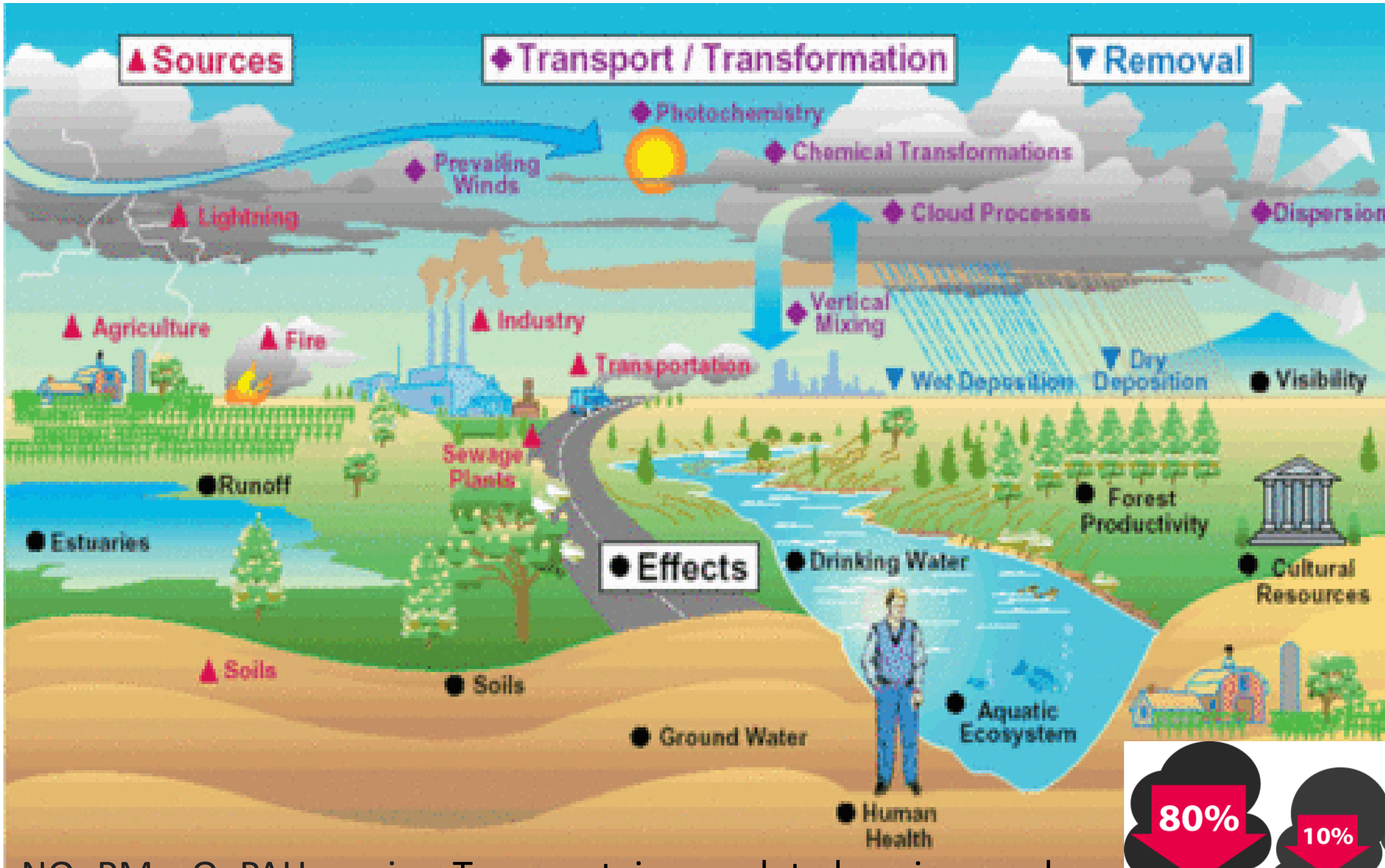
# A quick (~ 2 hours searches) review the published references about pollution, Mongolia

Tamir Puntsag
Ulaanbaatar Mongolia
27 June 2018

# ХҮРЭЭЛЭН БАЙГАА АГААР, ТҮЛШНИЙ ШАТАЛТААС ЯЛГАРАХ БОХИРДУУЛАХ БОДИС/ ambient air pollutants sources, transformation and sinks

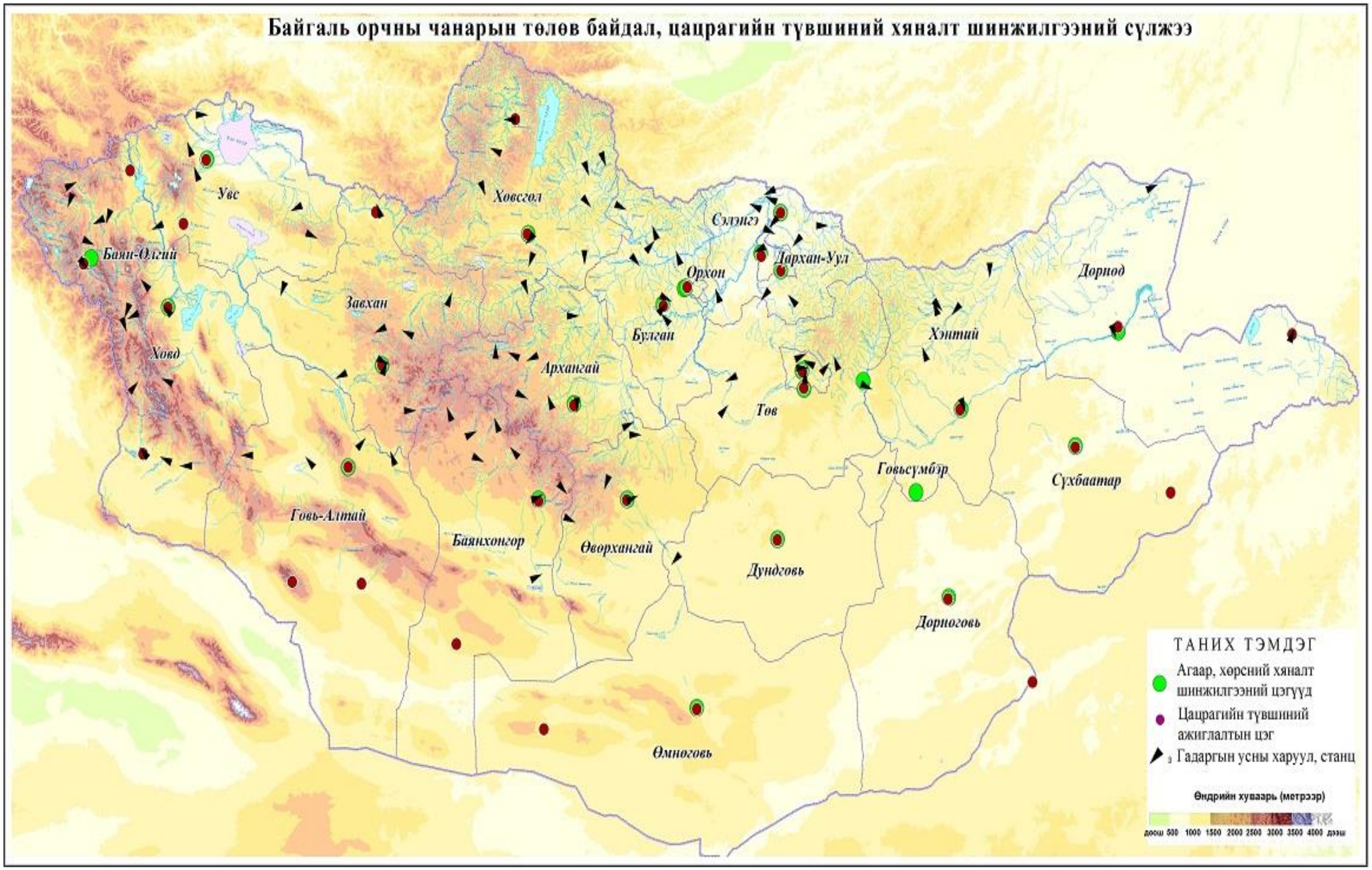




CO, $NO_x$ $PM_{10}$ $O_3$ PAHs, noise Transport, incomplete burning, coal burning

