



## Army Aviation Centre Oakey Stage 2C Environmental Investigation

### Human Health Risk Assessment - Key Findings and Next Steps

#### About the Investigation

The Department of Defence (Defence) has engaged an independent environmental consultant to undertake an environmental investigation of the soil, surface water, sediment, biota (plants and animals) and groundwater on, and in the vicinity of, Army Aviation Centre Oakey (the base). The first report completed as part of this environmental investigation was the Environmental Site Assessment (ESA).

The ESA was published on 27 July 2016 with a community meeting held on the same day to inform the community of the findings of the ESA. Walk-in sessions were held the following day where community members could ask Defence representatives, expert contractors and State Government representatives questions relating to the environmental investigation.

The purpose of the ESA was to better understand impacts to the environment from the historical use of aqueous film forming foam (AFFF), which are now known to have contained per- and poly-fluoroalkyl substances (PFAS) (including perfluorooctane sulfonate (PFOS) and perfluorooctanoic acid (PFOA)). Defence has phased out the use of AFFF containing PFOS and PFOA as active ingredients and is proactively managing legacy contamination across its estate.

A Human Health Risk Assessment (HHRA) has now been undertaken by the environmental consultant. The assessment of potential human health impacts considers the data collected during the ESA and previous environmental investigations together with samples of plants, animals and eggs.

#### Objectives of the HHRA

The objective of the HHRA is to assess the potential risks to human health associated with current exposure to PFAS within the Investigation Area, including PFAS detected in soil, groundwater, surface water, sediment and biota (plants and animals).

#### HHRA Investigations

Development of the HHRA included:

- Consideration of data collected during the ESA
- Interpretation of laboratory test results from pasture plant, fruit, vegetable, chicken egg, cow milk, sheep milk, beef blood serum, lamb blood serum, and fish samples collected to inform the HHRA
- Identification of groups of people (receptors) in the Investigation Area who may be exposed to PFAS in the environment
- Conduct of community surveys to identify potential ways people could be exposed to PFAS in the environment (exposure pathways)
- Risk characterisation by comparison of estimated PFAS intakes to tolerable levels
- Assessment of the potential for health effects based on measured and modelled PFAS concentrations in human blood serum.

#### Assessment of personal exposure

Feedback from the community survey was used to identify people or groups of people (receptors) within the Investigation Area potentially exposed to PFAS detected within the environment (e.g., soil, sediment, groundwater, surface water, plants and animals). Exposure pathways, which are the ways PFAS can move from a source area to a receptor (e.g. drinking groundwater) were also identified. A person can undertake multiple activities that may result in exposure to PFAS via ingestion, skin contact and inhalation. These are called exposure scenarios, and the HHRA assessed 47 different exposure scenarios both at typical (average) and upper (high) estimates of exposure. The HHRA assumed that all potential exposure pathways for a particular receptor group (e.g. residents) were complete. This is a conservative assumption because it is recognised that not all people within the Investigation Area undertake all activities that may result in exposure to PFAS in the environment. In this situation, the overall risk for those people would be lower than the risk modelled in the HHRA.

The HHRA was undertaken based on adoption of toxicity reference values established by European Food Safety Authority (EFSA) as recommended by ToxConsult, an Australian toxicology specialist.

The Australian Government is currently undertaking an independent review of the interim human health drinking water and surface water guidelines developed by the Environmental Health Standing Committee (enHealth) in June 2016. Defence's consultant will review the Oakey HHRA following completion of the review of these enHealth guidelines and any subsequent regulatory guidance.





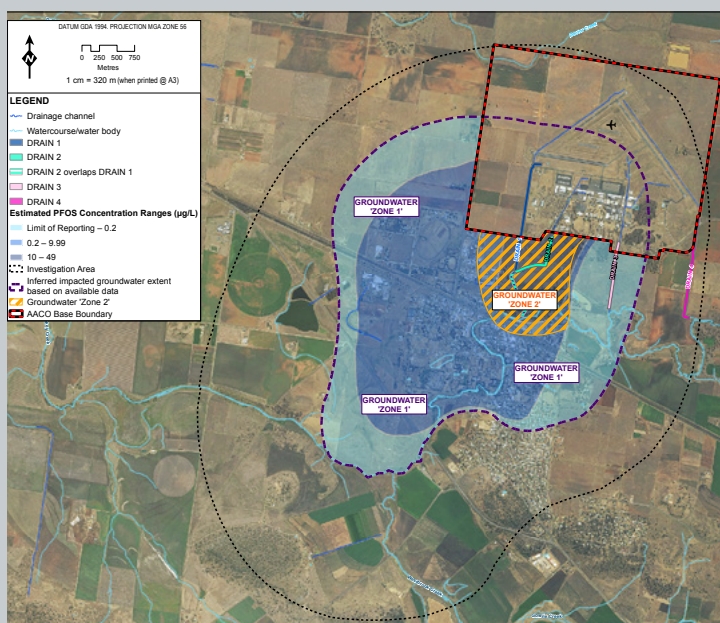
The HHRA considered multiple hypothetical exposure scenarios, each including multiple exposure pathways for a number of hypothetical groups of people (receptors). Receptors within the Investigation Area considered in the HHRA include:

- Residents (adults and children)
- Recreational users (adults and children)
- Commercial agricultural workers
- Base staff (at the Army Aviation Centre Oakey) including visitors.

