Kurdish Lobby Australia

REPORT ON WATER TESTING AT JUDY CAMP, MAKHMOUR, NORTHEN IRAQ

Figure 1: Judy Camp, one kilometre from the town of Makhmour in disputed territory in Erbil Province, Kurdistan Region of Iraq

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WATER TESTING AT JUDY CAMP, MAKHMOUR

Background

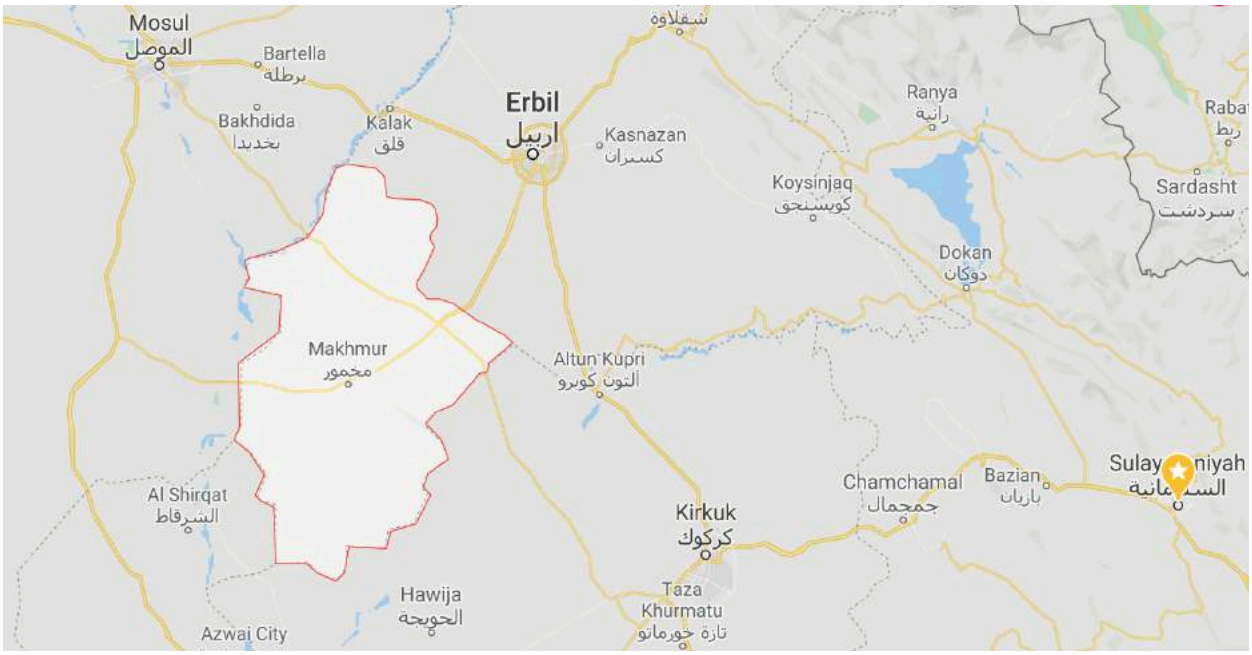

Figure 2: Map showing district of Makhmour in relation to Mosul in Nineveh province and Erbil and Sulaimani in the Kurdistan Region of Iraq.

Five percent of the world's population resides in the Middle East and North Africa but the region has less than one percent of the world's available water supply. With the regions young population bulge and shared rivers, water is going to be a major issue in the coming decades. I

n northern Iraq, one kilometre from the town of Makhmour, 5,000 families live in Judy refugee camp, having been driven from their homes and villages in southeastern Turkey by Turkish military offensives since 1994. In subsequent years they have been moved from camp to camp after being targeted by Turkish airstrikes. In 1998 they were moved to Judy camp. Here they have stayed despite Turkish airstrikes targeting the camp in late 2017, and July 2019, killing or injuring a dozen camp residents, and despite ISIS attacks in 2014 and 2020. On both occasions PKK militants defended the camp and forcibly removed the ISIS threat.