VOC- Industries, solvents Asbestos – Power generation, construction

# БАЙГАЛЬ ОРЧНЫ ХЯНАЛТ ШИНЖИЛГЭЭНИЙ УЛСЫН СҮЛЖЭЭ/ NATIONAL ENVIRONENTAL MONITORING (AIR SOIL AND WATER) STATIONS,




**AIR AND SOIL MONITORING STATIONS**

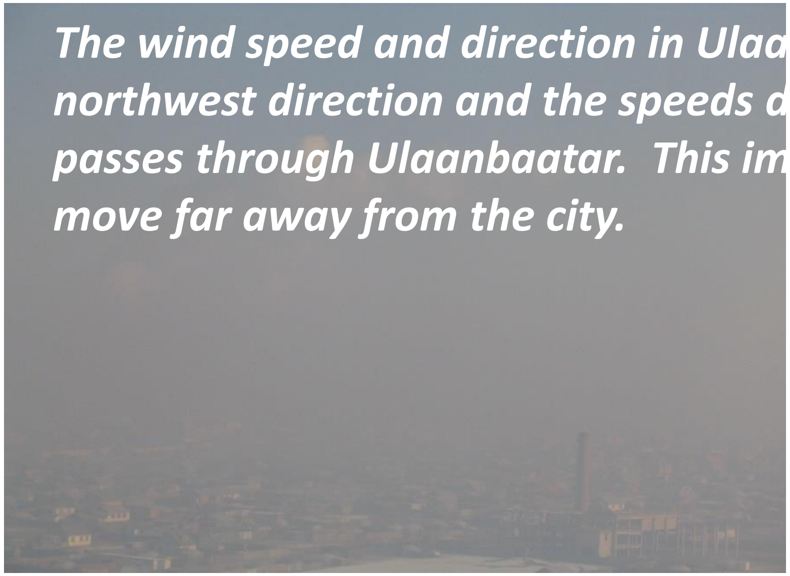
**RADIATION**

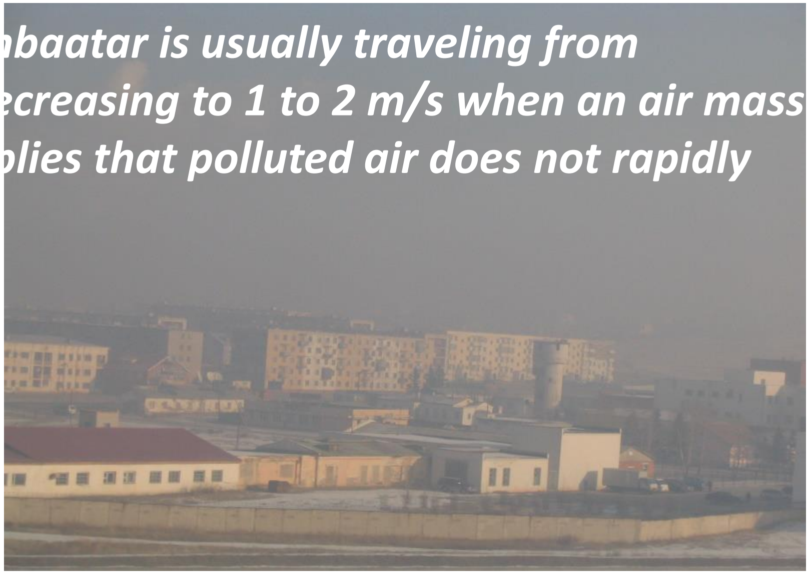
**Surface water monitoring sites and stations**

# Air quality standard with mean values

| Бохирдуулах бодисын нэр | Агаарын чанарын стандарт MNS 4585:2016 | Дундаж агууламж, мкг/м$^3$ | |
|---|---|---|---|
| | Хүлцэх агууламж, мкг/м$^3$ | 2016 оны 10-12-р сар, 2017 оны 1-2-р сарын дундаж | 2017 оны 10-12-р сар, 2018 оны 1-2-р сарын дундаж |
| PM10 тоосонцор | 100 | 182 | 172↓ |
| PM2.5 тоосонцор | 50 | 149 | 138↓ |
| Хүхэрлэг хий, $SO_2$ | 50 | 53 | 39↓ |
| Азотын давхар исэл, $NO_2$ | 50 | 53 | 50↔ |

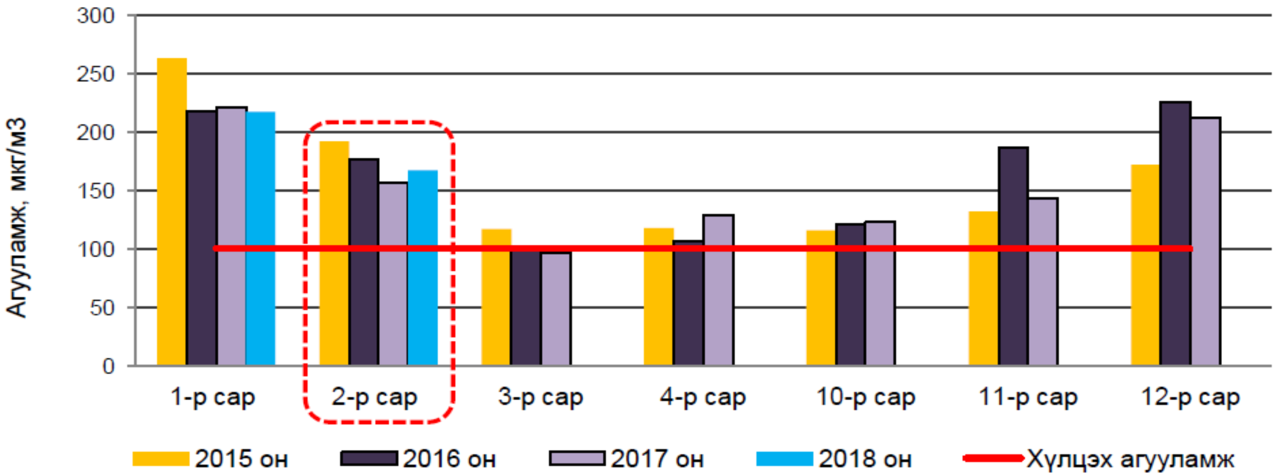
*The wind speed and direction in Ulaanbaatar is usually traveling from northwest direction and the speeds decreasing to 1 to 2 m/s when an air mass passes through Ulaanbaatar. This implies that polluted air does not rapidly move far away from the city.*





