

PFAS National Environmental
Management Plan Version 3.0

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1. Introduction and Overview

The Heads of EPAs of Australia and New Zealand (HEPA) have released the draft per- and poly-fluoroalkyl substances (PFAS) National Environmental Management Plan (PFAS NEMP) version 3.0 for public consultation. This version 3.0 contains important new guidance and standards, which builds on version 2.0 published in 2020.

The environmental management of PFAS manufactured chemicals is a high priority for environmental regulators around Australia and New Zealand. PFAS has been used widely in many applications due to their unique chemical properties which makes them resistant to heat, stains, grease and water and now can be found in the environment. PFAS have uncertainties associated with its potential risks, with the resulting need for a precautionary approach to protect the environment and human health.

The PFAS National Environmental Management Plan (PFAS NEMP) provides nationally agreed guidance and standards on the investigation, assessment and management of PFAS wastes and contamination in the environment, including prevention of the spread of contamination. Developed by all State, Territory and the Australian Governments, as well as the New Zealand Government, through HEPA's National Chemicals Working Group, the plan recognises the need for implementation of best practice regulation through individual jurisdictional mechanisms. It supports action on PFAS contamination around Australia and New Zealand.

The draft third version of the per- and poly-fluoroalkyl substances National Environmental Management Plan 3.0 (PFAS NEMP 3.0) builds on NEMP 2.0 with the inclusion of new and additional guidance and standards on priority areas as set out below.

Version 3 focuses on the following areas:

- Theme 1: PFAS family – international approaches to grouping of PFAS.
- Theme 2: Environmental data and monitoring - guidance on ambient monitoring data collection and land use classifications to enable comparability.
- Theme 3: Water- risk-based criteria and guidance for beneficial reuse of biosolids.
- Theme 4: Soil - guidance and standards around PFAS behaviour in soil, including leaching and associated ecological and human health guidance. It finalises and reviews two guideline values already in the NEMP and proposes two new guideline values for soil and one for wildlife diet.
- Theme 5: Resource recovery and waste - guidance on management of risks associated with PFAS in resource recovery products.
- Theme 6: Site specific guidance - guidance on principles and approaches to remediation and management; guidance on construction water; and guidance on estuarine, coastal and marine sediment.

2. Legislation of PFAS in New Zealand

2.1 Ministry for the Environment

The Ministry for the Environment (MfE) leads the all of government programme for PFAS. This involves overseeing and co-ordinating the response to (PFAS) contamination in New Zealand (<https://environment.govt.nz/what-government-is-doing/areas-of-work/land/per-and-poly-fluoroalkyl-substances-pfas/>).

From the MfE website it states that

The Ministry for the Environment (MfE) has led an All of Government response to assess and deal with potential PFAS contamination of land and groundwater around the country. The group is made up of representatives from Ministry of Defence, Ministry of Health, Ministry for Primary Industries, Environmental Protection Authority, Department of Prime Minister and Cabinet, as well as MfE. The All of Government response is focussed on identifying and investigating sites where PFAS may have been historically used and which have the potential for contamination and working in partnership with local authorities and local communities to ensure they are well informed on the issue.

PFAS chemicals have been widely used in a range of consumer and industrial products. People are exposed to small amounts of some PFAS in everyday life, through food, dust, air, water and contact with products that contain these compounds.

- A joint statement issued by Auckland Council and Ministry for the Environment (on behalf of the All of Government group) [PDF, 90 KB].
- *A presentation given to Auckland Council [PDF, 579 KB]*
- *Advice to councils on PFAS [PDF, 287 KB]*

The MfE website also lists investigations and that have been undertaken from March 2018 to February 2020. There is also information that has been released under the Official Information Act regarding test results from possible contaminated sites.

The consultation for the PFAS NEMP 3.0 is listed on the MfE website under consultations - <https://environment.govt.nz/what-you-can-do/have-your-say/>

The PFAS NEMP 2.0 could not be found on the MfE website

2.2 New Zealand Environmental Protection Agency

The New Zealand Environmental Protection Agency (NZEPA) governs and administer the rules for use of PFAS in New Zealand.

Searching for PFAS on the EPA website yields 92 results, which includes the following:

- PFAS NEMP 2.0;
- Numerous articles for the use and control of firefighting foams;
- Fire Fighting Group Standard;
- Position statement for an Intergovernmental Agreement with Australia;
- Several Official Information Act responses; and
- Submissions received on Standards.

This mostly centres around use of PFAs in firefighting foams, which is the predominant use in New Zealand and the cause of most concern.

A guidance document was completed by the NZEPA for disposal of PFOS to trade waste (<https://epa.govt.nz/assets/Uploads/Documents/Hazardous-Substances/Guidance/23c396d3b3/PFOS-disposal-to-trade-waste-guidance.pdf>). This document was completed by Dr Peter Dawson, Principal Scientist. There is no date on this document but it looks like it was published about 2018. It is a good document for trade waste discharges but needs to be updated to reflect changes in the NEMP 3.0.

2.3 Ministry for Primary Industries

The Ministry for Primary Industries is involved in the primary industries sector helping to seize export opportunities for our primary industries, improve sector productivity, ensure the food we produce is safe, increase sustainable resource use, and protect New Zealand from biological risk.

For MPI PFAS is about contamination of food based products. On their website they have a guidance documents for acceptable levels of PFAS in food products. One document is Contaminant in Animal Feed (New Zealand Food Safety technical Paper No: 2020/21, July 2020). This is a scientific interpretive summary of the potential risk to human and animal health from chemical contaminants being in food products.

Section 5.3 of this document addresses issues related to PFAS and gives toxicity values for PFOS (perfluorooctane sulfonic acid) and PFOA (perfluorooctanoic acid) for humans. It has the following information in Section 5.3.3:

- European Food Safety Authority derived a tolerable daily intake of 1.5 µg/kg bodyweight/day in 2008 for PFOA
- Food Standards Australia New Zealand derived a tolerable daily intake of 1.5 ng/kg bodyweight/day in 2017 for PFOS
- Food Standards Australia New Zealand derived a tolerable daily intake of 160 ng/kg bodyweight/day in 2017 for PFOA

No reference could be found to the PFAS NEMP on the MPI site.