Between 1994 and 2015, UNHCR provided aid to these refugees, but withdrew support in 2015 under pressure from Turkey, and after ISIS attacked and took control of the camp for three days in August 2014. The Government of Iraq had provided some assistance until the rise of ISIS, while the Kurdistan Regional Government continues to pay some salaries of camp residents and

also regularly conducts some limited tests for water quality. Kurdish Red Crescent provides medicines for children. Otherwise camp residents rely on their own resources, such as working in nearby towns. However, since the Government of Iraq took control of Kirkuk in October 2017, camp residents have been restricted from going outside the camp to work.

Since July 2015, new refugees have arrived at the camp following Turkey's military offensives against Kurds in Turkey. In other words, Judy camp residents will not be returning home in the foreseeable future. The camp's management committee runs schools for 3,500 students, who are taught by 200 mostly volunteer teachers. The committee also runs workshops for women and a health clinic.

At a meeting between KLA representatives and camp organisers on April 10, 2019, contaminated drinking water and a shortage of electricity were identified as the most critical issues facing camp residents. Camp residents complained the water was giving them skin rashes, stomach aches and diarrhoea. KLA focused on the camp's drinking water, given that water-born contaminants were causing so many illnesses in too many people. It was discovered that while the Kurdistan Regional Government tests the drinking and general use water for the camp every six months it was only for Coli, turbidity and other contaminants, and there had been no testing for heavy metals. Nevertheless, these tests found high concentrations of Coli and turbidity as shown in the test results for June 2019 displayed in Figure 16 and 17. This was of concern as:

1. Water from the Tigris River downstream from the industrial town of Altun Kopri enters the camp's water system for general use every few weeks. Industries at Altun Kopri are known to release untreated waste onto the land and into the Tigris; and
2. General use water and drinking water travel down the same pipes, albeit at different times.

KLA identified an efficient and cost effective way of filtering out bacteria, dirt etc. but was concerned that the identified equipment known as a Skyhydrant did not filter out heavy metals and other industrial contaminants. KLA decided the water had to be tested for heavy metals and other industrial waste contaminants. This report concerns the results of that testing.

Water Testing Process

On 16 November 2019 a member of KLA went to Judy Camp near Makhmour and with the help of camp committee members collected water samples in sterilised bottles from six sites. He took the water samples to Dr Omed (Telephone: +9647701587858) at the Society Chemists & Physicists of Kurdistan Laboratory in Sulaimani, Kurdistan Region of Iraq, where the six samples were tested for heavy metals and other industrial waste contaminants. KLA paid for the testing at a cost of AUD$1052.

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Figure 3: Water collection bottles

The Sites were:

S1 General Use Water collected from Segrden Well
S2 General Use Water collected from Tank 1, with water coming from Segrden Well
S3 Drinking water from Barzaga Well collected from Tank 2
S4 Home's tap - Drinking Water from Barzaga Well
S5 General Use Water, Tigris River Collection point
S6 Drinking Water from Gawara Well.

Note 1: There is concern that results for S5 and S6 may have been mixed up as S6 shows such high readings. Dr. Omed is going to check if the laboratory has retained the water samples and if so, retest. Otherwise, why should Gawara Well water have such high levels of contamination?

Note 2: It is unclear whether the water test results from the Erbil and Sulaimani laboratories are from the same drinking tap.

Figure 5 - 12: Water testing sites and tanks.

S1

S2

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S3 A.

S3 B

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S4

S5 Blue tanks are collection points for Tigris River water

S6

Figure 11: Makhmour Water Storage Tanks

Figure 12: Pipes going into one house showing pink common pipe for drinking and general use water.

WHO Standards

- Arsenic (unless first oxidised) (WHO safe drinking standard - Max 0.01 mg/L)
- Cadmium (WHO safe drinking standard - Max 0.003 mg/L)
- Chromium (WHO safe drinking standard - Max 0.05 mg/L)
- Copper (WHO safe drinking standard - Max 2.0 mg/L)
- Cyanide (WHO safe drinking standard - Max 0.07 mg/L)
- Fluoride (WHO safe drinking standard - 1.5 mg/L)
- Lead (WHO safe drinking standard - Max 0.01 mg/L)
- Mercury (WHO safe drinking standard - Max 0.006 mg/L)
- Nickel (WHO safe drinking standard - Max 0.07 mg/L)
- Nitrate (WHO safe drinking standard - Max 50 ml/L as NO3)
- Nitrite (WHO safe drinking standard - 3 mg/L as NO2)
- Sulphate (Safe Drinking Levels: 250 mg/L but up to 500mg/L can be tolerated

