



Ministry for the
Environment
Manatū Mō Te Taiao

PFAS investigation, response and funding guidance

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Introduction

This document outlines the process for gathering information to make decisions about investigating, managing and remediating sites contaminated with per- and poly-fluoroalkyl substances (PFAS). It is aimed at:

- contaminated land practitioners and regulatory authorities
- owners, potential owners, or occupiers of sites where PFAS are present or suspected in the soil or water.

The document is an overview of the duties, functions and responsibilities of councils and landowners. It supplements the [National Environmental Standard for Assessing and Managing Contaminants in Soil to Protect Human Health \(NES\)](#) and the [Contaminated Land Management Guidelines](#).

It also outlines potential funding streams for investigation and response, and considers stakeholder engagement.

What are PFAS?

PFAS (per- and poly-fluoroalkyl substances) are a group of man-made chemicals that have been widely used in industrial and domestic settings. They are stable, highly mobile, and are often present as a contaminant in soils, water and animal and plant life.

Scope

This document:

- outlines the current mechanisms to manage contaminated land
- links to PFAS documents
- gives references for more detailed information.

It does not:

- prioritise PFAS against other contaminants
- provide New Zealand-specific Environmental Guideline Values.

Applying Environmental Guideline Values (EGVs)

EGVs should be selected from the guidelines worldwide in accordance with *Contaminated Land Management Guideline No. 2 – Hierarchy and Application in New Zealand of Environmental Guideline Values*. Site-specific soil guideline values may be developed in line with the *Methodology for deriving standards for contaminants in soil to protect human health*. See the *Appendix for the Heads of Environmental Protection Authorities Australia New Zealand PFAS National Environmental Management Plan (January 2018) EGVs*.

PFAS investigation

Investigation process

PFAS have unique properties, and sampling and analysing these contaminants requires specific techniques. However, the process for assessing them is the same as for other contaminants such as lead, nitrates and dioxins.

Investigation involves four steps (see figure 1):

