NI Water Assessment of the raw water monitoring samples taken at Carmoney Water Treatment Works

Additional monitoring of the raw water abstracted from the River Faughan for a number of hydrocarbon parameters was put in place by NI Water. A toxicology assessment was undertaken on the levels of hydrocarbons detected in the raw water samples and the potential removal during the drinking water treatment process at the Carmoney Water Treatment Works (WTW).

Information is presented in Table 1 on the SNARLs (Suggested No Adverse Response Levels) and WHO (World Health Organisation) guidelines for the hydrocarbons detected in the raw untreated water above their respective limit of detection. None of the hydrocarbons in the raw water supply were detected at concentrations above their health-based SNARLs.

Following examination of data from samples of the final treated water at the Carmoney WTWs, the concentrations of these compounds were all below the limit of detection and therefore below the respective drinking water standard. This suggests that the water treatment process is successfully removing these contaminants from the drinking water before distribution. Therefore, adverse health effects would not be anticipated from these substances in the treated drinking water supply as the treatment process is removing them.

Table 1 SNARLs and WHO guideline values

Substance	CAS number	Maximum concentration detected in raw water (µg/l)	Maximum concentration detected in final water (µg/l)	Toxicity Datasheet Available?	Health-based SNARLs (ug/l)		Operational SNARL (µg/l)	WHO GDWQ (µg/l)
					24-hour	7-day		
Acenaphthene	83-32-9	0.063	<0.01	Yes (Polycyclic Aromatic Hydrocarbons)	2630, a	530, a	10, b	None
Acenaphthylene	208-96-8	0.047	<0.01	Yes (Limited data in Polycyclic Aromatic Hydrocarbons)	880 (tentative), c	None	10, b	None
Anthracene	120-12-7	0.052	<0.01	Yes (Anthracene)	15 000, d	3000, d	None	None
Benz(a)anthracene	56-55-3	0.14	<0.01	Yes (Limited data in Polycyclic Aromatic Hydrocarbons)	900, e	450, e	10, b	None
Benzo(a)pyrene	50-32-8	0.053	<0.01	Yes (Benzo(a)pyrene)	None, f	None, f	10, b	0.7, h
Benzo(b)fluoranthene	205-99-2	0.059	<0.01	Yes (Limited data in Polycyclic Aromatic Hydrocarbons)	900, e	450, e	10, b	None
Benzo(ghi)perylene	191-24-2	0.073	<0.01	Yes (Limited data in Polycyclic Aromatic Hydrocarbons)	900, e	450, e	10, b	None
Benzo(k)fluoranthene	207-08-9	0.077	<0.01	Yes (Limited data in Polycyclic Aromatic Hydrocarbons)	900, e	450, e	10, b	None

Substance	CAS number	Maximum concentration detected in raw water (µg/l)	Maximum concentration detected in final water (µg/l)	Toxicity Datasheet Available?	Health-based SNARLs (ug/l)		Operational SNARL (µg/l)	WHO GDWQ (µg/l)
					24-hour	7-day		
Indeno(1,2,3-cd)pyrene	193-39-5	0.063	<0.01	Yes (Limited data in Polycyclic aromatic hydrocarbons)	900, e	450, e	10, b	None
PAH - Sum of four substances	N/A	0.263	<0.01	Yes (Limited data in Polycyclic aromatic hydrocarbons)	900, e	450, e	10, b	None
Chrysene	218-01-9	0.088	<0.01	Yes (Limited data in Polycyclic Aromatic Hydrocarbons)	900, e	450, e	10, b	None
Dibenz(a,h)anthracene	53-70-3	0.068	<0.01	Yes (Limited data in Polycyclic Aromatic Hydrocarbons)	900, e	450, e	10, b	None
Fluoranthene	206-44-0	0.058	<0.01	Yes (Fluoranthene)	1880, i, j	380, i, j	10, b	None
Fluorene	86-73-7	0.049	<0.01	Yes (Polycyclic Aromatic Hydrocarbons)	1880, a	380, a	10, b	None
Napthalene	91-20-3	0.21	<0.01	Yes (Naphthalene)	600, k	240, k	2.5, k	None
Phenanthrene	85-01-8	0.074	<0.01	Yes (Limited data in Polycyclic aromatic hydrocarbons)	350, l (tentative)	None	10, b	None