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Water Test Results for Judy Camp, Makhmour

No.	Test	S1	S2	S3	S4	S5	S6	WHO Max Mg/l
1	Arsenic	0.010>	0.010>	0.010>	0.010>	0.010>	0.010>	0.01
2	Cadmium	0.001	0.2	0.4	>0.010	>0.010	0.2	0.003
3	Chromium	2	0.010>	0.010>	0.010>	0.010>	19	0.05
4	Copper	1	6.6	3	0.010>	1	9.1	2.0
5	Cyanide	0.010>	0.010>	0.010>	0.010>	0.010>	0.010>	0.07
6	Fluoride	0.01	0.01	0.013	0.011	0.001	0.0015	1.5
7	Lead	0.001	0.010>	0.010>	0.010>	0.010>	0.5	0.07
8	Mercury	0.010>	0.010>	0.010>	0.010>	0.010>	0.010>	0.006
9	Nickel	6.2	12	2.6	5.1	8.8	9.8	0.07
10	Nitrate	0.6	1.8	13.9	12.6	5.6	11.6	50
11	Nitrite	0.010>	0.010>	0.012	0.018	0.01	0.013	3
12	Sulphate	222	212	304	260	207	279	250-500

Figure 13: Results from testing water for heavy metal contamination, Judy Camp, Makhmour

CODE: Red — Unsafe levels as contamination exceeded the WHO standard
Orange — Level not specific enough to determine compliance with WHO standards
Blue — Drinking water sites (**S6 needs checking that it is Gawara Well**)

0.010> — Reading less than 0.010. Laboratory could not be more specific

Three of the tested sites were for drinking water, and three sites were for general use water. The readings were all in milligrams per litre and were compared with World Health Organisation (WHO) standards. As can be seen from Figure 13, there were high levels of cadmium, chromium, copper and nickel in two to six sites, and possibly a high level of mercury in a number of sites. Most worrying were the high levels of contamination in drinking water of cadmium, copper and nickel.

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Sources of Heavy Metals

Metal	Sources
Cadmium	Sewage sludge; phosphate fertilisers; air, water and soil pollution from industrial wastes from industries including metal plating, and paints, NiCd batteries & plastics manufacture; mining .
Chromium	Industrial wastes from steel, making alloys, in chrome plating, as a catalyst in dying and tanning leather, making moulds for fire bricks and textile manufacturing.
Copper	Corrosion of plumping including pipes, taps and other fittings.
Lead	Corrosion of lead pipes and other plumbing fixtures, especially when the water is very acidic; lead paint is a major source of lead pollution; the manufacture of plastics, rubber and cars; ore and metals processing, e.g. lead smelters, waste incinerators, utilities, and lead-acid battery manufacture.
Mercury	Coal combustion, waste incineration, industrial uses, and mining.
Nickel	Leeching from pipes and other water fixtures; released into the environment by power plants, waste incinerators and industries associated with producing stainless steels, non-ferrous alloys, super alloys, ceramic paint, kitchen ware, batteries, textiles and coins, and use of fertilisers, entering groundwater from farm runoff.

Figure 14: Sources for each heavy metal found in excess of the WHO standard in Judy camp water

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Potential Health Impacts of Heavy Metal Water Contamination

