Table 1

|  |  |  |  |
| --- | --- | --- | --- |
| I-geo value ; classes | Pollution level | Er classes | Er level |
| I-geo ≤ 0 ; 0 | Unpolluted | Er < 40 | Low potential ecological risk |
| I-geo = 0-1 ; 1 | Unpolluted to moderately polluted | Er = 40-80 | Moderate potential ecological risk |
| I-geo = 1-2 ; 2 | Moderately polluted | Er = 80-160 | Significant potential ecological risk |
| I-geo = 2-3 ; 3 | Moderately to strongly polluted | Er = 160-320 | High potential ecological risk |
| I-geo = 3-4 ; 4 | Strongly polluted | Er > 320 | Very high potential ecological risk |
| I-geo = 4-5 ; 5 | Strongly to very strongly polluted |  |  |
| RI classes | Risk level | CF classes | Contamination level |
| RI <150 | Low ecological risk | CF <1 | Low contamination |
| RI = 150-300 | Moderate ecological risk | CF = 1-3 | Moderate contamination |
| RI = 300-600 | Significant ecological risk | CF = 3-6 | Considerable contamination |
| RI > 600 | High ecological risk | CF > 6 | High contamination |

Table 2

|  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| ID | Fe | Mn | Cr | V | Ni | Co | Th | U | Station |
| Yo1 | 21471.58 | 309.8 | 615.78 | 37 | 9 | 5 | 8.9 | 1.46 | Yoyo II |
| Yo2 | 40355.38 | 1084.3 | 684.2 | 102 | 14 | 7 | 51.7 | 7.66 |
| Yo3 | 99314.8 | 2943.1 | 752.62 | 272 | 19 | 15 | 150 | 19.2 |
| Yo5 | 28115.88 | 542.15 | 821.04 | 53 | 11 | 5 | 30 | 4.2 |
| Yo6 | 116450.1 | 3407.8 | 684.2 | 318 | 22 | 18 | 161 | 21.9 |
| PYo0 | 16645.72 | 154.9 | 752.62 | 23 | 9 | 4 | 2.9 | 0.8 |
| Min | 16645.72 | 154.9 | 615.78 | 23 | 9 | 4 | 2.9 | 0.8 |
| Max | 116450.1 | 3407.8 | 821.04 | 318 | 22 | 18 | 161 | 21.9 |
| Mean | 53725.58 | 1407.01 | 718.41 | 134.17 | 14 | 9 | 67.42 | 9.20 |
| SD | 43040.91 | 1413.26 | 71.756 | 128.23 | 5.44 | 5.97 | 70.44 | 9.16 |
| Lje | 12169.56 | 154.9 | 684.2 | 15 | 7 | 3 | 3.1 | 0.61 | Kribi |
| Lji | 46230.34 | 1471.55 | 684.2 | 156 | 19 | 10 | 40.6 | 7.11 |
| Lo2 | 45181.24 | 697.05 | 615.78 | 72 | 14 | 10 | 8 | 1.82 |
| Lo1 | 17065.36 | 232.35 | 752.62 | 22 | 7 | 2 | 2.4 | 0.62 |
| Lb | 19862.96 | 309.8 | 752.62 | 24 | 9 | 4 | 4.3 | 0.9 |
| EB2 | 31822.7 | 542.15 | 615.78 | 60 | 12 | 6 | 6.9 | 1.42 |
| Eb1 | 31053.36 | 232.35 | 889.46 | 59 | 14 | 6 | 4.4 | 1.25 |
| Min | 12169.56 | 154.9 | 615.78 | 15 | 7 | 2 | 2.4 | 0.61 |
| Max | 46230.34 | 1471.55 | 889.46 | 156 | 19 | 10 | 40.6 | 7.11 |
| Mean | 29055.07 | 520.02 | 713.52 | 58.29 | 11.71 | 5.86 | 9.96 | 1.96 |
| SD | 13416.81 | 461.93 | 95.60 | 48.49 | 4.39 | 3.18 | 13.66 | 2.31 |
| CD | 23709.66 | 309.8 | 957.88 | 30 | 11 | 5 | 3.9 | 0.87 | Campo |
| CE | 41894.06 | 1084.3 | 752.62 | 84 | 14 | 8 | 12.5 | 2.67 |
| CRL | 48258.6 | 929.4 | 684.2 | 91 | 17 | 8 | 9.9 | 2.51 |
| CB1 | 4755.92 | 77.45 | 547.36 | 5 | 4 | 1 | 0.46 | 0.21 |
| CB2 | 24199.24 | 309.8 | 684.2 | 30 | 10 | 5 | 2.1 | 0.74 |
| CV1 | 27486.42 | 542.15 | 821.04 | 52 | 10 | 6 | 12.6 | 2.07 |
| CV2 | 20282.6 | 309.8 | 547.36 | 28 | 9 | 4 | 10.2 | 1.15 |
| Min | 4755.92 | 77.45 | 547.36 | 5 | 4 | 1 | 0.46 | 0.21 |
| Max | 48258.6 | 1084.3 | 957.88 | 91 | 17 | 8 | 12.6 | 2.67 |
| Mean | 27226.64 | 508.96 | 713.52 | 45.71 | 10.71 | 5.29 | 7.38 | 1.46 |
| SD | 14330.80 | 368.35 | 147.05 | 31.68 | 4.07 | 2.43 | 5.09 | 0.95 |
| Average Shale | 47,200 | 850 | 90 | 130 | 68 | 19 | 12 | 3.7 | - |