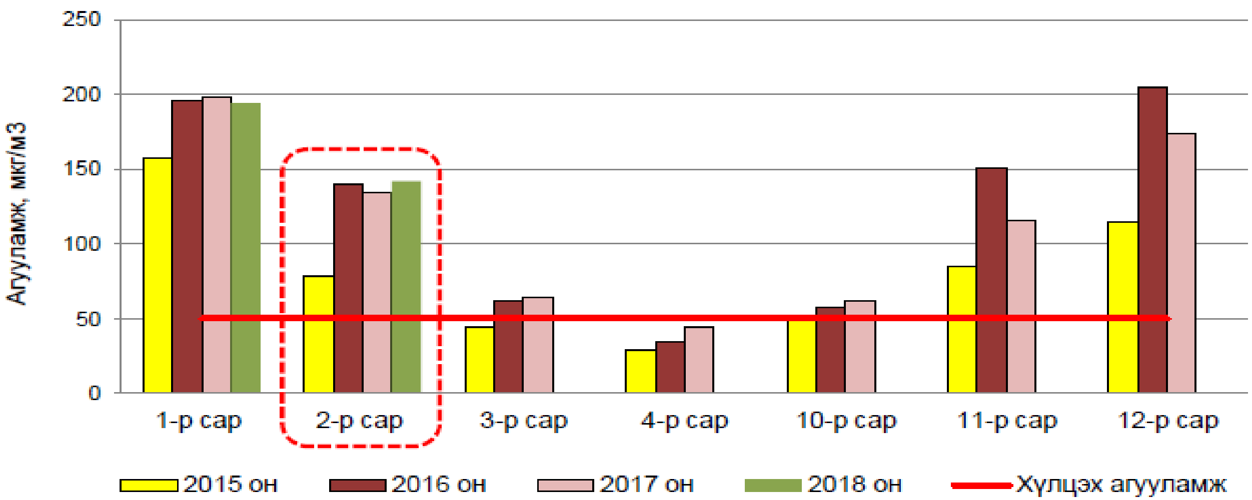
ЦАГ УУР, ОРЧНЫ ШИНЖИЛГЭЭНИЙ ГАЗАР ®
ОРЧНЫ ШИНЖИЛГЭЭНИЙ ХЭЛТЭС

**PM10 тоосонцор**




*Зураг 1. Хүйтний улирлын PM10 тоосонцрын сарын дундаж агууламж, 2015-2018он*

**PM2.5 тоосонцор**

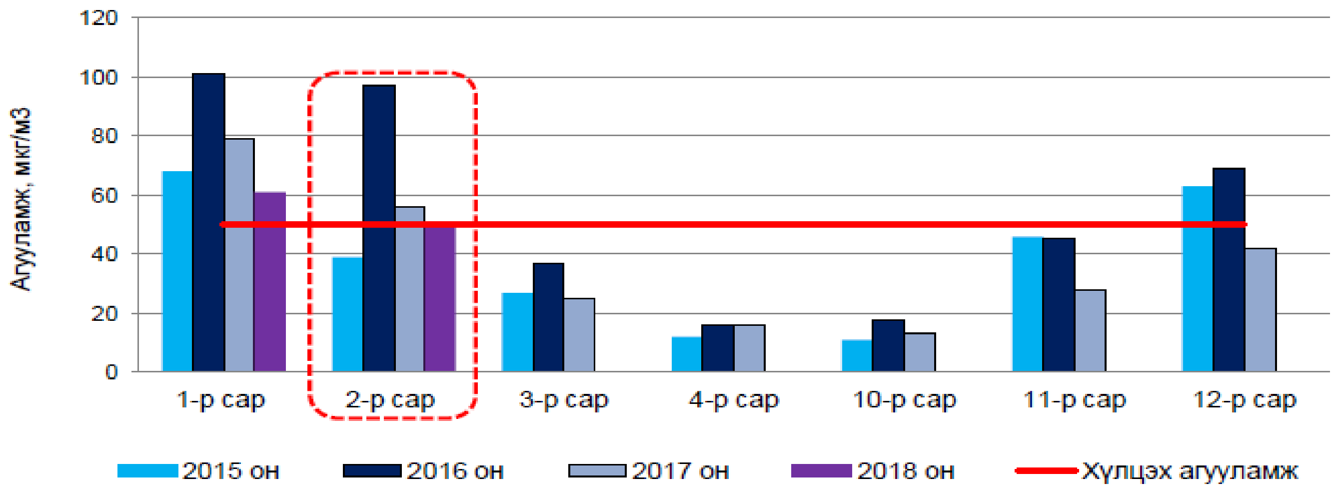



*Зураг 2. Хүйтний улирлын PM2.5 тоосонцрын сарын дундаж агууламж, 2015-2018он*

®ЦАГ УУР, ОРЧНЫ ШИНЖИЛГЭЭНИЙ ГАЗАР

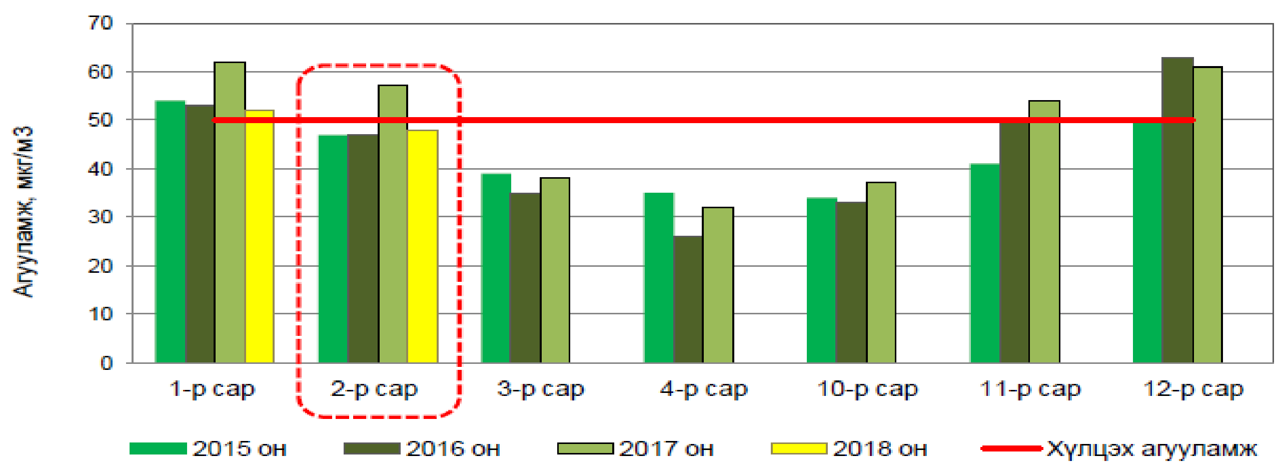
ОРЧНЫ ШИНЖИЛГЭЭНИЙ ХЭЛТЭС

**Хүхэрлэг хий ($SO_2$)**




*Зураг 3. Хүйтний улирлын хүхэрлэг хийн сарын дундаж агууламж, 2015-2018он*

**Азотын давхар исэл ($NO_2$)**



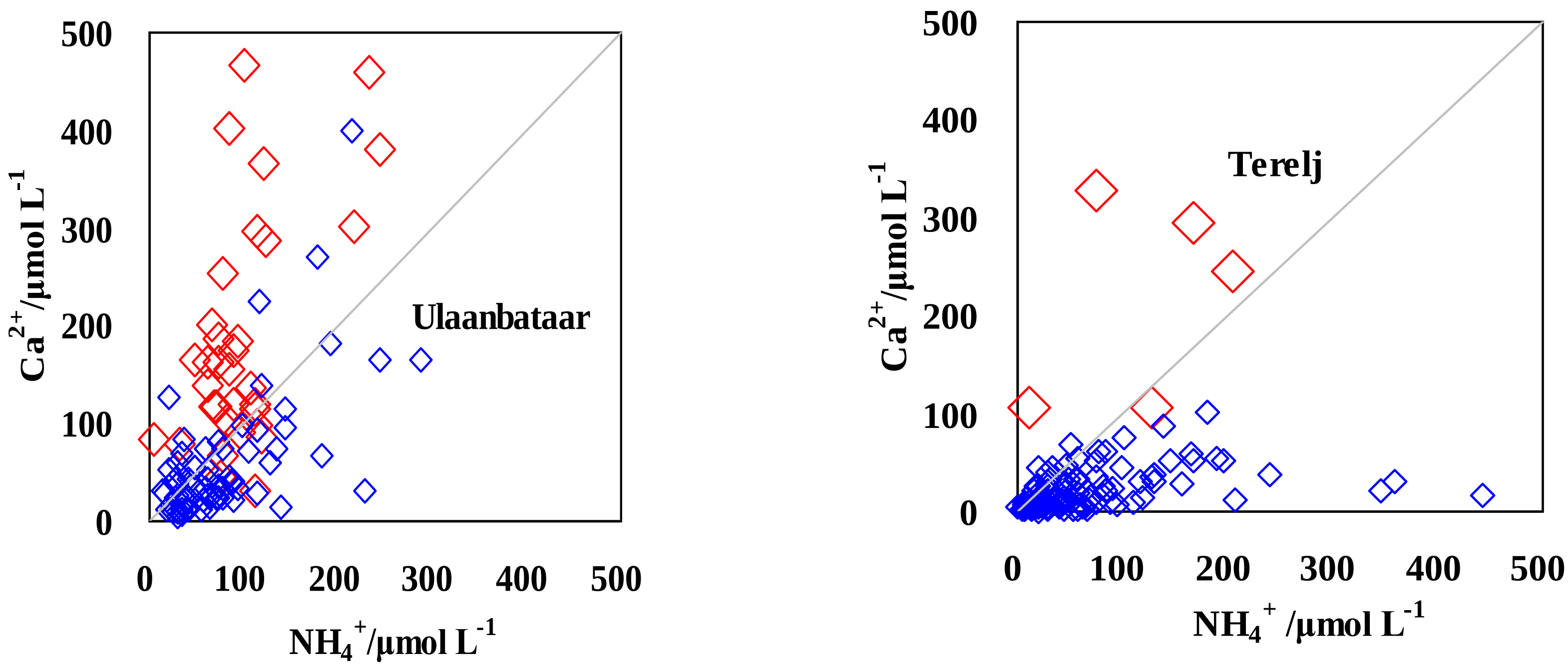

*Зураг 4. Хүйтний улирлын азотын давхар ислийн сарын дундаж агууламж, 2015-2017он*