Metal	Health Impacts if found in excess of WHO standards
Cadmium	Long-term exposure to cadmium through air, water, soil, and food leads to cancer and organ system toxicity including skeletal, urinary, reproductive, cardiovascular, central and peripheral nervous, and respiratory systems. High levels can lead to bone demineralisation and kidney and lung diseases. Cadmium levels can be measured in the blood, urine, hair, nail and saliva samples. Patients with cadmium toxicity need gastrointestinal tract irrigation, supportive care, and chemical decontamination.
Chromium	Skin rashes (ulcerations, dermatitis and allergiies). Depending on the oxidation state of Chromium, high levels can cause upset stomachs and ulcers, respiratory problems (e.g. asthma like symptoms), weakened immune systems, kidney and liver damage, alteration of genetic material, lung cancer and even death.
Copper	Nausea, vomiting diarrhoea, gastric (stomach) complaints, headaches and cirrhosis, and over years of exposure it can cause toxicity of the liver, renal disease and some cancers.
Lead	High levels accumulate in the body and cause serious poisoning. Lead can be transmitted to a foetus causing slow growth and premature birth. Impacts of high levels over time can cause a child to experience behaviour and learning problems, lower IQ, hyperactivity, slowed growth, hearing problems and anaemia. High levels in adults can lead to an increase in blood pressure, hypertension and other heart disease, and can reduce kidney function and fertility in men and women. In rare cases high lead levels can cause seizures, coma and even death.
Mercury	Depends on the form but can impact the nervous, digestive and immune systems, and on lungs, kidneys, skin and eyes.
Nickel	People have different sensitivities to nickel. Health impacts for those who are sensitive to high levels include skin allergies and rashes, and some cancers.

Figure 15: Health Impacts of each heavy metal found in excess of the WHO standard

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Test Results for Turbidity, E. Coli etc June 2019 from Erbil Laboratory

إقليم كوردستان -العراق
رئاسة المجلس الوزراء
وزارة البلديات والسياحة
المديرية العامة للماء والمجارى
الجودة النوعية

Kurdistan Region - Iraq
Council of Ministers
Ministry of Municipality & Tourism
General Directorate of water & Sewerage
Quality Assurance

هەرێمی کوردستان-عیراق
سەرۆکایەتی ئه نجومەنی وەزیران
وەزارەتی شارەوانی و گەشت وگوزار
بەڕێوەبەرایەتی گشتی ئاوو ئاوەڕۆ
دڵنیای جۆری