2.4 Taumata Arowai

The current standards for PFAS in water and wastewater for New Zealand are regulated through Taumata Arowai. The new Drinking Water Standards came into effect on the 14th November 2022. The maximum acceptable values for organic determinant (table 3) list values for PFHxS, PFOS and PFOA. These are as follows:

- PFHxS (perfluorohexacene sulfonate) + PFOS (perfluorooctane sulfonate) = 0.00007 mg/L
- PFOA (perfluorooctanoic acid) = 0.00056 mg/L

Current guidelines from PFAS NEMP 2.0 are shown in the table below.

2.5 Trade Waste Bylaw

The Trade Waste Bylaw (NZS 9201.23:2004) is a document that governs discharge of trade waste into the wastewater reticulation system. This standard provides a suitable model for all Territorial Authorities when dealing with trade waste discharges, which are empowered under Part 8 of the Local Government Act 2002 to make bylaws. The bylaw also includes a Guideline, which should be read in conjunction with it.

This document is used widely throughout New Zealand and is adapted to suit each local authority. Table 1A.2 and Table 1A.3 of this standard give indicative mass limits for heavy metals and organic compounds and pesticides respectively. These tables do not list mass limits for PFAS.

Under a Trade Waste Bylaw PFAS would need to be assessed by the Local Authority and modifications made to the Trade Waste Bylaw to include PFAS and mass limitations.

It is not known how many Trade Waste Bylaws in New Zealand include regulation of PFAS but it is something that should be investigated.

2.6 Water NZ

Water NZ has produced the Draft Guidelines for Beneficial Uses of Organic Material on Productive Land. This is a document put together through the joint effort of the following agencies:

- Centre of Integrated Biowaste Research(CIBR);
- MfE;
- Ministry of health;
- MPI;
- New Zealand Land Treatment Collective;
- Waste MINZ; and
- Water NZ.

This document has guidelines for the use of organic material on land and provide limits of allowable levels for heavy metals and emerging organic contaminants. Table 5.5 of this document lists concentration limit for contaminants but does not list any values for PFAS.

A review of the selection of the organics contaminants in the Guidelines was undertaken by CIBR (completed August 2017 by Grant Northcott, letter report sent to Nick Walmsley, Technical Manager, Water New Zealand). The review recommended the following in the executive summary:

“removing PFOS\PFOA, AOC and polycyclic aromatic hydrocarbons from the list of contaminants requiring product concentration limits in the draft Guideline for the Beneficial Use of Organic By-Products on Land.”

2.7 PFAS NEMP Version 2

The current version of the PFAS NEMP has tables which have guidelines for the following:

- Table 1. Human health guidelines values developed for health regulators;
- Table 2. Human health investigation for levels for soil;
- Table 3. Ecological guidelines values for soil;
- Table 4. Biota guidelines values, and
- Table 5. Ecological water quality guidelines values developed of water regulators.

These five table are copied from the PFAS MEMP 2.0 and are shown below.

Note that these guidelines draw on values from other sources. The other sources includes the following:

- ANZECC – Australian and New Zealand Environment and Conservation Council;
- ARMCANZ – Agriculture and Resource Management Council of Australia and New Zealand; and
- Australian and New Zealand Guidelines for Fresh Water and Marine Quality.

PFOA and PFOS are currently under consideration for default guideline values on the Australian and New Zealand Guidelines for Fresh Water and Marine Quality website

(<https://www.waterquality.gov.au/anz-guidelines/guideline-values/default/draft-dqvs#proposed-default-guidelines-values>).

Table 1. Table 1 from PFAS NEMP 2.0

Table 1. Human health guideline values developed by health regulators

Sum of PFOS and PFHxS	PFOA	Description	Comments and source
0.02 µg/kg _{bw} /day	0.16 µg/kg _{bw} /day	Tolerable daily intake (TDI)	FSANZ 2017
0.07 µg/L	0.56 µg/L	Drinking water quality guideline value	Australian Government Department of Health 2019
2 µg/L	10 µg/L	Recreational water quality guideline value*	NHMRC 2019

Notes: bw = body weight, µg = micrograms.

Where the guideline values refer to the sum of PFOS and PFHxS, this includes PFOS only, PFHxS only, and the sum of the two.

*NHMRC (2019) notes that people's use of recreational water is not the same, given Australia's climate and geography. Some recreational water resources may be used less frequently than the assumed guidelines (150 days/year), and (in rare cases) some may be used more frequently. In such cases more locally-appropriate event frequency based recreational guidelines can be considered in consultation with the state and regulatory health regulator.

Table 2. Table 2 from PFAS NEMP 2.0

Table 2. Human health investigation levels for soil

Sum of PFOS and PFHxS	PFOA	Land use	Comments and source
0.01 mg/kg	0.1 mg/kg	Residential with garden/accessible soil (HIL A)	<p>Assumes home-grown produce provides up to 10% of fruit and vegetable intake (does not account for consumption of any eggs from home poultry, nor of milk or meat from stock on the premises). Also includes children's day care centres, preschools and primary schools.</p> <p>The HILs were derived using the methodology consistent with assumptions set out in the ASC NEPM for HIL A.</p> <p>Note: If home-grown produce provides more than the 10% of fruit and vegetable intake assumed in the ASC NEPM generic example, a site-specific risk assessment is required. As an example, if home grown produce provides up to 50% of fruit and vegetable intake, the screening value would be 0.002 mg/kg for the sum of PFOS and PFHxS, and 0.02 mg/kg for PFOA.</p>
2 mg/kg	20 mg/kg	Residential with minimal opportunities for soil access (HIL B)	<p>Assumes no potential use of soil for consumption of home-grown produce. Includes dwellings with fully and permanently paved yard space such as high rise-buildings and flats.</p> <p>These were derived using the methodology consistent with assumptions set out in the ASC NEPM for HIL B.</p>
1 mg/kg	10 mg/kg	Public open space (HIL C)	<p>Relevant for public open space such as parks, playgrounds, playing fields (e.g. ovals), secondary schools (except for soil used for agricultural studies) and footpaths. Excludes undeveloped public open space (such as urban bushland and reserves), which should be subject to a site-specific assessment where appropriate.</p> <p>These were derived using the methodology consistent with assumptions set out in the ASC NEPM for HIL C.</p>
20 mg/kg	50 mg/kg	Industrial/commercial (HIL D)	<p>Assumes 8 hours is spent indoors and 1 hour spent outdoors at a site such as a shop, office, factory or industrial site. If the typical exposure for a site is predominantly outdoors with significant earthen areas, recalculation of a site-specific value is recommended.</p> <p>These were derived using the methodology consistent with assumptions set out in the ASC NEPM for HIL D.</p> <p>Note: the industrial/commercial direct exposure criterion for PFOA (including its salts and related compounds) has been set as 50 mg/kg in anticipation of the Stockholm Convention low content limit of 50 mg/kg.</p>
<p>Note: Where the guideline values refer to the sum of PFOS and PFHxS, this includes PFOS only, PFHxS only, and the sum of the two.</p>			

