2017 Off-Site Human Health Risk Assessment

The 2017 Off-Site Human Health Risk Assessment (HHRA) assessed the exposure risks to per- and poly-fluoroalkyl substances (PFAS) for people living, working and undertaking recreation activities within the New South Wales (NSW) Environment Protection Authority (EPA) Investigation Area. Specifically, the HHRA considered exposure via PFAS-impacted soil, groundwater, surface water, sediment, home grown fruit and vegetables, red meat, poultry eggs, milk and seafood from local waterways. It builds on previous risk assessments completed and is part of the phased approach to the assessment of risks, adopted in consultation with the NSW Government and NSW EPA Accredited Site Auditor.

The updates to the 2017 HHRA were based on:

- Additional data collected as part of the 2017 Stage 2B Environmental Investigation (2017 Stage 2B EI).
- This included analysis of PFAS in samples of:
  - Sediment, surface water samples from drains, open channels, creeks and marine waters
  - Soil and groundwater samples
  - Residential bore, tank and pool water samples
  - Home grown fruit, and finfish, prawns and crabs from local waterways.
- Adapting the Health Based Guidance Values and Tolerable Daily Intake (TDI) developed by Food Standards Australia New Zealand (FSANZ) and released by the Commonwealth Department of Health in April 2017.
- Identifying groups of people in the Williamtown community who may be exposed to PFAS in the environment.
- Information obtained from community surveys to identify potential ways people could be exposed to PFAS in the environment (exposure pathways).

Overall, the HHRA characterises potential risk by comparing the estimated PFAS intake levels experienced by people in the NSW EPA Investigation Area with the TDI developed by FSANZ and released by the Commonwealth Department of Health in April 2017. A TDI represents a level of a substance that a person can be exposed to every day of their entire lifetime with appreciable risk to their health. The TDI is based on toxicological studies and incorporates safety factors to account for uncertainty. TDI were only published by FSANZ for perfluorooctane sulfonate (PFOS), perfluorooctanoic acid (PFOA), and perfluorhexane sulfonate (PFHxS). The HHRA also assessed potential exposure to perfluorohexanoic acid (PFHxA) based on a TDI derived by ToxConsult (2016). There is currently insufficient data available to derive reliable TDI values for other types of PFAS.

The phrase ‘low and acceptable’ risk appears throughout the report and is standard terminology used in HHRA completed in accordance with the National Environment Protection (Assessment of Site Contamination) Measure 1999, as amended 2013. This phrase refers to circumstances where the exposure is estimated to be below the TDI, which is a threshold that is expected to be associated with no adverse health effects. There is currently no consistent evidence that exposure to PFOS and PFOA causes adverse human health effects, and exceeding the TDI does not mean that health effects will necessarily occur. The HHRA identifies individual activities where PFAS exposures are “elevated” and have the potential to approach or exceed the TDI. These pathways may contribute most significantly to PFAS exposure and should be managed to most effectively minimise future exposure to PFAS present in the environment (as per NSW Government advice).

2017 HHRA Key Findings

The concentrations of PFAS in groundwater and surface water vary within the NSW EPA Investigation Area. Concentrations of PFAS reported in additional groundwater samples collected during 2017 have been used to refine the boundaries of the groundwater areas defined in the 2016 HHRA. Surface water and sediment data collected during 2017 has also allowed for refinement of the assessment of land-based exposure to users of the creeks and drains within the NSW EPA Investigation Area. Inclusion of the additional groundwater and surface water data collected in 2017, has refined the 2017 Stage 2B EI Investigation Area into key Risk Zones.

The following classifications have been identified to communicate the key activities within each of these zones that have the potential to result in elevated exposure to PFAS and the ways people can manage future PFAS exposure:

- **Risk Zone A (Southern Area):** the area identified as including the Southern Area, first defined in the 2016 HHRA, is referred to as Risk Zone A. This zone is located immediately to the south of the base and the boundaries have been refined, compared to the 2016 HHRA. It has the highest level of PFAS concentrations in groundwater compared to the broader NSW EPA Investigation Area.
- **Risk Zone B (Eastern):** additional groundwater data collected as part of 2017 Stage 2B EI, combined with data from 2015 Stage 2A and 2016 Stage 2B, has allowed for the identification of a second groundwater area. This area follows interpreted groundwater impacts from infiltration of surface water east of the Base, as well as the interpreted plume originating from areas where fire fighting foams were used on-Base, or 200 metres from the Risk Zone A boundary, whichever is greater.
- **Risk Zone C (Part of the Remainder of the Investigation Area):** additional data collected as part of 2017 Stage 2B EI has allowed for the identification of an area referred to as Risk Zone C. This includes the area east of the Base, which generally follows Moors Drain and discharges at the tidal portion of Tilligerry Creek, and some of the surface water drainage network south of the Base, which predominantly discharges at Fullerton Cove. Risk Zone C extends outside the NSW EPA Investigation Area to the south along the eastern shoreline of Fullerton Cove.
- **Risk Zone D (Part of the Remainder of the Investigation Area):** additional data collected as part of 2017 Stage 2B EI has allowed for the identification of an area referred to as Risk Zone D. This includes the area south-east of the Base, which generally follows Tilligerry Creek to where is discharges in the tidal portion of Tilligerry Creek.