From Date :20 -Jun - 19
To Date :20 -Jun- 19

بەڕێوەبەرایەتی ئاوی دەوروبەری هەولێر

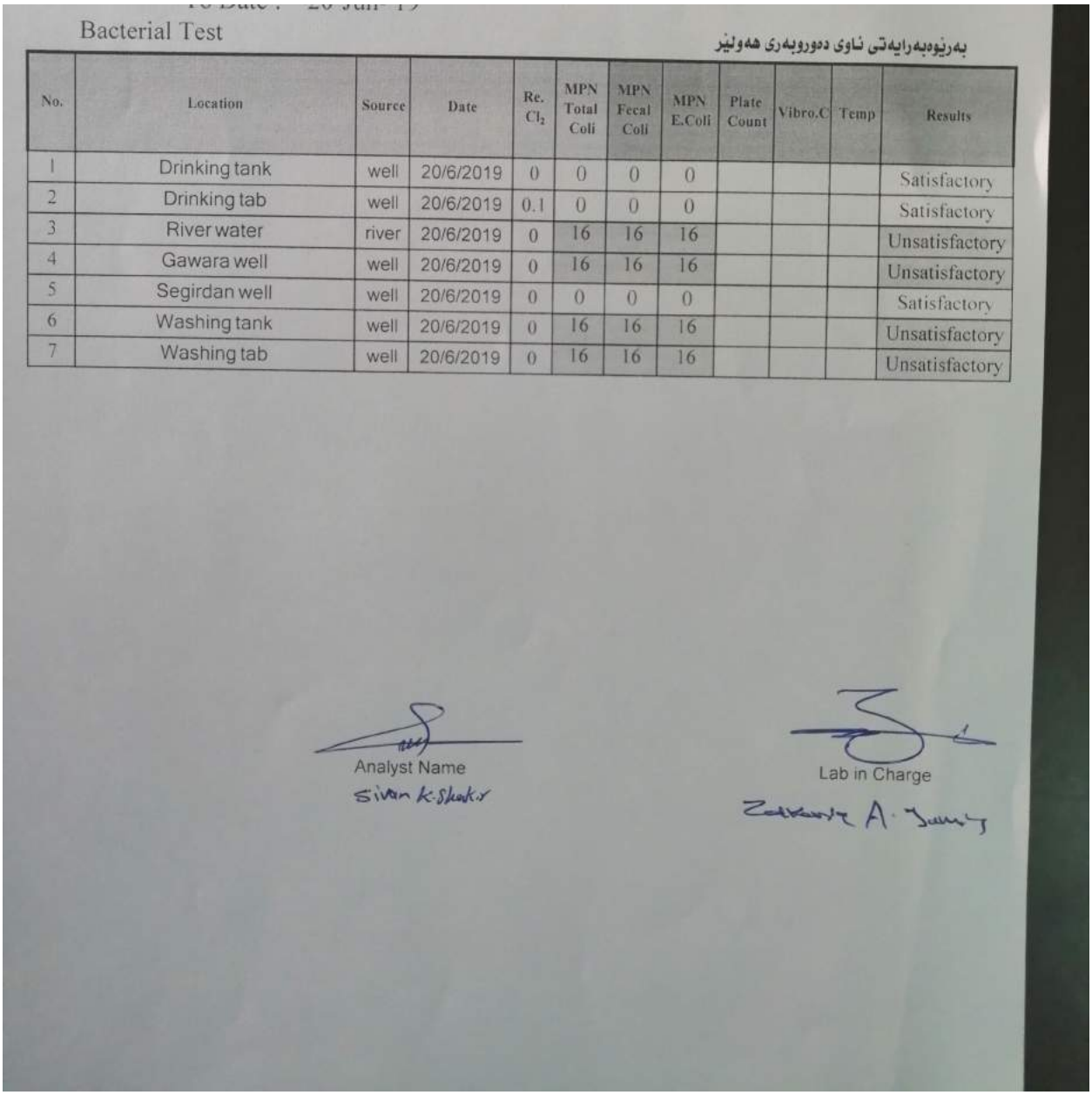
Chemical & Physical Test

No.	Location	Sourse	Date	Turb	PH	E.C	T.Alk.	T.Hard.	Ca^{++}	Cl	SO_4^{--}	Na^{+}	K^{+}	NO_3	T. D.S.	Mg^{++}	Results
1	Hewza xwardin	well	20/6/2019	1.0	8.0	1018	160	340	96	30	66	39.6	3.1	45	509	24	Satisfactory
2	Henefeya xwardin	well	20/6/2019	1.0	8.0	981	160	400	80	35	55	35	2.9	41	491	49	Satisfactory
3	Ava rubar	river	20/6/2019	20.0	7.8	817	163	376	88	30	58	21	2.3	8	409	38	Over range
4	Biren gaware xwardin	well	20/6/2019	0.3	7.7	1018	180	360	88	36	66	40.5	3.1	44	509	34	Satisfactory
5	Biren segirdan bi karanin	well	20/6/2019	1.0	7.5	884	175	440	64	25	64	14	2.2	5	442	68	Satisfactory
6	Hewza bikaranini	well	20/6/2019	38.0	7.6	809	160	416	88	35	55	16.1	2.2	5	405	48	Over range
7	Henefiya bikaranin	well	20/6/2019	8.0	7.5	858	165	440	96	37	39	14	2.2	0.5	429	49	Over range

Analyst Name
Saman S. Ibrahim

Lab in Charge
Zafeera A. Younis

Figure 16: Test results from Erbil Lab for various chemicals in water at seven sites in Judy Camp, June 2019



Bacterial Test

بەڕێوەبەرایەتی ناوی دەوروبەری هەولێر

No.	Location	Source	Date	Re. Cl_2	MPN Total Coli	MPN Fecal Coli	MPN E.Coli	Plate Count	Vibro.C	Temp	Results
1	Drinking tank	well	20/6/2019	0	0	0	0				Satisfactory
2	Drinking tab	well	20/6/2019	0.1	0	0	0				Satisfactory
3	River water	river	20/6/2019	0	16	16	16				Unsatisfactory
4	Gawara well	well	20/6/2019	0	16	16	16				Unsatisfactory
5	Segirdan well	well	20/6/2019	0	0	0	0				Satisfactory
6	Washing tank	well	20/6/2019	0	16	16	16				Unsatisfactory
7	Washing tab	well	20/6/2019	0	16	16	16				Unsatisfactory

Analyst Name

Lab in Charge

Figure 17: Test results from Erbil Lab for Coli in water at seven sites in Judy Camp, June 2019

Findings

The heavy metals cadmium, chromium, copper and nickel, were found to be at abnormally high levels in three to six sites, with site 6 displaying exceedingly high levels of chromium, copper, lead and nickel. It appears that these heavy metals could be the cause of skin rashes and other skin and stomach complaints that are commonly suffered by camp residents.

