,061 | 0,138 | 0,660 |
| **Contaminant** | **Variable** | **Estimate** | **Std.Error** | **Pr(>|t|)** | **Groups** | **Variance** | **Std.Dev.** |
| Iron (Fe)  (Yeo- Johnson transformed) | Intercept | -0,061 | 0,227 | 0,834 | Location | 0,085 | 0,291 |
| pH | -0,325 | 0,130 | **0,015** |
| Temperature | 0,188 | 0,095 | 0,051 | Residual | 0,728 | 0,854 |
| Year | 0,139 | 0,134 | 0,303 |
| Precipitation | -0,144 | 0,093 | 0,125 |
| **Contaminant** | **Variable** | **Estimate** | **Std.Error** | **Pr(>|t|)** | **Groups** | **Variance** | **Std.Dev.** |
| Manganese (Mn)  (Yeo- Johnson transformed) | Intercept | 0,140 | 0,714 | 0,877 | Location | 1,00 | 1,00 |
| pH | 0,029 | 0,109 | 0,794 |
| Temperature | -0,193 | 0,094 | **0,046** | Residual | 0,458 | 0,677 |
| Year | 0,102 | 0,109 | 0,350 |
| Precipitation | -0,189 | 0,093 | **0,049** |
| **Contaminant** | **Variable** | **Estimate** | **Std.Error** | **Pr(>|t|)** | **Groups** | **Variance** | **Std.Dev.** |
| Nickel (no transformation) | Intercept | -0,056 | 0,283 | 0,878 | Location | 0,121 | 0,347 |
| pH | 0,183 | 0,174 | 0,297 |
| Temperature | -0,135 | 0,144 | 0,356 |
| Year | -0,105 | 0,172 | 0,544 | Residual | 0,919 | 0,959 |
| Precipitation | -0,020 | 0,139 | 0,886 |
| **Contaminant** | **Variable** | **Estimate** | **Std.Error** | **Pr(>|t|)** | **Groups** | **Variance** | **Std.Dev.** |
| Nitrogen  (log-transformed (ln)) | Intercept | 2,697 | 0,559 | 0,131 | Location | 0,602 | 0,776 |
| pH | 0,154 | 0,140 | 0,272 |
| Temperature | 0,145 | 0,099 | 0,148 | Residual | 0,673 | 0,820 |
| Year | 0,296 | 0,140 | **0,037** |
| Precipitation | -0,011 | 0,096 | 0,910 |
| **Contaminant** | **Variable** | **Estimate** | **Std.Error** | **Pr(>|t|)** | **Groups** | **Variance** | **Std.Dev.** |
| Phosphorus (P) (no transformation) | Intercept | -3,06 | 0,795 | 0,162 | Location | 1,169 | 1,081 |
| pH | 0,048 | 0,213 | 0,822 |
| Temperature | 0,226 | 0,174 | 0,202 |
| Year | 0,006 | 0,214 | 0,980 | Residual | 1,065 | 1,032 |
| Precipitation | -0,030 | 0,146 | 0,836 |
| **Contaminant** | **Variable** | **Estimate** | **Std.Error** | **Pr(>|t|)** | **Groups** | **Variance** | **Std.Dev.** |
| Suspended matter (no transformation) | Intercept | 3,465 | 0,191 | **0,041** | Location | 0,051 | 0,226 |
| pH | -0,133 | 0,132 | 0,318 |
| Temperature | -0,042 | 0,114 | 0,714 |
| Year | -0,025 | 0,134 | 0,854 | Residual | 0,555 | 0,745 |
| Precipitation | -0,012 | 0,109 | 0,915 |
| **Contaminant** | **Variable** | **Estimate** | **Std.Error** | **Pr(>|t|)** | **Groups** | **Variance** | **Std.Dev.** |
| TOC (no transformation) | Intercept | 1,70 | 0,651 | 0,233 | Location | 0,804 | 0,897 |
| pH | 0,112 | 0,189 | 0,557 |
| Temperature | 0,059 | 0,129 | 0,650 |
| Year | 0,019 | 0,194 | 0,921 | Residual | 1,128 | 1,062 |
| Precipitation | -0,277 | 0,177 | 0,122 |
| **Contaminant** | **Variable** | **Estimate** | **Std.Error** | **Pr(>|t|)** | **Groups** | **Variance** | **Std.Dev.** |
| Zinc (no transformation) | Intercept | -4,70 | 0,403 | 0,063 | Location | 0,224 | 0,474 |
| pH | 0,347 | 0,249 | 0,174 |
| Temperature | 0,121 | 0,222 | 0,588 |
| Year | 0,120 | 0,240 | 0,620 | Residual | 1,73 | 1,31 |
| Precipitation | 0,272 | 0,206 | 0,197 |

A group of graphs showing different values

AI-generated content may be incorrect.

Figure S2. Plot of scaled fixed effects for iron (Yeo-Johnson transformed).

A group of graphs showing different values

AI-generated content may be incorrect.