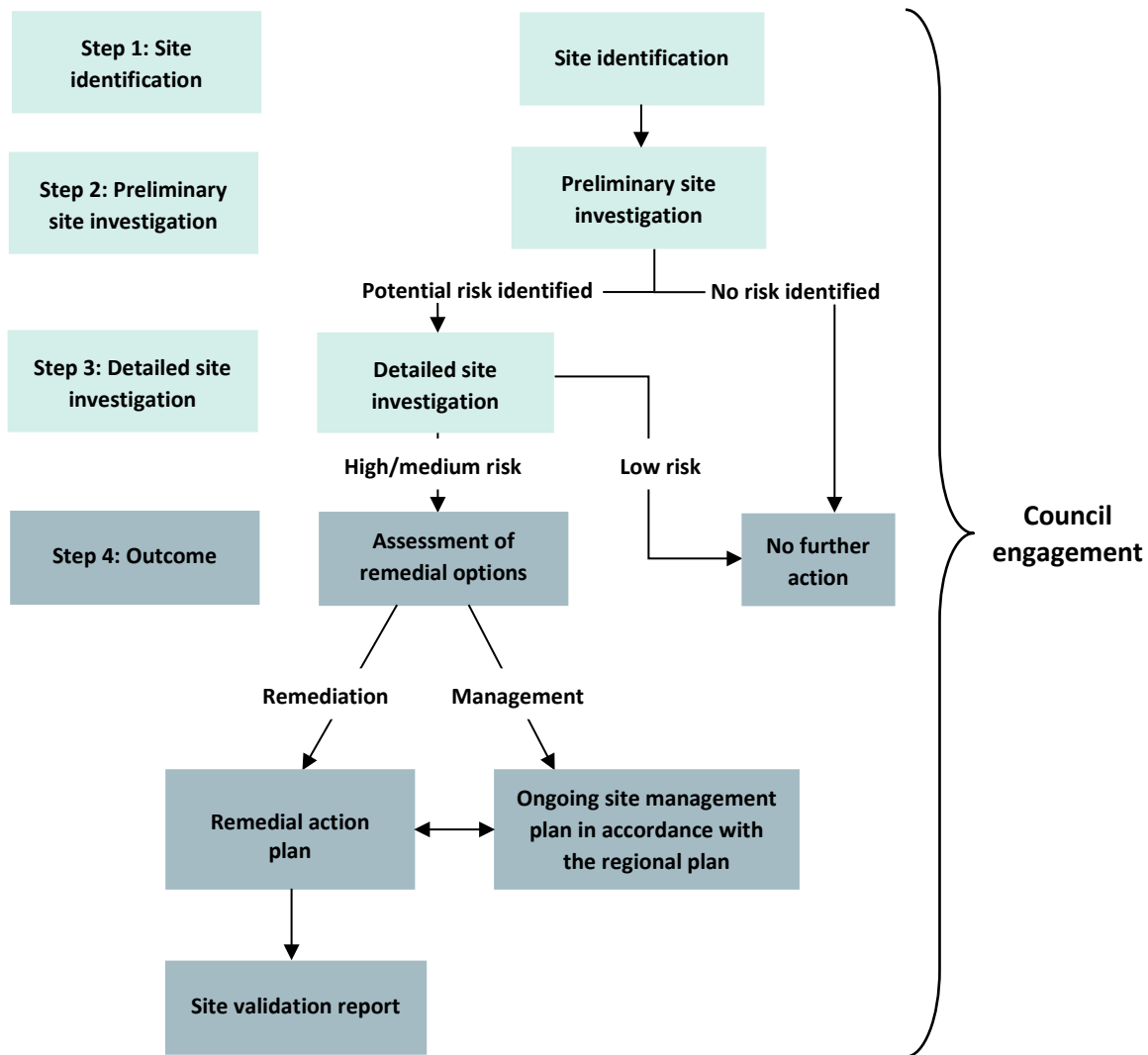
- Step 1: Site identification – identifying sites where PFAS have been manufactured, used or disposed of
- Step 2: Preliminary site investigation – developing a conceptual site model and risk assessment based on available information
- Step 3: Detailed site investigation – investigating the actual site environment to refine the conceptual site model and risk assessment
- Step 4: Outcome – this depends on the findings of the previous steps, and may include management and/or remediation.

This guidance is consistent with the processes that landowners and councils currently use to investigate or manage contaminated land.

The efficiency and effectiveness of the process relies on accurate, comprehensive and relevant data. Decisions may involve assessing compliance with the Resource Management Act 1991 (RMA), the National Environmental Standard for Assessing and Managing Contaminants in Soil to Protect Human Health (NES), and regional or district plans. Ideally, the landowner and councils would be actively engaged at each stage, the councils being recognised as the regulators of discharges, land use, resource consents, and monitoring.

Any investigations under this process should (and for NES purposes must) meet the Contaminated Land Management Guidelines, and be undertaken by a suitably qualified and experienced practitioner with contaminant specific experience. Ideally investigations would be made by a certified environmental practitioner with site contamination specialisation, or similar overseas certification.

Figure 1: Investigation process



Step 1: Site identification

Two main activities identify sites potentially contaminated with PFAS.

1. By councils:
 - a. regional councils identify and monitor contaminated land, control discharges to the environment, and control water quality in a water body
 - b. territorial authorities prevent or mitigate any adverse effects of the development, subdivision, or use of contaminated land usually achieved through the NES.
2. By landowners/prospective landowners making due diligence audits or investigations, to learn of any potential or actual contamination liabilities for a piece of land.

Regional councils compile registers of sites where hazardous activities and industries have taken place, to comply with their RMA section 30(1)(ca) duty. Industries and activities that have used PFAS/PFAS-containing products may be considered as [Hazardous Activities and Industries List](#) (HAIL) sites. These may be either as an identified industry category or, where evidence exists, as land that has been subject to intentional or accidental release of a hazardous substance in sufficient quantity that could be a risk to human health or the environment (HAIL category I).