The potential exposure pathways that were considered included ingestion, skin contact and/or inhalation of PFAS impacted materials such as:

- Drinking groundwater
- Incidental ingestion and skin contact with groundwater indoors (e.g. bathing, showering, household cleaning, laundry)
- Incidental ingestion and skin contact with groundwater outdoors (e.g. swimming, sprinkler play, irrigation, washing vehicles)
- Inhalation of dust
- Incidental ingestion of soil and dust
- Eating plants watered with groundwater
- Eating animal produce where the animals drink groundwater or eat plants watered with groundwater
- Eating locally caught fish
- Incidental ingestion and skin contact from recreation activities (e.g. fishing, boating, swimming)
- Ingestion of breastmilk.

During the HHRA development, groundwater sample results from the area south of the base (Groundwater Zone 2, refer to Figure 1) were identified as having higher



PFOS concentrations than the rest of the Investigation Area (Groundwater Zone 1). Therefore, the assessment of potential health risks for residents and commercial agricultural workers in these two zones was conducted separately. The HHRA provides different recommendations for residents in each of these Groundwater Zones to make informed decisions about ways to minimise PFAS exposure in the future.

### HHRA Key Findings

The key findings of the HHRA are summarised below and presented in more detail in Table 1.

#### Groundwater Zone 1 and Zone 2

The HHRA concluded that for the typical person living, working or undertaking recreation activities within the Investigation Area, there is a **low and acceptable** risk to health from PFAS exposure. Potential exposure can be further minimised by avoiding consumption of groundwater.

#### Low and Acceptable Risks

In the Investigation Area, health risks associated with the **typical (average) PFAS intakes** from the following pathways are low and acceptable:

- Incidental (unintentional) ingestion and skin contact with surface water and sediment during recreation in local creeks
- Incidental ingestion and skin contact with groundwater used at work or at home for irrigation, washing animals or washing vehicles
- Incidental ingestion and skin contact with soil
- Inhalation of dust from soil irrigated with groundwater
- Incidental ingestion and skin contact with groundwater used for household cleaning and laundry
- Eating fish caught recreationally in local waterways
- Eating beef and lamb from animals that have consumed groundwater
- Eating fruit and vegetables watered with groundwater and/or grown in soil where groundwater has been used for irrigation.

The phrase 'low and acceptable' which appears throughout the report is standard terminology used in human health risk assessments completed in accordance with the National Environment Protection (Assessment of Site Contamination) Measure (NEPM). This phrase refers to circumstances where the exposure is estimated to be below levels at which health effects are not expected to occur. Even though there is no consistent international evidence that PFOS/PFOA cause adverse health effects, this phrase is used to describe potential risks. According to enHealth, due to the elimination of PFAS from the human body being slow there is a risk that continued exposure could cause adverse health effects. Describing the potential level of risk assists individuals to manage their exposure to PFAS.





### Potential for Elevated Risks

In the Investigation Area, **upper (high) PFAS intakes** through the following pathways may theoretically exceed the tolerable daily intake and, therefore, may be associated with a risk to health:

- Drinking groundwater
- Incidental ingestion of groundwater used in home swimming pools in Groundwater Zone 2.

The HHRA provides an interpretation of the available blood serum data from the Oakey community (reported in Heffernan, 2015) and concludes that potential health risks associated with the elevated PFAS exposures listed above are unlikely to have occurred, however this cannot be stated with certainty.

Because the health effects of PFAS exposure are still not known, and because PFAS are persistent in the environment and have the potential to bioaccumulate in the food chain, enHealth recommends that exposure to PFAS be minimised as a precaution.

### Recommended Precautions

For all residents within Groundwater Zone 1 and Zone 2, the HHRA makes the following recommendations to minimise exposure to PFAS and any associated potential health risks:

- Restrict the use of groundwater for drinking
- Avoid or minimise consumption of eggs from chickens that drink water (including groundwater or surface water) containing detectable PFAS, until further data can be collected to evaluate potential exposures by this pathway.

For all residents within Groundwater Zone 2, the HHRA makes the following additional recommendations to further minimise exposure to PFAS and any associated potential health risks:

- Avoid or minimise the use of groundwater for showering and bathing
- Avoid or minimise the use of groundwater for filling swimming pools or paddling pools and household sprinklers.