Table 3. Table 3 from PFAS NEMP 2.0

Table 3. Ecological guideline values for soil

Exposure scenario	PFOS	PFOA	Land use	Comments and source
Ecological direct exposure	1 mg/kg	10 mg/kg	All land uses	<p>Future work may be undertaken to review available soil guideline values proposed by Australian research and industry organisations.³⁵</p> <p>The human health screening value for public open space is used as an interim value (see Table 2).</p>
Ecological indirect exposure	0.01 mg/kg		All land uses	<p>The guideline value is based on dietary exposure of a secondary consumer as the most sensitive exposure pathway assessed. This value may not be protective of specific animals relevant to Australia, including predatory animals such as quolls, antechinus and reptiles. For intensively developed sites with no secondary consumers and minimal potential for indirect ecological exposure, a higher criterion of up to 0.14 mg/kg may be appropriate as outlined in the accompanying text in section 8.2.1.</p>

Table 4. Table 4 from PFAS NEMP 2.0.

Table 4. Biota guideline values

Exposure scenario	Sum of PFOS and PFHxS	PFOA	Description	Comments and source
Ecological direct exposure for wildlife diet	4.6 $\mu\text{g}/\text{kg}$		Mammalian diet - consumption of biota as wet weight food	Canadian Federal Environment Quality Guidelines (ECCC 2018).
	8.2 $\mu\text{g}/\text{kg}$		Avian diet - consumption of biota as wet weight food	This guideline value is to be used on sampled biota tissue for assessing risk to mammal and avian receptors based on their diet. The avian diet value may not be protective of migratory wading birds that have a high food intake due to the need to gain weight rapidly. These diet values may also not be protective of reptiles and amphibians.
Ecological exposure protective of birds	0.2 $\mu\text{g}/\text{g}$		Whole bird egg as wet weight	Adapted from Canadian Federal Environment Quality Guidelines (ECCC 2018) using an additional uncertainty factor. This guideline value is to be used on sampled bird eggs to assess risk to sensitive avian ecological receptors.
<p>Notes: Where the guideline values refer to the sum of PFOS and PFHxS, this includes PFOS only, PFHxS only, and the sum of the two. The Canadian guidelines refer to the criterion for PFOS only; in the NEMP the guideline values for ecological direct exposure for wildlife diet refer to the levels of PFOS and PFHxS in food consumed by mammals or birds. This has been adapted to allow for uncertainties and potential similar toxicities of PFHxS with PFOS.</p> <p>The guideline value for ecological exposure protective of birds refers to the levels of PFOS and PFHxS in bird eggs.</p>				

Table 5. Table 5 from PFAS NEMP 2.0

Table 5. Ecological water quality guideline values developed by water regulators

Exposure scenario	PFOS	PFOA	Exposure scenario	Comments and source
Freshwater	0.00023 µg/L	19 µg/L	99% species protection - high conservation value systems	Australian and New Zealand Guidelines for Fresh and Marine Water Quality - technical draft default guideline values for PFOS and PFOA.
	0.13 µg/L	220 µg/L	95% species protection - slightly to moderately disturbed systems	Note 1: The 99% species protection level for PFOS is close to the level of detection. Agencies may wish to apply a 'detect' threshold in such circumstances rather than a quantified measurement.
	2 µg/L	632 µg/L	90% species protection - highly disturbed systems	Note 2: The draft guidelines do not account for effects which result from the biomagnification of toxicants in air-breathing animals or in animals which prey on aquatic organisms.
	31 µg/L	1824 µg/L	80% species protection - highly disturbed systems	Note 3: The WQGs advise... ⁴¹ that the 99% level of protection be used for slightly to moderately disturbed systems. This approach is generally adopted for chemicals that bioaccumulate and biomagnify in wildlife. Regulators may specify or environmental legislation may prescribe the level of species protection required, rather than allowing for case-by-case assessments.
Interim marine	0.00023 µg/L	19 µg/L	99% species protection - high conservation value systems	As above. Freshwater values are to be used on an interim basis until final marine guideline values can be set using the nationally-agreed process under the Australian and New Zealand Guidelines for Fresh and Marine Water Quality.
	0.13 µg/L	220 µg/L	95% species protection - slightly to moderately disturbed systems	Note 1: The WQG advise that in the case of estuaries, the most stringent of freshwater and marine criteria apply, taking account of any available salinity correction.
	2 µg/L	632 µg/L	90% species protection - highly disturbed systems	Note 2: Marine guideline values developed by CRC CARE are under consideration through the nationally-agreed water quality guideline development process.
	31 µg/L	1824 µg/L	80% species protection - highly disturbed systems	

3. Incidence of PFAS in New Zealand

3.1 MfE Information

PFAS has been acknowledged as a persistent chemical of concern and the engineering and scientific communities have been aware of its presence for some time as a persistent organic pollutant. The general public have only become aware of PFAs due to more high profile public stories that have promoted more general awareness. Shown in the table below is a chronological list of public investigations and articles about PFAs in New Zealand. The information is taken from the MfE website - <https://environment.govt.nz/what-government-is-doing/areas-of-work/land/per-and-poly-fluoroalkyl-substances-pfas/latest-updates-on-pfas/>. The article title is included with some of the entries more information has been provided for more context.