Substance	CAS number	Maximum concentration detected in raw water (µg/l)	Maximum concentration detected in final water (µg/l)	Toxicity Datasheet Available?	Health-based SNARLs (ug/l)		Operational SNARL (µg/l)	WHO GDWQ (µg/l)
					24-hour	7-day		
Pyrene	110-86-1	0.06	<0.01	Yes (Polycyclic aromatic hydrocarbons)	1130, a	230, a	10, b	None
EPH >C16-C21 aliphatic	N/A	22.5	N/A	Yes (Hydrocarbons)	See below	See below	None	None
EPH >C21-C35 aliphatic	N/A	29.9	N/A	Yes (Hydrocarbons)	See below	See below	None	None
Total aliphatic hydrocarbons (C16-C35 aliphatic)	N/A	52.4	N/A	Yes (Hydrocarbons)	60 000, m	30 000, m	None	None

a: UKWIR/WRc, 2016a.

b: An operational SNARL of 10 µg/l is recommended for a total concentration for both PAHs and monoaromatic hydrocarbons, as described in the Polycyclic Aromatic Hydrocarbons Toxicity Datasheet. The odour is generally described as 'petrol', 'turpentine', white spirit' or 'hydrocarbon'. (UKWIR/WRc, 2016a).

c: Based on an oral LD50 of 1760 mg/kg bw identified in mice (ChemID, 2016) with application of an uncertainty factor of 10 000 to derive a short-term Tolerable Daily Intake (TDI) of 0.5 mg/kg bw/day and assuming a 10 kg child drinking 1 litre of water per day with a 50% allocation of the TDI to water.

d: UKWIR/WRc, 2016b.

e: No toxicity data were located specifically for these compounds. However, these chemicals are polycyclic aromatic hydrocarbons (PAHs). Therefore, the health-based SNARLs derived for the C17-C35 aromatic hydrocarbon fraction, based on Reference Doses (RfDs) proposed by the Total Petroleum Hydrocarbon Criteria Working Group (TPHWG), would be appropriate. Please see the group Toxicity Datasheet for Hydrocarbons for further details (UKWIR/WRc, 2016c).

f: There are inadequate toxicity data to set a short-term SNARL for benzo(a)pyrene. However, it is unlikely that the ng/l concentrations (occasionally up to 1 µg/l) sometimes found in drinking water are of significant additional risk to human health following short-term exposure, particularly when considering the exposure of the general public to benzo(a)pyrene through food and other sources. It should be noted that benzo(a)pyrene is classified by the International Agency for Research on Cancer (IARC) as a Group 1 carcinogen, and therefore its presence in water should be kept as low as reasonably practicable.

g: For substances that are considered to be carcinogenic, the guideline value is the concentration in drinking water associated with an upper bound excess lifetime cancer risk of 1 x10-5 (one additional cancer per 100 000 of the population ingesting drinking water containing the substance at the guideline value for 70 years).

h: Sum of benzo[b]fluoranthene, benzo[k]fluoranthene, benzo[g,h,i]perylene and indeno[1,2,3-cd]pyrene substances.

i: UKWIR/WRc, 2016d.

j: Concentrations at or below these health-based SNARLs may cause adverse effects to aquatic organisms. Therefore, please refer to the Ecotoxicity sections of the relevant Toxicity Datasheets for information on toxicity to aquatic organisms.

k: UKWIR/WRc, 2016e.

l: Based on an oral LD50 of 700 mg/kg bw identified in mice (ChemID, 2016) with application of an uncertainty factor of 10 000 to derive a short-term Tolerable Daily Intake (TDI) of 0.07 mg/kg bw/day and assuming a 10 kg child drinking 1 litre of water per day with a 50% allocation of the TDI to water.

m: Based on the C17-C35 aliphatic hydrocarbon fraction (UKWIR/WRc, 2016c).

GDWQ: Guideline for Drinking-water Quality

WHO: World Health Organization

SNARL: suggested no adverse response level