# 1. Precipitation Chemistry in Mongolia

M. Yamada1, Bulgan2, S. Alimaa2, I. Noguchi3, and H. Hara1

# 2. Evaluation of Acid Rain for the Central Mongolia

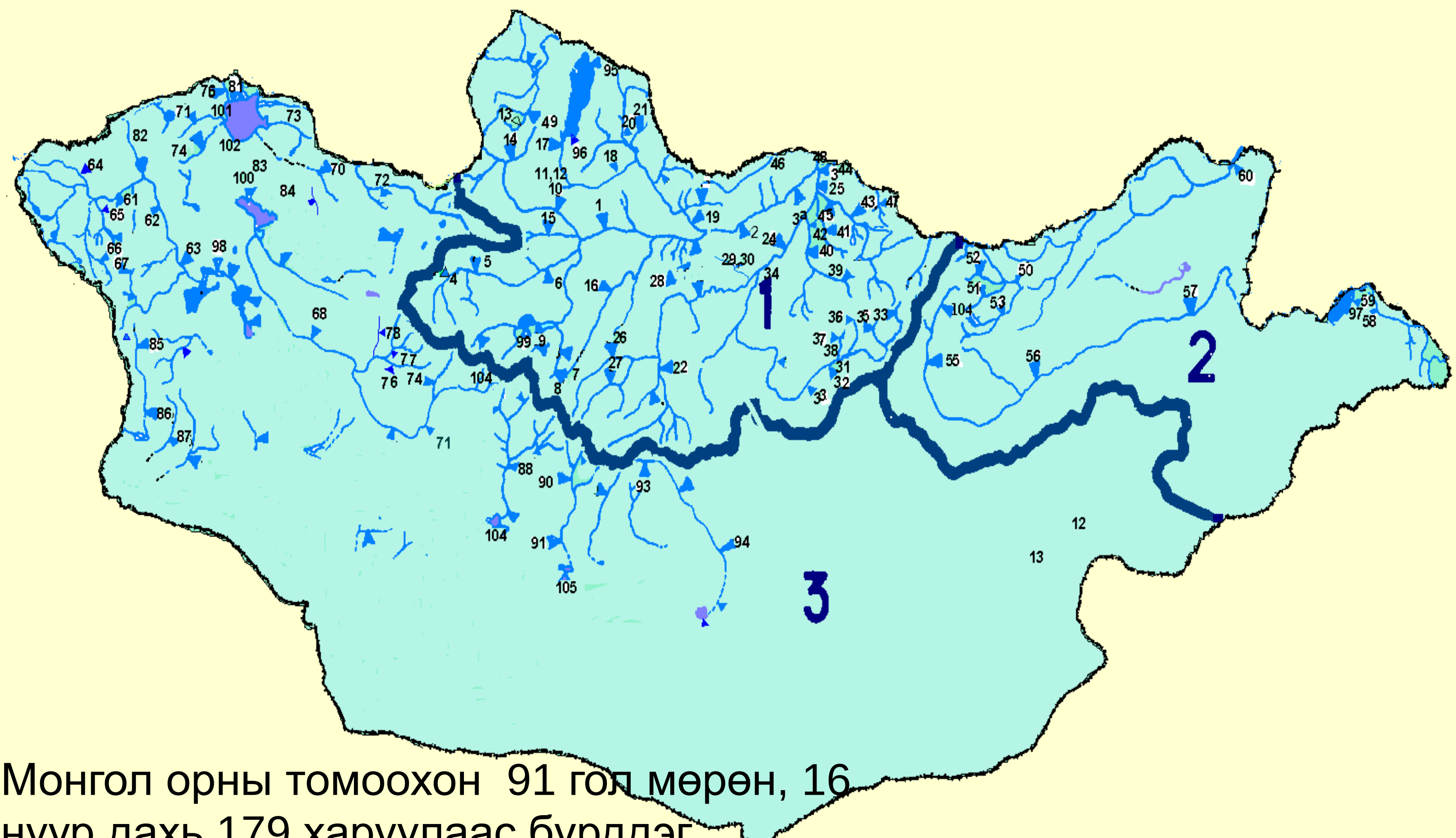
T.Bulgan



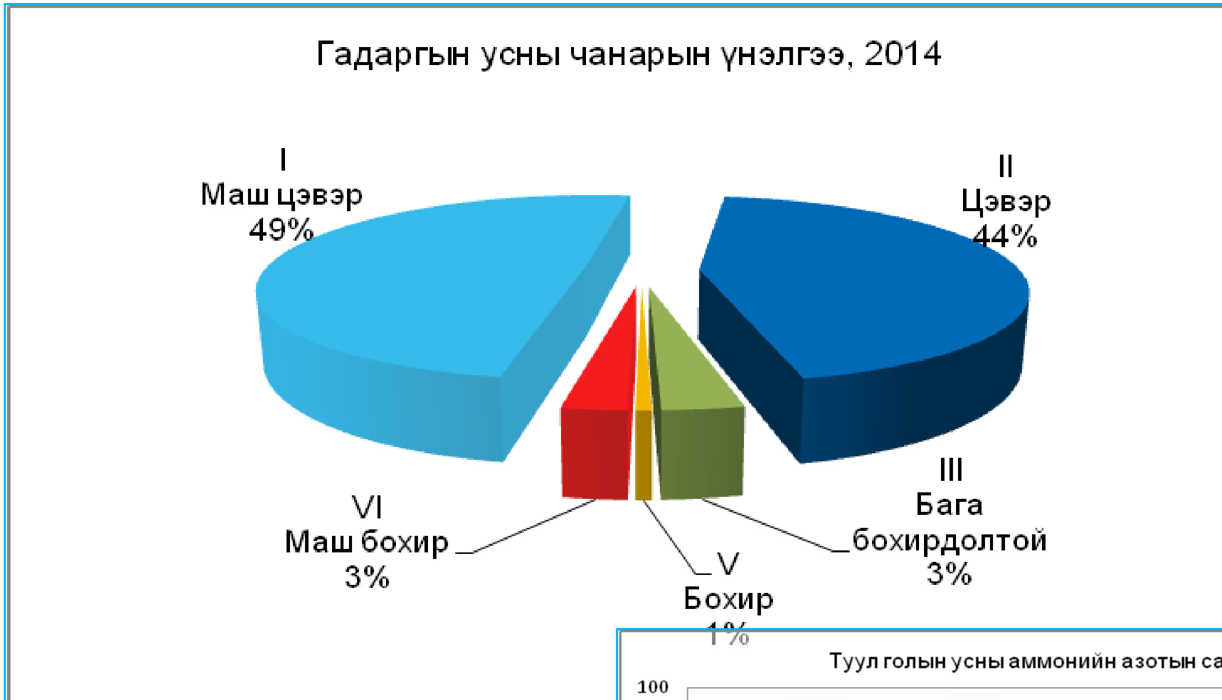

nss-$Ca^{2+}$ concentration against $NH_4^+$ in Ulaanbataar (left) and Terelj (right)
◇: pH≧6.0, ◇: pH<6.0.

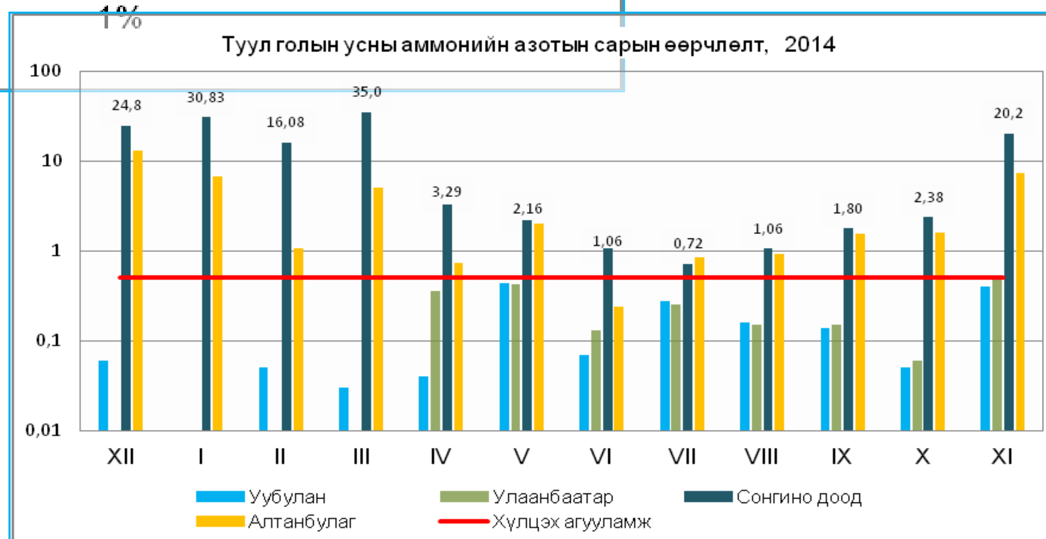
In remote area, NH4 was the most predominant cation, which accounts in average foe 44% of its cation total while in Ulaanbaatar, Ca2+ was the predominant with 51% accounts due to alkaline dust effects.

# WATER POLLUTANTS – УС БОХИРДУУЛАХ БОДИС



Монгол орны томоохон 91 гол мөрөн, 16 нуур дахь 179 харуулаас бүрддэг

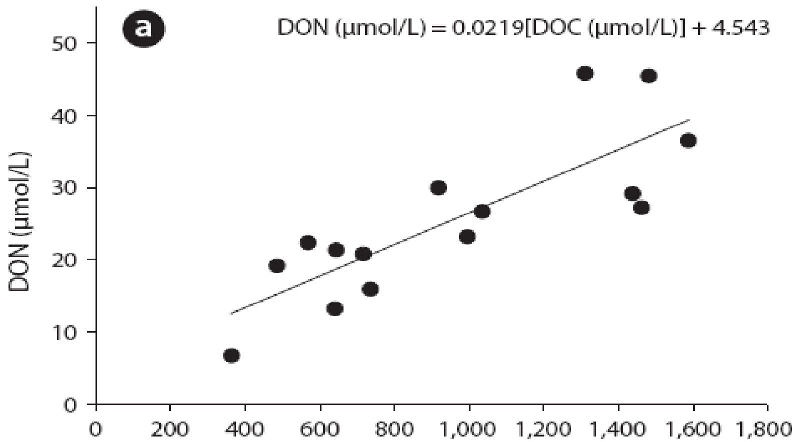

Гадаргын усны чанарын үнэлгээ, 2014
I
Маш цэвэр
49%
II
Цэвэр
44%
III
Бага
бохирдолтой
3%
V
Бохир
1%
VI
Маш бохир
3%


Туул голын усны аммонийн азотын сарын өөрчлөлт, 2014
100
10
1
0,1
0,01
24,8
30,83
16,08
35,0
3,29
2,16
1,06
0,72
1,06
1,80
2,38
20,2
XII
I
II
III
IV
V
VI
VII
VIII
IX
X
XI
Уубулан
Улаанбаатар
Сонгино доод
Алтанбулаг
Хүлцэх агууламж

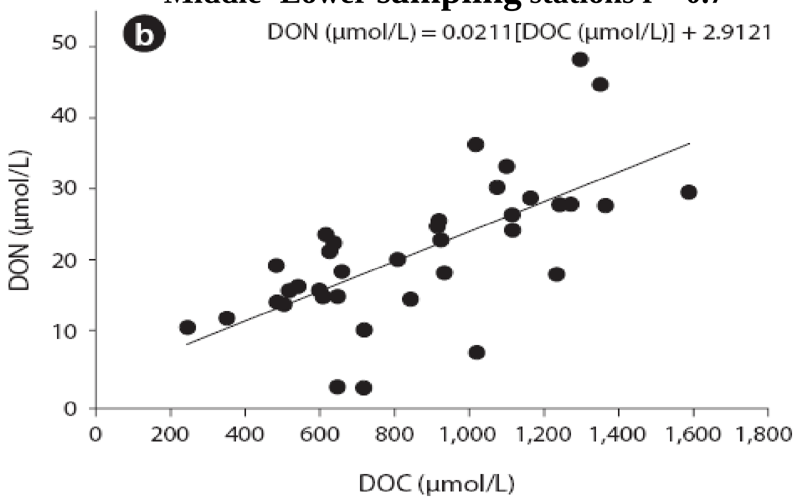
## Patterns in solute chemistry of six inlet streams to Lake Hövsgöl, Mongolia

Tamir Puntsag[1], Jeffrey S. Owen[2,5,*], Myron J. Mitchell[3], Clyde E. Goulden[4] and Patrick J. McHale[3]

**Upper sampling stations $r^2$=0.5**




**Middle+Lower sampling stations $r^2$=0.7**




Differences in solute concentrations among these streams can possibly be affected by livestock grazing, and also affected by the thickness of the permafrost active layer and general soil characteristics in the sub watersheds.