Figure S3. Plot of scaled fixed effects for chromium (natural logarithm).

Table S3. Overview of contaminants measured in leachate from Boelstad and Spillhaug. Values in brackets are standard deviation (SD). Season “winter” is defined as leachate dropping below 8 °C and “summer” is when leachate exceeds 8 °C.

| LOCATION  (“B” = Boelstad,  “S” = Spillhaug) | Contaminant | Year | Mean difference measured Value [mg/l] | Mean difference measured Value Summer [mg/l] | Mean difference measured Value Winter [mg/l] | Mean Treatment Removal [%] | Mean Treatment Removal Summer [%] | Mean Treatment Removal Winter [%] | Values <LOQ [%in/%out] | Temperature Category |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| B | Acenaphthene | 2010-2023 | 2,3e-04  (1,58e-04) | 2,24e-04  (1,4e-04) | 2,5e-04  (2,19e-04) | 87,0 (28) | 89,4 (24,3) | 79,5 (39,4) | 12/100 | Total: 25  Summer: 19 Winter: 6 |
| S | 2010-2023 | 1,17e-04  (3,16e-05) | 1,12e-04 (2,34e-05) | 1,49e-04  (7,14e-05) | 95,7 (0,996) | 95,6 (0,91) | 96,4 (1,69) | 0/100 | Total: 15  Summer: 13 Winter: 2 |
| B | Ammonium-N | 1995-2023 | 39,9 (32) | 48,5 (32) | 28,4 (28,6) | 55,9 (41,6) | 70,6 (29,5) | 36 (47,4) | 0/6 | Total: 80  Summer: 46 Winter: 34 |
| S | 1999-2023 | 11,5 (12,2) | 14,1 (11,4) | 4,39 (12,1) | 6,88 (199) | 26,9 (195) | -48,0 (216) | 0/17 | Total: 30  Summer: 22 Winter: 8 |
| B | Arsenic | 2003-2023 | 4,54e-04  (5,79e-04) | 4,78e-04 (6,11e-04) | 3,69e-04  (0,0004,75e-04) | 27,9 (30,7) | 29,4 (31) | 22,5 (31,6) | 59/69 | Total: 32  Summer: 25 Winter: 7 |
| S | 2008-2023 | 2,8e-04  (4,26e-04) | 3,15e-04  (4,4e-04) | 0 (0) | 30,5 (35,1) | 34,3 (35,4) | 0 (0) | 72/94 | Total: 18  Summer: 16 Winter: 2 |
| B | BOD 5 | 1999-2023 | 4,31 (19,9) | 3,37  (4,87) | 6,07  (33,7) | 33,9 (76,3) | 44,5 (66,7) | 14 (71) | 19/32 | Total: 46  Summer: 30 Winter: 16 |
| S | 1999-2023 | -0,434 (10,1) | -1,72 (11,2) | 2,93 (5,93) | -17,9 (118) | -28,2 (135) | 9,09 (52,2) | 55/62 | Total: 29  Summer: 21 Winter: 8 |
| B | BTEX | 2005-2023 | 1,62e-03  (2,1e-03) | 1,31 e-03  (1,72e-03) | 3,13e-03  (3,22e-03) | 51,8 (50,7) | 44,8 (52,6) | 85,7 (17) | 20/69 | Total: 29  Summer: 24 Winter: 5 |
| S | 2009-2023 | 4,62e-04  (2,22e-04) | 4,6e-04 (2,37e-04) | 4,72e-04  (1,1e-04) | 64 (26) | 64,3 (27,5) | 61,5 (16,7) | 0/100 | Total: 16  Summer: 14 Winter: 2 |
| B | Benzene | 2010-2023 | 1,16e-03  (1,48e-03) | 0,849e-03 (1,11e-03) | 2,13e-03  (2,13e-03) | 55,2 (44,9) | 48,5 (45,6) | 76,7 (38,1) | 36/96 | Total: 25  Summer: 19 Winter: 6 |
| S | 2010-2023 | 0,6e-03  (0,238e-03) | 0,59e-03  (0,254e-03) | 0,672e-03  (3,18e-05) | 83,8 (7,99) | 83,4 (8,47) | 87 (0,534) | 0/100 | Total: 16  Summer: 14 Winter: 2 |
| B | Cadmium | 1995-2023 | 3,49e-05  (9,77e-05) | 2,34e-05 (8,45e-05) | 5,96e-05 (0,000121) | 11,4 (39,8) | 12,9 (40,1) | 8,07 (40,4) | 88/83 | Total: 44  Summer: 30 Winter: 14 |
| S | 2008-2023 | 4,23e-06  (1,62e-05) | 4,76e-06 (1,72e-05) | 0 (0) | 7,29 (18,4) | 8,21 (19,4) | 0 (0) | 13/0 | Total: 18  Summer: 16 Winter: 2 |
