Defending Australia and its National Interests

Project Update
November 2016

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 site). The investigation is part of Defence’s review of a number of its sites around Australia that used legacy aqueous fire-fighting foams (AFFF) containing per- and poly-fluoroalkyl substances (PFAS) including perfluorooctane sulfonate (PFOS) and perflourooctanoic acid (PFOA) as active ingredients. Defence has phased out the use of AFFF containing PFOS and PFOA as active ingredients and is proactively managing the presence of PFAS across its estate.

The first report completed as part of this environmental investigation was the Environmental Site Assessment (ESA) which was published on 27 July 2016. The second report completed was the Human Health Risk Assessment (HHRA), published on 5 September 2016. The ESA and HHRA reports are available on the project website: www.defence.gov.au/id/oakey/Documents.asp

When the ESA and HHRA reports were published, community meetings were held on the same day, with walk-in sessions held the following day to inform the community of the findings of the assessments. At these sessions community members could ask Defence representatives, expert contractors and State Government representatives questions relating to the environmental investigation. The reports are large and often technical in their nature. Direct communication about the key findings of the assessments and the ability to ask questions are important to understanding the content of the reports.

A Preliminary Ecological Risk Assessment (ERA) has now been undertaken and is available on the project website: www.defence.gov.au/id/oakey/Documents.asp

Objective of the Preliminary ERA
The objective of the Preliminary ERA was to assess the potential for adverse effects on land-based (terrestrial) and water-based (aquatic) wildlife species as a result of direct exposure (e.g. ingestion) to PFAS in soil, sediment and surface water within the Investigation Area. The Preliminary ERA also considered potential adverse effects due to bioaccumulation of PFAS in food sources within the Investigation Area that are consumed by wildlife (e.g. PFAS in fish and plant tissue).

This ERA is considered to be preliminary in nature because this is the first ERA completed for the Investigation Area and data from the ESA and HHRA has been used to complete the assessment. These data sets were focussed on the assessment of potential human health impacts, so there are some limitations associated with applying this data to make an assessment of potential ecological risks. This Preliminary ERA is intended to inform future sampling, risk assessment and management approaches, and is not intended to provide the final conclusion with regard to risks to all ecological receptors within the Investigation Area.
Preliminary ERA Investigation

Development of the Preliminary ERA involved the:

- Review of data collected during the ESA and HHRA and the findings of ecological field surveys conducted on, and surrounding the site.
- Interpretation of laboratory test results from soil, groundwater, surface water, sediment, pasture plant, fruit, vegetable, chicken egg, and fish samples.
- Identification of ecological receptor species. These are terrestrial or aquatic animals inhabiting environments in the Investigation Area that may be affected by exposure to PFAS. Potential risks to domestic animals (e.g. pets and livestock) were not assessed. Their exposures are considered to be different from those experienced by wildlife. Defence is working with Commonwealth and State Government Agencies to identify assessment or management options in relation to potential impacts to domestic animals from PFAS exposure.
- Selection of indicator species. These are animal species considered to be representative of a larger group of species with similar food and habitat requirements, and therefore likely to be exposed to PFAS in the same ways, within the Investigation Area. By assessing indicator species, not every species of animal within the Investigation Area is assessed as part of the Preliminary ERA.
- Determination of the main pathways through which indicator species may be exposed to PFAS. Exposure pathways for different indicator species vary depending on the food they eat, the habitat in which they live and the way they interact with the environment. For example, fish-eating bids living near local waterways are likely to be exposed to PFAS differently than migratory birds only accessing the Investigation Area for parts of the year. Fish-eating birds are also likely to be exposed to PFAS from different sources than birds that feed primarily on plants.
- Assessment of potential risks to indicator species. This was done by comparing the amount of PFAS likely to be ingested by the animal with the exposure concentrations considered acceptable for animals (birds or mammals). The amount of PFAS entering the animal varies depending on their food source(s), food requirements (e.g. how much they need to eat), habitat, weight and a number of other variables. The sensitivity of the animal to PFAS exposure will also vary between species (e.g. some animals may experience adverse effects at lower concentrations than others). As such, it is not possible to determine the specific nature of any adverse impacts experienced by the animal (e.g. general health or reproductive issues) as a result of PFAS exposure.

### Indicator species included in the Preliminary ERA

Based on field surveys and the types of habitat present in the Investigation Area, it was determined that the following types of animals could potentially be exposed to PFAS in soil, sediment, surface water and in the food they eat (either plants or other animals). Indicator species were then selected to represent each of the following types of animal species:

<table>
<thead>
<tr>
<th>Type of animal species</th>
<th>Indicator species</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Land based animals (terrestrial)</strong></td>
<td></td>
</tr>
<tr>
<td>Mammals that eat plants (herbivorous) and animals (carnivorous)</td>
<td>Eastern Grey Kangaroo, Northern Quoll</td>
</tr>
<tr>
<td>Birds that eat plants (herbivorous). This group also includes semi-aquatic birds.</td>
<td>Painted Honeyeater, Australian Wood Duck, Squatter Pigeon, Yellow-rumped Thornbill, Masked Lapwing, Straw-necked Ibis, Noisy Minor, Noisy Friarbird</td>
</tr>
<tr>
<td>Birds that eat insects (invertivorous), or plants and animals/insects (omnivorous)</td>
<td></td>
</tr>
<tr>
<td>Reptiles that eat insects (invertivorous), or plants and animals/insects (omnivorous)</td>
<td>Collared Delma (legless lizard), Red-bellied Black Snake, Black-shouldered Kite</td>
</tr>
<tr>
<td>Predatory reptiles (carnivorous)</td>
<td>Red-bellied Black Snake, Black-shouldered Kite</td>
</tr>
<tr>
<td>Predatory birds (carnivorous)</td>
<td>Red-bellied Black Snake, Black-shouldered Kite</td>
</tr>
<tr>
<td><strong>Water-based animals (aquatic)</strong></td>
<td></td>
</tr>
<tr>
<td>Birds that eat insects/aquatic invertebrates (invertivorous), or plants and animals (omnivorous)</td>
<td>White-faced Heron, Australian White Ibis, Australasian Darter, Great Egret</td>
</tr>
<tr>
<td>Birds that eat fish (piscivorous)</td>
<td>Eastern Water Dragon</td>
</tr>
<tr>
<td>Reptiles that eat insects/aquatic invertebrates (invertivorous), or plants and animals (omnivorous)</td>
<td>Eastern Water Dragon</td>
</tr>
</tbody>
</table>