Average shale, after Turekian and Wedepohl (1961)

Table 3

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| *Elements* | *Fe* | *Mn* | *Cr* | *V* | *Ni* | *Co* | *Th* | *U* |
| Fe | 1 |  |  |  |  |  |  |  |
| Mn | 0.98 | 1 |  |  |  |  |  |  |
| Cr | 0.03 | -0.02 | 1 |  |  |  |  |  |
| V | 0.983 | 0.99 | 0.00 | 1 |  |  |  |  |
| Ni | 0.893 | 0.85 | 0.12 | 0.88 | 1 |  |  |  |
| Co | 0.98 | 0.95 | 0.02 | 0.96 | 0.93 | 1 |  |  |
| Th | 0.93 | 0.96 | 0.00 | 0.96 | 0.73 | 0.87 | 1 |  |
| U | 0.94 | 0.98 | 0.01 | 0.97 | 0.77 | 0.89 | 1.00 | 1 |

Appendix 1

|  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| ID | Fe | Mn | Cr | V | Ni | Co | Th | U | Station |
| Yo1 | -1.72 | -2.04 | 2.19 | -2.40 | -3.50 | -2.51 | -1.02 | -1.93 | Yoyo II |
| Yo2 | -0.81 | -0.23 | 2.34 | -0.93 | -2.87 | -2.03 | 1.52 | 0.46 |
| Yo3 | 0.49 | 1.21 | 2.48 | 0.48 | -2.42 | -0.93 | 3.06 | 1.79 |
| Yo5 | -1.33 | -1.23 | 2.60 | -1.88 | -3.21 | -2.51 | 0.74 | -0.40 |
| Yo6 | 0.72 | 1.42 | 2.34 | 0.71 | -2.21 | -0.66 | 3.16 | 1.98 |
| PYo0 | -2.09 | -3.04 | 2.48 | -3.08 | -3.50 | -2.83 | -2.63 | -2.79 |
| Lje | -2.54 | -3.04 | 2.34 | -3.70 | -3.87 | -3.25 | -2.54 | -3.19 |  |
| Lji | -0.61 | 0.21 | 2.34 | -0.32 | -2.42 | -1.51 | 1.17 | 0.36 |  |
| Lo2 | -0.65 | -0.87 | 2.19 | -1.44 | -2.87 | -1.51 | -1.17 | -1.61 |  |
| Lo1 | -2.05 | -2.46 | 2.48 | -3.15 | -3.87 | -3.83 | -2.91 | -3.16 | Kribi |
| Lb | -1.83 | -2.04 | 2.48 | -3.02 | -3.50 | -2.83 | -2.07 | -2.62 |  |
| EB2 | -1.15 | -1.23 | 2.19 | -1.70 | -3.09 | -2.25 | -1.38 | -1.97 |  |
| Eb1 | -1.19 | -2.46 | 2.72 | -1.72 | -2.87 | -2.25 | -2.03 | -2.15 |  |
| CD | -1.58 | -2.04 | 2.83 | -2.70 | -3.21 | -2.51 | -2.21 | -2.67 |  |
| CE | -0.76 | -0.23 | 2.48 | -1.22 | -2.87 | -1.83 | -0.53 | -1.06 |  |
| CRL | -0.55 | -0.46 | 2.34 | -1.10 | -2.58 | -1.83 | -0.86 | -1.14 |  |
| CB1 | -3.90 | -4.04 | 2.02 | -5.29 | -4.67 | -4.83 | -5.29 | -4.72 | Campo |
| CB2 | -1.55 | -2.04 | 2.34 | -2.70 | -3.35 | -2.51 | -3.10 | -2.91 |  |
| CV1 | -1.37 | -1.23 | 2.60 | -1.91 | -3.35 | -2.25 | -0.51 | -1.42 |  |
| CV2 | -1.80 | -2.04 | 2.02 | -2.80 | -3.50 | -2.83 | -0.82 | -2.27 |  |