| B | Chemical Oxygen Demand (COD) | 1995-2023 | 65,7 (69,2) | 64,9 (65,7) | 66,9 (75,2) | 33 (21,1) | 34,5 (20,2) | 30,9 (22,5) | 0/0 | Total: 87  Summer: 52 Winter: 35 |
| S | 2000-2023 | 2,03 (22) | 5,65 (20,7) | -7,92 (23,8) | -105 (287) | -69,2 (257) | -205 (358) | 13/0 | Total: 30  Summer: 22 Winter: 8 |
| B | Chloride Ion (Cl) | 1995-2017 | 36,6 (45,6) | 43,7 (44,6) | 29,3 (46,2) | 12,4 (33,5) | 17,9 (22,9) | 6,68 (41,5) | 0/0 | Total: 57  Summer: 29 Winter: 28 |
| S | 1999-2010 | -16,5 (22,3) | -10,7 (23,6) | -24,1 (19,7) | -203 (607) | -47,3 (95,4) | -403 (908) | 23/65 | Total: 16  Summer: 9 Winter: 7 |
| B | Chromium | 1997-2023 | 0,001 (0,001) | 0,001 (0,001) | 0,002 (0,001) | 51,2 (45) | 48,5 (49,4) | 62,6 (16,2) | 3/45 | Total: 31  Summer: 25 Winter: 6 |
| S | 2008-2023 | 0,001 (0,002) | 0,001 (0,002) | -0,002 (0,004) | 18,2 (104) | 38,4 (59,6) | -133 (265) | 23/65 | Total: 17  Summer: 15 Winter: 2 |
| B | Copper | 1997-2023 | -5,06e-04 (0,007) | -5,78e-04 (0,008) | -2,92e-04 (0,004) | -59,2 (179) | -70,1 (193) | -26,3 (133) | 60/52 | Total: 32  Summer: 24 Winter: 8 |
| S | 2008-2023 | 1,62e-03  (0,004) | 1,68e-03 (0,004) | 1,15e-03 (0,002) | 12,7 (74,1) | 9,97 (77,3) | 34,8 (49,3) | 78/78 | Total: 18  Summer: 16 Winter: 2 |
| B | Fluorene | 2010-2023 | 1,36e-04  (1,01e-04) | 1,33e-04 (9,01e-05) | 1,46e-04  (1,38e-04) | 76,6 (35,2) | 80,8 (30,2) | 63,4 (49,1) | 16/100 | Total: 25 Summer: 19 Winter: 6 |
| S | 2010-2023 | 4,3e-05  (1,49e-05) | 4,05e-05 (1,26e-05) | 5,9e-05  (2,47e-05) | 82 (6,95) | 81 (6,88) | 88,8 (0,571) | 0/100 | Total: 15 Summer: 13 Winter: 2 |
| B | Iron | 1995-2023 | 18,0 (18,2) | 20,5 (19,8) | 14,0 (14,6) | 71 (45) | 77,9 (37,5) | 58,9 (39,3) | 0/9,3 | Total: 86  Summer: 52 Winter: 34 |
| S | 1999-2023 | 14,7 (12,2) | 17 (11,8) | 9,38 (12,1) | -61 (520) | 20,5 (323) | -251 (814) | 0,3/20 | Total: 30  Summer: 21 Winter: 9 |
| B | Lead  . | 1995-2023 | 2,63e-04  (6,49e-04) | 1,71e-04 (3,66e-04) | 4,93e-04  (1,07e-03) | 12,8 (46,8) | 11,1 (53,2) | 17,1 (26,1) | 37/85 | Total: 42  Summer: 30 Winter: 12 |
| S | 2008-2023 | 4,23e-05  (1,11e-04) | 4,76e-05 (1,18e-04) | 0 (0) | 9,03 (24,3) | 10,2 (25,6) | 0 (0) | 88/89 | Total: 18  Summer: 16 Winter: 2 |
| B | Manganese | 1997-2023 | 1,01 (0,809) | 0,893 (0,741) | 1,11 (0,849) | 67,6 (48,7) | 66,4 (41,9) | 80,5 (52,3) | 0/21 | Total: 33  Summer: 24 Winter: 9 |
| S | 1999-2023 | 2,68 (0,97) | 2,51 (1,1) | 3,06 (0,473) | 84,8 (24,8) | 82,8 (29,7) | 91,6 (4,95) | 5/9 | Total: 22  Summer: 15 Winter: 7 |
| B | Mercury | 1995-2023 | 1,31e-06 (9,4e-05) | 1,63e-05 (7,27e-05) | -3,08e-05 (0,000126) | -12,7 (139) | 12,5 (28) | -66,7 (240) | 68/75 | Total: 44  Summer: 30 Winter: 14 |
| S | 2008-2023 | 2,95e-06  (1,27e-05) | 3,32e-06 (1,35e-05) | 0 (0) | 4,94 (22,1) | 5,55 (23,4) | 0 (0) | 72/77 | Total: 18  Summer: 16 Winter: 2 |
| B | NO3-N | 1995-2023 | -24,4 (31,4) | -30,4 (38,2) | -16,8 (18,3) | -5,43e+03 (7,31e+03) | -8,54e+03 (6,93e+03) | -1,43e+03 (2,37e+03) | 6/3 | Total: 32  Summer: 18 Winter: 14 |