EASTERN GREY KANGAROO AUSTRALIAN WOOD DUCK

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Exposure pathways considered in the Preliminary ERA

The way an animal can be exposed to PFAS is called an ‘exposure pathway’. The Preliminary ERA identified the following main exposure pathways for animal species living in the Investigation Area:

**Direct exposure through ingestion:**
- Incidental ingestion of PFAS in soil, surface water and sediment (during feeding)
- Ingestion of PFAS in surface water.

**Bioaccumulation in food sources:**
- Ingestion of PFAS accumulated in terrestrial plants and animals through food sources
- Ingestion of PFAS accumulated in aquatic plants and animals through food sources.

An assessment of the various exposure pathways was used to estimate the cumulative amount of PFAS entering the animal.

The Preliminary ERA assumed that each animal’s food source(s) was sourced entirely within the Investigation Area and always contained PFAS. This is likely to have resulted in an overestimate of exposure for animals that source their food over large distances and for animals that eat food that does not contain PFAS. This approach was adopted to provide a conservative estimate of potential exposure and assist in understanding where ecological risks may occur.

**Method used to assess potential risk from direct exposure**

The potential for adverse effects to wildlife as a result of direct exposure to PFAS in soil, surface water and sediment was assessed by comparing PFAS concentrations detected in samples against screening benchmarks published by Australian and international regulatory agencies. These screening benchmarks represent the PFAS concentrations considered acceptable for plants and animals.

**Method used to assess potential risk from dietary intakes**

The potential for adverse effects to wildlife as a result of ingesting PFAS accumulated in plants or animals were assessed by estimating how much food each indicator species would consume and what concentration of PFAS may be present in their food source(s). Concentrations of PFAS directly measured in plant, fish and terrestrial mammal samples were used to estimate dietary intakes of PFAS for animals eating these food types.

Not all types of potential food source(s) could be sampled, and therefore some modelling was completed to estimate the amount of PFAS in certain food source(s). For example, it is difficult to analyse insect samples for PFAS and therefore the dietary intakes of animals that eat invertebrates that live in soil (e.g. insect-eating birds) were estimated by modelling bioaccumulation of PFAS from soil into earthworms.

Estimated dietary exposure concentrations were then compared to toxicity reference values available for birds and mammals reviewed or published by international regulatory agencies. Toxicity reference values are concentrations at which low or no adverse effects are considered likely to occur.

**Key Findings of the Preliminary ERA**

The Preliminary ERA found that risks to the following groups of animals are low and acceptable:

- Plants and animals directly exposed to soil containing PFAS within the Investigation Area
- Plant-eating birds and mammals in off-site areas
- Reptiles that eat insects, plants and mammals
- Predatory terrestrial mammals and reptiles.

Even though there is no consistent international evidence that PFOS/PFOA cause adverse effects in ecosystems, this phrase is used to describe potential risks.

The Preliminary ERA found that the animal groups listed below may have exposures to PFAS that approach a potential risk:

- Aquatic plants and animals directly exposed to sediment, surface water and pore water (the water between sediment particles) containing PFAS
- Birds that eat terrestrial invertebrates (e.g. insects, earthworms)
- Birds that eat fish and other aquatic organisms
- Predatory birds that eat terrestrial herbivores (specifically rabbits and other small herbivorous mammals).

It is noted that because additional information is needed to assess PFAS exposures to animals that source their food from within the boundary of the site, risks associated with exposure to animals accessing the site have not been fully characterised within the Preliminary ERA.
Next steps

Further Considerations
The Preliminary ERA is the first step in understanding potential ecological impacts from PFAS detected within the Investigation Area.

The results of the Preliminary ERA provide an improved understanding of the potential for adverse effects to wildlife from direct exposure to PFAS impacted soil, sediment and surface water within habitats present in the Investigation Area. The outcomes of the Preliminary ERA also provide an improved understanding of potential risks that may result from the accumulation of PFAS in terrestrial and aquatic plants and animals consumed by wildlife.

Because the ecological 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, exposure of wildlife species to PFAS must be investigated carefully. As such, the findings of this Preliminary ERA are a conservative estimate of potential exposure, and assist in understanding where further assessment may be required.

Management Options
Defence continues to engage with industry specialists, 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.

Planning for the following short-term management actions is underway at the site:

- Groundwater treatment trial using technology from the United States of America
- Excavation and stockpiling of sediment from the drains on site
- Removal of a large AFFF waste water tank on site.

Further information

Water assistance
Defence's first priority continues to be that Oakey community members that rely on bore water 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.