For advice, see [Contaminated Land Management Guideline No. 4: Classification and Information Management Protocols](#) (CLMG#4).

Territorial authorities use the registers to identify sites that may be subject to these regulations.

Section 9 of the RMA prohibits using land in a way that contravenes a national environmental standard or the rules in regional and district plans. Landowners also have a general duty under section 17 of the RMA to avoid, remedy or mitigate adverse effects on the environment from an activity carried out by or on behalf of the person. Owners or occupiers of land must also comply with the Health Act 1956 and the RMA to avoid nuisance and adverse environmental effects.

Other activities that may lead to councils identifying sites include inspections for another purpose, eg, compliance audits or pollution. If a council finds anything that may not comply with the RMA, it is empowered, and expected, to investigate.

Prioritising sites

A council's register of HAIL sites allows for prioritising potentially contaminated sites. Prioritisation uses known information to highlight sites that may require urgent assessment, management and/or remediation.

Prioritisation also enables the landowner and regulator to consider and, if necessary, address sites in descending order of priority. This makes the most efficient use of resources.

Landowners should discuss their prioritisation exercises with councils (as the responsible regulators), particularly about a site of concern.

Guidelines and information

Information sources that could help identify sites include council registers of HAIL land-use sites, and those identified in CLMG#4. Also helpful are PFAS-specific studies, such as the [Non fire-fighting foam sources of PFAS contamination in New Zealand scoping study](#).

Site-specific information can support more robust assessment. Any prioritisation of sites is likely to change over time as more information becomes available.

Step 2: Preliminary site investigation (PSI)

If a landowner plans an activity regulated by the NES, they may need a PSI to inform any decisions. Landowners may also carry out a PSI to identify risks and better understand their liability if there is contamination.

The PSI involves compiling information about a site's history, and identifying all potential contaminants, sources and discharges, pathways and receptors. This data underpins a conceptual site model (see Step 3) and highlights any gaps, before assessing risk.

Guidelines and information

[Contaminated Land Management Guideline No. 1: Reporting on Contaminated Sites in New Zealand](#) (CLMG#1) sets out minimum information required for each reporting phase.

If the available information/conceptual site model suggests a potential contamination risk exists, further detailed investigations may be required to confirm and quantify the levels and extent of contamination. The Source-Pathway-Receptor model should be used to help identify contamination risk. Refer to [Contaminated Land Management Guideline No. 3 – Risk Screening System](#). Section 2 has details on the Source-Pathway-Receptor model.

See also the sections on conceptual site models in [Contaminated Land Management Guideline No. 5 – Site Investigation and Analysis of Soils](#) (CLMG#5).

For the common descriptors of the investigation phases, see CLMG#5. This guideline is mainly about soil, although the same principles could apply to other media, such as groundwater or surface waters. In the case of drinking water, see the [NES for Sources of Human Drinking Water](#).

Step 3: Detailed site investigation (DSI)

What is a DSI?

A DSI involves sampling and analysis to understand the contaminants, their extent and concentration. It should address information gaps found during the PSI. The DSI can confirm assumptions made during the PSI about geology, potential pathways, and environmental receptors. It may also consider cultural, community and economic values.

Conceptual site models

A qualified and experienced practitioner will use the DSI to develop or refine a conceptual site model. This is used as the basis for an assessment of risk to human and environmental receptors.

Reasons for a DSI

Landowners may need to undertake a DSI when:

- a PSI identifies information gaps, or does not assess the potential risk from a site, or signals a potential risk to health or the environment
- under the NES, a council decides that a DSI is required to assess either an application for resource consent or compliance with resource consent
- a council has reason to believe there has been a discharge, and requires a site assessment to determine:
 - compliance with the RMA, any regulation, a rule in a plan, or resource consent
 - the actions to avoid, remedy or mitigate any actual or likely adverse effect on the environment.