| S | 2002-2023 | -1,66 (2,21) | -2,15 (2,44) | -0,92 (1,89) | -1,56e+03 (7,3e+03) | -2e+03 (2,25e+03) | -901 (1,82e+03) | 0/0 | Total: 20  Summer: 6 Winter: 4 |
| B | Naphthalene | 2010-2023 | 5,56e-04  (8,72e-04) | 3,41e-04 (5,50e-04) | 1,23e-03  (1,36e-03) | 47 (47,1) | 42,1 (46,8) | 62,4 (48,8) | 48/100 | Total: 25  Summer: 19 Winter: 6 |
| S | 2010-2023 | 8,67e-07  (3,36e-06) | 1e-06 (3,61e-06) | 0 (0) | 4,81 (18,6) | 5,56 (20) | 0 (0) | 93/100 | Total: 15  Summer: 13 Winter: 2 |
| B | Nickel | 1995-2023 | 0,002 (0,004) | 0,002 (0,003) | 4,7e-04  (7,97e-03) | -3,28e+03 (1,86e+04) | 17 (24,8) | -1,32e+04 (3,73e+04) | 3/3 | Total: 32  Summer: 24 Winter: 8 |
| S | 2008-2023 | 8,99e-04  (9,89e-04) | 9,27e-04 (1,02e-03) | 6,75e-04  (9,55e-04) | 21,1 (22,5) | 21,6 (23,1) | 17,5 (24,8) | 33/38 | Total: 18  Summer: 16 Winter: 2 |
| B | Nitrogen | 1995-2023 | 32,7 (25,9) | 37,9 (24,6) | 24,6 (26,2) | 35 (27,5) | 43,6 (18,6) | 21,8 (33,5) | 0/0 | Total: 86 Summer: 52 Winter: 34 |
| S | 1999-2023 | 5,92 (14) | 8,33 (14,8) | 0,0122 (10,3) | -32,5 (185) | 1,91 (141) | -117 (255) | 0/0 | Total: 31  Summer: 22 Winter: 9 |
| B | ∑ Oil | 2005-2023 | -0,023 (0,122) | -0,030 (0,134) | 0,011 (0,008) | -4,39e+03 (2,08e+04) | -5,33e+03 (2,29e+04) | 38,9 (18,7) | 48/78 | Total: 25  Summer: 19 Winter: 4 |
| S | 2008-2023 | 0,003 (0,010) | 0,003 (0,01) | 0 (0) | 6,9 (31,2) | 7,82 (33,2) | 0 (0) | 82/94 | Total: 17  Summer: 15 Winter: 2 |
| B | Oil (C10-C12) | 2011-2023 | 0,005 (0,007) | 0,004 (0,005) | 0,010 (0,010) | 35,7 (40,6) | 28,7 (38,2) | 56,5 (43,9) | 58/96 | Total: 24  Summer: 18 Winter: 6 |
| S | 2011-2023 | 2,18e-04  (5,84e-04) | 2,54e-04 (6,27e-04) | 0 (0) | 4,14 (12,1) | 4,83 (13,1) | 0 (0) | 86/93 | Total: 14  Summer: 12 Winter: 2 |
| B | Oil (C12-C16) | 2011-2023 | 0,002 (0,003) | 0,001 (0,002) | 0,004 (0,003) | 21,7 (36,7) | 13,6 (33,9) | 46,1 (36,3) | 58/96 | Total: 24  Summer: 18 Winter: 6 |
| S | 2011-2023 | 3,04e-04 (0,002) | 3,54e-04 (0,002) | 0 (0) | 3,26 (19,7) | 3,8 (21,4) | 0 (0) | 86/93 | Total: 14  Summer: 12 Winter: 2 |
| B | Oil (C16-C35) | 2011-2023 | 0,002 (0,006) | 0,002 (0,007) | 0 (0) | 4,8 (16,4) | 6,4 (18,8) | 0 (0) | 92/100 | Total: 24  Summer: 18 Winter: 6 |
| S | 2011-2023 | 0,002 (0,007) | 0,002 (0,007) | 0 (0) | 4,46 (16,7) | 5,21 (18) | 0 (0) | 92/100 | Total: 14  Summer: 12 Winter: 2 |
| B | Phosphorus | 1995-2023 | 0,118 (0,59) | 0,131 (0,705) | 0,093 (0,248) | 18,2 (103) | 15 (105) | 24,6 (100) | 0/5 | Total: 60 Summer: 40 Winter: 20 |
| S | 2001-2023 | 0,013 (0,056) | 0,015 (0,062) | 0,004 (0,015) | -45,9 (92) | -48,3 (94,3) | -35,6 (91) | 15/15 | Total: 26 Summer: 21 Winter: 5 |
| B | Suspended matter | 1995-2023 | 300 (1,47e+03) | 335 (1,79e+03) | 239 (601) | 47,6 (76,9) | 43,2 (82,9) | 55,4 (66,5) | 0/29 | Total: 55 Summer: 35 Winter: 20 |
| S | 2000-2023 | 18,7 (32,9) | 22,8 (24,4) | 2,29 (57,1) | -93,3 (748) | 60,5 (78) | -708 (1,65e+03) | 8/68 | Total: 25 Summer: 20 Winter: 5 |