One implication of our study is that as air temperature increases and permafrost active layer depths increase in this watershed, recently-thawed soils may act as a source of both dissolved inorganic and organic N to streams.

Understanding the relationship between soil C/N ratios and surface chemistry will be required in future studies.

# High-levels of microplastic pollution in a large, remote, mountain lake

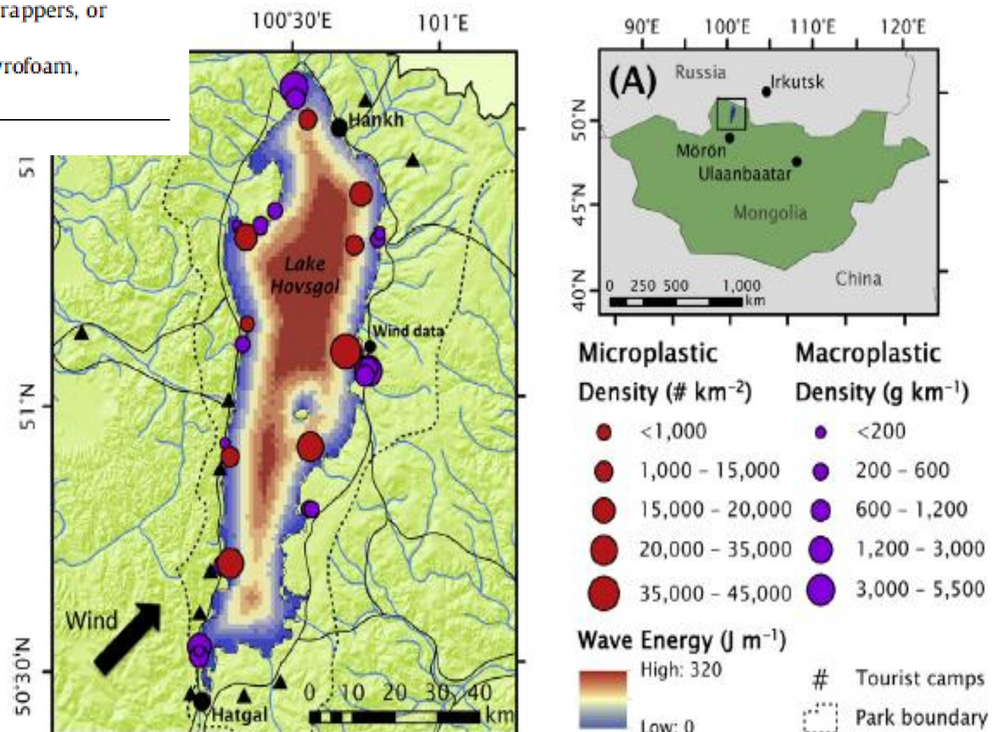
Christopher M. Free [a,*], Olaf P. Jensen [a], Sherri A. Mason [b], Marcus Eriksen [c], Nicholas J. Williamson [b], Bazartseren Boldgiv [d]

[a] Institute of Marine and Coastal Sciences, Rutgers University, 71 Dudley Road, New Brunswick, NJ 08901, USA
[b] Department of Chemistry, State University of New York College at Fredonia, 280 Central Avenue, Fredonia, NY 14063, USA
[c] 5 Gyres Institute, 2122 S. Spaulding Avenue, Los Angeles, CA 90016, USA
[d] Department of Biology, School of Arts and Sciences, National University of Mongolia, Ulaanbaatar 14201, Mongolia

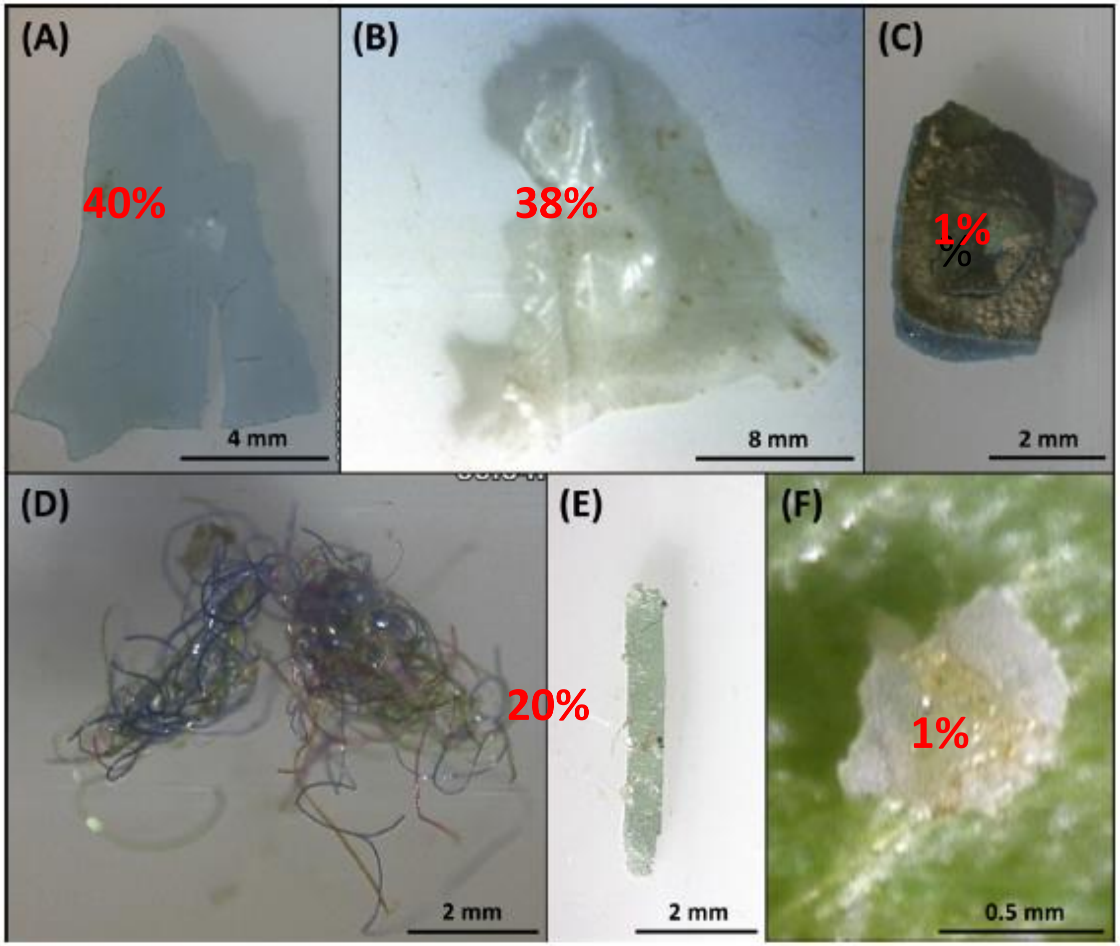
Table 1
Definitions and potential sources of microplastic types.

| Microplastic type | Definition | Potential sources |
|---|---|---|
| Fragment | Hard, jagged plastic particle | Bottles; hard, sturdy plastics |
| Line/fiber | Thin or fibrous, straight plastic | Fishing line/nets; clothing or textiles |
| Pellet | Hard, rounded plastic particle | Virgin resin pellets; facial cleansers |
| Film | Thin plane of flimsy plastic | Plastics bags, wrappers, or sheeting |
| Foam | Lightweight, sponge-like plastic | Foam floats, Styrofoam, cushioning |

C.M. Free et al. / Marine Pollution Bulletin 85 (2014) 156–163



Despite the large and growing literature on microplastics in the ocean, little information exists on microplastics in freshwater systems. This study is the first to evaluate the abundance, distribution, and composition of pelagic microplastic pollution in a large, remote, mountain lake. We quantified pelagic microplastics and shoreline anthropogenic debris in Lake Hovsgol, Mongolia. With an average microplastic density of 20,264 particles $km^{-2}$, Lake Hovsgol is more heavily polluted with microplastics than the more developed Lakes Huron and Superior in the Laurentian Great Lakes. Fragments and films were the most abundant microplastic types; no plastic microbeads and few pellets were observed. Household plastics dominated the shoreline debris and were comprised largely of plastic bottles, fishing gear, and bags. Microplastic density decreased with distance from the southwestern shore, the most populated and accessible section of the park, and was distributed by the prevailing winds. These results demonstrate that without proper waste management, low-density populations can heavily pollute freshwater systems with consumer plastics.




ig. 3. Photographs of (A) fragment, (B) film, (C) foam, (D) fiber, (E) line, and (F) pellet microplastics observed in the manta trawl samples.