Table 6. MfE Information about PFAs Investigations

Date of Article	Article title and description
16 th September 2019	Base Ohakea Comprehensive Site Investigation Report Complete.
1st May 2019	PFAS investigation, response and funding guiding released
4 th April 2019	Report of EPA investigation into firefighting foams released
31 st January 2019	Devonport detailed site report completed
30 th November 2018	A literature review completed to look at the impacts of PFAS on ecosystems.
21 st November 2018	Report on PFAS testing at Whenuapai Air Base
9 th November 2018	Latest PFAS testing results reported to Ohakea landowners. Latest PFAS testing results reported to Woodbourne landowners
31 st October 2018	New Zealand Food Safety report for MPI
19 th October 2018	Results from Whenuapai testing
8 th October 2018	PFAS Summit in Sydney

11 th September 2018	Fourth round of testing has begun near Ohakea and Woodbourne
10 th September 2018	Palmerston North city water supply safe
20 th August 2018	Sampling near Whenuapai Air Base completed
16 th August 2018	No PFAS compounds detected near site of 1996 Skyhawk crash.
10 th August 2018	Statement from Environmental Protection Authority The Environment Protection Authority (EPA) said it was not aware of any evidence that fire-fighting foams manufactured using PFOS or PFOA continue to be discharged into the environment, as recently reported by news outlets.
10 th August 2018	Food safety advice on Oaanui stream, South Taranaki While the Ministry for Primary Industries has received Taranaki Regional Council's findings and is finalising its food safety advice, it has provisionally advised the Council that eels and fish from the Oaanui stream should not be consumed. For Ngapirua stream, the Ministry says consumption should be limited to no more than one meal a month for adults and children.
10 th August 2018	Taranaki Regional Council investigation Taranaki Regional Council has found eels in two South Taranaki streams with elevated levels of chemicals associated with firefighting foam – the only finding of note in a wide-ranging regional investigation into any such contamination.
26 th July 2018	Defence testing near Whenuapai Air Base
18 th July 2018	Testing around old crash site near Bulls
18 th July 2018	Ohakea water scheme design study. Funding has been provided to the Manawatū District Council to conduct a study into creating a water scheme for the community at Ohakea.
4 th July 2018	Latest PFAS testing results reported to Ohakea landowners Results of third stage testing for the PFAS compounds PFOA, PFOS and PFHxS have been reported back to landowners near RNZAF Base Ohakea. The testing is to investigate the extent of PFAS compounds in the environment around the base. These results provide the most recent update to the broad New Zealand Defence Force testing programme that included sampling and testing in December 2017 and February-March 2018. This third round of testing was conducted in May and included groundwater and surface water sampling. The number of samples that detected PFAS compounds has not significantly changed from the previous rounds of testing. Of the 70 groundwater samples tested, 18

	<p>samples exceeded the interim guidance levels for drinking water for the sum total of PFOA and PFHxS, up from 15 samples in the previous testing round.</p> <p>Alternative drinking water supplies have been offered to people at all affected properties.</p>
4 th July 2018	<p>Latest PFAS testing results reported to Woodbourne landowners</p> <p>Results of third stage testing for the PFAS compounds PFOA, PFOS and PFHxS have been reported back to landowners near RNZAF Base Woodbourne. This testing is to investigate the extent of PFAS compounds in the environment around the base.</p> <p>These results provide the most recent update to the broad New Zealand Defence Force testing programme that included sampling and testing in December 2017 and February-March 2018. This third round of testing was conducted in May and included groundwater and surface water sampling.</p> <p>The number of samples that detected PFAS compounds has not significantly changed from the previous rounds of testing. None of the groundwater samples exceeded the interim guidance levels for drinking water. More surface water samples were taken in this round, with a similar percentage of samples having detectable levels of PFAS. Some groundwater wells could not be re-tested as they are not operational during the winter months.</p>
13 th June 2018	<p>This presentation, Health Effects of PFAS [PDF, 381 KB], was given to a community meeting in Ohakea by Dr Caroline McElinay, the Ministry of Health's Director of Public Health.</p>
30 th May 2018	<p>This letter (attached) was sent earlier this month by the Minister for the Environment David Parker to Andy Russell of the Ohakea Water Committee. The letter addresses issues that have been raised by Ohakea landowners. It is published with Mr Russell's consent. View the letter [PDF, 92 KB]</p>
25 th May 2018	<p>Third stage sampling of properties around Ohakea and Woodbourne was completed this week. Over 400 samples were taken in 11 days. Results from this sampling round are expected to be available in July.</p> <p>The 26 April cabinet paper (attached) covers the work planned by the All of Government PFAS programme for the rest of the year. Cabinet has asked for a report back in October. View the cabinet paper [PDF, 397 KB]</p>
8 th May 2018	<p>Australia - Expert health panel's independent PFAS advice - Media release [PDF, 270 KB]</p> <p>Australia - Read the Expert Health Panel for PFAS Report on the Australian Government Department of Health website</p>
4 th May 2018	<p>The third stage of testing in Ohakea and Woodbourne is due to begin on 14 May. All areas covered in the first and second stages will be resampled. Local councils are being engaged in finalising the sampling areas.</p>
23 rd April 2018	<p>Latest PFAS testing results reported to Woodbourne landowners</p> <p>Results of second stage testing for the PFAS compounds PFOA and PFOS have been reported back to landowners near RNZAF Base Woodbourne.</p> <p>Following the first round of testing in December last year, the testing zone around Base Woodbourne was expanded for the second stage of testing.</p> <p>One hundred and sixty eight groundwater samples were taken in Woodbourne in the second stage of testing, up from 67 samples in the first stage. One sample was found to contain PFAS concentrations that exceed the interim guidance levels for drinking water, but the bore from which this sample was obtained is not used for drinking water</p>