| B | TOC | 1995-2023 | 31,2 (48,1) | 35,7 (51,2) | 23 (41,5) | 33,2 (22,7) | 35,9 (19) | 28,3 (28,3) | 0/0 | Total: 73  Summer: 47 Winter: 26 |
| S | 2000-2023 | 0,116 (7,84) | 0,609 (8,18) | -1,43 (6,99) | -21,7 (81,8) | -18,5 (85) | -31,6 (75,9) | 0/0 | Total: 29  Summer: 22 Winter: 7 |
| B | Zinc | 1997-2023 | 0,0307 (0,102) | 0,0369 (0,117) | 0,0112 (0,00903) | 28,4 (109) | 24,3 (124) | 41,1 (33,9) | 9/30 | Total: 33  Summer: 25 Winter: 8 |
| S | 1999-2023 | -0,005 (0,034) | -0,007 (0,039) | -2,35e-04 (0,011) | -25,1 (196) | -23,5 (198) | -30,2 (210) | 32/39 | Total: 31  Summer: 16 Winter: 5 |
| B | m,p-Xylene | 2010-2023 | 6,39e-04  (8,2e-04) | 5,12e-04 (7,72e-04) | 0,001  (9,07e-04) | 60,4 (36,7) | 53,9 (39,1) | 81,3 (16,5) | 24/96 | Total: 25  Summer: 19 Winter: 6 |
| S | 2010-2023 | NA | NA | 0 (0) | NA | NA | NA | 100/100 | Total: 16  Summer: 14 Winter: 2 |
| B | Σ PAH16 (USEPA) | 2005-2023 | 6,04e-04  (1,05e-03) | 3,91e-04 (5,56e-04) | 0,002 (0,002) | 13,9 (133) | 5,27 (142) | 61,3 (47,2) | 35/77 | Total: 26  Summer: 22 Winter: 4 |
| S | 2008-2023 | 1,35e-04  (6,04e-05) | 1,27e-04 (4,82e-05) | 1,94e-04  (1,29e-04) | 74,8 (17,4) | 73,7 (17,5) | 82,5 (20) | 0/82 | Total: 16  Summer: 14 Winter: 2 |
| B | 1,1,2,2-Tetrahydroperfluoro-1-decanol (PFOD) | 2021-2023 | NA | NA | NA | NA | NA | NA | 100/100 | Total: 5  Summer: 5 Winter: 0 |
| S | 2023-2023 | NA | NA | NA | NA | NA | NA | 100/100 | Total: 1  Summer: 1 Winter: 0 |
| B | 6:2 Fluorotelomer sulfonic acid (H4PFOS) | 2021-2023 | NA | NA | NA | NA | NA | NA | 100/100 | Total: 5  Summer: 5 Winter: 0 |
| S | 2023-2023 | NA | NA | NA | NA | NA | NA | 100/100 | Total: 1  Summer: 1 Winter: 0 |
| B | 8:2 Fluorotelomer sulfonic acid | 2021-2023 | NA | NA | NA | NA | NA | NA | 100/100 | Total: 5 Summer: 5 Winter: 0 |
| S | 2023-2023 | NA | NA | NA | NA | NA | NA | 100/100 | Total: 1  Summer: 1 Winter: 0 |
| B | Acenaphthylene | 2010-2023 | 4,4e-07 (2,2e-06) | 0 (0) | 1,83e-06  (4,49e-06) | 2,75 (13,8) | 0 (0) | 11,5 (28,1) | 96/100 | Total: 25 Summer: 19 Winter: 6 |
| S | 2010-2023 | NA | NA | NA | NA | NA | NA | 100/100 | Total: 15  Summer: 13 Winter: 2 |
| B | Anthracene | 2010-2023 | 4,2e-06  (6,61e-06) | 4,37e-06 (5,98e-06) | 3,67e-06  (8,98e-06) | 20,4 (30,8) | 23,2 (31,8) | 11,5 (28,1) | 68/100 | Total: 25  Summer: 19 Winter: 6 |
| S | 2010-2023 | NA | NA | NA | NA | NA | NA | 100/100 | Total: 15 Summer: 13 Winter: 2 |
| B | Antimony | 2017-2019 | 3,33e-05  (5,51e-05) | 3,22e-05 (6,71e-05) | 3,5e-05  (4,03e-05) | 12,8 (18,4) | 9,58 (18,9) | 18,1 (20) | 57/57 | Total: 8  Summer: 5 Winter: 3 |
| B | Benz(a)antracene | 2010-2023 | NA | NA | NA | NA | NA | NA | 100/100 | Total: 25 Summer: 19 Winter: 6 |
| S | 2010-2023 | NA | NA | NA | NA | NA | NA | 100/100 | Total: 15 Summer: 13 Winter: 2 |
| B | Benzo(a)pyrene | 2010-2023 | NA | NA | NA | NA | NA | NA | 100/100 | Total: 25 Summer: 19 Winter: 6 |