Environmental Geochemistry and Health
January 2011, Volume 33, Supplement 1, pp 57–69| Cite as

# Geochemical distribution of trace element concentrations in the vicinity of Boroo gold mine, Selenge Province, Mongolia

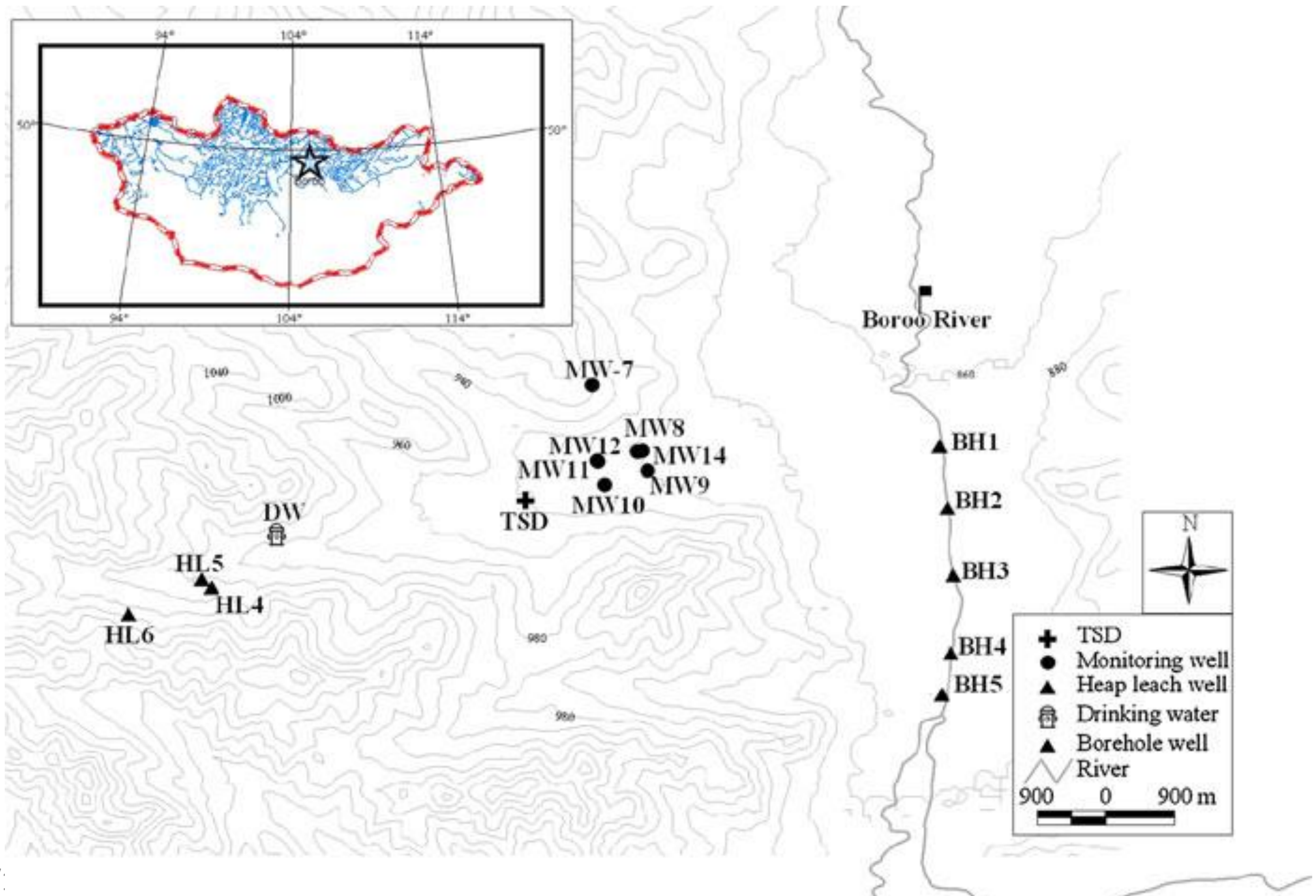


Table 3 Ranges and averages of As and heavy metal concentrations in tailing dam sediment and soils (units in mg/kg) in the vicinity of Boroo gold mine, Mongolia

| | As | Cd | Cu | Ni | Pb | Zn |
|---|---|---|---|---|---|---|
| Tailing dam sediment | 3917–4920 | 51.8–65.1 | 53.9–58.2 | 2.9–6.8 | 17.3–23.9 | 22.1–29.3 |
| | 4419 | 58.5 | 56.0 | 4.8 | 20.6 | 25.7 |
| Tailing dam area soil | 3.4–9.0 | nd[d] | 11.0–15.1 | 15.6–18.8 | 7.1–7.4 | 38.0–45.0 |
| | 6.2 | | 12.6 | 17.2 | 7.3 | 41.0 |
| Heap leach area soil | 8.6–261.4 | nd | 10.0–15.0 | 11.5–21.0 | 8.5–18.3 | 46.0–56.0 |
| | 102.3 | | 12.5 | 17.4 | 14.4 | 50.0 |
| Borehole area soil | 6.3–9.9 | nd | 18.0–29.0 | 21.6–26.2 | 9.2–13.1 | 55.0–72.0 |
| | 8.3 | | 22.5 | 23.0 | 10.9 | 60.6 |
| Control area | 3.4–3.7 | nd | 10.0–20.0 | 17.1–21.1 | 7.8–8.2 | 41.0–43.0 |
| | 3.6 | | 15.0 | 19.1 | 8.0 | 42.0 |
| Mongolia soil standard[a] | 6.0 | 3.0 | 100 | 150 | 100 | 300 |
| Natural soil[b] | 6.0 | 0.4 | 30 | | 35 | 90 |
| Tolerable level[c] | 20 | 3.0 | 100 | 150 | 100 | 300 |

[a] MNS 5850:2008 Mongolian standard (2008)

[b] Bowen (1979)

[c] Kabata-Pendias and Pendias (1984)

[d] Not detected

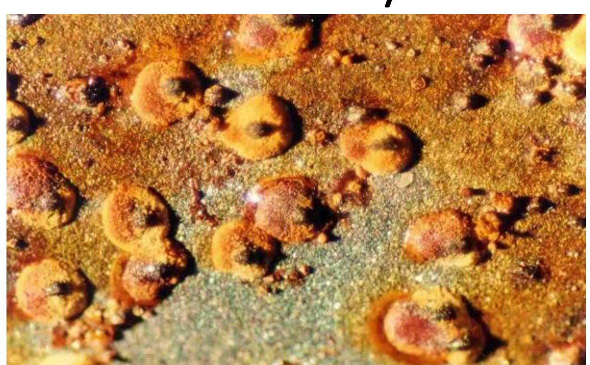
# Process water pollution types/ Үйлдвэрийн усны бохирдлын төрлүүд

Scale/Хаг

Biofouling/Гадаргууд наалдсан нянгийн давхарга

Pollution/БОХИРДОЛТ

Corrosion/КОРРОЗИ



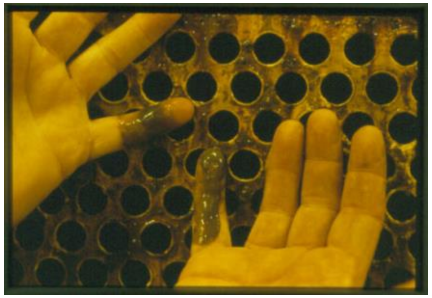
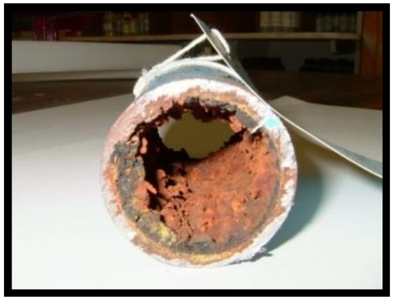
# 2.What Needs to be Controlled/Ямар зүйлсийг хянахаа тодорхойлох - Хэрэгцээ

- Химийн нэмэлт бодисууд нь багаж тоног төхөөрөмжийг суурилуулсаны дараа хийгддэг
- Усны системийн найдвартай ажиллагааг хангахын тулд химийн нэмэлтийг байнга тэжээж байхыг шаарддаг
- Усыг дахин боловсруулж ашиглах хамгийн хэцүү ($PO_4$, $SO_4$, $NO_3$, TOC, COD, BOD, $NH_{3,}$ )

# 3. Ойлгох – Юу буруу болж болох вэ? Үүнийг яаж хяналтанд байлгах

## Асуудал - Үр ашгийн буюу найдвартай байдал алдагдах

- Үндсэн шалтгаан: эрдэс давстай ус, усны температур өндөр, дулаан солилцогчийн хананы температур өндөр, хадгалагдах хугацаа их,
- Залруулах арга хэмжээ: Хүчтэй хагжилтын болон исэлдэлтийг дарангуйлагч хэрэгтэй. Тохирсон тунг тааруулах. Агаараар бохирдсон шороо, микро организм болон процессын бохирдуулагчдыг багасгах, хяналтын систем