Exposure pathway	Potential PFAS Exposures - Groundwater Zone 1		Potential PFAS Exposures - Groundwater Zone 2		Precautions suggested in the HHRA
	Upper Exposure	Typical Exposure	Upper Exposure	Typical Exposure	
<b>Groundwater</b>					
<i>Ingestion of groundwater</i>	Elevated	Elevated	Elevated	Elevated	Do not drink groundwater within the Investigation Area
<i>Incidental ingestion of groundwater</i> as a result of indoor domestic use (excluding drinking groundwater) and outdoor domestic use	Low & Acceptable	Low & Acceptable	Elevated	Low & Acceptable	Avoid or minimise the use of groundwater in Zone 2 for: showering and bathing; filling swimming pools and children's wading pools; and sprinkler play.
<i>Dermal contact with groundwater</i> as a result of indoor domestic use (excluding drinking groundwater) and outdoor domestic use	Low & Acceptable	Low & Acceptable	Low & Acceptable	Low & Acceptable	None Advised
<b>Soil</b>					
<i>Incidental ingestion of soil</i> as a result of outdoor activities	Low & Acceptable	Low & Acceptable	Low & Acceptable	Low & Acceptable	None Advised
<i>Dermal contact with soil and</i> as a result of outdoor activities	Low & Acceptable	Low & Acceptable	Low & Acceptable	Low & Acceptable	None Advised
<i>Inhalation of Dust</i> as a result of outdoor activities or dust tracked back into the home	Low & Acceptable	Low & Acceptable	Low & Acceptable	Low & Acceptable	None Advised
<b>Locally Sourced Food</b>					
<i>Consumption of fruit and vegetables</i> irrigated with water containing detectable PFAS or grown in soil that has been irrigated with water containing detectable PFAS	Low & Acceptable	Low & Acceptable	Low & Acceptable	Low & Acceptable	None Advised
<i>Consumption of meat</i> from sheep or cattle that have consumed water containing detectable PFAS or plants that have accumulated PFAS from irrigation water	Low & Acceptable	Low & Acceptable	Low & Acceptable	Low & Acceptable	None Advised
<i>Consumption of milk</i> from cattle that have consumed water containing detectable PFAS or plants that have accumulated PFAS from irrigation water	Low & Acceptable	Low & Acceptable	Low & Acceptable	Low & Acceptable	None Advised
<i>Consumption of eggs</i> from chickens that have consumed water containing detectable PFAS or plants that have accumulated PFAS from irrigation water	Elevated	Low & Acceptable	Elevated	Low & Acceptable	Restrict consumption of eggs from backyard chickens exposed to water containing detectable PFAS, until additional data can be collected to further characterise PFAS concentrations in eggs at a range of groundwater PFAS concentrations in both Groundwater Zone 1 and Zone 2

TABLE 1: DEVELOPED BY AECOM Australia Pty Ltd





## Next steps

### Further Considerations

The results of this HHRA provide an improved understanding of the potential human health risks to identified people or groups of people (receptors) within the Investigation area. This HHRA considers exposure to PFAS in the environment through various pathways.

Defence will undertake further assessment to address limitations in the current understanding of PFAS impacts within the Investigation Area. The outcomes of the ESA and the HHRA will inform these further assessments and will also inform ongoing environmental monitoring and future management decisions in relation to PFAS on, or in the vicinity of the base. The further assessments and ongoing monitoring programs of work will be developed in consultation with the Queensland Government. Depending on the outcome of these additional investigations, it may be necessary to revise the HHRA to quantify changes to currently identified potential human health risks. The HHRA will be updated, if required, based on changes in the regulatory environment (including the current review of the recent enHealth guidance).

### Ecological Risk Assessment (ERA)

An ERA is being undertaken to assess the potential risk from identified PFAS impacts to plants and animals (ecological receptors) within habitats present at the base and in the surrounding area. The ERA also considers the potential for wider ecosystem impacts that may result from the accumulation of PFAS in terrestrial and aquatic organisms. This assessment includes an ecological survey to identify potentially impacted plants, birds, fish and other animals, together with the analytical results of PFAS testing completed for the HHRA. The ERA is expected to be completed by the end of October 2016.

### Management Options

Defence continues to engage with industry experts both nationally and internationally and is working collaboratively with the Queensland Government to explore a number of short and long-term PFAS management options. These include research into potential remediation technologies such as foam separation, ultrasonification, solidification and stabilisation.

Field trials commenced for some of these options in April 2016. More information on these management options can be found at: <http://www.defence.gov.au/id/Oakey/Guidance.asp>

## Further information

### Water assistance

Defence's first priority continues to be that Oakey community members have access to an alternative source of drinking water. If you rely on bore water for drinking, or drink water sourced from a rainwater tank that contains, or has contained, bore water please contact 1800 136 129 to discuss possible management strategies.

### Keeping the community informed

Defence is committed to regularly updating the community throughout the investigation. The project website will be updated as the investigation progresses. Community information sessions, direct mail and factsheets will be provided as new information becomes available. Enquiries or requests relating to individual properties will be considered on a case-by-case basis.

### Queensland and Local Government

Defence is working collaboratively with a number of Queensland (QLD) and local government agencies.

- QLD Department of Environment and Heritage Protection: 13 74 68
- QLD Department of Natural Resources: 13 74 68
- QLD Department of Agriculture and Fisheries: 13 25 23
- QLD Department of Health: 13 43 25 84
- 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

### Contact the project team

Phone: 1800 136 129 freecall (business hours)

Web: <http://www.defence.gov.au/id/Oakey>

Email: [defence.oakey.anz@aecom.com](mailto:defence.oakey.anz@aecom.com)

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