This guidance document does not lay out all the RMA requirements. Landowners and councils should consider any other provisions on a case-by-case basis.

For advice on enforcement, local authorities should refer to the [Compliance, Monitoring and Enforcement Best Practice Guidelines](#).

Assessing risk

A well-designed DSI should result in a robust assessment of the health and environmental risks of contamination. If it finds an unacceptable risk, or cannot determine the level of risk, further work is needed. This may include remedial planning, site monitoring and management. Decisions should be based on factors such as the nature, extent and concentration of the contamination, exposure pathways, and receptors.

Determining an unacceptable level of risk must be based on the severity of adverse effects on receptors, and the likelihood of harm to health, safety or the environment. In these cases it is best for landowners to work with councils and, in some cases, district health boards. Unresolved risk statements are not acceptable for a DSI.

Guidance and information

Guidance on methods, instrumentation and reporting for a DSI is in CLMG#1, CLMG#5 and [National Environmental Monitoring Standards – Water Quality Parts 1–4](#).

To help councils maintain their HAIL registers and property files, landowners should give them copies of DSIs. In some regions this is a requirement under the regional plan. Using this information, the council can reflect the current contamination status of a site on its register. This information will then be available to prospective landowners and territorial authorities when assessing the site under the RMA/NES.

Step 4: Outcome

Any recommendations in a DSI, such as site remediation, risk management, or taking no action, should be informed by the conceptual site model and expert advice. If risks have been identified, whatever the outcome, the landowner should discuss and agree on next steps with the councils in their region/district/city.

The possible outcomes are:

- no further action
- assessment of remedial options (ARO)
- an ongoing site management plan
- a remedial action plan (RAP) and remediation of the site.

These next steps may also include further DSIs, ecological and cultural assessments, and structural and geotechnical investigations. These measures may give a better understanding of the contamination, identify any receptors to protect, and clarify the usefulness of any risk reduction. The DSI and other investigations should yield enough information to support any recommendations.

No further action

No further action may apply if the DSI or PSI has determined that PFAS were never used or are highly unlikely to be present on a site. The DSI may show that PFAS are not present, or only at concentrations below health or environmental guidelines. These sites could be considered not to pose a risk and, as figure 1 shows, no further action by the landowner is required at that time. However, a DSI may identify other contaminants at the site, which may require action.

Remediation or mitigation

If remediation or mitigation is planned or required, landowners should seek direction in an assessment of remedial options (ARO), and discuss this with councils. They should also consider the risks and benefits, as well as costs and funding. Councils may need to assess legal and consenting requirements.

Councils should be given the ARO, including the justification for any response, and include it on HAIL registers and other records.

Assessment of remedial options (ARO)

If a DSI shows that PFAS are present at or above the guidelines, and that complete pathways exist, these sites may require management and/or remedial action to prevent contaminant exposure to receptors. Responses may involve one or more of these actions:

- no action
- ongoing site management plans
- site remediation.

The ARO sets out the process for remediation. It includes setting goals and identifying ways to treat or remove the contaminants, or break pathways at the site. The practical, technical and fiscal benefits and drawbacks of each approach should be identified, assessed and documented. The ARO allows councils and landowners to understand and compare each option.

The response should suit the risks, and address identified and predictable future scenarios. If appropriate, provisions in the regional plan. If any works must comply with the NES, these will be permitted through the standard NES process.

Ongoing site management plan (OSMP)

The OSMP will be site-specific and could include long-term monitoring and detailed on-site controls to manage risks from residual contamination.

The aim of an OSMP is to:

- control activities on or around sites where contamination has been identified but does not require remedial action, or on remediated sites with residual contamination
- document analysis and reporting requirements, sampling methods and frequency of long-term monitoring.