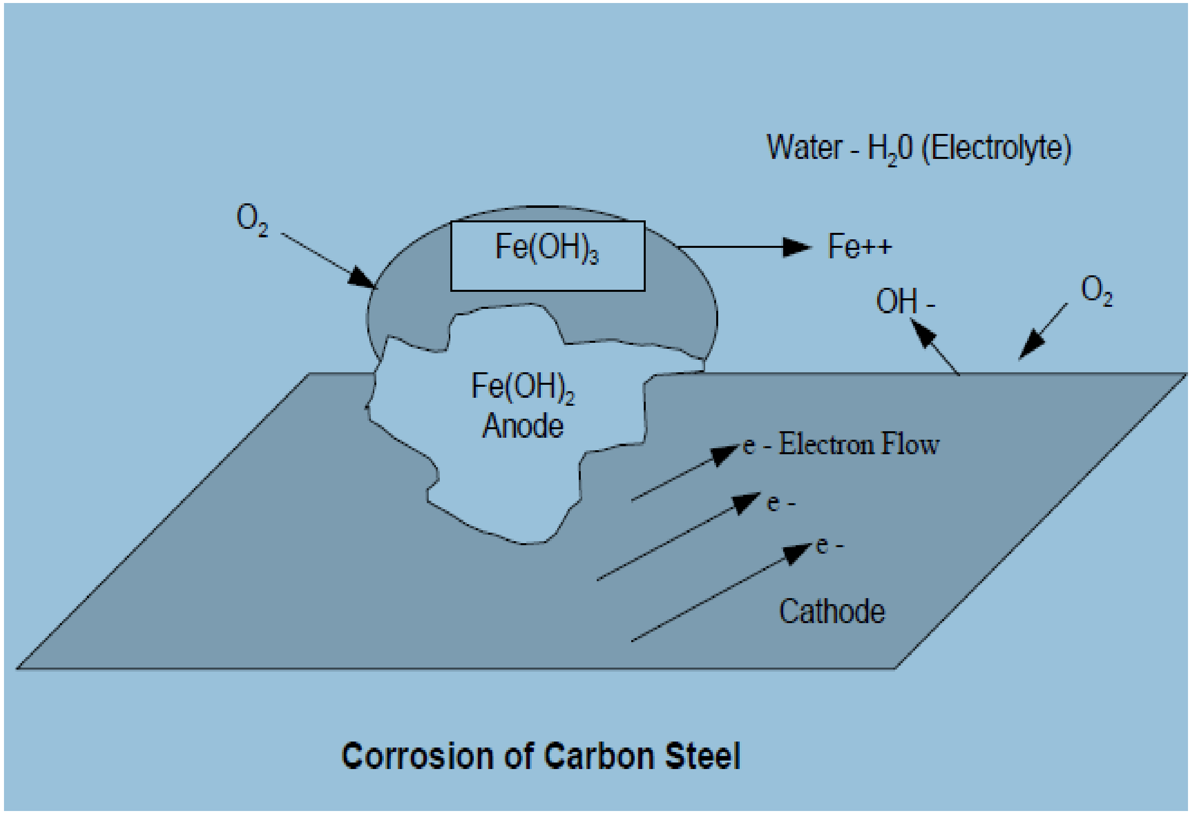

# 4a. Reagents/Урвалжууд

| Ашиглагдах бодис | Найрлага | Физик ба химийн шинж чанар | Хор аюулын талаарх мэдээлэл |
|---|---|---|---|
| HYDREX 2254 | Цайрын хлорид ($ZnCl_2$)– 20-30%; Фосфорын хүчил ( $H_3PO_4$ ) – 30-40% | Тунгалгаас цайвар шар өнгөтэй, усанд уусамтгай, үнэргүй шингэн бодис<br>-pH: <1<br>-Хайлах температур: <8 °C<br>-Хувийн жин: 1.25 ~ 1.35 |  |
| HYDREX 2331 | Полиакрилик хүчил ($C_3H_4O_2$) >48% | Цайвар шар өнгөтэй, сулавтар үнэртэй шингэн бодис<br>-pH: 2 ~ 3<br>-Хайлах температур: -8⁰C<br>-Хувийн жин: 1.10 ~ 1.20 |   |
| HYDREX 2213 | Натрийн толитриазол – <25%;<br>Натрийн гидроксид – <0.5%<br>$C_7H_7N_3Na$; NaOH | - Цайвар шараас улаан шаргал өнгөтэй, сулавтар үнэртэй шингэн бодис<br>-pH: >12<br>-Хайлах температур: -8⁰C<br>-Буцлах температур – 108⁰C<br>-Хувийн жин: 1.12 ~ 1.23 |   |

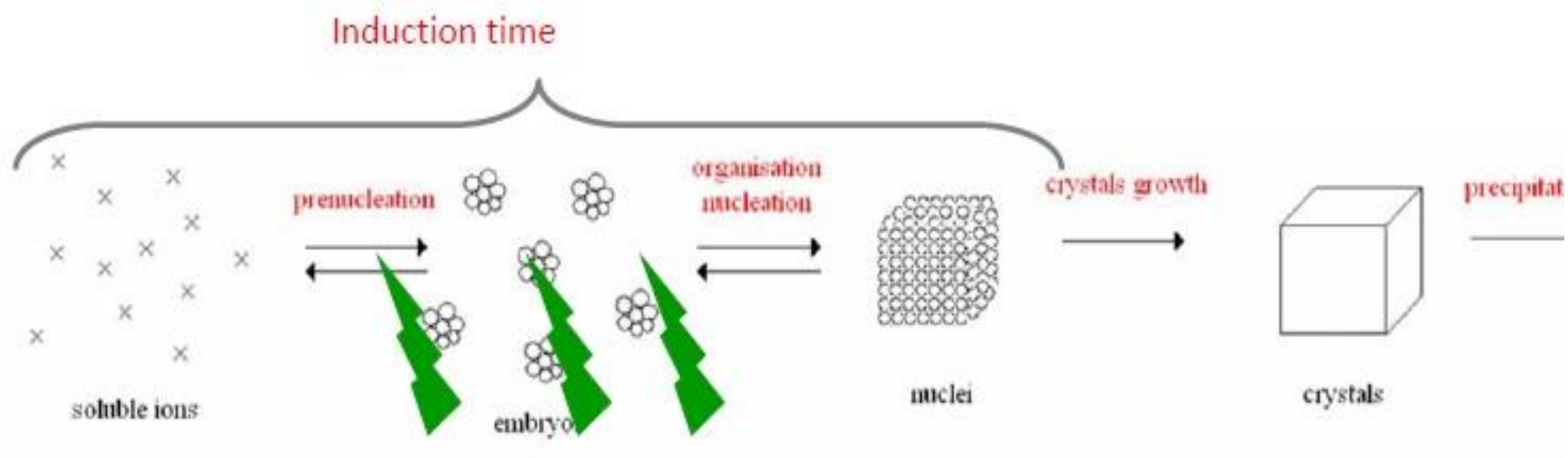
## 4b. HYDREX 2254

Фосфат ион нь зөөлөн гангийн хувьд анодын зэврэлтийг удаашруулагч. Анодын талбайд төмрийн фосфат болж тунадасждаг.

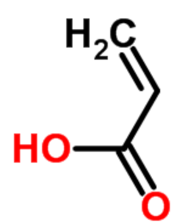
Цайр нь зөөлөн гангийн хувьд катодын зэврэлтийг удаашруулагч. Цайрын гидроксид болж тунадасждаг.