The extent of these Risk Zones may change following the collection of additional data during ongoing monitoring or as a result of groundwater movement over time. These Risk Zones are shown on the map over the page.

Overall Risk Summary

The 2017 HHRA separately assessed potential PFAS exposure in each of the four Risk Zones. “Typical” and “upper range” exposure scenarios were modelled for each Risk Zone. Typical scenarios are intended to represent the average person in Williamtown, based on average duration/ frequency of activities reported in community surveys or Australian statistical data. Upper range scenarios are considered to only apply to a small number of people in the community. Both scenarios were coupled with representative concentrations of PFAS in groundwater, soil, sediment, surface water and estimated home grown produce concentrations in each Risk Zone to provide an overall conservative estimate of PFAS exposure. The highest levels of PFAS exposure are associated with the pathways that NSW Government has previously advised should be avoided or minimised.

The most effective way for all people in the Risk Zones to minimise future PFAS exposure is to follow NSW Government advice to not drink groundwater. The 2017 HHRA also identifies which other aspects of the general precautionary advice published by NSW Government may be followed by people in each Risk Zone to most effectively minimise future PFAS exposure, as discussed below.
Activities with Elevated PFAS Exposure

In some of the Risk Zones, elevated exposure to PFAS in comparison to the TDI may occur under specific circumstances, for example if a person is exposed to elevated levels of PFAS in multiple ways. The highest levels of PFAS exposure in each Risk Zone are associated with the activities shown with a dot in the table below. NSW Government has previously advised that for residents living in or near an area contaminated by PFAS these activities should be avoided or minimised.

The potential exposures to PFAS through the following activities are considered to be elevated (i.e. approach or exceed the TDI):

<table>
<thead>
<tr>
<th>Risk Zones</th>
<th>A</th>
<th>B</th>
<th>C</th>
<th>D</th>
</tr>
</thead>
<tbody>
<tr>
<td>Drinking groundwater with detectable PFAS or using it in cooking</td>
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<tr>
<td>Drinking groundwater where the average PFAS concentration exceeds the drinking water guidelines (FSANZ 2017)</td>
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<tr>
<td>Unintentionally ingesting groundwater when used indoors for showering or bathing</td>
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<tr>
<td>Unintentionally ingesting groundwater when used outdoors (filling swimming pools and children’s wading pools, and sprinkler play) (Zone A only)</td>
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<tr>
<td>Unintentionally ingesting surface water during recreational activities (swimming in creeks)</td>
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<tr>
<td>Eating home grown vegetables</td>
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<tr>
<td>Eating eggs from backyard poultry. Where exposure to PFAS-impacted groundwater, soil or feed can be prevented, it is estimated that PFAS would reduce to less than the laboratory limit of reporting (LOR) in eggs after 100 days</td>
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<tr>
<td>Eating high quantities of locally sourced finfish</td>
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<tr>
<td>Drinking milk from home grown cattle or using it in cooking</td>
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Pathways with Low and Acceptable PFAS Exposure

Some of the key activities that have been identified to present a low potential risk to residents from exposure to PFAS are listed below:

<table>
<thead>
<tr>
<th>Risk Zones</th>
<th>A</th>
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<th>C</th>
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<tr>
<td>Eating low quantities of locally sourced finfish or crustaceans</td>
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<tr>
<td>Unintentional ingestion of groundwater used for household cleaning, laundry, washing vehicles or washing pets</td>
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<tr>
<td>Skin contact with soil, sediment, groundwater, surface water during domestic or recreational activities</td>
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<tr>
<td>Inhaling dust as a result of outdoor domestic or recreational activities or dust tracked back into the home</td>
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<tr>
<td>Unintentional ingestion of soil or sediment during domestic or recreational activities</td>
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<td></td>
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<tr>
<td>Unintentional ingestion of surface water during boating or fishing activities</td>
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</table>

Indicates activities with potential PFAS exposure approaching, or greater than, the TDI.

ACTIVITIES WITH ELEVATED PFAS EXPOSURE

- Drinking groundwater where the average PFAS concentration exceeds the drinking water guidelines (FSANZ 2017)
- Unintentionally ingesting groundwater when used indoors for showering or bathing
- Unintentionally ingesting groundwater when used outdoors (filling swimming pools and children’s wading pools, and sprinkler play)
- Unintentionally ingesting surface water during recreational activities (swimming in creeks)
- Eating home grown vegetables
- Eating home grown beef
- Eating eggs from backyard poultry. Where exposure to PFAS-impacted groundwater, soil or feed can be prevented, it is estimated that PFAS would reduce to less than the laboratory limit of reporting (LOR) in eggs after 100 days
- Eating high quantities of locally sourced finfish
- Drinking milk from home grown cattle or using it in cooking