| S | 2010-2023 | NA | NA | NA | NA | NA | NA | 100/100 | Total: 15 Summer: 13 Winter: 2 |
| B | Benzo(bjk)fluoranthene | 2022-2023 | NA | NA | NA | NA | NA | NA | 100/100 | Total: 4  Summer: 4 Winter: 0 |
| S | 2022-2023 | NA | NA | NA | NA | NA | NA | 100/100 | Total: 1 Summer: 1 Winter: 1 |
| B | Benzo(ghi)perylene | 2010-2023 | NA | NA | NA | NA | NA | NA | 100/100 | Total: 25  Summer: 19 Winter: 6 |
| S | 2010-2023 | NA | NA | NA | NA | NA | NA | 100/100 | Total: 15  Summer: 13 Winter: 2 |
| B | Benzo(k)fluoranthene | 2010-2023 | NA | NA | NA | NA | NA | NA | 100/100 | Total: 25  Summer: 19 Winter: 6 |
| S | 2010-2023 | NA | NA | NA | NA | NA | NA | 100/100 | Total: 15  Summer: 13 Winter: 2 |
| B | Benzo[b]fluoranthene | 2010-2021 | NA | NA | NA | NA | NA | NA | 100/100 | Total: 21  Summer: 15 Winter: 6 |
| S | 2010-2021 | NA | NA | NA | NA | NA | NA | 100/100 | Total: 13 Summer: 12 Winter: 1 |
| B | Boron | 2010-2010 | 0,17 (NA) | 0,17 (NA) | NA | 24,6 (NA) | 24,6 (NA) | NA | 0/0 | Total: 1  Summer: 1 Winter: 0 |
| S | 2010-2010 | -0,015 (NA) | -0,015 (NA) | NA | -4,35 (NA) | -4,35 (NA) | NA | 0/0 | Total: 1 Summer: 1 Winter: 0 |
| B | Chrysene | 2010-2023 | NA | NA | NA | NA | NA | NA | 100/100 | Total: 25  Summer: 19 Winter: 6 |
| S | 2010-2023 | NA | NA | NA | NA | NA | NA | 100/100 | Total: 15  Summer: 13 Winter: 2 |
| B | Dibenz[a,h]anthracene | 2010-2023 | NA | NA | NA | NA | NA | NA | 100/100 | Total: 25  Summer: 19 Winter: 6 |
| S | 2010-2023 | NA | NA | NA | NA | NA | NA | 100/100 | Total: 15  Summer: 13 Winter: 2 |
| B | EtFOSE. Precursor to PFOS.. | 2021-2023 | NA | NA | NA | NA | NA | NA | 100/100 | Total: 5 Summer: 5 Winter: 0 |
| S | 2023-2023 | NA | NA | NA | NA | NA | NA | 100/100 | Total: 1  Summer: 1 Winter: 0 |
| B | Etyhlbenzene | 2010-2023 | 1,91e-04  (3,15e-04) | 1,28e-04 (2,53e-04) | 3,90e-04  (4,28e-04) | 31 (42,9) | 26 (40) | 47 (51,5) | 56/100 | Total: 25 Summer: 19 Winter: 6 |
| S | 2010-2023 | NA | NA | NA | NA | NA | NA | 100/100 | Total: 16  Summer: 14 Winter: 2 |
| B | Fluoranthene | 2010-2023 | 1,92e-06  (4,04e-06) | 2,53e-06 (4,49e-06) | NA | 13 (26,6) | 17,1 (29,5) | NA | 20/100 | Total: 25  Summer: 19 Winter: 6 |
| S | 2010-2023 | NA | NA | NA | NA | NA | NA | 100/100 | Total: 15  Summer: 13 Winter: 2 |
| B | Indeno[1,2,3-cd]pyrene | 2010-2023 | NA | NA | NA | NA | NA | NA | 100/100 | Total: 25  Summer: 19 Winter: 6 |
| S | 2010-2023 | NA | NA | NA | NA | NA | NA | 100/100 | Total: 15  Summer: 13 Winter: 2 |
| B | MeFOSA. Precursor to PFOS. | 2021-2023 | NA | NA | NA | NA | NA | NA | 100/100 | Total: 5  Summer: 5 Winter: 0 |
| S | 2023-2023 | NA | NA | NA | NA | NA | NA | 100/100 | Total: 1  Summer: 1 Winter: 0 |
| B | MeFOSE. Precursor to PFOS. | 2021-2023 | NA | NA | NA | NA | NA | NA | 100/100 | Total: 5  Summer: 5 Winter: 0 |
| S | 2023-2023 | NA | NA | NA | NA | NA | NA | 100/100 | Total: 1  Summer: 1 Winter: 0 |
| B | O-Xylene | 2010-2023 | 1,96e-04  (1,8e-04) | 1,52e-04 (1,48e-04) | 3,33e-04  (2,15e-04) | 61 (33,5) | 54,9 (35,7) | 80,3 (14,7) | 20/100 | Total: 25  Summer: 19 Winter: 6 |