As can be seen from Figures 13, 16 and 17, the last two figures showing the test results from the KRG lab in Erbil, water from the Tigris River is particularly problematic for Coli, turbidity, chemicals and heavy metals.

A high level of contamination is also seen in Gawara Well as shown in Figure 16.

Treatments

Before testing for heavy metal contamination, Kurdish Lobby Australia proposed filtering Judy camp's water with a series of Skyhydrants. However, Skyhydrants only remove Coli and dirt. Skyhydrants do not remove heavy metals.

Different methods can be used to remove heavy metals from contaminated water. They include chemical precipitation [17,18], ion exchange [19,20], adsorption [21,22], membrane filtration [23,24], reverse osmosis [25,26], solvent extraction [27], and electrochemical treatment [28,29]. Many of these methods suffer from high capital and operational costs. Adsorption seems to be one of the best-suited methods, due to its high efficiency, low-cost, and ease of operation. Various adsorbents, such as carbon foam [30], activated carbon [31], zeolite [32], clay minerals [33,34], organic polymers [35], and biochar [36], and many waste materials, such as fly ash [37], reused sanding wastes [38], biomass [39], and water treatment residuals (WTRs) [40,41], have been used for the removal of heavy metals by adsorption. The most effective heavy metal adsorbents are adsorbents based on metal oxides (Fe, Al, Mn oxides), such as WTRs, bog iron ores [42], ferrihydrite [43], goethite [44], layered double hydroxide (LDH) [45], Sn/Ti-Mn binary metal oxides [46,47], Al/Fe oxide-oxyhydroxide composite powders [48], and red mud [49].

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APPENDIX A: TEST RESULTS FOR WATER TESTING FOR HEAVY METALS

SOCIETY CHEMISTS & PHYSISTS
OF KURDISTAN
NO:- 185
Date :- 4 / 12 / 2019
- Tel :- 3202112

KURDISTAN CHEMISTS & PHYSISTS SOCIETY

کـۆمـەڵـەی کیـمیایی و فیـزیـایـی
کـوردسـتـان
ژمـارە :- ١٨٥
بەروار :- ٤ / ١٢ / ٢٠١٩
ت :- ٣٢٠٢١١٢

بـۆ/ بەڕێز کومپانیای زریان
ب/ نە نجامی شیکاری

نامازە بە داواکاریتان لە ٢٠١٩/١١/١٨ تایبەت بە شیکاری شەش نمونە ئاو کەلە لایەن بەڕێزتانەوە بەدەستمان گەیشتووە . ئاگاداری بەڕێزتان دەکەین کە نە نجامی شیکاریەکان بەم شێوەیەی خوارەوەیە ٠

لـەگـەڵ ڕێـــزماندا

No.	Test	S1 سێ گردان	S 2 خزانی سێ گردان	S 3 بازارگە	S 4 خزانی بازارگە	S 5 زێ ی بچوک	S 6 گاوەرە
1	Arsenic	0.010>	0.010>	0.010>	0.010>	0.010>	0.010>
2	Cadimium	0.001	0.2	0.4	0.010>	0.010>	0.2
3	Chromiun	2	0.010>	0.010>	0.010>	0.010>	19
4	Copper	1	6.6	3	0.010>	1	9.1
5	Cyanide	0.010>	0.010>	0.010>	0.010>	0.010>	0.010>
6	Floride	0.01	0.01	0.013	0.011	0.001	0.0015
7	Lead	0.001	0.010>	0.010>	0.010>	0.010>	0.5
8	Mercury	0.010>	0.010>	0.010>	0.010>	0.010>	0.010>
9	Nickel	6.2	12	2.6	5.1	8.8	9.8
10	Nitrate	0.6	1.8	13.9	12.6	5.6	11.6
11	Nitrite	0.010>	0.010>	0.012	0.018	0.01	0.013
12	Sulphate	222	212	304	260	207	279

سەرۆکی تاقیگە

نەندام

وێنەیەک بۆ//
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