LEGEND

RAAF Base Williamtown
NSW EPA Investigation Area

RISK ZONE A

- Drinking groundwater with detectable PFAS or using it in cooking
- Unintentionally ingesting groundwater when used indoors for showering or bathing
- Unintentionally ingesting groundwater when used outdoors (filling swimming pools and children’s wading pools, and sprinkler play)
- Unintentionally ingesting surface water during recreational activities (swimming in creeks)
- Eating home grown vegetables
- Eating home grown beef
- Eating eggs from backyard poultry. Where exposure to PFAS-impacted groundwater, soil or feed can be prevented, it is estimated that PFAS would reduce to less than the laboratory limit of reporting (LOR) in eggs after 100 days
- Eating high quantities of locally sourced finfish
- Drinking milk from home grown cattle or using it in cooking

RISK ZONE B

- Drinking groundwater with detectable PFAS or using it in cooking
- Unintentionally ingesting groundwater when used outdoors (filling swimming pools and children’s wading pools)
- Unintentionally ingesting surface water during recreational activities (swimming in creeks)
- Eating home grown vegetables
- Eating home grown beef
- Eating eggs from backyard poultry. Where exposure to PFAS-impacted groundwater, soil or feed can be prevented, it is estimated that PFAS would reduce to less than the laboratory limit of reporting (LOR) in eggs after 100 days
- Eating high quantities of locally sourced finfish
- Drinking milk from home grown cattle or using it in cooking

RISK ZONE C

- Unintentionally ingesting surface water during recreational activities (swimming in creeks)
- Eating home grown beef
- Eating eggs from backyard poultry. Where exposure to PFAS-impacted groundwater, soil or feed can be prevented, it is estimated that PFAS would reduce to less than the laboratory limit of reporting (LOR) in eggs after 100 days
- Eating high quantities of locally sourced finfish
- Drinking milk from home grown cattle or using it in cooking
- Drinking groundwater where the average PFAS concentrations exceed the drinking water guidelines

Defining Risk:

Risk Zones are defined as areas where the average PFAS concentrations exceed the drinking water guidelines, and are indicated on the map with a dot.

Risk Characteristics:

- Eating eggs from backyard poultry. Where exposure to PFAS-impacted groundwater, soil or feed can be prevented, it is estimated that PFAS would reduce to less than the laboratory limit of reporting (LOR) in eggs after 100 days.

Suggested Precautions:

- Drinking milk from home grown cattle or using it in cooking
- Eating home grown vegetables
- Eating home grown beef
- Eating eggs from backyard poultry.
- Drinking groundwater where the average PFAS concentrations exceed the drinking water guidelines
- Eating high quantities of locally sourced finfish
- Drinking milk from home grown cattle or using it in cooking
- Drinking groundwater where the average PFAS concentrations exceed the drinking water guidelines
NSW EPA Management Area

On 19 November 2017, the NSW PFAS Expert Panel, led by NSW Chief Scientist and Engineer Professor Mary O’Kane AC, recommended changes to the NSW EPA Investigation Area and precautionary advice based on the data presented in the 2017 HHRA.

The NSW Government has refined the boundary of the Investigation Area, originally determined in late 2015. The overall investigation area will now be called the ‘Management Area’, and comprises three zones:

- Primary Management Zone – this area has significantly higher levels of PFAS detected and therefore, the strongest advice applies.
- Secondary Management Zone – this area has some detected levels of PFAS.
- Broader Management Zone – the topography and hydrology of the area means PFAS detections could occur now and into the future.

Each zone has tailored precautionary advice for residents to minimise exposure to PFAS originating from the RAAF Base Williamtown.

For more information about the NSW EPA Management Area and precautionary recommendations, contact 131 555 or visit http://www.epa.nsw.gov.au.

Next Steps

2017 Ecological Risk Assessment

The updated 2017 Ecological Risk Assessment will be published in early 2018 and will assess the potential risks of PFAS contamination to wild animals inhabiting the Base and surrounding area. The updated ERA will also assess the potential for impacts to the wider ecosystem from accumulation of PFAS in plants and animals.

The updated ERA will utilise data from the 2016 and 2017 Environmental Investigations.

It will include outcomes of an ecological survey and investigation of Ramsar Wetlands around Fullerton Cove.

Strategic Management Plan and Ongoing Monitoring Plan

The Strategic Management Plan will identify and prioritise all PFAS response management actions planned for the Base and surrounding area. Some of these actions are already underway as explained in the Response Management Activities factsheet.

The Strategic Management Plan will include an Ongoing Monitoring Plan which will detail the ongoing environmental monitoring and residential sampling programs to be conducted within the NSW EPA Investigation Area. The Ongoing Monitoring Plan will define where to collect samples from key locations within the NSW EPA Investigation Area. The data collected will be used to understand changes in the distribution of PFAS in the environment over time and as a result of seasonal changes. Data from the Ongoing Monitoring Plan will be used to regularly review and where necessary, re-prioritise the response management actions at the Base and surrounding area.

Keeping the Community Informed

Defence is committed to regularly updating the community on ongoing monitoring. Updates will be provided through the project website, community information sessions, direct mail and information sheets as new information becomes available.