| S | 2010-2023 | NA | NA | NA | NA | NA | NA | 100/100 | Total: 16  Summer: 14 Winter: 2 |
| B | Oil (C10-C40).. | 2022-2023 | NA | NA | NA | NA | NA | NA | 100/100 | Total: 4  Summer: 4 Winter: 0 |
| S | 2022-2023 | NA | NA | NA | NA | NA | NA | 100/100 | Total: 1  Summer: 1 Winter: 1 |
| B | Oil (C35-C40) | 2020-2023 | NA | NA | NA | NA | NA | NA | 100/100 | Total: 5  Summer: 5 Winter: 0 |
| S | 2022-2023 | NA | NA | NA | NA | NA | NA | 100/100 | Total: Summer: 1 Winter: 1 |
| B | Perfluorobutanesulfonic acid (PFBS) | 2021-2023 | -4e-07 (6,54e-06) | -4e-07 (6,54e-06) | NA (NA) | -34,7 (82,5) | -34,7 (82,5) | NA (NA) | 100/***60*** | Total: 5 Summer: 5 Winter: 0 |
| S | 2023-2023 | NA | NA | NA | NA | NA | NA | 100/100 | Total: 1  Summer: 1 Winter: 0 |
| B | Perfluorodecanoic acid (PFDA) | 2021-2023 | NA | NA | NA | NA | NA | NA | 100/100 | Total: 5  Summer: 5 Winter: 0 |
| S | 2023-2023 | NA | NA | NA | NA | NA | NA | 100/100 | Total: 1  Summer: 1 Winter: 0 |
| B | Perfluorododecanoic acid (PFDoDA). | 2021-2023 | NA | NA | NA | NA | NA | NA | 100/100 | Total: 5 Summer: 5 Winter: 0 |
| S | 2023-2023 | NA | NA | NA | NA | NA | NA | 100/100 | Total: 1 Summer: 1 Winter: 0 |
| B | Perfluorohexanoic acid (PFHxA) | 2021-2023 | -1,52e-05  (1,15e-05) | -1,52e-05 (1,15e-05) | NA (NA) | -91,2 (119) | -91,2 (119) | NA (NA) | 20/0 | Total: 5  Summer: 5 Winter: 0 |
| S | 2023-2023 | 6e-06 (NA) | 6e-06 (NA) | NA | 21,4 (NA) | 21,4 (NA) | NA | 0/0 | Total: 1  Summer: 1 Winter: 0 |
| B | Perfluorohexsan sulfonate (PFHxS). | 2021-2023 | -2,2e-06 (3,03e-06) | -2,2e-06 (3,03e-06) | NA | -30 (44,7) | -30 (44,7) | NA | 40/40 | Total: 5  Summer: 5 Winter: 0 |
| S | 2023-2023 | NA | NA | NA | NA | NA | NA | 100/100 | Total: 1  Summer: 1 Winter: 0 |
| B | Perfluorononanoic acid (PFNA) | 2021-2023 | NA | NA | NA | NA | NA | NA | 100/100 | Total: 5  Summer: 5 Winter: 0 |
| S | 2023-2023 | NA | NA | NA | NA | NA | NA | 100/100 | Total: 1  Summer: 1 Winter: 0 |
| B | Perfluorooctanesulfonamide (PFOSA) | 2021-2023 | NA | NA | NA | NA | NA | NA | 100/100 | Total: 5  Summer: 5 Winter: 0 |
| S | 2023-2023 | NA | NA | NA | NA | NA | NA | 100/100 | Total: 1 Summer: 1 Winter: 0 |
| B | Perfluorooctanesulfonic acid (PFOS) | 2019-2023 | 1,94e-06  (1,59e-05) | 1,94e-06 (1,59e-05) | NA | -4,47 (40,8) | -4,47 (40,8) | NA | 0/0 | Total: 7  Summer: 7 Winter: 0 |
| S | 2023-2023 | 6,9e-06 (NA) | 6,9e-06 (NA) | NA | 27,5 (NA) | 27,5 (NA) | NA | 0/0 | Total: 1  Summer: 1 Winter: 0 |
| B | Perfluorooctanoic acid (PFOA) | 2019-2023 | 4,83e-06  (2,58e-05) | 4,83e-06 (2,58e-05) | NA | -3,88 (34,2) | -3,88 (34,2) | NA | 0/0 | Total: 7  Summer: 7 Winter: 0 |
| S | 2023-2023 | 1,19e-05 (NA) | 1,19e-05 (NA) | NA | 25 (NA) | 25 (NA) | NA | 0/0 | Total: 1  Summer: 1 Winter: 0 |
| B | Perfluorotetradecanoic acid (PFTeDA) | 2021-2023 | NA | NA | NA | NA | NA | NA | 100/100 | Total: 5  Summer: 5 Winter: 0 |