Appendix 2

|  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| ID | CF | | | | | | | | DC | PLI | Station |
| Fe | Mn | Cr | V | Ni | Co | Th | U |
| Yo1 | 0.45 | 0.36 | 6.84 | 0.28 | 0.13 | 0.26 | 0.74 | 0.39 | 9.48 | 0.49 |  |
| Yo2 | 0.85 | 1.28 | 7.60 | 0.78 | 0.21 | 0.37 | 4.31 | 2.07 | 17.47 | 1.20 |  |
| Yo3 | 2.10 | 3.46 | 8.36 | 2.09 | 0.28 | 0.79 | 12.50 | 5.19 | 34.78 | 2.56 |  |
| Yo5 | 0.60 | 0.64 | 9.12 | 0.41 | 0.16 | 0.26 | 2.50 | 1.14 | 14.82 | 0.80 | Yoyo II |
| Yo6 | 2.47 | 4.01 | 7.60 | 2.45 | 0.32 | 0.95 | 13.42 | 5.92 | 37.13 | 2.86 |  |
| PYo0 | 0.35 | 0.18 | 8.36 | 0.18 | 0.13 | 0.21 | 0.24 | 0.22 | 9.88 | 0.33 |  |
| Lje | 0.26 | 0.18 | 7.60 | 0.12 | 0.10 | 0.16 | 0.26 | 0.16 | 8.84 | 0.27 |  |
| Lji | 0.98 | 1.73 | 7.60 | 1.20 | 0.28 | 0.53 | 3.38 | 1.92 | 17.62 | 1.40 |  |
| Lo2 | 0.96 | 0.82 | 6.84 | 0.55 | 0.21 | 0.53 | 0.67 | 0.49 | 11.06 | 0.76 |  |
| Lo1 | 0.36 | 0.27 | 8.36 | 0.17 | 0.10 | 0.11 | 0.20 | 0.17 | 9.74 | 0.29 | Kribi |
| Lb | 0.42 | 0.36 | 8.36 | 0.18 | 0.13 | 0.21 | 0.36 | 0.24 | 10.28 | 0.39 |  |
| EB2 | 0.67 | 0.64 | 6.84 | 0.46 | 0.18 | 0.32 | 0.58 | 0.38 | 10.07 | 0.60 |  |
| Eb1 | 0.66 | 0.27 | 9.88 | 0.45 | 0.21 | 0.32 | 0.37 | 0.34 | 12.49 | 0.53 |  |
| CD | 0.50 | 0.36 | 10.64 | 0.23 | 0.16 | 0.26 | 0.33 | 0.24 | 12.73 | 0.44 |  |
| CE | 0.89 | 1.28 | 8.36 | 0.65 | 0.21 | 0.42 | 1.04 | 0.72 | 13.56 | 0.89 |  |
| CRL | 1.02 | 1.09 | 7.60 | 0.70 | 0.25 | 0.42 | 0.83 | 0.68 | 12.59 | 0.88 |  |
| CB1 | 0.10 | 0.09 | 6.08 | 0.04 | 0.06 | 0.05 | 0.04 | 0.06 | 6.52 | 0.10 | Campo |
| CB2 | 0.51 | 0.36 | 7.60 | 0.23 | 0.15 | 0.26 | 0.18 | 0.20 | 9.50 | 0.38 |  |
| CV1 | 0.58 | 0.64 | 9.12 | 0.40 | 0.15 | 0.32 | 1.05 | 0.56 | 12.82 | 0.66 |  |
| CV2 | 0.43 | 0.36 | 6.08 | 0.22 | 0.13 | 0.21 | 0.85 | 0.31 | 8.60 | 0.44 |  |