	<p>purposes. Two samples that exceeded the guidance levels during the first stage of testing were found to be under the guidance levels in the second stage testing.</p>
20 th April 2018	<p>Latest PFAS testing results reported to Ohakea landowners</p> <p>Results of second stage testing for the PFAS compounds PFOA and PFOS have been reported back to landowners near RNZAF Base Ohakea.</p> <p>Following the first round of testing in December last year, the testing zone around Base Ohakea was expanded for the second stage of testing.</p> <p>Seventy-four groundwater samples were taken in Ohakea in the second stage of testing, up from 26 samples in the first stage. Six wells servicing eight households returned results with levels at or above the interim drinking water guidelines. Two of these wells are newly identified and servicing three households in total.</p>
29 th March 2018	<p>Results released this week showed no PFAS contamination is present in the Sanson town water supply. The Manawatu District Council took up New Zealand Defence Force's offer to undertake the testing because of the town's proximity to the Ohakea Base.</p>
23 rd March 2018	<p>The New Zealand Defence Force is continuing its testing programme on and around Defence sites. Landowners around the Ohakea and Woodbourne bases will receive results of the latest round of testing on their properties around the end of April.</p> <p>Given the proximity of Bulls and Sanson to Ohakea, Defence offered to test the water supplies of the two towns. The Rangitikei District Council has welcomed the results for Bulls, showing PFAS levels to be well below the national Drinking Water Guidelines and that the town's water supply safe to drink.</p>
1 st March 2018	<p>The New Zealand Defence Force has been concentrating its investigations at bases where firefighting training has occurred and where drinking water at properties surrounding the base is taken from bores and wells – Ohakea and Woodbourne.</p>
23 rd February 2018	<p>NZDF, at the request of wine growers, tested grapes from vineyards in the vicinity of the base at Woodbourne for the presence of PFOS and PFOA. The results have come back clear - no PFOS or PFOA was detected. We are pleased to be able to provide this information and reassurance for growers and the wine industry. The Ministry for Primary Industries is confident that there is no food safety risk for grapes or wine from PFAS.</p>
25 th January 2018	<p>The first stage of testing for potential water contamination at properties neighbouring the Ohakea and Woodbourne airbases is complete.</p> <p>Following tests on 64 properties, seven have been identified where water used for drinking tested above the interim drinking water guideline for PFAS compounds. We are currently sharing the results with those people whose properties were tested.</p>

The table demonstrates that most of the issues have been related to New Zealand Defence Force (NZDF) bases or petrochemical sites.

The activities involved have significantly raised public awareness of PFAS and its potential for contamination of drinking water supplies and effects on crop production.

3.2 MPI Information

MPI produced a document in October 2018 call Per- and Poly-Fluorinated Alkyl Substances (PFAS) in selected New Zealand Foods (<https://www.mpi.govt.nz/dmsdocument/43975-Per-and-Poly-Fluorinated-Alkyl-Substances-PFAS-in-selected-New-Zealand-foods-Survey-report>).

96 food samples were tested for levels of PFAS. These food were collected from supermarkets in Auckland, Napier, Christchurch and Dunedin. These foods were cooked using normal methods and then tested.

The results from the study are as follows:

A single PFAS, perfluorohexanoic acid (PFHxA), was found in a beef rump steak sample, with no samples reporting the PFAS congeners related to current contaminated site investigations. Comparison of the analytical method performance to occurrence values for perfluorooctanoic acid (PFOA) and perfluorooctane sulphononic acid (PFOS) in overseas monitoring identified it was suitably sensitive to capture the potential ranges of occurrence in the food supply. Exposure of PFOS and PFOA, accounting for hypothetical levels up to the analytical limit of reporting (LOR), indicated negligible dietary risk.

This document also has health based guidance values for daily tolerable intakes, based on the Food Standard Australia and New Zealand (FSANZ, 2017). These values are as follows:

- Sum of PFOS and PFHxS: 20 ng/kg bw/day.
- PFOA: 160 ng/kg bw/day

3.3 NZEPA Information

The New Zealand Environmental Protection Agency (NZEPA) governs and administer the rules for use of PFAS in New Zealand. As such there is only information relating to the use for PFAS containing substances in New Zealand on the NZEPA website.

3.4 PFAS in Water

All of current testing that is publicly available is in relation to the testing completed as part of the investigation by MfE. This is illustrated in the section above for MfE.

There have been a lot of news articles relating to PFAS. Most of the news articles relate to the release of information, investigations and reports from MfE. Searching of the RNZ and Stuff websites gave 92 results from RNZ and 540 results from Stuff. These articles cover water and food contamination and PFAs levels in land and aquatic animals. Most of the people in the articles were unaware that PFAS was used in so many applications.

A recent article was published by RNZ on 2nd November 2022 regarding the Onehunga WTP that has been shut down due to recent PFAS contamination. The article indicated that PFAS had been above the limit on four occasions, but no information was given as to the actual readings.

3.5 PFAS in Wastewater and Biosolids

PFAS may be in the wastewater coming into a WWTP through domestic, commercial or industrial sources. It will the exit the WWTP via treated wastewater or in biosolids (sludge). There has not been much work completed to understand the level of PFAS in wastewater and biosolids in New Zealand.

Testing is being completed by some organisations as the importance of PFAS has become apparent but no public information is available yet.

The United States EPA (USEPA) had done a lot of work with PFAS. A presentation from the US EPA on PFAS treatment in drinking water and wastewater (https://www.epa.gov/sites/default/files/2020-09/documents/r1-pfas_webinar_day_1_session_3_speth.pdf) included a survey of 50 WWTP. They found the following

- Greater than 80% WWTPS had measurable C4-10 PF carboxylates, PFBS, PFHS, and PFOS
- PFHxA, PFOA and PFOS were predominant
- Median levels ~ 10–30 ng/L, although some plants were much higher

- Results shows temporal and spatial variability.

It is unlikely that NZ would have similar issues to the US, given our lack of production of PFAS products and the use being confined to isolated activities.