On-site controls are designed to ensure that activities avoid:

- exposing workers or site occupants to contaminated soil or groundwater
- uncontrolled movement of contaminated soil or other media
- contamination of groundwater
- inappropriate disposal of contaminated soil or groundwater.

The purpose of long-term monitoring is to:

- measure any changes in the contamination
- alert landowners to any potential changes in exposure to new and existing receptors.

Remedial action plan (RAP)

An RAP is needed if the DSI recommends remediation.

The RAP is used to plan the remediation and management, to reduce the risk from contaminants. It should set out the tasks and resources to carry out the action in the ARO. The plan should document:

- the goals, objectives and strategies of remedial works
- the proposed action
- health, safety and environmental risks
- the validation testing, monitoring or inspection to show that remediation was successful
- the legal requirements, including the NES, rules in regional and district plans, and conditions of resource consent
- who is responsible for the actions within a timeframe.

After remediation, there is generally a site validation report to confirm the RAP targets have been met.

Responses may require agreements and resource consents from affected parties and regulators. Regulators will need to authorise activities that are regulated by the RMA and the NES. These could include:

- monitoring schedules
- sampling and remediation standards
- details of remediation methods
- access to land
- reporting requirements
- monitoring well installation
- soil disturbance
- sediment controls
- air discharges.

If contamination has migrated beyond the site boundaries, monitoring and managing this may require a broader action plan. Councils and landowners need to agree on this, to ensure the best course of action.

Initiating action

The RMA must be considered when actual or likely adverse effects on the environment require action. The regulatory process is clear for sites where the NES applies.

Regional plans have rules about discharges. Regional councils need to assess compliance, to determine whether there has been a breach of rules, and whether to enforce them.

If an action does not comply with the RMA, regional/district plan rules, or resource consent, the council may consider taking enforcement action against the landowner/polluter.

To ensure any risks to health or the environment are managed, an application can be made to the Environment Court for an enforcement order under section 319 of the RMA, or an interim order under section 320.

Councils may investigate or take enforcement action

- Regional councils have a duty under section 30(1)(ca) of the RMA to investigate land, to identify contaminated land.
- Section 332 of the RMA authorises entry onto private property by enforcement officers for the purpose of inspection to determine compliance, including taking samples of water, soil or organic matter. This section does not apply where the officer already has reasonable grounds to believe that the RMA has been breached. In this case, the council needs a search warrant to enter a property.
- If a council has reason to believe a piece of land is contaminated, it may require an investigation to assess the level and extent of the contamination in the soil and groundwater, to inform any further course of action (RMA section 322 (1)(b)(ii)).
- The council may be able to conduct testing on private land adjoining land where a contaminant may have been discharged, and further afield. This could be done as part of a survey if the council considers that a district or regional plan should be reviewed in light of contamination identified on land (RMA section 333).
- Any person may apply for an enforcement order from the Environment Court on any grounds set out in section 314. These include the requirement to ensure compliance with the RMA, any regulations, a rule in a plan or proposed plan, or a resource consent. If an enforcement order is sought against a Crown organisation, a council must apply to the court.¹
- RMA enforcement officers (warranted under the HSNO Act) are empowered to take enforcement action under the HSNO Act if they are in or on private property to enforce the RMA (section 97 (1)(h) and section 97(2)).

Other agencies may also take action

The Ministry for Primary Industries may give direction if it reasonably suspects the existence of a hazard or a source of contamination that may affect food, or anything that may become food, that imposes movement or related controls to determine, minimise, manage, or control the risk to human life or public health created by the suspected non-compliance or suspected existence of the hazard or the source of contamination.

¹ RMA section 4(6).

Roles and responsibilities

In general, the landowner/polluter is responsible and accountable for all stages of the investigation, including mitigation or remediation. If such action is taken, councils should be kept informed. For more information, see [National PFAS Programme Roles and Responsibilities](#).

Broader agreements should clarify the roles and responsibilities of stakeholders – for example, a memorandum of understanding or terms of reference.