Appendix 3

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| ID | Mn | Cr | Ni | RI | Station |
| Yo1 | 0.36 | 13.68 | 0.66 | 14.71 |  |
| Yo2 | 1.28 | 15.20 | 1.03 | 17.51 |  |
| Yo3 | 3.47 | 16.72 | 1.40 | 21.58 |  |
| Yo5 | 0.64 | 18.25 | 0.81 | 19.69 | YOYO II |
| Yo6 | 4.01 | 15.20 | 1.61 | 20.83 |  |
| PYo0 | 0.18 | 16.72 | 0.66 | 17.57 |  |
| Lje | 0.18 | 15.20 | 0.51 | 15.90 |  |
| Lji | 1.73 | 15.20 | 1.40 | 18.33 |  |
| Lo2 | 0.82 | 13.68 | 1.03 | 15.53 |  |
| Lo1 | 0.27 | 16.72 | 0.51 | 17.51 | Kribi |
| Lb | 0.36 | 16.72 | 0.66 | 17.75 |  |
| EB2 | 0.64 | 13.68 | 0.88 | 15.20 |  |
| Eb1 | 0.27 | 19.77 | 1.03 | 21.07 |  |
| CD | 0.36 | 21.29 | 0.81 | 22.46 |  |
| CE | 1.28 | 16.72 | 1.03 | 19.03 |  |
| CRL | 1.09 | 15.20 | 1.25 | 17.55 |  |
| CB1 | 0.09 | 12.16 | 0.29 | 12.55 | Campo |
| CB2 | 0.36 | 15.20 | 0.74 | 16.30 |  |
| CV1 | 0.64 | 18.25 | 0.73 | 19.62 |  |
| CV2 | 0.36 | 12.16 | 0.66 | 13.19 |  |

Appendix 4

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| Factor loading | F1 | F2 | F3 | F4 | F5 |
| Fe | 0.387 | 0.005 | 0.069 | 0.458 | 0.098 |
| Mn | 0.387 | -0.053 | -0.110 | -0.010 | 0.750 |
| Cr | 0.011 | 0.987 | -0.143 | 0.046 | 0.041 |
| V | 0.389 | -0.026 | -0.035 | -0.184 | 0.255 |
| Ni | 0.349 | 0.135 | 0.689 | -0.553 | -0.158 |
| Co | 0.379 | 0.010 | 0.315 | 0.610 | -0.320 |
| Th | 0.373 | -0.046 | -0.488 | -0.124 | -0.404 |
| U | 0.379 | -0.040 | -0.388 | -0.247 | -0.266 |
| Eigenvalue | 6.548 | 1.018 | 0.353 | 0.048 | 0.016 |
| Variability (%) | 81.844 | 12.723 | 4.413 | 0.601 | 0.206 |
| Cumulative % | 81.844 | 94.568 | 98.981 | 99.582 | 99.788 |