Removal of PFAS by wastewater treatment processes (biological, physical and chemical) is relatively unknown. More data is needed to ascertain the removal of PFAS through wastewater treatment processes and the concentration in effluent and biosolids.

4. PFAS Treatment Technologies

4.1 Drinking Water

PFAS has a number of treatment options depending on the concentration and type of PFAS. Certain technologies have been found to remove PFAS from drinking water, especially Perfluorooctanoic acid (PFOA) and Perfluorooctane sulfonic acid (PFOS). Those technologies include:

- Granular activated carbon (GAC) adsorption;
- Ion exchange resins; and
- High-pressure membranes.

These technologies can be used in drinking water treatment facilities or as point of use systems. These treatment technologies are effective but can be very expensive for capital and operating costs. With any waste product from water treatment that contains PFAS the material must go to accredited facilities for disposal, thermal regeneration (e.g. GAC) or destruction.

4.2 Wastewater and Biosolids

PFAS may be in the wastewater coming into a WWTP. It will exit the WWTP via treated wastewater or in biosolids (sludge). There has not been much work to understand the level of PFAS in wastewater and biosolids in New Zealand.

Treatment for removal of PFAS will be similar to those used for water treatment technologies. However, the efficiency at removal is uncertain as this technology has not been tested thoroughly on wastewater.

For biosolids that are contaminated with PFAS amendments can be added to adsorb or stabilise PFAS to reduce their release into the soil. The other option is the material must go to accredited facilities for disposal, thermal regeneration (e.g. GAC) or destruction.

5. Review of Draft PFAS NEMP 3.0

The draft version has highlighted sections that differ from Version 2.0. Note that submissions are only on the changes between versions 2.0 and 3.0 and not the entire document.

A review of the document with areas that affect water sectors in NZ is shown in the table below with reference and comments.

Table 7. review of Changes to PFAS NEMP 3.0.

Row number	Comment	Sector affected and impact
Row 46-55	Elaboration of definition of PFAS compounds	
Row 65-69	Additional sources of PFAS to include landfills and wastewater treatment plants.	
Row 134	States Australia’s international obligations – not clear if this also binds New Zealand to this as well.	
Row 156	Perfluorohexane sulfonate (PFHxS), it’s salts and related compound added to international obligations.	
Row 261	<p>Section 3.1 General environmental obligations concerning PFAS has the following.</p> <p><i>Understanding the environmental values that may be impacted by the contamination, both on- and off-site, such as:</i></p> <ul style="list-style-type: none"> • <i>determining the surface water and groundwater environments, including any freshwater, estuarine and marine components and any groundwater dependent ecosystems</i> • <i>determining potential impacts of soil contamination on current and future land uses and terrestrial ecosystems</i> • <i>determining what the water is used for, particularly its community values</i> • <i>considering important issues including any off-site movement, PFAS transformations, and exposure pathways to receptors</i> • <i>identifying and monitoring potential environmental sinks and receptors, such as soils, sediments and biota</i> 	<p>Water authorities</p> <ul style="list-style-type: none"> • This could add significant testing requirements for water authorities for water and wastewater activities
Row 373 to 374	<p>Section 5 PFAS Monitoring</p> <p><i>Environmental monitoring is used to determine if PFAS are present within an area of interest and to provide quantitative and qualitative data about the</i></p>	<p>Water authorities</p> <p>This could add significant testing requirements for water authorities for water and wastewater activities</p>

Row number	Comment	Sector affected and impact
	<i>distribution, concentrations and types of PFAS within this area. This includes data on PFAS in receptors, such as wildlife and seafood species (Section 8.7) and assessing potential for PFAS to leach from soils and construction materials (Section 18.3).</i>	
Row 410	Comment regarding requirements under the Intergovernmental Agreement on Responding to PFAS Contamination. Is this relevant to NZ?	Common theme is that the NEMP refers to Australia's commitments and requirements. What is NZ required or committed to do?
Row 452	Section 5.2 Ambient monitoring program Changes to ambient monitoring to better understand PFAS sources and nature of land catchment	No impact Clarifies requirement of ambient monitoring
Row 490	Section 5.2.1 Definition of Ambient land use classification added. Requires classification of land use.	
Row 578	Section 5.3 Site specific monitoring program Requires sampling of exposed aquatic biota even if water concentrations are below the limit of reporting.	Water authorities This could add significant testing requirements for water authorities for water and wastewater activities
Row 767-773	Section 8.1 Considerations for using guideline values Has relevant guidance using Australian Water Quality and Environmental documents but no New Zealand references. Do we have relevant documents?	Common theme is that the NEMP refers to Australia's commitments and requirements. What is NZ required or committed to do?
Row 1050	Table 6 Ecological guideline values for soil <ul style="list-style-type: none"> • Reptiles are included for exposure to soil, needs to be accounted for in studies • Ecological direct and indirect exposure to all include all land uses 	Water authorities This could add significant testing requirements for water authorities for water and wastewater activities

Row number	Comment	Sector affected and impact
	<ul style="list-style-type: none"> New PFOA guideline values for indirect is 0.005 mg/kg 	
Row 1909-1913	<p>Stockpiling and storage</p> <p>This whole section has been revised which will impact on the storage or containment of water or wastewater contaminated with PFAS.</p> <p><i>Unless otherwise required by the relevant regulators, the capacity of the containment bunding should be at least 100% of the planned storage capacity plus 25% of the storage capacity up to 10 000 L, together with 10% of the storage capacity between 10,000 L and 100,000 L, and 5% above 100,000 L.</i></p>	<p>Water authorities</p> <ul style="list-style-type: none"> Requirements for containment of water, wastewater any or material contaminated with PFAS. Unknown impact as containment size depends on extent of contamination event
Row 2343 to 2461	<p>Section 12.4.Organic waste and resource recovery materials</p> <ul style="list-style-type: none"> New section added which includes biosolids, food waste and animal wastes. Recommendation of a feedstock management plan to assess levels of PFAS in feedstock for organic wastes. Biosolids to land covered in Section 15. Table 10 give level of assessment required. WWTP biosolids and septage wastes require the PFAS assessment and management is essential to address potential risks. 	<p>Water authorities</p> <ul style="list-style-type: none"> Recommendation for testing and management required for organic material (food waste, green waste). Recommendation only of higher level of testing and management required for septage waste and sludge/biosolids.
Row 2498 to	<p>Section 12.5.1 Management of PFAS-contaminated construction water</p> <p>New section.</p>	<p>Construction sector</p> <ul style="list-style-type: none"> Provides guidance on construction site that abstract water that may contain PFAS. Will affect construction projects that source their own water.
Row 2566	<p>Section 13 PFAS Remediation and Management</p> <p>Whole section has been revised. Comments in next three rows.</p>	
Row 2743	Section 13 PFAS Remediation and Management	