Territorial authorities have statutory responsibility for requests for a land information memorandum or project information memorandum. This refers to the requirement to disclose information on the land, including the likely presence of hazardous contaminants.

Regional councils and territorial authorities are subject to the Local Government Official Information and Meetings Act 1987. Individuals can request information on investigations in the council's region or district.

Funding

Responsibility

Under the RMA, the landowner or the polluter is generally responsible for managing land contamination, and therefore the funding for any investigation and response. Councils will act as regulator if there is a breach of local statutes or legislation. Councils will also need to authorise activities controlled under the Resource Management Act, National Environmental Standard for Assessing and Managing Contaminants in Soil to Protect Human Health (NES) and regional or district plans.

For Crown land, the Crown organisation should fund any investigation and remedial action. If the cost is beyond the organisation's scope, it can seek supplementary funding through the Public Finance Act 1989 and Cabinet directives. Such funding will be subject to approval by ministers and Cabinet.

Private and other public landowners are mainly responsible for the cost of addressing contamination on their sites. Other potential sources for landowners who are not responsible for contamination are outlined below.

Contaminated Sites Remediation Fund (CSRF)

The CSRF is available on a competitive basis through two annual funding rounds, subject to eligibility criteria. Applicants will be competing with other high-risk sites in New Zealand. There is a limited pool of about \$2.6 million per financial year (subject to continued approval).

The CSRF is not typically available for Crown sites, except where the contamination was not caused by the Crown, and occurred before the site became Crown land.

For more information, visit the Ministry for the Environment's [CSRF web pages](#).

Deductions for environmental expenditure

Tax deductions are available to business taxpayers for expenditure related to managing and remediating contaminated land. This may help private individuals who own contaminated land. For more information see the [Inland Revenue website](#).

Stakeholder engagement and risk communication

Investigating sites affected by PFAS contamination can cause significant stress and uncertainty to stakeholders and property owners, as well as members of communities indirectly affected.

Where appropriate, a robust stakeholder engagement and risk communication plan should be developed ahead of any investigation or remediation. This can be shared with stakeholders, including regional or territorial authorities.

An effective stakeholder engagement and risk communication plan gives clear, timely and accurate information to stakeholders and the community. A well-informed community is more likely to support your project and reduce the spread of inaccurate or false information.

Refer to the [PFAS Communication, Engagement and Information Sharing Guidelines](#) for further information.

Further information

These processes take the 'business as usual' approach to managing contaminated land. However, the All-of-Government PFAS Governance Group will, where requested, contribute to and help with decisions made using this process, until the All-of-Government programme ceases. However, the agencies will continue to advise and guide as needed.

- Visit the Ministry for the Environment [PFAS web page](#)
- Email: PFAS@mfe.govt.nz

Appendix: Environmental guideline values

Taken from the [Heads of the Environmental Protection Authority PFAS National Environmental Management Plan](#) dated January 2018, section 9, pages 13–16.

8 Environmental guideline values

The following guideline values represent a nationally-agreed suite that should be used to inform site investigations.

Where possible these guidance values have been derived based on, or using, existing nationally-agreed and long standing Australian processes. For guidance values that are not yet available, in particular those where there are nationally recognised processes for the review and adoption of new criteria, such as the Water Quality Guidelines, appropriate interim criteria are recommended below.

Where the above options have not been possible, internationally derived guideline values are provided with a recommendation for future work to review these within the Australian context.

A degree of conservatism has been included in the following criteria, which means that exceeding these values does not constitute a risk if other pathways are controlled. This inbuilt conservatism is necessary when deriving screening values to be protective of affected communities where multiple exposure pathways may be present. This is especially important for bioaccumulative chemicals such as PFOS, PFHxS and PFOA. The consequence of this is that an exceedance of the screening values should trigger further investigation such as site-specific risk assessment to refine the likely degree of possible risk (as opposed to the assumption that harm will have occurred).

