2017 Human Health Risk Assessment

About the Investigation
The 2017 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 Investigation Area (IA). Specifically, the HHRA considered exposure via PFAS-impacted soil, groundwater, surface water, sediment, home grown fruit, vegetables, red meat, poultry eggs, milk, fish and yabbies 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 Queensland Government.

The updates to the 2017 HHRA were based on:

- Additional data collected as part of the 2017 Stage 2C Environmental Investigation. This included analysis of PFAS in samples of sediment, surface water, soil, groundwater, home grown fruit and vegetables, eggs from backyard poultry, and fish and yabbies from local waterways.
- Adopting 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 Oakey 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 IA 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 without any 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 perfluorohexane 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 human health risk assessments 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. However, as a precautionary measure Queensland Health has recommended that for residents living in or near an area contaminated by PFAS, the most important thing to do is to reduce exposure to PFAS.

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 overall PFAS exposure and therefore should be managed to most effectively minimise future exposure to PFAS present in the environment (as recommended by Queensland Health).

2017 HHRA Key Findings
The concentrations of PFAS in groundwater vary within the IA. Concentrations of PFOS and PFHxS tested in additional groundwater samples collected during 2017 have been used to refine the boundaries of the Groundwater Zones defined in the 2016 HHRA. The 2016 HHRA defined Groundwater Zone 1 and Groundwater Zone 2. Inclusion of the additional groundwater data collected during 2017 has identified a third Groundwater Zone referred to as the “Rest of the Investigation Area”.

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

- **Management Area**: the area identified as the IA during the Stage 2C Environmental Investigation is now referred to as the Management Area. It is divided into three Management Zones, including:
  - **Management Zone 1**: the area identified as Groundwater Zone 2 in the 2017 HHRA is now referred to as Management Zone 1. This zone is located immediately to the south and southwest of the Base. It has the highest PFOS+PFHxS concentrations in groundwater in the Management Area given its closer proximity to the Base and potential downwards migration of PFAS from surface water in drainage channels 1 and 2.
  - **Management Zone 2**: the area identified as Groundwater Zone 1 in the 2017 HHRA is now referred to as Management Zone 2. This zone is located further to the south and west of the Base. It has higher PFOS+PFHxS concentrations in groundwater in comparison with Management Zone 3 as a result of a combination of impacted groundwater flowing to the south and west from the Base together with downwards migration of PFAS-impacted surface water from the drains leaving the Base.
  - **Management Zone 3**: the area identified as Groundwater Zone ‘Rest of the Investigation Area’ in the 2017 HHRA is now referred to as Management Zone 3. This zone is located outside Management Zone 1 and Zone 2 and within the remainder of the Management Area. PFAS was not detected by the laboratory in the majority of groundwater samples collected from groundwater monitoring wells in this Management Zone.

The extent of these Management Zones may change following the collection of additional data during ongoing monitoring or as a result of groundwater movement over time.
Overall Risk Summary

The 2017 HHRA separately assessed potential PFAS exposure in each of the three Management Zones. Typical and upper range exposure scenarios were modelled for each Management Zone. Typical scenarios are intended to represent the average person in Oakey, 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 maximum concentrations of PFAS in groundwater, soil, sediment, surface water and selected home grown produce in each Management Zone to provide an overall conservative estimate of PFAS exposure. The highest levels of PFAS exposure are associated with the pathways that Queensland Health has previously advised should be avoided or minimised.

The most effective way for all people in the Management Area to minimise future PFAS exposure is to follow Queensland Health advice to not drink groundwater. The 2017 HHRA also identifies which other aspects of the general precautionary advice published by Queensland Health should be followed by people in each Management Zone to most effectively minimise future PFAS exposure, as discussed below.

Activities with Elevated PFAS Exposure in each Management Zone

- **Management Zone 1**
  - Drinking groundwater or using it in cooking
  - Unintentionally ingesting groundwater when used indoors for showering or bathing or outdoors for filling swimming pools and children’s wading pools, and sprinkler play
  - Eating home grown leafy green vegetables
  - Eating home grown red meat and/or offal
  - 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
  - Fishing from Oakey Creek
  - Drinking home grown milk

- **Management Zone 2**
  - Drinking groundwater or using it in cooking
  - Unintentionally ingesting groundwater when used indoors for showering or bathing or outdoors for filling swimming pools and children’s wading pools, and sprinkler play
  - Eating home grown leafy green vegetables
  - Eating home grown red meat and/or offal
  - 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
  - Fishing from Oakey Creek
  - Drinking home grown milk

- **Management Zone 3**
  - Drinking groundwater or using it in cooking
  - Fishing from Oakey Creek

Activities with Elevated PFAS Exposure

In some parts of the Management Area, 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 Management Zone are associated with the activities shown with a dot in the table below. Queensland Health 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):

- Drinking groundwater or using it in cooking
- Unintentionally ingesting groundwater when used indoors for showering or bathing or outdoors for filling swimming pools and children’s wading pools, and sprinkler play
- Eating home grown leafy green vegetables
- Eating red meat and/or offal from home grown cattle or sheep that have consumed PFAS-impacted water, or grazed in areas irrigated or flooded with PFAS-impacted water
- Eating eggs from backyard poultry
- Eating fish from Oakey Creek
- Drinking home grown milk

Key activities 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:

- Eating home grown fruit, or eating yabbies from Oakey Creek
- Unintentionally ingesting groundwater used for household cleaning, laundry, washing vehicles or washing pets
- Unintentionally ingesting soil or sediment during domestic or recreational activities
- Unintentionally ingesting surface water or skin contact with surface water during recreational activities such as swimming, boating or fishing
- Skin contact with soil, sediment, groundwater or surface water during domestic, work or recreational activities
- Inhaling dust as a result of outdoor activities (e.g., lawn mowing) or dust tracked back into the home or workplace
Government Agencies

Defence is cooperating in the investigation and management of PFAS contamination with a number of Government agencies. These agencies include:

- Commonwealth Department of Health: 1800 941 180
- QLD Department of Environment and Heritage Protection: 13 74 68
- QLD Department of Natural Resources: 13 25 23
- QLD Department of Health: 13 HEALTH (1343 2584)
- Darling Downs Hospital and Health Service (Oakey Hospital): 07 4691 4888
- Darling Downs Mental Health Acute Care Team (24/7): 07 4616 5210
- Toowoomba Regional Council: 131 872

Next Steps

2017 Ecological Risk Assessment

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

Strategic Management Plan and Ongoing Monitoring Plan

The Strategic Management Plan will identify and prioritise all PFAS response management actions planned for the AACO and the 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 Investigation Area.

The Ongoing Monitoring Plan will define where to collect samples from key locations within the 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 AACO and surrounding area.

Keeping the Community Informed

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