Row number	Comment	Sector affected and impact
	<p><i>In general, due to the persistent nature of PFAS and the potential for long-term generational impacts, the preferred remediation hierarchy starts with the separation and treatment for destruction of the PFAS contaminated materials on site, including contaminated water, so that the PFAS content is destroyed, removed, or otherwise reduced to an acceptable level. Destruction off-site at an appropriately licensed facility is also a highly preferred option, due to the permanent removal of POPs from the environment. Highly preferred may not always mean that it is possible or selected on a site.</i></p>	<p>Water authorities</p> <ul style="list-style-type: none"> • Advice of remediation and management. • Preference given to on-site remediation, treatment and destruction of PFAS containing materials including contaminated water.
Row 2756	<p>Section 13 PFAS Remediation and Management</p> <p><i>Least preferred options in the management hierarchy is off-site removal to a specific landfill cell (see Section 11). This may or may not include immobilisation prior to landfill disposal, noting that the conditions in some landfills may affect immobilisation chemistry. Acceptance of PFAS-contaminated materials is a commercial decision for the landfill operator and must be approved by the environmental regulator (see Section 14). Immobilisation prior to landfill disposal may also require environmental regulatory approval, as could the disposal to landfill itself. Leachate should be captured and treated to remove PFAS and the removed PFAS should be destroyed.</i></p>	<p>Water authorities</p> <ul style="list-style-type: none"> • Advice of remediation and management. • Preference given to on-site remediation, treatment and destruction of PFAS containing materials including contaminated water.
Row 2814	<p>Section 13 PFAS Remediation and Management</p> <p>Need to demonstrate remediation success</p>	<p>Water authorities</p> <p>Any project that deals with PFAS contamination needs to show that it has been successful. This will be through the treatment, containment or destruction methodology along with testing to prove this.</p>

Row number	Comment	Sector affected and impact
Row 2832	<p>Section 13.7 Long Term management Strategy</p> <p>Some sites may require long term management plan if PFAS contamination is to remain on site.</p> <p>Could affect biosolids applications or where treated effluent is applied to land.</p>	<p>Water authorities</p> <ul style="list-style-type: none"> • Long term management plans required for site where PFAS has been applied. • This may affect sites where biosolids or biosolid related products have been applied.
Row 3060	<p>Section 15.1 PFAs management framework (Wastewater)</p> <p>Changes to include the environmental regulator for the PFAS management framework</p>	<p>Wastewater</p> <ul style="list-style-type: none"> • Regulators need to be included in any PFAS management framework. • This is probably the case already but need to be assessed and reported.
Row 3095-3098	<p>Section 15.2. Additional management tools (wastewater)</p> <p>Inputs of PFAS that are outside of the NEMP are covered by other processes.</p> <p><i>PFAS inventories for specific wastewater catchments or priority areas within catchments – In addition to point sources, PFASs are present in a wide range of products, which contributes to the PFAS inputs to wastewater systems. Options to manage these diffuse sources of PFAS and reduce any associated environmental and human health risks are covered by other national processes outside of the PFAS NEMP</i></p>	<p>Wastewater</p> <ul style="list-style-type: none"> • Relates to trade waste discharges into the wastewater network.
Row 3129	<p>Section 15.4 PFAS Criteria in biosolids</p> <p>New section. Comments in sections below for Section 15.4.</p>	

Row number	Comment	Sector affected and impact
Row 3146	<p>Section 15.4.1 Characterization of biosolids</p> <p>New section. First paragraph of this section below. Requires a lot more testing for biosolids.</p> <p><i>To understand the risks that biosolids may pose to the environment, it is recommended that biosolids are characterised for the full suite of PFAS analytes included in the standard methods as described Section 19. As biosolids are a complex matrix it is important that robust quality assurance is included within the sampling and analysis program. Further details on the analysis of PFAS in waste materials including biosolids can be found in Chapter 19.4. Details of biosolids sampling requirements to ensure characterisation is representative should be determined by each jurisdiction. The responsibility for sampling biosolids should be consistent with the existing guidance in each jurisdiction.</i></p>	<p>Biosolids</p> <ul style="list-style-type: none"> • Recommendation for testing of biosolids for full characterization of PFAS content.
Row 3168	<p>Section 15.4.2 Details on proposed land application and characterisation of in-situ soils</p> <p>First two sentences below.</p> <p><i>Information about the proposed land application approach and soil properties, including the depth of incorporation and soil bulk density is required (conservative default values can be used if these are not available, see NCWG Supporting Document—Derivation of biosolids criteria (2021)). It is recommended that the soil at the land application site is characterised to determine the existing in-situ baseline soil concentrations of PFAS prior to application of biosolids.</i></p>	<p>Biosolids</p> <ul style="list-style-type: none"> • Note that the use of “is required” and also the reference to the “depth of incorporation”. In Australia they incorporate the biosolids into land (by ploughing or ripping) whereas in New Zealand it is applied to the land surface. • If biosolids are required to be incorporated into the soil in New Zealand it will probably make it uneconomical to apply biosolids to land or be used in compost .