Table 1: Health-based guidance values for use in site investigations in Australia

Health based guidance values are used to investigate and assess potential human health risks and are to be used to inform human health risk assessments and for setting human health based guidance values.

Note: the degree of conservatism in the drinking water and recreational water guidance values (90% attributed to other exposure pathways) means that exceeding these values does not constitute a risk if other pathways are controlled.

| Exposure scenario | PFOS/ PFHxS | PFOA | Description | Comments and source |
|------------------------------|----------------|----------------|------------------------------|--|
| Health-based guidance values | 0.02 µg/kgbw/d | 0.16 µg/kgbw/d | Tolerable daily intake (TDI) | Food Standards Australia New Zealand (FSANZ) 2017a |
| | 0.07 µg/L | 0.56 µg/L | Drinking water | Australian Government Department of Health 2017 |
| | 0.7 µg/L | 5.6 µg/L | Recreational Water | |

Note: bw= body weight, µg= micrograms

Table 2: Soil criteria for investigation — human health based guidance values

These soil guidance values should only be used to assess potential human exposure through direct soil contact. They should be applied in conjunction with other lines of investigation to account for potential leaching, off-site transport, bioaccumulation and secondary exposure.

Note: The degree of conservatism in the soil criteria for investigation — human health based guidance values (80% attributed to other exposure pathways) means that exceeding these values does not constitute a risk if other pathways are controlled. Future work is recommended to review the human health based guidance values to ensure that as new information becomes available, including further development of transfer factors, it will be used to inform updates to these values.

| Exposure scenario | PFOS/ PFHxS | PFOA | Land use | Comments and source |
|--------------------------------------|-------------|-----------|--|--|
| Soil — Human health screening values | 0.009 mg/kg | 0.1 mg/kg | Residential with garden/ accessible soil | Based on 20% of FSANZ TDI, i.e. up to 80% of exposure is assumed to come from other pathways. National Environment Protection (Assessment of Site Contamination) Measure Health Investigation Level -A assumptions with home-grown produce providing up to 10% of fruit and vegetable intake (no poultry), also includes children's day care centres, preschools and primary schools. Does not include home-grown poultry/egg. |
| | 2 mg/kg | 20 mg/kg | Residential with minimal opportunities for soil access | Based on 20% of FSANZ TDI, i.e. up to 80% of exposure is assumed to come from other pathways. National Environment Protection (Assessment of Site Contamination) Measure Health Investigation Level-B assumptions with no use for home-grown produce and poultry and includes dwellings with fully and permanent paved yard space such as high rise-buildings and flats. |
| | 1mg/kg | 10 mg/kg | Public open space | Based on 20% of FSANZ TDI, i.e. up to 80% of exposure is assumed to come from other pathways. National Environment Protection (Assessment of Site Contamination) Measure Health Investigation Level C assumptions for public open space such as parks, playgrounds, playing fields (e.g. ovals), secondary schools (except where soil used for agriculture studies) and footpaths. It does not include undeveloped public open space (such as urban bushland and reserves) which should be subject to a site-specific assessment where appropriate. |
| | 20 mg/kg | 50 mg/kg | Industrial/ commercial | Based on 20% of FSANZ TDI, i.e. up to 80% of exposure is assumed to come from other pathways. National Environment Protection (Assessment of Site Contamination) Measure Health Investigation Level-D assumptions including 8 hrs spent indoors and 1 hr spent outdoors at a site such as a shop, office, factory or industrial site. Note: the industrial commercial — Ecological Direct Exposure for PFOA has been set as 50 mg/kg in anticipation of the Stockholm Convention low content limit of 50 mg/kg. |

Table 3: Soil criteria for investigation — ecological guideline values

Soil guideline values for ecological protection need to consider both direct exposure and indirect exposure. Direct exposure applies specifically to protection of organisms that live within, or are closely associated with, the soil, such as earthworms and plants. The direct exposure guidelines can be used to assess the possibility of harm to these organisms. In the absence of acceptable published guideline values for direct exposure, the Soil Criteria — Human Health are recommended as an interim position. Other factors important for assessing exposure, for example bioaccumulation and leaching/off-site transport, must be accounted for by including other lines of investigation.