# 4b. HYDREX 2331



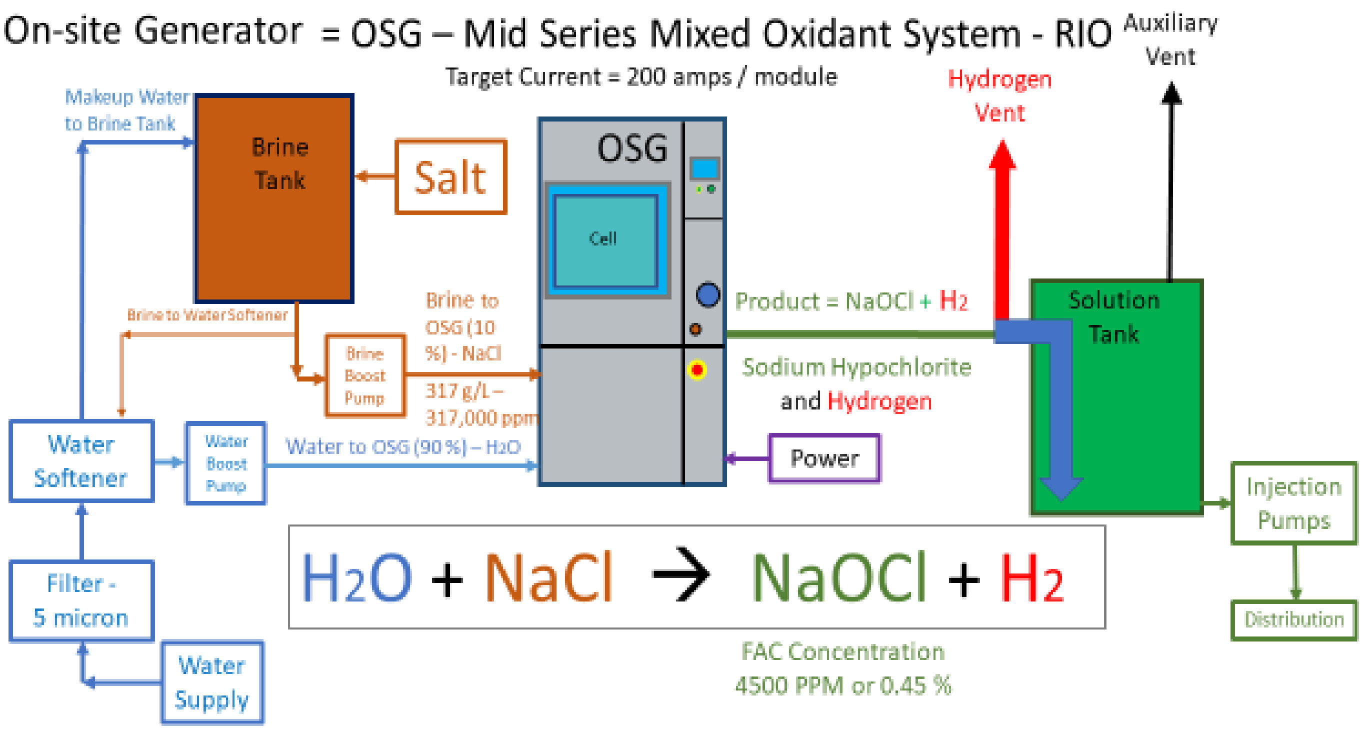

Inhibition/blockage





# ON-SITE GENERATION SYSTEM – MIOX CORPORATION

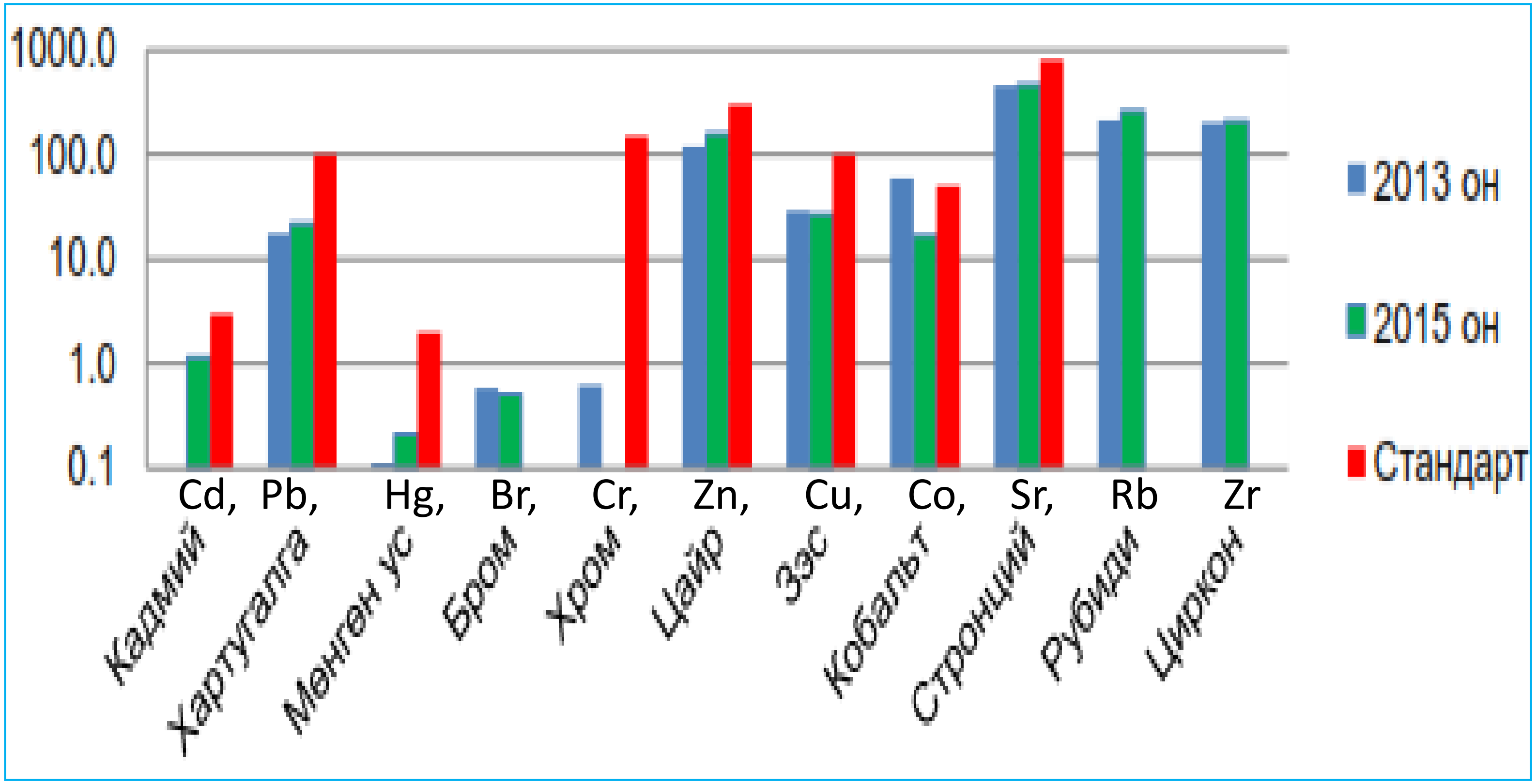
On-site Generator = OSG – Mid Series Mixed Oxidant System - RIO



# 6. Hazards/Risks and Аюул/Эрсдэлүүд

| № | Химийн бодис | Аюулын үнэлгээ | Хүний эрүүл мэндэд үзүүлэх нөлөөлөл | Хүрээлэн буй орчинд үзүүлэх нөлөөлөл |
|---|---|---|---|---|
| **1** | HYDREX 2254 | **Их аюултай** | **3** – Бодисын багахан хэмжээ нь ч эрүүл мэндэд ноцтой гэмтэл учруулж болзошгүй | **1** - Бодис нь байгаль орчинд аюултай гэсэн ангилалд багтдаггүй хэдий ч их хэмжээний болон байнгын бодисын асгаралт үүсэх тохиолдолд байгаль орчинд сөрөг нөлөөлөл үзүүлж болзошгүй |
| **2** | HYDREX 2331 | **Бага аюултай** | **1** – Бодисын нөлөөлөлд өртсөн тохиолдолд эрүүл мэндэд бага зэргийн хор хөнөөл учруулна | **1** – Бодис нь байгаль орчинд аюултай гэсэн ангилалд багтдаггүй хэдий ч их хэмжээний болон байнгын бодисын асгаралт үүсэх тохиолдолд байгаль орчинд сөрөг нөлөөлөл үзүүлж болзошгүй |

## SOIL POLLUTANTS –ХӨРС БОХИРДУУЛАХ БОДИСУУД



# Uranium and Fluoride geochemical pathways in Ulaanbaatar and rural Mongolia

Robin Grayson, Baatar Tumenbayar,
Daramsenge Luvsanvandan and Amarsaikhan Lkhamsuren

Robin Grayson[a1], Baatar Tumenbayar[b],
Daramsenge Luvsanvandan[c] and Amarsaikhan Lkhamsuren[d]

[a] *Independent consultant, Manchester, United Kingdom*
[b] *Sans Frontiere Progres NGO, Sukhbaatar district, Ulaanbaatar, Mongolia*
[c] *Academician of National Academy of Science of Mongolia*
[d] *Environmental consultant, Mongolia*





Figure 6 Ar Janchivlan bottled water on sale in Ulaanbaatar, October 2nd 2012. This is a gassy Na/Ca/Mg bicarbonate soda water. According to the label, uranium ("Uran") is 0.05 mg/L, radium ("Radi") is 10-18.5 mg/L, fluoride ("Ftorid") is 1.5 mg/L and selenium ("Selen") is 0.05 mg/L.

**Table 10** Activity concentration of uranium, thorium and potassium in soil samples.
(Data from Shagjjamba and Zuzaan, 2006)

| | natural radioactive nuclides in soil – Bq/kg | | |
|---|---|---|---|
| | $^{238}$U | $^{232}$Th | $^{40}$K |
| Tsetserleg | 49.0 ± 5.4 | 42.2 ± 5.6 | 1,181.0 ± 82.0 |
| Darkhan | 45.1 ± 4.4 | 32.7 ± 4.3 | 736.0 ± 53.1 |
| Baruun-Urt | 41.4 ± 4.3 | 50.7 ± 5.6 | 725.9 ± 52.0 |
| Sukhbaatar | 38.6 ± 4.2 | 36.3 ± 4.9 | 850.6 ± 57.8 |
| Erdenet | 36.6 ± 4.0 | 30.7 ± 5.0 | 677.8 ± 54.0 |
| Muren | 35.6 ± 3.8 | 27.3 ± 3.5 | 897.9 ± 57.0 |
| Khovd | 35.0 ± 4.5 | 39.0 ± 4.9 | 826.0 ± 67.7 |
| Ulaanbaatar | 33.2 ± 9.4 | 39.0 ± 7.3 | 881.9 ± 94.3 |
| Dalanzadgad | 29.0 ± 4.1 | 28.0 ± 3.1 | 778.0 ± 60.7 |
| **Mongolia mean** | **28.2** | **31.8** | **840.7** |
| Undurkhaan | 25.4 ± 3.1 | 28.5 ± 3.7 | 1,031 ± 60.8 |
| **World mean** | **25** | **25** | **370** |
| Mandalgovi | 23.8 ± 2.9 | 21.5 ± 3.1 | 939.0 ± 56.3 |
| Uliastai | 23.4 ± 3.7 | 38.1 ± 5.6 | 1,330.0 ± 88.3 |
| Sainshand | 22.5 ± 3.0 | 36.4 ± 4.5 | 780.4 ± 57.3 |
| Bulgan | 21.2 ± 3.5 | 26.3 ± 4.3 | 895.4 ± 104.3 |
| Zuunmod | 20.0 ± 2.9 | 54.6 ± 5.5 | 741.5 ± 54.2 |
| Bayanhongor | 19.3 ± 2.5 | 22.2 ± 3.0 | 781.5 ± 48.1 |
| Altai | 18.1 ± 2.4 | 11.3 ± 2.2 | 322.4 ± 27.3 |
| Choibalsan | 15.5 ± 2.4 | 13.9 ± 2.6 | 965.7 ± 60.5 |
| Ulgii | 14.2 ± 1.9 | 25.8 ± 3.3 | 530.1 ± 36.6 |