Row number	Comment	Sector affected and impact
Row 3185	<p>Section 15.4.3 Criteria</p> <p>Mention of biosolids being incorporated into soil for restricted use.</p> <p>Text below with sentence relating to incorporated highlighted.</p> <p><i>The HHERA for PFAS in biosolids was developed to identify the key exposure pathways that should be considered to derive risk-based criteria. The HHERA assessed potential risks for different classes of biosolids use with a focus on 'restricted use' and 'unrestricted use' biosolids scenarios. The 'restricted use' biosolids scenario in the HHERA assumed that biosolids are land applied and incorporated into the soil for agricultural use. The 'unrestricted use' biosolids scenarios assumed biosolids are applied to soil without any restrictions on the application rate</i></p>	<p>Biosolids</p> <ul style="list-style-type: none"> • Same as for 15.4.2 above • <i>The 'restricted use' biosolids scenario in the HHERA assumed that biosolids are land applied and incorporated into the soil for agricultural use.</i> • Reference to incorporation of biosolids into soil of agricultural use.

Row number	Comment	Sector affected and impact																																		
<p>Row 3227</p>	<p>Section 15.4.3 Criteria</p> <p>Table 11 gives criteria for PFAS levels of biosolids applied to land depending on class of biosolids (restricted, unrestricted and Maximum Allowable Soil Contamination Concentration (MASCC)). Table below.</p> <p>3227 Table 11 Criteria for PFOS+PFHxS and PFOA in biosolids and maximum allowable soil contaminant concentrations (MASCC) based on a 1, 2 and 5-fold margin of safety</p> <table border="1" data-bbox="401 683 1150 987"> <thead> <tr> <th>Criteria type</th> <th>Margin of safety</th> <th>PFOS+PFHxS (µg/kg)</th> <th>PFOA (µg/kg)</th> </tr> </thead> <tbody> <tr> <td rowspan="3">Biosolids threshold restricted use</td> <td>5</td> <td>6.2</td> <td>25</td> </tr> <tr> <td>2</td> <td>15</td> <td>65</td> </tr> <tr> <td>1</td> <td>31</td> <td>130</td> </tr> <tr> <td rowspan="3">Biosolids threshold unrestricted use*</td> <td>5</td> <td>0.22</td> <td>1.0</td> </tr> <tr> <td>2</td> <td>0.55</td> <td>2.5</td> </tr> <tr> <td>1</td> <td>1.1</td> <td>5</td> </tr> <tr> <td rowspan="3">MASCC</td> <td>5</td> <td>0.22</td> <td>1.0</td> </tr> <tr> <td>2</td> <td>0.55</td> <td>2.5</td> </tr> <tr> <td>1</td> <td>1.1</td> <td>5</td> </tr> </tbody> </table> <p>3229 * The unrestricted use threshold may not be applicable in all jurisdictions. Where it is applicable, it should be applied to the final biosolids product for land application.</p> <p>3230</p>	Criteria type	Margin of safety	PFOS+PFHxS (µg/kg)	PFOA (µg/kg)	Biosolids threshold restricted use	5	6.2	25	2	15	65	1	31	130	Biosolids threshold unrestricted use*	5	0.22	1.0	2	0.55	2.5	1	1.1	5	MASCC	5	0.22	1.0	2	0.55	2.5	1	1.1	5	<p>Biosolids</p> <ul style="list-style-type: none"> • This needs to be assessed against the Draft Guidelines for Beneficial Use of Organics on Productive Land and determined if these values form Table 11 should be included. • This would add cost to biosolids testing
Criteria type	Margin of safety	PFOS+PFHxS (µg/kg)	PFOA (µg/kg)																																	
Biosolids threshold restricted use	5	6.2	25																																	
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	2	0.55	2.5																																	
	1	1.1	5																																	
<p>Row 3480</p>	<p>Section 18.3 Assessing PFAS Leachability</p> <p>This is a new section and gives descriptive process on how to measure, test and assess leachate from contaminated material or sites.</p> <p>This relates to soils, solid materials and biosolids in terms of what is required.</p>	<p>Biosolids</p> <ul style="list-style-type: none"> • Will impact on the level of testing and investigation required. 																																		

Row number	Comment	Sector affected and impact
Row 3942	<p>Section 19.4 Guidance on the analysis of PFAS in solid organic waste and resource recovery materials</p> <p>New section.</p> <p>Relates to organic and recovered waste which at times can be combined with biosolids to produce compost.</p>	<p>Biosolids and Organics</p> <ul style="list-style-type: none"> Will impact on biosolids that are mixed with food waste and green waste to make compost.
Appendix B	<p>Appendix B PFAS Ambient sampling guideline.</p> <p>This is a new appendix, with the objectives below.</p> <p><i>This document details a guideline to undertake sampling for per- and poly-fluoroalkyl substances (PFAS) in locations that are defined as ambient or not directly impacted by point sources. It provides guidance which can form part of jurisdictional programs or one-time sampling projects that aim to determine ambient or baseline concentrations of PFAS in surface waters, groundwater, sediments or biota. Current ambient programs have not considered soil or air comprehensively, and this will be included as future work progresses. It also provides information on quality control measures and advice on how to assess data. It should be used in conjunction with the NEMP to ensure a consistent approach is taken for the sampling and analysis of PFAS. This document is not intended for use in sampling known contaminated sites or investigation areas although may provide useful context for the design of monitoring programs for offsite monitoring of contaminated sites.</i></p> <p>Give a typical suite of PFAS compounds to be tested in Table B-2.</p>	<p>Biosolids and Compost</p> <ul style="list-style-type: none"> Requirements to more fully encompass discharges to air and soil.
Appendix D	<p>Appendix D Treatment technologies potentially available in Australia</p>	<p>Water authorities</p> <ul style="list-style-type: none"> Treatment of PFAS

Row number	Comment	Sector affected and impact
	Some minor alterations. Separates out treatment technologies that are currently available and those under trial or that require further development.	
Appendix E	Appendix E. Matters to inform selection of management and remediation options New appendix that gives guidance on selection of management and remediation options.	Water authorities <ul style="list-style-type: none"> • Management of PFAS
Appendix H	Appendix H. Overview of laboratory-based leaching methods commonly applied and commercially available in Australia.	No reference to what is available in NZ.

