

# Chemical composition of groundwater in wells around the Hellisheidi Power Plant in 2018

Well	HK-24	HK-07	HK-25	HK-12	HK-31	KH-50	HK-13	LK-1	KH-05	KH-06	HU-1	HK-14		
Groundwater flow	Selvogsstráumur						Selvogsstráumur/ Eiðlaástráumur	Eiðlaástráumur	Þingvallastráumur					
Sample no.	18-5355	18-5356	18-5228	18-5205	18-5204	18-5364	18-5367	18-5174	18-5366	18-5365	18-5368	18-5383		
Date	19.9.2018	20.9.2018	19.6.2018	30.5.2018	29.5.2018	26.9.2018	27.9.2018	18.5.2018	27.9.2018	26.9.2018	26.9.2018	23.10.2018		
Chemical properties	Unit	Max. recommended value												
Acidity	pH		7.82	7.78	7.85	8.32	9.7	7.05	7.53	7.75	7.61	6.87	7.22	7.62
T (pH)	°C		10	22.4	23.2	23.5	23.4	22	22.3	22.6	22.2	22.5	22.1	22.6
Conductivity	µS/cm	2,500	135	174.5	182	162	273	148.3	125	125.1	133.3	90.9	80.7	66.7
T (Conductivity)	°C		22.1	22	21.6	21	21	22.1	22.2	22.4	21.6	22.2	22.1	22.6
CO2	mg/kg	*	33.45	51.7	54.2	42.0	71.1	38.9	25.5	18.9	49.9	39.9	26.6	20.2
F	mg/kg	1.5	0.017	0.04	0.04	0.07	0.78	0.05	0.01	0.05	0.03	0.00	0.03	0.00
Cl	mg/kg	*	7.75	5.85	7.28	8.80	7.96	5.67	12.73	23.03	4.84	4.17	5.03	4.35
SO4	mg/kg	200	8.63	12.11	6.95	13.09	8.68	16.70	4.31	2.23	2.41	1.28	1.36	18.06
Ca	mg/kg	100	7.82	9.40	10.90	11.60	1.81	5.97	5.74	5.45	9.10	4.69	4.53	2.83
Fe	mg/kg	0.2	0.03	0.01	0.04	0.02	0.00	0.01	0.01	0.03	0.01	0.01	0.00	0.08
K	mg/kg	12	1.02	0.97	1.39	1.11	1.35	1.01	1.04	0.98	0.82	0.57	0.84	0.67
Mg	mg/kg	50	4.27	9.31	7.21	5.43	0.15	7.81	3.37	3.32	5.62	4.16	2.59	2.06
Na	mg/kg	200	9.26	10.50	12.30	10.40	61.20	8.64	11.10	11.40	7.93	5.75	6.45	5.98
SiO2	mg/kg	*	19.07	31.07	24.00	20.74	50.14	34.71	18.45	14.68	27.43	15.84	23.14	14.85
Al	µg/kg	200	6.31	2.66	14.10	8.18	86.50	2.30	4.11	17.80	1.90	1.45	2.53	29.10
As	µg/kg	10	<0.05	<0.05	0.06	<0.05	0.981	0.0602	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05
Ba	µg/kg	700	0.82	0.34	1.10	1.44	0.43	0.55	0.75	0.62	0.13	1.08	0.54	0.24
Cd	µg/kg	5	<0.002	<0.002	<0.002	<0.002	<0.002	0.0022	<0.002	0.00411	<0.002	<0.002	<0.002	<0.002
Co	µg/kg	*	0.1	0.0	0.0	0.1	<0.005	0.010	0.0143	0.018	0.0	0.0	0.006	0.107
Cr	µg/kg	50	0.48	0.55	0.70	2.18	0.04	0.29	0.34	0.29	0.48	0.10	0.52	0.37
Cu	µg/kg	2,000	0.68	0.66	0.65	0.21	0.21	1.72	0.60	2.13	0.209	0.85	<0.1	0.97
Hg	µg/kg	1	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002
Mn	µg/kg	50	14.00	1.03	6.17	3.20	0.76	1.07	1.31	1.68	0.92	1.55	0.033	2.43
Mo	µg/kg	*	0.37	0.32	0.39	0.33	2.36	0.22	0.25	0.10	0.17	0.08	0.25	0.11
Ni	µg/kg	20	5.52	0.54	3.04	1.38	0.44	0.51	0.71	0.11	0.226	0.39	<0.05	1.11
P	µg/kg	5,000	17.4	54.2	34.8	29.9	19.9	33.9	19.0	15.9	58.7	7.2	47.6	18.8
Pb	µg/kg	10	0.145	0.112	0.104	0.029	0.107	0.0975	0.095	0.045	0.093	0.0884	<0.01	0.051
Sb	µg/kg	5	0.032	0.068	0.034	0.015	<0.01	0.391	0.021	<0.5	<0.01	<0.01	0.0194	<0.01
Se	µg/kg	10	0.52	0.67	<0.5	<0.5	<0.5	1.01	1.16	12	<0.5	<0.5	<0.5	<0.5
Sr	µg/kg	*	19.1	22.4	20.7	23.9	6.2	14.7	17.6	2.5	16.1	10.1	9.6	7.2
Ti	µg/kg	*	0.344	0.128	1.030	0.166	0.063	0.150	0.171	<0.01	0.125	0.042	0.164	0.836
V	µg/kg	*	12.1	20.4	14.5	17.1	25.9	6.81	5.32	9.07	10.4	2.5	7.02	4.89
Zn	µg/kg	3,000	32.40	27.90	50.20	5.92	2.68	24.50	22.40	241.00	16.50	24.80	1.74	13.90

\* Maximum value not found in Icelandic regulation

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The impact of the Hellisheidi Power Plant on groundwater is closely monitored in surveillance wells at and around the plant. Samples are collected to analyse overall chemical content and trace elements, in addition to measuring their temperature, conductivity and acidity. The concentration of dissolved solids is far below the limits set for potable water. However, the concentration of sulphate has risen considerably above background limits in well HK-7 (reached maximum at the end of 2017) and KH-50 (maximum reached in mid-2018) without any substantial increase in silica, sodium and chlorine. Since reaching their maximum values, the concentrations of sulphate has been falling in both wells. Sulphate is created from the oxidation process of hydrogen sulphide which follows the steam released from the plant. Up until 2016, when the gas abatement unit at Hellisheidi was relaunched after its capacity was increased, the bulk of the hydrogen sulphide filtered through the cooling towers, along with condensate water, where the oxidation occurs. Approximately 10 kg of water per second goes into each cooling tower's overflow before it's released into shallow wells at the plant. This release was stopped in 2016 and this water is currently injected back into the geothermal reservoir. Moreover, trace elements, which are mostly in gas form, have been measured in well KH-50 (selenium and mercury, although both well below the limits set for potable water), while other substances which mostly follow separated water, e.g. arsenic, have not been detected in the same well. These impacts are likely to be reduced with the ongoing operation of the gas abatement unit and the reinjection of hydrogen sulphide. The chemical composition will continue to be monitored in the surveillance well to gain a better picture of groundwater flows and the release of geothermal water from the Hellisheidi Geothermal Power Plant.

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