| S | 2023-2023 | NA | NA | NA | NA | NA | NA | 100/100 | Total: 1  Summer: 1 Winter: 0 |
| B | Perfluorotridecanoic acid (PFTrDA) | 2021-2023 | NA | NA | NA | NA | NA | NA | 100/100 | Total: 5  Summer: 5 Winter: 0 |
| S | 2023-2023 | NA | NA | NA | NA | NA | NA | 100/100 | Total: 1  Summer: 1 Winter: 0 |
| B | Perfluoroundecanoic acid (PFUnA)  . | 2021-2023 | NA | NA | NA | NA | NA | NA | 100/100 | Total: 5  Summer: 5 Winter: 0 |
| S | 2023-2023 | NA | NA | NA | NA | NA | NA | 100/100 | Total: 1  Summer: 1 Winter: 0 |
| B | Phenanthrene | 2010-2023 | 8,53e-05  (7,94e-05) | 7,65e-05 (6,61e-05) | 1,13e-04  (1,15e-04) | 57,5 (44,2) | 56,6 (44,6) | 60,4 (46,8) | 36/100 | Total: 25 Summer: 19 Winter: 6 |
| S | 2010-2023 | NA | NA | NA | NA | NA | NA | 100/100 | Total: 15  Summer: 13 Winter: 2 |
| B | Pyrene | 2010-2023 | 1,32e-06  (3,11e-06) | 1,74e-06 (3,48e-06) | 0 (0) | 9,94 (23,3) | 13,1 (26) | 0 (0) | 84/100 | Total: 25  Summer: 19 Winter: 6 |
| S | 2010-2023 | NA | NA | NA | NA | NA | NA | 100/100 | Total: 15  Summer: 13 Winter: 2 |
| B | Sodium | 2010-2010 | 17 (NA) | 17 (NA) | NA | 21 (NA) | 21 (NA) | NA | 0/0 | Total: 1  Summer: 1 Winter: 0 |
| S | 2010-2010 | 7 (NA) | 7 (NA) | NA | 22,6 (NA) | 22,6 (NA) | NA | 0/0 | Total: 1  Summer: 1 Winter: 0 |
| B | Sulfluramid (N-EtFOSA). Precursor. | 2021-2023 | NA | NA | NA | NA | NA | NA | 100/100 | Total: 5  Summer: 5 Winter: 0 |
| S | 2023-2023 | NA | NA | NA | NA | NA | NA | 100/100 | Total: 1  Summer: 1 Winter: 0 |
| B | Toluene | 2010-2023 | -6,92e-05 (0,000247) | -8,16e-05 (0,000281) | -3e-05 (7,35e-05) | -76,7 (273) | -101 (311) | -1,21 (2,96) | 96/84 | Total: 25  Summer: 19 Winter: 6 |
| S | 2010-2023 | 6,25e-06  (5,04e-05) | 7,14e-06 (5,41e-05) | 0 (0) | -5,98 (44,1) | -6,84 (47,3) | 0 (0) | 94/94 | Total: 16  Summer: 14 Winter: 2 |
| B | Σ Nitrate/nitrite  . | 2022-2022 | -65,5 (3,76) | -65,5 (3,76) | NA (NA) | -6,55e+04 (NaN) | -6,55e+04 (3,76e+03) | NA (NA) | 0/0 | Total: 2  Summer: 2 Winter: 0 |
| S | 2005-2022 | -3,97 (2,46) | -2,54 (1,91) | -5,4 (2,51) | -2,44e+03 (1,52e+03) | -2,54e+03 (1,91e+03) | -2,35e+03 (1,81e+03) | 0/0 | Total: 2  Summer: 2 Winter: 2 |
| B | Σ PFAS | 2019-2023 | 4,56e-05  (1,67e-04) | 4,56e-05 (1,67e-04) | NA | -14,8 (45) | -14,8 (47,2) | NA | 0/0 | Total: 7  Summer: 7 Winter: 0 |
| S | 2023-2023 | 2,48e-05 (NA) | 2,48e-05 (NA) | NA | 24,6 (NA) | 24,6 (NA) | NA | 0/0 | Total: 1  Summer: 1 Winter: 0 |
| B | Σ Xylenes | 2020-2023 | 1,79e-04  (2,45e-04) | 1,22 e-04  (2,01 e-04) | 5,75 e-04 (NA) | 36,1 (42,5) | 28,6 (39,8) | 88,5 (NA) | 50/100 | Total: 8  Summer: 7 Winter: 1 |
| S | 2021-2023 | NA | NA | NA | NA | NA | NA | 100/100 | Total: 4  Summer: 3 Winter: 1 |

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Figure S4. Displayed treatment of environmental stressors with seasonal changes. Samples from winter (leachate temperature below 8 °C) is marked in circles. Samples without marking is defined as “summer” (leachate temperature above 8 °C).