The indirect exposure guideline values are intended to amount for the various pathways other organisms can be exposed due to bioaccumulation and/or off-site transport. The Canadian ecological soil guideline values, adopted here as interim criteria, assessed a range of these exposure pathways scenarios, and the PFOS criteria were set based on the most sensitive of those pathways. As an interim measure, these values can be used for screening these important indirect pathways.

| Exposure scenario | PFOS | PFOA | Land use | Comments and sources |
|---|-------------|----------|-----------------------|---|
| Interim soil – ecological direct exposure | 1 mg/kg | 10 mg/kg | Public open space | <p>Future work is recommended to review available soil – ecological direct exposure criteria proposed by Australian research and industry organisations³.</p> <p>As an interim, it is proposed that the human health screening value for Public open space be used (see Table 2).</p> |
| Interim soil – ecological indirect exposure | 0.01 mg/kg | | Residential | <p>2017 Canadian Federal Environmental Quality Guidelines for Residential and Parkland (soil ingestion by a secondary consumer) and Commercial and Industrial – Coarse Soil (concentration in soil that is expected to protect against potential impacts on freshwater life from PFOS originating in groundwater and subsequently discharge to a surface water body.)</p> <p>Future work is recommended to review these values for the Australian context. The Canadian Guidelines are currently being finalised.</p> |
| | 0.140 mg/kg | | Industrial/commercial | |

³ For example, CEC CARE 2017, Assessment, management and remediation guidance for Perfluorooctanesulphonate (PFOS) and perfluorooctanoic acid (PFOA) – Part 3: ecological screening levels, CEC CARE Technical Report no. 38, CRC for Contamination Assessment and Remediation of the Environment, Newcastle, Australia

Table 4: Terrestrial biota guideline values

The Canadian Federal Environmental Quality Guidelines (Feb 2017) state that effects have been reported at lower concentrations than the bird egg value, and should be considered in risk assessment. 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.

| Exposure scenario | PFOS/PFHxS | PFOA | Description | Comments and source |
|--|------------|------|------------------------------|--|
| Interim — ecological direct exposure for wildlife diet | 4.6 µg/kg | | Mammalian diet biota ww food | Canadian Federal Environment Quality Guidelines (Feb 2017) |
| | 8.2 µg/kg | | Avian diet biota ww food | |
| Interim — ecological exposure protective of birds | 1.9 µg/kg | | Bird egg ww | |

Table 5: Aquatic ecosystems: freshwater and marine water guideline values

The 99th percentile species protection level may be below the ambient background concentration. Actions to incorporate background concentrations for organic chemicals with widespread (eg. global) contamination are discussed in Volume 2, section 8.3.5.5 of ANZECC and ARMCANZ (2000). The 80th percentile of background established for reference sites with low levels of human impact may be used as a default guideline values where the trigger value is less than the reliable background figure.

| 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. |
| | 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 WQG advise 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. |
| Interim marine | 0.00023 µg/L | 19 µg/L | 99% species protection — high conservation value systems | As above |
| | 0.13 µg/L | 220 µg/L | 95% species protection — slightly to moderately disturbed systems | 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* |
| | 2 µg/L | 632 µg/L | 90% species protection — highly disturbed systems | Note 1: The WQG advise that in the case of estuaries, the most stringent of |

| | | | | |
|--|---------|-----------|---|---|
| | 31 µg/L | 1824 µg/L | 80% species protection — highly disturbed systems | freshwater and marine criteria apply, taking account of any available salinity correction. |
|--|---------|-----------|---|---|

*It is recommended that marine guidelines values developed by CRC CARE be forwarded for consideration using the nationally-agreed process.